

## Name Of Project

### REDEVELOPMENT OF CHAIN WORKS, ITHACA, NY

## Participants – Team And Individuals

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## Executive Summary

Ithaca, New York is a city with history deep in nature and sustainability. A large part of their history involves the Morse Chain factory where they employed many people from surrounding areas as well as immigrants from across the Atlantic in the early 1900's. The factory manufactured multiple things from power chains to airplane automotive parts for the U.S. Army. The factory officially closed in 2009 after being deemed a contaminated site, or brownfield. The city now wants to redevelop the Chain Works site into a new district that would include residential, offices, and entertainment, or a "Live, Work, Play" neighborhood which meets the LEED ND standards (LEED for Neighborhood Development). The new site will be very walkable, like most places in Ithaca, with a pedestrian walkway. Ithaca has a population of 30,014 with a walk score of 68 and a bike score of 55 on 100. In addition to the redevelopment, the city also wants to create a new form of transit that will better connect the city and overcome the mountainous terrain. To do this, we are implementing a solar power podcar system called the Futran System, that decreases travel time as well as emissions from cars, creating a more sustainable interconnected city. That's 2,075 tons of CO2 emissions annually not being produced, which is the equivalent of planting 10,375 trees annually. By not using a car to go work commuters will also save \$1,697,670 annually on gas. The system itself will be in part powered by solar panels located on both the roofs of the stations and elevated track. With over 19 km of solar panel space available for use, we can power a large percentage of the total systems electrical needs, creating a fully sustainable Ithaca.



Country Map Showing Ithaca



State Map Showing Ithaca

## **Purpose Of the Project**

The purpose of the project is redevelopment of the Chain Works site while also providing Ithaca with better transportation and fast connectivity. Ithaca, NY is an area with a mountainous terrain. Several creeks and rivers flow through the town, creating deep gorges and valleys. This presents a challenge for easy transportation. The solution to this challenge is to design and implement a podcar transit system. This system would connect many key areas within the town including the proposed project site, the Chain Works District. The goal of the Chain Works District project is to develop the former Emerson Transmission property to a mix-used “live, work, play” district, LEED for Neighborhood Development.

## **Images And Link To The Video**

Images will be found referenced throughout the paper and the 4D program was submitted.

## **Why You Selected This Project**

We chose the chain works site in Ithaca, NY because of the unique challenges that it presented to us. The mountainous terrain of Ithaca is an obstacle that we are not used to working with in the Midwest United States. Besides the steep slopes, Ithaca, along with our site, is boasting with a rich history. The existing buildings on the chain works site were formerly part of a large industrial factory. There have been many toxins from the manufacturing process dumped into the ground causing chain works to be listed as a brownfield. Along with these challenges, incorporating a new podcar system into the city added an interesting new aspect to design.

## **History**

Ithaca, established in 1804 is the county seat of Tompkins County in south-central New York, U.S. It lies at the southern end of Cayuga Lake, 55 miles southwest of Syracuse. Founded in 1789 by Simeon DeWitt, surveyor general of New York, it had formerly been a part of the military tract granted in 1782 to veterans of the American Revolution. Ithaca got its name from an ancient Greek island. In 1795, it developed as an agricultural and lumber center. Its growth was stimulated by the establishment of Cornell University in 1865 and Ithaca College in 1892. Ithaca is a southern gateway to the Finger Lakes recreational area, and tourism enhances the economy. The population of Ithaca today is 30,565.

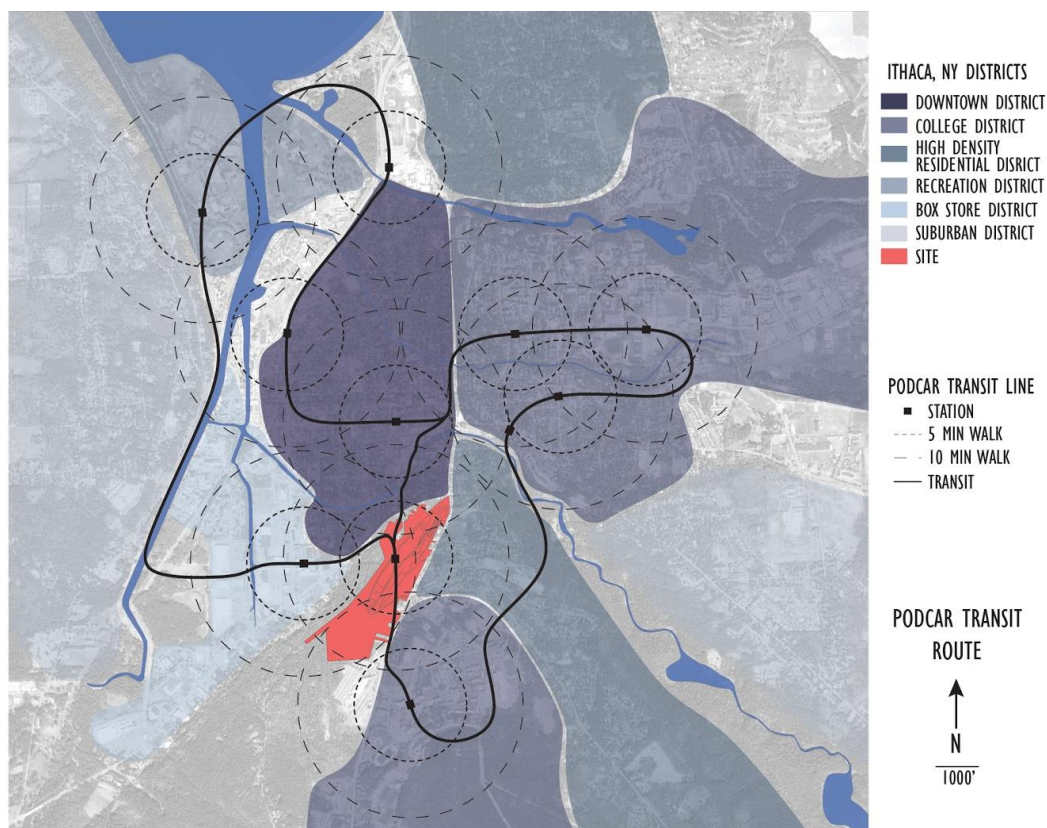
In the early 1900s, Morse Chain, located in the 95-acre Chain Works District, drew in many laborers to the town of Ithaca. This company manufactured steel roller chains for the automobile industry. “During Morse Chain’s operation, they manufactured everything from power chains to the Thomas-Morse Scout airplane (Tommy planes) for the U.S. Army.” From 1928 to 1982, BorgWarner Corporation owned the property and manufactured automotive components and power transmission equipment. BorgWarner sold automobile equipment directly to the major automotive manufacturers, such as Ford, GM, and Chrysler. About 70% of the vehicles on the road contain a Morse Systems product. In 1983, Emerson Power Transmission purchased the site, only utilizing half of the existing facility. The chemical TCE,

commonly used by the BorgWarner Co. for cleaning and degreasing metal parts, was detected in the site's groundwater. This contamination resulted in the site being zoned as a brownfield when the factory closed in 2009.

