

RESILIENT AGONDA FRAMEWORK REPORT 2013

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For the Panchayat of Agonda



Pratt Institute

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FOREWARD

Building upon previous two years of community-based participatory planning engagements in the Village Panchayat of Agonda in Goa, India, this year Pratt Institute's Graduate Planning Studio focused on Land Use Planning and Resiliency Design Guidelines. The scope included studying the viability of a waste management plan for Agonda, and exploring sustainable tourism strategies for more people to benefit from its positive impacts. Together with co-faculty Gita Nandan, we set the syllabus to model professional planning and design studio-based practices. Having a real community partner that would benefit from the academic work was particularly meaningful and inspiring for the students who went the extra mile on each task.

The Third-year Studio from the Goa College of Architecture (GCA) complemented Pratt Institute's effort by focusing on a design exercise for a Disaster Management and Emergency Response Center. Students from both institutes facilitated a two-day public workshop in Agonda in January 2013. It was well-attended and helped identify and prioritize the problems. Participants also listed a number of possible solutions and policies. The workshop and community engagement was made possible in partnership with the Council for Social Justice and Peace, St. Anne's Church, Agonda United Business Association, and the Panchayat.

Students engaged the community through creative and professional quality workshop techniques. A lot of thoughtful work went into the design and creation of the participatory workshop. The Fall-2012 Semester for the Pratt team involved extensive preparations for conducting a workshop in a foreign country. Through readings, research and presentations students were introduced to basic socio-cultural-economic and environmental aspects in India and Agonda. Assignments included conducting Focused Planning and Design Case Studies applicable for Agonda, which were exhibited during the workshop. Prior to travel, a web-conference with our partners in Goa was very essential in setting expectations and coordinating the logistics.

Resilient Agonda Framework Report 2013 summarizes inputs from the community, with planning and design interpretations from Pratt Institute's graduate-level planning team, applying their subject-area knowledge and methodologies. The ideas and recommendations are presented for public review and comment and constitute part of an iterative planning process. A 'Process' which allows for a fair and transparent dialogue between stakeholders is in itself is an essential component of Planning for Sustainable Development. While the process of planning is ongoing and can even take several years for a community to get on the same page, it is important to identify some early-action and easily implementable measures to keep the momentum and build capacity. Such action has to be owned and initiated by the local community. As noted in the previous years, the need for training and capacity development remains high on the Agenda. A little can go a long way towards 'Organizational Development'. Resources from the Government in the form of Skilled Planning Staff to support the Panchayat and Citizen's Working Groups efforts would bring enormous returns.

The Report is structured to serve as a reference for the Panchayat and Community, to help assess the merits of future development proposals and guide initiatives. It documents the Community's Vision and Long-term needs and lists considerations aligning with the Vision and identified needs.

The Pratt Team would like to thank our partners in Goa, and the community of Agonda for taking us in. The time spent in Agonda, and the friendships formed overseas are meaningful and memorable for each one of us. We remain committed and available to support the Community's efforts in our professional and personal capacities. The next steps involve taking Ideas into Action!

By: Meenakshi Varandani, AIA, AICP
Faculty, Pratt Institute
July 2013

Introduction

PURPOSE: This document is drawn from 3 years of workshops and community identified needs. This is meant to be a tool to help Agonda accommodate growth that fosters sustainable solutions and community character. It is meant to be a living document that is updated in a timely manner to reflect the current needs and desires of Agonda. The Panchayat should consult this document in tandem with an ongoing conversation held with the community.

Executive Summary

Approaching Agonda Village for the third time, we have looked at the village through the lens of land use and climatic design. Based on previous years, the residents of Agonda had also identified a need for a Waste Management plan as well as a vested interest in Sustainable Tourism. With these concerns in mind, we hosted two intensive days of workshops in concert with the Goa College of Architecture to reach the recommendations found within this report.

The Land Use recommendations fall into three categories: population growth accommodation, improved road networks and access, and environmental protection. These recommendations range from programs such as development considerations for new community facilities, to programs such as agricultural land trusts, and alternatives for prioritizing road network upgrades.

The Climatic Design recommendations span five key areas: Site Planning, Building Materials, Water, Energy and Flood Mitigation. These recommendations span from informational, such as explaining how to properly bore a well, to technical, such as the means to properly design a wall. The Design recommendations are accompanied with a development considerations checklist, which new developers in Agonda can use to consider the climatic impacts of their projects, as well as being mindful of Agonda's environment while developing.

We also created a guide for the Panchayat of Agonda to begin exploratory research into a municipal waste management program for the village. The guide outlines the steps for the village to undertake a waste survey, as well as the methodology for the Panchayat to begin municipal waste pick up. Sustainable tourism was a concern for the residents of Agonda for many years; to that, we have created two documents regarding tourism: a guide for the Panchayat and business working group to enable sustainable tourism practices in Agonda, and a sample self-guided walking tour for visiting tourists to explore the village.

CONTENTS

RECOMMENDATIONS FOR LAND USE IN AGONDA VILLAGE

SUMMARY

DECISION SETTING FRAMEWORK

EXISTING CONDITIONS

1| PROTECT AND PRESERVE THE ENVIRONMENT

Coastal Management Zones
Eco-Belts
Agricultural Land Trusts



2| ACCOMODATE FOR GROWTH

Population
Facilities
Industries



3| IMPROVING CONNECTIVITY AND ACCESS

Improve Existing Road Network
Improve Pedestrian Networks
Meet Agonda's Demand for Parking



DESIGN RECOMMENDATIONS FOR CLIMATE RESILIENCY IN AGONDA

CLIMATE CHANGE & AGONDA

DEFINING CLIMATE RESILIENCE: WORKSHOP SYNOPSIS

SUMMARY OF REGION-SPECIFIC CLIMATIC CHALLENGES AND BUILDING TYPOLOGIES

SCOPE OF RECOMMENDATIONS

DESIGN RECOMMENDATIONS

1| SITE

Slope
Coast

2| BUILDING CONSTRUCTION & MATERIALS

Construction Methods
Materials

3| WATER

Potable Water
Wastewater

4| ENERGY

Passive Cooling
Renewable Energy

5| FLOOD MITIGATION

Buffers
Stormwater Management
Building Construction

APPENDIX

ADDITIONAL RESOURCES (A-C)

CHECKLIST

MAPS

GLOSSARY OF TERMS

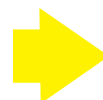
SURVEY DOCUMENTS

WASTE MANAGEMENT RECOMMENDATIONS

STEPS TO WASTE MANAGEMENT PLAN
WASTE MANAGEMENT SURVEY

SUSTAINABLE TOURISM RECOMMENDATIONS

SUSTAINABLE TOURISM VISITORS' GUIDE

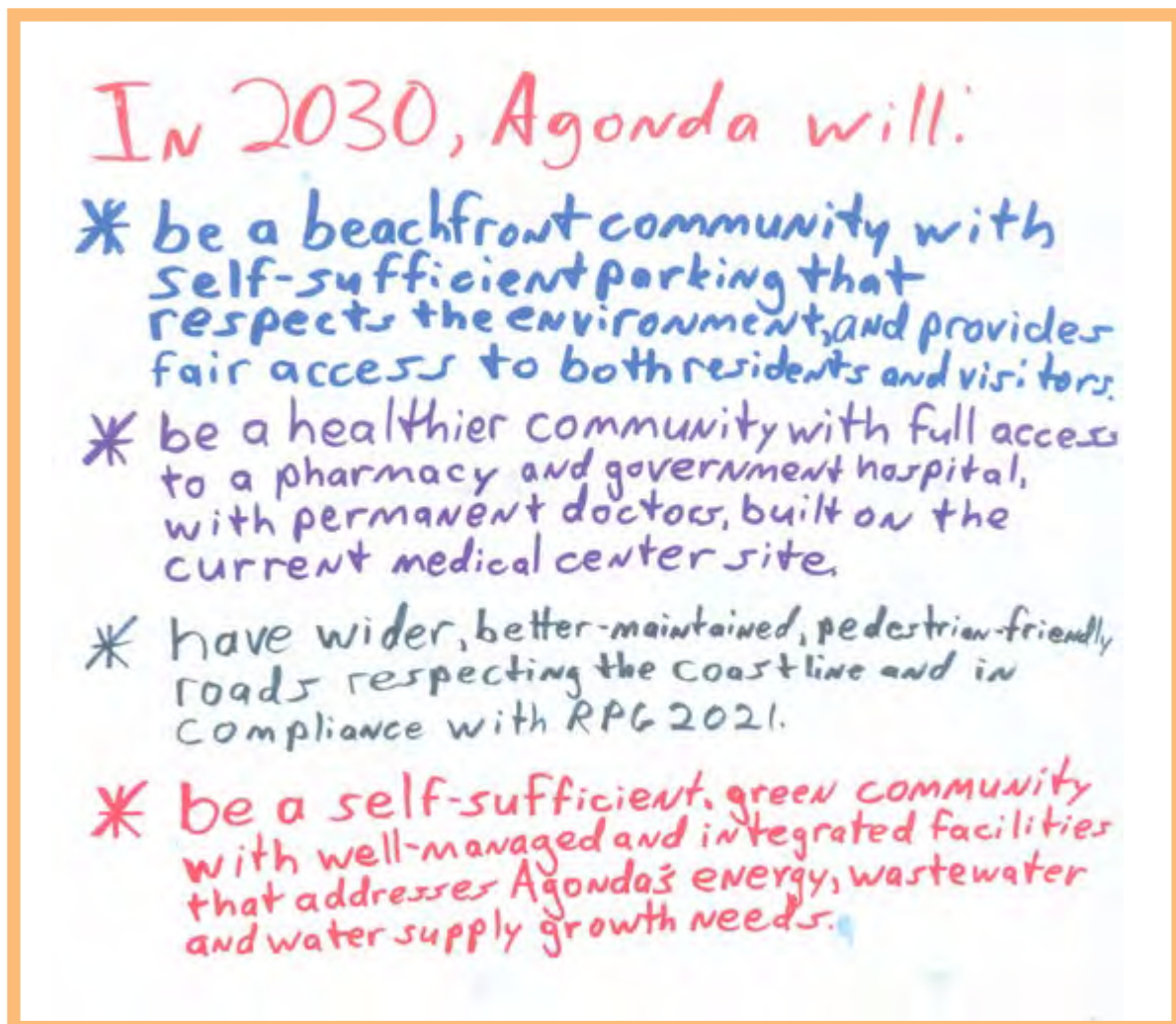


RECOMMENDATIONS FOR LAND USE IN AGONDA VILLAGE

SUMMARY

In 2010, a vision statement was developed to establish the guiding principles and values of what the Village of Agonda wishes to be.

“Agonda will be an environmentally friendly beach front community that is self-sufficient, healthy, and pedestrian friendly.”



GUIDING PRINCIPLES

Improve the quality of life and culture of local Agondans

- Improve access to community facilities
- Provide safe networks for vehicles and pedestrians
- Encourage a healthy and vibrant community life

Protect Agonda's valuable natural environment and resources

- Preserve and promote agricultural uses
- Consider the impact of additional populations during the tourism season on Agonda's natural resources

Protect and preserve the rural character of Agonda

- Formalize and regulate tourism
- Plan and invest in vital infrastructure at an appropriate scale
- Foster respectful relationships between locals and tourists

Issues

In 2011, a series of workshops were conducted with members of the community. Several pressing issues facing Agonda were identified.

These issues should be updated with a regularity to reflect current conditions in the village of Agonda.

Economic development <ul style="list-style-type: none">Lack of local jobs for those with higher educationNo land available for developmentHard to get financing	Circulation <ul style="list-style-type: none">Road congestionParking availabilityLack of lighting and signsWalking paths are not well connected
Tourism <ul style="list-style-type: none">Heritage & history not communicatedNo state/local tourism rulesNeed tourism organization to manageLack of info for visitors	Waste <ul style="list-style-type: none">Hotels do not manage waste properlyLack of facilities to dispose & store wasteNo penalty or enforcement for illegal dumping

EXISTING CONDITIONS

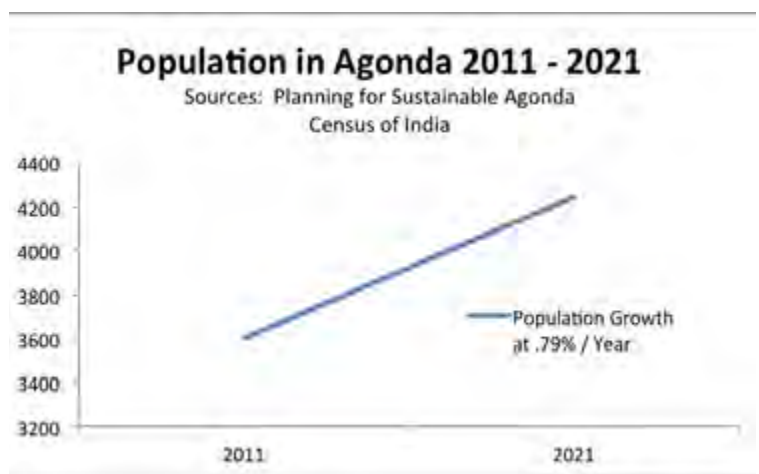
Located in southwestern India and bordered on the west by the Arabian Sea, Goa is the smallest state in the country by both area and population. The Village Panchayat of Agonda is a 15 square km village bordering the coastal Ghat Mountains of South Goa with a population of approximately 3,600. Administratively, Agonda is located in the Taluka of Canacona in the District of South Goa, and is roughly 70 km from Panjim, the capital.



DEMOGRAPHICS

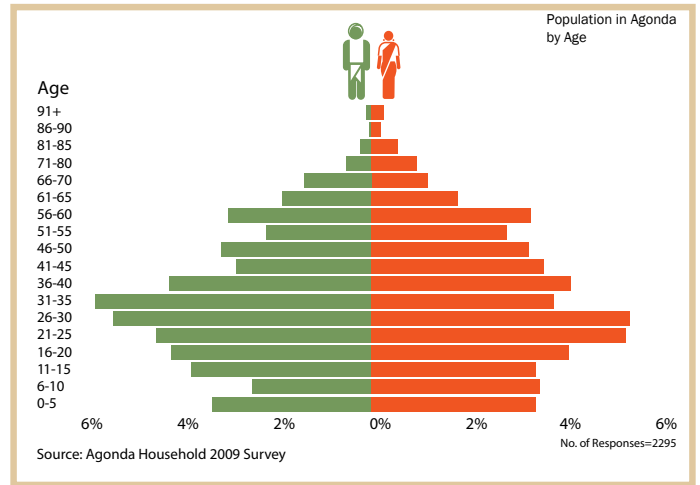
Population

Agonda’s population in 2011 is estimated to be 3,600 with a low population density of approximately 240 persons per sq. km. As a comparison, the average density in all of Goa is approximately 363 persons per sq. km, nearly 25% greater, which is a testament to the rural nature of the village. The majority of Agonda’s live in Ward 2, northwest area off the beach, and Ward 7, located in the center. Agonda’s population is projected to grow to 4,244 by 2021 (Indian Census, Demographic Indicators), an increase of 18%. Tourists and seasonal labor are considered temporary population and are not included in these numbers. Any future planning will also need to include projections on the number of tourists coming to Agonda and also account for tourist concentrations in particular seasons.



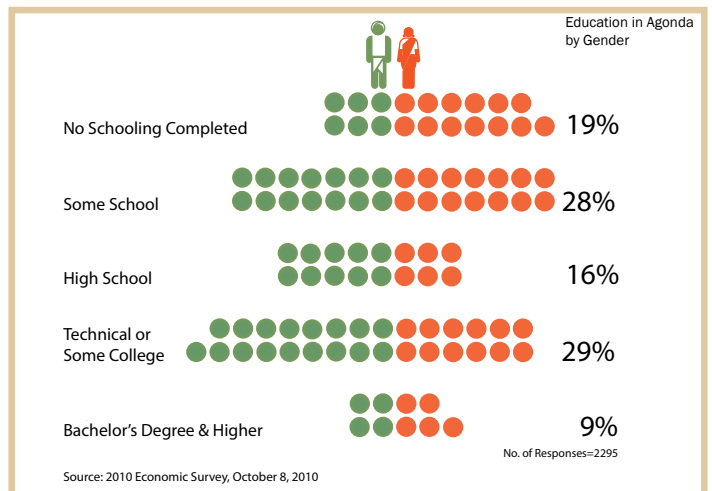
Age

Half of Agonda's population in 2009 was 30 years old and younger, with the largest age cohort being 26 to 30. This generation of young people will play an ever increasing role in Agonda and will have different skill sets and needs than previous generations. Half of the population of Agonda is female, which is important because in rural India women tend to have different roles than men, such as taking charge of household responsibilities. A successful economic development strategy should address the needs of all Agondans, while also taking advantage of their skills.



