CURITIBA, BRAZIL



VALE DO PINHÃO

C40 CITIES

INTRODUCTION

Curitiba, the city-capital of Paraná, Brazil, has a longstanding reputation of being at the forefront of urban innovation and sustainability, boasting titles such as the “greenest city in the world” and the “most innovative city in the world”.

In the city’s 1968 Master Plan, Curitiba introduced a new road design and implemented a mass bus rapid transit (BRT) system. Its transformations emphasized the importance of a convenient and affordable public transit system, successfully mitigating traffic, reducing urban sprawl, and preserving the city's historic district.

Curitiba continues to be a pioneer among eco-friendly cities with its successful recycling program, many parks, Solar Pyramid, new electric buses, Free University for the Environment to educate the poor about sustainability, and the city’s smart growth commitment to the United Nations Sustainable Development Goals.

Alongside the many notable urban planning and sustainability accomplishments, Curitiba has recently begun a formal effort to incentivize innovation. In 2018, Curitiba passed the “The Innovation Law” which encourages innovation and technological research through tax incentives, public private partnerships with firms and the over 150 universities in Curitiba, the development of innovation and technology projects, and access to various funding sources. A central feature of this plan is the Vale do Pinhão area in the Rebouças neighborhood, which is already home to a community center at 1732 Rua Engenheiros.

Our plan for Vale do Pinhão accounts for the rich history, diversity, ingenuity, and sustainability ethos Curitiba embodies.

Since Curitiba’s founding in 1654 as a gold mining camp, to becoming cattle-breeding grounds, to today, our project further enhances Curitiba’s new identity at the nexus of sustainability, urban planning, and innovation by (1) expanding existing resources into Vale do Pinhão, (2) attracting young talent with housing and enjoyable open spaces, (3) adding bikes lanes and mobility hubs to ease access to areas of interest in Vale do Pinhão, (4) installing electric vehicle charging, (5) adding greenery to sidewalks (6) making stormwater systems, and (6) implementing solar panels on existing buildings and new projects.

We have created this entire design plan with a reasonable budget in mind, as reflected in our implementation plan, and we expect all our current ideas to be enhanced with further collaboration with Curitiba residents.

Sincerely,

The Bear Builders Team



SUSTAINABLE MOBILITY

Our plan for sustainable mobility is focused on expanding the bike network of the area both in terms of its coverage and safety, improving the pedestrian experience with increased sidewalk vegetation, improving bus stops, and providing electric vehicle charging stations (also mentioned in our renewable energy section). We decided that we liked the coverage of the bus network of the area, so we did not want to change any lines, but we would like to increase the safety of the bus stops. Additionally, the results of our survey of Curitiba residents (survey described further in the community benefits and engagement section below) stated that public transit access was not a barrier to traveling to Rebouças.

FIGURE 1: BIKE LANES MAP



In alignment with the ideals of the 15-minute city, where all resources are a short walk or bike ride away, we have added bike lanes to certain streets as shown in figure 1 that are integrated to the existing network, and will provide easy access to the area's numerous bus stops and incoming innovation hub development

We also plan for a wide usage of signage (as accounted for in our implementation plan) to raise awareness of the lanes and promote safety. The signage should focus on images of bike riders, so an individual's ability to read does not impact their comprehension.

As part of our green infrastructure plan, discussed in detail below, we are increasing the amount of vegetation along our sidewalks with curb extensions that will enhance the pedestrian experience.

We also have decided to create existing bus stops into safe and accessible sustainable mobility hubs with multimodal stations, well-lit bus stops, and benches (see figure 2).



FIGURE 2: R. ROCKEFELLER INTERSECTION AT RUA ENGENHEIROS BUS STOP WITH IMPROVEMENTS

INNOVATION HUB

Recognizing the existing professional development infrastruture in Curitiba, our innovation hub plan for Vale do Pinhão expands upon the work nonprofits, libraries, and coworking spaces have begun in the city.

The rationale for our plan is based on our research into innovation hubs which indicates that successful innovation hubs are a place with resources to build people's dreams into reality, a place that connects people, and a place where people want to spend their time.

We felt like Curitiba's current coworking space, Worktiba, could be copied in this area. We added in a hotel, as once the innovation hub is successful, investors, students, educators, and others may want to visit the area and be in close proximity to the people and/or event they are there for. Additionally, hotels often have conference rooms which could be helpful for large events like Hackathons. We also included a coworking space as having a large conference room for this reason.