Historically, Ithaca had two rail lines. There was one that ran along the lake towards Auburn (presently carries coal and salt cars and ends at the AES Cayuga Power Plant). The other rail was called the "Auburn Short Line" connecting the downtown trolley with rails that went as far as Auburn, NY. Based on the current transportation infrastructure within Ithaca, NY, there are many plans that have been in the works for a few years. Some plans include bike trails, low carbon emission plants, as well as improving Ithaca's current bus system ("TCAT"). Many of these plans include adding or improving routes and roads to better accommodate those who don't have cars or rely heavily on public transportation.

## What Would Be the Effect of the Built Environment?

Our proposal for the Chain Works site is a "live, work, play" area which will create a new downtown for Ithaca College. The students would have easy accessibility to the commercial, residential and recreational areas of the new neighborhood. The Automated Transit Network (ATN or PodCar) will act as a major connectivity hub between downtown Ithaca, Cornell University, the commercial district, and Ithaca college. The newly built environment would allow a person to commute anywhere in the city in less than twenty minutes using the public ATN. Thus, reducing the number of vehicles on roads, the areas allocated for parking lots, greenhouse gas emissions and providing a better quality of life.



Podcar Transit Route

## Figure Grounds/ location

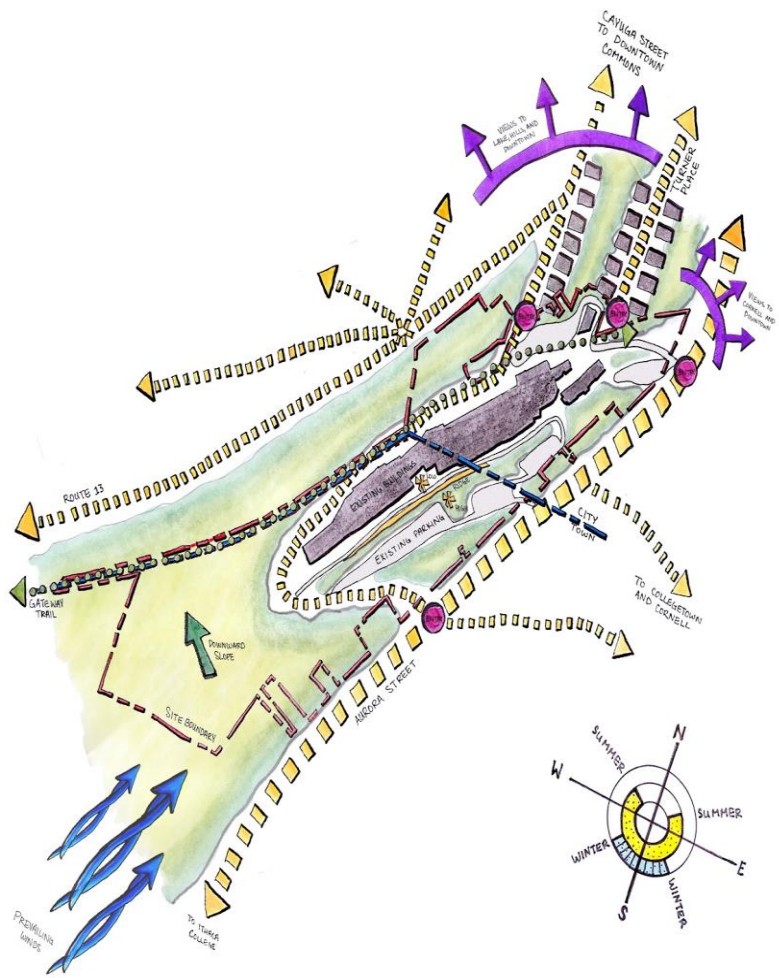
Ithaca, New York is a city with a population of approximately 31,006 people. It lies just below the Finger Lakes, specifically Cayuga Lake. Within the city there are five different neighborhoods or social hubs. These include the downtown (known as Ithaca Commons), College town (next to Cornell University), Cornell University, box store district, and Ithaca College. The two colleges in the city bring a lot of people in during the school year. Cornell students are typically the only ones who occupy College town, whereas Ithaca Commons is occupied by students of Ithaca College as well as Ithaca locals. These locations in the city are fairly close to one another and very walkable, but because of the hilly terrain it makes it feel like a bigger effort for the students and residents and can be difficult to navigate, especially in the winter. The new Chain Works site will add a sixth social hub to the city as well as better connect the other areas and provide a center for the Ithaca College students.



