

Central Plaza Recommendations

ENVI460 | Spring 2021
Conservation and Sustainability of Natural Resources

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This report represents original student work and recommendations prepared by students in the Indiana State University Sustainable City Program for the City of Sullivan. Text and images contained in this report may not be used without permission from Indiana State University. All information provided is not subject to publication.

ACKNOWLEDGMENTS

The authors wish to acknowledge and thank the City of Sullivan for making this project possible. We would like to thank the staff for their assistance and contributions that were instrumental to the completion of this report. We would specifically like to thank Mayor Lamb for his contributions to the class and providing information needed to complete this project.

Mayor Clint Lamb, *City of Sullivan*

ABOUT SC

The Sustainable Cities (SC) Program is an experiential learning partnership focusing on sustainability and cities in Indiana. Disciplines across the institution are tasked with addressing sustainability issues in a specific community by integrating these into experiential projects for ISU students. These problems range from strategic planning recommendations to community needs assessment, and understanding the impacts of waste strategies to mapping trail systems, and many other issues.

This is a year-long partnership, in which students and faculty in courses collaborate with one specific community partner on these projects. Communities throughout Indiana have leaders who want to make real change. These leaders are passionate about moving their cities forward into the future, but are often limited by lack of resources, staff, and budget.

The SC Program utilizes the innovation and energy of students and faculty to provide ideas that will address these issues. This relationship reinforces and strengthens our Indiana communities.

Each ISU course and community partner will produce tangible and relevant outcomes for the community partner while providing ISU students with real world project completion. This report serves as this outcome.

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ABOUT SULLIVAN, IN

Sullivan, IN is the county seat of Sullivan County and serves as a hub for the towns of Carlisle, Dugger, Farmersburg, Hymera, Merom, and Shelburn. Sullivan, IN was founded in 1853 and became the county seat. The total city limits is 1.88 square miles, but there are more residents living outside of this area that contribute to the community of Sullivan. Today, Sullivan has the largest estimated population as an incorporated town in Sullivan County.

Sullivan faces many similar social, environmental, and economic challenges to other rural Hoosier towns and others that are unique to the city itself. There are approximately 8,500 people available for the labor force in Sullivan County. Since 2009, the unemployment rate has steadily decreased in the county. There's approximately 2,500 people that live in Sullivan but work in other counties. Some of the major employers in Sullivan are Raybestos Powertrain LLC, Hoosier Energy Emergency, Peabody Energy Corp., Sullivan County Community Hospital, and Raybestos Products Co.

A common thought among Sullivan community members is that students that go to college graduate and don't return to Sullivan. The highest degree attainment of folks 25 and older in Sullivan County is a high school diploma. Trade programs and certifications are a community concern from folks.

Sullivan has a vast history and many points of interest in the community. The Sullivan County Public Library is one of 1,679 libraries designated as a Carnegie library. The Sullivan Civic Center was recently renovated to provide a central location for community members in Sullivan. The Heart of Sullivan is a civic organization that hosts many large events throughout the year. One of the largest events hosted in Sullivan is the Sullivan Annual Rotary Corn Festival.

This community is full of potential and is being led through a strategic plan intended to bolster its standing for Hoosiers. The ISU Sustainable Cities program intends to help reach that potential.

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EXECUTIVE SUMMARY

The City of Sullivan intends to leverage the new Central Plaza and Civic Center as key to the city. The Quality of Life plan indicates a desire to construct appealing aspects to Central Plaza. ENVI460 students were tasked with providing recommendations for a water feature and other sustainable features like a green roofing. This report reflects students' recommendations for a sustainable green roofing and wall for Central Plaza.

INTRODUCTION

The Sullivan Quality of Life Plan intends to improve the Sullivan community. The City of Sullivan wanted to look at their Central Plaza and any recommendations for bringing community to the space. One aspect of the was to create ideas that would bring community and tourists to Central Plaza and actually use it. ENVI460 was tasked with providing recommendations for things that could bring folks to Central Plaza.

