

Use of the Envision Sustainable Infrastructure Rating System for Water Infrastructure

The Envision Sustainable Infrastructure Rating System is a triple bottom line based sustainability rating system specifically developed for use in civil infrastructure. The water infrastructure sector has successfully leveraged Envision to achieve application of sustainable practices in the planning, design, and long-term operation of a full range of facilities.

Introduction

Envision is a comprehensive sustainability system encompassing the full spectrum of triple bottom line (social, economic, and environmental) criteria that are directly applicable to the planning, design, construction, and long-term operation of physical civil infrastructure. Although the system is best applied at the initial planning phase of a project, it can be readily applied at any point in a project's life cycle, and is used by infrastructure owners, engineers, planners, designers, and other sustainability professionals as a vehicle for incorporation of sustainable elements into infrastructure projects of any type, size, or complexity.

Envision is the product of a joint collaboration between the Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design and the Institute for Sustainable Infrastructure (ISI). ISI was founded by the American Public Works Association (APWA), the American Society of Civil Engineers (ASCE), and the American Council of Engineering Companies (ACEC). Since its launch in 2012, many infrastructure owners have adopted the use of Envision their as standard for planning and design of their projects, and thousands of individuals have become credentialed as an Envision Sustainability Professionals (ENV SP).

The primary objective of Envision is to encourage use of sustainability principles through ease and wide availability, such that it fosters an increase in sustainable infrastructure throughout our built environment. The structure of Envision provides its users the capability to perform an extensive self-assessment of their projects to aid in identifying gaps in which sustainability improvements could be instituted. Envision is comprised of multiple categories, each containing several credits that encourage the project team to not only do the "project right", but identify the "right project". Should the project team be interested in validating their project, an optional independent, third-party ISI verification program is available that provides an

objective review of the project, as well as an avenue for public recognition of the project. This third-party verification allows the project team to demonstrate the owner's commitment to sustainability through a transparent and industry-recognized system. As with many projects, public acceptance is critical and the use of this nationally recognized standard is a valuable tool to convince citizens that their resources are being wisely invested.

Envision for Water Infrastructure

Prior to the release of Envision, those in the water industry interested in improving the sustainability of water infrastructure projects, as well as to provide recognition for those projects that did so, found the existing sustainability rating systems lacking. Leadership in Energy and Environmental Design (LEED), the rating system developed by the United States Green Building Council (USGBC), was most commonly used. However, while it was feasible to apply LEED to occupied buildings, it was more difficult to apply it to other aspects of water infrastructure such as water treatment plants, water resource recovery facilities, green infrastructure systems, and collection and distribution systems which were generally not occupied, and thus required other considerations when looking to improve project sustainability.

Water infrastructure owners are increasingly requiring that Envision be utilized in the planning, design, and long-term operation of their projects. Envision is being used in several ways including the following:

- To compare alternatives
- To assess the sustainability of past and current projects
- To identify ways to improve the sustainability of projects
- To identify the areas where projects are performing well, along with areas for improvement

- To compare the sustainability of similar projects, referencing a standard, industry accepted system
- To identify and/or set a baseline for sustainability and demonstrate improvements in sustainability as enhancements are made to projects of a similar typology
- To receive public recognition for sustainability achievements by an independent, recognized system
- Verifiable way to show community / rate payers that project addressed community concerns and was more sustainable than typical water infrastructure projects

To achieve these goals, owners are:

- Training internal planning, design, construction, and operations staff in the use of Envision, and requiring that their consultants do the same with their staff
- Including requirements for ENV SPs and the use of Envision in requests for qualifications and proposals
- Adopting resolutions requiring that Envision be used in some capacity for all infrastructure projects
- As part of their standard project procedures, requiring the use of envision in planning and design projects
- Using Envision to identify areas for improvement and developing standards, procedures, and minimum requirements to continuously move the needle on project sustainability

Case Study: New York City Department of Environmental Protection

The City of New York (NYC) is the single largest municipal and regional economy in the United States. Home to over 8.5 million people, NYC is the most densely populated city in the country which swells daily to 9.5 million people with commuters, visitors and tourists. NYC recognizes that a sustainable city is one that is grounded in the recognition that people, economic development, and the environment are interconnected, and for any to thrive, all must thrive together. This is why NYC has committed to the United Nation's Framework Convention on Climate Change in order to limit temperature increases this century to just 2°C and to avert the worst effects of climate change.

