Galveston SROI Case Study Condolidated Report

Prepared for:

Houston-Galveston Area Council

and the

City of Galveston

May 2013

Introduction

This document is a compilation of the reports produced during the Galveston Sustainable Return on Investment Case Study, conducted for the Houston-Galveston Area Council and its local project sponsor the City of Galveston from autumn 2012 through spring 2013. The compiled report comprises:

Sustainable Development Case Studies reports (Overview and Final Report)

These reports describe the economic concepts behind Sustainable Return on Investment (SROI) and present a demonstration of SROI in three different public investment scenarios for the City of Galveston: municipal water reuse, streetscape and safety improvements, and curbside recycling.

Community Involvement and Taxpayer Survey Report

A Stakeholder Group and a survey of City of Galveston taxpayers was conducted to obtain guidance on the sustainability factors that matter most to the respondents and help shape elements of the modeling. An overview of this community involvement process and the results of the survey are summarized in this report.

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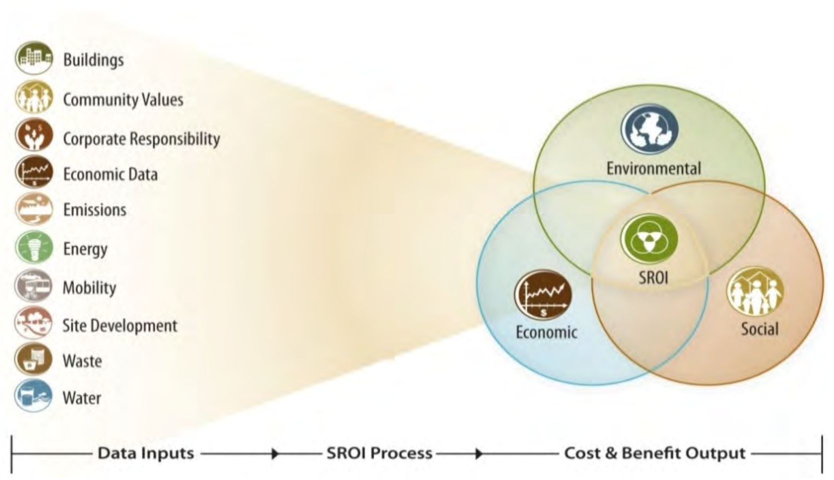
OVERVIEW: SUSTAINABLE RETURN ON INVESTMENT

A Galveston Case Study Analysis

What is Sustainable Return on Investment (SROI)?

When a public entity makes a capital investment or policy decision, it is spending taxpayer funds to achieve a desired functional result. The impact on the entity's fiscal position in such endeavors can be reasonably easily measured through its financial inflows (taxes and fees) and outflows (public spending). However, many public spending decisions seek results that are not strictly tied to the financial returns to a particular agency. Other concerns and desires factor in the decision. Increasingly, one of those concerns is impact on "sustainability." Sustainable development is typically defined as the pattern of development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, Brundtland Commission, 1987). Sustainable development combines the financial considerations of development with broader socio-economic concerns including environmental stewardship, human health and equity issues, social well-being, and the social implications of decisions.

Many of these issues can be quantitatively assessed and included in an analysis model called Sustainable Return on Investment (SROI), developed by HDR, Inc. HDR's (SROI) process is a broad-based analysis that accounts for a project's "triple-bottom line" – its full range of financial, economic, as well as social and environmental impacts. SROI has been used by corporations and all levels of government to evaluate the monetary value of sustainability programs and projects with a combined value of over $15 Billion.



SROI uses economic theory, real-world data, and social research to express these impacts using financial measurements (conversion to dollars). It then incorporates them into an overall analysis to determine whether the benefits of the project in the future exceed the costs of the project today. In this case, the analysis monetized non-cash benefits and costs including impacts related to greenhouse gases, criteria air contaminants, safety, mobility, livability, water conservation, and materials recovery (reducing waste in landfills).

Galveston Case Studies

The City of Galveston and the Houston-Galveston Area Council (H-GAC) engaged HDR and CDS Market Research to provide an SROI analysis for three pilot case studies:

- Building a 1 million gallon per day water reuse facility
- Streetscape and safety improvements for streets east of downtown
- Creating a curbside recycling program

These case study scenarios were developed with regard to the six Livability Principles designated by the U.S. Department of Housing and Urban Development (HUD), which funded the Galveston SROI study. These principles are summarized as thus:

1. **Provide more transportation choices:** Develop safe, reliable and economical transportation choices to decrease household transportation costs, reduce our nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions and promote public health.
2. **Promote equitable, affordable housing**: Expand location- and energy-efficient housing choices for people of all ages, incomes, races and ethnicities to increase mobility and lower the combined cost of housing and transportation.
3. **Enhance economic competitiveness**: Improve economic competitiveness through reliable and timely access to employment centers, educational opportunities, services and other basic needs by workers as well as expanded business access to markets.
4. **Support existing communities:** Target federal funding toward existing communities—through such strategies as transit-oriented, mixed-use development and land recycling—to increase community revitalization, improve the efficiency of public works investments, and safeguard rural landscapes.
5. **Coordinate policies and leverage investment:** Align federal policies and funding to remove barriers to collaboration, leverage funding and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy.
6. **Value communities and neighborhoods:** Enhance the unique characteristics of all communities by investing in healthy, safe, and walkable neighborhoods—rural, urban, or suburban.

The modeling for each case study included an analysis of both Financial Return on Investment (FROI) – a projection of the actual net cash flows to the City – and SROI. A stakeholder group assembled by the City and a community survey of sustainability factors guided construction of the models.

The output of these case studies included Excel spreadsheet models for each scenario. It is intended that this exercise will not only inform the City of Galveston but also other public entities interested in this type of project evaluation tool. All cash flows used to calculate benefits vs. costs are expressed in a Net Present Value (NPV) format – meaning that positive and negative cash flows occurring in the future are discounted so that they measured in today's dollars (a dollar in the future is worth less than a dollar today).

Case Study	Analysis
1. Water Conservation	• **Alternative:** Building a 1 million gallon per day Water Reuse Facility used for City irrigation and in the chillers at University of Texas Medical Branch • **Baseline:** Status Quo using potable water for the same activities from the existing City water treatment facility • **Net Present Value and Benefit/Cost Ratio results:** FROI – **($15,264,720)**, benefit/cost = **0.11** SROI – **($9,163,378)**, benefit/cost = **0.27**
2. Curbside Recycling Program	• **Alternative:** Establishing a residential curbside recycling program operated by Republic on four materials: HDPE, PET, corrugated paper, and mixed paper • **Baseline:** Status Quo of citizens dropping off some recyclables at the ECO Center and landfilling the remaining recyclables • **Net Present Value and Benefit/Cost Ratio results:** FROI – **$0**, benefit/cost = **0.0** SROI – **$2,335,121**, benefit/cost = **1.2**
3. Streetscape and Safety Improvements	• **Alternative 1:** Recommendation #2 from H-GAC's 2012 Livable Centers Study for Galveston Housing Authority • **Alternative 2:** Recommendation #4 from H-GAC's 2012 Livable Centers Study for Galveston Housing Authority • **Baseline:** Status Quo of existing streets • **Alternative 1 Net Present Value and Benefit/Cost Ratio results:** FROI – **$(2,957,928)**, benefit/cost = **0.0** SROI – **$(1,286,926)**, benefit/cost = **0.56** • **Alternative 2 Net Present Value and Benefit/Cost Ratio results:** FROI – **($3,469,179),** benefit/cost = **0.0** SROI – **($373,851)**, benefit/cost = **0.89**

The results showed that, on an SROI basis, the curbside recycling program is estimated to be beneficial. The other proposed projects did not show a net benefit, though Alternative 2 of the Streetscape and Safety Improvements was nearly break-even.

A detailed description of the case studies and SROI methodology is available in the consultant's (HDR Inc.) full report.

Implementation Considerations

SROI offers a useful way for municipalities and other public agencies to better understand not only the environmental and sustainability implications of various policies, programs, and investments, but also how meaningful those actions might be in a sustainability context and with a limited taxpayer budget to allocate. The use of a supporting survey allows public officials to adjust the quantitative modeling for the subjective preferences of the taxpayer population.

The SROI modeling also provides insight into the factors that can cause public policies and projects to have a larger or lesser impact. For example, the Water Reuse case study scenario showed how such a strategy is not justified on a single-project basis (either from an FROI or SROI standpoint) due to the infrastructure costs and the lack of savings to the City given its "take or pay" commitment to its current water supplier. A whole set of internal policies and systems, along with relationships to other public agencies (the Gulf Coast Water Authority for example), need to be aligned to maximize ROI from this concept.

Also, for the SROI modeling itself to be accomplished, it is vital that a public agency be prepared to collect and assemble the up to date and projected modeling inputs. For infrastructure projects, this means having staff from public works and engineering departments, transportation departments, building code enforcement, etc. dedicated to responding to the information requests by the performer of the modeling (most likely an outside consultant). As much data as can be sensibly collected in advance of the modeling effort will considerably shorten the timeline; for example, it was vital for Galveston to provide traffic counts (vehicle and pedestrian) in the Streetscape and Safety Improvements scenario.

It is also wise for City staff to directly participate in RAP sessions and other meetings with the model preparers as well as stakeholder meetings, so that questions about model assumptions can be answered accurately.

SROI modeling, while a quantitative method based in reasonable economic theory, is a potentially useful tool for community and infrastructure planning. However, even with a quantitative result, a community will have its own priorities and desires that guide planning recommendations that go beyond the modeling. For example, the most direct sustainability benefits of providing curbside recycling were quantified during the modeling process; however, other potential benefits are less tangible, such as the improvement in the City's image and appeal by offering this service to residents. Thus basing a planning decision solely on the results of an SROI model is not advisable – it should be used instead as a guidance mechanism for what are ultimately subjective decisions on the part of a community and its leaders.

Houston-Galveston Area Council

HDR

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SROI | SUSTAINABLE RETURN ON INVESTMENT

SROI

City of Galveston Sustainability Case Studies

Final Report

HDR Corporation
Decision Economics

Risk Analysis – Investment and Finance
Economics and Policy

Prepared for:

Houston-Galveston Area Council (H-GAC)

City of Galveston

May 17th, 2013

Sustainable Return On Investment

City of Galveston Sustainability Case Studies

Final Report

Houston-Galveston Area Council (H-GAC)

City of Galveston

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EXECUTIVE SUMMARY

HDR was engaged to provide a Sustainable Return on Investment (SROI) analysis of economic and 'non-economic' criteria for the City of Galveston (City) with guidance and funding from the Houston-Galveston Area Council (H-GAC) and CDS Market Research. These three pilot case studies identify implementation strategies to local challenges in the realms of transportation and livable communities (streetscape and safety improvements), water conservation (building a 1 million gallon per day Water Reuse Facility used for City irrigation and in the chillers at University of Texas Medical Branch), and waste management (creating a mixed-stream curbside recycling program for City residents). For the City, the SROI analysis provides an objective, transparent, and defensible triple bottom line business case for investing in different infrastructure alternatives. The goal is to measure and demonstrate the sustainability-related benefits and costs of four specific investments by the City of Galveston and prioritize these investments.

The SROI analysis can be applied by the City of Galveston as an extension of the Sustainable Action Plan to help evaluate and prioritize potential projects. Additionally, the emphasis on sustainability benefits is fully consistent with the Regional Plan for Sustainable Development (RPSD) for H-GAC. The projects that were analyzed as part of the SROI analysis were chosen due to their consistency with the Partnership for Sustainable Communities' six Livability Principles which include:

1. **Provide more transportation choices:** *Develop safe, reliable and economical transportation choices to decrease household transportation costs, reduce our nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions and promote public health.*

   One of the case study SROI scenarios explicitly addresses this first principle. The Streetscape and Safety Improvements are intended to make the designated street sections more conducive to non-automotive travel, especially walking.

2. **Promote equitable, affordable housing**: *Expand location- and energy-efficient housing choices for people of all ages, incomes, races and ethnicities to increase mobility and lower the combined cost of housing and transportation.*

   While not directly addressed in the chosen case study scenarios, housing affordability and equity would be indirectly addressed in the Streetscape and Safety Improvements, which are envisioned for a area of the city that will have rebuilt public housing; improving the ability of public housing residents to travel on foot or by other non-car modes will help them save on household expenses.

3. **Enhance economic competitiveness**: *Improve economic competitiveness through reliable and timely access to employment centers, educational opportunities, services and other basic needs by workers as well as expanded business access to markets*.

   The Water Reuse scenario examines a practice that could help Galveston remain economically competitive as it encounters constraints in its fresh water supply in the future. The Streetscape and Safety Improvements could help improve the image and attractiveness of streets near downtown Galveston, thereby potentially increasing real estate and business investment.

4. **Support existing communities:** *Target federal funding toward existing communities—through such strategies as transit-oriented, mixed-use development and land recycling—to increase community revitalization, improve the efficiency of public works investments, and safeguard rural landscapes.*

   The three scenarios all evaluated projects which would be largely City of Galveston investments, though federal funding might be applicable for the Streetscape and Safety Improvements. However, this Case Study exercise in itself has been a way to help Galveston improve its own efficiency in decision-making and plan for those improvements that will have the greatest livability impacts for its own residents and taxpayers.

5. **Coordinate policies and leverage investment:** *Align federal policies and funding to remove barriers to collaboration, leverage funding and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy.*

   While these case study scenarios did not directly address coordination of policies and funding across different levels of government, they were heavily oriented toward helping the City of Galveston better understand the efficiency and effectiveness of its own potential actions as related to the objective of sustainability.

6. **Value communities and neighborhoods:** *Enhance the unique characteristics of all communities by investing in healthy, safe, and walkable neighborhoods—rural, urban, or suburban.*

   The Curbside Recycling scenario would help Galveston neighborhoods compete against mainland neighborhoods where such services might be expected; furthermore, it would reduce landfill pressure that can have a negative impact on other neighborhoods adjacent to such facilities.

Furthermore, SROI modeling can be a method for Galveston to more efficiently and effectively carry out the elements of its comprehensive plan, updated in 2011. Key plan elements and directives that have been noted by the City where SROI could be useful include:

Housing & Neighborhoods Element

- HN-2.6 Support the Provision of Neighborhood Amenities
- HN-2.9 Promote Sustainability and Energy Efficiency
- HN-5.3 Improve Mobility for Seniors

Economic Development Element

- ED-1.7 Promote and Maintain Galveston as a Leader in Sustainable Development and Economic Growth

Land Use Element

- LU-3.5 Support Provision of Neighborhood Amenities

Historic Preservation Element

- HP-1.12 Maintain Public Street, Sidewalk, and Utilities in Accordance with Historic Neighborhood Character
- HP-4.7 Support the Provision of Neighborhood Amenities and Increase Beautification Efforts

Natural Resources Element

- NR-7.2 Modify City Policies and Regulations to Promote More Sustainable Practices

Transportation Element

- T-2.1 Establish a Complete Streets Program

Infrastructure Element

- I-1.2 Encourage Water Conservation

- I-1.3 Explore Alternative Water Sources
- I-3.2 Explore Other Uses for Wastewater
- I-4.1 Investigate and Implement More Sustainable Options for Waste Disposal

The proposed SROI analysis broadens traditional financial analysis to incorporate and value social and environmental factors within an expanded cost-benefit analysis framework.

More infrastructure owners and investors are wisely seeking to use economic analysis to comprehensively assess investment options to make the best use of their funds. Collaborative, risk-based triple bottom line cost-benefit analysis is the best approach to understanding the overall net benefit of infrastructure projects. HDR has recognized that decision makers want information to enable budgetary decisions that reflect value-for-money comparisons of investment proposals among different projects. This includes the need to compare competing projects on a 'common language' basis – whereby environmental and social impacts must be converted into monetary values to estimate the overall impacts in comparable financial terms. By comparing specific infrastructure alternatives on an apples-to-apples basis, the City can show greater rigor in the decision-making process and create a defensible position for its capital budget allocation choices.

Sustainable Return on Investment (SROI) is an enhanced form of a cost-benefit analysis (CBA) - a systematic process for calculating and comparing benefits and costs of a project or policy, and is generally conducted to justify an investment or compare projects. The SROI process accounts for a project's triple-bottom line – its full range of environmental, social and economic impacts. The process builds on best practices in cost-benefit and financial analysis methodologies, complemented by advanced risk analysis and stakeholder elicitation techniques. In this analysis, actual financial costs and benefits incurred by the City are accounted for, in addition to the monetized value of various social and environmental impacts to account for the triple bottom line. In this case, the analysis monetized non-cash benefits and costs including impacts related to greenhouse gases, criteria air contaminants, safety, mobility, livability, water conservation, and materials recovery.

For H-GAC, the sustainability pilot case studies offer transferable knowledge that can serve as tools for local governments and implementing entities in the region facing similar challenges. At a minimum, the study's outcomes will benefit the entire community of Galveston; however, there is a strong potential to adapt this kind of analysis to other communities throughout the region. That being said, this analysis used a unique combination of site-specific costs, electricity grid composition, water sources, utility rates, demographics, facility users, and other assumptions that will prevent these results from being transferable to other jurisdictions. To help remedy this challenge, HDR has provided the SROI Excel-based models used in the three sustainability case studies to H-GAC for use in other communities on a limited scope within the region. These models have incorporated a user-friendly template to allow for changes in inputs based on a very narrow range of specific investments that are the same as those analyzed in this project - building a water reuse facility, forming a curbside recycling program, and investing in streetscape and safety improvements (such as sidewalks, bulb-outs, and cross walks). A broader cross-sector infrastructure SROI tool could be developed, but was out of the scope of this project.

SROI can act as a methodology and process to help municipalities understand that sustainability can be analyzed in a rigorous, objective, and standardized manner. These communities can use this process to support the sustainable goals within their own area and may choose to pursue a similar project to further investigate their own plans. Ultimately, the region will be able to use the Galveston case studies as an example to show how sustainability can be incorporated into a fiscally responsible municipal budget.

SROI originated from a Commitment to Action by HDR to develop a new generation of public decision support metrics for the Clinton Global Initiative (CGI) in 2007. SROI was developed with input from Columbia University's Graduate School of International Public Affairs and launched at the 2009 CGI annual meeting. Since then, the SROI process has been used by HDR to evaluate the monetary value of sustainability programs and projects with a combined value of over $15 Billion. It has been used by corporations and all levels of government.

Investments Analyzed:

In total, there are three distinct case studies with four alternatives analyzed using SROI. A standard SROI analysis starts with the definition of the baseline and alternate scenarios. The project benefits and costs are then estimated based on the incremental differences between the alternate and baseline scenarios over a period of 25 years using a 3% real discount rate.

Case Study	Analysis
1. Water Conservation	• **Alternative:** Building a 1 million gallon per day Water Reuse Facility used for City irrigation and in the chillers at University of Texas Medical Branch • **Baseline:** Status Quo using potable water for the same activities from the existing City water treatment facility
2. Curbside Recycling Program	• **Alternative:** Establishing a residential curbside recycling program operated by Republic on four materials: HDPE (plastic), PET (plastic), corrugated paper, and mixed paper • **Baseline:** Status Quo of citizens dropping off recyclables at the ECO Center
3. Streetscape and Safety Improvements	• **Alternative 1:** Recommendation #2 from H-GAC's 2012 Livable Centers Study for Galveston Housing Authority • **Alternative 2:** Recommendation #4 from H-GAC's 2012 Livable Centers Study for Galveston Housing Authority • **Baseline:** Status Quo

The delivery of this SROI analysis included the facilitation of two Risk Analysis Process (RAP) sessions at Galveston City Hall offices, plus one kick-off meeting, and a presentation of the results. A RAP session is a meeting, similar to a one-day charrette, which brings together key stakeholders to reach consensus on input data values and calculations to be used in the model. Participants in the two RAP sessions included representatives from City staff, H-GAC, interest groups, and City council-appointed representatives.

Additionally, CDS Market Research conducted a 'Survey of Galveston Taxpayer' which was conducted in January, February and March of 2013. This survey was created to elicit feedback from Galveston residents regarding five broad community values or concerns. The categories included: General Values or Concerns; Economic and Financial Impact Values or Concerns; Environmental Values or Concerns; Security Values or Concerns; and Other Values or Concerns. The results of the survey helped HDR refine/confirm which environmental and social categories to include in the analysis.

The results tables that are generated from the SROI analysis provide a summary of the study's financial results, shown as the Net Present Value (NPV), Discounted Payback Period (DPP), Internal Rate of Return (IRR), and Benefit-Cost Ratio (BCR) for each of the alternatives. NPV is defined as the present value of total benefits over the life of the investment minus the present value of total costs over the same period. NPV is the principal measure of a capital investment's economic worth. A positive value means that the investment would furnish benefits to the region whose total economic value exceeds the capital costs and operating funds needed to build and run the system. If alternatives are ranked in order of economic merit, the appropriate basis for ranking is the NPV. The FROI NPV is based on the cash-only costs and benefits to the City of Galveston, while the SROI NPV is based on the triple bottom line costs and benefits (adding the monetized value of social and environmental impacts to the FROI values). The results are all mean expected values resulting from a Monte Carlo simulation, using 10,000 iterations with @Risk software.

The following section segments the three case studies and provides further information regarding each analysis, including the results.

1. Water Conservation:

Overview:

This case study analyzes a water conservation investment in the form of a 1 million gallon per day (MGD) Type II water reuse facility. The capital costs of this facility are to be born by the City and include the Reverse Osmosis (RO) technology to treat the waste water, and the underground piping to deliver the reuse water. The City will use 0.75 MGD for irrigation uses, and University of Texas Medical Branch (UTMB) will use 0.25 MGD for the on-site chillers. This 1 MGD will offset potable water treated by the City, which it purchases from the Gulf Coast Water Authority (GCWA).

Results:

The table on the next page includes two sets of metrics: the first box provides the mean expected FROI results, which only accounts for the traditional cash benefits and the second box provides the mean expected SROI results, which corresponds to the triple bottom line.

Table ES-1: Summary of Results – Water Reuse Facility ($2013)

Financial Metrics		
Metrics	**Mean Values**	**Description**
FROI		
Net Present Value (NPV)	**($15,264,720)**	PV Benefits - PV All Costs
Discounted Payback Period	**N/A**	Time in years until positive discounted cash flow
Internal Rate of Return (%)	**N/A**	Discount rate which would make NPV = 0
Benefit to Cost Ratio	**0.11**	PV Benefits / PV Costs
SROI		
Net Present Value (NPV)	**($9,163,378)**	PV Benefits - PV All Costs
Discounted Payback Period	**N/A**	Time in years until positive discounted cash flow
Internal Rate of Return (%)	**N/A**	Discount rate which would make NPV = 0
Benefit to Cost Ratio	**0.27**	PV Benefits / PV Costs

Note: 'Reduced Water Utility Revenues' is not Included in the SROI Analysis.

From a FROI perspective (cash-only), the water reuse project has a NPV of roughly $-15.3M; meaning the present value of the total costs to this project exceed that of its total benefits. The Benefit to Cost Ratio (BCR) is 0.11; meaning the costs are roughly nine times larger than the benefits. The City will incur capital costs related to this investment. The current contract with GCWA uses fixed rate structure (also called 'take or pay'), whereby the City is obligated to buy a certain amount of water whether it gets consumed or not. Since the City is selling the reuse water at a lower rate than the potable water to UTMB, the City loses revenue which it cannot recoup due to its contract structure with GCWA. However, there are benefits relating to the reduced annual O&M costs of treating the reuse water versus the potable water, and as the useful life of the RO facility exceeds the 25 year study period, the residual value of the equipment needs to be included as a benefit at the end of the study period.

When taking into account the benefits to society from reducing potable water use, the SROI NPV remains negative, but improves to $-9.2M. The lost revenue counted as a cost in the FROI to the City is excluded from the SROI, since from society's point of view, it's simply a transfer of resources (UTMB saves money, but the City loses money). The value of the social savings from reduced potable water use, although valuable, is not enough to offset the high capital costs of this investment.