Sullivan has vast areas of buildings surrounding streets, parks, and people within the community. A green roof or green wall could compel a new style that brings more life to the community.

Green roofs have many benefits that Sullivan could use, such as storm water runoff control, property value, and sustainable practices within a community. **Green roofs** are vegetation on top of roofs and typically implemented in urban areas to reduce the urban heat island effect. Green roofs provide multiple social benefits like attracting more people to an area, providing more green space, breaking up the monotony of buildings, and providing health benefits to the community.

Green roofs provide energy efficiency and reduce energy usage by removing heat, and reduce the urban heat island effect through cooling. Green roofs encourage more native planting.

Another option is **green walls**. Green walls can be installed either indoors or outdoors. These are essentially a wall, or part of a wall, that is covered with greenery growing in soil or another type of substrate. Green walls require little to no maintenance and are quick to build. These are also more financially cost-effective. Green walls allow for a lot of creativity in design and installation.

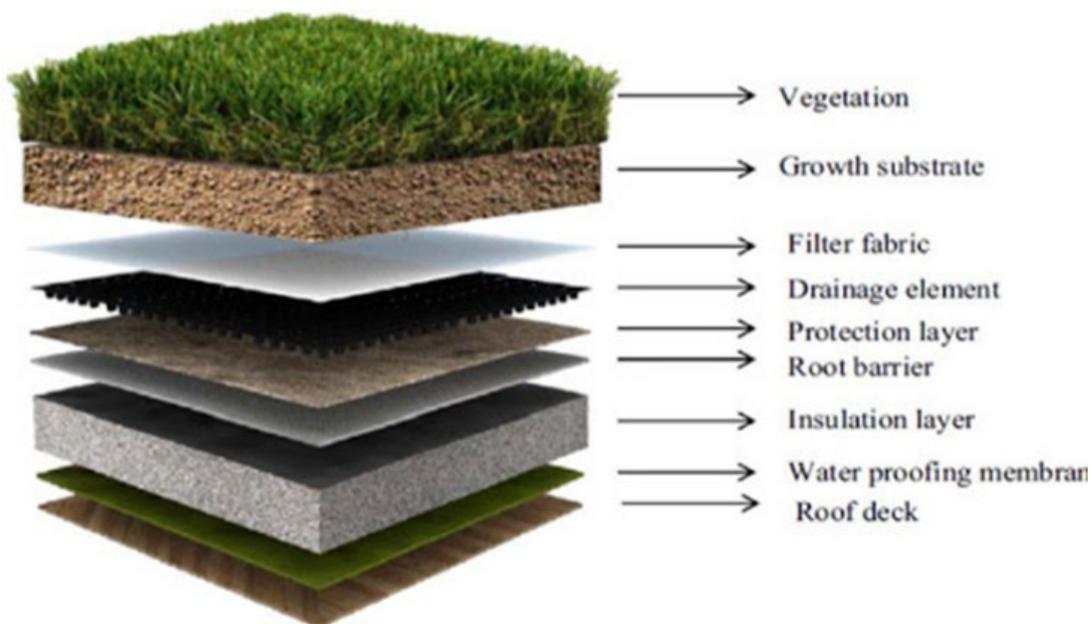
GREEN ROOF

Green roofs are recommended to incorporate into city construction for public buildings. These can help sustain communities by cooling urban areas, insulating buildings, removing heat with the process of evapotranspiration, retains rainwater and prevents flooding, and provides an artistic draw for people. Students provide recommends for green roofing in Sullivan below:

Green roofs should be implemented in urban areas to reduce urban heat island effect. They also provide aesthetic and health benefits to the community. Green roofs break up monotony in concrete buildings and are a draw for community and tourists alike. Having more green spaces in a city has been shown to increase health for community. Incorporating green spaces encourages folks to be outside and improve their physical health while simultaneously reducing stress and anxiety (Lawton et al., 2017). Green roofs also provide energy efficiency and reduce energy use by

removing heat with the process of evapotranspiration (US EPA, 2014). The final benefit is crucial, as green roofs help prevent stormwater runoff that can increase floods and hurt local communities.