Education

The 2010 Characteristic Economic Survey showed that many Agondans completed some course of education. Half of the resident population had a post high-school level of education and only one in five did not complete any schooling. The majority of those who completed no schooling were female. The gender gap narrowed somewhat in higher education levels but overall, the prevailing trend was that women in Agonda tended to have lower education levels than men. Agondans between the ages of 16 and 30 tended to be more educated than those older than them. As many as half of the population had education beyond a high school diploma, as opposed to only three in ten of those older than 30 who had a similar level of education in 2010.

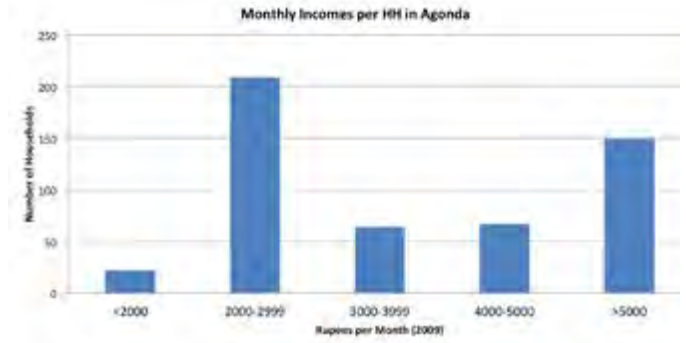


As Agonda's young grow older, planning for the future of Agonda will need to account for the changing skills and demands of a more educated population.

ECONOMIC CHARACTERISTICS

Income and Ownership

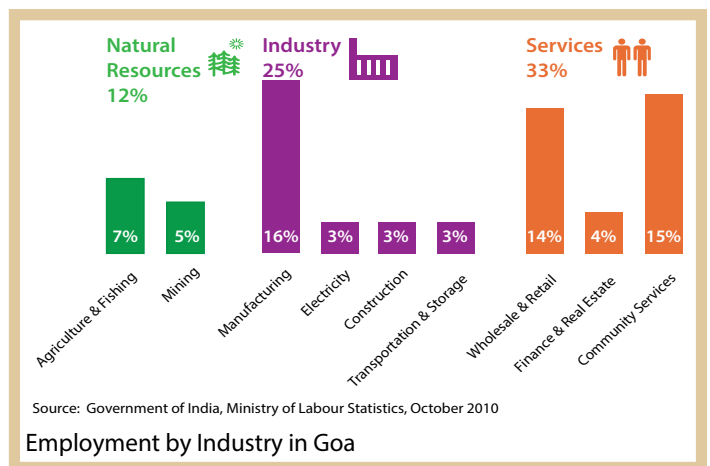
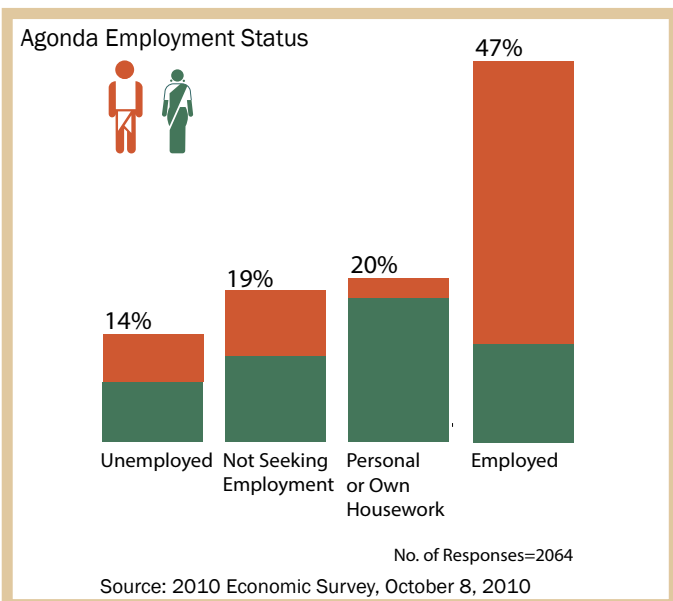
The most common occupation in Agonda is housework, followed by students and then the service and hospitality sector. Most Agondan's make approximately 2,000-2,999 rupees per month. However, the second largest amount of Agondan's makes over 5,000 rupees a month. Most Agondan's own their own home, with only 4 percent of the population as renters.



Employment

According to the 2010 Economic Characteristic Survey, nearly half of Agondans ages 16 and older, or about 1,000 survey responders and their family members, were employed outside their homes. Of those, about half left Agonda in order to get to their place of employment. They tended to be older, compared to those unemployed who are seeking work, and forty five percent had more than a high school education. Nearly four out of five of those employed were men, and the employed women tended to earn lower wages than the men.

The various economic sectors in which they worked are detailed below. Only half of Agonda's population was formally employed, however. One in five Agondans did housework within their homes and the vast majority of them were women. One in four Agondans were not interested in getting employment, whether this may be because they were retired, pursuing an education or possibly because they had given up on the idea of finding work. Agonda's unemployed are discussed in the section below.



A significant portion of the services sector can be accounted for by tourism businesses. The services sector itself was the largest sector in Agonda, employing two out of five Agondans above the age of 16. People employed in the services sector tended to earn more than those employed in other sectors. One in four people are employed in the industrial sector.

Agondan's interested in developing only food production, arts and crafts and small electronics, all industries that could potentially have little negative impact on Agonda's landscape. One in five employees worked in the natural resource sector, with the jobs evenly divided between farming and fishing. Farming and fishing are also industries that Agondan's would like to see developed further.

LAND USE

Agonda is rural in character, with much of the land used for agricultural purposes. The village is currently zoned for as a VP-3 Classification. A large portion of the village is Comunidade land, which is a type of common land left over from the Portuguese.

A portion of the land is also considered Devasthan, or sacred, land. This is concentrated mainly along the connector road.

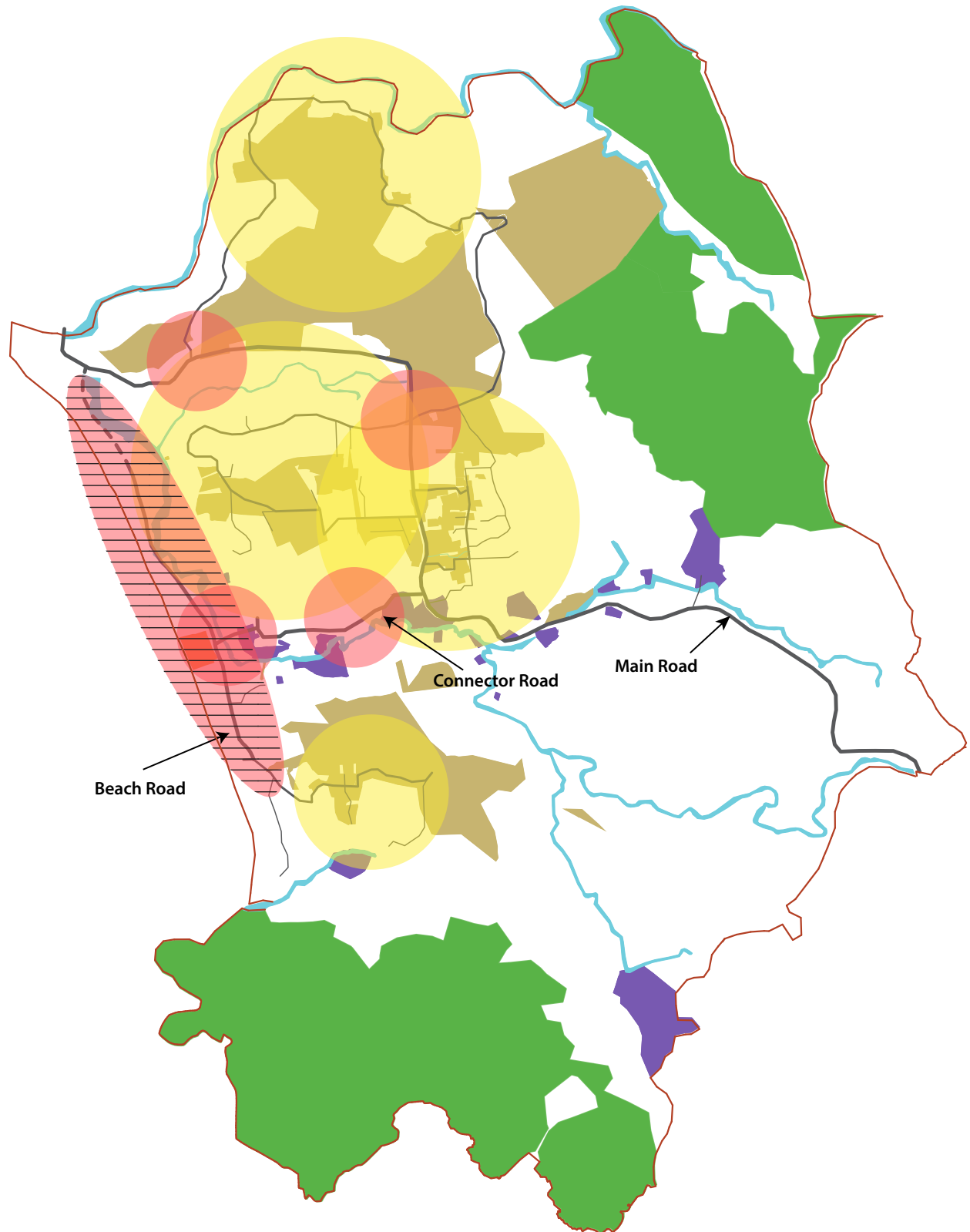
Zones

There are two main residential zones, both looping out from at the center of the Main Road. There are also smaller clusters of residential home at the far end of the beach road and above the village along the mountain loop. Commercial activity is concentrated along three major corridors:







The Beach Road: Businesses along this corridor are there primarily to serve the tourist population. Beach huts and restaurants occupy a large amount of area on each plot, with smaller shops and general stores adding to a near continuous line of business activity along the road.

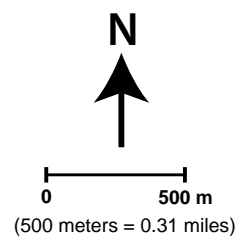
The Main Road: The concentration of businesses is much lower along this corridor than it is along the beach road. Additionally, these businesses cater more to local customers than to tourists. Community facilities, such as the medical dispensary, the main Panchayat office, and athletic fields are also located along this corridor.

The Connector Road: Like the area along the main road, the focus of businesses along this corridor is for local customers. There are also several religious and community facilities along this road.



Existing Land Classification Existing Land Use Zones

- | | |
|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
|  Devasthan |  Residential |
|  Forest |  Commercial |
|  Comunidade |  Mixed Use |

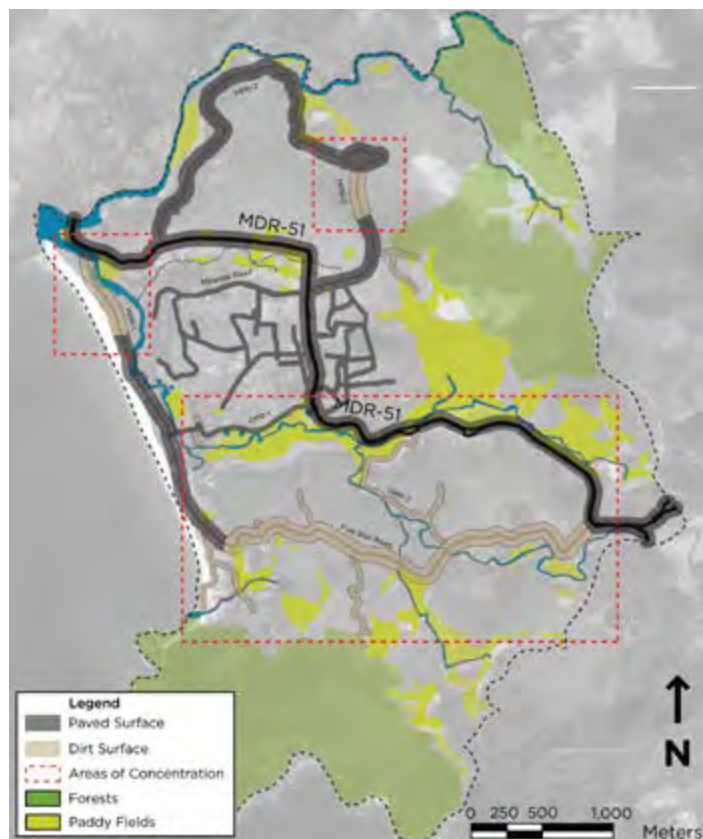


INFRASTRUCTURE AND PUBLIC FACILITIES

Infrastructure can be thought of as any basic physical or organizational structure that is designed to facilitate the development of society, the economy, or the environment.

Roads

Most paved roads in Agonda are between four and five meters wide, accommodating two lanes, one in each direction. Non-paved roads, like the northern end of MPR-1 and Five Star Road, are narrower than 3 meters at certain points. Many other roads in Agonda are approximately 8 meters wide, which nicely compliments the rural nature of the village. Additionally, the Donal Khazam Bridge regularly receives traffic that exceeds its design in both volume and size. A section of Beach Road directly south of the Donal Khazam Bridge that extends nearly half way to St. Anne's Church is made up mostly of bare rock and dirt.



Source: Agonda Framework Report 2011

It is often created, funded, or planned for by the government and can be something as simple as a trashcan, and something as complex as a ferry port or a power station.

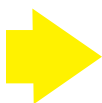
This particular section gets quite narrow at times due to the presence of trees in the roadway. While many roads in Agonda are paved, there are some portions of road, particularly in the south, that are not. This can present safety and reliability issues for those who live and work on these roads, especially during the rainy season. Roads that are not paved are more susceptible to heavy rains, which present a problem in the event of an emergency condition that takes place during a time of bad weather.



Example of a narrow, paved road in Agonda



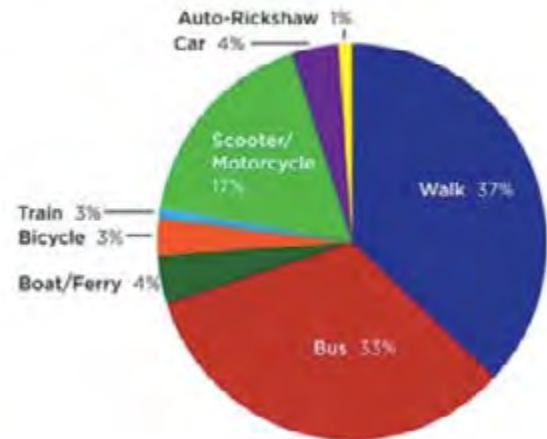
Unpaved roads: left- along east bank of the creek, right- extension of the Five Star Road near the waste management facility (see map page 48)



Modes of Transportation

Circulation is vital for efficient land development. Being able to get from place to place in a safe, reliable, and efficient manner is a key element of economic development and sustainable growth. According to the 2010 Agonda Community Survey, only 4% of residents own their own car. However, many rely on either bus service or ride smaller scooters and motorcycles for transportation. 37% of Agonda's walk as their main mode of transportation. Therefore, strengthening the existing pedestrian network should be a priority for Agonda.

Figure 3.14 Modes of Transportation



Public Facilities

Agonda has many important to the community facilities, including a number of religious places: churches, temples and shrines; public facilities like schools, for example the well-recognized St. Ann's Church, an office of the local Panchayat and a medical dispensary open two days a week. There are also a few unofficial recreational outdoor

spaces that have the potential to be recognized as public playfields or playgrounds. However, some facilities that the village of Agonda still needs for a healthy and safe lifestyle are: information and an evacuation center, a community center, a trade school, and a centralized market with a fresh local produce.



St. Anne's Church and Elementary School



The Boys Elementary School



Temple on the Beach Road, adjacent to the Boys School



Temple hall, adjacent to the Boy's School used for school activities and classes



Panchayat of Agonda Village



Medical dispensary, adjacent to the Panchayat's building, open two days a week



Rangini Temple, one of the few temples in Agonda, located on the Main Panchayat Road.



Recreational field located on the Main Panchayat Road, about a quarter mile south from the Panchayat's building

ENVIRONMENTAL FEATURES

Agonda's most pronounced environmental features include Agonda Beach stretching north-south approximately 2.5 km, the Bandhara River which empties into the Arabian Sea at the northern end of the beach and includes extensive mangrove estuaries, and the protected and preserved forests along the slopes of the two mountains which are

located at Agonda's northern and southern Panchayat limits. Agonda is also home to seasonal turtle nesting, fish populations in the estuaries and coastline, a large bat population in the north and productive paddy/khazan lands through Agonda's center and eastern limits.