2. Curbside Recycling Program:

Overview:

This case study analyzes a curbside recycling program operated by a private company, Republic, versus the status-quo baseline of residents dropping off recyclables at the ECO Center and landfilling through the garbage program. The scenario is contained to four specific waste materials: HDPE, PET, corrugated paper, and mixed paper. Benefits to this alternative are a result of reduced residential vehicle miles travelled (VMTs) to the ECO Center and from induced recycling amounts due to the convenience of the curbside pick-up program. In order to quantify the environmental benefits related to increased recycling rates, the EPA WARM Model was used by HDR to account for life-cycle changes in greenhouse gas emissions (GHGs). In the context of integrated waste management systems, a life-cycle assessment (LCA) tracks the energy and environmental burdens associated with all stages of upstream processing to the downstream waste management activities (waste collection, transfer, materials recovery, treatment, and final disposal). These GHG impacts were then monetized by HDR, in additional to VMT-related impacts such as GHG and CAC emissions, accident costs, vehicle operating costs, congestion costs, pavement damage O&M costs, and noise pollution costs.

Results:

The table below includes two sets of metrics: the first box provides the mean expected FROI results, which only accounts for the traditional cash benefits and the second box provides the mean expected SROI results, which corresponds to the triple bottom line.

Table ES-2: Summary of Results – Curbside Recycling Program ($2013)

Financial Metrics		
Metrics	**Mean Values**	**Description**
FROI		
Net Present Value (NPV)	**$0**	PV Benefits - PV All Costs
Discounted Payback Period	**N/A**	Time in years until positive discounted cash flow
Internal Rate of Return (%)	**N/A**	Discount rate which would make NPV = 0
Benefit to Cost Ratio	**N/A**	PV Benefits / PV Costs
SROI		
Net Present Value (NPV)	**$2,335,121**	PV Benefits - PV All Costs
Discounted Payback Period	**20 y 6 m**	Time in years until positive discounted cash flow
Internal Rate of Return (%)	**55%**	Discount rate which would make NPV = 0
Benefit to Cost Ratio	**1.2**	PV Benefits / PV Costs

From a FROI perspective (cash-only), the curbside program has no direct impact to the City of Galveston. The monthly fee levied by Republic on each household does not affect the municipal budget.

Alternatively, from a SROI perspective (triple bottom line), the project appears to be a good investment. The NPV is $2.3M, the IRR is 55%, the project pays for itself within 21 years, and the BCR is 1.2, meaning the benefits are roughly 20% higher than the costs. Although offset by increased recycling truck miles, total VMTs are reduced from reduced drop-off activity by residents. Changes in VMTs directly relate to values attributed to accidents, pavement damage, traffic noise, and congestion – recycling trucks and personal vehicles have different corresponding VMT values for each. When the increase in recycling truck VMTs and reduced personal vehicle VMTs are both accounted for, there is a net cost over the study period. However, fewer residential trips means saved travel time, and lower vehicle operating costs. There are more GHG and CAC emissions produced by the recycling trucks than are saved from reduced residential travel. The induced recycling tonnage converted from the landfill from the curbside pick-up program saved a considerable amount of CO2 equivalents. Total GHG savings from decreased car mileage and induced recycling, net of increased recycling truck miles, was significant. Two additional benefits from the increased recycling rates include: the proxy value for recycled materials, which was the additional recyclables revenue value that would have otherwise have been landfilled and not existed; and the landfill offset value, which was the value of the avoided tipping fees from less landfill tonnage.

3. Streetscape and Safety Improvements:

Overview:

This case study analyzes two streetscape and safety alternatives that are based on two specific recommendations from the H-GAC Livable Centers Study[1]. Recommendation #2 - *Reconfigure Streets for Safety and Green Space* includes the street segments of 15th through 18th, between Harborside and Avenue F, and improvements such as: widen sidewalks; construct bulb outs and curb extensions; improved curb ramps; shorter crosswalks; street lighting and furnishings; on-street parking; trees. Recommendation #4 – *Improve Pedestrian Connections to UTMB* includes the street segments of Mechanic St, Market St, and Strand, between 19th and 11th, and improvements such as: widening sidewalks; constructing bulb outs and curb extensions; improving curb ramps; creating shorter crosswalks; street lighting and furnishings; on-street parking; trees; improving existing building facades. This analysis did not take into account any hypothetical future redevelopment activity.

Results:

The table on the next page includes two sets of metrics: the first box provides the mean expected FROI results, which only accounts for the traditional cash benefits and the second box provides the mean expected SROI results, which corresponds to the triple bottom line.

[1] H-GAC Livable Centers Study for the Galveston Housing Authority in Conjunction with Historic Downtown Strand Seaport Partnership, December 2012

Table ES-3: Summary of Results – Streetscape and Safety Improvements Alternatives ($2013)

Financial Metrics			
	Recommendation #2	Recommendation #4	
Metrics	Mean Values	Mean Values	Description
FROI			
Net Present Value (NPV)	($2,957,928)	($3,469,179)	PV Benefits - PV All Costs
Discounted Payback Period	N/A	N/A	Time in years until positive discounted cash flow
Internal Rate of Return (%)	N/A	N/A	Discount rate which would make NPV = 0
Benefit to Cost Ratio	0.00	0.00	PV Benefits / PV Costs
SROI			
Net Present Value (NPV)	($1,286,926)★	($373,851)★	PV Benefits - PV All Costs
Discounted Payback Period	N/A	N/A	Time in years until positive discounted cash flow
Internal Rate of Return (%)	N/A	3%	Discount rate which would make NPV = 0
Benefit to Cost Ratio	0.56	0.89	PV Benefits / PV Costs

★***Caveat****: The main drivers to the benefits are the number of users (pedestrians, cyclists, and auto traffic) on the specific street segments and the reductions in accidents. The SROI analysis in this case was limited to the direct improvements to which the capital costs were based off of in the H-GAC Livable Centers Study, and therefore did not take into account any hypothetical future redevelopment activity. It can be said that the benefits would be amplified if these two investments were part of a broader redevelopment project in the immediate area (transformation of a larger connected area) or if similar improvements were completed on street segments that are more widely utilized. As population density grows, so do the number of users in the area and subsequently so would the benefits of these streetscape and safety improvements; however, the costs remain the same. At some point, with enough users, this investment generates a positive return. In other words, if these improvements were completed in a more highly developed area, there would be a certainty of positive returns due to the large number of users.*

From a FROI perspective, the cash impacts to the City are strictly costs and therefore the NPVs of Recommendations #2 & #4 are respectively $-2.96M and $-3.47M and are based solely on the capital costs.

From a SROI perspective (triple bottom line), the analysis accounted for a variety of additional benefits relating to improved safety, streetscape enhancements, and modal shift from cars to bicycles and walking. Although the benefits categories attributed to each recommendation were identical, the magnitude of those benefits was different because of the different number of users and a different mode shift (Recommendation #4 had higher pedestrian, cyclist, and auto counts, as well as twice the mode shift and therefore additional benefits). HDR monetized the following benefits: Reduction in Social Cost of Accidents; Enhanced Streetscape Value; Health Benefits Due to Improved Facilities; Reduction in Social Cost of Pavement Damage; Reduction in Social Cost of Traffic Noise; Reduction in Social Cost of Traffic Congestion; Personal Vehicle Operating Cost (VOC) Savings; Green House Gas Social Savings from Decreased Car Mileage; and Criteria Air Contaminant Social Savings from Decreased Car Mileage. Aggregate benefits from these nine categories of impacts added roughly $1.6M to Recommendation #2 and $3.1M to Recommendation #4 over the study period. That being said, the

NPVs are still negative, although Recommendation #4 marginally so. The risk-adjusted S-Curves, shown in the results section, actually show a 15% chance of a positive return to Recommendation #4.

Breakeven Analysis:

HDR conducted a breakeven analysis to determine the approximate numbers of pedestrians and cyclists in the area (in the base case without the improvements) which would generate enough benefits to offset the costs of the streetscape and safety improvements (Net Present Value (NPV) = 0, whereby the discounted costs equal the discounted benefits). Although auto traffic and accident reduction also generate benefits, the focus is on the number of pedestrians and cyclists. For Recommendation #2, the City would need 7.35 times more pedestrians and cyclists to generate a NPV=0, and for Recommendation #4, the City would need 2.87 times more pedestrians and cyclists. In other words, Recommendation #2 would need 1,707 users (1,623 pedestrians and 168 cyclists per day) and Recommendation #4 would need 734 users (697 pedestrians and 74 cyclists per day) to breakeven. As additional public and private development investments in housing units, densification, commercial and retail facilities is augmented, the societal benefits to the streetscape and safety improvement commensurately increase.

1. INTRODUCTION

HDR was engaged to provide a Sustainable Return on Investment (SROI) analysis of economic and 'non-economic' criteria for the City of Galveston (City) with guidance and funding from the Houston-Galveston Area Council (H-GAC). The case studies help to identify implementation strategies to local challenges in the realms of transportation & livable communities (streetscape and safety improvements), water conservation (building a 1MGD water reuse facility), and waste management (creating a curbside recycling program). For the City, the SROI analysis provides an objective, transparent, and defensible triple bottom line business case for investing in different infrastructure alternatives. The goal is to measure and demonstrate the sustainability-related benefits and costs of four specific investments by the City of Galveston and prioritize these investments. The SROI analysis can be applied by the City of Galveston as an extension of the Sustainable Action Plan to help evaluate and prioritize potential projects. Additionally, the emphasis on sustainability benefits is fully consistent with the Regional Plan for Sustainable Development (RPSD) for H-GAC. The proposed analysis broadens traditional financial analysis to incorporate and value social and environmental factors within an expanded cost-benefit analysis framework.

Sustainable Return on Investment (SROI) is an enhanced form of a cost-benefit analysis (CBA) - a systematic process for calculating and comparing benefits and costs of a project or policy, and is generally conducted to justify an investment or compare projects. The SROI process accounts for a project's triple-bottom line – its full range of environmental, social and economic impacts. The process builds on best practices in cost-benefit and financial analysis methodologies, complemented by advanced risk analysis and stakeholder elicitation techniques. In this analysis, actual financial costs and benefits incurred by the City are accounted for, in addition to the monetized value of various social and environmental impacts to account for the triple bottom line. In this case, the analysis monetized non-cash benefits and costs including impacts related to greenhouse gases, criteria air contaminants, safety, mobility, livability, water conservation, and materials recovery.

For H-GAC, the sustainability case studies offer transferable knowledge that can serve as tools for local governments and implementing entities in the region facing similar challenges. At a minimum, the study outcomes will benefit the entire community of Galveston; however, there is a strong potential to adapt this kind of analysis to other communities throughout the region. That being said, this analysis utilized a unique combination of site-specific costs, electricity grid composition, water sources, utility rates, demographics, facility users, and other assumptions that will prevent these results from being utilized in other jurisdictions. To help remedy this challenge, HDR has provided the SROI Excel-based models used in the three sustainability case studies to H-GAC for use in other communities on a limited scope within Texas. These models have incorporated a user-friendly template to allow for changes in inputs based on a very narrow range of specific investments that are the same as those analyzed in this project - building a water reuse facility, forming a curbside recycling program, and investing in streetscape and safety improvements (such as sidewalks, bulb-outs, and cross walks). A broader cross-sector infrastructure SROI tool was out of the scope of this project.

SROI can act as a methodology and process to help municipalities understand that sustainability can be analyzed in a rigorous, objective, and standardized manner. These communities can use this process to support the sustainable goals within their own area and may choose to pursue a similar project to further investigate their own plans. Ultimately, the region will be able to use the Galveston case studies as an example to show how sustainability can be incorporated into a fiscally responsible municipal budget.

Investments Analyzed:

In total, there are three distinct case studies with four alternatives analyzed using SROI. A standard SROI analysis starts with the definition of the baseline and alternate scenarios. The project benefits and costs are then estimated based on the incremental differences between the alternate and baseline scenarios over a period of 25 years using a 3% real discount rate.

Case Study	Analysis
1. Water Conservation	• **Alternative:** Building a 1 MGD Water Reuse Facility used for City irrigation and in the chillers at UTMB • **Baseline:** Status Quo using potable water for the same activities from the existing City water treatment facility
2. Curbside Recycling Program	• **Alternative:** Establishing a residential curbside recycling program operated by Republic on four materials: HDPE, PET, corrugated paper, and mixed paper • **Baseline:** Status Quo of citizens dropping off recyclables at the ECO Center
3. Streetscape and Safety Improvements	• **Alternative 1:** Recommendation #2 from H-GAC's 2012 Livable Centers Study for Galveston Housing Authority • **Alternative 2:** Recommendation #4 from H-GAC's 2012 Livable Centers Study for Galveston Housing Authority • **Baseline:** Status Quo

The process of this SROI analysis included the facilitation of two Risk Analysis Process (RAP) sessions at Galveston City Hall offices, plus one kick-off meeting, and a presentation of the results. A RAP session is a meeting, similar to a one-day charrette, which brings together key stakeholders to reach consensus on input data values and calculations to be used in the model. In this case, the group included representatives from City staff, H-GAC, interest groups, and City council-appointed representatives.

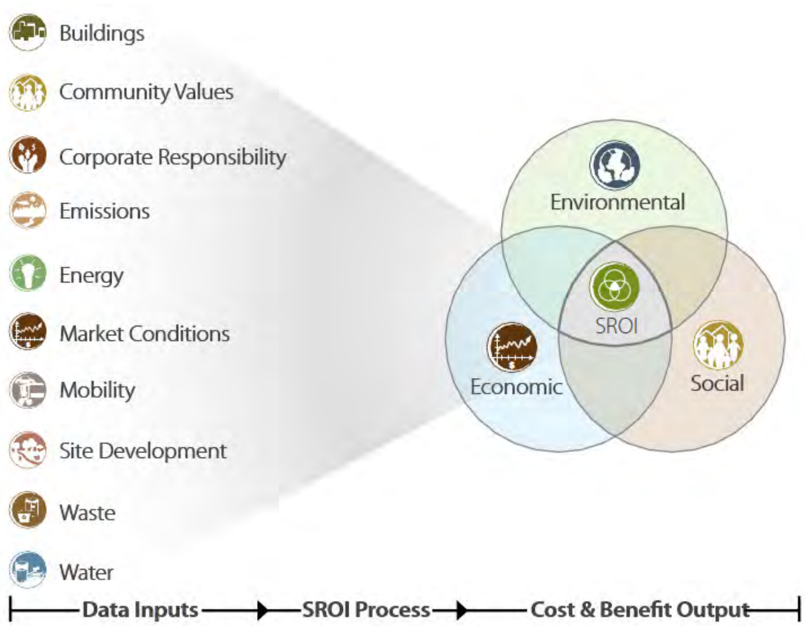
Additionally, CDS Market Research conducted a 'Survey of Galveston Taxpayer' (see accompanying report) which was conducted in January, February and March of 2013. This survey was created to elicit feedback from Galveston residents regarding five broad community values or concerns. The categories included: General Values or Concerns; Economic and Financial Impact Values or Concerns; Environmental Values or Concerns; Security Values or Concerns; and Other Values or Concerns. The results of the survey helped HDR refine/confirm which environmental and social categories to include in the analysis.

For the City, outputs are split into two perspectives: Financial Return on Investment (FROI), and Sustainable Return on Investment (SROI).

- Financial Return on Investment (FROI) metrics includes only the cash impacts to the City.
- Sustainable Return on Investment (SROI) adds the external non-cash impacts to the City that affect society to the FROI (items such as greenhouse gases (GHG's) and criteria air contaminants (CAC's)).

Conventional wisdom has always asserted that financial and social goals were in opposition: economic development versus environmental protection was always framed as a zero-sum game. However, today we are quickly realizing that the real opportunity lies in the "blended value" model in which organizations achieve economic success while acting in a sustainable and socially responsible manner. If positive and negative externalities (social and environmental impacts) resulting from organizational operations were quantified, managers and investors could design, manage and fund organizations that maximized the combined financial and social returns.

Most professionals in the Architecture, Engineering and Construction industry rely on basic financial tools to quantify the first costs of sustainable projects and to show the financial return on investment (or FROI) of sustainable strategy benefits. The first instance where these traditional methods often fall short is in the accurate quantification of the benefits that accrue to society as a whole as a result of these decisions. The second instance where traditional tools fall short is that they fail to incorporate the element of risk. Sustainable project decisions require the forecasting of future costs and benefits and these are subject to uncertainty, which is typically not captured by conventional methods.



Since traditional analytical methods fall short in accurately quantifying all positive and negative externalities,[2] HDR developed the SROI process. Today, when evaluating public investment, focus should be put on accounting for the impacts of a project on local residents and their communities – including the environment. If positive and negative externalities were quantified, decision makers could design and carry out the project that maximizes the combined financial, environmental and social returns.

[2] In economics, an externality is a non-internalized cost or benefit resulting from one economic agent's actions that affect the well-being of others. For instance, pollution and other forms of environmental degradation are the result of some production process and are not reflected in the price of the goods or services being produced.

HDR's SROI analysis involves four distinct steps:

STEP 1	Develop Structure and Logic Diagrams	Map out economic, social and environmental variables and graphically illustrate the calculations required.
STEP 2	Assign Monetary Values and Risk Ranges	Measure the impacts of the project by assigning monetary values and probability distributions, where possible, to each variable.
STEP 3	Develop Consensus among Stakeholders	Bring stakeholders together and develop consensus on model and the assigned values.
STEP 4	Simulate and Quantify Outcomes	Compute SROI metrics such as Net Present Value, Benefit-Cost Ratio, Internal Rate of Return, etc.

Risk analysis and Monte Carlo simulation techniques were used to account for uncertainty in both the input values and model parameters. Projections were expressed as probability distributions (a range of possible outcomes and the probability of each outcome). Finally, each element was developed or converted into monetary values to estimate the overall impacts in comparable financial terms.

Our analysis produced results on both a financial and a sustainable basis using many of the most recognized evaluation metrics. For example:

Net Present Value (NPV)	The net value that a project generate to the public benefit, calculated as the sum of the present value of future benefit flows less the present value of the project's costs.
Discounted Payback Period (DPP)	The period of time required for the return on an investment to recover the sum of the original investment on a discounted cash flow basis.
Internal Rate of Return (IRR)	The discount rate at which the net present value of a project would be zero; represents the annualized effective compounded return rate which can be earned on the invested capital, and is compared relative to the cost of capital.
Benefit-Cost Ratio (B/C ratio)	The overall "value for money" of a project, expressed as the ratio of the benefits of a project relative to its costs, with both expressed in present-value monetary terms.

SROI originated from a Commitment to Action by HDR to develop a new generation of public decision support metrics for the Clinton Global Initiative (CGI) in 2007. SROI was developed with input from Columbia University's Graduate School of International Public Affairs and launched at the 2009 CGI annual meeting. Since then, the SROI process has been used by HDR to evaluate the monetary value of sustainability programs and projects with a combined value of over $15 Billion. It has been used by corporations and all levels of government.

2. SUSTAINABLE RETURN ON INVESTMENT (SROI) BACKGROUND FOR ANALYSIS

2.1 Structure & Logic Diagrams

The purpose of this report is to develop an FROI and SROI analysis framework for the City of Galveston. The methodology for the various benefits and costs is presented graphically in the form of a flow chart called a "structure and logic model". Such models provide a graphical illustration of how the various inputs combine to determine the benefit or cost evaluated. They are intended to provide a transparent record of how each benefit and cost is calculated.

The figure below shows the legend for all structure and logic models presented in this report.

Figure 1: Structure and Logic Diagrams Legend

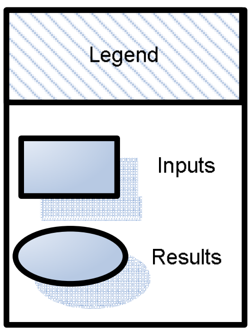
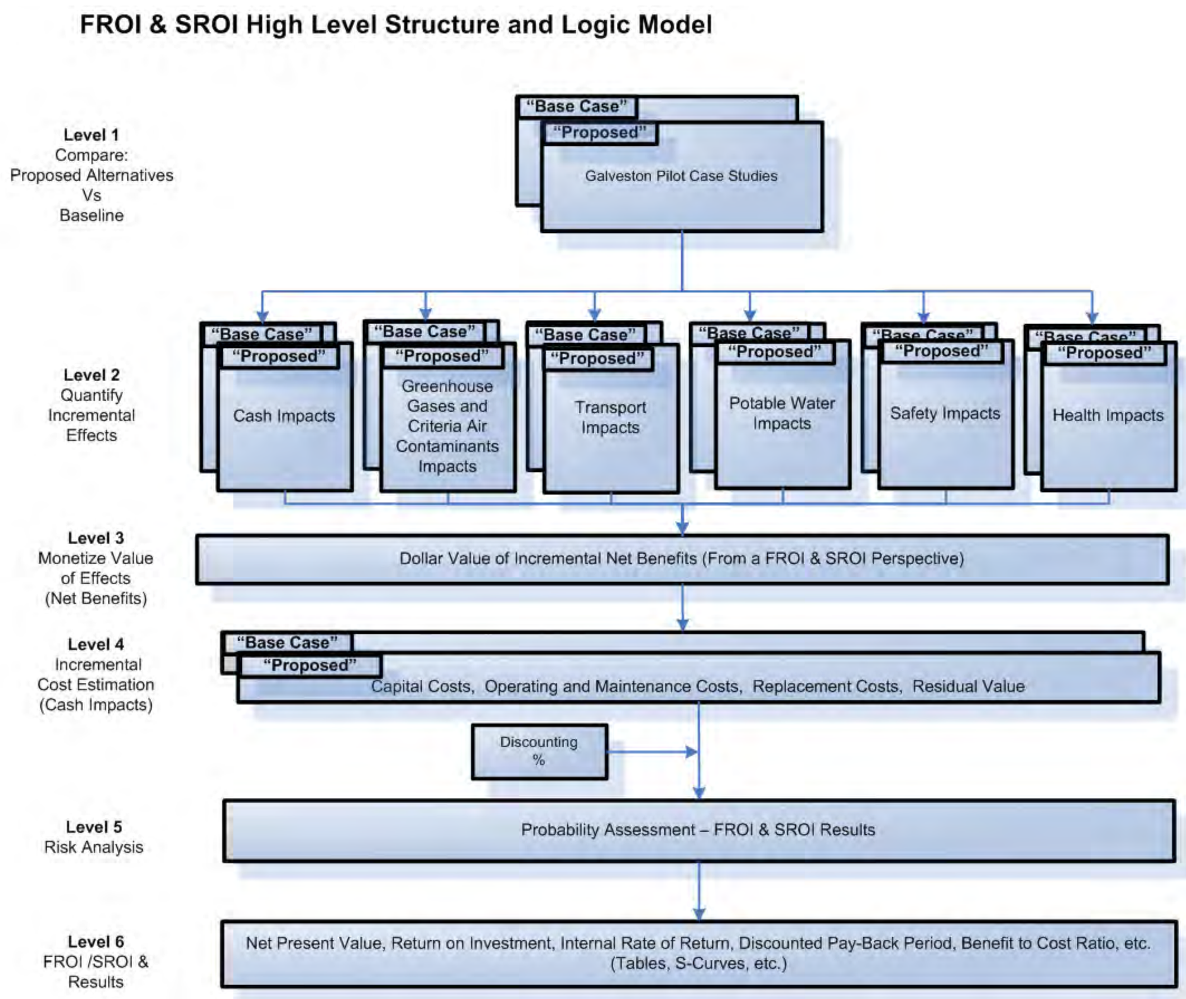


Figure 2 identifies the methodological format of the analysis. The analysis starts at Level 1 with a detailed description of the design alternative. Level 2 involves the identification of impacts. The third level involves an explicit calculation of the social and environmental impacts of the alternative, while the fourth level monetizes (converts to monetary terms) those incremental impacts. This analysis requires a series of exercises generated by an array of inputs that often carry a high degree of uncertainty. Each of these inputs is assessed by the model at Level 5 to get the overall probability distribution of the net present value of the alternative. Once the incremental costs for each alternative have been determined they are weighed against the monetized incremental cost to obtain the NPV of the cost-benefit analysis at Level 6.