NYC Department of Environmental Protection (NYCDEP) supplies and distributes more than 1 billion gallons of high-quality drinking water daily to nine million New Yorkers and visitors, and treats 1.3 billion gallons of wastewater to achieve the smallest possible impact on water quality in New York Harbor. This monumental task is accomplished through the ownership and maintenance of 19 reservoirs and 3 controlled lakes, and the capture and delivery of wastewater via 7,000 miles of water mains and 7,400 miles of sewers. In-city infrastructure alone includes 14 wastewater treatment plants and 96 pumping stations. These critical structures are in need of constant maintenance, and are often located in densely populated locations by virtue of

the necessary coastal locations. NYCDEP collectively represents the second largest greenhouse gas emitter in NYC, and the third largest consumer of energy. Because of these major contributions to the environment, both physical and social, NYCDEP aspires to stand at the forefront of sustainability in New York City, the nation, and the world.

NYCDEP's mission is "to be the safest, most efficient, cost-effective, resilient, and transparent water utility in the nation." As the agency strives to meet this goal, the need for a systemic and quantifiable approach to integrate the triple bottom line criteria of social, economic, and environmental impacts becomes ever more acute. The triple bottom line is currently considered in NYCDEP projects based primarily on economic value, with environmental impacts a rapidly gaining second, and social impacts largely underrepresented in critical design decisions.

City sustainability initiatives/laws

The incentive for meaningful sustainability integration is being rapidly applied on a city-wide level. Living in dense spaces with a legacy of environmental issues, compounded with the continual sprawl and associated demographic shift of urban areas and NYC in particular, creates an environment where environmental and social issues are inextricably linked. The current landscape increasingly motivates designers to place the triple bottom line at the forefront of design. Mayor De Blasio's OneNYC and subsequent Local Laws (Table 1) expand on the mainly environmental initiatives of Bloomberg's PlaNYC to include heavy emphasis on human rights and a higher quality of life for all New Yorkers.

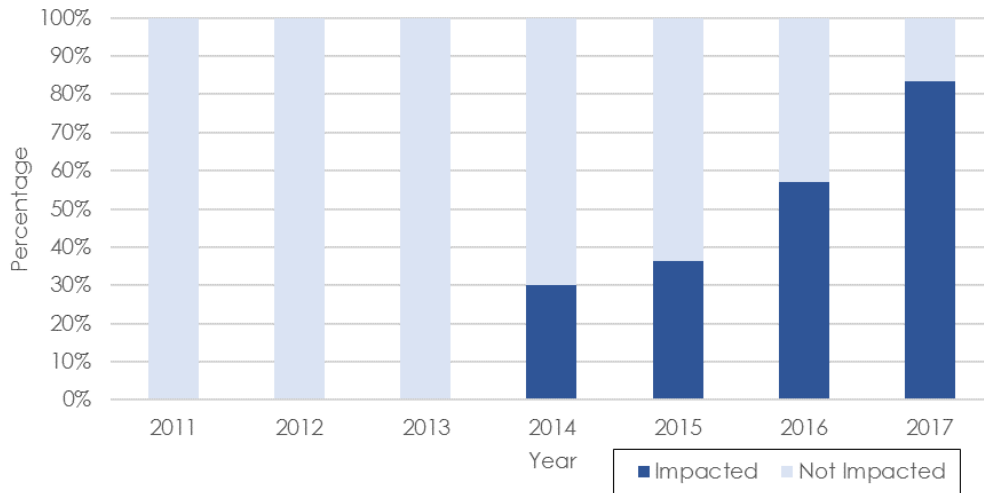
Local Law (Year)	Objective / Mandate
LL 86 (2005)	LEED Silver Rated Green Buildings
LL 22 (2008)	30% Reduction in Energy / GHG
LL 57 (2010)	Water Efficiency Standards
LL 20 (2011)	Rooftop Solar Analysis
LL 71 (2011)	Asphalt Pavement Recycled Content
LL 10 (2013)	Stormwater BMPs
LL 130 (2013)	Electric Vehicle Charging Stations
LL 66 (2014)	80% reduction in Energy / GHG by 2050
LL 6 (2016)	Geothermal Systems
LL 24 (2016)	Photovoltaic Systems
LL 31 (2016)	Low Energy Buildings
LL 32 (2016)	Expanded Green Buildings Ratings to LEED V4 Gold / Envision Alt.