The innovation hub should have everything needed for people to be successful inside it, so we have also included the creation of another Fab Lab, and the implementation of a public library which also included a makerspace as envisioned in Curitiba Lighthouses of Knowledge and Innovation initiative.

We are excited by Vale do Pinhão's community center located at 1732 Rua Engenheiros, and we see the building next door as a potential place of learning, with classes aligned with Vale de Pinhão's technological innovation goals, such as learning to code, data analysis, and English. Teachers can be encouraged to work here with possibly free apartments provided such as museums provided to "artists-in-residence".

Aside from resources we have implemented into the space, we wanted Vale do Pinhão to be a place that residents and visitors actively seek out and can spend time outside of work. This translated into the inclusion of a lot of community gardens, parks, and high density housing.

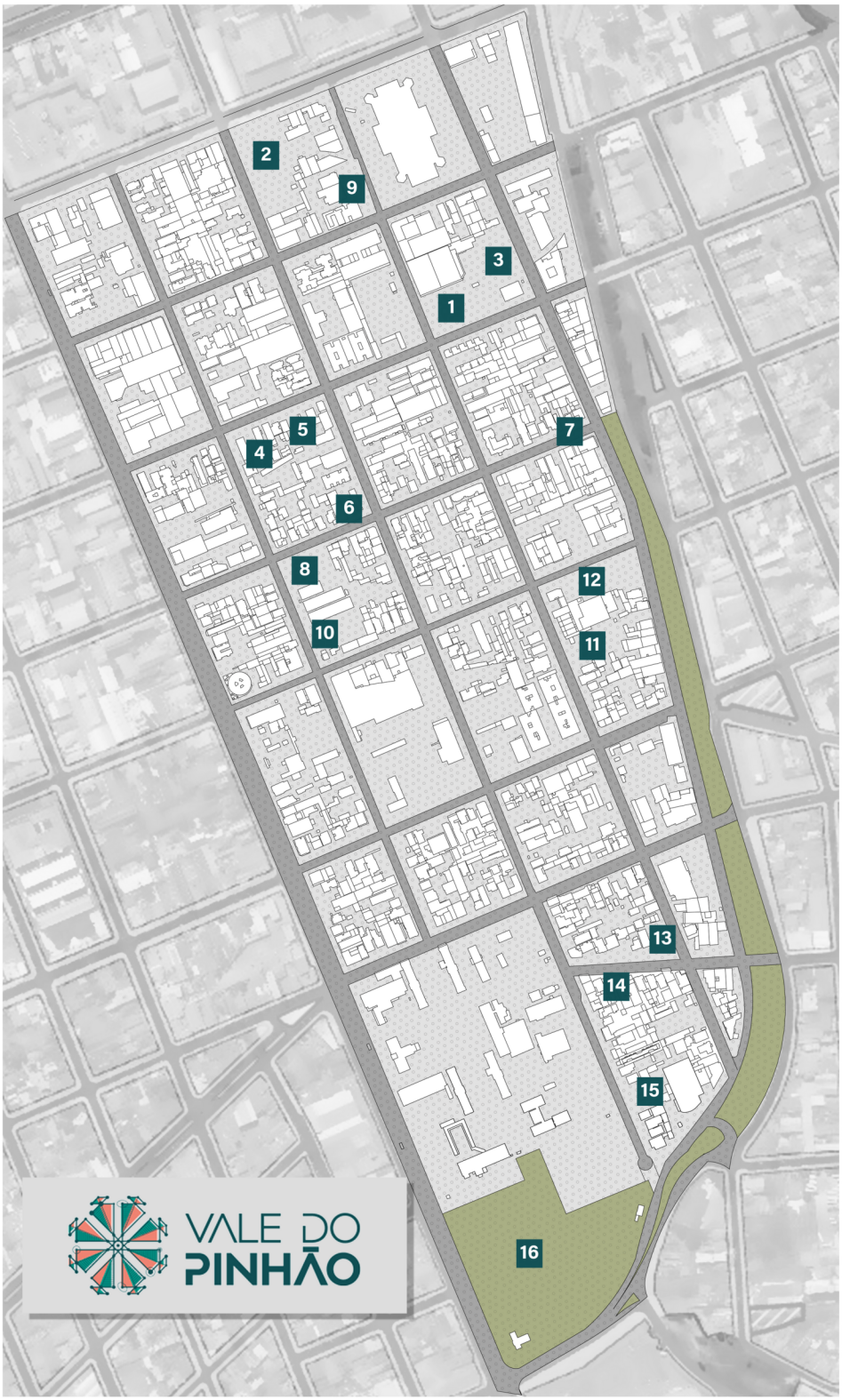
A community garden can increase people's appreciation of Vale do Pinhão, be a source of learning for youth, and promote a healthier lifestyle for nearby inhabitants. For those not interested in the upkeep of a community garden but would like to have accessible greenspace, we proposed the implementation of two spacious parks. Each of them would be ADA accessible, include water fountains for hot days, a playground for youth, and the largest one would have an extensive walking path and sports field.