Figure 2: FROI & SROI High Level Structure and Logic Model



In the following discussion, the structure and logic diagrams for each alternative are presented.

Water Conservation

Figure 3 identifies the specific financial impacts associated with the water reuse case study. The financial costs consist of capital costs from the RO facility/pump station and the piping infrastructure needed for distribution as well as the opportunity costs associated with selling the reuse water at a lower rate than potable water to UTMB. Financial benefits are related to the residual value applied to the distribution infrastructure and the annual savings related to the lower per gallon O&M costs of the reuse facility versus the potable water treatment facility.

Figure 3: Water Reuse - FROI

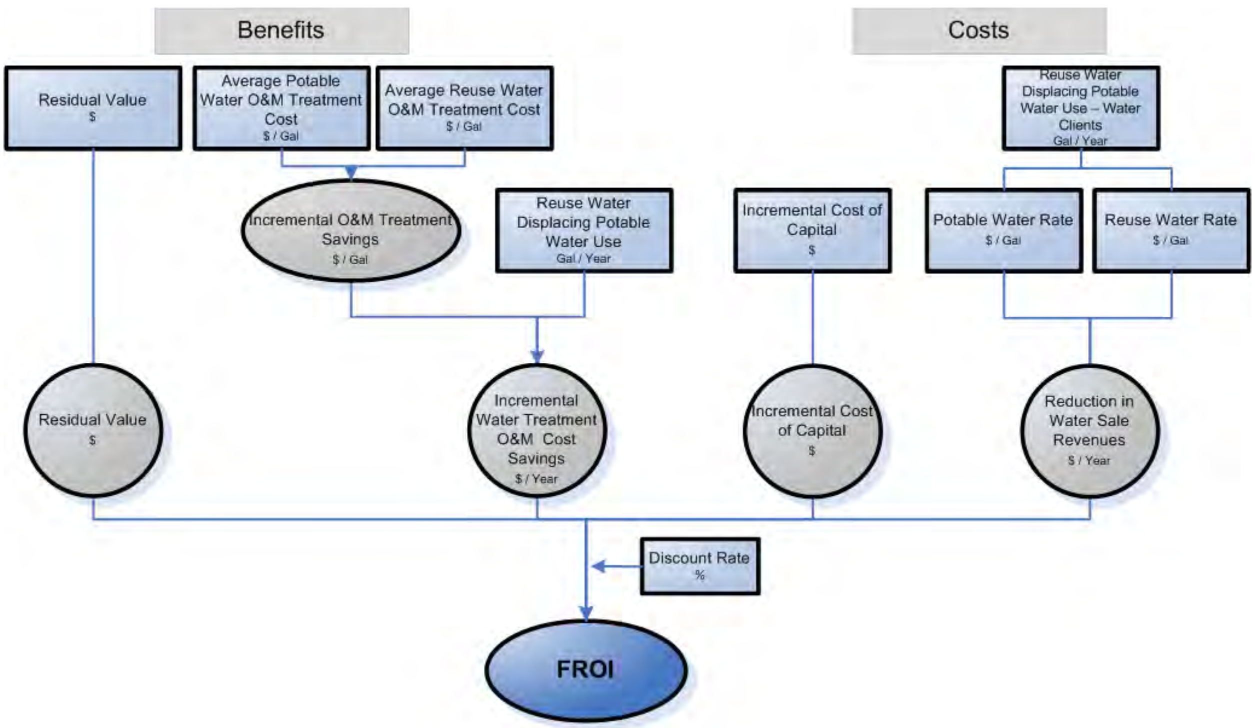
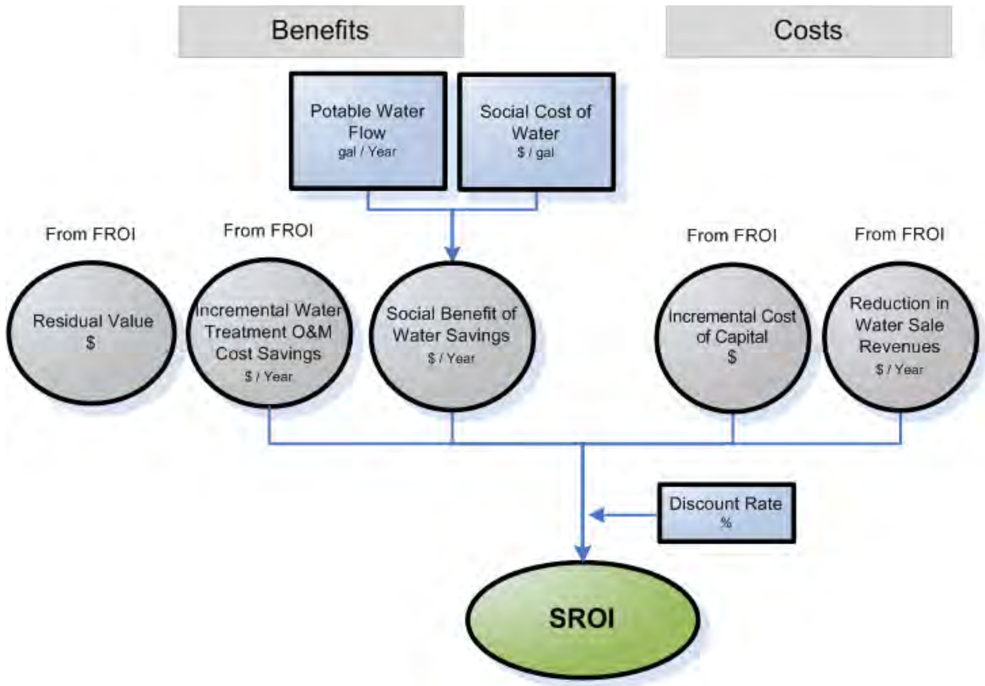


Figure 4 identifies the social impacts that are pertinent to society as a whole. There is one social benefit for this alternative, which is related to the externality value of potable water use. The SROI total encompasses FROI outputs.

Figure 4: Water Reuse - SROI



Curbside Recycling

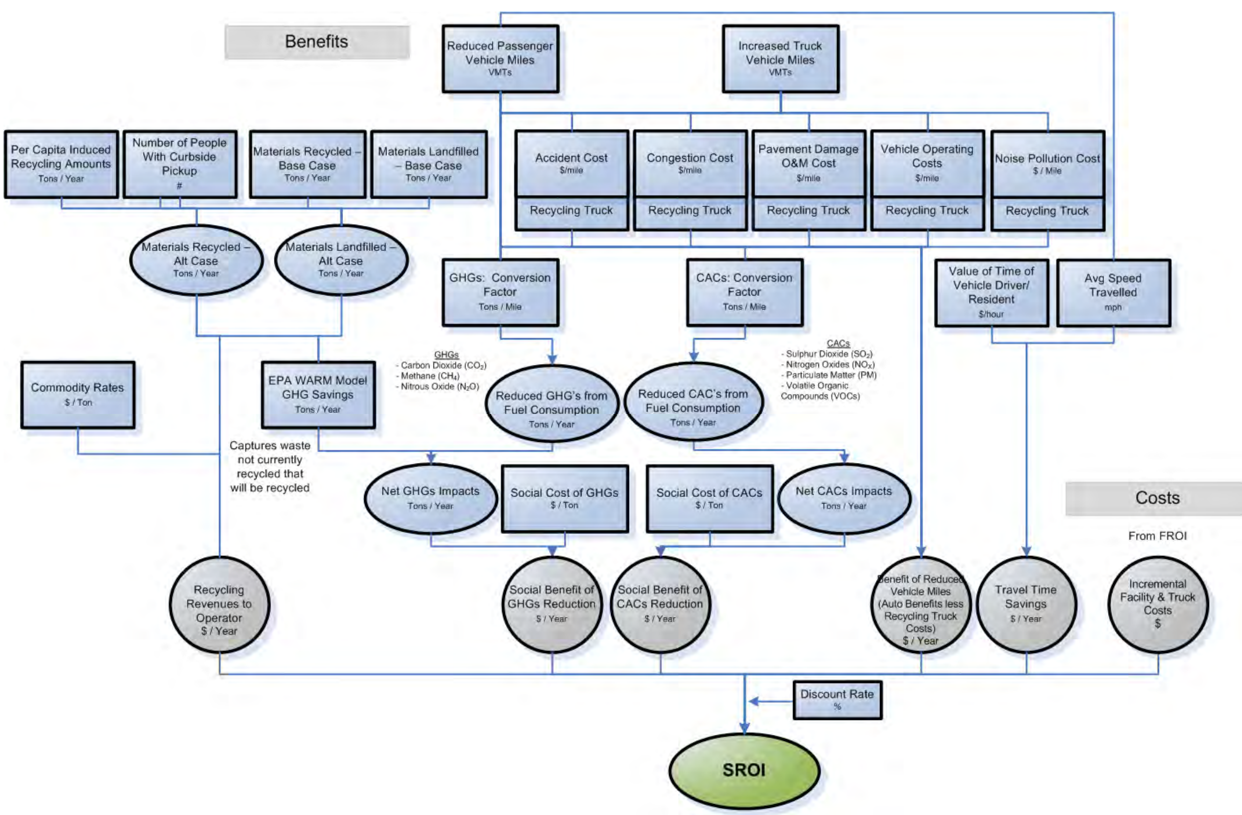
From a FROI perspective (cash-only), the mixed-stream curbside program has no direct impact to the City of Galveston. The monthly fee levied by Republic on each household does not affect the municipal budget.

Figure 5: Curbside Recycling – FROI

None

Figure 6 identifies the impacts that affect society as a whole. Benefits to this alternative are a result of reduced residential vehicle miles travelled (VMTs) to the ECO Center and from induced recycling amounts due to the convenience of the curbside pick-up program. Changes in VMTs are attributed to both the reduction in personal trips taken to drop off recycling and the increase in recycling truck miles from the creation of the curbside pick-up program. VMT related impacts include: GHG and CAC emissions, accident costs, vehicle operating costs, congestion costs, pavement damage O&M costs, and noise pollution costs. The US DOT provides guidance regarding most of these values. As there is a reduction in personal trips travelled, there is also a benefit associated with reduced travel time. From a recycling volume perspective, HDR obtained literature on induced recycling rates from curbside pick-up programs and used a benefits transfer methodology to imply changes in recycling rates for Galveston.[3] Methodology included using EPA data on municipal solid waste generation and recovery rates by material allowed HDR to convert the materials listed in the paper to those recycled in Galveston's program. Taking the ratio of paper to the sum of the other materials yields a multiplier (paper accounts for 88% of recovered materials when the material group is limited to aluminum, glass, plastic, and paper). This value is then multiplied by the average increase in annual pounds/capita of the other three materials when curbside recycling is increased. In order to quantify the environmental benefits related to increased recycling rates, the EPA WARM Model was used and ran by HDR to account for life-cycle changes in greenhouse gas emissions (GHGs). In the context of integrated waste management systems, a life-cycle assessment (LCA) tracks the energy and environmental burdens associated with all stages of upstream processing to the downstream waste management activities (waste collection, transfer, materials recovery, treatment, and final disposal). These GHG impacts were then monetized by HDR. The SROI total encompasses FROI outputs.

Figure 6: Curbside Recycling – SROI



Streetscape and Safety Improvements

Figure 7 identifies the specific financial benefits and costs associated with the streetscape and safety improvements case study. This case study analyzes two Streetscape and Safety Improvements

[3] Beatty, Berck, Shimshack; Curbside Recycling in the Presence of Alternatives; Tufts University and California Department of Conservation, Division of Recycling; December 2006

alternatives, which are based on two specific recommendations from the H-GAC Livable Centers Study[4]; Recommendation #2 and Recommendation #4. There are no direct financial benefits to the City, although there are capital costs related to widening sidewalks; constructing bulb outs and curb extensions; improving curb ramps; creating shorter crosswalks; providing street lighting and furnishings; creating on-street parking; and planting trees. Recommendation #4 has an added component relating to improving existing building facades. Capital costs were provided in detail in the Livable Centers Study and used in this analysis (updated to 2013$).

Figure 7: Streetscape and Safety Improvements – FROI

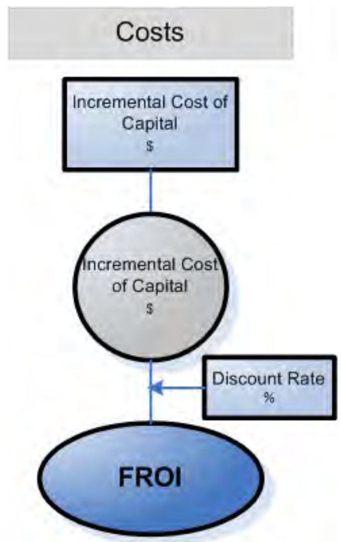
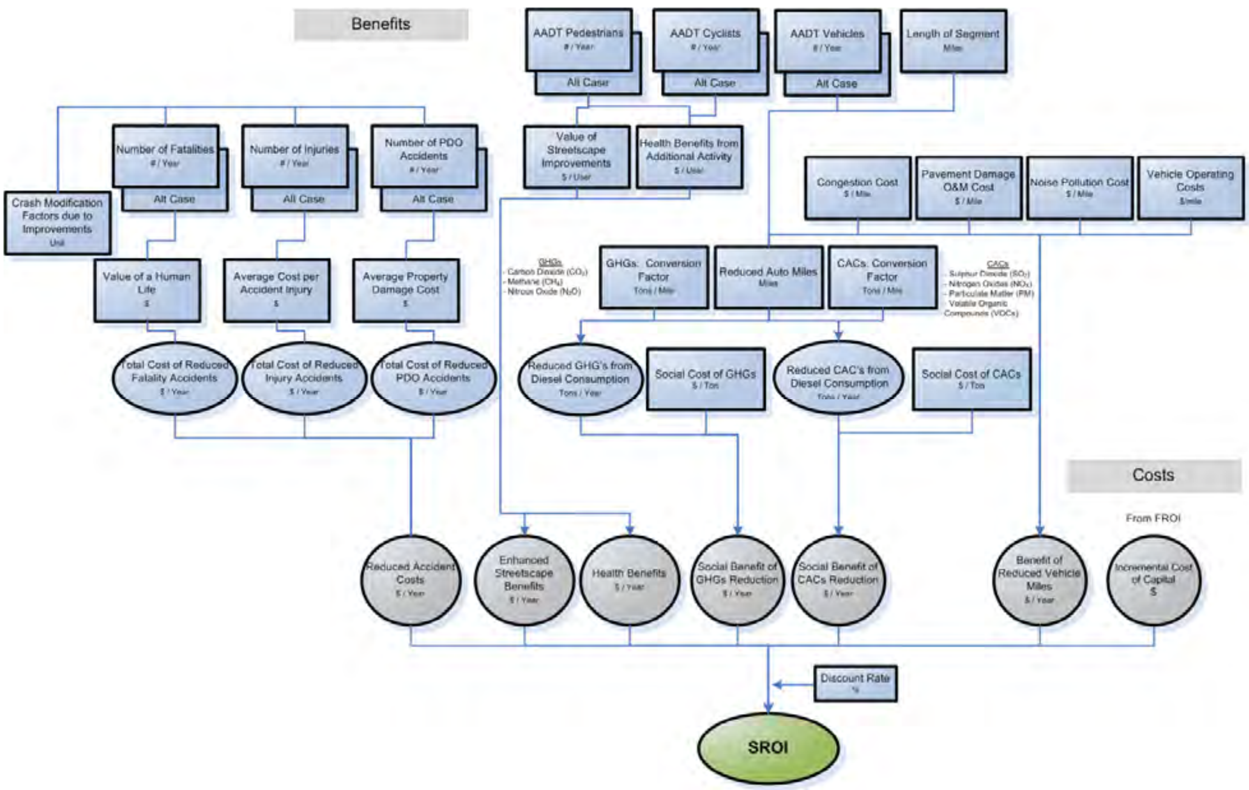


Figure 8 identifies the impacts that are pertinent to society as a whole. The analysis accounted for a variety of additional benefits relating to improved safety, streetscape enhancements, and modal shift from cars to bicycles and walking. Although the benefits categories attributed to each recommendation were identical, the magnitude of those benefits was different because of the different number of users and a different mode shift (Recommendation #4 had higher pedestrian, cyclist, and auto counts, as well as double the mode shift and therefore more benefits). HDR monetized the following benefits: Reduction in Social Cost of Accidents; Enhanced Streetscape Value; Health Benefits Due to Improved Facilities; Reduction in Social Cost of Pavement Damage; Reduction in Social Cost of Traffic Noise; Reduction in Social Cost of Traffic Congestion; Personal Vehicle Operating Cost (VOC) Savings; Green House Gas Social Savings from Decreased Car Mileage; and Criteria Air Contaminant Social Savings from Decreased Car Mileage. The SROI total encompasses FROI outputs. The auto traffic counts, bicycle counts, and mode shift rates were provided by HDR transportation engineers and planners. The values were extrapolated from TxDOT counts using engineering judgment which considered the existing road network, local origins/destinations, and available area traffic volumes. Pedestrian counts were based on counters placed on specific streets segments by the City and H-GAC and were adjusted to reflect

[4] H-GAC Livable Centers Study for the Galveston Housing Authority in Conjunction with Historic Downtown Strand Seaport Partnership, December 2012

opinions concerning network and seasonality impacts. The SROI analysis was limited to the direct improvements to which the capital costs were based off of in the H-GAC Livable Centers Study, and therefore did not take into account any hypothetical future redevelopment activity. Safety improvements were based on crash modification factors from the FHWA.

Figure 8: Streetscape and Safety Improvements – SROI



2.2 Additional Background Information

Further information relating to the inputs used in the structure & logic diagrams can be found in Appendix B and C.

Appendix A provides a useful glossary of terms.

Appendix B provides a list of input parameters utilized to populate the SROI model. Values were obtained from various sources listed in the notes.

Appendix C provides descriptions of the methodology behind the monetized social values of greenhouse gases, criteria air contaminants, streetscape enhancements, nuclear energy use, and water.

Appendix D is the SROI Primer that explains the SROI process more in-depth.

Appendix E is the tutorial on utilizing the SROI models.

3. FROI & SROI ANALYSIS RESULTS

The tables below provide a summary of the study's financial results, split by case study. The results are all mean expected values resulting from a Monte Carlo simulation, using 10,000 iterations with @Risk software. It is important to note the results are location/project specific for the City and not necessarily transferable to other regions or projects. This analysis utilized a unique combination of site-specific costs, electricity grid composition, utility rates, and other assumptions that are not applicable to other jurisdictions. All monetary values were converted to constant 2013 U.S. dollars by using the Consumer Price Index (CPI) and relative discount factors. This conversion ensures meaningful comparison of dollar streams over the project lifecycle. Additionally, the model uses a 3% real discount rate; this rate was based on inputs provided by the City of Galveston. Unless stated otherwise, the useful life of the equipment is assumed to be 25 years, and the study period is 26 years (2013 to 2038), with each scenario up-and-running in 2014.

Each case study results section includes two tables. The first table includes two sets of metrics: the first box (blue) provides the mean expected FROI results (traditional cash-only results). The second box (green) provides the mean expected SROI results - i.e. those that correspond to the triple bottom line. The second table provides a further breakdown of the present value (PV) of the costs and benefit categories which sum to the NPVs found in the first table. The analysis covers a period of 26 years (2013-2038).

Water Conservation:

Table 1: Summary of Results – Water Reuse Facility ($2013)

Financial Metrics		
Metrics	**Mean Values**	**Description**
FROI		
Net Present Value (NPV)	**($15,264,720)**	PV Benefits - PV All Costs
Discounted Payback Period	**N/A**	Time in years until positive discounted cash flow
Internal Rate of Return (%)	**N/A**	Discount rate which would make NPV = 0
Benefit to Cost Ratio	**0.11**	PV Benefits / PV Costs
SROI		
Net Present Value (NPV)	**($9,163,378)**	PV Benefits - PV All Costs
Discounted Payback Period	**N/A**	Time in years until positive discounted cash flow
Internal Rate of Return (%)	**N/A**	Discount rate which would make NPV = 0
Benefit to Cost Ratio	**0.27**	PV Benefits / PV Costs

Note: 'Reduced Water Utility Revenues' is not Included in the SROI Analysis.

From a FROI perspective (cash-only), the water reuse project has a NPV of roughly $-15.3M; meaning the present value of the total costs to this project exceed that of its total benefits. The Benefit to Cost Ratio (BCR) is 0.11; meaning the costs are roughly nine times larger than the benefits. The City will incur capital costs related to this investment of roughly $12.5M as shown in Table 2 below. The current contract with GCWA uses fixed rate structure (also called 'take or pay'), whereby the City is obligated to buy a certain amount of water whether it gets consumed or not. Since the City is selling the reuse water at a lower rate than the potable water to UTMB, the City loses revenue ($-4.7M) which it cannot recoup due to its contractual structure with GCWA. However, there are benefits relating to the reduced annual O&M costs of treating the reuse water versus the potable water ($1.1M), and as the useful life of the RO facility exceeds the 25 year study period, the residual value of the equipment needs to be included as a benefit at the end of the study period ($818K).

When taking into account the benefits to society from reducing potable water use, the SROI NPV remains negative, but increases to $-9.2M. The lost revenue counted as a cost in the FROI to the City is excluded from the SROI, since from society's point of view, it's simply a transfer of resources (UTMB saves money, but the City looses money). The value of the social savings from reduced potable water use ($1.4M), although valuable, is not enough to offset the high capital costs of this investment.

Table 2: Present Value of Costs and Benefits Breakdown – Water Reuse Facility ($2013)

Financial Metrics Specific Impacts (Mean Values)	Water Reuse Facility
Metrics	Values
SROI	
Benefits	
Incremental Operations and Maintenance Savings:	$1,083,412
Utility Savings from Gallons Switched to Non-Potable Water:	$0
Electricity Savings:	$0
Residual Value:	$817,963
Social Savings of GHGs decrease:	$0
Social Savings of CACs decrease:	$0
Social Savings of State Nuclear Power Reduction:	$0
Social Savings of Potable Water Reduction:	$1,435,245
Costs	
Incremental Capital Costs:	$12,500,000
Reduced Water Utility Revenues	$4,666,095
Incremental Operations and Maintenance Costs:	$0

Note: 'Reduced Water Utility Revenues' is not Included in the SROI Analysis.

Curbside Recycling Program:

Table 3: Summary of Results – Curbside Recycling Program ($2013)

Financial Metrics		
Metrics	**Mean Values**	**Description**
FROI		
Net Present Value (NPV)	**$0**	PV Benefits - PV All Costs
Discounted Payback Period	**N/A**	Time in years until positive discounted cash flow
Internal Rate of Return (%)	**N/A**	Discount rate which would make NPV = 0
Benefit to Cost Ratio	**N/A**	PV Benefits / PV Costs
SROI		
Net Present Value (NPV)	**$2,335,121**	PV Benefits - PV All Costs
Discounted Payback Period	**20 y 6 m**	Time in years until positive discounted cash flow
Internal Rate of Return (%)	**55%**	Discount rate which would make NPV = 0
Benefit to Cost Ratio	**1.2**	PV Benefits / PV Costs

From a FROI perspective (cash-only), the curbside program has no direct impact to the City of Galveston. The monthly fee levied by Republic on each household does not affect the municipal budget.