Table 1: Sustainability Focused NYC Local Laws Impacting Water Infrastructure

Ambitious environmental objectives, such as an 80% carbon reduction by 2050, are paired with a human element, such as fostering higher percentages of New Yorkers living within

walking distance of a park. Preparing for resiliency in the face of sea level rise induced by climate change is paired with an initiative to decrease flooding in vulnerable and often poor neighborhoods. The need for a framework by which to measure the success of these newly human-centric environmental initiatives becomes even more critical in creating truly sustainable projects.

Projects Impacted by Sustainability Local Laws



Departmental History of Sustainable Design (pre-Envision)

With these overarching goals in mind, NYCDEP was tasked with finding an agency-appropriate method of fulfilling them. The challenges with identifying a universally appropriate triple bottom line analysis were numerous. NYCDEP infrastructure is by design unseen. Pump stations, wastewater treatment plants, and drinking water purification operations are not open to the public for safety and security. The community should not interact tactilely with this infrastructure and therefore it cannot be subject to traditional measurements of social impact. Designers as well are challenged to convey the indirect community benefit that can be gained from NYCDEP projects.

For example, visualizing how a sewer modification project can fit into the abstract concept of the "larger community" can be difficult, and even more challenging to justify during early planning stages when critical design decisions are made. In addition, NYCDEP's diverse portfolio of projects require a system to evaluate infrastructure that ranges from unmanned, subgrade pump stations to large scale drinking water filtration plants coupled with community recreation areas.

NYCDEP has limited experience with the USGBC's LEED rating system. Two projects have been evaluated, using LEED, to date. Between 2009 and 2012 NYCDEP evaluated nearly a dozen TBL Rating systems for Agency use. NYCDEP was moving forward with development of its own rating structure in 2012 when the Zofnass Program for Sustainable Infrastructure approached NYCDEP for a case study to use in the development of what would become Envision.

Triple Bottom Line Systems

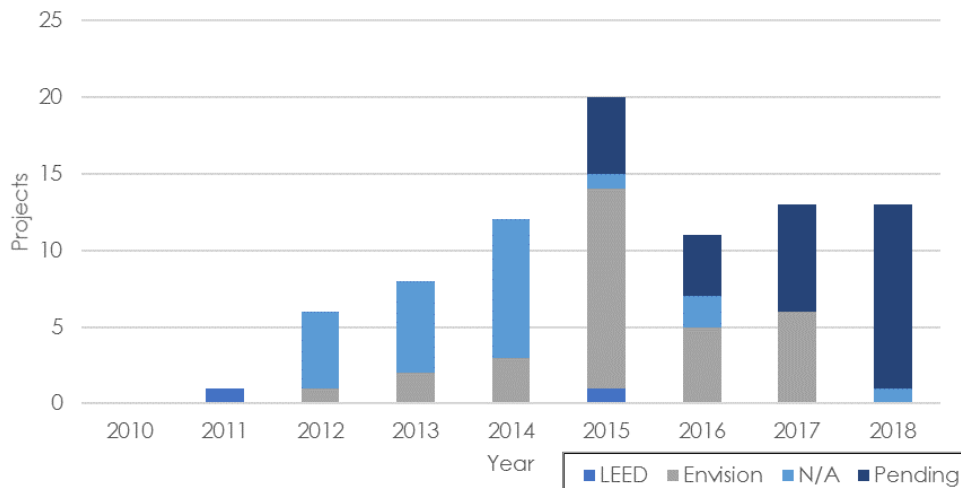




Photo 1: 26th Ward WWTP – Envision encouraged reductions in energy and solid waste. (Photo provided from : Google Earth)

Approach/standardization of Envision use for Departmental projects and context within BEDC Program

Implementing Envision into NYCDEP practice was a process of incremental change. The process began in 2012, when the Sustainability Division was created at NYCDEP within the Bureau of Engineering Design & Construction (BEDC). Projects are evaluated for their sustainable attributes early in design, allowing for flexibility in the addition of features with lower costs and effort than if these methods were implemented retroactively. The BEDC sustainability program key performance indicators are updated at each major project milestone, starting with a series of workshops which occur at project kickoff, 30% design, and continuing thru 100% design completion. Within the program, Envision is embedded as a tool for evaluating the sustainable components inherent in the project design and to identify areas in need of further consideration. LL 32 (2016) has expanded the need to perform triple bottom line assessments of capital projects: DEP uses Envision as part of its compliance. Thus far, NYCDEP has trained over 300 employees to use the system, and currently has over 80 registered ENV SPs on staff.