“Our environmental features such as turtle nesting, mangroves, forests and mountain views, are some of our best as well as our most threatened assets.”



Agonda Beach

1.1 Coastal Management Zones

1.2 Eco-Belts

1.3 Agricultural Land Trusts

OVERVIEW

Throughout the participatory workshops held at St. Anne's Church from 2010 to the present, Agondans expressed concerns about how land uses impact the quality of Agonda's environment. Zoning, green infrastructure, and conservation tools like easements and land trusts are implementable methods to protect Agonda from the impacts of development and growth. Zones separate land by the intended use type or expected impact of the use type on the environment. Green infrastructure has the ability to avoid negative impacts on the environment—from development and storm water, and conservation has the ability to retain land for a particular use or non-use protection.

In particular, the **Coastal Management Zone Plan** introduced in the Regional Plan for GOA 2021, if enforced, has the potential to manage development near waterways. The plan could shape continued tourism growth and development along the road away from the coast. Instead of an overly saturated strip, between the Bandhara River and the Coast, tourism could develop more evenly along the road and tourism could grow utilizing more sustain-

able practices.

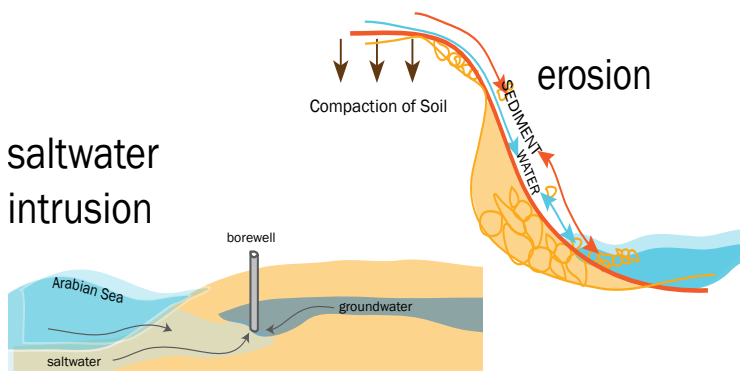
Similarly, Eco-Zones were identified in the RPG-21 and are further emphasized with the recommendation to establish **Eco-Belts**. In Agonda, the zones could be further identified as belts, strips or buffers that run throughout the village and not just in designated zones. The Eco-Belts are characterized as greenbelts and bluebelts. Greenbelts are strips of parkland - formal or informal that have the potential to buffer uses, provide environmental benefits, or simply offer recreation space. Bluebelts are storm water management features that complement the natural environment along wetlands, rivers, creeks, and coasts.

Agricultural land trusts are recommended due to Agonda's need to conserve agricultural land. Land trusts are agreements where one party agrees to hold ownership of land in protection for the entire community. In Agonda a private land owner could make an agreement with the city to forever keep their property in agricultural use or non-development use that does not take away from its agricultural viability.

1.1 COASTAL MANAGEMENT ZONE

Issue:

Agonda is threatened with deterioration of the natural environment along the coast resulting in continued saltwater intrusion of bore wells, erosion, and flooding as well as a host of climate related issues - sea level rise and exposure to more unpredictable weather events.



RECOMMENDATION:

Enforce Coastal Management Zone Plan

“In Agonda, the entire Agonda village is classified as CRZ-I except built up areas which are classified as CRZ-III.” (COASTAL REGULATION ZONE NOTIFICATION IN INDIA, 1996).

The Coastal Management Zone Plan limits the development of land in the Coastal Regulation Zone I (CRZ I), defined as all land within 500 meters of the High Tide Line (HTL) and 100 meters from any tidal creeks, and the Coastal Regulation Zone III (CRZ III), are defined as coastal zones in rural areas and enforce no development within 200 meters. Though not recognized in the Goa Coastal Management Zone Plan, Agonda also has areas that could be classified as CRZ III, which are areas that have been developed up to the coastline with approach roads and other utilities.

CRZ I protects against the mining of sand, altering of sand dunes in any way, construction unless a waterfront use (ie fishing), dumping of waste or release of effluent.

CRZ III allows for agriculture, horticulture, gardens, pastures, parks, play fields, forestry.

Note: CRZ II zones are not found in the village of Agonda.

The objective of the Coastal Management Zone Plan is to **protect Agonda** and its people. Agonda needs to be protected against erosion, slope denudation, saltwater intrusion of groundwater, flooding and saltwater ruin of agricultural land, loss of plant and fish biodiversity. The people of Agonda need to ensure access to the natural elements of their community—the beach, the riverbanks, etc. as well as be protected against flooding, loss of fishing or agricultural heritage, and loss of groundwater for drinking and washing purposes. (See Design Guidelines for Planting Native Vegetation in the CRZ I and CRZ III).

The Coastal Management Zone Plan calls for a balance of the built environment and the natural environment—both of which Agonda depends on heavily. The built environment provides structures and shelters, roads provide connections to work and family and daily needs, and hotels bring tourism and with tourism possible economic generation.

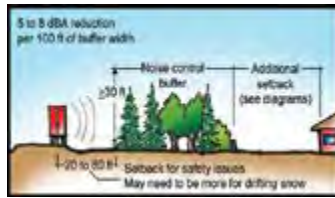
Process: Encourage the Panchayat to adopt the Coastal Management Plan, Encourage planners to educate the community and hoteliers—possibly convene a coastal conference to discuss best method of enforcement + incentivizing abiding by the zone regulations.

WHO TO INVOLVE:

- Panchayat
- Planners + Community
- Hoteliers

Development Considerations:

COMPATIBILITY & BUFFERS



- Facilities in the Coastal Regulation Zones along the coast and Bandhara River should be water dependent uses.
- Neighboring facilities need to be compatible with protection of the Coastal Zones.
- The Coastal Regulation Zones provide protection from certain uses, especially a use that has a potentially negative impact on the coastal environment.

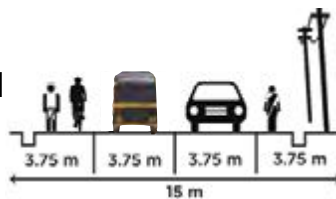
STORM WATER MANAGEMENT



(See Design Recommendations chapter 5).

- Coastal Regulation Zones aid in managing storm water by protecting the natural ecology of the coast and river.
- Impervious surfaces (roads/pavement) should be limited in the Coastal Regulation Zones to aid in the land's ability to manage water and prevent erosion.

TRANSPORTATION NETWORKS



- Improve coastal and river access points that require minimal construction and abide by the Coastal Regulation Zones.
- Coastal Regulation Zones are most appropriate for foot traffic and limited vehicle access to further protect the environment.

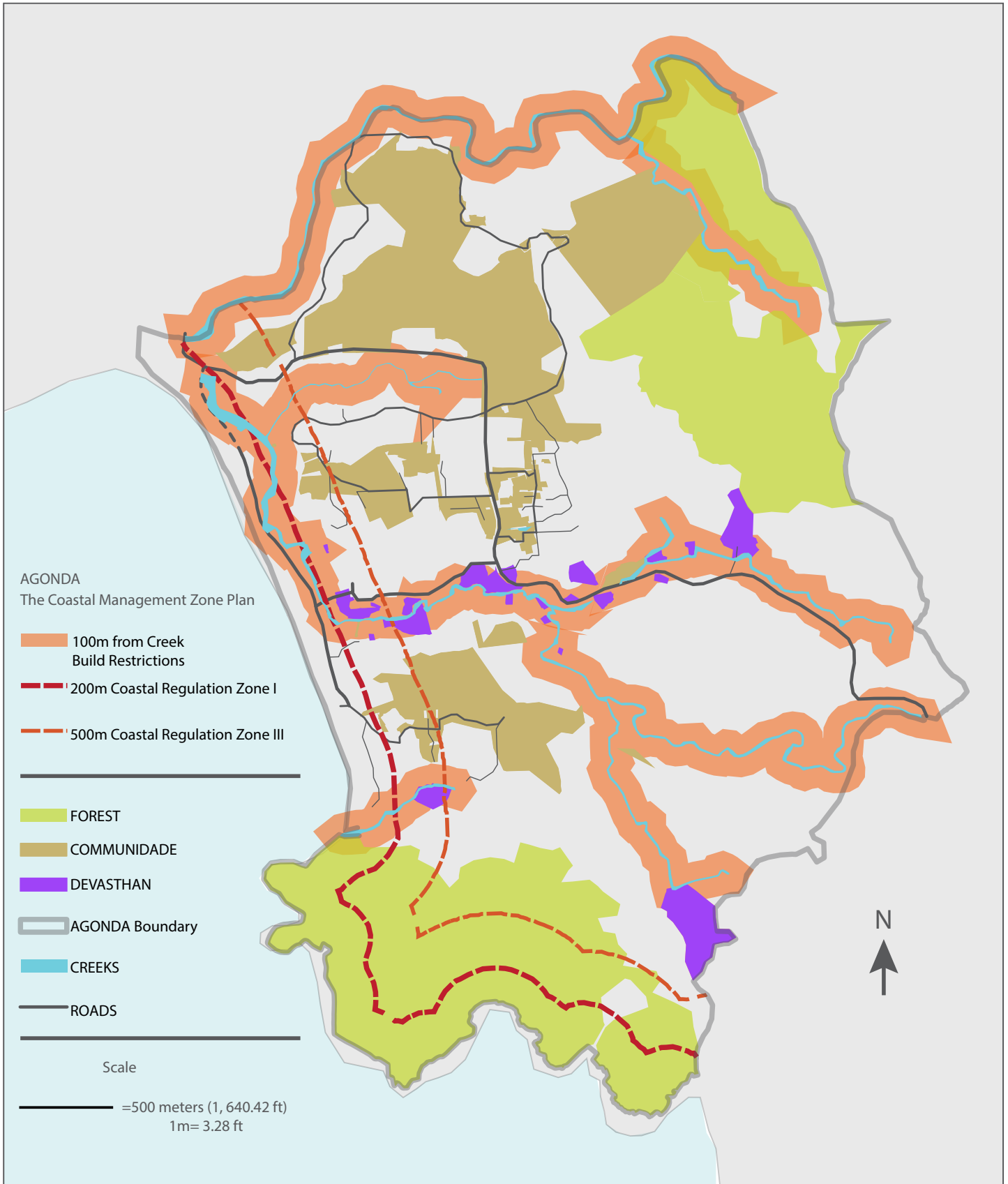
COASTAL DEVELOPMENT



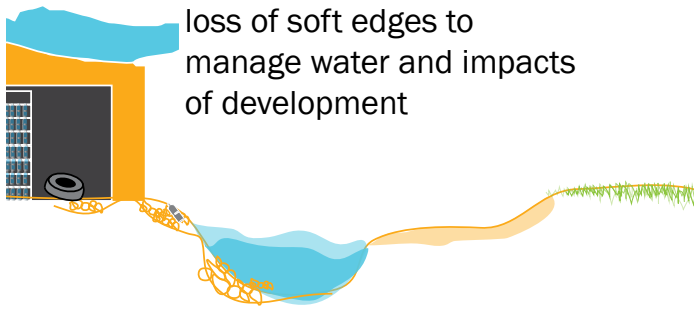
- With the Coastal Regulation Zones in mind, Agonda should decide the future of beach front development.
- The Coastal Regulation Zones protect the environment and Agondan inhabitants in the case of a disaster--i.e. cyclone, tsunamis.
- The Coastal Regulation Zones, if enforced protect against further groundwater salinization and erosion.

Impact: Enforcement of the Coastal Management Zone plan may affect several Devasthan held land plots, some Comunidade held land plots, and many individual and family property owners along the coast.

1.1 COASTAL MANAGEMENT ZONE



1.2 ECO-BELTS



RECOMMENDATION: Implement Eco-Belts, inclusive of greenbelts & bluebelts

The implementation of Eco-Belts will include **greenbelts** comprising of all forests, conservation lands, parks, informal recreation spaces, sacred spaces, mangroves, paddy fields, khazan lands, wildlife sanctuaries, playgrounds and **bluebelts** inclusive of rivulets, rivers, streams, water channels/sluices and dikes, sand dunes.

The objective of the Eco-Belts is to protect natural and semi-natural environments from the impacts of development and development itself. The Eco-Zone Belts can serve as buffers between conservation lands or valued natural entities and development, which lessen the impacts of development– pollution, erosion, and loss of shade that provides cooling.

Issue:

Natural resources need protection for ecoservice benefits—storm water management, sediment control, contaminants and pollution filtering, as well as their ability to provide shade, cooling, a place to recreate and foster improved public health.

Greenbelts ensure that there is access to passive and active recreation as in the field on the main road or the informal play space along the creek in Desaiwaduu. They can also provide clean air, provide or protect existing walking paths, protect wildlife habitat, prevent overcrowding.

Bluebelts serve as natural and man-made storm water management infrastructure - drainage corridors that interface with as creeks, dikes, sluices and paddy fields and valleys to retain storm water (See Design Guidelines for Bioswales, Earthen Dikes, and Wetland Protection). The purpose of bluebelts is to prevent flooding damage, erosion and its cascading effects, filter polluted water before it is released into creeks, rivers, and the sea, and potentially provide wildlife habitat and access to open space for Agondans to enjoy.

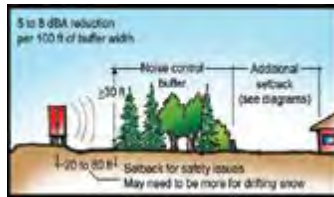
Process: Identify areas that are eco-sensitive that could be protected under greenbelts or bluebelts as well as small corridors or slices of developing areas that can be protected and serve the function of open space and pollution prevention or storm water management infrastructure.

WHO TO INVOLVE:

- Panchayat
- Planners + Community
- Hoteliers

Development Considerations:

COMPATIBILITY & BUFFERS



- Eco-belts act as buffers between two facilities or land uses that may not be compatible.
- Eco-belts provide protection from negative impacts on the land by offering respite from development.

STORM WATER MANAGEMENT



(See Design Recommendations chapter 5).

- Bluebelts aid in managing storms and floods by providing natural and man-made storm water management infrastructure.
- Impervious surfaces (roads/pavement/buildings) should be limited within Eco-belts to aid in the land's ability to manage water and prevent erosion.

CONSERVATION LANDS



- Eco-belts provide protections for conservation lands that should not be developed for ecological reasons.
- Eco-belts create a system that connects conservation lands—encouraging continuous access and habitat protection for wildlife and plants.

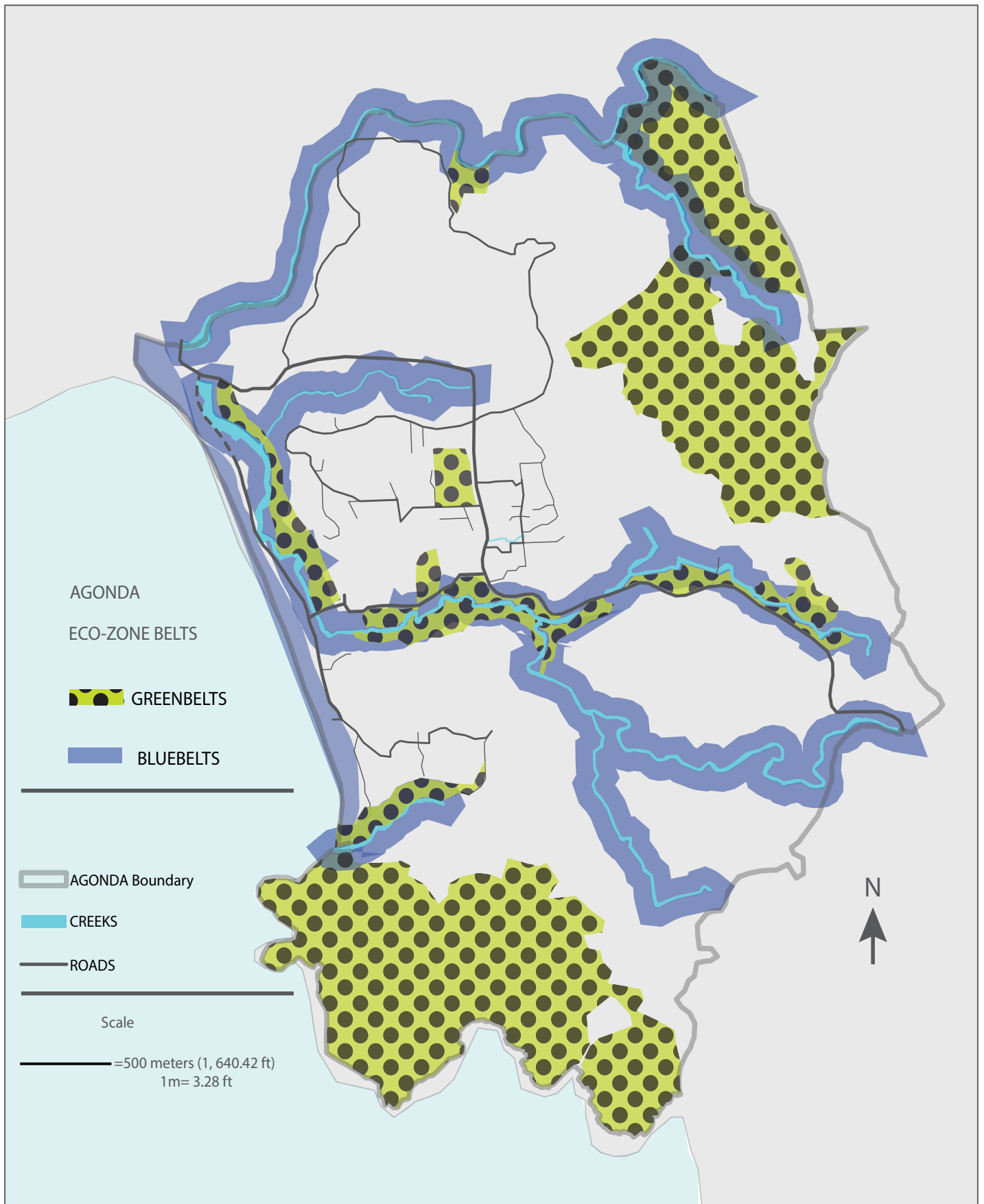
CLUSTERED DEVELOPMENT



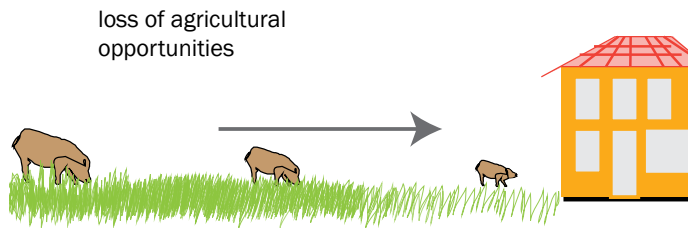
- Eco-belts encourage facilities to cluster and further support not using virgin land for development.
- Eco-belts encourage clustered development with the aim of minimizing the affects of traffic and waste.