From a SROI perspective (triple bottom line), the project appears to be a good investment. The NPV is $2.3M, the IRR is 55%, the project pays for itself within 21 years, and the BCR is 1.2, meaning the benefits are roughly 20% higher than the costs. Although offset by increased recycling truck miles, total VMTs are reduced from reduced drop-off activity by residents. Changes in VMTs directly relate to values attributed to accidents, pavement damage, traffic noise, and congestion – recycling trucks and personal vehicles have different corresponding VMT values for each. When the increase in recycling truck VMTs and reduced personal vehicle VMTs are both accounted for, there is a net cost over the study period ($-17K) However, less residential trips means saved travel time ($104K), and lower vehicle operating costs ($102K). There are more GHG and CAC emissions produced by the recycling trucks than are saved from reduced residential travel. The induced recycling tonnage converted from the landfill from the curbside pick-up program saved a considerable amount of CO2 equivalents. Total GHG savings from decreased car mileage and induced recycling, net of increased recycling truck miles was roughly $1.9M. Two additional benefits to increased recycling rates included: the proxy value for recycled materials ($575K) – which was the additional recyclables revenue value that would have otherwise have been landfilled and not existed; and the landfill offset value ($578K) – which was the value of the avoided tipping fees from less landfill tonnage.

Table 4: Present Value of Costs and Benefits Breakdown – Curbside Recycling Program ($2013)

Financial Metrics Specific Impacts (Mean Values)	Curbside Recycling Program
Metrics	**Values**
SROI	
Benefits	
Savings from Avoided Costs in Operating the ECO Center (Cost less Materials Reven	$0
Residual Value	$0
Green House Gas Social Savings from Decreased Car Mileage and Induced Recycling	$1,932,527
Criteria Air Contaminant Social Savings from Decreased Car Mileage	$608
Proxy Value For Recycled Materials	$574,857
Reduction in Social Cost of Accidents	$7,292
Reduction in Social Cost of Pavement Damage	$449
Reduction in Social Cost of Traffic Noise	$554
Reduction in Social Cost of Traffic Congestion	$32,721
Travel Time Saved from Personal Trip Reduction	$104,350
Personal Vehicle Operating Cost (VOC) Savings	$101,811
Landfill Offset Value	$577,713
Costs	
Additional Capital Expenditures	$471,713
Increased Annual O&M Costs (Operator) Excluding Truck	$0
Recycling Truck Operating Cost (VOC)	$275,805
Increased Social Cost of Accidents - Trucking	$5,224
Increased Social Cost of Pavement Damage - Recycling Truck	$24,726
Increased Social Cost of Traffic Noise - Recycling Truck	$4,272
Increased Social Cost of Traffic Congestion - Recycling Truck	$24,243
Green House Gas Social Costs - Recycling Truck	$17,395
Criteria Air Contaminant Social Costs - Recycling Truck	$11,748

Streetscape and Safety Improvements:

Table 5: Summary of Results – Streetscape and Safety Improvements Alternatives ($2013)

Financial Metrics			
	Recommendation #2	Recommendation #4	
Metrics	Mean Values	Mean Values	Description
FROI			
Net Present Value (NPV)	($2,957,928)	($3,469,179)	PV Benefits - PV All Costs
Discounted Payback Period	N/A	N/A	Time in years until positive discounted cash flow
Internal Rate of Return (%)	N/A	N/A	Discount rate which would make NPV = 0
Benefit to Cost Ratio	0.00	0.00	PV Benefits / PV Costs
SROI			
Net Present Value (NPV)	($1,286,926)★	($373,851)★	PV Benefits - PV All Costs
Discounted Payback Period	N/A	N/A	Time in years until positive discounted cash flow
Internal Rate of Return (%)	N/A	3%	Discount rate which would make NPV = 0
Benefit to Cost Ratio	0.56	0.89	PV Benefits / PV Costs

★***Caveat**: The main drivers to the benefits are the number of users (pedestrians, cyclists, and auto traffic) on the specific street segments and the reductions in accidents. The SROI analysis in this case was limited to the direct improvements to which the capital costs were based off of in the H-GAC Livable Centers Study, and therefore did not take into account any hypothetical future redevelopment activity. It can be said that the benefits would be amplified if these two investments were part of a broader redevelopment project in the immediate area (transformation of a larger connected area) or if similar improvements were completed on street segments that are more widely utilized. As population density grows, so do the number of users in the area and subsequently so would the benefits of these streetscape and safety improvements; however, the costs remain the same. At some point, with enough users, this investment generates a positive return. In other words, if these improvements were completed in a more highly developed area, there would be a certainty of positive returns due to the large number of users.*

From a FROI perspective, the cash impacts to the City are strictly costs and therefore the NPVs of Recommendations #2 & #4 are respectively $-2.96M and $-3.47M and are based solely on the capital costs.

From a SROI perspective (triple bottom line), the analysis accounted for a variety of additional benefits relating to improved safety, streetscape enhancements, and modal shift from cars to bicycles and walking. HDR adjusted the 2013 pedestrian street counts (and subsequently cyclist counts) upwards by 25% to reflect the sentiment by stakeholders that the counts seemed low. Although the benefits categories attributed to each recommendation were identical, the magnitude of those benefits was different because of the different number of users and a different mode shift (Recommendation #4 had higher pedestrian, cyclist, and auto counts, as well as twice the mode shift and therefore additional benefits). HDR monetized the following benefits: Reduction in Social Cost of Accidents; Enhanced Streetscape Value; Health Benefits Due to Improved Facilities; Reduction in Social Cost of Pavement Damage; Reduction in Social Cost of Traffic Noise; Reduction in Social Cost of Traffic Congestion; Personal Vehicle Operating Cost (VOC) Savings; Green House Gas Social Savings from Decreased Car Mileage; and Criteria Air Contaminant Social Savings from Decreased Car Mileage. Aggregate benefits from these nine categories of impacts added roughly $1.6M to Recommendation #2 and $3.1M to

Recommendation #4 over the study period. That being said, the NPVs are still negative, although Recommendation #4 marginally so.

The main drivers to the benefits are the number of users on the specific street segments and the reductions in accidents. It can be said that the benefits would be amplified if these two investments were part of a broader redevelopment project in the immediate area (transformation of a larger connected area) or if similar improvements were completed on street segments that are more widely utilized.

Table 6: Present Value of Costs and Benefits Breakdown – Streetscape and Safety Improvements Alternatives ($2013)

Financial Metrics	Recommendation #2	Recommendation #4
Specific Impacts (Mean Values)		
Metrics	Values	Values
SROI		
Benefits		
Incremental Operating & Maintenance Savings	$0	$0
Residual Value:	$0	$0
Reduction in Social Cost of Accidents	$1,271,948	$1,672,798
Enhanced Streetscape Value	$274,832	$381,712
Health Benefits Due to Improved Facilities	$46,434	$301,818
Reduction in Social Cost of Pavement Damage	$248	$2,352
Reduction in Social Cost of Traffic Noise	$305	$2,899
Reduction in Social Cost of Traffic Congestion	$18,039	$171,367
Personal Vehicle Operating Cost (VOC) Savings	$56,121	$533,154
Green House Gas Social Savings from Decreased Car Mileage	$2,740	$26,046
Criteria Air Contaminant Social Savings from Decreased Car Mileage	$335	$3,183
Costs		
Incremental Capital Costs:	$2,957,928	$3,469,179
Incremental Operations and Maintenance Costs:	$0	$0

Sensitivity Analysis:

HDR also ran a sensitivity analysis based on double the pedestrian and cyclist counts in the normal case above. This was done to elicit further understanding in the case of additional development along the street segments, or simply account for greater volume. Both alternatives show improved results, with Recommendation #4 becoming very close to a positive return – the BCR is 0.98, which means costs are marginally exceeding the benefits of this investment. One could assert, given the inherent uncertainty built into the analysis, that this scenario essentially reaches the break-even point. The main drivers to the benefits are the number of users on the specific street segments and the reductions in accidents. With an even greater number of users and/or reduction in accidents, this investment would be more likely to yield a positive net present value.

Table 7: Summary of Results – Streetscape and Safety Improvements Alternatives – Sensitivity: Double Ped/Bike Counts ($2013)

Financial Metrics			
	Recommendation #2	Recommendation #4	
Metrics	Mean Values	Mean Values	Description
FROI			
Net Present Value (NPV)	($2,957,928)	($3,469,179)	PV Benefits - PV All Costs
Discounted Payback Period	N/A	N/A	Time in years until positive discounted cash flow
Internal Rate of Return (%)	N/A	N/A	Discount rate which would make NPV = 0
Benefit to Cost Ratio	0.00	0.00	PV Benefits / PV Costs
SROI			
Net Present Value (NPV)	($1,021,637)★	($84,704)★	PV Benefits - PV All Costs
Discounted Payback Period	N/A	N/A	Time in years until positive discounted cash flow
Internal Rate of Return (%)	N/A	3%	Discount rate which would make NPV = 0
Benefit to Cost Ratio	0.65	0.98	PV Benefits / PV Costs

★***Caveat****: The main drivers to the benefits are the number of users (pedestrians, cyclists, and auto traffic) on the specific street segments and the reductions in accidents. The SROI analysis in this case was limited to the direct improvements to which the capital costs were based off of in the H-GAC Livable Centers Study, and therefore did not take into account any hypothetical future redevelopment activity. It can be said that the benefits would be amplified if these two investments were part of a broader redevelopment project in the immediate area (transformation of a larger connected area) or if similar improvements were completed on street segments that are more widely utilized. As population density grows, so do the number of users in the area and subsequently so would the benefits of these streetscape and safety improvements; however, the costs remain the same. At some point, with enough users, this investment generates a positive return. In other words, if these improvements were completed in a more highly developed area, there would be a certainty of positive returns due to the large number of users.*

Table 8: Present Value of Costs and Benefits Breakdown – Streetscape and Safety Improvements Alternatives – Sensitivity: Double Ped/Bike Counts ($2013)

Financial Metrics Specific Impacts (Mean Values)	Recommendation #2	Recommendation #4
Metrics	Values	Values
SROI		
Benefits		
Incremental Operating & Maintenance Savings	$0	$0
Residual Value:	$0	$0
Reduction in Social Cost of Accidents	$1,271,899	$1,672,798
Enhanced Streetscape Value	$540,133	$670,859
Health Benefits Due to Improved Facilities	$46,434	$301,818
Reduction in Social Cost of Pavement Damage	$248	$2,352
Reduction in Social Cost of Traffic Noise	$305	$2,899
Reduction in Social Cost of Traffic Congestion	$18,038	$171,367
Personal Vehicle Operating Cost (VOC) Savings	$56,121	$533,154
Green House Gas Social Savings from Decreased Car Mileage	$2,741	$26,046
Criteria Air Contaminant Social Savings from Decreased Car Mileage	$335	$3,183
Costs		
Incremental Capital Costs:	$2,957,926	$3,469,179
Incremental Operations and Maintenance Costs:	$0	$0

Breakeven Analysis:

HDR conducted a breakeven analysis to determine the approximate numbers of pedestrians and cyclists in the area (in the base case without the improvements) which would generate enough benefits to offset the costs of the streetscape and safety improvements (Net Present Value (NPV) = 0, whereby the discounted costs equal the discounted benefits). For Recommendation #2, the City would need 7.35 times more pedestrians and cyclists to generate a NPV=0, and for Recommendation #4, the City would need 2.87 times more pedestrians and cyclists. In other words, Recommendation #2 would need 1,707 users (1,623 pedestrians and 168 cyclists per day) and Recommendation #4 would need 734 users (697 pedestrians and 74 cyclists per day) to breakeven.

S-Curves:

Figures 9-12 provide risk-adjusted information (in the form of S-curves) for FROI and SROI with regards to the Net Present Value (NPV). The S-Curves identify the probability distributions from each perspective for the alternative. The median (50% probability) NPV for each of the alternatives is slightly different than the mean (average) NPV values provided in the results Table 1 above. The purpose of an S-Curve is to show the range of possibilities, expected outcomes, and their probability of occurrence. The NPV calculation is derived by discounting the project's cash flows over a 26-year period (2013-2038).

Water Conservation: In Figure 9, both the FROI and SROI S-curves have a 100% probability that the present values of all the positive cash flows (benefits) are less than the present value of all the negative cash flows (costs). This means there's a 100% chance of having a negative NPV from both a cash-only and triple bottom line perspective, even though the SROI is roughly $6.1M higher.

The median NPV and 80% confidence interval ranges (between the 10th and 90th percentile) are:

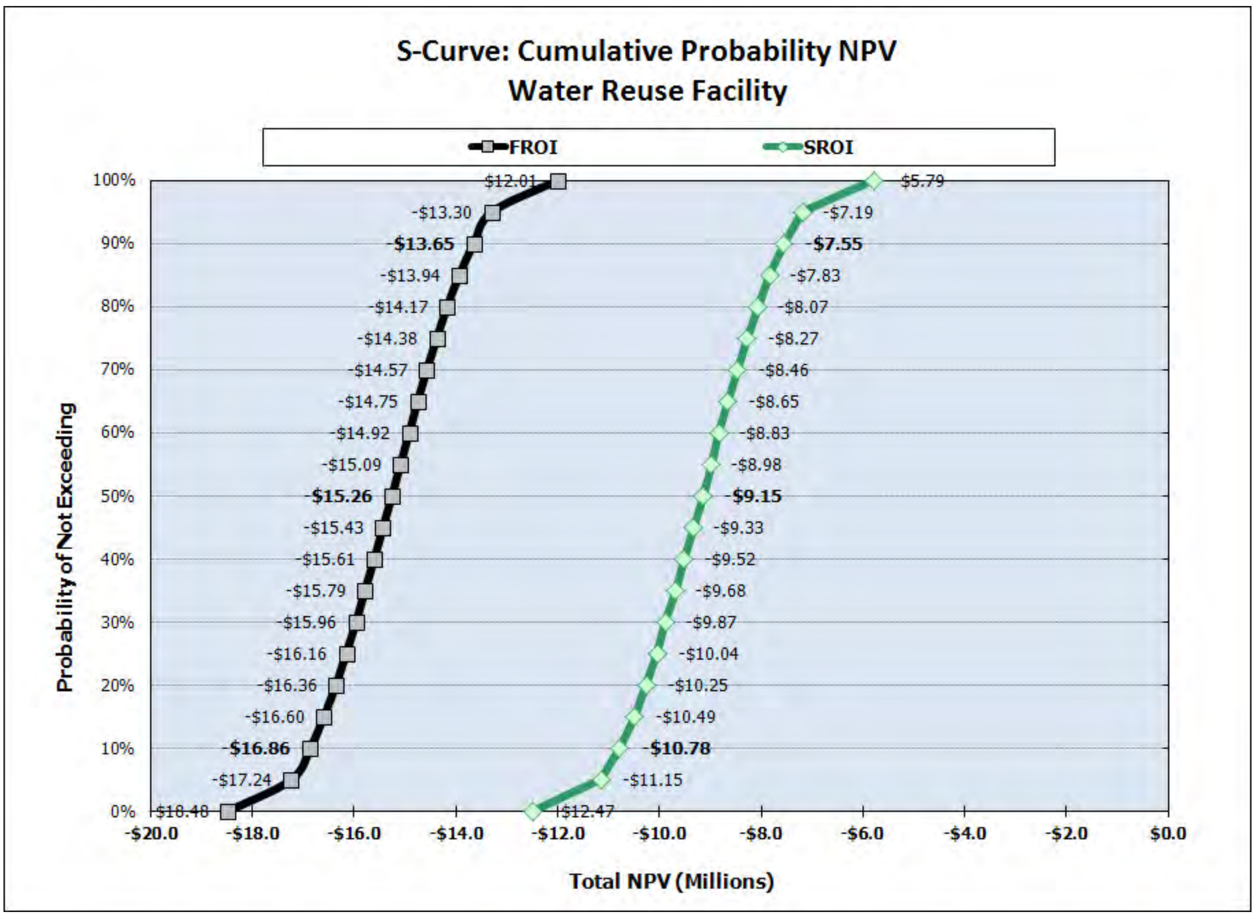
FROI

- Water Reuse: $-15.26M (median of 50th percentile); $-16.86M (10th percentile) and $-13.65M (90th percentile)

SROI

- Water Reuse: $-9.15M (median of 50th percentile); $-10.78 (10th percentile) and $-7.55 (90th percentile)

Figure 9: NPV S-Curves: Water Reuse Facility



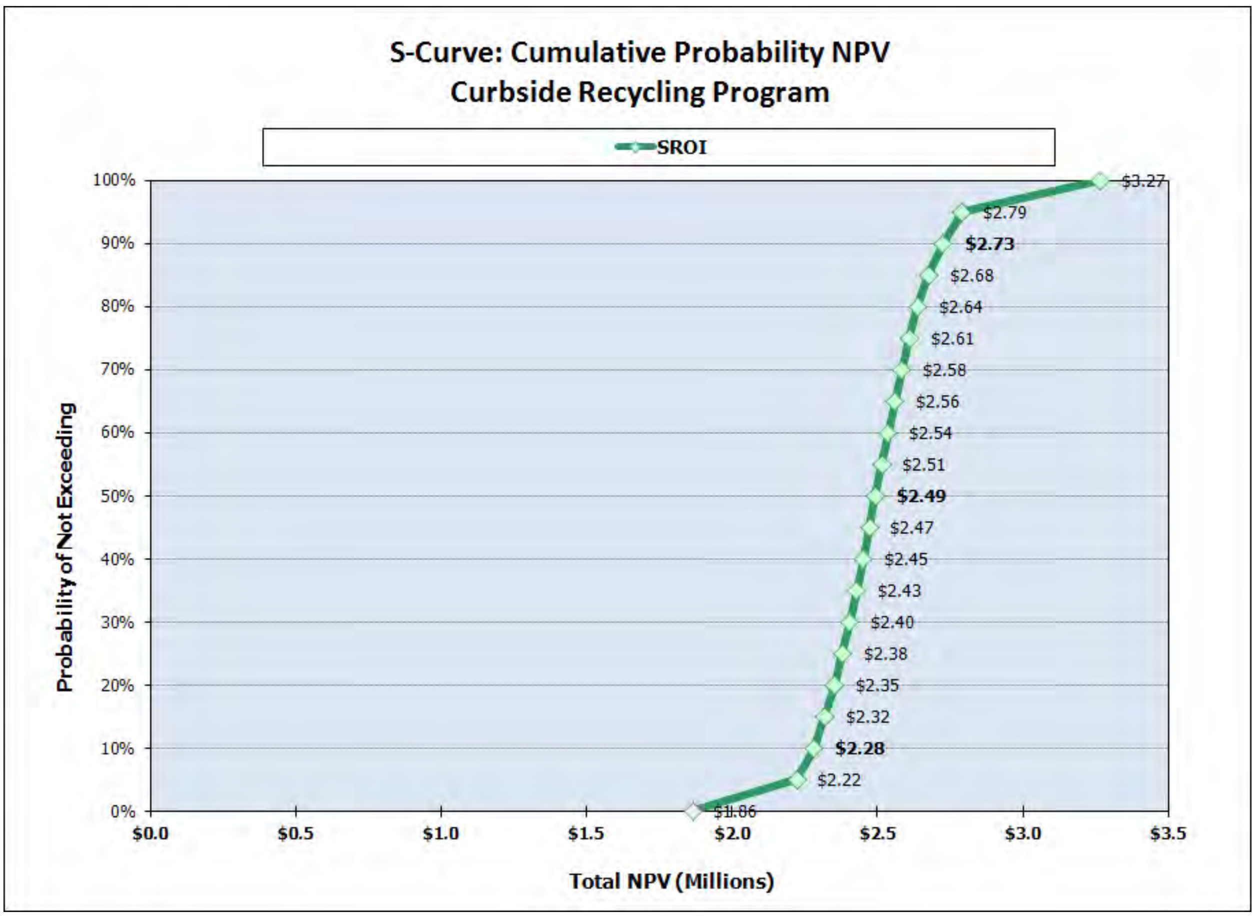
Curbside Recycling Program: In Figure 10, there are no impacts from a cash standpoint to the City, and thus no S-Curve. However, the SROI S-Curve has a 100% probability of having a positive NPV - in this case the social and environmental benefits from the induced recycling and reduced private trips outweigh the costs of the recycling truck and increased the social and environmental benefits costs relating to increased recycling truck miles.

The median NPV and 80% confidence interval ranges (between the 10th and 90th percentile) are:

SROI

- Curbside Recycling Program: $2.49M (median of 50th percentile); $2.28M (10th percentile) and $2.73M (90th percentile)

Figure 10: NPV – S-Curve: Curbside Recycling Program



Streetscape and Safety Improvements: In Figure 10, we can see that from a cash-only standpoint, both FROI curves for the alternatives have a 100% probability of having a negative NPV. However, when taking into account the social and environmental benefits, the SROI curves move to the right. In this case, due to the greater user count and higher mode shift factor, Recommendation #4 shows a higher return. In fact, although Recommendation #2 has 0% chance of being positive under the current assumptions, it appears the Recommendation #4 has a 15% chance of becoming positive.

The median NPV and 80% confidence interval ranges (between the 10th and 90th percentile) are:

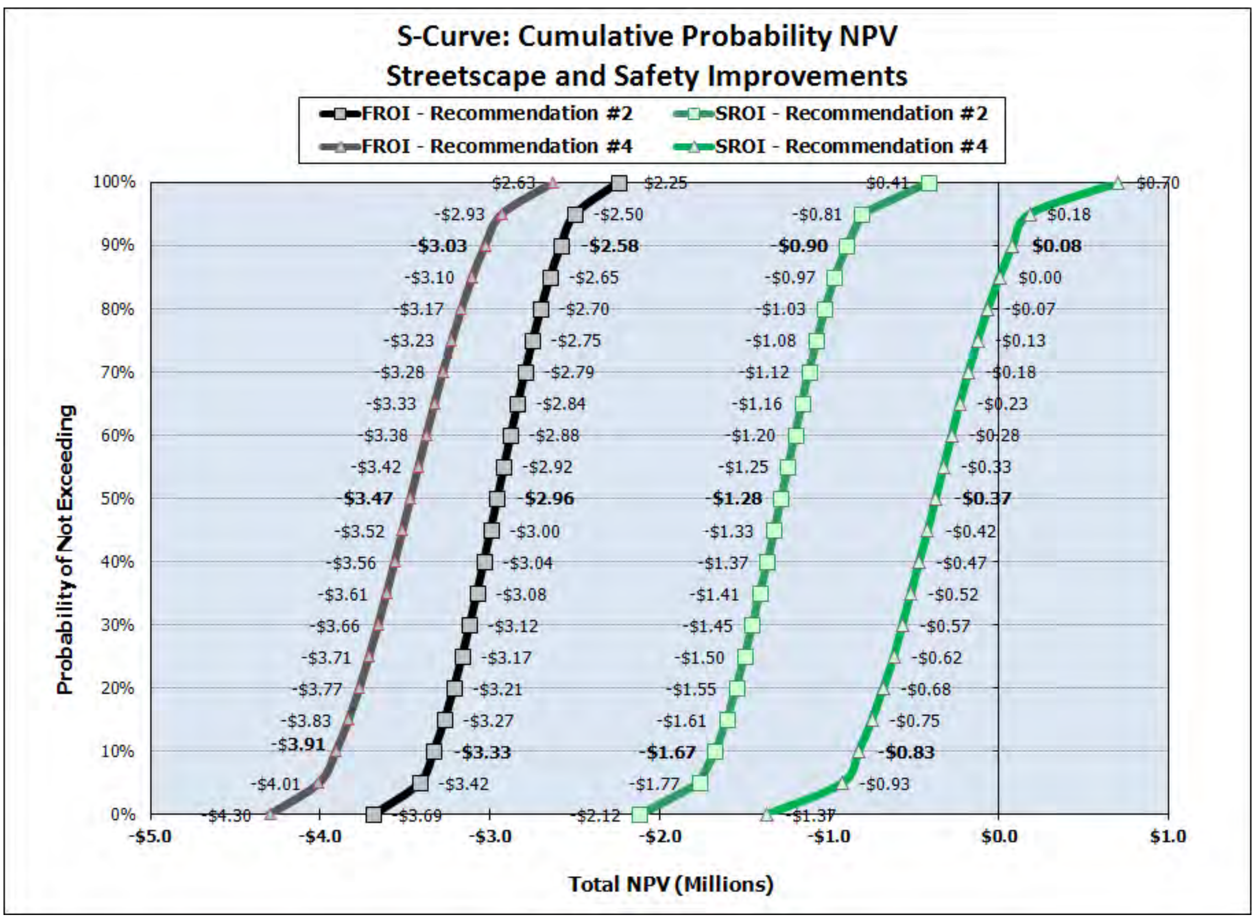
FROI

- Streetscape and Safety Improvements - Recommendation #2: $-2.96M (median of 50th percentile); $-3.33M (10th percentile) and $-2.58M (90th percentile)
- Streetscape and Safety Improvements - Recommendation #4: $-3.47M (median of 50th percentile); $-3.91M (10th percentile) and $-3.03M (90th percentile)

SROI

- Streetscape and Safety Improvements - Recommendation #2: $-1.28M (median of 50th percentile); $-1.67M (10th percentile) and $-0.90M (90th percentile)
- Streetscape and Safety Improvements - Recommendation #4: $-0.37M (median of 50th percentile); $-0.83M (10th percentile) and $0.08M (90th percentile)

Figure 11: NPV – S-Curve: Streetscape and Safety Improvements Alternatives



APPENDIX A: GLOSSARY OF TERMS

Discounted Value: The discounted value is the present value of a future cash amount. The present value is determined by reducing its future value by the appropriate discount rate (interest rate used in determining the present value of future cash flows) for each unit of time between the times when the cash flow is to be valued to the time of the cash flow. To calculate the present value of a single cash flow, it is divided by one plus the interest rate (discount rate) for each period of time that will pass. This is expressed mathematically as raising the divisor to the power of the number of units of time.