SOP049 – Sustainability Management Plan
SOP050 – Sustainability Workshop, Preliminary (Facility Planning Stage)
SOP051 – Sustainability Workshop, Deep Dive (Design Stage)
SOP052 – Sustainability Rating Systems
SOP053 – Energy Conservation & GHG Reduction Plan
SOP055 – Climate Risk Assessment and Adaptation Plan
SOP056 – Recycled Content for New Materials
SOP057 – Construction Waste Estimate Reporting
GHG Emissions Calculating Tool (LGOP Based)
Climate Risk Mitigation Guidance
Rooftop Solar Design Guidance

Table 2: NYCDEP Sustainability Focused Standard Operating Procedures

The use of the Envision has aided NYCDEP designers to push the boundaries of traditionally gray infrastructure projects, therefore incentivizing the inclusion of sustainable stormwater management solutions and low impact development techniques. When placed in the context of greater community and city resiliency, and even further defined through an accredited rating system, these concepts become less abstract. Implementing Envision on NYCDEP projects can level the field of understanding and better illustrate the sustainable design decisions consciously inserted into a project.

Project highlights

- 26th Ward Wastewater Treatment Plant – Preliminary Treatment and Reliability Improvements

The 26th Ward Wastewater Treatment Plant is located on a 57.3 acre site in Canarsie, Brooklyn (Photo 1). The plant is located in Brooklyn Community District 5, which covers the east-central portion of Brooklyn. The plant currently serves a population of approximately 283,400 from a drainage area of 5,907 acres. The current design dry weather flow is 85 million gallons per day (mgd). The treated and chlorinated effluent is discharged into the Hendrix Street Canal that borders the plant to the east and is tributary to Jamaica Bay. The 26W-20 Preliminary Treatment and Reliability Improvements project has the overall goal of increasing the reliability of preliminary treatment at the plant, and to improve flow, solids, and grit distribution to the primary settling tanks. The project will include improvements to the Primary Treatment Facilities, Pump and Blower House, Sludge Degritting Wing, and Biological Nutrient Removal Building, as well as the installation of the first green roof installed on an in-city wastewater treatment plant. This contract was estimated at \$134 million dollars. The project design was completed in December 2014 and construction completion is targeted at October 2021.

26W-20 received an Envision Silver Rating in August of 2015. This project was the first wastewater treatment plant to receive an Envision certification in the United States, and the first NYCDEP project to achieve full third-party accreditation. Goals to incorporate TBL initiatives into this traditionally gray infrastructure project included increased durability and energy efficiency, sustainable

procurement and reused materials, strategic use of landscaping techniques, installation of a green roof, reduction of climate threat, and meaningful stakeholder involvement. Defining the level of public engagement as a key indicator of project success solidified its importance in design and implementation. Envision was used as a platform to guide designers in the creation of a project incorporating all aspects of the triple bottom line.

- Esopus Creek Bridge Replacements

This project involves the complete removal and replacement of bridges carrying Route 28A over the former Ulster and Delaware Railroad corridor and the Esopus Creek (Photo 2). Route 28A is a 20-mile long rural collector roadway that connects the communities located south of the Ashokan Reservoir to NYS Route 28 and points along the north side of the reservoir. Both Bridges were constructed in 1913 and are now structurally deficient and functionally obsolete.



Photo 2: Esopus Creek Bridge Replacements – Envision encouraged greater connections between community assets and reduced impacts on the natural environment. (Photo provided from: Google Earth).

The NYCDEP is proceeding with design of the replacement of both bridges, to address structural deficiencies and provide structures that will satisfy current design standards. Based on the inherent nature of NYCDEP's efforts to increase infrastructure resiliency, the designer and NYCDEP are working in partnership to deliver a sustainable project with respect to the triple bottom line.

In using Envision, the project has prioritized stormwater BMPs and minimized disturbed habitat through the design process. The project is designed to recycle all waste from the demolition of the existing structures. A center pier was removed from one of the bridge spans to improve hydraulic performance, and minimize impact on the waterway. Most notably, the project had a collaborative approach with stakeholders through a communications engagement program. This resulted in a reduction of parking spaces required for a nearby rail trail by adding a protected bike lane to the project.