Impact: Establishing Eco-belts may affect several Devasthan held land plots, some Comunidade held land plots, and many individual and family property owners throughout the village.

1.2 ECO-BELTS



1.3 AGRICULTURAL LAND TRUSTS



Issue:

Agricultural land which is not currently under the Comunidade may be threatened by commercial ventures, hoteliers, and potential public infrastructure project ventures.

RECOMMENDATION: Establish and incentivize Agricultural Land Trusts

The creation of Agricultural Land Trusts would assist the Panchayat, Comunidade, Devasthan or individually owned lands to be put into conservation and protection as agricultural land in perpetuity. The Agricultural Land Trust could operate as the Panchayat acquiring and owning land to be used only for agriculture use and protection. Individual entities could also voluntarily sign their land into an agricultural use only agreement. The Agricultural Land Trust would work to conserve existing paddy/khazan lands and other land used for additional agricultural purposes such as palms, livestock, processing of food or products grown on site, etc.

The Agricultural Land Trust would ensure that the farming heritage in Agonda would remain, even against threats from development and tourism. The Agricultural Land Trusts would symbolize a commitment to traditional agricultural heritage as well as the potential to capitalize off the value, agri-tourism or other entrepreneurial ventures such as food processing that add value to **local agriculture**.

In a state like Goa that imports 50% of its subsistence food, Agricultural Land Trusts could also aim to ensure a local source of food for Agondans and protect against food insecurity. By increasing locally grown food and reducing food imports, Agonda would be supporting its local economy, have more control over whether chemicals are used or not in production, and promote local sustainable development goals.

Currently most of the traditional agriculture—paddy fields, khazan lands, and even other agriculture spaces exist along creeks—sometimes directly in the floodplain. Therefore, most agricultural land would be protected from development by both the CMZP and the Agricultural Land Trust.

Establishing an Agricultural Land Trust in AGONDA will need:

- Governmental support
- Partnerships with funders or foundations
- Community recognition of the importance of conserving land for agriculture

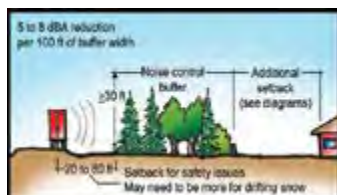
Process: Identify ownership of all productive and potential agricultural land in Agonda. Panchayat and Comunidade to organize agreements on putting land into trusts, current farmers and those involved in agriculture must be engaged to realize value and potential of the Agricultural Land Trust.

WHO TO INVOLVE:

- Panchayat + Comunidade
- Planners + Community
- Hoteliers + Businesses

Development Considerations:

COMPATIBILITY & BUFFERS



- Agricultural Land Trusts support existing agricultural uses and ensure future use is compatible.
- Agricultural Land Trusts can provide further protections to creeks and other natural features in Agonda.

CONSERVATION LANDS



- Agricultural Land Trusts protect agricultural lands from dissimilar use that threatens its historical use.
- Agricultural Land Trusts treat agricultural land as conservation land, limiting development to structures and use that support agriculture.

STORM WATER MANAGEMENT



- Natural storm water features are largely surrounded by or made up of agricultural lands, and thus both would be protected by the Agricultural Land Trusts.
- Agricultural Land Trusts would ensure impervious surfaces are kept to a minimum to further assist in water management and erosion prevention.

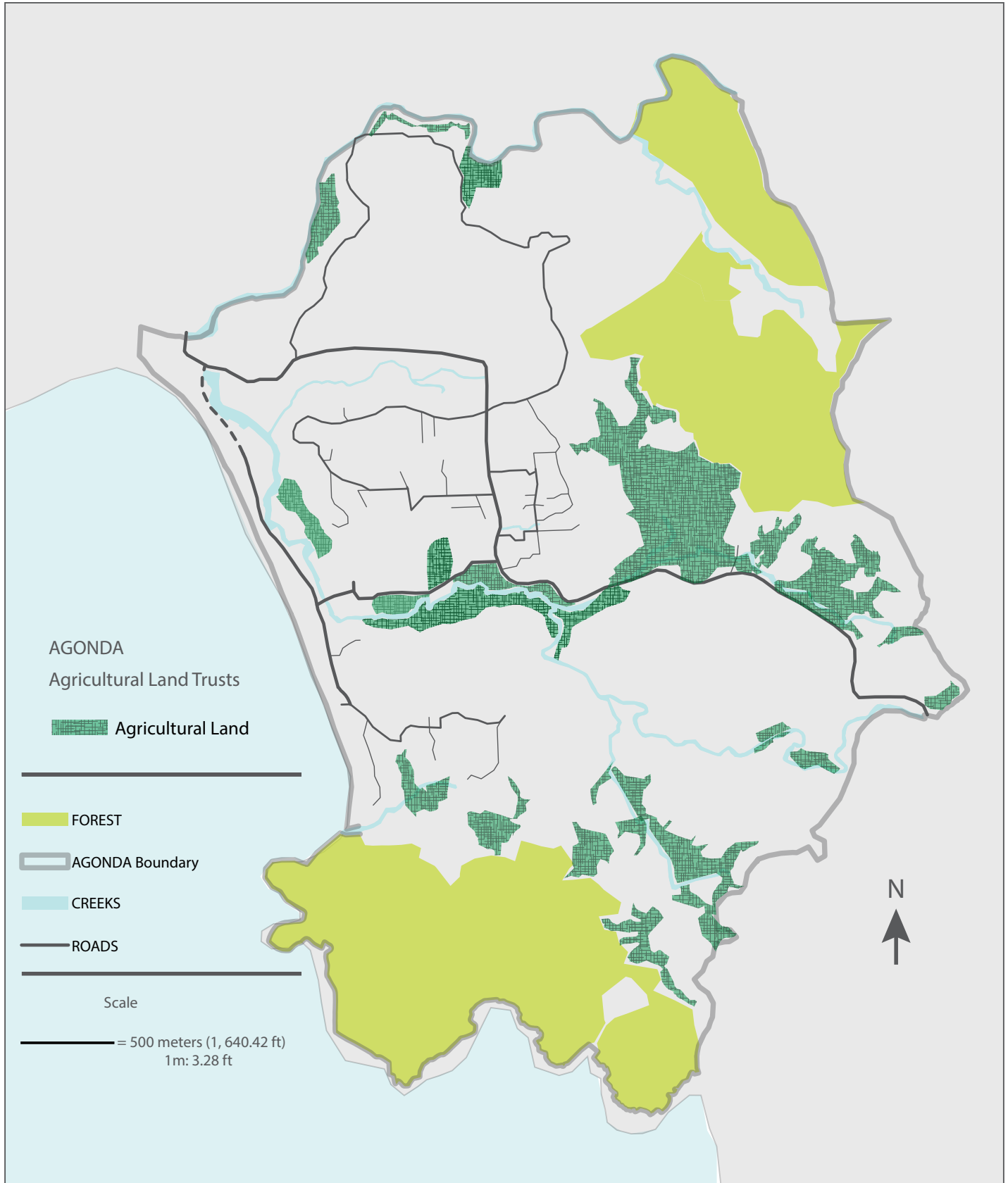
CLUSTERED DEVELOPMENT



- Agricultural Land Trusts limit potential land available for development/redevelopment, therefore, encouraging alternatives to land development and facility use.
- Agricultural Land Trusts protect Agonda's agricultural heritage by encouraging clustered development that allows agriculture to consist its own cluster.

Impact: Introducing an Agricultural Land Trust may involve inclusion of privately held land and family properties along the creeks.

1.3 AGRICULTURAL LAND TRUSTS



2.0 ACCOMMODATE GROWTH

1.1 RESIDENTIAL USES

1.2 COMMUNITY FACILITIES

1.3 BUSINESS AND INDUSTRIES

OVERVIEW

It is projected that by 2021, Agonda’s population will grow from 3,600 to over 4,100 residents; and it is also assumed, that there will be more short and long term visitors coming to Agonda. With more people settling in Agonda, the existing problems pertaining to the whole Agenda community may intensify. Accommodation for growth is one of the main guiding principles developed with and for Agondans.

There are three major geographic communities distinguished in Agonda: the beachfront community, the hillside community in the immediate vicinity of the east bank of the creek, and the upland community along the main Panchayat road. Each community has different geographic characteristics and natural challenges like: influence of the ocean tides and ocean inundation during the wet season in the coastal areas (the beachfront communities), building construction and infrastructure challenges on steeper slopes, shortage of water for public use and agricultural vegetation in the flat upland areas. Each community is also characterized by different land use patterns and population density. The beachfront strip has the most commercial character of all communities during the tourist season. Some temporary commercial structures and semi-permanent hotels are the most prominent

in this area. However, well – established public facilities: the St. Ann’s Church and Elementary school, the Boys School as well as a few stationary markets and residences are also interwoven in the land use fabric. The hillside communities stretch along the hills running through Agonda in the north-south orientation, and the most populated area is situated in the “fork” between the estuary of the creek and the Panchayat road loop coming down from the uphill. They have much more residential character with some commercial activities along the connecting roads like the Five Star Road and the east-west Connector Road linking the Main Road with the Beach Road (see existing conditions map page 14 and the road networks map page 48). The upland communities have the least residential density with few residential clusters near the Panchayat and along the MPR-2 road, presenting some opportunities with adding more residences in those areas.

The beachfront and hillside communities with larger population densities may not be suitable for additional residences because of flood hazards. The annual floods or larger events like tsunamis may cause major destruction of fresh water sources (water salinization) and of permanent structures. Similarly, more development tourism industry is not advised within the flood zones.

Development of tourism in the beachfront communities is not only hazardous because of flooding possibility; it also causes oversaturation and overflow of hotels and tourist-catered businesses in the beachfront communities that permanently change the village character of Agonda, and prevent the residents from accessing the beach during the high tourism season.

With the residential expansion, it is also expected, that some small manufacturing businesses could thrive in Agonda, fostering the local trade, production of goods and provision of jobs. Based on the existing land use patterns, natural resources and cultural heritage of Agonda, businesses like food and dairy production, arts and crafts and small-scale manufacturing among others could thrive. Therefore, utilizing the guiding principles addressing the immediate and long-

term needs of Agonda's community expressed during the consecutive workshops should take a priority in order to achieve a healthy and self-sustaining model community. Those needs include: community facilities, better road networks, a waste management system, solutions for impeding tourism, better mechanism protecting and promoting agricultural and special zones, preserving local heritage and initiation of locally based and community driven businesses. All planning towards meeting the aforementioned needs and should be done with the community's participation. The set of land use guidelines developed below addressing issues related to population growth is based on the feedback from Agonda's community and is meant to help with solidifying the steps towards Agonda's vision of sustainability.

Agonda Projected Development

	2011	2021	Number increase	Scenario	Land use implications	Environmental implications	
PEOPLE	POPULATION	3600	4100	500	The increased population will result from addition of new children to the village as well as some new residents settling in the village.	RESIDENTIAL USES More rental and ownership-based housing will be necessary to accommodate the new households INFRASTRUCTURE New housing established on previously undeveloped land, can require provision of road, water, sewage, energy and waste management infrastructure. The new residential areas can also add to the vehicular traffic on some roads jeopardizing pedestrian safety and as well as jeopardize unique traits of special zones or view corridors.	New housing necessary to accommodate the new households of Agonda can raise multiple environmental issues if not managed properly like: -INCREASED WASTE STREAM -INCREASED WATER AND ENERGY USAGE -INCREASED POLLUTION FROM MORE CARS AND FROM HOUSEHOLDS -ENCROACHMENT OF DEVELOPMENT AND PEOPLE ONTO OR NEAR SPECIAL AND PROTECTED ZONES
	HOUSEHOLDS	1038	1182	144			
	HOUSES	1385					
FACILITIES	PRIMARY SCHOOLS	4	5 or more	1		new schools will most likely be necessary in the developing residential areas experiencing shortage of schools	
	HIGH SCHOOLS	2			Population growth and residential expansion may cause the need for new schools over time.	new schools may be necessary within undeveloped but prone to development zones (soft sites), that are experiencing residential expansion	New schools, just like the new houses may call for environmental siting considerations
	PLAYGROUNDS	3					
	RECREATIONAL FIELDS	1 (formal)	2	1	Whether fast or slow pace of the population growth, having playgrounds and recreational fields contribute to a better public health in any settlement.	The increased number of residents in Agonda, especially those of young age, will require more access to recreational spaces. Siting recreational fields and parks do not carry heavy land use implications, however, it needs to be done strategically by looking at population density, environment and proximity to special and preserved lands.	Scenic unpaved pathways and recreational parks can be a tool in protecting special character zones like the creek and ocean edges, view corridors and vistas or prime community lands.
	MEDICAL DISPENSARY	1	1		The community has requested the clinic to be available 5-7 days a week.	Current medical dispensary building is sufficient to accommodate the medical staff and patients. However, as the future development progresses, a building a local clinic might be required.	
	CHURCHES AND TEMPLES	7				Because more community spaces are needed, new and existing religious facilities should consider sharing their space for other community oriented uses like: community centers, meeting, exhibition, celebration or educational spots.	
	COMMUNITY CENTER	0	1 or more		Agonda lacks a community center where various groups could meet together, and where local community life could be celebrated.	Accommodation of a community center will require some land and access, and should be situated strategically within the high population zones. However, a community center could be also a part of another facility like a religious institution or a school.	
	SEASONAL AND YEAR ROUND FRESH PRODUCE MARKETS	2	4 or more	2	Currently, Agonda lacks central markets that sell fish, dairy and local fresh produce seasonally or all year round. With increased population, and promotion of residential development and tourism away from the shore, it will be required to provide venues for selling the local food produce.	Provision and siting of food markets, both seasonal and permanent ones, should be driven by the proximity to the marketplace-the residential uses, proximity to commercial corridors as well as access to the main roads.	Seasonal farmers markets can promote local food production, protect the agricultural land from being developed and encourage the hoteliers to shop for their food supply within Agonda.
COMMERCIAL/INDUSTRIAL USES	MICRO-INDUSTRIES	0 (formal)	Further study required to determine suitable forms of micro-industries and their promotion in Agonda		Examples of micro-industries can vary from small scale hand-made arts and crafts making, local specialty food production, or other special produce making like coconut oil, pottery, basket weaving; to large scale recycling, fruit and vegetable production, etc. Some necessary industries or businesses should serve the population of Agonda and its needs in terms of produce that is currently underserved or job opportunities that are desired by people.	Establishment of micro-industries in Agonda should follow a set of land use guidelines that can maximize the potential for creating smaller in scale manufacturing businesses without jeopardizing already established residential, agricultural or special character zones. Certain types of micro-industries can co-exist with others, as well as near some commercial corridors creating clusters promoting specialization of produce, jobs and markets.	Spread of micro-industries and establishment of micro-industrial zones can harm Agonda's natural environment, special and preserved zones; it can deplete clean water and energy supply.
	ECO-TOURISM/FOOD PRODUCTION/ARTS AND CRAFTS BUSINESSES - IN ASSOCIATION WITH TRAINING CENTERS	0 (formal)	Further study required to determine suitable forms of eco-tourism and its promotion in Agonda		Abundance of farmland, variety of wildlife and the necessity to preserve both without separating them from the visitors of Agonda reinforce the opportunities to promote eco-tourism and local food production. Agonda's heritage in crafts-making can also improve economic development; however, the craftsmanship and local food production would need to be reinforced by training Agonda's workforce. Currently, Agonda lacks trade schools and specialized training centers.	Food production businesses could occur on the already existing farmland utilizing the green belts and land trusts. Eco-tourism mechanisms would control the spread of tourism while protecting farmland and wildlife of Agonda.	Food production and eco-tourism can contribute to protecting farmland and wildlife of Agonda.