Net Present Value (NPV): The net value that an investment or project adds to the value of the organization, calculated as the sum of the present value of future cash flows less the present value of the project's costs.

Discounted Payback Period (DPP): The period of time required for the return on an investment to recover the sum of the original investment on a discounted cash flow basis.

Internal rate of return (IRR): The discount rate at which the net present value of a project would be zero; represents the annualized effective compounded return rate which can be earned on the invested capital, and is compared relative to the cost of capital.

Benefit To Cost Ratio (BCR): The overall "value for money" of a project, expressed as the ratio of the benefits of a project relative to its costs, with both expressed in present-value monetary terms.

Sustainable Return on Investment (SROI): SROI is an enhanced form of Cost-Benefit Analysis (CBA) - it provides a triple-bottom line view of a project's economic results and goes even further by incorporating state-of-the-art risk analysis. SROI monetizes (converts to monetary terms) all relevant social and environmental impacts related to a given project, and provides the equivalent of traditional financial metrics.

Greenhouse Gases: A greenhouse gas (abbreviated GHG) is a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. The primary greenhouse gases in the Earth's atmosphere are water vapour, carbon dioxide, methane, nitrous oxide, and ozone. SROI monetizes carbon dioxide, methane, and nitrous oxide.

Criteria Air Contaminants: Criteria air contaminants (abbreviated CAC) are a set of air pollutants that cause smog, acid rain and other health hazards. CACs are typically emitted from many sources in industry, mining, transportation, electricity generation and agriculture. In most cases they are the products of the combustion of fossil fuels or industrial processes. The basis for monetizing the social impacts of criteria air contaminants was to primarily use the results from three reputable studies by the U.S. Department of Transportation, the European Commission, and Yale University. The main criteria air contaminants analyzed were Nitrogen Oxide (NOx), Volatile Organic Compounds (VOCs), Particulate Matter (PM), and Sulfur Dioxide (SO2). The latter two were further split and categorized into Rural, Urban, and Dense Urban.

Carbon Dioxide (C02): Carbon dioxide is a heavy colorless gas that does not support combustion and is absorbed from the air by plans in photosynthesis. Industrial carbon dioxide is produced mainly from six processes: Directly from natural carbon dioxide springs, where it is produced by the action of acidified water on limestone or dolomite; As a by-product of hydrogen production plants, where methane is converted to CO_2; From combustion of fossil fuels and wood; As a by-product of fermentation of sugar in the brewing of beer, whisky and other alcoholic beverages; From thermal decomposition of limestone, $CaCO_3$, in the manufacture of lime, CaO.

Nitrogen Oxides (NOx): Nitrogen oxides include a number of gases that are composed of oxygen and nitrogen. In the presence of sunlight these substances can transform into acidic air pollutants such as nitrate particles. The nitrogen oxides family of gases can be transported long distances in our atmosphere. Nitrogen oxides play a key role in the formation of smog (ground-level ozone). At elevated levels, NOx can impair lung function, irritate the respiratory system and, at very high levels, make breathing difficult, especially for people who already suffer form asthma or bronchitis.

Particulate Matter (PM): Particulate matter refers to tiny particles of solid or liquid suspended in a gas. Sources of particulate matter can be man made or natural. Some particulates occur naturally, originating from volcanoes, dust storms, forest and grassland fires, living vegetation, and sea spray. Human activities, such as the burning of fossil fuels in vehicles, power plants and various industrial processes also generate significant amounts of aerosols.

Volatile Organic Compound (VOC): Volatile organic compounds (VOCs) are a large and diverse family of chemicals that contain carbon and hydrogen. They can be emitted into indoor air from a variety of sources including cigarette smoke, household products like air fresheners, furnishings, vehicle exhaust and building materials such as paint, varnish and glues. Examples of VOCs are aldehydes, ketones, and hydrocarbons.

APPENDIX B: INPUTS

A range of uncertainty was applied to the following inputs, which were used to populate the Excel-based models for Galveston.

General Inputs

Input Name	Unit	Value
Study Period	Years	26
Location	City, State	Galveston, Texas
Base Date	Year	2013
Real Discount Rate	%	3%

General Inputs – Social Values of GHGs and CACs (2013 Only, Varies Annually)

Input Name	Unit	Value	Source/Comment
Social Cost of GHGs (Co2e)	$/Ton	$35.53	Risk adjusted value from three different sources. Median Value: Interagency Working Group on Social Cost of Carbon, US Government. For regulatory impact analysis under Executive Order 12866. 2010; Low Value: Nordhaus' 2008 book "A Question of Balance" represents a conservative estimate; High value: 2006 "Stern Review" study, commissioned by the U.K. government.
Social Cost of CACs (NOx)	$/Ton	$6,371.55	Risk adjusted value from three different sources. Median Value: US DOT, NHSTA. Corporate Average Fuel Economy for MY 2012-MY 2016 Passenger Cars and Light Trucks; Low Value: Muller et al. Measuring the damages of air pollution in United States. 2007. ; High value: ECDG, "Damages per tonne emission of PM2.5, NH3, SO2, NOx and VOCs from each EU25 Member State (excluding Cyprus) and surrounding seas", Average for 25 Member States". 2005
Social Cost of CACs (SO2)	$/Ton	$32,696.98	Same as above.
Social Cost of CACs (PM)	$/Ton	$256,430.91	Same as above.
Social Cost of CACs (VOC)	$/Ton	$1,470.46	Same as above.

General Inputs: Conversion Factors for Vehicle Miles (2013 Only, Varies Annually)

Input Name	Unit	Value	Source/Comment
GHG Conversion Factor (Co2e) - Car	Tons / Mile	0.00039265	EPA Motor Vehicle Emission Simulator (MOVES) Model
CAC Conversion Factor (NOx) - Car	Tons / Mile	0.00000032	EPA Motor Vehicle Emission Simulator (MOVES) Model
CAC Conversion Factor (SO2) - Car	Tons / Mile	0.00000001	EPA Motor Vehicle Emission Simulator (MOVES) Model
CAC Conversion Factor (PM) - Car	Tons / Mile	0.00000000	EPA Motor Vehicle Emission Simulator (MOVES) Model
CAC Conversion Factor (VOC) - Car	Tons / Mile	0.00000006	EPA Motor Vehicle Emission Simulator (MOVES) Model
GHG Conversion Factor (Co2e) - Truck	Tons / Mile	0.00222849	EPA Motor Vehicle Emission Simulator (MOVES) Model
CAC Conversion Factor (NOx) - Truck	Tons / Mile	0.00001106	EPA Motor Vehicle Emission Simulator (MOVES) Model
CAC Conversion Factor (SO2) - Truck	Tons / Mile	0.00000002	EPA Motor Vehicle Emission Simulator (MOVES) Model
CAC Conversion Factor (PM) - Truck	Tons / Mile	0.00000044	EPA Motor Vehicle Emission Simulator (MOVES) Model
CAC Conversion Factor (VOC) - Truck	Tons / Mile	0.00000044	EPA Motor Vehicle Emission Simulator (MOVES) Model

Water Reuse Inputs

Input Name	Unit	Value	Source/Comment
Residual Value	$	$1,750,000	HDR calculation. Remaining value of capital at end of study period.
Incremental O&M Treatment Savings	$/Gal	$0.00017	HDR calculation based on the annual material and supplies cost from Enterprise Fund per gallon treated.
Reuse Water Displacing Potable Water Use	Gal Year	365,000,000	Range - 0.5MGD to 1.5MGD, so avg is 1MGD; City of Galveston

Input Name	Unit	Value	Source/Comment
Reuse Water Displacing Potable Water Use (Clients)	Gal / Year	91,250,000	0.5MGD for UTMB in the summer, reduced to 0.25MGD for annual avg
Potable Water Rate	$/Gal	$0.00533	City of Galveston
Reuse Water Rate	$/Gal	$0.00234	City of Galveston
Capital Cost: Ultrafiltration/RO Unit, Pump Station, GST plus Distribution System	$	$12,500,000	$3-$4M plus $8-10 estimated - City of Galveston
Social Cost of Water	$ / gal	$0.000178	HDR derivation based on the marginal economic value of streamflow and the water supply social value

Curbside Recycling Inputs

Input Name	Unit	Value	Source/Comment
Per Capita Induced Recycling Amounts	Tons / Year	807	Beatty, Berck, Shimshack; Curbside Recycling in the Presence of Alternatives; Tufts University and California Department of Conservation, Division of Recycling; December 2006. HDR Calculation.
Number of People with Curbside Pickup	#	19,943	US Census 2010. Number of Households in Galveston.
Materials Recycled - Base Case	Tons / Year	492	City of Galveston Recycling Center Tonnage Report
Materials Landfilled - Base Case	Tons / Year	6,116	City of Galveston
Reduced Passenger Vehicle Miles	VMTs / Year	19,070	HDR Calculation based on distance to ECO Center and number of trips to the ECO Center per year (City of Galveston)
Increased Truck Vehicle Miles	VMTs /Year	10,000	City of Galveston - Average distance 1 garbage truck travels/year + additional distance to recycling station.
Accident Cost	$/Mile	$0.0176	Source: Federal Highway Administration, 1997 Federal Highway Cost Allocation Study, Tables V-22, V-23, and V-24. Quoted in: National Highway Traffic Safety Administration, "Corporate Average Fuel Economy for FY 2011 Passenger Cars and Light Trucks", March 2009, Table VIII-5, page VIII-60

Congestion Cost	$/Mile	$0.0850	Same as above.
Pavement Damage O&M Cost	$/Mile	$0.0014	Same as above.
Noise Cost	$/Mile	$0.0015	Same as above.
Vehicle Operating Cost	$/Mile	$0.30	Based on Fuel Cost, Tire Cost, Repair and Maintenance Cost, Vehicle Depreciable Value, Oil Cost. Sources: (1)Final Regulatory Impact Analysis Corporate Average Fuel Economy for MY 2012-MY 2016 Passenger Cars and Light Trucks, March 2010, Table VIII-8 Economic Values Used for Benefits Computations (2007 Dollars), Table VIII-6 Adjustment of Forecast Retail Gasoline Prices to Reflect the Economic Value of Fuel Savings; (2) http://www.fhwa.dot.gov/asset/hersst/pubs/tech/tech05.cfm#table57.
WARM Model GHG Savings	Tons / Year	2469	EPA Waste Reduction Model (WARM) Model
Commodity Rates (Cardboard)	$/Ton	$63.00	City of Galveston
Commodity Rates (Paper)	$/Ton	$19.80	City of Galveston
Commodity Rates (Plastic)	$/Ton	$60.00	City of Galveston
Value of Time of Vehicle Driver/Resident	$/hour	$19.23	50% of the median wage rate. City of Galveston.
Avg Speed Travelled (Car)	mph	30	HDR Estimate
Avg Speed Travelled (Recycling Truck)	mph	10	US average garbage truck speed; "$20 Per Gallon: How the Inevitable Rise in the Price of Gasoline Will Change Our Lives for the Better"; Hachette Digital, Inc., Jul 15, 2009
Landfill Tipping Fee	$	$41.90	City of Galveston
Capital Cost - Recycling Truck	$/Truck	$180,000	Cost based on current industry value. Estimated average life of 12.5 Years.
Capital Cost - Recycling Bins	$	$99,715	$5.00 median cost per recycling bin. 19,943 households. Estimated Average life: 12.5 Years.

Streetscape and Safety Improvements Inputs – Recommendation #2

Input Name	Unit	Value	Source/Comment
Number of Fatalities (Base)	#/year	0.00	City of Galveston Calculation based on, Source: Texas Motor Vehicle Traffic Crash Statistics, Crashes & Injuries Cities & Towns, Texas Department of Transportation (2007-2011). Prorated to study area.
Number of Fatalities (Alt)	#/year	0.00	Same as above.
Number of Injuries (Base)	#/year	1.00	Same as above.
Number of Injuries (Alt)	#/year	0.63	Same as above.
Number of PDO Accidents (Base)	#/year	2.00	Same as above.
Number of PDO Accidents (Alt)	#/year	1.26	Same as above.
Crash Modification Factors due to Improvements (% reduction)	%/year	37%	FHWA, US DOT. HDR determined based on improvements.
Value of a Human Life	$	$6,328,443.33	TIGER 4 Resource Guidance: page 12
Average Cost per Accident Injury	$	$114,722.53	TIGER 4 Resource Guidance: page 12
Average Property Damage cost	$	$3,502.76	TIGER 4 Resource Guidance: page 12
AADT Pedestrians (Base)	#/day	274	Estimated based on avg pedestrians per day counted on Strand st segment, Market st segment, and 16th st segment in March 2013. Then multiplied by numbers of streets segments in the altenative and mulitplied by 1.25 to account for additional users.
AADT Pedestrians (Alt)	#/day	302	HDR estimate based on assumed total trips shifted out of vehicles, multiplied by assumed average vehicle occupancy of 1.4 persons per vehicle.
AADT Cyclists (Base)	#/day	32	HDR Estimation.
AADT Cyclists (Alt)	#/day	36	HDR estimate based on assumed total trips shifted out of vehicles, multiplied by assumed average vehicle occupancy of 1.4 persons per vehicle.

Input Name	Unit	Value	Source/Comment
AADT Vehicles (Base)	#/day	1200	Strand St: Estimated based on Strand Street 2006 volume multiplied by ratio of 2011 to 2006 Mechanic + Market Streets summed volumes; Mechanic St: 2011 Houston Urban Traffic Map, Texas Department of Transportation; Market St: Estimated based on engineering judgment considering existing road network, local origins/destinations, and available area traffic volumes.
AADT Vehicles (Alt)	#/day	1176	HDR estimate based on a 2% mode switch.
Length of Segment	Miles	1.2	Google Mapping Tool.
Value of Streetscape Improvements	$/User	$0.15	Guidance on the Appraisal of Walking and Cycling Schemes, TAG Unit 3.14.1, Department for Transport (United Kingdom), January 2010
Health Benefits from Additional Activity	$/User	$151.07	National Cooperative Highway Research Program (NCHRP Report 522) 2006
Congestion Cost	$ / Mile	$0.0850	Source: Federal Highway Administration, 1997 Federal Highway Cost Allocation Study, Tables V-22, V-23, and V-24. Quoted in: National Highway Traffic Safety Administration, "Corporate Average Fuel Economy for FY 2011 Passenger Cars and Light Trucks", March 2009, Table VIII-5, page VIII-60
Pavement Damage O&M Cost	$ / Mile	$0.0014	Same as above.
Noise Pollution Cost	$ / Mile	$0.0015	Same as above.
Vehicle Operating (VOC) Cost	$/Mile	$0.30	Based on Fuel Cost, Tire Cost, Repair and Maintenance Cost, Vehicle Depreciable Value, Oil Cost. Sources: (1)Final Regulatory Impact Analysis Corporate Average Fuel Economy for MY 2012-MY 2016 Passenger Cars and Light Trucks, March 2010, Table VIII-8 Economic Values Used for Benefits Computations (2007 Dollars), Table VIII-6 Adjustment of Forecast Retail Gasoline Prices to Reflect the Economic Value of Fuel Savings; (2) http://www.fhwa.dot.gov/asset/hersst/pubs/tech/tech05.cfm#table57.
Capital Costs (Total for all streets)	$	$2,957,926.15	H-GAC Livable Centers Study, pg. 16-17, inflated to 2013$

Streetscape and Safety Improvements Inputs – Recommendation #4

Input Name	Unit	Value	Source/Comment
Number of Fatalities (Base)	#/year	0.00	City of Galveston Calculation based on, Source: Texas Motor Vehicle Traffic Crash Statistics, Crashes & Injuries Cities & Towns, Texas Department of Transportation (2007-2011). Prorated to study area.
Number of Fatalities (Alt)	#/year	0.00	Same as above.
Number of Injuries (Base)	#/year	1.00	Same as above.
Number of Injuries (Alt)	#/year	0.63	Same as above.
Number of PDO Accidents (Base)	#/year	2.00	Same as above.
Number of PDO Accidents (Alt)	#/year	1.26	Same as above.
Crash Modification Factors due to Improvements (% reduction)	%/year	37%	FHWA, US DOT. HDR determined based on improvements.
Value of a Human Life	$	$6,328,443.33	TIGER 4 Resource Guidance: page 12
Average Cost per Accident Injury	$	$114,722.53	TIGER 4 Resource Guidance: page 12
Average Property Damage cost	$	$3,502.76	TIGER 4 Resource Guidance: page 12
AADT Pedestrians (Base)	#/Day	304	Estimated based on avg pedestrians per day counted on Strand st segment, Market st segment, and 16th st segment in March 2013
AADT Pedestrians (Alt)	#/Day	496	HDR estimate based on assumed total trips shifted out of vehicles, multiplied by assumed average vehicle occupancy of 1.4 persons per vehicle.
AADT Cyclists (Base)	#/Day	32	HDR Estimation.
AADT Cyclists (Alt)	#/Day	53	HDR estimate based on assumed total trips shifted out of vehicles, multiplied by assumed average vehicle occupancy of 1.4 persons per vehicle.

Input Name	Unit	Value	Source/Comment
AADT Vehicles (Base)	#/Day	3810	Strand St: Estimated based on Strand Street 2006 volume multiplied by ratio of 2011 to 2006 Mechanic + Market Streets summed volumes; Mechanic St: 2011 Houston Urban Traffic Map, Texas Department of Transportation; Market St: Estimated based on engineering judgment considering existing road network, local origins/destinations, and available area traffic volumes.
AADT Vehicles (Alt)	#/Day	3733	HDR estimate based on a 2% mode switch.
Length of Segment	Miles	1.8	Google Mapping Tool.
Value of Streetscape Improvements	$/User	$0.15	Guidance on the Appraisal of Walking and Cycling Schemes, TAG Unit 3.14.1, Department for Transport (United Kingdom), January 2010
Health Benefits from Additional Activity	$/User	$151.07	National Cooperative Highway Research Program (NCHRP Report 522) 2006
Congestion Cost	$ / Mile	$0.0850	Source: Federal Highway Administration, 1997 Federal Highway Cost Allocation Study, Tables V-22, V-23, and V-24. Quoted in: National Highway Traffic Safety Administration, "Corporate Average Fuel Economy for FY 2011 Passenger Cars and Light Trucks", March 2009, Table VIII-5, page VIII-60
Pavement Damage O&M Cost	$ / Mile	$0.0014	Same as above.
Noise Pollution Cost	$ / Mile	$0.0015	Same as above.
Vehicle Operating (VOC) Cost	$/Mile	$0.30	Based on Fuel Cost, Tire Cost, Repair and Maintenance Cost, Vehicle Depreciable Value, Oil Cost. Sources: (1)Final Regulatory Impact Analysis Corporate Average Fuel Economy for MY 2012-MY 2016 Passenger Cars and Light Trucks, March 2010, Table VIII-8 Economic Values Used for Benefits Computations (2007 Dollars), Table VIII-6 Adjustment of Forecast Retail Gasoline Prices to Reflect the Economic Value of Fuel Savings; (2) http://www.fhwa.dot.gov/asset/hersst/pubs/tech/tech05.cfm#table57.
Capital Costs (Total for all streets)	$	$3,469,180.45	H-GAC Livable Centers Study, pg. 26-27, inflated to 2013$

APPENDIX C: VALUATION METHODOLOGY

GHG Valuation Methodology:

As with all inputs used in its studies, HDR uses a probability distribution to represent the potential value for a ton of CO_2 (in this case a PERT distribution was used). In order to define the PERT distribution we require three key data points: an expected median or 50th percentile value, a low value representing the minimum realistic value and a high value representing the highest realistic value. In order to determine which would be the most appropriate data point, a meta-analysis of over 200 recent scientific estimates of the social cost of CO_2 was conducted.

For the upper and lower bounds, we used two well-established yet extreme views of the theoretical impact on the planet of an incremental ton of CO_2; the median value was generated under the auspices of several US Federal departments to assist agencies in regulatory impact analysis.

These values are based on the calculation of the expected damage caused by climate change including not only impacts on market outputs like food and forestry but also estimates of losses from non-market impacts. The most comprehensive damage studies include such factors as the greater intensity of hurricanes, impacts of changes in Temperature and precipitation on food production, ecosystem services, recreation, and the increased burdens of disease. The estimates also include adjustments for the risk of low-probability, high-consequence events such as abrupt climate change. The primary difference between these estimates is in the discount rate used to value future impacts.

This value is then escalated annually using rates derived from the Federal Interagency Working Group on Social Cost of Carbon. All values are in 2013 US dollars per short ton.

Greenhouse Gases	Expected Mean Value	Probability Distribution	$/Short Ton (2013 $)	Source
Carbon Dioxide		Median	$ 23.41	IWGSCC (2010)
CO_2 Equivalents	**$35.53**	Low	$ 13.23	Nordhaus (2008)
		High	$ 106.33	Stern Review (2006)

CAC Valuation Methodology:

The basis for monetizing the social impacts of criteria air contaminants was to primarily use the results from three reputable studies by the U.S. Department of Transportation, the European Commission, and Yale University. As with many other social impact quantification initiatives, the varying methodologies for each study yielded a wide array of results. Furthermore, some studies included certain compounds such as Ozone or Nitrogen Dioxide while others did not. For consistency purpose, only overlapping compounds were analyzed. The results from each study were ranked into a lower, median, and upper range and then analyzed with a PERT distribution to obtain a mean expected value. The main criteria air contaminants analyzed were Nitrogen Oxide (NOx), Volatile Organic Compounds (VOCs), Particulate

Matter (PM), and Sulfur Dioxide (SO2). The latter two were further split and categorized into Rural, Urban, and Dense Urban. The expected values of each CAC and the respective sources are listed below. All values are in 2013 US dollars per short ton.