Case Study: Los Angeles County Department of Public Works

The County of Los Angeles covers over 4,700 square miles and has a population of 10 million people. Within the County there are 88 incorporated cities and over 140 unincorporated communities. The local geography is varied, and rising from the beaches to the mountains and beyond to the high desert, and encompassing 5 distinct climate zones. Supporting this population in such a geographically diverse region requires a wide variety of infrastructure.

The County of Los Angeles Department of Public Works was formed in January 1985, consolidating the former County Road Department, County Engineer, and the County Flood Control District. The Department is one of the largest public works departments in the nation and is responsible for the design, construction, operation, and maintenance of roads, traffic signals, bridges, airports, sewers, flood control, water supply, water quality, and water-conservation facilities. The Department's diverse operations are defined within six core service areas: Development Services, Emergency Management, Public Buildings, Transportation, Waste Management, and Water Resources. Its annual operating budget is over \$2.4 billion and it employs over 4,000 people.

Much of the County's infrastructure was built in the 1940s and 50s and has lasted well beyond its initial life expectancy. Coupled with the age of the infrastructure, climate change is creating new extremes in sea level rise, temperature, rainfall, flooding, fires, mud flows, drought, and earthquake risks. Flood control infrastructure maintained by Public Works includes 14 major dams and reservoirs, 483 miles of open channel, 27 spreading grounds, 3,330 miles of underground storm drains, 47 pump plants, 172 debris basins, 27 sediment placement sites, 3 seawater intrusion barriers, and an estimated 82,000 catch basins. County transportation infrastructure includes 3,200 centerline miles of County roads, 533 County-owned bridges, 144 miles of bikeways, and 5 general aviation airports. This infrastructure plays a critical behind-the-scenes role in protecting County residents and keeping the area economy moving. With limited funding, it is critical that new projects are planned with sustainability in mind to provide the greatest social, economic, and environmental benefits possible to the residents of Los Angeles County.

The County of Los Angeles Department of Public Works has been a national leader in promoting sustainability in civil infrastructure project planning, programs, and services. Public Works demonstrated its leadership in its 2012 Strategic

Plan, which identified sustainability as one of Public Works' core values and incorporated sustainability into all five Strategic Focus Areas. Following current County policy, Public Works designs all new County-owned buildings with an area of 10,000 square feet or more to a minimum of Gold Certification LEED. The County also has a Low-Impact Development ordinance to address storm water runoff and enhance groundwater quality. Public Works has also developed green infrastructure guidelines, which are currently being updated to include additional design standards for green streets and alleys.

Sustainability Initiatives	Date
Healthy Design Ordinance	February, 2013
Green Building Program	November, 2013
Clean Fuel Sustainable Fleet Policy	June, 2015
Roadmap to a Sustainable Waste Management Future	October, 2015
Community Climate Action Plan	October, 2015
Park Needs Assessment	July, 2016
Renewable Energy Ordinance	December, 2016
LEED Gold Policy for County Buildings	December, 2016
Los Angeles Community Choice Energy Program	April, 2017

Table 3: LA County Sustainability Initiatives

County sustainability initiatives/laws

The County of Los Angeles has undertaken a number of sustainability initiatives over the last several years, some of which are highlighted in table 3.

On August 16, 2016, the County Board of Supervisors directed the Director of Public Works, in coordination with the Chief Sustainability Officer and Chief Executive Officer, to expand and adopt the use of Envision as a standard for County infrastructure projects and programs as appropriate, including those related to energy, water, waste, transportation, landscape, and information.

Departmental approach/standardization of Envision use

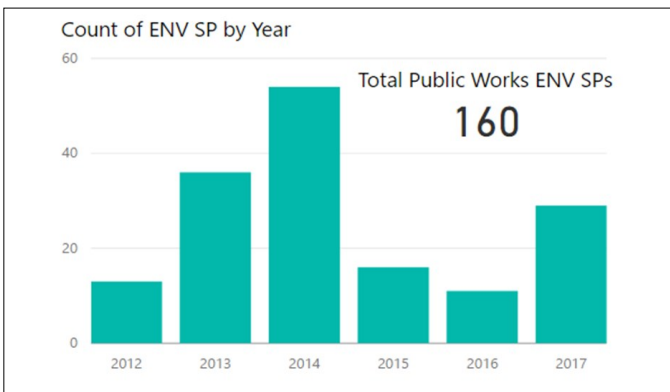
Since 2011, Public Works has used Envision on a variety of infrastructure projects, including road improvement, stormwater capture, and multi-benefit projects.