Figure Ground Showing Districts

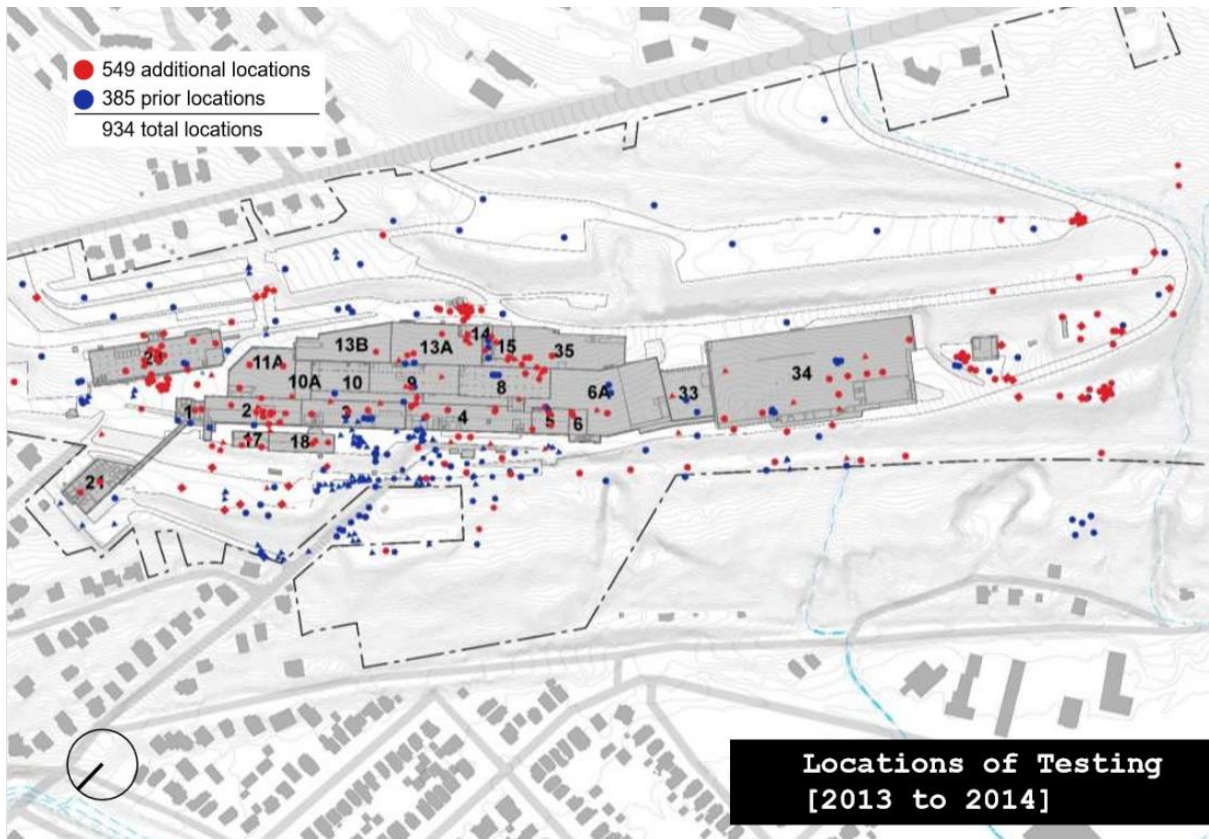
## Site Analysis

Ithaca, NY has a fairly moderate climate. The average annual temperature there is 46.6 degrees Fahrenheit with the annual high being 56.5 degrees Fahrenheit and the low being 36.8 degrees Fahrenheit. Ithaca receives approximately 37.3 inches of rain and 65 inches of snow a year. Like most other places with a moderate climate, the coldest month is January and the warmest is July. The most rain falls during June with 3.98 inches. In January the city of Ithaca can receive about 18 inches of snow making it the snowiest month. Despite all the snow and rainfall, this city has about 155 sunny days a year. This gives Ithaca great potential for solar power. The wind is most often coming in from the southwest. Since Ithaca is located in the northern half of the United States it has a frost depth of about 50 to 60 inches below grade.



Site Analysis

The Chain Works site is located on a steep hill sloping downward toward downtown and Cayuga Lake located toward the north. Amazing views of the city and Cayuga Lake can be seen from all over our site looking north east. There are four main roads that go around or through our site connecting it to the rest of Ithaca. This gives extra access to the site for the residents, visitors, deliveries, maintenance, and emergencies. The roads are narrow and run through older residential neighborhoods. Besides the steep terrain, the other challenge with the Chain Works site is that it is listed as a brownfield. This site was determined as an environmental issue in 1987. Since then there have been 934 testing locations in and around the factory. There are currently toxins in the soil and groundwater under the site such as Barium Cyanide, metals, and trichloroethene (TCE). Some of these contaminants have flowed downhill, affecting the homes of surrounding neighborhoods.