If innovation hubs are a place people are spending a lot of their time, they should be able to live there too. The ground floors of incoming apartment buildings can be available for rent, for retail, restaurant, or preschool purposes, to further the outdoor life of the area and align with the concept of the 15-minute city. The suggestion of a grocery store was also informed by our commitment to the 15-minute city model, as an analysis of the area showed us that the nearest grocery stores were outside 15 minutes for some areas of Vale do Pinhão.

INNOVATION HUB

FIGURE 3: INNOVATION HUB ELEMENTS

We advise that all new development be in accordance with LEED Gold, but due to the costs of the LEED process, an official LEED certification is not necessary, and a building inspection in accordance with stated green elements will suffice.



LEGEND

1 - HOTEL WITH CONFERENCE ROOM
2 - PARK (WITH PLAYGROUND)
3 - PARKING LOT WITH ELECTRIC VEHICLE CHARGING AND SOLAR PANELS
4 - COMMUNITY GARDEN
5 - HIGH-DENSITY HOUSING WITH SOLAR PANELS AND RETAIL SPACE
6 - FREE SPACE FOR NONPROFITS. (2 STORIES)
7 - FREE START-UP SPACE.
8 - LIBRARY WITH MAKERSPACE
9 - LIVE-IN SPACES FOR TEACHERS/PROFESSORS
10 - COWORKING SPACE WITH LARGE CONFERENCE ROOM
11 - FAB LAB
12 - HIGH DENSITY HOUSING WITH GROCERY STORE IN BOTTOM
13 - HIGH DENSITY HOUSING WITH GREEN BUSINESS/PRESCHOOL
14 - HOUSING
15 - GREEN BUSINESS SPACE IN BOTTOM WITH HIGH DENSITY HOUSING
16 - ACCESSIBLE PARK, WALKWAYS, FLOWERS, FOUNTAINS, LONG SWING. PLAYGROUND.

INNOVATION HUB

GREEN INFRASTRUCTURE

Our plan for green infrastructure in Vale do Pinhão has eight key components:

- stormwater retention system (accounting for flood sensitive areas and areas of fast traffic)
- sidewalk vegetation (with native species and biodiverse planting palette)
- urban heat measures (tree canopy, green roofs, vertical greening)
- small irregular spaces for community/guerilla gardens

Stormwater Retention Systems

Stormwater retention systems are needed in several streets of Curitiba, taking a cautious approach to the city's design of low sidewalk heights, lack of permeable paving, and stormwater drainages. We have identified areas of high traffic and areas of low traffic according to Google Maps, and familiarized ourselves with the neighborhood through a digital walkthrough. By targeting areas of fast traffic to install stormwater drainage systems, such as the streets of R. Rockefeller, R. Alm. Goncalves, Av. Mal. Floriano Peixoto, and R. Brazilio Itibere, we infer that with an increase in surface runoff during rainstorms, stormwater retention systems will prevent the risk of overwhelmed storm drains. Proper stormwater management will positively impact the environment, as pollutants from roads can be treated and filtered through the retention systems and stay cost-effective by avoiding frequent road repairs caused by constant flooding.

Sidewalk Vegetation

Large sidewalk spaces in Curitiba provides an opportunity to add more vegetation for greater access to groundwater storage.