Green roofs can be heavy due to the various layers they require to be effective. Each layer has a purpose that is not just the vegetation layer. Depicted in the provided graphic you can see the necessary layers for an effective green roof. This helps support vegetation and protect the buildings roof from water damage (Vijayaraghayavan, 2016).



There are two types of green roofs: intensive and extensive. The differences between the two types are listed in this table.

Areas	Intensive	Extensive
Maintenance	High	Low
Irrigation	Regularly	Periodically
Diversity	Lawn-Perennial-shrub-tree	Sedum-Herb-Moss-Grass
Cost	High	Low
Weight	Heavy (15-50lbs/sq. ft.)	Lightweight- (50-150lbs/sq. ft.)
Thickness	140-400mm	60-200mm
Use	Accessible	Inaccessible

Extensive green roofs are cheaper and require little maintenance but are inaccessible to the public which lowers social value. Intensive green roofs can provide more biodiversity and are accessible, but it is costly on time and money.

RECOMMENDATION



A green roof on the Central Plaza performance stage could be beneficial for storm water management. Placing green roofs on the wings of a performance stage in Central Plaza will provide benefits in storm water management and provide an artistic look to the performance stage.

Including rainwater collection by implementing collection spouts at the end of each wing leading to a rain barrel will also help recycle usable water. This could also be beneficial to tie into the reused water in the proposed water feature. The wings should be slightly slanted to make it easier for maintenance workers to take care of vegetation and to easily collect rainwater.

GREEN WALL

A green wall is an excellent option for Sullivan to implement on existing buildings and to future builds. They provide similar benefits as green roofs, but they are less extensive in installation and can be more readily accessed by the public. Green roofs are a public draw and will break up the monotony of concrete buildings.

Green walls are an alternative as they are cheaper and can be either indoors or outdoors. Usually, green walls are on a smaller scale, but they can be designed to be as big and tall as a side of a building. Green walls reduce urban heat island effect, attract tourists, and reduce the usage of heating and cooling.



We recommend using a design like the one depicted for Central Plaza on either a performance stage build or on the existing civic center. By incorporating a green wall into an existing structure like the civic center, the City of Sullivan could provide another artistic feature and curb appeal for community and tourists. This will also provide excellent benefits for heating/cooling, and storm water management for the plaza.

CONCLUSION

After researching green roof and green wall structures, students in ENVI460 recommended ways to implement green roofs or green wall into the Central Plaza plans. It is believed that these will provide environmental benefits, economic benefits, tourism appeal, and health benefits. The students provided two primary recommendations for the city to implement at Central Plaza.

Recommendation:

1. Green roofing components on the performance stage planned for Central Plaza.
2. Green wall on the existing Civic Center.

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APPENDIX A.

Student Report.

GREEN ROOFS AND GREEN WALLS

Pros/Cons

Before listing the advantages and disadvantages of the green roofs, there needs to be an understanding of what a green roof actually is. Green roofs are the idea of planting vegetation on the tops of rooftops (Vijayaraghavan, 2016, p. 740). Green roofs have been used in many different places but more so in urban areas. Green roofs are implemented in urban areas because it focuses on the reduction of the urban heat island effect. Besides decreasing the effects of the urban heat island effect, green roofs can provide benefits to the town of Sullivan that target to the social, economic, and environment areas of a community.

The social benefits are endless when it comes to green roofs but the benefits that Sullivan would thrive on are the aesthetic look and health benefits. One of the goals from this project is to attract more people to the city of Sullivan. A way to do that is to incorporate green roofs in the downtown area. With incorporating a few green roofs along with other sustainability efforts like green space, downtown Sullivan will give the people a break from the sore-eye concrete building and bring to life a lively environment that is refreshing to look at and engage with. Green roofs will provide a natural look that will bring beauty to the downtown area but appearance is not the only benefits.