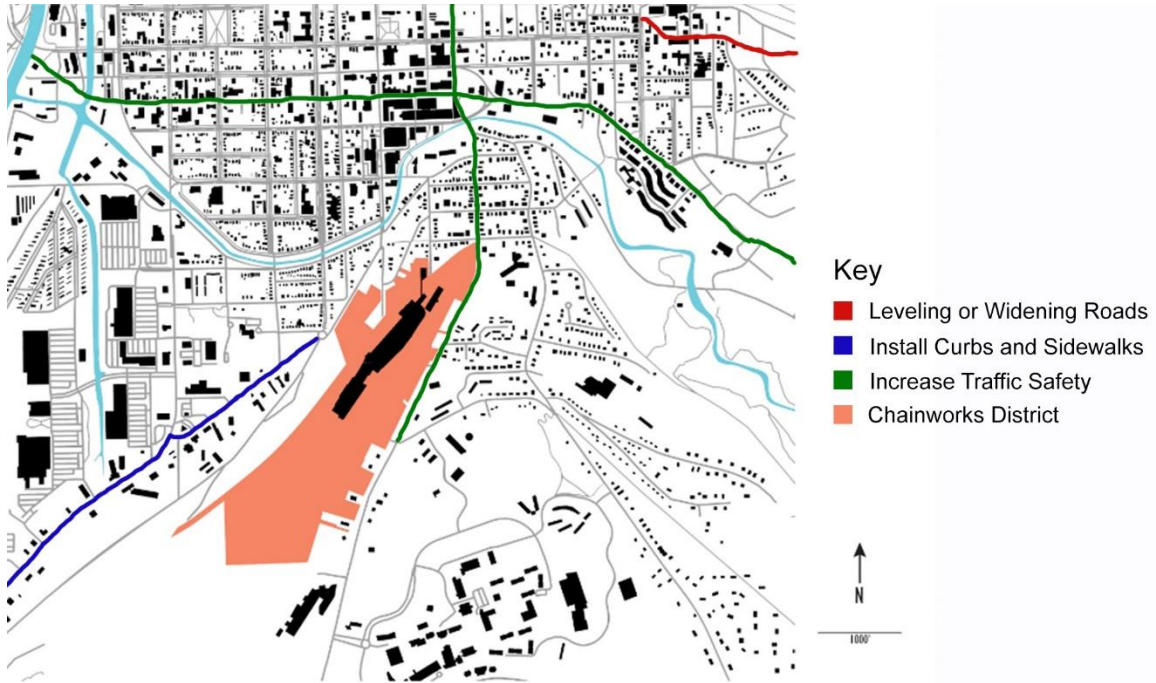
Soil Testing Map

### Circulation of City of Ithaca/ transportation and trails

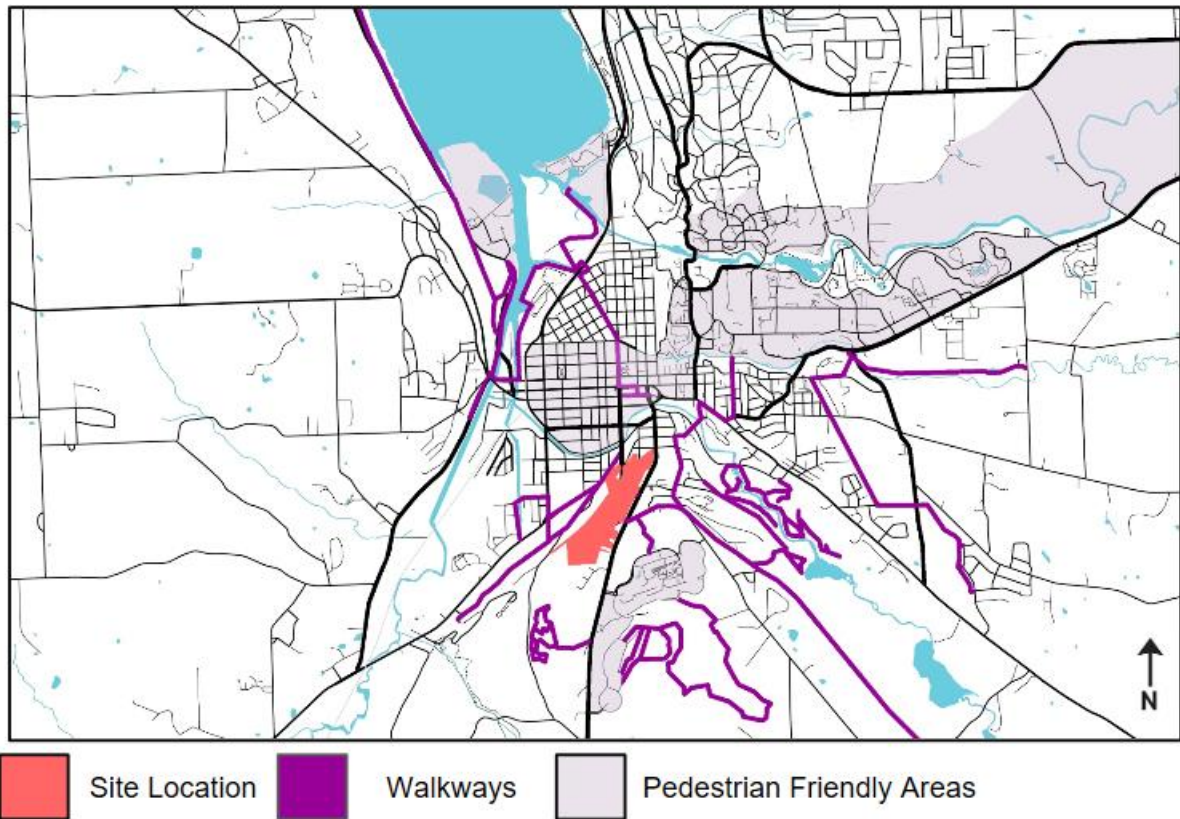
The circulation of the streets are dependent upon the land they occupy, whether it be residential, commercial or arterial (highways/high speed roads). Based on the history of the traffic generators, again, the influence of the kind of land use can have an effect on how much traffic is generated by that area. The City of Ithaca mentions in their "General Plan" that local collector streets or residential streets need to accommodate the flow of traffic within the town. The Central Business District involves downtown Ithaca's streets of Aurora, Cayuga, Green and Seneca street. Due to the large faculty and student population of over 10,000, Cornell University has the largest influence on traffic flow. Both approaches to the campus are from either the west or south (including both State Street and other Ithaca roads from the south).

Ithaca Town Master/General plan proposed a few changes that could improve the circulation; some include

- Leveling or widening main roads such as Dryden Rad and University Ave
- Installing curbs and sidewalks along Elmira Road
- Increasing traffic safety by improving certain intersections at streets like State and Aurora.



Road Improvement Map



Walkability Map

### The History the Present Recreation Trails

There are currently 3 recreation trails whose original purpose either served or was proposed to be a transportation route that go throughout some of the natural areas of Ithaca, NY.

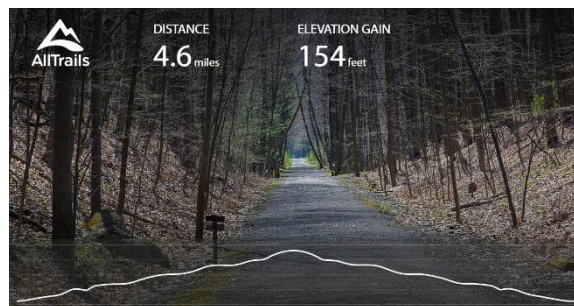
- The South Hill Recreation Way

- Black Diamond Trail
- East Ithaca Recreation Way.

Historically, Ithaca is one of the first towns to use railroads as a transportation system (commercially). Originally, the City of Ithaca thought of having a canal but railroads were a better and more modern option at the time.

### ***South Hill Recreation Way Trail (Present)***

The Lackawanna Line was a train line that went from NYC to Buffalo and was called the “Route of Phoebe Snow”. It was operated until about 1956 before it became abandoned. It was a cleaner railroad system since it burned anthracite coal that produced an acute amount of ash. This route was originally to come to Ithaca but instead its switchback line became the South Hill Recreation Way trail in the 1980s. Today, it is used as a hiking and biking trail as well as skiing with no motorized vehicles. There are also small side trails that branch of this trail and go towards Six Mile Creek.



South Hill Recreation Way Trail (Present)

### ***Black Diamond Trail (Present)***

Around 1874 one of the major R.R lines called the Geneva and Ithaca was built up West Hill and is now presently the Black Diamond Trail. It ran from Cas Park to Taughannock Falls. It lasted to about 1959 and stretches along Cayuga Lake. Today, it provides view of pastoral agricultural lands and ravines that head toward Cayuga Lake. In the winter the topography allows for this trail to be used for skiing as well.



Black Diamond Trail (Present)

### ***East Ithaca Recreation Way (Present)***

As for East Ithaca Recreation Way, it was originally a rural line that went across the hills and valleys of South Ithaca to Cortland, NY. By the late 1930s, the line shut down and only a portion of it is used as a recreation trail (originally a switchback line). Today, it is used as a hiking trail as well as an easy access to Cornell University.