Air Pollutants	**Expected Mean Value**	**Probability Distribution**	**\$/Short Ton (2013 \$)**	**Source**
Nitrogen Oxide		Median	\$5,390.76	US DOT (2009)
NO_x	**\$6,372**	Low	\$413.70	Muller et al. (2006)
Urban		High	\$16,252.60	European Commission DG Environment (2005)
Volatile Organic Compounds		Median	\$1,322.26	US DOT (2009)
VOCs	**\$1,470**	Low	\$689.49	Muller et al. (2006)
Urban		High	\$2,844.20	European Commission DG Environment (2005)
Particulate Matter		Median	\$294,965.89	US DOT (2009)
PM	**\$256,431**	Low	\$4,550.65	Muller et al. (2006)
Urban		High	\$354,171.21	European Commission DG Environment (2002)
Sulfur Dioxide		Median	\$31,530.84	US DOT (2009)
SO_2	**\$32,697**	Low	\$2,068.48	Muller et al. (2006)
Urban		High	\$67,990.04	European Commission DG Environment (2002)

Specific studies:

- Yale University Muller et al. (2006): Measuring the damages of air pollution in United States
- US DOT NHTSA Final Regulatory Impact Analysis (2009)
- U.S DOT (2003): HERS-ST v2.0
- European Commission DG Environment (2005): Damages per tonne emission of PM2.5, NH3, SO2, NOx and VOCs from each EU25 Member State (excluding Cyprus) and surrounding seas
- European Commission DG Environment (2002): Benefits Table database: Estimates of the marginal external costs of air pollution in Europe
- Matthews and Lave (2000): Applications of Environmental Valuation for Determining Externality Costs.

Streetscape Enhancement Valuation Methodology:

Urban planners often propose streetscape beautification and upgrade projects to improve street appearance and enhance its environment. Examples of projects and improved street attributes include upgraded street lighting, improved paving (more even surface and of better quality), plants, public art, benches, signage and informational boards, separated cycling areas/lanes, and changes in vehicle access. These projects are expected to create a more inviting, safe and comfortable public space for pedestrians and cyclists, residents and visitors to come to the area, to meet and interact with other people and businesses. The monetary value of people's enhanced personal enjoyment from a more pleasant street environment is the streetscape improvement benefit. This is a distinct benefit that goes over and beyond related benefits and impacts of improved user health and recreation that may also result from the project. Monetary valuation of streetscape improvements rests on the assumption that people enjoy and value more pleasant, safe, and comfortable street environment.

The specific practice for developing the input assumptions for valuing streetscape improvements benefits is just emerging, and few jurisdictions have formal approaches and recommendations. Based on the literature identified and reviewed by HDR, the valuations of streetscape improvements benefits are based on the willingness to pay approaches (WTP). The values range from about $25 per user to about $110 per user annually (in 2012 dollars). This assumes implicitly that the street being improved is long enough for the users to experience it in a significant way, that the users frequently come to the street, and that the improvements change the street in some noticeable way

HDR recommends a value of streetscape improvement benefits of **$0.15** per user-day (in 2013 dollars and rounded to a full-dollar amount) based on the ranges of values reported in the relevant literature, primarily based on the values recommended by in *Guidance on the Appraisal of Walking and Cycling Schemes*, TAG Unit 3.14.1, Department for Transport (United Kingdom), January 2010.

For cost-benefit evaluations of new schemes, this value would be multiplied by the number of daily users or visits that represent a combination of new and additional users or visits by both pedestrians and cyclists. For the existing users and visits, this benefit would be applied at 100% of the value, and for the new users and visits (attracted by the improvements) it would be applied at 50% of the value.

Monetizing the Social Value of Water:

Marginal Economic Value of Streamflow

HDR recommends using a widely-known report on the marginal economic value of streamflow for valuing water, from the US Forest Service (Brown 2004)[5]. That paper proposes that the aggregate marginal value of streamflow from a national forest (raw water) is equal to the sum of the values in the different in-stream, off-stream, and hydroelectric uses from the point source of water to its journey to sea. Brown values these uses based on benefits transfers from: water market rights and lease transactions in the US; avoided cost savings to produce peaking power generation via hydroelectric versus thermoelectric; and Frederick et al. (1996) meta-analysis values for in-stream and off-stream use. Brown segments values into 18 water resource regions (WRRs). Galveston falls under WRR #12; Texas-Gulf. Brown's marginal economic value of streamflow equation is:

$$V^* = \left(\sum_k \alpha_k^o\right)\left(\beta^o V^o\right) + \left(\alpha^h \beta^h\right)\left(\sum_i V_i^h\right) + \left(\sum_j \alpha_j^s\right)\left(\beta^r V^r + \beta^w V^w + \beta^e V^e + \beta^f V^f + \beta^n V^n\right) + N$$

HDR recreated the equation and populated coefficients for WRR #12, and utilized the current system rate for water rights posted by the Brazos River Authority in Vo. HDR then escalated the overall value for V* at a rate of 2%, which is representative of the system rate growth less inflation.

Eak	Bo	Vo	ah	Bh	EVh	Eas	Br	Vr	Bw	Vw	Be	Ve	Bf	Vf	Bn	Vn	N
1.96	0.11	$ 67.00	0.92	0.8	$ 0.93	1	0.32	$ 12.77	0.32	$ 1.28	0.32	$ 12.77		$ -		$ -	0

Water Supply Social Value

Water pumping, treatment and delivery consume a significant amount of energy. Water conservation projects reduce energy consumption and result in reductions in the emitted criteria air contaminants (CACs) and greenhouse gases (GHGs) that are associated with water pumping, treatment and distribution needed in water supply. HDR proposes to add to the value of raw water, the monetized value of the changes in GHGs, CACs, and nuclear energy use as a proxy for the social cost of providing potable water to end users. The valuation of these impacts is generated from information and guidance provided by the US EPA, US DOT, Electric Power Research Institute, and calculations performed by HDR.

By summing the Marginal Economic Value of Streamflow and the Water Supply Social Value, HDR recommends the Economic Value of Potable Water to be **$0.000178/gallon** in 2013 for Galveston, TX.

[5] Brown, Thomas C., US Forest Service, The Marginal Economic Value of Streamflow From National Forests, 12-28-2004

Value Component	Economic Value ($/gal) 2012		
GHG Value	$	0.000031	Water Supply Social Value
CAC Value	$	0.000066	
Nuclear Value	$	0.000008	
Marginal Value of Streamflow	$	0.000073	Marginal Value of Streamflow
Economic Value of Potable Water	**$**	**0.000178**	

Electricity Changes:

In the water valuation above, the electricity use from treatment and distribution is quantified and the subsequent changes in emissions that are emitted from the generation of that electricity is monetized. In order to assess this benefit, one must know the amount of pollutant emitted for every unit of energy generated by the electricity grid. The emission rate associated with a unit of energy is dependent on the grid's profile – the mix of technologies that produce electricity for the area. Texas's 2009 grid profile, complied by the EPA, is shown below.

State name	State coal generation percent	State oil generation percent	State gas generation percent	State nuclear generation percent	State hydro generation percent	State biomass generation percent	State wind generation percent	State other fossil generation percent	State other unknown /purchased fuel generation percent
TX	35.2%	1.1%	47.5%	10.4%	0.3%	0.3%	5.0%	0.2%	0.1%

To convert the generation profile into emissions, we used emission inventories published by EPA[6] to derive a ton/megawatt hour (MWh) emission rates for Texas. The overall emission conversion factors are shown below.

GHG Conversion Factors

	Metrics	Median	Comment
CO_2 E	Tons/MWh	0.62396	U.S. EPA and U.S. Energy Information Administration

[6] http://www.epa.gov/ttn/chief/net/2008inventory.html

CAC Conversion Factors

	Metrics	Median	Comment
NOx	Tons/MWh	0.00041	U.S. EPA and U.S. Energy Information Administration
SO2	Tons/MWh	0.00114	U.S. EPA and U.S. Energy Information Administration
PM	Tons/MWh	0.00003	U.S. EPA and U.S. Energy Information Administration
VOC	Tons/MWh	0.00001	U.S. EPA and U.S. Energy Information Administration

Nuclear Energy Use:

The social cost of nuclear power is the result of several different studies undertaken by Pace University, the European Commission, and D. Pearce et al. for the UK Department of Trade and Industry. These studies were carried out in order to establish a cost of externalities that went well beyond internalized financial aspects and the qualitative stigma of nuclear energy. These studies focused on both health and environmental impacts of every aspect of nuclear energy generation including but not limited to mining and milling, enrichment, operation, reprocessing, and transportation. Given the low emission rates of nuclear energy, most of the externalities stem from the risk of minor accidents; some of the aspects that were quantified include effects on air, soil, and vegetation with analysis ranging from short to long term. All values are in 2013 US dollars.

Expected	**$0.0542**	**per kWh**	
Median	**$0.06**	**per kWh**	Ottinger, et al. (1990). Environmental Costs of Electricity. Pace University Oceania Press: NY
Low	**$0.0285**	**per kWh**	Pearce, D. W., Bann, C. & Georgiou, E. (1992). The Social Cost of Fuel Cycles. Report to the Department of Trade and Industry, HMSO publications. ISBN 011-4142-882.
High	**$0.0705**	**per kWh**	European Commission DGXII, ExternE: Externalities of Energy, Vol. 5, Nuclear, EC, Brussels, Belgium, 1995. OECD 2003. Average of 5 countries.

APPENDIX D: OVERVIEW OF SUSTAINABLE RETURN ON INVESTMENT (SROI) AND RISK ANALYSIS PROCESS

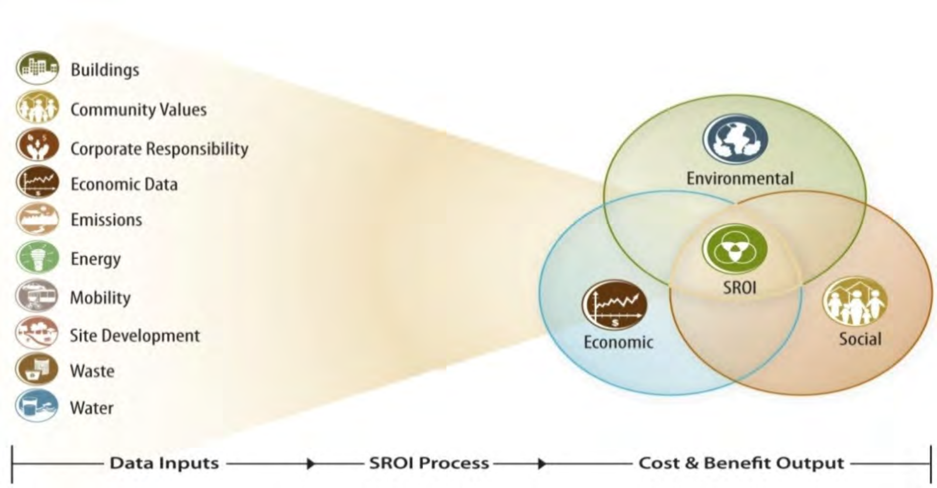
Issues related to sustainability, sustainable communities, and sustainable development is at the forefront of social debate today. Sustainable development is typically defined as the pattern of development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, Brundtland Commission, 1987). Sustainable development combines the financial considerations of development with broader socio-economic concerns including environmental stewardship, human health and equity issues, social well-being, and the social implications of decisions.

While the importance of these issues is widely recognized, organizations are challenged when they try to integrate sustainability considerations into their investment and operating decisions. Traditional financial evaluation tools used to assess an investment project, such as Business Case Analysis or Life-Cycle Cost Analysis (LCCA), rely exclusively on financial impacts. These traditional tools have two primary drawbacks:

1. An inability to accurately quantify the non-cash benefits and costs accruing to both the organization in question and to society as a whole resulting from a specific investment (sustainable benefits and costs).
2. A failure to adequately incorporate the element of risk and uncertainty.

HDR's Sustainable Return on Investment (SROI) process is a broad-based analysis that helps overcome these drawbacks by accounting for a project's triple-bottom line – its full range of financial, economic, as well as social and environmental impacts (see Figure A-1).

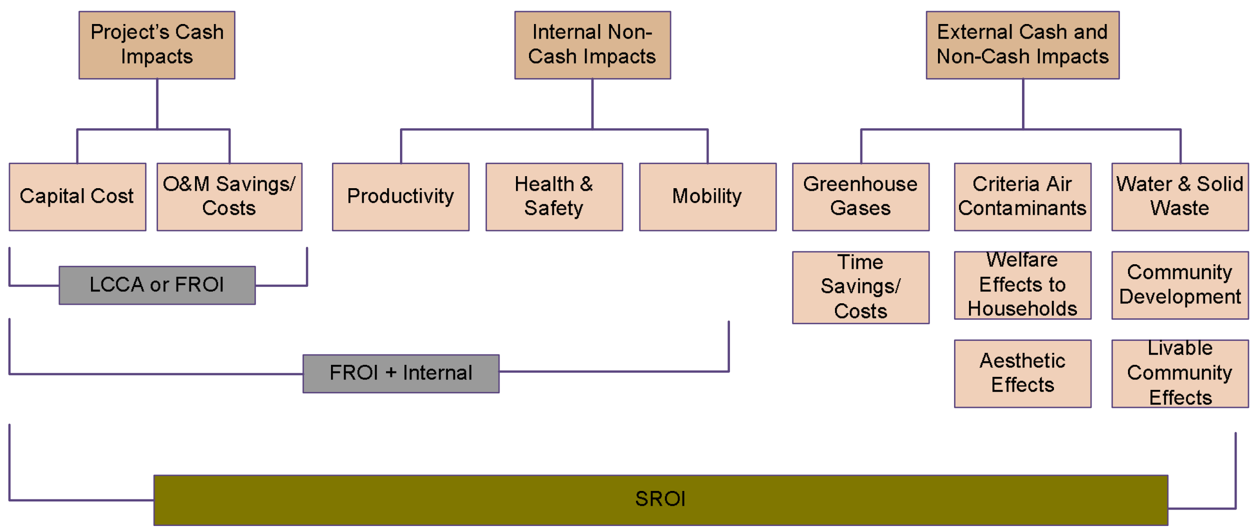
Figure A-1: SROI Methodology Guides Your Decision Making Process



The SROI process builds on best practices in Cost-Benefit Analysis and Financial Analysis methodologies, complemented by Risk Analysis and Stakeholder Elicitation techniques. The SROI process identifies the significant impacts of a given investment, and makes every attempt to credibly value them in monetary terms. Any relevant impacts that cannot be monetized are also identified, and ideally quantified in

some way. Results are presented in innovative ways that help clients and their stakeholders prioritize projects, better understand trade-offs, and evaluate risk.
A key feature of SROI is that it converts to dollar terms (monetizes) the relevant social and environmental impacts of a project yet still provides the equivalent of traditional financial metrics (referred to as "Financial Return on Investment (FROI)"). FROI accounts for internal (i.e., accruing to the organization) cash costs and benefits only, while SROI accounts for all internal and external costs and benefits. Figure A-2 below illustrates how traditional financial models differ from SROI.

Figure A-2: Comparison of SROI to Traditional Life-Cycle Costing



The SROI process includes the traditional financial impacts, such as savings on utility bills or reduced/ higher O&M costs, internal productivity effects and a range of social and environmental impacts that would result directly from the evaluated project. Examples include:

- Value of enhanced productivity from employees working in a green building (e.g., fewer sick days or performing a task more efficiently);
- Quantified and monetized value of reduction in environmental emissions;
- Quantified and monetized value of reduction in generation of waste ;
- Value of time savings and costs resulting from the evaluated project; and,
- Value of quality of life improvements, including improvements to households and broader community.

The SROI process involves four steps:

1. Development of the structure and logic of costs and benefits over the project life cycle. This involves determining the costs and benefits that result from the proposed investment and a graphical depiction to quantify these values. In particular, this step focuses on quantification of all broad (financial and sustainable) costs and benefits.

2. Quantification of input assumptions and assignment of risk/uncertainty, or initial risk analysis. This step involves building the preliminary outline of the SROI model, populating the model with initial data assumptions and performing initial calculations for identified costs and benefits (financial, social and environmental).

3. Facilitation of a Risk Analysis Process (RAP) session. This is a meeting, similar to a one-day charrette, which brings together key stakeholders to reach consensus on input data values and calculations to be used in the model.[7]

4. Simulation of outcomes and probabilistic analysis. The final step in the process is the generation of SROI metrics, including Net Present Value (NPV), Discounted Payback Period, Benefit-Cost Ratio and the Internal Rate of Return, in addition to the traditional financial metrics. Financial metrics are included as a point of comparison and to transparently and comprehensively illustrate the relative merits of all potential investment scenarios being analyzed.

Each of the above steps is discussed in detail below.

Step 1: Structure and Logic of the Cost and Benefits

A "structure and logic model" depicts the variables and cause and effect relationships that underpin the forecasting problem at-hand. The structure and logic model is written mathematically to facilitate analysis and also depicted diagrammatically to permit stakeholder scrutiny and modification during Step 3.

Step 2: Central Estimates and Probability Analysis

Traditional financial analysis takes the form of a single "expected outcome" supplemented with alternative scenarios. The limitation of a forecast with a single expected outcome is clear – while it may provide the single best statistical estimate, it offers no information about the range of other possible outcomes and their associated probabilities. The problem becomes acute when uncertainties surrounding the underlying assumptions of a forecast are material.

Another common approach to provide added perspective on reality is "sensitivity analysis." Key forecast assumptions are varied one at a time, in order, to assess their relative impact on the expected outcome. A concern with this approach is that assumptions are often varied by arbitrary amounts. A more serious concern with this approach is that, in the real world, assumptions do not veer from actual outcomes one at a time but rather the impact of simultaneous differences between assumptions and actual outcomes is needed to provide a realistic perspective on the riskiness of a forecast.

Risk analysis provides a way around the problems outlined above. It helps avoid the lack of perspective in "high" and "low" cases by measuring the probability or "odds" that an outcome will actually materialize. A risk-based approach allows all inputs to be varied simultaneously within their distributions, avoiding the problems inherent in conventional sensitivity analysis. Risk analysis also recognizes interrelationships between variables and their associated probability distributions.

Risk analysis and Monte Carlo simulation techniques can be used to account for uncertainty in both the input values and model parameters. All projections and input values are expressed as probability distributions (a range of possible outcomes and the probability of each outcome), with a wider range of values provided for inputs exhibiting a greater degree of uncertainty. Of note, each element is converted into monetary values to estimate overall impacts in comparable financial terms and discounted to translate all values into present-value terms. Specifying uncertainty ranges for key parameters entering the decision calculus allows the SROI framework to evaluate the full array of social costs and benefits of a project while illustrating the range of possible outcomes to inform decision-makers.

Each variable is assigned a central estimate and a range to represent the degree of uncertainty. Estimates are recorded on Excel-based data sheets (see Figure A- 3). The first column gives an initial median. The second and third columns define an uncertainty range representing a 90 percent confidence interval—the range within which there exists a 90 percent probability of finding the actual outcome. The greater the uncertainty associated with a forecast variable the wider the range.

Figure A- 3: Example of Data Input Sheet *(Illustrative Example)*

Data Input	Median	Low	High	Realized
Percent reduction in electricity use	30.0%	22.5%	37.5%	**30.0%**
Building sqft	252,752	252,752	252,752	**$ 252,752**
Cost of electricity per kWh	$ 0.100	$ 0.050	$ 0.250	**$ 0.117**
Electricity use in kWh per sqft/year	49.33	39.46	59.19	**49.33**

Probability ranges are established using both statistical analysis and subjective probability assessment. Probability ranges do not have to be normal or symmetrical. In other words, there is no need to assume a bell-shaped normal probability curve. The bell curve assumes an equal likelihood of being too low and too high in forecasting a particular value. For example, if projected unit construction costs deviate from expectations, it is more likely that the costs will be higher than the median expected outcome than lower.

The Excel-based risk analysis add-on tool @Risk transforms the ranges depicted in Figure A- 3 into formal probability distributions (or "probability density functions"), helping stakeholders understand and participate in the process even without formal training in statistical analysis.

The central estimates and probability ranges for each assumption in the forecasting structure and logic framework come from one of three key sources, as described below:

- The best available third party information from a variety of sources, including the Environmental Protection Agency, the Department of Energy, the Federal Highway Administration, the Bureau of Labor Statistics, other government agencies, financial markets, universities, think tanks, etc.
- Historical analysis of statistical uncertainty in relevant time series data and an error analysis of forecasting "coefficients," which are numbers that represent the measured impact of one variable (say, fuel prices) on another (such as the price of steel). While these coefficients can only be known with uncertainty, statistical methods help uncover the level of uncertainty (using diagnostic statistics

such as standard deviation, confidence intervals, and so on). This is also referred to as "frequentist" probability.

- Subjective probability assessment (also called "Bayesian" statistics, for the mathematician who developed it) in which a frequentist probability represents the measured frequency with which different outcomes occur (i.e., the number of heads and tails after thousands of tosses). The Bayesian probability of an event occurring is the degree of belief held by an informed person or group that it will occur. Obtaining subjective probabilities is the subject of Step 3.

Step 3: Expert Evaluation: The RAP© Session

The third step in the SROI process involves the formation of an expert panel to hold a charette-like one or two day meeting that we call the Risk Analysis Process (RAP) session. We use facilitation techniques to elicit risk and probability beliefs from participants about:

I. The structure of the forecasting framework
II. Uncertainty attached to each input variable and forecasting coefficient in the framework

In (i), experts are invited to add variables and hypothesized causal relationships that may be material, yet missing from the model. In (ii), the initial central estimates and ranges that were provided to panelists prior to the session are modified based on subjective expert beliefs and discussion.

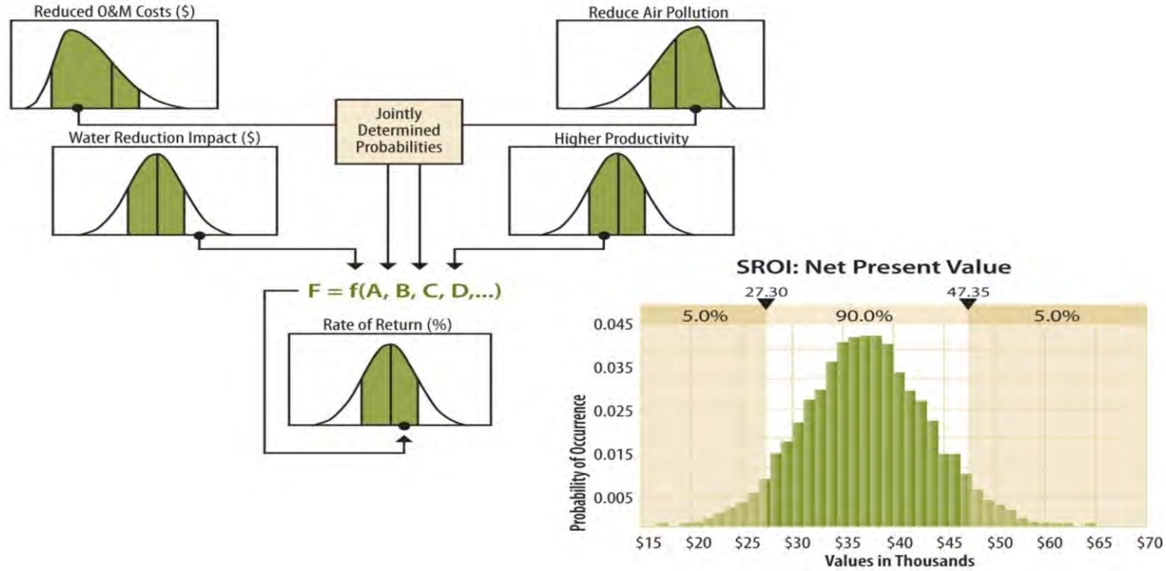
Examples of typical RAP session participants include:

- **Client**
  - Project tam
  - Technical specialists
  - Financial experts
- **HDR**
  - Facilitator
  - Economists
  - Technical Specialists
- **Outside Experts**
  - Public Agencies and Officials
  - Business Groups

Step 4: Simulation of Outcomes and Probabilistic Analysis

In step four, final probability distributions are formulated by the risk analyst (Economist) and represent a combination of probability information drawn from Steps 2 and 3. These are combined using simulation techniques (called Monte Carlo analysis) that allow each variable and forecasting coefficient to vary simultaneously according to its associated probability distribution (see Fig A-4 for a graphical representation of this process).