2.1 RESIDENTIAL USES



RECOMMENDATION: Offset for increasing density of residential uses and provide more residential uses.

Various sustainable practices and land use mechanisms could address the need for new housing for the growing population of Agonda while preventing increasing density in some other areas of the village, specifically those near the creek area, both along the beach front and on the north-east slope from the creek. There may be over a 100 new households created by 2021. The current family structure, land subdivision or housing-sharing availability can not determine where all those households have to reside; some will stay in their family homes, some will need new housing and some will come from outside of Agonda and will need both land and new housing. It is however known from the feedback of the workshop participants, that the areas adjacent to the creek are becoming over-developed with housing settlements. The Agondans have also expressed their desire for exploring new residential zones for housing development.

Issue:

Addition of over 500 people by 2021 to the number of Agonda's inhabitants may lead to the need for additional housing over-populated residential uses in some parts of Agonda.

One of the first steps in establishing solutions for housing availability could be to determine **soft sites** for building new residences. These soft sites are suitable lands for new development in the form of smaller or larger **clusters** (concentrations) of housing units that do not interfere with special and preserved zones, are easily accessible, and are away from the CMZ's. Citing soft sites needs to follow the development considerations. Another indirect strategy for creating housing in Agonda may be to **sustain existing residences** and residential clusters from the encroachment of tourism and commercial development.

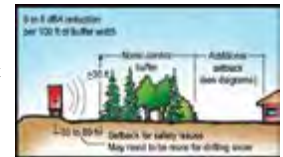
The more concentrated tourism and commercial development, the less space for residential uses in the prime areas of Agonda. Tourism and commercial development should follow their own set of guidelines without undermining residential neighborhoods. Additionally, allowing **infill** strategies in the less dense areas of development would strengthen the residential zones and clusters of housing.

Development Considerations:

Site Selection

- Choose sites away from CMZ's (Coastal Management Zones) to avoid flooding and fresh water salinization.
- Choose flatlands (outside of coast) and moderate slopes to protect structures from flash floods or soil erosion. (See Chapter 1.1 in Design Recommendations)
- Build outside of special/preserved zones as well as outside of prime agricultural zones.

COMPATIBILITY & BUFFERS



CONSERVATION LANDS



Built Environment

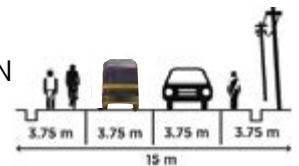
- Prioritize infill development in the less dense residential areas
- Consider “clustering” of residential uses (creating denser residential areas) instead of allowing spread onto an undeveloped land.
- Build near other compatible uses like institutional or commercial ones.

CLUSTERED DEVELOPMENT



- Consider existing road network/water supply system as well as some pedestrian circulatory networks that can be potentially expanded.

TRANSPORTATION NETWORKS



- Consider (and build away from) special and preserved zones setting boundaries for the developments.

CONSERVATION LANDS



- Utilize abandoned structures for residential, rental or ownership-based development. (There are multiple abandoned hotel structures which, could be turned into rental housing in consultation with the Panchayat)

Process:

Estimate and Assess

- Determine current housing availability and possible housing shortage within the next 8 years.
- Siting the future development areas may be guided by the development considerations listed as well as projection trends for other uses like the micro - manufacturing, tourism, and commercial uses
- Create conceptual land use plans for community feedback.

Progress

- Maintain community cooperation on developing, implementing and approving the development plan
- Establish guiding land development policies for residents and outsiders to follow while purchasing/developing land for residential uses
- Provide a trained Panchayat staff to provide support and guidance on development policies

Maintain

- Seek periodic stakeholder's and community feedback
- Monitor the trends in tourism and economic development as well as new demographic projections
- Maintain reviews of the plan over the period of time based on changes in population trends, prices of land and economic development needs.

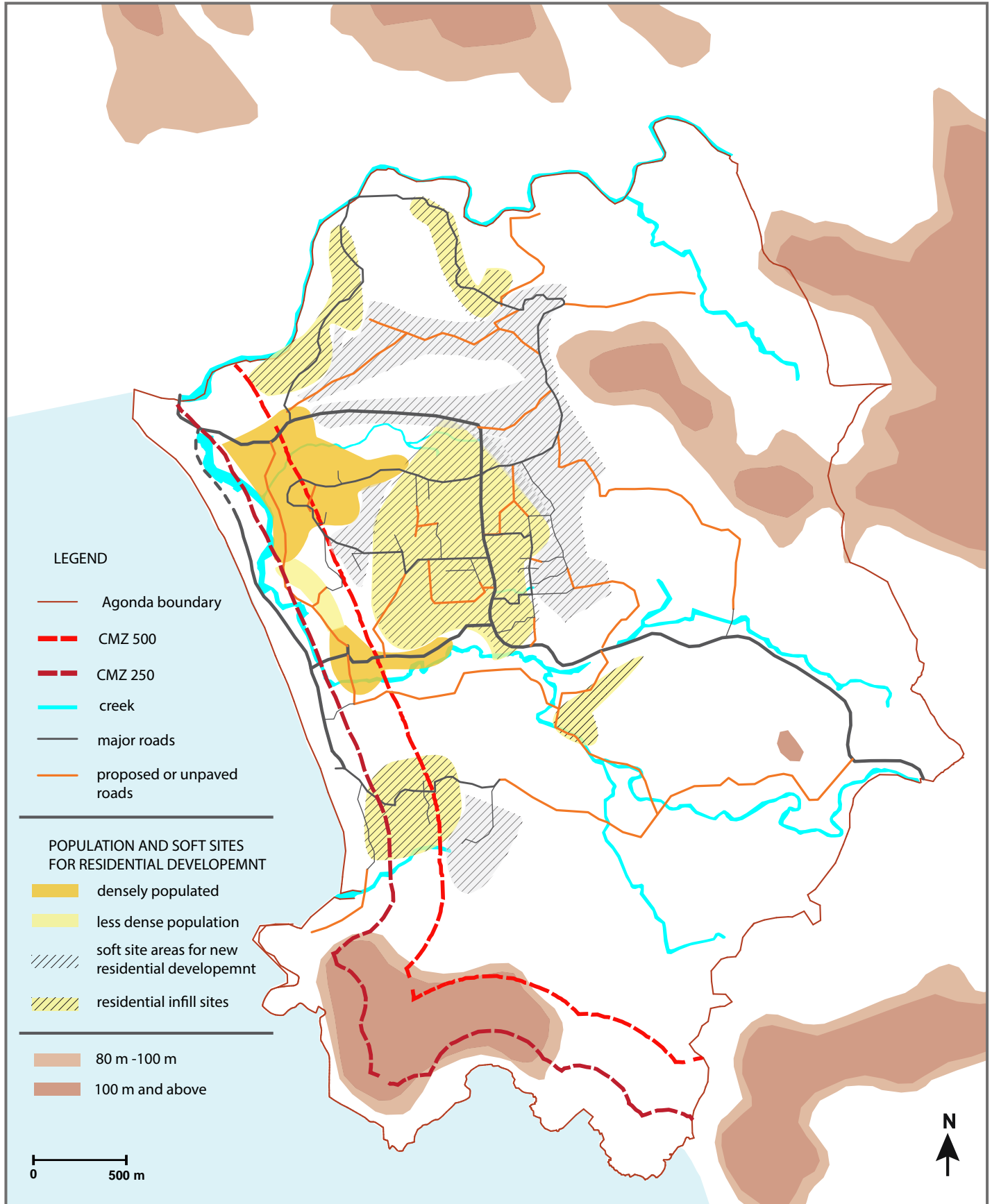
WHO TO INVOLVE:

- Panchayat + Community Groups

- Panchayat + Community Groups

- Panchayat + Community Groups
+ Regional Planners

2.1 RESIDENTIAL USES - soft sites



2.2 COMMUNITY FACILITIES

Issue:

Currently, the Agonda community lacks a formal community center where people and various groups can gather and discuss issues pertaining to them. Agonda also lacks a disaster management center; a fully serviced clinic and a fresh produce market place where local food growers, dairy producers and fishermen can sell their produce.



RECOMMENDATION: Provide Agondans with community spaces to gather for activities, community group meetings, as well as provide facilities of evacuation, healthcare and information purposes.

The residents of Agonda have expressed that currently; the village lacks appropriate number of facilities that could enable Agondans to lead a healthy, safe, sociable and empowered community life. While there is a need for a number of community facilities, those that are of immediate need include: a community center, a disaster information and evacuation center, fresh food and produce markets, recreational fields and parks and a fully operating healthcare clinic.

Siting community facilities may be guided by development considerations suggested below.

Practices for obtaining community space for the beach front and creek area communities that fall within the CMZ's are more specific, since the CMZ regulations forbid the spread of development and building new facilities. Here, the existing facilities like the schools and religious places should consider **sharing community space** with other appropriate community uses. In addition, the **use of temporary or seasonal space** within, but not limited to, the CMZ's could prove beneficial in hosting

activities like the farmers markets or open-air community gathering events.

In the areas outside of CMZ's, the new community spaces can be sited based on the development considerations. Appropriate **soft sites** for community spaces are those, which can serve concentrations of residences lacking any community spaces, particularly in those communities that are the most populated in the immediate vicinity to the creek. Soft sites also consider proximity to the road, sewage, water and energy infrastructure as well as proximity to other compatible uses. Easy road access is particularly important when determining the disaster management center. In addition, **re-purposing** some abandoned or unused structures found in Agonda for community uses could be an affordable and sustainable way to obtain the necessary facilities.

2.2 COMMUNITY FACILITIES - specific siting considerations

Facility	Where it is needed	Where it should be sited
COMMUNITY CENTER (in conjunction with other community uses like: a trade school, performance center, disaster information center, library)	In the beachfront and the upland communities	<p>The beachfront community should seek existing facilities to share their space for a community center, for example, the St. Ann's school could host community meetings and gatherings during the off-school time.</p> <p>The upland communities should site their center near the Panchayat main road because of an easy road access, the proximity to other community uses like the medical dispensary and the proximity to other compatible uses like the recreational field and the commercial activities near the road that already drive some traffic. A community center near the Panchayat could also reinforce the Panchayat's participation in the community life. Abandoned hotel structures found on the hill in the vicinity of residential development and near two schools could also be considered for repurposing for community uses like trade and training schools for adults.</p>
DISASTER MANAGEMENT CENTER	Central for the whole village	Away from the CMZ's, in the uphill area. With easy road access.
FRESH PRODUCE MARKET	In the beachfront and the upland communities	<p>The beachfront community can muster an open space near the beachroad or near existing community facilities like the St. Ann's School or the Boy's School for seasonal farmers markets selling fresh fish, dairy and food produce.</p> <p>The upland communities are in need of a permanent and central fresh produce market which could be sited near the Panchayat's main road or in the vicinity of Farmalnd Trusts and food production zones.</p>
RECREATIONAL FIELD OR PARK	In the beachfront and the upland communities	<p>The beachfront community should consider creating playgrounds near the existing schools.</p> <p>The upland communities can utilize their informal recreational fields, particularly those near the creek, as well as some special zones with beautiful vistas in the uphill area to protect them from development.</p>

Development Considerations:

Site Selection

- Build new facilities outside outside of floodplain zones to avoid flooding and fresh water salinization
- Build on flatlands (outside of coast) and moderate slopes to protect structures from flush floods or soil erosion
- Promote reinforcing existing facilities in the established communities within the CMZ's instead of building new structures
- Promote temporary and seasonal community uses within the CMZ's
- Utilize green energy and water harvesting techniques

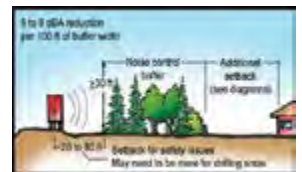
CONSERVATION LANDS



CLUSTERED DEVELOPMENT



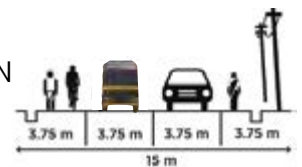
COMPATIBILITY & BUFFERS



Built Environment-Infrastructure

- Build near existing road networks and infrastructure
- Provide an evacuation center within an easy route access
- Re-purpose abandoned structures (hotels, homes) for community uses (through buying out the property with public money or through other legal means)

TRANSPORTATION NETWORKS

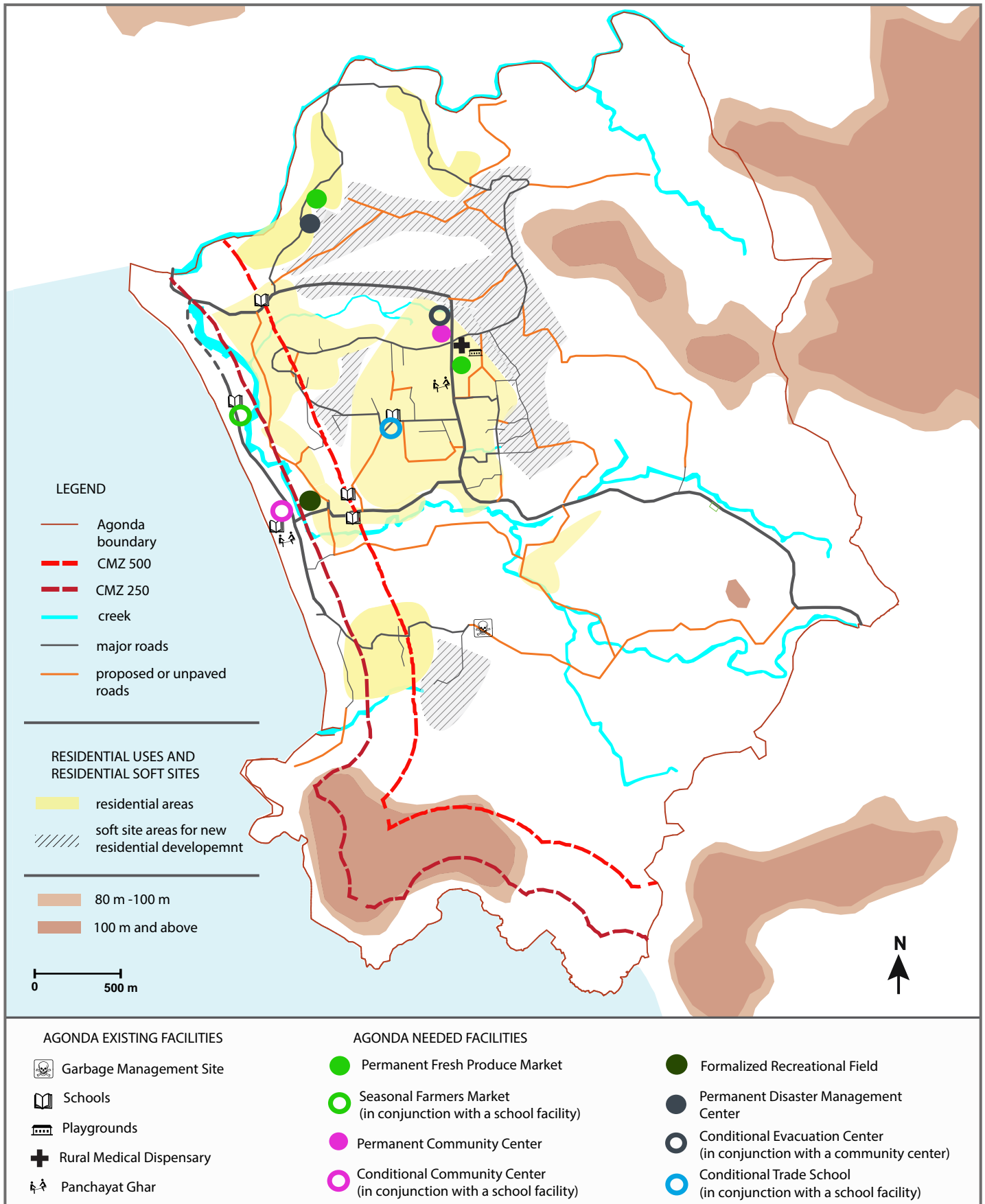


Process: Prioritizing community facilities may be one of the first steps in meeting all adequate needs for Agonda. Agondans have expressed that a community center and a central food market are among main facilities they need. Siting facilities with the input from all stakeholders would be needed taking into consideration land uses, road access and residential development projections. During siting, existing facilities should be looked at for possible sharing of uses, such as: existing schools with proposed community centers or a proposed community center with proposed evacuation center.