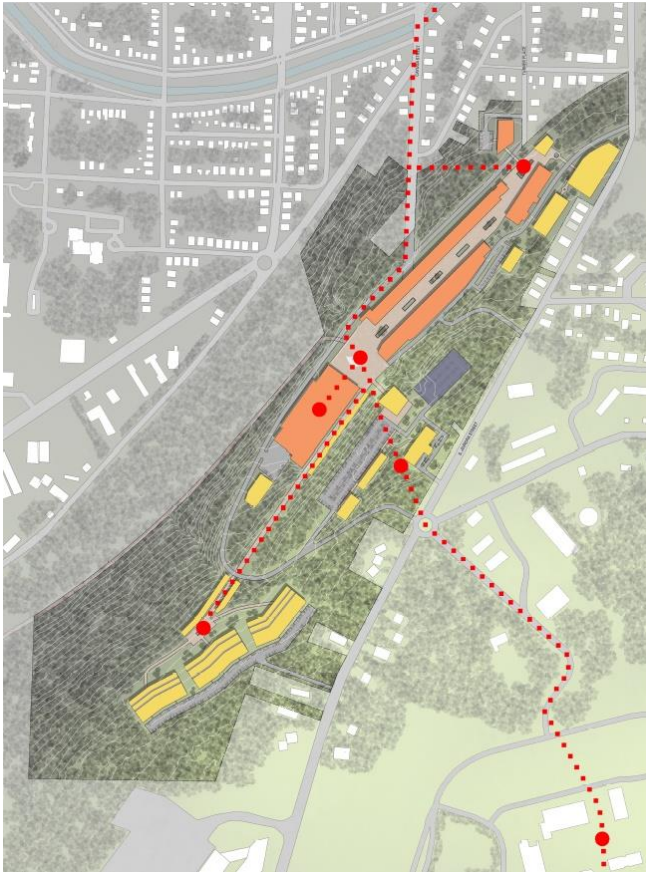
East Ithaca Recreation Way (Present)

## Site Decisions

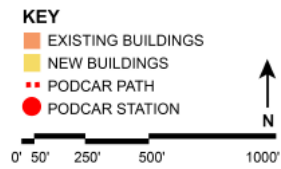
The Chain Works site has a long history of heavy manufacturing and employing many people in the city of Ithaca and surrounding areas. The Chain Works project's main goal is to bring back jobs and people to this area while reclaiming what has been deemed as a brownfield site for so long. This new site redesign will create a new live, work, play neighborhood within the city as well as connecting all the main hubs. The existing buildings will be redesigned to include affordable residential housing, offices, retail, city hall, and light manufacturing. New buildings will be added around the rest of the site to include more residential (including student housing for Ithaca College), offices, retail, restaurants, a hotel, museum, day care, recreation center, and convenient care clinic. The rezoning of the Chain Works site will bring more people into the city and create more connectivity.

Most of the existing buildings on the site will be kept because they still have good structural integrity. Another good reason to keep the existing buildings, is because of the city's appreciation of historical preservation and the fact that it is one of the last few industrial districts left within Ithaca. We chose to remove a few of the existing buildings in the middle of the site to break up the large massing and create a pedestrian friendly community with a walkway between buildings, similar to the Ithaca Commons area. The podcar system that will run directly through the center of our site follows the urban design principles of creating a walkable site with access to quality transit. To offer other transportation through our site, we also created roads along the outside of our buildings for vehicle access. The podcar system runs down Cayuga Street, giving the site direct access to the downtown commons area. There are multiple stops within the site, the main one being placed in the central courtyard as a landmark piece. From our site, the podcar system also connects to Ithaca College.

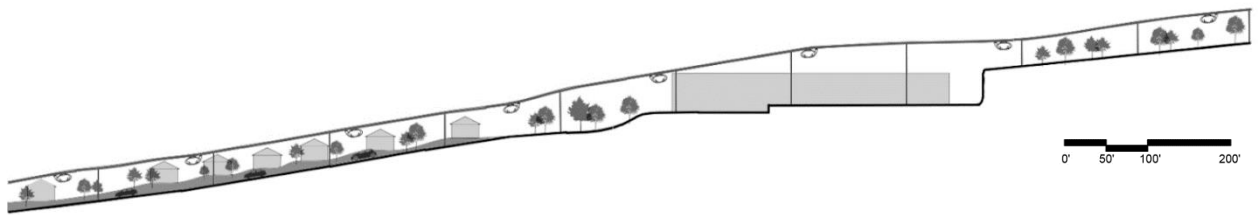
A "complete community" is formed with the new programming on our site which provides the needs of daily living within a walkable distance of 500 meters. We made a majority of our site mixed use in order to create a diversity of users and events to occur throughout the site activating it throughout the day and evening. The different districts created on our site include areas for: students only, outside visitors, employees, and transitional housing residents. Our site also includes the integration of natural systems by maintaining the vegetation and wildlife through the creation of natural zones. The natural zones will be left untouched during the construction process. The sustainability and appreciation of the natural environment has a rich and long tradition in Ithaca.