Figure A- 4: Combining Probability Distributions *(Illustrative Example)*



The result of the analysis is a forecast that includes estimates of the probability of achieving alternative outcomes given the uncertainty in underlying variables and coefficients.

For example, probability distribution of NPV of a project is demonstrated in Figures A-5 and A-6. As the figure and the table show, the average expected outcome of the hypothetical project is an NPV of $392.41 over the period of analysis considered. There is a 10% chance that the NPV will exceed $580.11, and a 1% chance that the NPV will exceed $751.29. However, the proposed project also has a downside and a non-zero probability of performing at a much lower magnitude of NPV than the average outcome. Specifically, as the table shows there is a 99% probability that the NPV will exceed the negative $36.29. This implies that there is a risk (about 1% to 2% in this case) that the NPV of the project considered would fall below zero, or generate no net benefits. Examining the table further, one can also determine that there is a risk of underperformance of the project, or the situations when the project generates net benefits that are much lower than the mean expected outcome.

Figure A- 5: Risk Analysis of Net Incremental Benefits of a Project

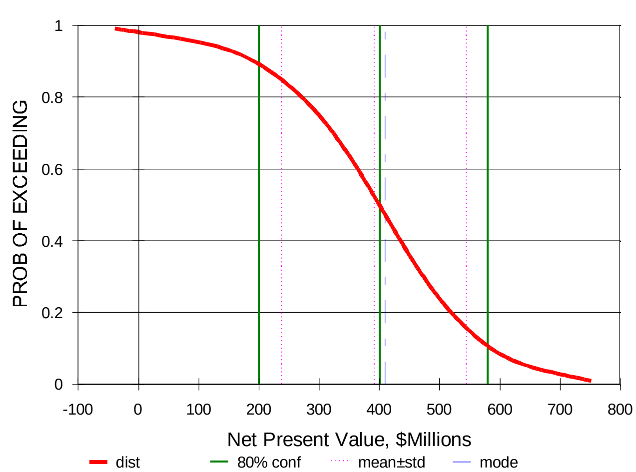


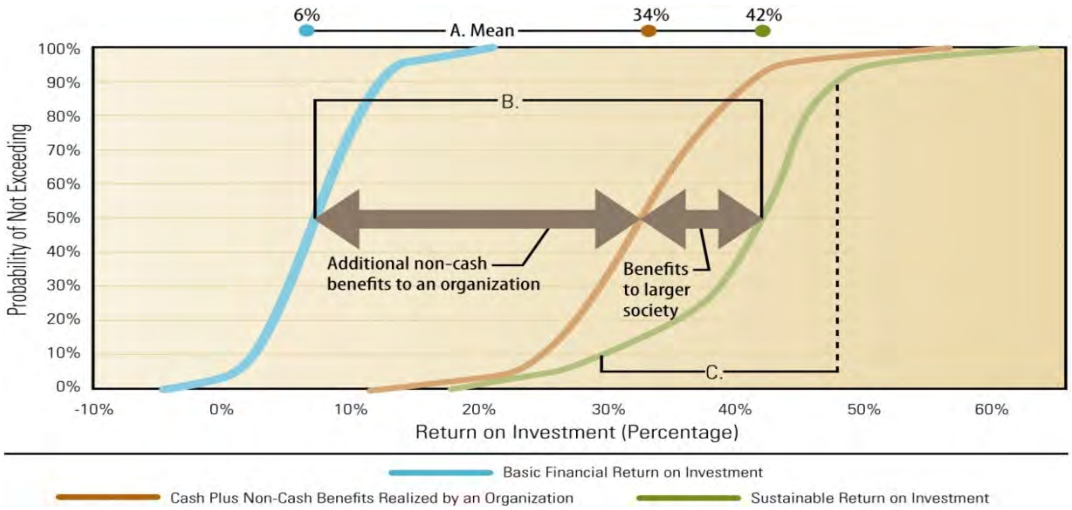
Figure A- 6: Risk Analysis of Net Present Value of a Project (*Illustrative Example)*

Project Net present Value ($ M)	**Probability of Exceeding Value Shown at Left**
-$36.29	0.99
$128.11	0.95
$**200.01**	**0.90**
$275.91	0.80
$325.05	0.70
$364.50	0.60
$**400.05**	**0.50**
$434.81	0.40
$471.95	0.30
$516.08	0.20
$**580.11**	**0.10**
$636.22	0.05
$751.29	0.01
$**392.41**	**Mean Expected Outcome**

Using the SROI process, the net present value of a project (as in the example above) and other evaluation metrics can be estimated taking into account the three types if impacts discussed earlier: (1) only project cash impacts, (2) project cash impacts and non-cash impacts internal to the organization, and (3) all comprehensive societal or sustainable impacts. This allows decision-makers the ability to prioritize worthy—but competing—projects for funding based on the maximum financial and societal returns. In the following example, a project's outcome metrics are synthesized into an intuitive risk analysis model based on estimated return on investment.

A. Compare the financial return on investment and sustainable return on investment. In this example, the mean sustainable return on investment is more than double the traditional return on investment.
B. Evaluate non-cash benefits, such as improvements in employee health and productivity, and the benefits to larger community.
C. Assess the statistical likelihood that return will fall within an 80% confidence interval. In this example, sustainable return on investment ranges from 15% to 34%.

Figure A- 7: The Sustainability “S” Curve to Optimize the Total Value of Your Projects



APPENDIX E: TUTORIAL ON UTILIZING THE SROI MODELS

SROI Tutorial and Model Operation:

As discussed in the report, the SROI models are broken down into three distinct modules and have incorporated a user-friendly template to allow for changes in inputs based on a very narrow range of specific investments that are the same as those analyzed in this project - building a water reuse facility, forming a curbside recycling program, and investing in streetscape and safety improvements (such as streetscape, sidewalks, bulb-outs, and cross walks). A broader cross-sector infrastructure SROI tool could be developed, but was out of the scope of this project.

It is recommended the user of the models read the SROI report, as there is detailed discussion on the structure of the methodology of each analysis, a comprehensive list of inputs, in-depth background into SROI, and additional relevant information that, in general, will improve the users' understanding and effectiveness in operating these three models. It is assumed the user has a good understanding of Excel and basic knowledge of finance and economics. These models are intended for relatively simple manipulation of the key inputs, and again, can be used only on those infrastructure investments that fall within the same scope of investments as those analyzed in the three pilot case studies.

The Models:

Each model has many worksheet tabs incorporated into the Excel workbook; each of these serves a purpose. The main point of interaction for the user will be the 'GenInputs' tab. This tab will allow the modeller to modify various inputs that will impact the outcome of the analysis; these are the key variables which drive the models. The cells colored in green are those that can be modified based on the specific investment parameters. The model is built such that all capital costs are incurred in a lump-sum in 2013, with the investment operational at the start of 2014. At this point annual operating & maintenance costs (O&M) and benefits are applied. The study period is 25 years of benefits, or 26 years including the construction period. This was generally equating to the useful life of the improvements HDR was analyzing and cannot be changed without additional modification to the models.

The models are built in Excel and for HDR, incorporate risk analysis using third-party software called @Risk by Palisades Corp. Without this software, the model will show error messages in each of the cells that incorporate a risk analysis function. This risk analysis function can be disabled by setting the Risk Index, cell D9, equal to 2 in the GenInputs tab. There is the ability here to conduct a sensitivity analysis, if one wishes, by setting this cell to 3 for low values, and 4 for high values. The low/high values are based off of the median values, with ranges based on relative degrees of uncertainty. These values are shown in the 'Inputs' and 'Calcs' tabs.

Following through the model, after the 'GenInputs' tab, each model has subsequent worksheets named: 'Inputs', 'Calcs', 'CF', and 'DCF'. These four worksheets run through the process of annualizing the 'GenInputs', creating the calculations, inflating, then discounting and summarizing the results. There are several additional tabs in the model that work only with the @Risk software; for instance the 'GraphData', 'NPV S-curve', and '@Risk' worksheets are there to capture results from the Monte Carlo simulation and then generate the S-Curves which were provided in the results section of the report (to show the risk-adjusted cumulative probabilities of results) and the Financial Metrics summary table in the 'Summary1' tab, which are also risk-adjusted results based on the simulation. When operating the models without risk analysis, the results of the analysis will appear in the 'DCF' tab underneath the sets of calculations, as a table with blue, green, and grey highlights. Once the inputs in 'GenInputs' are changed to reflect the specific parameters of the analysis, the outputs will automatically be generated in the 'DCF' tab. There is nothing else to do.

Worksheet Descriptions:

After the 'GenInputs', 'Inputs', 'Calcs', 'CF', and 'DCF' worksheets, the rest of tabs generally play the role of providing inputs into the 'GenInputs' or 'Calc' worksheets.

General Worksheets:

Moving along the worksheets, below is a list of additional tabs that can be found in all three models, with explanations on their functions.

Electricity Emissions:

- These are the emissions conversion factors HDR calculated with information provided by the U.S. Environmental Protection Agency - eGRID 2012 (2009 Data). Texas's grid values are used in the 'GenInputs' tab and used in the social value of potable water calculations.

GHG Social Cost:

- These are the values for CO_2 used in the analysis to determine the value of one ton of greenhouse gases.

CAC Social Cost:

- These are the values for criteria air contaminants used in the analysis to determine the value of one ton of each type of emission.

Generation Resource Mix:

- These values show the generation resource mix of each state's electricity grid. This is used to determine the proportion of nuclear energy generated in Texas's grid.

Nuclear Social Cost:

- These are the values used in the determination of the social value of nuclear energy use.

Inflation Factor:

- This table provides the monthly and annualized CPI information used to inflate any values to 2013 dollars

This next section provides a description of worksheets that are module-specific.

Water Conservation Model:

Residual Value:

- This worksheet calculates the residual value of the reuse water distribution system, which has a 50 year useful life.

Water Value:

- This is a summary table of the economic value of potable water calculations.

Water Supply Energy Rates:

- These values show the average electricity consumption for surface and ground water supply to be treated, pumped, and distributed to the end consumer.

Water Supply Values:

- This is the background calculations on estimating the GHG and CAC costs related to electricity use resulting from potable water use.

Background E Wilson:

- This shows some of the inputs which an employee from the City provided us relating to the reuse investment.

Brown – Marginal Value of Water:

- This worksheet replicates the equation provided by Brown (2006) used for determining the economic value of Streamflow in the potable water valuation.

O&M Costs – Proxy:

- This provides the background information on how the O&M costs were calculated as the incremental $/gallon cost difference proxy between the reuse facility and the current water treatment plant.

Curbside Recycling:

Transport External Costs:

- This workbook contains marginal external costs relating to transportation impacts. The green highlighted cells were used in this model.

Emissions_Lookup:

- The emissions generated for car traffic at various speeds is located here and generated by the EPA MOVES model.

Income – Wage – VOT:

- This provides demographic data on Galveston from the Bureau of Labor Statistics. Median household income was use in the value of travel time calculations.

VOC_Lookup:

- This worksheet provides the data used in the determination of Vehicle Operating Costs (VOC).

Per mile VOCs:

- This tab uses the HLOOKUP function in Excel to determine the VOCs based on average auto speed. This is set to 30 mph for cars and 10 mph for recycling trucks, so if it needs to be changed – it needs to be changed in cells C2/C3.

OTHER VEHICLE COSTS:

- This tab provides additional VOC data used in the model.

FUEL COSTS:

- The tables provide the fuel costs predictions used in the model.

Demographics:

- This worksheet provides additional demographic data on Galveston with respect to number of households, population density, and commuting statistics.

2012 Recycling Info - ECO Center:

- This worksheet sums the monthly City of Galveston Recycling Center Tonnage Reports into an annual basis and provides annual car visits.

EPA WARM Inputs:

- This tab captures what values were inputted into the EPA WARM model for both the base case and alternative case with induced recycling and diversion from the landfill.

Changes in Recycling:

- This tab shows the background calculations to the induced recycling rates and amounts as a result of the curbside recycling program.

Distance to the Eco Center:

- This worksheet shows the methodology and calculations for determining the average distance travelled to the ECO Center by each household.

WARM Model Outputs:

- The outputs from running the EPA WARM model are found here. These are inputs into the model.

Recycling Values:

- This worksheet provides information on the recycling commodity rates for the four materials included in this analysis.

Streetscape and Safety Improvements Model:

Transport External Costs:

- This workbook contains marginal external costs relating to transportation impacts. The green highlighted cells were used in this model.

Crashes:

- This provides the list of accidents in Galveston over a five year period from TxDOT. This worksheet calculates the anticipated number of crashes/accidents in the streets segments analyzed in the alternatives.

Emissions_Lookup:

- The emissions generated for car traffic at various speeds is located here and generated by the EPA MOVES model.

Income – Wage – VOT:

- This provides demographic data on Galveston from the Bureau of Labor Statistics. Median household income was use in the value of travel time calculations.

VOC_Lookup:

- This worksheet provides the data used in the determination of Vehicle Operating Costs (VOC).

Per mile VOCs:

- This tab uses the HLOOKUP function in Excel to determine the VOCs based on average auto speed. This is set to 30 mph, so if it needs to be changed – it needs to be changed in cell C2.

OTHER VEHICLE COSTS:

- This tab provides additional VOC data used in the model.

FUEL COSTS:

- The tables provide the fuel costs predictions used in the model.

Demographics:

- This worksheet provides additional demographic data on Galveston with respect to number of households, population density, and commuting statistics.

Injury & Fatality Values:

- The value of statistical life and disutility factors used in the model are found here. This provides the weighted average cost of injury/fatality/PDO accidents.

Healthcare Costs:

- The annual healthcare cost savings from induced cycling/walking is provided here.

Street Distances:

- This worksheet shows the mapping HDR used to determine the road distances in each of the alternatives.

Vehicle Counts:

- This is the background information to the AADT of vehicles travelling in the two alternatives.

Peds and Cyclist Counts:

- This is the background information to the pedestrian and cycling counts used in the model for both alternatives.

Crash Modification Factors:

- This is the table from the CRF Clearinghouse showing the Crash Modification Factors categories and values.

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Community Involvement and Taxpayer Survey Report
Sustainable Return on Investment Case Study
Galveston, TX

Prepared for:
Houston-Galveston Area Council
City of Galveston

Community Development Strategies

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TABLE OF EXHIBITS

COMMUNITY ENGAGEMENT OVERVIEW

Community engagement during the SROI Case Study process took two primary forms: a Stakeholder Group, put together by staff of the Galveston Planning Department, and a survey of Galveston taxpayers (residents and business operators).

The Stakeholder Group consisted of representatives from interest groups within Galveston. Represented groups included:

- Galveston Historical Society
- Galveston Hotel and Lodging Association
- West Galveston Island Property Owners Association
- U.S. Green Building Council
- Galveston Economic Development Partnership
- East End Historical Association
- Mitchell Historic Properties
- Galveston Planning Commission
- Galveston City Council
- Galveston Long Term Recovery Committee
- UTMB
- Galveston Alliance of Island Neighborhoods
- Texas A&M - Galveston

The Stakeholder Group provided feedback on the SROI inputs and modeling structure through a series of four meetings conducted in Galveston during the study. Two of the meetings were classified as "RAP Sessions" meant to provide conversation and feedback opportunities during specific points in the development of the case study scenarios and model creation. One RAP session was notable for the Stakeholders providing crucial guidance as to the specific street segments to be studied in the Streetscape and Safety Improvements case study scenario. The final Stakeholder Group meeting allowed for presentation of initial model results by the consultant team.

It is estimated that the Stakeholders volunteered between 64 and 80 hours during the course of the project attending meetings and reviewing consultant team materials.

SURVEY SUMMARY

The Survey of Galveston Taxpayers was conducted in January, February and March of 2013. The survey was conducted primarily through the online survey system SurveyMonkey. The City of Galveston sent links to the survey to internal email lists and requested that local organizations send links to their members. In addition, paper survey forms were placed in the City of Galveston Planning Department and at community centers. In addition, paper surveys were distributed to local organizations.

In total, 310 surveys were begun and 292 were completed.

- Overall, the respondents to this survey represent a reasonable cross section of the community when considering that non-resident business persons completed the survey as well.
- When compared with Galveston residents, the respondents to this survey were older, had higher income, had higher educational attainment and were predominately Caucasian.
- Five groups of community values or concerns were rated on a scale of 1 to 10 of importance to the respondent, where: 1=

least important, being completely unimportant or irrelevant and 10 = most important, being absolutely vital:

- 1. General Values or Concerns
- 2. Economic and Financial Impact Values or Concerns
- 3. Environmental Values or Concerns
- 4. Security Values or Concerns
- 5. Other Values or Concerns

- In the **General Values Group**, the highest rated value was "Increasing U.S. energy independence" and "Improving the availability of fresh and locally produced food" came in a close second. The lowest rated value in this group was "Increasing the density of housing."
- In the **Economic and Financial Impact Group**, the highest rated was "Improving the health of locally-owned businesses," followed closely by "Attracting middle income residents" and "Adding middle income jobs." On the low end of this set of ratings were the two tax related issues, "Minimizing local and state taxes" and "Minimizing federal taxes."
- In the **Environmental Group**, the highest rated was "Reducing water pollution from sewage treatment", closely followed by "Increasing energy efficiency," "Reducing water pollution from industry" and "Reducing water pollution from urban runoff. At the bottom was "Creating green jobs."
- In the **Security Group,** the highest rated value was "Protecting community property values" followed by "Protecting community from storm damage and erosion." The lowest rating is this list was "Increasing police protection."
- In the **Other Group,** the highest ratings were given to Improving reliability of water supply" and "Improving public education," followed by "Creating a more attractive or beautiful community" and "Providing additional flood control." The lowest rated value in this list was "Reducing isolation and segregation of disadvantaged populations."

SURVEY RESPONDENT DEMOGRAPHICS

In this section, the demographic profile of the survey respondents is compared with the estimated demographic profile of the City of Galveston. The 2013 demographic profile used for Galveston is from Nielsen/Claritas Demographics. While such comparisons are often a useful measure of how the respondents compare to the community as a whole, this survey included persons who business owners or managers and were not Galveston residents.

The chart on the right presents the profile of the persons completing the survey.

- Almost 86% were full-time Galveston residents and one in three of those were business owners or managers.
- The respondents were reasonably split between women and men with only slightly fewer women in the survey than in Galveston As a whole.

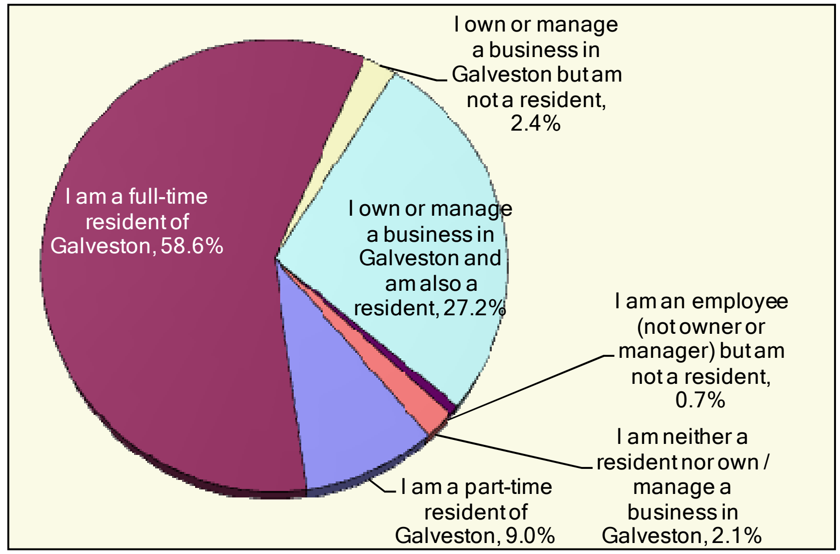
Q7. Are you a male or Female?

Gender	Survey Percent	Galveston 2013
Female	46.6%	48.9%
Male	53.4%	51.1%

On the right is the age profile of the respondents compared with the percentages in the Galveston population over 17 years of age.

- Overall, the survey included an older base of respondents with a median age of 56 when compared to 45.4 in Galveston.

Q12. Please describe the nature of your involvement with Galveston



Q8. What is your Age?

Age of Population over 17	Survey Percent	Galveston 2013
Age 18 to 24	2.4%	15.1%
Age 25 to 34	7.0%	17.3%
Age 35 to 44	12.2%	13.7%
Age 45 to 54	22.3%	17.9%
Age 55 to 64	29.6%	17.7%
Age 65 and over	26.5%	18.2%
Estimated Median over 17	56.0	45.4

The tables on the right present the comparison of the respondent by ethnicity, educational attainment and income.

- Overall, the median survey respondent was a white person with a bachelor's degree and a household income of nearly $100,000.
- 20% of the survey respondents were Hispanic, Black or Asian, which is typical of surveys of this type.
- 84.2% of the respondents have some form of college degree as compared with 32.0% of Galvestonians.
- 46.2% of the respondents have household incomes in excess of $100,000 as compared with 14.8% of Galvestonians.

Question 11 asked the respondents the number of persons living in their household.

- The average persons per household of the survey respondents was 2.36 – slightly larger than the estimated average household size in Galveston of 2.24.

Overall, the respondents to this survey represent a reasonable cross section of the community when considering that non-resident business persons completed the survey as well.

Q9. What is your race or ethnicity?

Race/Ethnic Options	Survey Percent	Galveston 2013
White/Anglo	80.5%	46.0%
Black/African American	7.2%	16.8%
Hispanic/Latino	7.2%	32.4%
Asian	0.3%	3.1%
Other	4.8%	1.6%

Q10. What is the highest level of education you completed?

Educational Attainment	Survey Percent	Galveston 2013
Less than high school diploma	1.0%	19.2%
High school diploma or GED	14.7%	48.8%
Associate degree	16.4%	5.6%
Bachelor's degree	30.5%	15.0%
Graduate/professional degree	37.3%	11.4%

Q13. What was your household income in 2012?

Household Income Ranges	Survey Percent	Galveston 2013
Less than $25,000	5.9%	34.7%
$25,000 to $49,999	16.2%	28.3%
$50,000 to $74,999	18.3%	13.9%
$75,000 to $99,999	13.4%	9.3%
$100,000 to $149,999	20.0%	7.4%
$150,000 to $199,999	13.1%	2.9%
$200,000 or more	13.1%	3.5%

GALVESTON VALUES/CONCERNS

The majority of this survey was devoted to discerning the concerns or values that were most important to residents and business persons in Galveston.