The green roofs act like another green space that Sullivan County is already working towards in their Quality Life Plan (HWC Engineers, 2021). By adding green roofs to the other designs of green spaces, Sullivan will not only bring liveness to the city but health benefits for the community. With available green spaces and roofs, the community will have a variety of areas that they can engage with, getting them outside and into the environment. According to Lawton et al. (2017), physically being outside has shown to improve physical health while reducing the stress and anxiety. In another study on post-surgery recovery patients in Texas, they found that patient recovery was quicker when the patients were allowed to look at green spaces instead of four white walls (*The Link between Green Roofs and Improved Wellbeing*, 2020). With having green roofs accessible in Sullivan County, the community can benefit their own health by simply going outside in a designated area that they can engage with the environment.

With the installation of green roofs, the town of Sullivan can benefit economically. Some of those benefits include saving cost on heating/cooling, and improve storm water management. With the urban heat island effect causing temperatures within the city to be warmer than the outside areas, this result in an increase usage of cooling throughout the day and through the night. When it becomes later in the day, we assume that it gets colder however, because if the material used on building, the heat that is gathered throughout the day radiates through the night. Green roofs can provide energy efficiency and reduce energy use by removing heat with the process of evapotranspiration, from the vegetation, and acts as an insulator for buildings which helps reduce the usage of heating and cooling (US EPA, 2014).

One economic problem that Sullivan County, and other surrounding counties, is facing is stormwater runoff. When it comes to storm water runoff, it is one of the most important benefits a green roof gives (Berardi, 2014, p. 421). Green roofs provides a retention of rain water that helps prevent flooding by not overwhelming storm drains in a city. When storm

drains are bombarded with heavy amounts of rain, flooding occurs which can be devastating towards a community and cost thousands of dollars of damage. According to Clark (2008), green roofs can retain an average of about 70% of annual rainfall, depending on the type of climate (p. 2158). If Sullivan were to implement green roofs into their city, they can save money that they lose from the overflow of storm drains.

The biggest use of the green roofs is the environmental benefits. Some environmental benefits include reducing the urban heat island effect, increasing biodiversity, and reducing storm water runoff. The urban heat island effect increases the temperature in urban areas, which can increase air pollution. With having green roofs that can improve the urban heat island effect by using evapotranspiration to cool the rooftops and increase the surface albedo on rooftops (Debating Science, 2019). With biodiversity, green roofs can promote planting more native plants in the area and act as an “intermediate link for migration for species of insects and birds, using the urban environment as stepping stones for wildlife movement” (Tolderland, 2010). A common problem that urban areas face is managing their storm water. By utilizing green roofs, the vegetation can retain the storm water, which can reduce the amount of storm water build up and “improve the quality of storm water released into the city sewer system” (Tolderland, 2010).

Even though green roofs have their benefits it is important to look at the drawbacks of green roofs. Some drawbacks of green roofs include: cost, weight, and maintenance. Green roofs can provide many benefits to a community but only if they can be funded. Firstly, green roofs are costly because of the many layers of material that is needed to create a green roof. Green roofs are also costly because of the type of green roof, construction labor, and the price of vegetation used on the green roofs (Drodz, 2019, p. 7). Secondly, green roofs are heavy because of the extra layer of material laid on the rooftop. Depending on the type of green roof determines the weight load on the rooftop. If the rooftop is not stable enough then the weight can cause damage to the roof which can cause cracks or leaks. Lastly, maintenance is another drawback of green roofs that is also determined by the type of green roofs.

Structure and Types of Green Roof

When it comes to green roofs, there are many components that give green roofs their look and benefits [shown in image below] (*Components of Green Roof*, 2017). Green roofs are



very complex with their structure that varies with the kind of green roof that is built. One of the disadvantages to green roofs is that they are heavy which can set drawbacks to older buildings. Green roofs are heavy in nature because they need many layers to support the vegetation and protect water damage to building's roof tops (Vijayaraghayavan, 2016, p. 744).

Each layer has an important function that is needed to maintain any type of green roof so it is important to focus on the structure before buying and installing any vegetation.