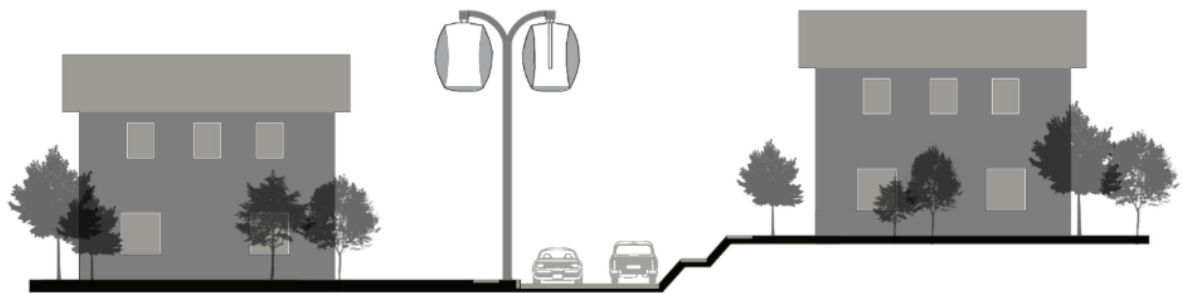
Site Showing Existing and New Buildings



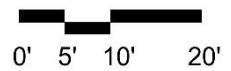
Site Showing Existing and New Parking

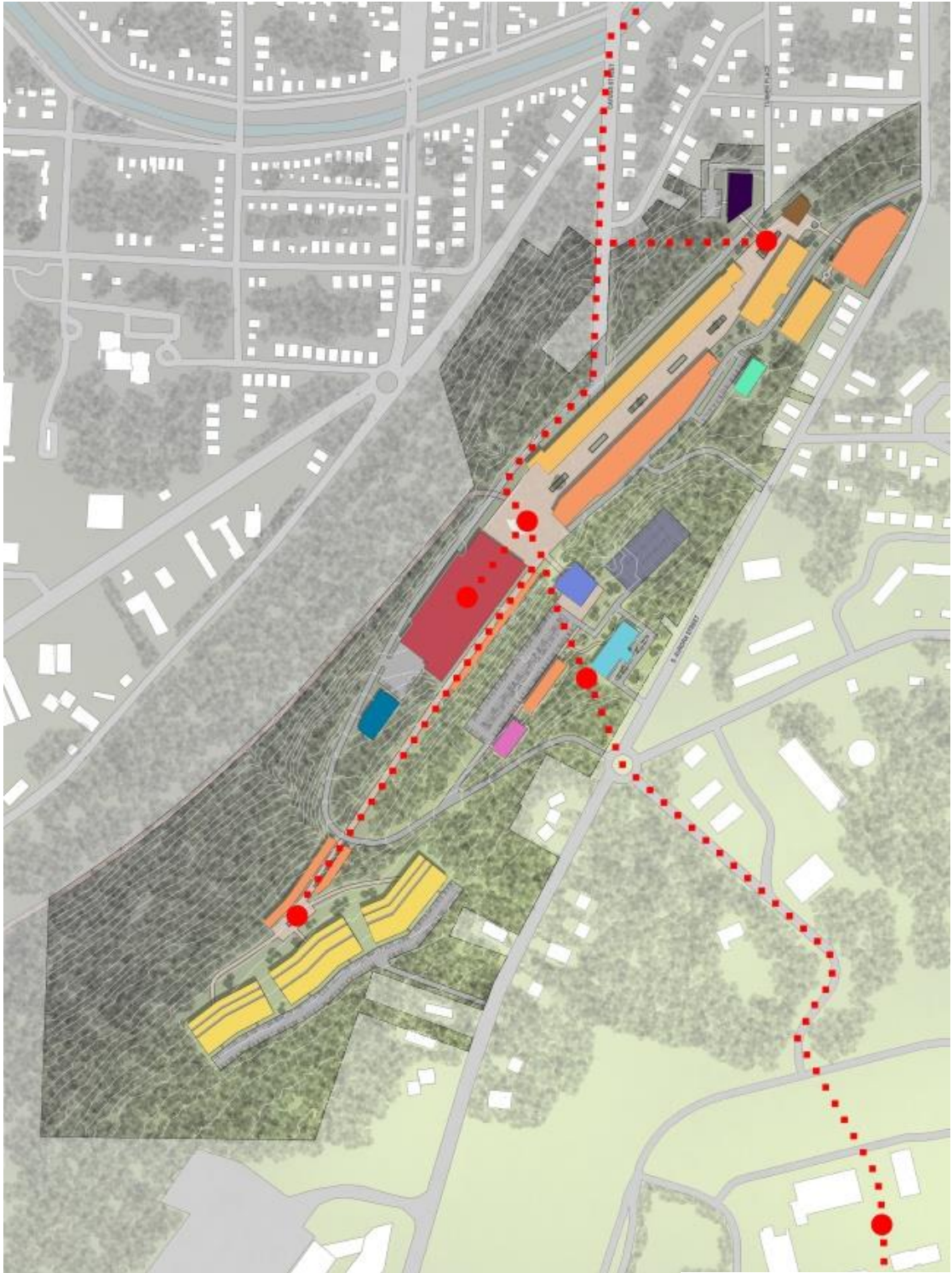


Schematic Longitudinal Street Section



Schematic Cross Street Section



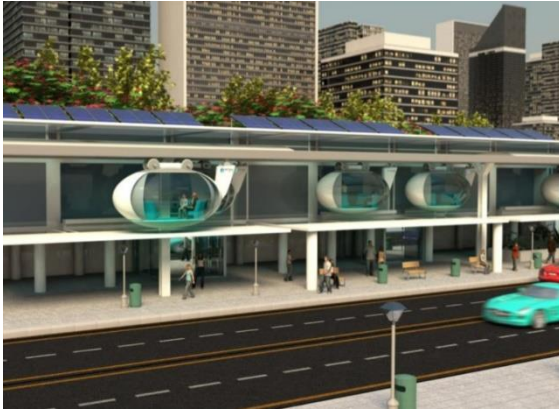


Site Showing Building Types



## What Transportation Effect Has Been Created?

We chose the Futran System, a suspended ATN system. The Futran System is the new revolution in public urban mobility that would change the way people and goods move around in cities, where new solutions are required to address challenges. The system can retrofit onto existing urban infrastructure without demolishing houses or buildings. The system is low cost efficiency, while using solar power, local manufacturing and skills.



Futran Podcar System

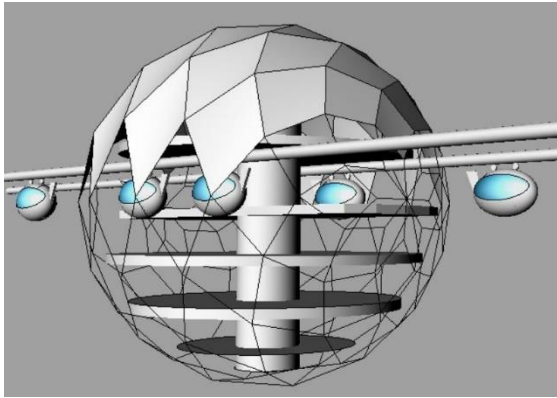


Futran Podcar System

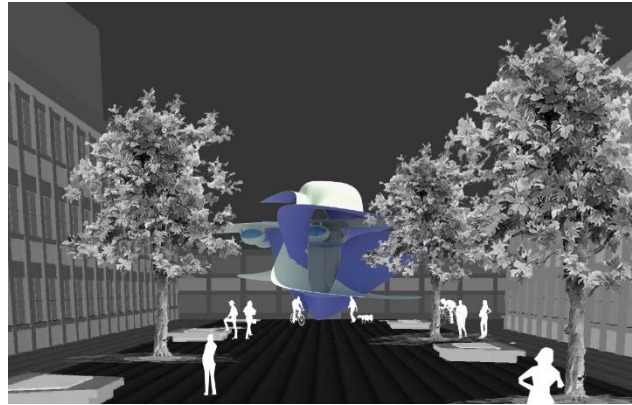
“As human activity increases we are increasingly running out of land, and if we want to increase the level of mobility of people and goods without using more land we either have to go underground, like the metro system, or above ground, as per flyways and monorails. To reduce the number of vehicles that need parking at every destination, we have to increase the shared usage of vehicles as opposed to single owner vehicle ownership.

The Futran technology is designed to facilitate low-cost, high-impact multi-modal transportation. By combining the benefits of automation, cost effective elevated guideway design, ultra-efficient electric motor technologies, shared utilization of vehicles and sophisticated grid-based traffic management, the system was developed that can be used to transform, manufacturing, distribution, people mobility and haulage.