With the Board's adoption of Envision as a County standard, it will be used to guide all County infrastructure projects and programs as appropriate. Using Envision as a guideline, Public Works reviewed its existing planning and design processes and identified several opportunities to incorporate Envision and improve sustainability. These opportunities include updates to project planning, design and construction, contracting, and private developer-driven plan review processes.

Public Works is also developing sustainable infrastructure design guidelines to facilitate sustainable design. The guidelines utilize and integrate sustainable best practices and design criteria into the project planning and concept phase of a project. The guidelines will provide design teams with templates to achieve various levels of sustainability and are also being developed based on the Envision framework. Therefore, designing a project following the steps and elements in the guidelines will automatically implement the sustainability principles of Envision, leading to a high Envision rating and a more sustainable project. Further, the guidelines will encourage the entire infrastructure management team to collaborate early in the process.

Contractor requirements

One way to incorporate Envision into the existing contracting process is by awarding proposers additional points for demonstrating their experience in incorporating sustainable practices in their work, or making this experience a requirement during the contractor evaluation process. Public Works is now requiring as-needed engineering and design consultants to have an ENV SP on staff and to discuss their experience with the Envision rating system in their proposals. Design consultants will be required to use Envision when developing project design concepts and follow Public Work's sustainable infrastructure design guidelines on all future projects.



Internal staff training

Currently Public Works has 160 credentialed ENV SPs on staff and 81 staff enrolled in the online training program to become credentialed. Since the 2016 Board Motion, 35 staff have completed the training and earned their ENV SP credentials. Public Works is currently developing an in-person training program that would provide training sessions at Public Works Headquarters facilitated by a certified Envision trainer. The training sessions would be available to Public Works staff, other County department staff, and consultants who contract with Public Works.



Photo 3: Installation of Sun Valley Infiltration Basins
(Photo provided by LA County DPW)

Project highlights

- Sun Valley Watershed Multi-Benefit Project

The County's Sun Valley Watershed Multi-Benefit Project (Photos 3 and 4) received a Platinum Award from ISI. The project was a first-of-its-kind for managing storm water and provide much needed flood protection for residents in the San Fernando valley. The project improved the health of the watershed and increased the wildlife habitat, all while maximizing the opportunities of an existing park.

The project consists of several completed components including Tuxford Green, Sun Valley Park Drain and Infiltration System, Elmer Avenue Neighborhood Retrofit, and the Elmer Avenue Paseo. Other components include the Rory M. Shaw Wetlands Park and the Sun Valley Watershed Upper Storm Drain System and Recycled Water Line, which are in the final design stage.

- Rosemead Boulevard Improvement Project

The Envision framework has also informed the planning of the pioneering Rosemead Boulevard Improvement Project, a major thoroughfare that cuts through Whittier Narrows, in the unincorporated communities of Supervisorial District 1. This project will transform the area from a barren State highway to a County maintained road with landscaping, bike lanes, bioswales, and street calming measures to complement the 1,492-acre Whittier Narrow Recreation Area.



Photo 4: Completed Sun Valley project area above Infiltration Basins (Photo provided by LA County DPW)

References

Envision Sustainable Infrastructure Rating System Guidance Manual

Institute for Sustainable Infrastructure

<https://sustainableinfrastructure.org/>

Los Angeles County Department of Public Works Sustainability

<http://dpw.lacounty.gov/adm/sustainability/>

New York City Department of Environmental Protection

<http://www.nyc.gov/html/dep/html/home/home.shtml>

New York City Department of Environmental Protection Knowledge Reservoir

<https://app.e-builder.net/public/publicLanding.aspx?>

Additional Resources

Water Environment Federation Envision Guidance Document

<https://www.wef.org/globalassets/assets-wef/direct-download-library/public/03---resources/envision---compiled-conversion---final.pdf>

Zofnass Program for Sustainable Infrastructure

<http://research.gsd.harvard.edu/zofnass/>

Acknowledgments

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