There are two types of green roofs that Sullivan can choose from: extensive and intensive green roofs. The table below provides a look into the differences between intensive and extensive green roofs regarding important areas to consider when installing green roofs.

Areas	Intensive	Extensive
Maintenance	High	Low
Irrigation	Regularly	Periodically
Diversity	Lawn-Perennial-shrub-tree	Sedum-Herb-Moss-Grass
Cost	High	Low
Weight	Heavy (15-50lbs/sq. ft.)	Lightweight- (50-150lbs/sq. ft.)
Thickness	140-400mm	60-200mm
Use	Accessible	Inaccessible

Even though extensive green roofs are cheaper and require little maintenance, they are inaccessible to public which lowers the social value of green roofs as well as the limitations of increasing biodiversity. However, with intensive green roofs, it can provide more biodiversity but it is costly on time and money. With looking at the city of Sullivan, there are older buildings residing in the area which cannot withstand the weight of an intensive green roof. For the city of Sullivan, good start to implement green roofs into the community is through small-scale extensive green roofs. The lightweight of the green roof can be supported by the old stability of the building or a smaller scale buildings in the area.

Green Roof Design for Sullivan

In Sullivan’s Quality Life Plan, there was plan for implementing green roofs on the wings of the performance stage in Central Plaza that they want to build. For the performance stage, an extensive green roofs are better for the wings of the stages because they are lightweight. To help with storm water management, there will be a spout on each end of the each wing that leads into a rain barrel shown on the next page (Tucker, 2017). The rainwater collected in the barrels can be used to water the plants and vegetation that are planted on the green roof. Also the rain barrels can be utilize as reusable water to use in the water feature. With the rain barrels collecting the left over rainwater from the green



roofs can reduce the amount of water that accumulates in the storm drains, which results in easier manage storm water.

For the collection of rainwater to happen, the wings of the stage should be slightly slanted. This will make it easier for maintenance workers to take care of the vegetation.

Alternative-Green Walls

With green roofs, they can be expensive and take a lot of time to design and build. An alternative the Sullivan County can take part in that is similar to green roofs are green walls.

Green walls are essentially “a wall, or part of a wall, that is covered with greenery growing in soil or another type of substrate” (Reggev, n.d.). Green walls can be installed either indoors or outdoors. Usually green walls are on a smaller scale but they can be designed to be as big and tall as a side of a building like the image to the right (*Green Wall*, n.d.).



We bring the idea of a green wall as an alternative for Sullivan, if they don't want to take their chances on green roofs. Green walls require little to no maintenance and a quick to build and cheaper than a green roof. Also green walls would allow Sullivan to take small steps towards being a sustainable community. What is great about green walls is that they have all the benefits of a green roof like reducing the urban



heat island effect, attracting tourist, and reducing the usage of heating and cooling. The image to the left (Live Wall, 2017) is the design that we think Sullivan would benefit from. It is small scale, takes up little room, and brings liveliness to the surrounding buildings with a diversity of plants. With green walls, Sullivan can get as creative as they want to be because green walls are very versatile when it comes to design and installing. More ideas provided in

Appendix A.

In short, Sullivan has many options that they can utilize to attract tourist, improve the economy, and strive towards sustainable practices. The water feature can become a new center piece for Sullivan to attract people from the surrounding areas to create an inclusive environment for outsiders. We found many interesting and exciting design for the water feature that is kid friendly and can utilize music from the performance stage. Sullivan can also use idea to implement a green roof or green wall within the downtown area or on the wings of the performance stage. We found that green roofs and green walls can be beneficial to a community, socially, economically, and environmentally. Before installing green roofs into a community or on residential building, people need to first list out the pros and cons are them having a green roof or green wall. Green roofs can get expensive, especially when choosing an intensive green roof but the expensive can provide many benefits from supporting the environment, attracting outsiders, to bringing market value to a building. To begin with, especially for an older county like Sullivan, start off on a small scale project like a wall or a small area of a roof. Overall, green roofs are beneficial for many reasons however, be cautious when deciding what type of green roof you want.