WHO TO INVOLVE:

- Panchayat
- Community Groups + Community
- Institutions

2.2 COMMUNITY FACILITIES - proposed sites



2.3 BUSINESS AND INDUSTRIES

Issue:

Current employment opportunities in Agonda rely mostly on hospitality businesses, housework and fishing. Without promoting new businesses utilizing local heritage, farmland and allowing micro-manufacturing, these employment scenario could remain unchanged.



RECOMMENDATION: Allow establishment of locally-based, sustainable business in Agonda.

In the community planning workshops conducted with the Agondan community, the village residents have expressed the need for more employment opportunities as well as new ways to encourage local business to grow. Large number of youths, relatively high level of education among the younger group of population, stable homeowner population, transportation network in place as well as the local heritage, farmland and natural environment are one of the many assets that can facilitate different kinds of businesses.

In the 2011 Agonda community workshop, the participants have determined the “desired” industries that are suitable for Agonda, those included: agriculture and fishing, food processing, artisan (craftsmanship), manufacturing, and public facilities industries. The three main sectors chosen for siting are based on the responders’ preference.

Food production associated with agri-tourism and local food supply strategies can be one of the focus areas for business. Since Agonda lacks fresh produce markets or farmers markets, the local hoteliers travel outside of the village to seek larger quantities of food supply. Also the upland communities lack such access to fresh produce markets. Food production by the local farmers and agri-tourism business owners needs to be encouraged by creating market places where food could be sold. Siting agri-related businesses, for example eco-

farms or dairy farms, needs to be aligned with the **agricultural lands**, as well as special and protected zones and land trusts where agricultural activity is allowed. Such businesses should also consider **proximity to the roads and local food markets**.

Micro-manufacturing and related fields like light industries and pharmaceuticals, also have many advantages for establishment in Agonda. Available land and educated workforce are just some examples. For appropriate siting of micro-manufacturing uses, **road access** and **proximity to fresh water and residential development** should be considered. The more noxious the use, the further it should be situated from the residences, prime agricultural lands and fresh water.

Arts and crafts are non-environmentally invasive activities. However, for successful utilization of local arts and crafts heritage in economic sustainability, certain practices should be implemented. Many locals possess the skills and traditions of crafts-making. However, lack of space for making and selling crafts disables this kind of activity to become an economic development strategy. Spaces for making, selling and learning about crafts can be easily interwoven into the **residential and commercial fabric** of the community. Local **community facilities** could be utilized into providing space and to promote arts and crafts.

Development Considerations:

Food Production and Processing

- Within easy road access
- Near possible market areas
- Near or within agricultural land

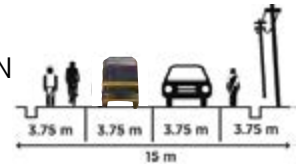
Micro-Manufacturing

- Within easy road access
- Access to fresh or grey water, but not at the cost of water for residential uses
- For heavy manufacturing, site further away from the residential developments, prime lands or special and preserved zones or sensitive natural habitats

Arts and Crafts

- May be sited within residential or commercial development
- Should consider utilizing space of existing institutions (schools) for the purpose of visibility and selling of arts and crafts

TRANSPORTATION NETWORKS



CONSERVATION LANDS



CLUSTERED DEVELOPMENT

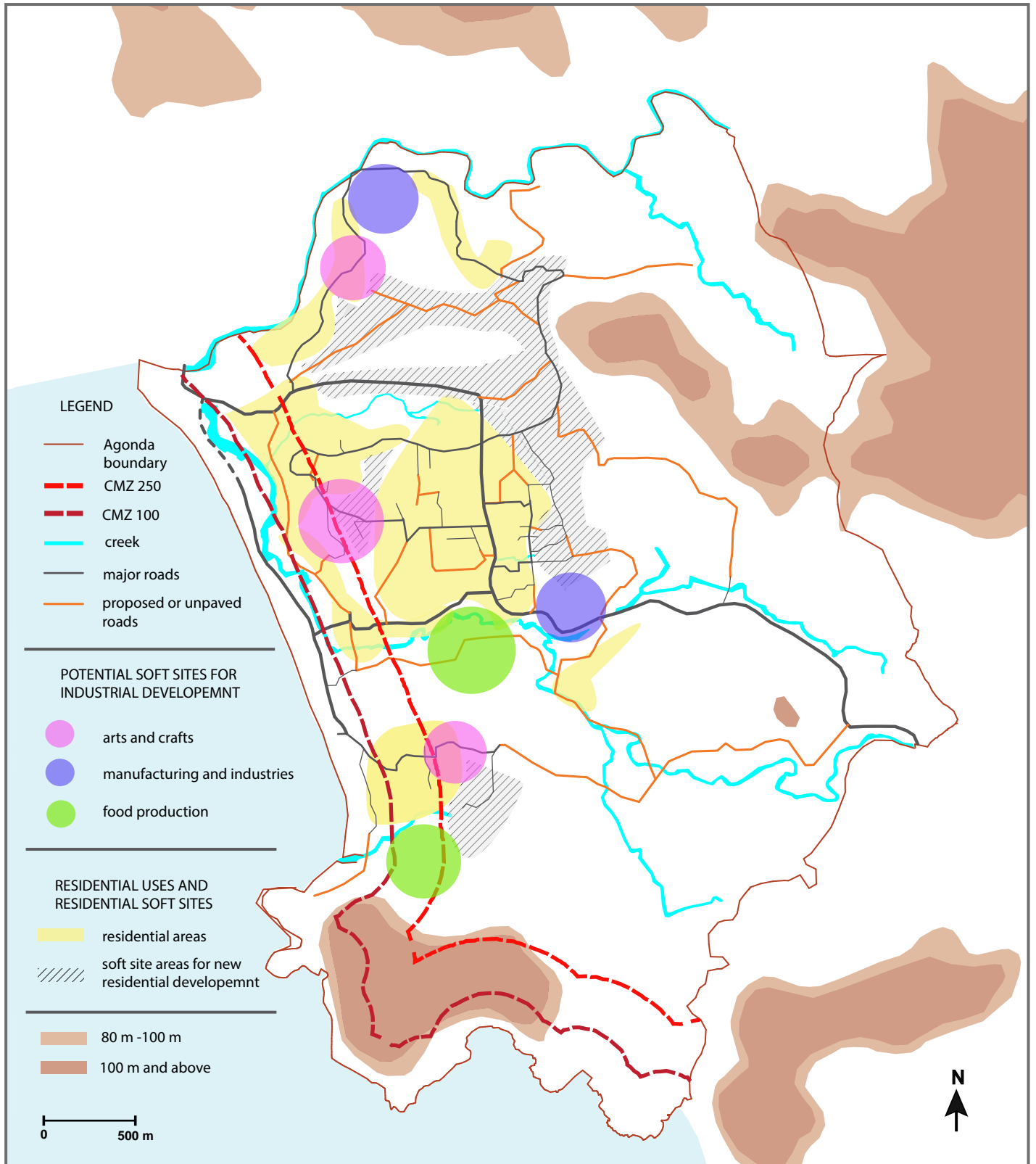


Process: One of the first steps to enable sustainable businesses in Agonda would be to analyze the strengths and attributes of the village including: individual craftsmen, potential business owners, farmers as well as land uses suitable for siting industries and businesses. Land use plan in coordination with the village would need to be then developed to establish shorter and longer implementation strategies for businesses. Arts and crafts as well as food production use could be integrated more easily, but allowing micro-manufacturing and heavier industries requires a thorough assessment to ensure viability and protection from negative environmental and socio-cultural impacts.

WHO TO INVOLVE:

- Panchayat
- Community Groups + Community
- Farmers
- Business Owners

2.3 BUSINESS AND INDUSTRIES - proposed sites



2.1 Improve Existing Road Network

2.2 Improve Pedestrian Networks

2.3 Parking

OVERVIEW

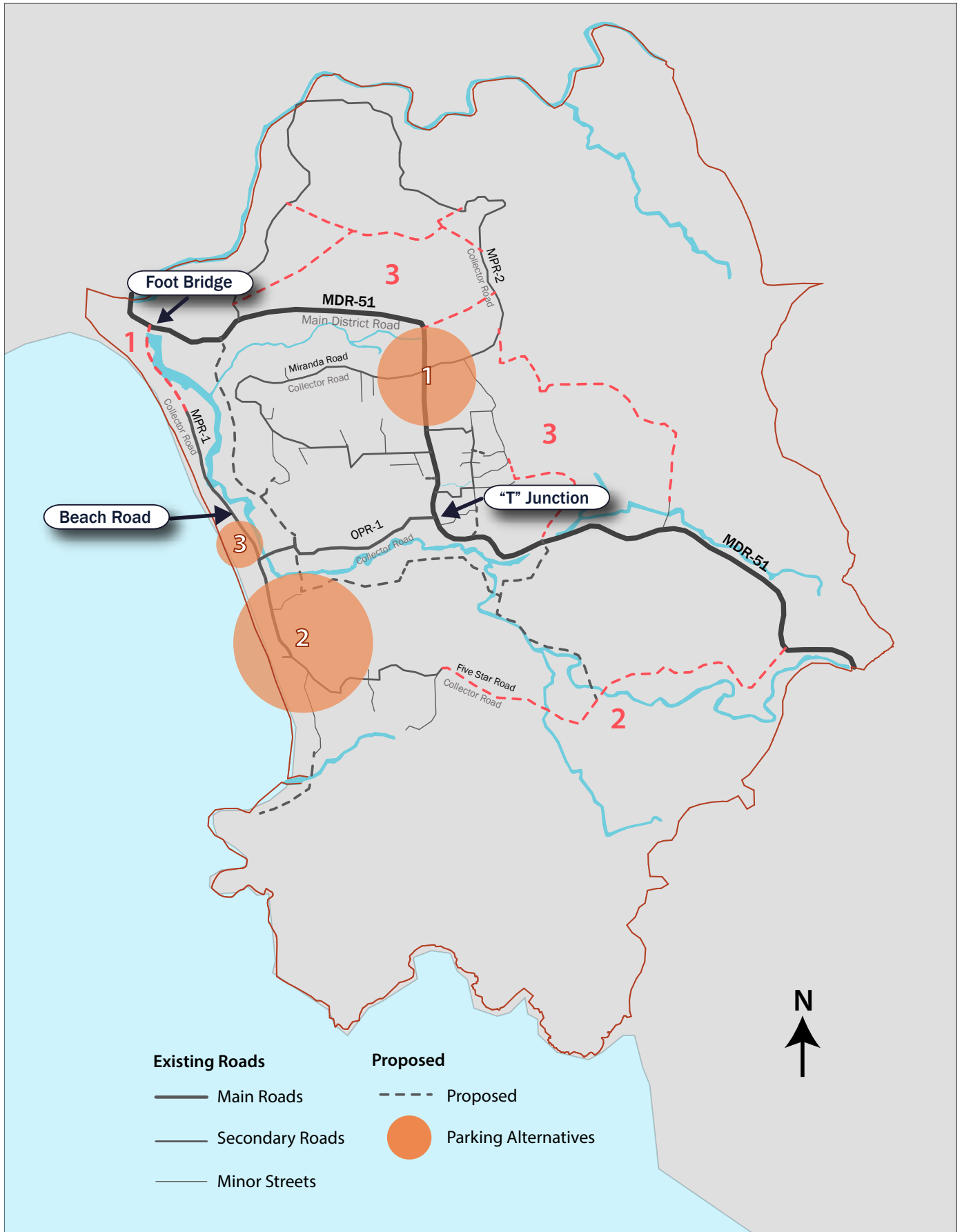
Transportation is an essential element of a land use and economic development plan. Transportation networks allow goods to move in and out and connect people to jobs. Well-built streets can improve property values. Recommendations for transportation networks generally seek to improve mobility and accessibility. Mobility refers to the movement of people and goods, while accessibility refers to the ease with which people can connect to needed services, and employment. Mobility generally translates to faster movement from point A to point B, while accessibility is improved linkage of destinations. When introducing circulation improvements for Agonda, it is important to keep both of these goals in mind. Many plans seek to resolve automobile congestion issues and parking woes, but other important issues to consider are the needs of those who walk and use transit (who need space to walk safely on the road), health issues, and energy sustainability.

It is also important to consider the effects of improving mobility for automobiles. The demand for driving on the roads is more elastic than it would seem, and improvements to the road network will increase demand for driving, while making roads less “driver friendly” and including infrastructure for other modes of travel will lower demand for driving and may encourage the use of alternative modes. Similarly, additional free parking may increase the demand for driving. An increase in driving means

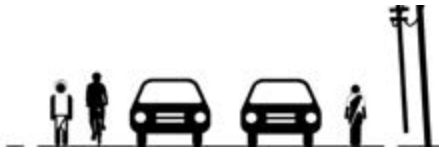
an increase in pollutants in the air, and those who live near busy travel corridors will breathe more of this emitted particulate matter. More vehicles on the road also means a greater dependence on oil in Agonda. Streets that are fast and friendly to cars may lead to cars using Agonda’s roads as a “through roads,” zipping through without stopping. These sorts of roads may be out of keeping with Agonda’s village character. Our recommendations suggest ideas for meeting the needs for improved roads as well as scaling back on roads to prevent increasing car usage in Agonda while keeping all road users in mind.

Roads need to be improved with knowledge of future land development in mind. A current example of this issue is that the proposed Agonda waste management site is located on a Five Star Road connected only to the beach road (see map). Siting such a facility would significantly increase traffic on the beach road. Unless more traffic on the beach road is a desired outcome, either the roads leading to the site must be improved and connected to a more suitable, high capacity road or the site must be changed. Such considerations must be kept in mind when building on new residential sites. Development leads to more road users, and people will want to move into homes that are well connected to a road network that will take them to work.

Improving Connectivity and Access



3.1 ROAD NETWORKS



RECOMMENDATION: Improve circulation around and access to the road network in Agonda, relieving current choke points for cars and providing additional capacity so that the flow of goods and people through will not be restricted. New roads and improved roads should be at least wide enough for two average sized cars to pass one another.

Issue:

As it is currently built, the beach road lacks connections to outside roads, limited by a narrow bridge leading to a game of chicken for anyone trying to enter from the north, a road to the south that doesn't connect back to the larger road network, and only one viable point of access to the beach for cars. The beach is a major attraction, and it is only easy to get there if you are on the beach road, so the main access point becomes congested.

SUGGESTED ROAD IMPROVEMENTS:

1. Improve conditions at the north end of the beach road
 - a. Widen the foot bridge at the north end of the beach road
 - b. Pave the beach road from the bridge to the current paved area
2. Connect beach road to the main road via a new connector road on the southern end
 - a. If waste management or light industrial is sited on this road as planned, there needs to be a road to accommodate the vehicle traffic generated at the site
3. Improve road connectivity throughout current residential zones.
 - a. New roads in residential areas as indicated on the map

PROS

CONS

Improving connections to the beach road will alleviate the choke point at the T junction between the beach road and the main road.	More cars may choose to use the beach road as a through road, since it will now be a convenient shortcut through Agonda.
More roads will provide improved freedom of movement for drivers in Agonda.	More convenient roads will induce more demand for driving, increasing the amount of trips made by car, congestion, and pollution from cars.
If roads are built with amenities for pedestrians, new roads will make walking more convenient by providing quicker routes.	If new or improved roads are built as roads are currently built in Agonda, with no amenities for walkers, it will be a lost opportunity.
Better connections will raise the value of property away from the T junction, encouraging development at the north and south ends of the beach road.	Effects of new development will have to be carefully managed so that Agonda's character can be preserved and that it remains within what is allowed under the CMZ.