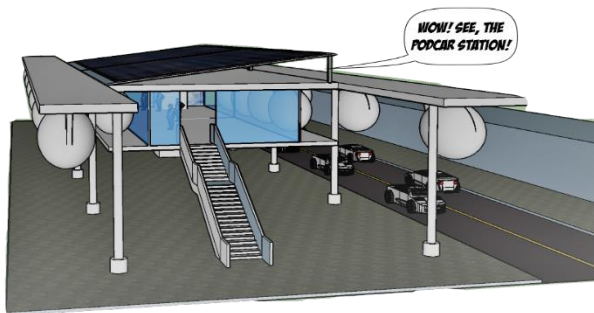
Futran People Pods are six to eight-seater units that are beautifully designed to enhance the aesthetics of cityscapes. Pods run at a fixed speed on a dedicated track in the air, so there is no traffic congestion or time wasted for passengers. Passengers can request a pod for individual or shared use via a mobile phone app, at station-based kiosks or online pre-loaded access.” (The Futran System)



Proposed Station Type 1



Proposed Station Type 3



Proposed Station Type 2



Proposed Station Type 3

## A Rudimentary LEED, Transportation and Energy Analysis

A comprehensive transportation study on how a Personal Rapid Transit (PRT) system in Ithaca, NY would be needed to determine how much of an impact a system like this would specifically accomplish. However, there are general data points we can use from already existing transportation studies done by the city to figure out a general idea of how much CO<sub>2</sub> emissions can be stopped and how much money can be saved.

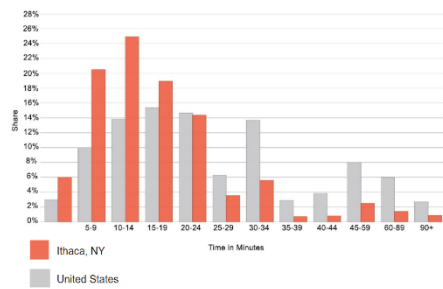
With the average commuting distances in the city of Ithaca, NY being 3.5 miles and the average miles per gallon for cars, trucks, and SUVs in 2018 being 22.2 miles per gallon we can calculate the distance and price saved (Cars.com, 2018).

The average price of a gallon of gas in Ithaca, NY is \$2.84, which turns out to be around 45 cents for every 3.5 miles (Gasbuddy, 2018). (Street Light Data). A round trip of 7 miles is needed for a commuter to go to work, which means 90 cents is spent each day by commuters on gas. This of course doesn't consider Ithaca's topography, but helps give an idea for the amount of money spent by the people of Ithaca just going to work.

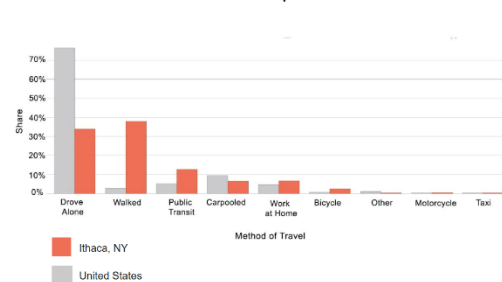
With the average days worked being 260 a year in the United States, and the total amount a commuter can save on gas by using the PRT system is \$234 (Symmetry, 2017). Also by cutting out the 7 mile commute to work the average resident of Ithaca travels we can calculate how many miles they can save. By multiplying the average commute distance (7 miles) and the amount of days the average American works (260 days) we can calculate that 1,820 miles annually can be taken off their odometer.

If 20% of the people that drive to work alone use this system, we will be able to cut 3,772,600 miles off the road. ***That's 2,075 tons of CO2 emissions annually not being produced, which is the equivalent of planting 10,375 trees annually.***

Statistics: Commute Time



Statistics: Commuter Transportation



***By not using a car to go work commuters will also save \$1,697,670 annually on gas.*** However, any new PRT system will not be free of charge and will cost commuters money. By looking at the Tompkins Consolidated Area Transit (TCAT) annual pass of \$450 dollars and Morgantown’s PRT system of 50 cents per trip, we can start to calculate how much this system will save the average commuter (TCAT, 2018) (WVU, 2018). If our PRT system was more in line with Morgantown’s prices, then commuters would save \$190 a year compared to the commuters that only use the TCAT to go to work.

Our PRT system will be able to hold up to 8 people per podcar and reach speeds exceeding 31 mph or 50 kph. With the total track length coming in at 12 miles or 19 km it will take a total of 23 minutes to navigate the entire system. However, it will take less than 12.5 minutes to get to any location in Ithaca, which ends up being comparable to the average time commuting by car of 14.6 minutes (Data USA, 2016).

There will be 10 stations strategically located around the city of Ithaca, NY and 200 podcars to support the system. We calculated this by using the examples of the Furtran’s plan for Durban, South Africa and the existing Morgantown, WVA system. In the Durban, South Africa system they plan on using 10 podcars per station (The Furtran System, n,d).

The Morgantown’s PRT system was another case study we studied because of the similar sizes of Morgantown and Ithaca. Morgantown only uses 73 podcars, but their podcars are designed for 20 people (WVU, 2018). Even though our system will be capable of holding less people than Morgantown, our system will be more efficient. This means we will be able to have a larger user base with less podcars.

The system its self will be in part powered by solar panels located on both the roofs of the stations and elevated track. With over 19 km of solar panel space available for use, we can power a large percentage of the total systems electrical needs.

Our site at Chain Works will also take advantage of solar power and with its abundance of space will be capable of holding up to 42,350 sqm of solar panels. With the track/stations and Chain Works site combining for an estimated space of 80,000 sqm for the use of solar panels, we can create enough energy to power a large percentage of the overall electrical output of both developments.

According to Solar Energy Local, “Ithaca has an average monthly Global Horizontal Irradiance of 3.69 kilowatt hours per square meter per day” (Solar Energy Local, 2018). Meaning that the possible kilowatt-hours per square meter per day for the city of Ithaca is around 327,000. That is more than enough energy to power most of the Furtran system and have a lot left over for use on the Chain Works site.

Passive solar building design will also be implemented in this project, to retain heat in the cold winter months and reject solar heat in the warm months. Through the process of creating a more passive solar design we looked at things like window placement and size, and glazing type, thermal insulation, thermal mass, and shading (Norton, 2014). Passive solar design techniques will be applied to all new buildings on the Chain Works site. The already existing buildings will be adapted or "retrofitted" with such techniques to maximize Passive solar gain throughout the site.