- Ex. Wide streets with minimal traffic flow can be reduced from 4 lanes to 2 lanes (ex R. Conselheiro Dantas is three lanes)
  - R. Brazilio Itibere and R. Piquiri: has lanes on both sides reserved for parking
    - Can replace parking space as a base for vegetation
  - R. Rockefeller and R. Brazilio Itibere: large sidewalk about the width of a car lane
    - Judging through Google Maps, there seems to be a lack of human movement through the area, allowing us to infer that more vegetation can be installed here by taking away parts of the sidewalk

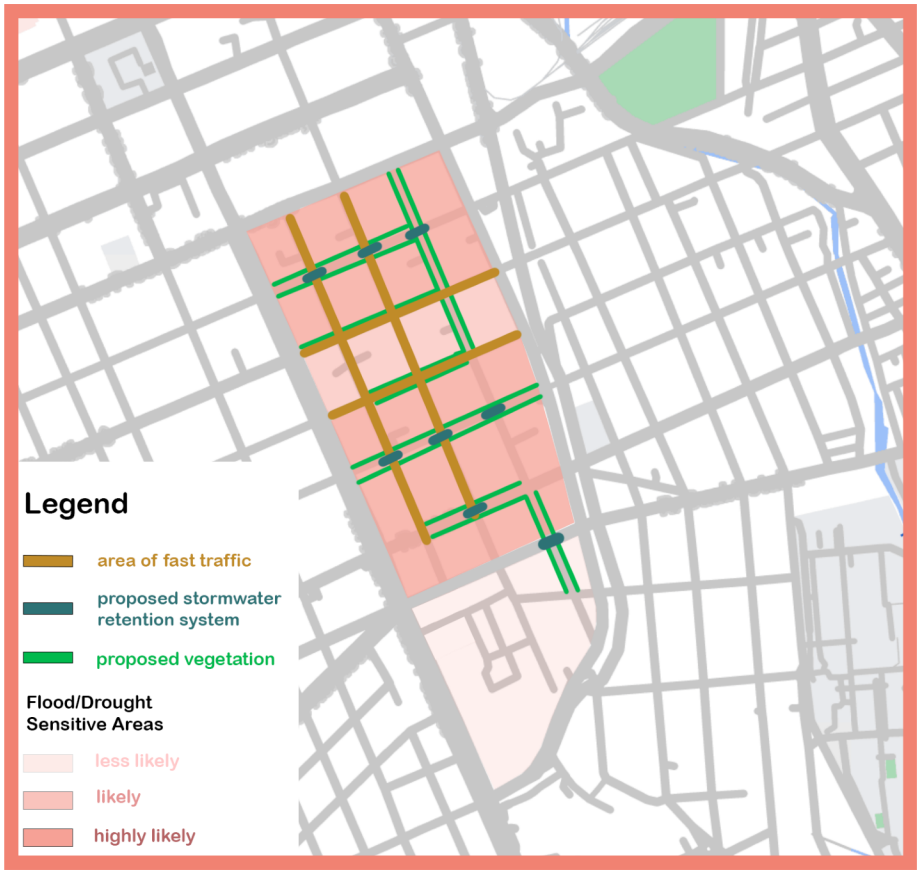


FIGURE 4: LOCATION OF GREEN INFRASTRUCTURE INSTALLMENTS

GREEN INFRASTRUCTURE

Urban Heat Measures

- High species diversity of trees in urban areas is key to maintaining ecosystem resilience and maximizing the cooling capacity of trees:
  - Shade— tree canopies absorb and reflect solar radiation ultimately reducing the amount of radiation that is transmitted to the surrounding environment. In hot climates in the southern hemisphere having tree canopy shade on the roof of buildings and along the north and western walls was seen to be most effective in providing cooling
  - Evapotranspiration— some solar radiation is converted into latent heat or latent cooling through evapotranspiration processes within leaves creating evaporative cooling benefits for the local environment.
  - Altering the movement of air— trees can be used to change the direction and speed of wind flow in an area. Even trees without a leaf canopy can reduce wind speeds by 50-90%. Reduced wind speeds can lower the cost of heating however prevent cool breezes in summer and the impact of trees on wind speeds decreases as urban density increases.
- Green Roofs— can be retrofitted for many existing buildings, are relatively inexpensive to install and require minimal maintenance. Green roofs cool urban microclimates by increasing albedo, shading heat absorbing materials, and providing evapotranspirative cooling which dramatically reduces the need for air conditioning. The performance of green roofs is dependent on the plants in the green roof and the substrate and drainage layers of the roof.
  - Un-amended sandy loam substrate has been seen to provide the greatest temperature fluctuations— rapidly absorbing heat during the day and dissipating it at night. The plant L. camara (west indian lantana) was seen to do the best in this kind of substrate
  - A substrate depth of 100 mm in Hong Kong was seen to reduce heat transfer into buildings but for hot arid climates 500-1000 mm was seen to be the most beneficial
  - Offer the highest energy savings for buildings with high roof to wall ratios like low-rise warehouses, shopping centers, and factories.
- Vertical greening— green walls can be retrofitted to buildings and incorporated into building designs to reduce internal temperature and improve thermal insulation. Also, due to proximity to the ground, help shade heat absorbing concrete which increases the albedo of these surfaces and increases cooling.