Process:

- Determine possible paths for the south road based on a traffic study
- Take into consideration soft sites for future development and current proposed sites
- Set up a funding element with hoteliers
- Prioritize investments

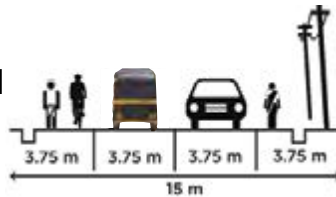
WHO TO INVOLVE:

Since **hoteliers** stand to gain much by improving road conditions, they can be “road stewards”, paying into a collective fund for road maintenance

Hotel developers seeking any kind of special exceptions may be requested to provide road improvements that will be necessary because of their hotel (at a “rational nexus” to the demand created)

Development Considerations:

TRANSPORTATION NETWORKS



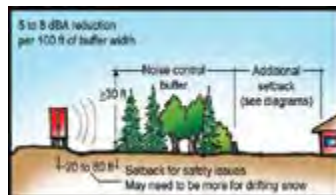
- Improve accessibility and mobility for users of all modes of transportation

CLUSTERED DEVELOPMENT



- Improving existing roads and building roads near existing and proposed development will encourage clustering, keeping development from spreading into adjoining farmland.

COMPATIBILITY & BUFFERS



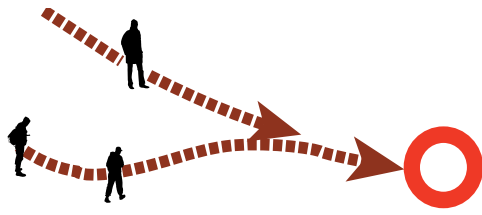
- Connecting the beach road to the main road at the south end will divert traffic from the possible industrial uses (see map of proposed sites for businesses and industries, chapter 2.3) and waste management site, providing a traffic buffer for residential and commercial areas.

WASTE MANAGEMENT



- Improved transportation networks will improve accessibility for waste management vehicles. Improved residential roads will allow for easier trash pick-up and the proposed road connecting the beach road to the main road will allow for waste to be trucked out of Agonda.

3.2 PEDESTRIAN NETWORKS



RECOMMENDATION: Improve pedestrian networks in Agonda by creating additional pedestrian links and adding pedestrian facilities to existing roads. Actively encourage people to explore the village on foot.

Issue:

Pedestrian networks are underdeveloped. The 2011 report determined that 78% of trips in Agonda included walking. This means that many people are pedestrians, even if that is not their primary method of getting around. If walking becomes more pleasant and safe, car trips will decrease and the use of more environmentally friendly methods of transportation like walking and transit will increase.

Alternative 1:

Walking paths could allow for connections to other roads about every quarter mile. There is a stretch of beach road that runs for at least one mile without connecting to any other road, making it relatively inaccessible. There could be at least one new pedestrian foot bridge across the creek. Improved and new roads could include sidewalks or nearby walking paths to further strengthen these networks.

PROS

CONS

This type of connection is necessary to encourage walking, since pedestrians like to take the shortest, most direct route	It may be expensive to find and procure additional right-of-way for pedestrian paths
If it is easier to get to the beach from hotels off of the beach road, more people will be willing to stay at locations away from the beach, taking some pressure off of development on the beach road and making development outside the CMZ more palatable.	Maintenance of these paths will incur additional expenses.
Improved pedestrian networks will encourage people to leave their cars at home, lowering congestion for those who choose to drive and reducing pollution from cars	

Process:

- Study current pedestrian circulation, including counts of pedestrians along roads as well as the mapping of informal walking paths
- Determine where the public has the right of way, and where it may need to be procured to provide access
- Identify the range of walking needs – for instance, school commutes, scenic spots for walking for pleasure that could connect to the network, and shopping corridors.
- Start a “walking club” amongst those who are interested in identifying walking issues in Agonda

WHO TO INVOLVE:

- The Panchayat
- Hoteliers
- A group of citizens ready to tackle this issue

3.2 PEDESTRIAN NETWORKS

Alternative 2: Close the beach road to large vehicles (i.e. larger than an auto-rickshaw) during the tourist season, allowing for improved pedestrian access to the commercial area. The road would be open during certain hours for deliveries and other necessary services. The road would remain open to emergency vehicles and personnel at all times. Auto-rickshaws and scooters could provide luggage service for tourists.

PROS

A more pedestrian friendly beach road would encourage pedestrians to walk further, past more storefronts, encouraging them to spend more money in Agonda

Closing off the beach road to larger vehicles will discourage its use as a through corridor, making it available to Agondans as well as visitors.

Traffic in Agonda will be mitigated because making this road more friendly to pedestrians will reduce driving demand in general.

A pedestrian street could lead to a better public marketplace for local entrepreneurs to sell their wares.

CONS

Closing the road to cars may pose seasonal inconvenience to residents who drive, as they will have limited access to travel or park on the road.

People who usually drive to shops and other services along the beach may be discouraged if they do not have a viable alternate method of reaching the shops

Making deliveries at “off hours” can be difficult to schedule, as someone must be present at the business to receive these deliveries

If not carefully managed, the additional open space could be utilized for other less desirable activities

Process:

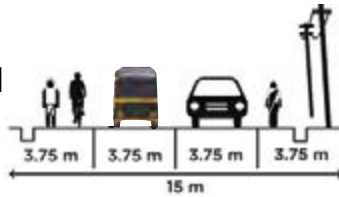
- Perform a traffic impact study for the closing of the road
- Create a Business Improvement District funded by the local businesses and hoteliers, who would benefit most from improvements to the beach road
- Perform public outreach to determine how citizens feel about the seasonal closure of the road

WHO TO INVOLVE:

- The Panchayat
- Hoteliers
- Citizens

Development Considerations:

TRANSPORTATION NETWORKS



Better pedestrian networks benefit all transportation modes:

- Walkers
- Transit users (who must walk to bus stops)
- Drivers (who must walk from their parking spots to their destination).

STORM WATER MANAGEMENT



- Pedestrian paths can be constructed out of more porous paving material than heavily used roads, so they will be more effective in managing storm water than roads paved with asphalt.

COASTAL DEVELOPMENT



- Improving pedestrian networks will allow for less car use in the CMZ's, which will protect sensitive environmental habitats from negative impacts.

CLUSTERED DEVELOPMENT



- Improved pedestrian networks make it easy to get around in clustered development settings. Since buildings are located in close proximity, most trips can be made on foot. New paths will make these trips safer and will make walking more desirable.



Issue:

Agonda’s residents and taxi operators need additional parking access because of limited availability in high demand areas.

RECOMMENDATION: Develop parking in a way that respects Agonda’s character. Areas that are important to preserve should be minimally disturbed by paving. A study needs to be undertaken to determine areas of high parking demand.

Alternative 1: A large off-site park-and-walk/ride areas could be designed at several locations near the Panchayat with travel services to the beach road. At least one bus should stop at these sites. Additional amenities, like a restroom, taxi stand, information station, and a scooter rental could be included at the site. Programming ideas like these could be studied to determine what would be best for the community while attracting visitors. The parking may be offered for free to incentivize parking there over other places. Permeable pavement would be used. Free shuttles may be operated to the Church on Sunday. This option is most attractive if the beach road is closed to large vehicles.

PROS

CONS

Drivers would be able to park both in a busy section of town with services and recreation and reach the beach road.	It can be difficult to change people’s perception to use an off-site lot when there is available roadside parking. If people are able to drive to the beach road and find parking, they will be unlikely to use the lot.
These park-and-walk/ride locations would take pressure off of neighborhood parking	
This lot could also accept excess demand caused if the beach road is closed to large vehicles. The site would allow those who want to travel to the beach a convenient place to drop off their vehicle.	
If commercial activity along the main road expands, this lot can be used by shoppers	

Alternative 2 (studied but not a feasible option): A beach-front parking lot could be added at the south end of the beach with a taxi stand that would be open during the tourist season. Programming options like restrooms, changing stations, and information stations could be explored. During the tourist season, the town could charge a small fee for use of the lot and allow free use during the off-season. This would allow the town to collect a public benefit from the strong tourist industry around the beach-front. Consider design standards for paving.

PROS

CONS

A lot near the beach would leave more street parking open for Agondans, as the bulk of tourists would likely opt to park as close to the beach as possible.	This option is not feasible, as it is not permitted under the CMZ. Storm water runoff from the parking lot must be diverted and treated to avoid polluting Agonda’s creek and ocean
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3.3 PARKING

Alternative 3: During the tourist season, the church could open its lot to parking when it is not being used for church events.

PROS	CONS
The church already has a large space available for parking	The Church is a privately owned site
The church is centrally located	This area could also be used for play for the children at the school - citizens will need to determine which use is more needed

Alternative 4: Small “pocket” parking lots could be added around the town as needed. A study would need to be done to determine the best locations for these lots, or groups of neighbors could apply to develop a lot. These lots would be planted aesthetically in keeping with Agonda’s character.

PROS	CONS
This method would be minimally invasive, determining small areas that can accept parking and instituting lots.	It may involve developing unutilized land for parking, which may be undesirable if Agondans want to preserve this land

Alternative 5: Develop on-street parking in commercial areas by widening roads and studying current roads to see where a lane can be given up and devoted to parking. If this parking is in very high demand, the town should charge for it to ensure turnover of cars so the businesses have spaces available for customers.

PROS	CONS
On-street parking creates a barrier between pedestrian sidewalk and traffic, creating a safer pedestrian environment.	If no new pedestrian infrastructure is developed, on-street parking will take up the spaces currently used by pedestrians or take up the available space where pedestrian networks could have been improved.
Provides convenient access to on-street entrances, which is good for both shopkeepers and shoppers.	Widening roads is a high cost venture. Costs include paving as well as potentially purchasing easements if a widening project encroaches on private property.
	Slows traffic as cars stop to parallel park, increasing congestion.

Development Considerations:

STORM WATER MANAGEMENT



- The impact of paved areas on storm water runoff must be managed.
- The effect of the location and design of parking on storm water absorption must be considered to prevent polluted runoff from entering Agonda's water bodies.

COASTAL DEVELOPMENT



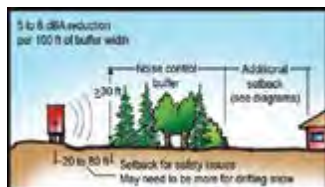
- See storm water management above - these issues are amplified in a coastal area.

CONSERVATION LANDS



- Parking alternatives need to be chosen with the goal of avoiding farmlands, forest, and other conservation lands and environmental habitats..

COMPATIBILITY & BUFFERS



- Parking lots are generally not aesthetically pleasing, and buffers need to be integrated to prevent negative impacts.
- Landscaped parking lots with plantings can be an effective way to buffer these lots from other uses.

DESIGN RECOMMENDATIONS FOR CLIMATE RESILIENCY IN AGONDA

CONTENTS

INTRODUCTION

CLIMATE CHANGE & AGONDA

DEFINING CLIMATE RESILIENCE: WORKSHOP SYNOPSIS

SUMMARY OF REGION-SPECIFIC CLIMATIC CHALLENGES AND BUILDING TYPOLOGIES

SCOPE OF RECOMMENDATIONS

APPENDIX

ADDITIONAL RESOURCES (A-C)

CHECKLIST

MAPS

GLOSSARY OF TERMS

SURVEY DOCUMENTS

RECOMMENDATIONS

1| SITE

Slope
Coast



2| BUILDING CONSTRUCTION & MATERIALS

Construction Methods
Materials



3 | WATER

Potable Water
Wastewater



4| ENERGY

Passive Cooling
Renewable Energy



5| FLOOD MITIGATION

Buffers
Stormwater Management
Building Construction



INTRODUCTION

CLIMATE CHANGE AND AGONDA

The focus of the recommendations described in the following sections is climate resilience and design.

By climate resilience, we are referring to Agonda's ability to respond to the climatic changes and extreme weather events that are becoming more frequent worldwide.

Climate affects every aspect of life in Agonda, and directly shapes its architecture and design. In the following sections, potential design solutions that can increase Agonda's ability to respond to these climatic changes are described in detail.

There are a number of climate change impacts that could potentially effect Agonda, including more extreme and variable temperatures and extreme weather events, more intense flooding during the monsoon season, and erosion of coastal areas as storms result in stronger waves. It is important to prepare for the changes because climate-related events have implications for agriculture, fisheries, health and local tourism.

Although Agonda already successfully responds to its climate in many ways, it is important to note that climate change ensures that these impacts will become more extreme and unpredictable in the coming years.

As flooding events become more frequent and extreme, potential impacts include damage to agriculture and agricultural lands, infrastructure, and property. In addition, public health impacts can result as people come into contact with floodwaters. Water and food security are directly related to temperature and precipitation. Changing weather patterns make temperature and precipitation more variable and can compromise Agonda's water and food supply. These changing weather patterns can cause increased beach erosion with changing wind and ocean currents.

The following sections contain potential design solutions that may act as buffers in protecting Agonda from climate change impacts.

DEFINING CLIMATE RESILIENCE: WORKSHOP SYNOPSIS & SCOPE OF REPORT

On Jan 8 2013, Agondan residents and business owners gathered at St. Anne's Church to discuss how sustainable design decisions can allow Agonda to prepare for climate change. Participants engaged in a series of participatory design and mapping activities focused on climate change in Agonda.

Some of the key issues that were raised during these conversations concerned water shortages throughout the tourist and rainy season, flooding, coastal erosion, and an increasingly unreliable energy supply. With these challenges in mind, participants utilized visual aids to express how some of these issues might be addressed through design measures. A number of the design solutions featured in this document were discussed in terms of their benefits, limitations, and contextual feasibility.

The issues and potential design measures discussed in the 2013 workshop framed the content of this report, and the concerns raised by workshop participants were integrated into a set of design recommendations. While the recommendations in the following sections are not the only strategies for increasing climate resiliency, they are intended to provide a sampling of design strategies that fit into Agonda's existing cultural, architectural, and environmental landscape of while mitigating the effects of global climate change.

1.0 SITE PLANNING

Site planning is the organization and layout of a building in relationship to its landscape and site. Designers and developers must analyze the best techniques and applications in construction that create the least amount of impact on the environment, whether it be in the hills or along the coast. This relationship between the structure and the land are integral to sustainable design. Site planning also takes into account information regarding slopes, soil content, hydrology, existing and planned vegetation and orientation, before having a structure built. Through the process of site analysis, development can be made more sustainably and longer lasting.



RECOMMENDATION: Appropriate Hillside Construction

Objective: When constructing on hillsides, there are many considerations to take into account in order to reduce the risk of damage to the structure and most importantly to people. By following these guidelines, many of the risks associated with hillside construction may be mitigated.

Issue

Hillside areas cover many parts of Agonda, especially Wards 1 and 7, and may be used as new construction areas when the more level areas of Agonda are fully built out. Living on slopes in Agonda can lead to greater possibilities of landslides, and increased property damage due to runoff.

Description

Landslides are caused by rapid slope instability due to heavy rain, erosion, surface runoff and heavy excavation. These actions can be mitigated through proper site planning and design. As seen in the figures, knowing how to build with the hillside allows for structural integrity and support such that water flows are controlled and sent away from the structural members of a home. Keeping the existing vegetation, while providing flood mitigation, also locks in the surface soil structures, providing resistance to land flows and slips. Making sure that the structure is anchored in bedrock, as well as having well designed retaining walls and water retention basins can provide for a safer, more stable home on the hillside.

Benefits

One of the biggest benefits is having a soundly designed structure to ensure quality of life for residents. Many of the earthworks that go into ensuring a stable structure also provides with many means of mitigating stormwater and flooding.

Limitations

The best practice for building in Agonda is to avoid hillsides greater than a 15% grade so that there is less of a risk of landslide. Encouraging development on these slopes can cause of more clearing of vegetation, allowing for faster water infiltration and increased surface runoff, often associated with new paving. In order to ensure that the site chosen for a building is proper, there should be a geological survey done to see the soil composition before building.