**MASTER PLAN SITE ANALYSIS: LEED NEIGHBORHOOD DEVELOPMENT CHECKLIST**

**SMART LOCATION AND LINKAGE (SLL)**

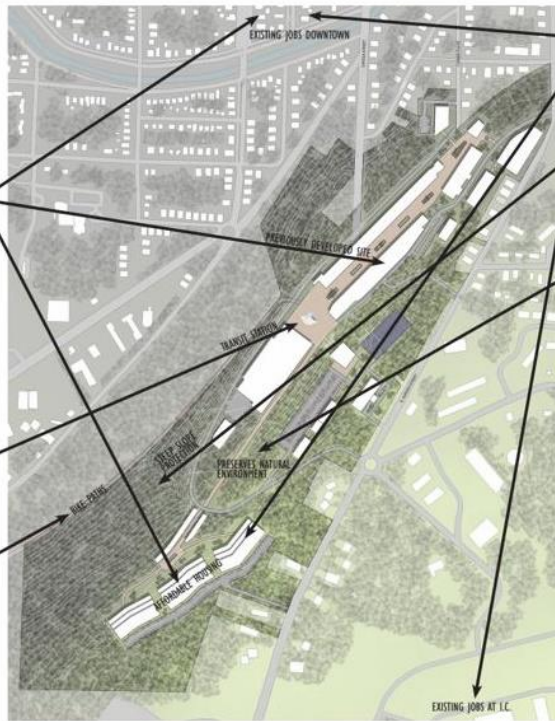
- Prereq 1: Located on a site well served by transit or neighborhood amenities
- Prereq 2: Does not build a habitat where species are threatened endangered or imperiled
- Prereq 3: Does not build on wetland or water bodies
- Prereq 4: Does not build on prime agricultural land
- Prereq 5: Does not build on flood plains

Credit 1 Preferred Locations: Is located on a site that is infill and also a previously developed site; is surrounded (within 1/2 mile) by a well connected existing street network, estimated to have 200 intersections per square mile; is located in an economically distressed area while also providing affordable housing (9/10 Points)

Credit 2 Brown-field Redevelopment: Remediate a contaminated site in an economically distressed area, and then locates it there (2/2 Points)

Credit 3 Locations with Reduced Auto Dependence: Within walking distance (within 1/4 mile) of high levels of transit service (7/7 Points)

Credit 4 Bicycle Network/Storage: Is located within 1/4 mile of a bicycle network that is 5 miles long (1/1 Points)



**SMART LOCATION AND LINKAGE (SLL)**

Credit 5 Housing/Jobs Proximity: Existing jobs within 1/2 mile walk distance outnumber project's dwelling units, and the project provides affordable housing (3/3 Points)

Credit 6 Steep Slope Protection: Limits development on steep slopes (greater than 15%), and restores many or all previously developed steep slopes with native or noninvasive plants (1/1 Points)

Credit 7 Site Design for Habitat/ Wetland Conservation: Conserves pre-existing on-site habitat, native plants, wetlands, and water bodies in perpetuity. (1/1 Points)

Credit 8 Restoration of Habitat/Wetlands: Restores degraded on-site habitat, wetlands, or water bodies, and conserves them in perpetuity (1/1 Points)

Credit 9 Long Term Management of Habitat/Wetlands: Implements a long-term (at least 10 years), fully funded management plan for on-site wetlands, water bodies, and habitat (1/1 Points)



**LEED v4 for Neighborhood Development Plan Project Checklist**

Team Name:  
Date:

Yes	?	No			Yes	?	No		
26	0	0	<b>Smart Location &amp; Linkage</b>	<b>28</b>	20	0	0	<b>Green Infrastructure &amp; Buildings</b>	<b>31</b>
Y			Prereq Smart Location	Required	Y			Prereq Certified Green Building	Required
Y			Prereq Imperiled Species and Ecological Communities	Required	Y			Prereq Minimum Building Energy Performance	Required
Y			Prereq Wetland and Water Body Conservation	Required	Y			Prereq Indoor Water Use Reduction	Required
Y			Prereq Agricultural Land Conservation	Required	Y			Prereq Construction Activity Pollution Prevention	Required
Y			Prereq Floodplain Avoidance	Required	4			Credit Certified Green Buildings	5
9			Credit Preferred Locations	10	1			Credit Optimize Building Energy Performance	2
2			Credit Brownfield Remediation	2	1			Credit Indoor Water Use Reduction	1
7			Credit Access to Quality Transit	7	1			Credit Outdoor Water Use Reduction	2
1			Credit Bicycle Facilities	2	1			Credit Building Reuse	1
3			Credit Housing and Jobs Proximity	3	1			Credit Historic Resource Preservation and Adaptive Reuse	2
1			Credit Steep Slope Protection	1	1			Credit Minimized Site Disturbance	1
1			Credit Site Design for Habitat or Wetland and Water Body Conservation	1	1			Credit Rainwater Management	4
1			Credit Restoration of Habitat or Wetlands and Water Bodies	1	1			Credit Heat Island Reduction	1
1			Credit Long-Term Conservation Management of Habitat or Wetlands and Water Bodies	1	0			Credit Solar Orientation	1
1					1			Credit Renewable Energy Production	3
33	0	0	<b>Neighborhood Pattern &amp; Design</b>	<b>41</b>	2			Credit District Heating and Cooling	2
Y			Prereq Walkable Streets	Required	1			Credit Infrastructure Energy Efficiency	1
Y			Prereq Compact Development	Required	1			Credit Wastewater Management	2
Y			Prereq Connected and Open Community	Required	1			Credit Recycled and Reused Infrastructure	1
9			Credit Walkable Streets	9	1			Credit Solid Waste Management	1
5			Credit Compact Development	6	1			Credit Light Pollution Reduction	1
3			Credit Mixed-Use Neighborhoods	4	0				
4			Credit Housing Types and Affordability	7	0			<b>Bonus Scoring</b>	<b>10</b>
0			Credit Reduced Parking Footprint	1				Credit Innovation	5
1			Credit Connected and Open Community	2				Credit Excellence	5
1			Credit Transit Facilities	1					
2			Credit Transportation Demand Management	2					
1			Credit Access to Civic & Public Space	1					
1			Credit Access to Recreation Facilities	1					
1			Credit Visitability and Universal Design	1					
2			Credit Community Outreach and Involvement	2					
1			Credit Local Food Production	1					
1			Credit Tree-Lined and Shaded Streetscapes	2					
1			Credit Neighborhood Schools	1					
					<b>PROJECT TOTALS (Certification estimates)</b>				<b>110</b>
Grading: Silver (C): 50-69 points. Gold (B): 70-89 points. Platinum (A): 90+ points									

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