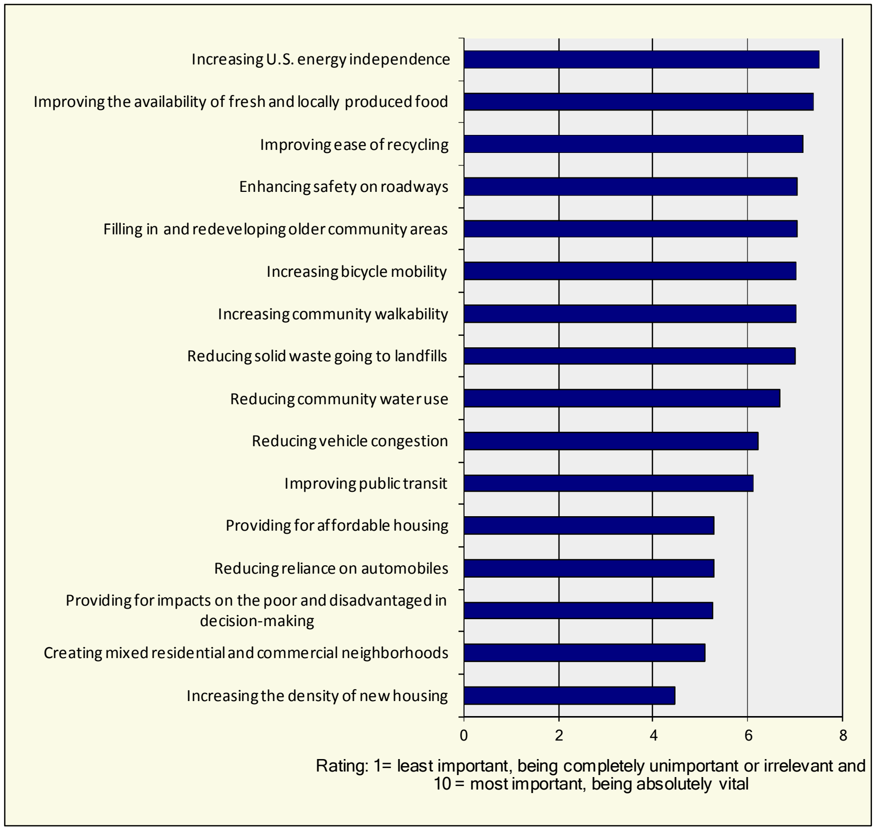
Five sets of values were presented for evaluation and rating:

1. General Values or Concerns
2. Economic and Financial Impact Values or Concerns
3. Environmental Values or Concerns
4. Security Values or Concerns
5. Other Values or Concerns

Question 1 focused on **General** values and concerns. The chart on the right illustrates the ratings of all of the values presented in this section.

- The highest rated value was "Increasing U.S. energy independence" with an average score of 7.51.
- "Improving the availability of fresh and locally produced food" came in a close second with an average score of 7.38.
- The lowest rated value in this group was "Increasing the density of housing" with a rating of 4.46 – below the neutral rating of 5.0.

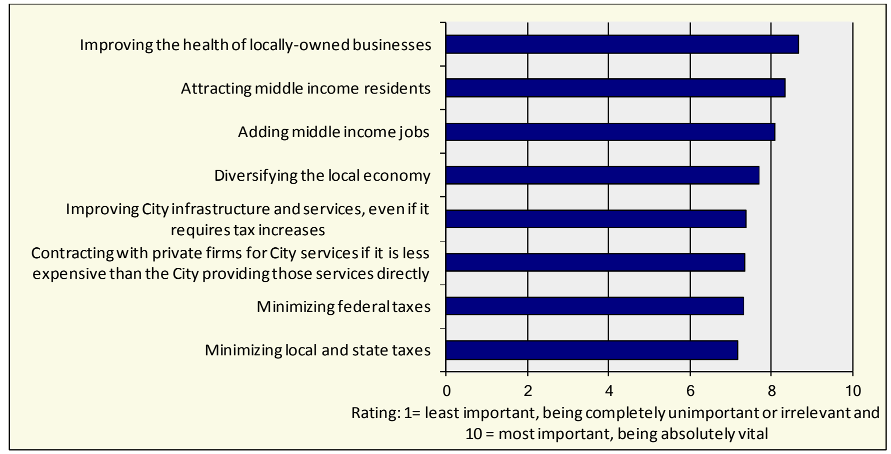
Q1. Please rate the following GENERAL concerns by order of importance to you on a scale from 1 to 10.



Question 2 switched to Economic and Financial Impact issues. The chart on the right illustrates the results.

- The highest rated Economic and Financial Impact concern was “Improving the health of locally-owned businesses,” with an average rating of 8.03 – one of the highest ratings in the survey.
- Also highly rated were “Attracting middle income residents” (7.78) and “Adding middle income jobs” (7.68).
- On the low end of this set of ratings were the two tax related issues, “Minimizing local and state taxes” (6.27) and “Minimizing federal taxes” (6.44). While low in this group, these values rated somewhat higher than neutral.

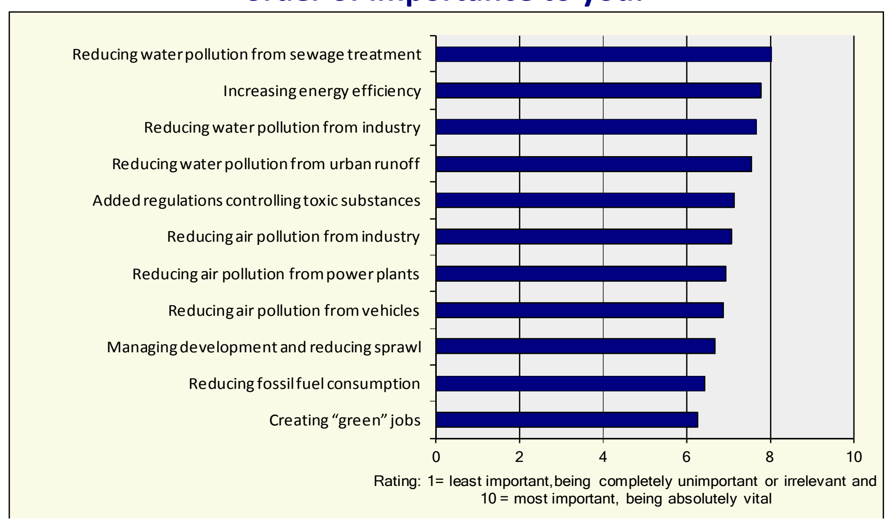
Q2. Please rate the following ECONOMIC AND FINANCIAL IMPACT concerns by order of importance to you.



Question 3 included a list of Environmental values to be rated.

- The highest rated environmental value was “Reducing water pollution from sewage treatment” with a rating of 8.03.
- Just behind water pollution was “Increasing energy efficiency” (7.78) and “Reducing water pollution from industry” (7.68) and “Reducing water pollution from urban runoff” (7.57).
- At the bottom of this list, still with a positive ranking, was “Creating green jobs” (6.27)

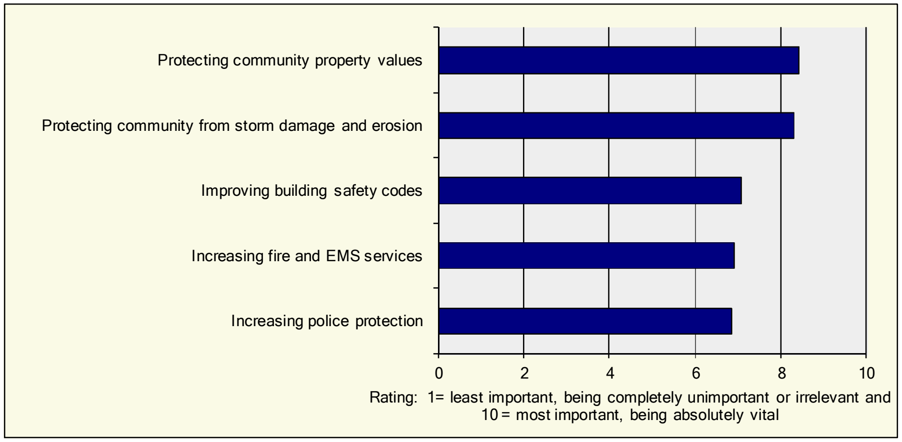
Q3. Please rate the following ENVIRONMENTAL VALUES by order of importance to you.



Question 4 was concerned with the respondents' view of the importance of a set of issues related to personal and community security.

- The highest rated value in this group was "Protecting community property values" with a rating of 8.41 – one of the highest valued issues in this survey.
- Just behind protecting property values was "Protecting community from storm damage and erosion" with a rating of 8.31.
- The lowest rating is this list was "Increasing police protection" (6.86) still well above an average neutral rating of 5.0.

Q4. Please rate the following SECURITY concerns by order of importance to you.

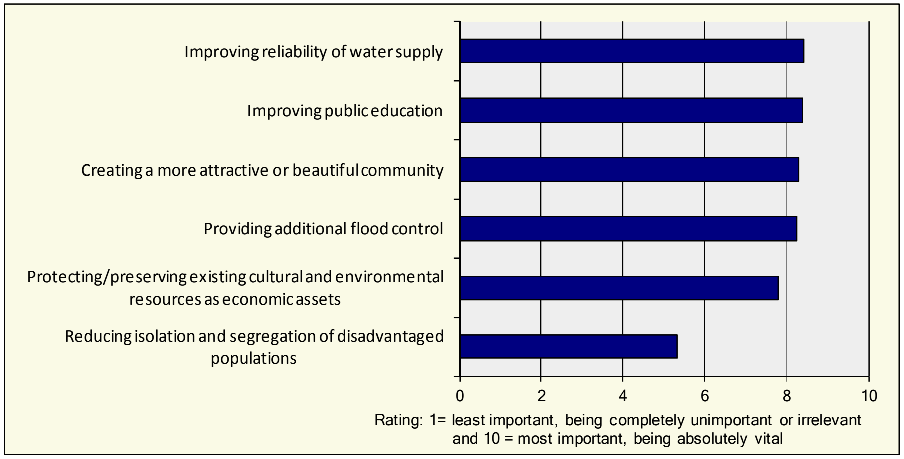


Question 5 included a list of other values to be rated.

- The highest rated valued in this group were "Improving reliability of water supply" with a rating of 8.41 and "Improving public education" (8.40).
- Just behind those values with very high ratings were:

  "Creating a more attractive or beautiful community" (8.31)
  "Providing additional flood control" (8.25)
- The lowest rated value in this list was "Reducing isolation and segregation of disadvantaged populations" (5.32) – slightly above neutral.

Q5. Please rate the following OTHER VALUES by order of importance to you



Combining the Groups

In this section all five of the group values ratings were combined to present a picture of the overall priorities of Galveston stakeholders.

When considering the groups of value statements, it appears that overall priorities are in the following order:

1. **Other** (water supply, flooding, education, beautification)
2. **Economic** (local business, diversification, attracting residents)
3. **Security** (storm protection, police/fire/EMS, building codes)
4. **Environmental** (development regulations, water/air, fossil fuels, green jobs)
5. **General** (reduce auto/water use, housing affordability/density, transit)

The table on the top right presents the top 10 rated values/ concerns. The community's highest priorities are evident in this list. Each of the value statements in the list were rated 8.0 or better, evidence of strong agreement.

On the opposite end of the spectrum are the items in the list on the bottom right. These are the lowest ranked values/concerns, all with average ratings hovering around neutral. With the exception of "Increasing the density of new housing," all of these low rated issues received an overall positive rating. This means that, on average more of the respondents rated them as important.

Top 10 Galveston Values/Concerns

Ratings of 8.0 or Higher

#	Value or Concern	Rating
1	Improving the health of locally-owned businesses	8.65
2	Protecting community property values	8.41
3	Improving reliability of water supply	8.41
4	Improving public education	8.40
5	Attracting middle income residents	8.33
6	Protecting community from storm damage and erosion	8.31
7	Creating a more attractive or beautiful community	8.31
8	Providing additional flood control	8.25
9	Adding middle income jobs	8.07
10	Reducing water pollution from sewage treatment	8.03

Bottom 6 Galveston Values/Concerns

Ratings below 6.0

#	Value or Concern	Rating
46	Increasing the density of new housing	4.46
45	Creating mixed residential and commercial neighborhoods	5.08
44	Providing for affordable housing	5.26
43	Reducing reliance on automobiles	5.28
42	Reducing isolation and segregation of disadvantaged populations	5.28
41	Improving public transit	5.32

Respondent Disagreement

This section measures the issue on which the respondents were most split. The table on the right listed the percentage of the respondents who rated the value/concern very low (1 or 2) and who rated that same value high (9 or 10). This table presents all of the values/concerns that had a substantial number of respondents on both ends of the rating spectrum.

The order of presentation in the table is alphabetical because there was no obvious metric that demonstrated the dichotomy of the answers.

This is a list of those issues where Galveston stakeholders are most divided such as "Providing for affordable housing" where 29.7% felt that was a low priority and 20.1% felt it was a high priority.

Some issues like "Creating 'green' jobs" and "Reducing fossil fuel consumption" evenly split about 40% of the respondents.

Others, like "Creating mixed residential and commercial neighborhoods" and 'Reducing isolation and segregation of disadvantaged populations" were imbalanced toward the low side while splitting almost one-half of the respondents.

Values/Concerns with Greatest Disagreement

Value	% Low 1 or 2	% High 9 or 10
Added regulations controlling toxic substances	13.0%	23.9%
Creating "green" jobs	20.5%	19.5%
Creating mixed residential and commercial neighborhoods	30.3%	15.8%
Improving public transit	16.6%	22.8%
Managing development and reducing sprawl	12.2%	21.5%
Providing for affordable housing	29.7%	20.1%
Providing for impacts on the poor and disadvantaged in decision-making	26.4%	17.8%
Reducing air pollution from vehicles	11.9%	23.2%
Reducing fossil fuel consumption	17.4%	20.8%
Reducing isolation and segregation of disadvantaged populations	32.1%	17.9%
Reducing reliance on automobiles	23.9%	12.5%
Reducing vehicle congestion	16.6%	20.5%

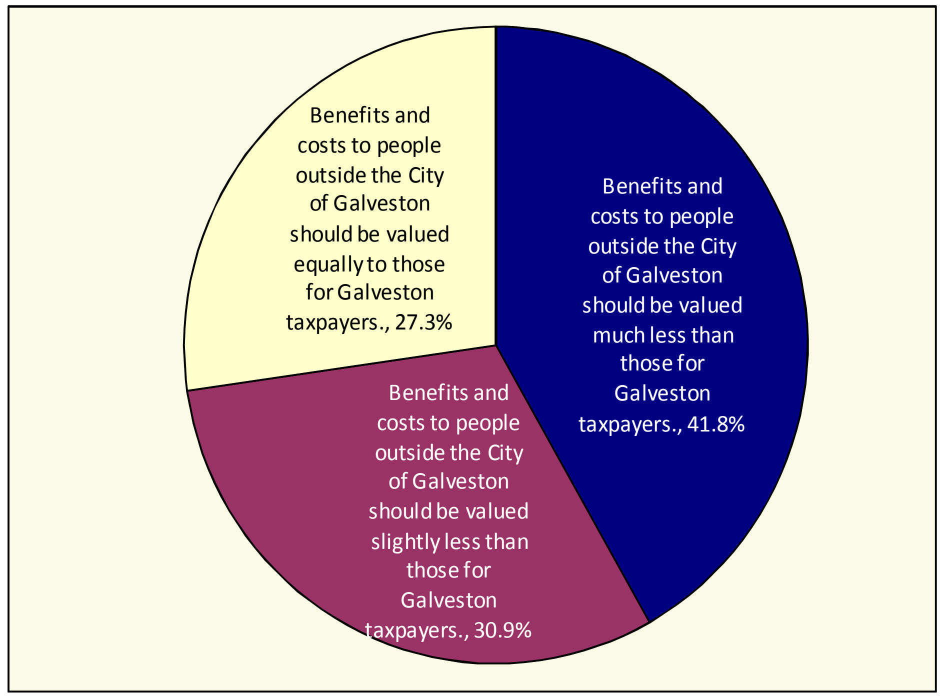
EVALUATING COSTS AND BENEFITS

In question 6 of the survey, the respondents were asked how projects should be evaluated in terms of whose is most affected (benefitted or harmed).

The respondents were spilt on the issue of valuing benefits and costs. The chart on the right presents the results of this question.

- More than one in four (27.3%) of the respondents felt that "Benefits and costs to people outside the City of Galveston should be valued **equally** to those for Galveston taxpayers."
- However, 72.7% felt that the impacts on Galveston should receive a higher value than those outside of Galveston.

Q6. When making public policy and infrastructure decisions, how should benefits and costs which affect people outside the City of Galveston be compared with those which affect taxpayers in the City?



APPENDIX – SURVEY INSTRUMENT

WELCOME

The City of Galveston is investigating a new way of evaluating potential projects. This new approach would consider costs and benefits that go beyond the immediate impacts to consider long term aspects affecting the health and well-being of the city and society at large.

This survey is intended to gather information on values, attitudes and preferences from Galveston citizens and taxpayers such as you. It will help the City determine the information to be included in the project evaluation. Examples of typical projects where this would be applied could include evaluation of the costs and benefits of building a new roadway on the island or the impacts of changing building codes.

Your opinions are valuable and will be used in developing this new tool. So, the City is asking you to consider and rank the importance of a wide variety of items that might be included. Please complete the entire survey to make sure that your voice is heard. Your answers will remain completely anonymous.

GENERAL RATINGS

1. Please rate the following GENERAL concerns by order of importance to you on a scale from 1 to 10. Where: 1= least important, being completely unimportant or irrelevant and 10 = most important, being absolutely vital

	1-Least	2	3	4	5-Neutral	6	7	8	9	10-Most
Reducing reliance on automobiles	○	○	○	○	○	○	○	○	○	○
Enhancing safety on roadways	○	○	○	○	○	○	○	○	○	○
Improving public transit	○	○	○	○	○	○	○	○	○	○
Increasing community walkability	○	○	○	○	○	○	○	○	○	○
Increasing bicycle mobility	○	○	○	○	○	○	○	○	○	○
Reducing vehicle congestion	○	○	○	○	○	○	○	○	○	○
Increasing the density of new housing	○	○	○	○	○	○	○	○	○	○
Creating mixed residential and commercial neighborhoods	○	○	○	○	○	○	○	○	○	○
Filling in and redeveloping older community areas	○	○	○	○	○	○	○	○	○	○
Providing for affordable housing	○	○	○	○	○	○	○	○	○	○
Providing for impacts on the poor and disadvantaged in decision-making	○	○	○	○	○	○	○	○	○	○
Improving ease of recycling	○	○	○	○	○	○	○	○	○	○
Reducing solid waste going to landfills	○	○	○	○	○	○	○	○	○	○
Reducing community water use	○	○	○	○	○	○	○	○	○	○
Increasing U.S. energy independence	○	○	○	○	○	○	○	○	○	○
Improving the availability of fresh and locally produced food	○	○	○	○	○	○	○	○	○	○

FINANCIAL AND ECONOMIC IMPACT RATINGS

2. Please rate the following ECONOMIC AND FINANCIAL IMPACT concerns by order of importance to you on a scale from 1 to 10. Where: 1= least important, being completely unimportant or irrelevant and 10 = most important, being absolutely vital

	1-Least	2	3	4	5-Neutral	6	7	8	9	10-Most
Minimizing local and state taxes	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Minimizing federal taxes	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Improving City infrastructure and services, even if it requires tax increases	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Contracting with private firms for City services if it is less expensive than the City providing those services directly	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Adding middle income jobs	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Diversifying the local economy	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Attracting middle income residents	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Improving the health of locally-owned businesses	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

ENVIRONMENTAL VALUES RATINGS

3. Please rate the following ENVIRONMENTAL VALUES by order of importance to you on a scale from 1 to 10. Where: 1= least important, being completely unimportant or irrelevant and 10 = most important, being absolutely vital

	1-Least	2	3	4	5-Neutral	6	7	8	9	10-Most
Reducing air pollution from power plants	○	○	○	○	○	○	○	○	○	○
Reducing air pollution from industry	○	○	○	○	○	○	○	○	○	○
Reducing air pollution from vehicles	○	○	○	○	○	○	○	○	○	○
Reducing fossil fuel consumption	○	○	○	○	○	○	○	○	○	○
Increasing energy efficiency	○	○	○	○	○	○	○	○	○	○
Managing development and reducing sprawl	○	○	○	○	○	○	○	○	○	○
Reducing water pollution from industry	○	○	○	○	○	○	○	○	○	○
Reducing water pollution from urban runoff	○	○	○	○	○	○	○	○	○	○
Reducing water pollution from sewage treatment	○	○	○	○	○	○	○	○	○	○
Added regulations controlling toxic substances	○	○	○	○	○	○	○	○	○	○
Creating "green" jobs	○	○	○	○	○	○	○	○	○	○

SECURITY VALUES RATINGS

4. Please rate the following SECURITY VALUES by order of importance to you on a scale from 1 to 10. Where: 1= least important, being completely unimportant or irrelevant and 10 = most important, being absolutely vital

	1-Least	2	3	4	5-Neutral	6	7	8	9	10-Most
Increasing police protection	○	○	○	○	○	○	○	○	○	○
Increasing fire and EMS services	○	○	○	○	○	○	○	○	○	○
Protecting community from storm damage and erosion	○	○	○	○	○	○	○	○	○	○
Protecting community property values	○	○	○	○	○	○	○	○	○	○
Improving building safety codes	○	○	○	○	○	○	○	○	○	○

OTHER VALUES RATINGS

5. Please rate the following OTHER VALUES by order of importance to you on a scale from 1 to 10. Where: 1= least important, being completely unimportant or irrelevant and 10 = most important, being absolutely vital

	1-Least	2	3	4	5-Neutral	6	7	8	9	10-Most
Improving public education	○	○	○	○	○	○	○	○	○	○
Improving reliability of water supply	○	○	○	○	○	○	○	○	○	○
Providing additional flood control	○	○	○	○	○	○	○	○	○	○
Reducing isolation and segregation of disadvantaged populations	○	○	○	○	○	○	○	○	○	○
Creating a more attractive or beautiful community	○	○	○	○	○	○	○	○	○	○
Protecting/preserving existing cultural and environmental resources as economic assets	○	○	○	○	○	○	○	○	○	○

GALVESTON VS. NON-GALVESTION EFFECTS

Some public investments will benefit persons beyond the City of Galveston. For example, reducing air and water pollution will benefit Galvestonians as well as other residents of the Houston region. In another example, obtaining reliable water supplies for Galveston might affect water supplies for those outside the city.

6. When making public policy and infrastructure decisions, how should benefits and costs which affect people outside the City of Galveston be compared with those which affect taxpayers in the City? Please choose one rating below.

- ○ Benefits and costs to people outside the City of Galveston should be valued much less than those for Galveston taxpayers.
- ○ Benefits and costs to people outside the City of Galveston should be valued slightly less than those for Galveston taxpayers.
- ○ Benefits and costs to people outside the City of Galveston should be valued equally to those for Galveston taxpayers.

RESPONDENT DEMOGRAPHIC INFORMATION

This information will be used to measure the validity of the survey sample when compared to the City of Galveston resident's social and economic characteristics. Again, your answers will remain completely anonymous.

7. Are you male or female?

- ◯ Female
- ◯ Male

8. Please enter your current age in the box below.

Age

9. What is your race or ethnicity? [Please select one option that most applies to you]

- ◯ White/Anglo
- ◯ Black/African American
- ◯ Hispanic/Latino
- ◯ Asian
- ◯ Other

10. What is the highest level of education that you have completed? [Select one answer below]

- ◯ Less than high school diploma
- ◯ High school diploma or GED
- ◯ Associate degree
- ◯ Bachelor's degree
- ◯ Graduate/professional degree

11. How many persons reside in your household? [Please enter the number in the box below]

Persons

12. Please describe the nature of your involvement with Galveston [Select one of the descriptions below that most accurately describes you]

- ◯ I am a part-time resident of Galveston
- ◯ I am a full-time resident of Galveston
- ◯ I own or manage a business in Galveston but am not a resident
- ◯ I own or manage a business in Galveston and am also a resident
- ◯ I am an employee (not owner or manager) but am not a resident
- ◯ I am neither a resident nor own / manage a business in Galveston

13. What was your household income in 2012? [Please select one category that best describes your total annual income]

- ◯ Less than $25,000
- ◯ $25,000 to $49,999
- ◯ $50,000 to $74,999
- ◯ $75,000 to $99,999
- ◯ $100,000 to $149,999
- ◯ $150,000 to $199,999
- ◯ $200,000 or more

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