Community/Guerilla Gardens

Location included in the innovation hub map (figure 3) community gardens are a space for locally grown produce, and provide a respite from city activity both in change of pace and a cooler environment due to the shade and evapotranspiration benefits.



FIGURE 5: EXAMPLE PLANTS FOR COMMUNITY GARDEN

RENEWABLE ENERGY

Our renewable energy plan is focused on solar panels and battery storage. We suggest all the parking lot by the hotel and new developments (not slated for green roofs) have solar panels and batteries to store the energy during the night or cloudy weather.

Curitiba's Climate Action Plan states "84% of the roofs in the city of Curitiba are suitable for the installation of solar panels" (PlanClima, 58), and given the success of Curitiba's Solar Pyramid, we decided to focus on continuing the legacy of solar for our renewable energy plan.

Additionally, we expect the usage of energy efficient appliances in all new construction (ex. LEDs, Energy Star) to reduce the energy load.

The installation of PV will not cover the building's loads, given the efficiency of solar panels on the market, anticipated energy usage, and roof space for solar panels, but solar will add to Vale do Pinhão's and Curitiba's reputation for sustainability, and save energy costs over the long run.



FIGURE 6: ELEMENTS OF A RENEWABLE ENERGY HUB

COMMUNITY BENEFITS EVALUTION & ENGAGEMENT STRATEGY

Our vision for Vale do Pinhão is one of a neighborhood where community and sustainability are inextricably linked alongside professional growth opportunities.

To ensure we achieved this, we created a survey in Portuguese and sent the survey out via Brazilian social media, asking residents in Curitiba about their experiences starting businesses and visiting Rebouças. Most entrepreneurs mentioned a lack of working capital to be a barrier for success. In regards to visiting Rebouças, most respondents stated they would visit more if there were more parks and restaurants.

This feedback informs our evaluation of community benefits, as we anticipate the new parks and green businesses/restuarant spaces to liven the area most. From a health standpoint, we hope that the increased bike lanes and greenspaces will encourage people to spend time outside, bettering their mental and physical health.

Additionally, we want the people who expressed interest in the library and start-up spaces to now have the economic/technological support they previously found lacking in their entrepreneurial aspirations so we predict these resources to be highly beneficial professionally.

Beyond our own survey and community benefits evaluation, we suggest connecting with the below community partners and using the described publicity strategy to further inform development of the area.

Community Partners	**Local Publicity Strategy**
Igreja Universal do Reino de Deus Templo Maior - Igreja Universal do Reino de Deus • Call Church and ask if they can post the our plan on their bulletin board, potentially meet with members of congregation after mass Unidade População em Situação de Rua Rebouças • contact/show up to social welfare center To connect with Curitiba organizers about our sustainability measures, we would like to reach out to: • Curitiba Forum on Climate Change • Global Shapers	Post plan at bus stops in Vale do Pinhão Post plan on The Curitiba App, with option for people to provide feedback on plan via an online form/google survey.

ENVIRONMENTAL ASSESSMENT

We take Curitiba's reputation as a sustainable city seriously, and so our green infrastructure, renewable energy installments, mobility improvements, and new development green building standards are comprehensive.

Strategy and Impact	
Avoid	Increased bike lanes and bike accessibility will reduce vehicle emissions. Increased nighttime visibility at stations will make people feel safer riding and reduce vehicle emissions.
Reduce	Increased greenspace will decrease the urban heat island effect and reduce flooding. Using local construction companies such as Dual D Engenharia or Planeja Engenharia will reduce construction vehicle transportation emissions. New development will be built to LEED Gold, thus reducing embodied and operating emissions, and ensuring that new projects do not worsen the area's AQI. Stormwater retention systems will reduce flooding.
Renewable	Install rooftop and parking lot solar. Implement electric vehicle charging stations. Lights at bus stations will be LEDs and solar-powered.

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