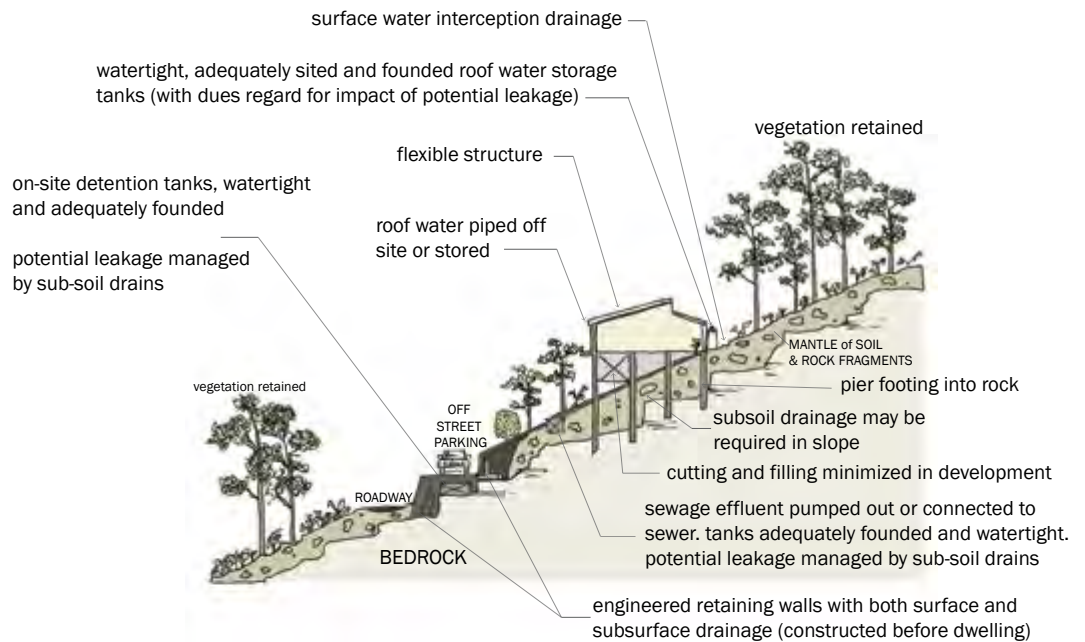
See Also: Flood Mitigation: Mangrove Preservation, Planting Native Vegetation; Potable Water: Rainwater Collection

References:

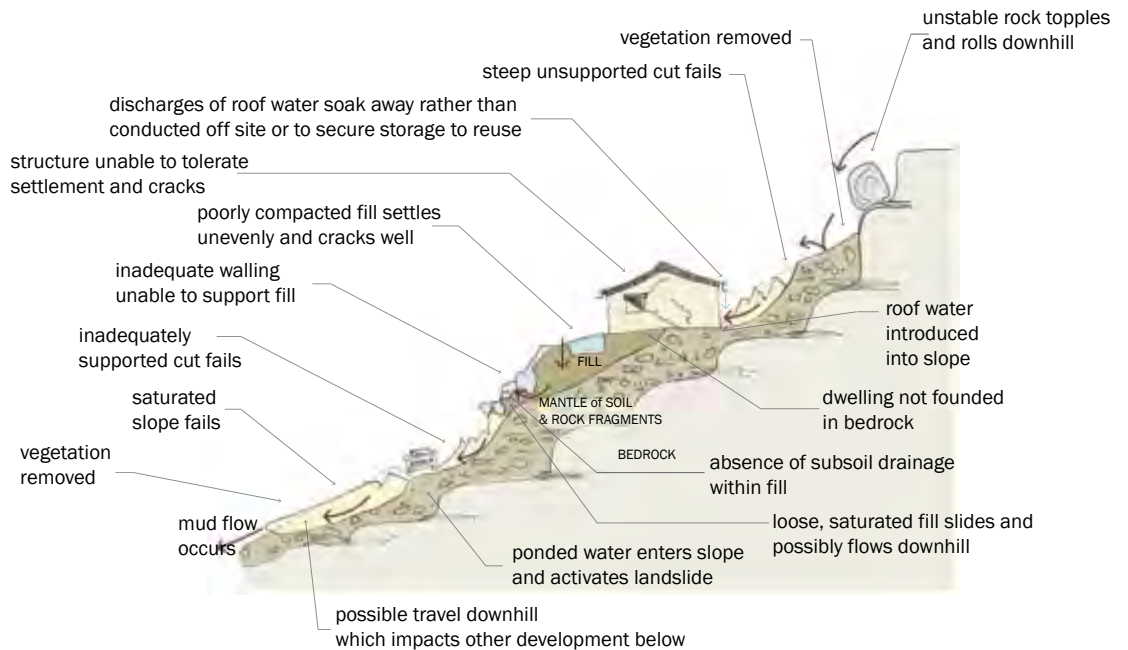
“Practice note guidelines for landslide risk management 2007.” Journal and News of the Australian Geomechanics Society 42.1 (2007): Web. 5 Mar. 2013.

HILLSIDE CONSTRUCTION

THIS



NOT THIS



Tags: Safety, Structural Integrity, Flood Mitigation

RECOMMENDATION: Site Planning for climatically resilient coastal development

Objective: Mitigate climate change impacts of unsafe and unsustainable coastal development

Issue

Agonda is already experiencing the impacts of global climate change. Development and construction decisions should be made with sea level rise and the potential for more unpredictable and intense flooding in mind.

Description

Coastal development (especially in the flood plain) should be avoided at all coasts. If construction in this region is unavoidable, a number of precautions should be taken to protect life, property, and Agonda's natural systems including safe storage of chemicals and materials. Chemicals, essential electrical equipment and potable water supply should be stored further inland or elevated above the high water mark.



Application

If possible, maintain a supply of safe drinking water where it cannot be washed away or polluted during a flood. This can be accomplished by placing a water tank above flood level and keeping it full of water during the flood season.

The **high water mark** should be painted or carved as a line on a concrete or stone structure, to record the maximum height of the flood.

Construction methods should be employed in order to mitigate flood damage (See Also: Section 2.0 Materials + Construction, Section 5.0 Flood Mitigation)

New houses and other buildings can be constructed with flood risk in mind. This could include:

- Constructing buildings on raised ground (See 5.1 Plinth)
- Constructing buildings on stilts (with non-essential storage underneath)
- Using flood resistant materials
- Constructing buildings away from areas that are subject to erosion, such as riverbanks and beaches.

Important community buildings should be constructed on raised ground to reduce the risk of flooding, and serve as community meeting spaces

See Also: Flood Mitigation: Mangrove Preservation, Planting Native Vegetation; Potable Water: Rainwater Collection

Info and Image Source
“Practice note guidelines for landslide risk management 2007.” Journal and News of the Australian Geomechanics Society 42.1 (2007): Web. 5 Mar. 2013.

Tags: Safety, Structural Integrity, Flood Mitigation

2.0

MATERIALS +

CONSTRUCTION

Material selection and construction techniques can increase the structural integrity of Agonda's built environment while protecting human health and safety. Stronger, more resilient buildings will need less repairs after the monsoon season. The design strategies in this section range from proper wall and roof construction to simple paint choices and will simultaneously support a more sustainable and resilient Agonda.



CONSTRUCTION METHODS

RECOMMENDATION: Consider Length, Height, and Thickness in Wall Construction

Issue: When flooding occurs, poorly constructed walls are susceptible to damages such as severe cracking scouring of the wall base and wall erosion. The damages will weaken the structural integrity of the wall which can lead to the wall collapsing. If the wall is a load bearing (carries the load of the roof) then the building will collapse.

Objective: Build better (stronger) walls considering length, height and thickness.

Description

The main function of the wall is to support the roof and ceiling (load bearing walls) and secondly as a divider also known as the partition wall (non- load bearing). A well-constructed wall must consider the relationship between length, height and thickness. Longer walls (more than 7 meters) are susceptible to collapse and easily damaged. As well as walls that are tall and thin.

Application

- Avoid constructing houses with wall length 3 times the width. If you must then construct a **cross interior wall** to connect the parallel long walls. The cross will help maintain the structural integrity of the building.
- Or add **buttresses** for additional supports
- To prevent cracks, a buttress used at the corners will help strengthen the wall.
- Thicker walls are better suited to withstand impact (bending and diagonal tension) and better as load bearing walls than thinner walls.

Benefits

A well-constructed wall is a stable wall which can withstand wind impact, flooding and constant rain. Secondly, it will not collapse nor lead to additional issues such as loss of a home (generating homeless), displacement of community members and deaths.

Limitations

A wall is only one component to whole system known as a building envelope which consists of the foundation, roof, doors and windows. A well-constructed wall may collapse if it does not correlate to the other components and attached properly by using the appropriate joints and frames.

Sources

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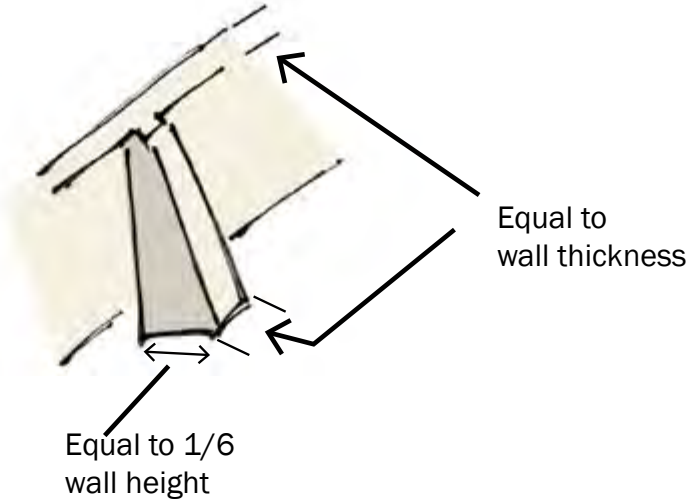
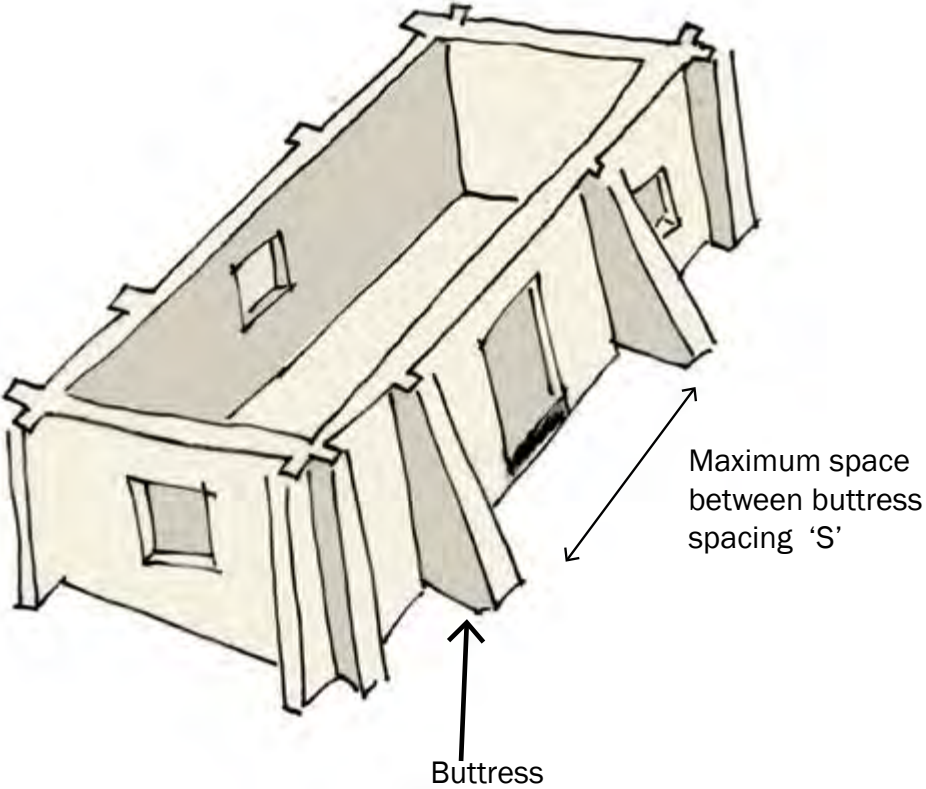
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Tags: Construction Methods, Building Materials

WALLS:
LENGTH, HEIGHT, THICKNESS
AND WINDOW OPENINGS



CONSTRUCTION METHODS

RECOMMENDATION: Build Stronger Roofs

Objective: To construct a roof with the capacity to withstand high wind pressure.

Issue

The monsoon season is accompanied by rain and wind. Damages to the roof are caused by uplift when the air pressure below the roofing assembly is greater than the air pressure above the building's roof. As result, the upward force on the roofing system is increased and the roof is lifted from the walls.

Description

The primary function of the roof is to provide a shelter from the environmental elements. Therefore it must span across the desired space and carry its own weight, as well as the weight of placed equipment (such as solar panels).

Application

- A building with a four-sided sloping roof is stronger than one with a two-sided sloping roof. Gable walls in two-sided sloping roof collapse easily.
- Houses should be ideally square or round, for structural stability. The pyramid shaped roof is ideally suited.
- A stable and secured roof will withstand high wind pressure however a steeply pitched roof deflects wind higher which is best.
- For pitched roof the roof slope should be between 22 to 30 degrees.
- Roof overhang must be no more than 500mm. This does not apply to veranda length and overhang.
- Secure roofing to roof frame and wall. Fasten at the connection between roof frame elements: purlins, rafters and beams.

- For sloping roof with span greater than 6 meters use trusses instead of rafters.
- Place rafters and trusses on wall-plate (instead directly on the wall) to reduce concentrated loads, and for anchor. The wall-plate is a timber member of the wall that exists to connect the roof to the wall.
- Existing roofs capable of being damaged during the next monsoon season should consider **retrofitting** and maintenance.

Benefits

A stable roof will not uplift during high wind velocity. Additionally, an attached roof will not leak water into the interior space. Any roof aside from the flat roof will be an asset to discharging rainwater off the edges and assist in keeping moisture away from the interiors.

Limitations

Existing roofs that are not retrofitted are problematic. A well-constructed roof is only a part of the system. The type of materials used plays an equally essential part of the roofing system.

ROOF TYPE AND HEIGHT

THIS

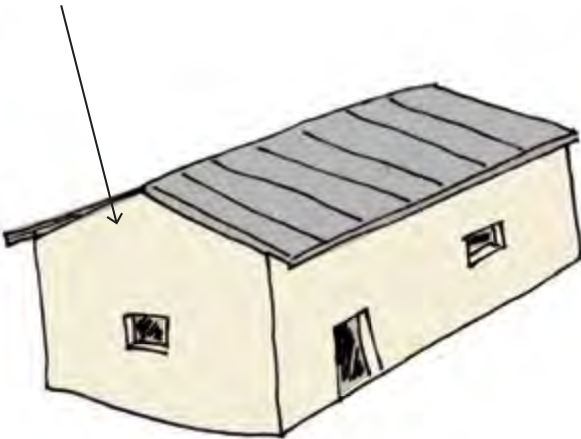
no gable wall



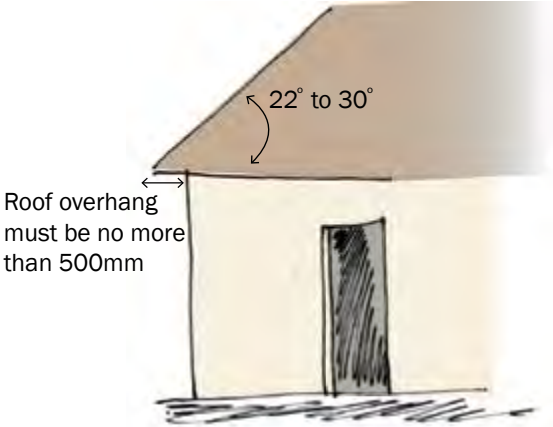
a building with four-sided sloping roof is stronger than one with two-sided sloping roof

NOT THIS

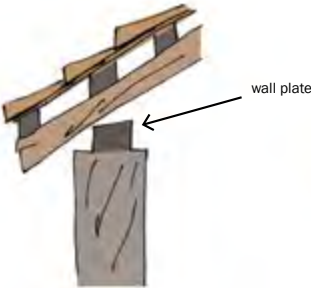
gable wall



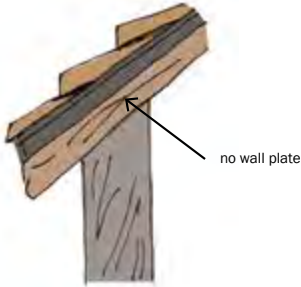
gable walls in two-sided sloping roof collapse easily.



THIS



NOT THIS



CONSTRUCTION METHODS

RECOMMENDATION: Consider the Size and Number of Openings in Wall Construction

Issue: When flooding occurs, poorly constructed walls are susceptible to damage, such as severe cracking, scouring of the wall base and wall erosion. The damage will weaken the structural integrity of the wall, which can lead to the wall collapsing. If it is a load-bearing wall (carries the load of the roof) then the building could collapse.

Objective: Consider restricting openings (windows and doors) to smaller sizes, few in numbers and symmetrical.

Issue & Description

A window is basically an opening within a wall or door. Too many and non-strategically placed windows can also weaken the strength of the wall which can attribute to the wall collapsing.

Application

- Houses with asymmetrically arranged wall openings can suffer more damage. For symmetry place identical openings in opposite walls. This also provides opportunities for cross-ventilation
- Consider maintaining same lintel level for all openings and the same size for all the windows.
- For smaller rooms, minimize the number of openings on each wall. eg: one opening per wall.

Benefits

When placed (constructed) properly, a window can increase ventilation, and exposure to daylight.

Limitations

Non- strategically placed openings (window) will weaken the structural integrity of the wall which may result in the wall collapsing.

Sources

Brown, G. Z., and Mark DeKay. *Sun, Wind & Light: Architectural Design Strategies*. New York: John Wiley & Sons, 2001. Part 2: Design Strategies. Print

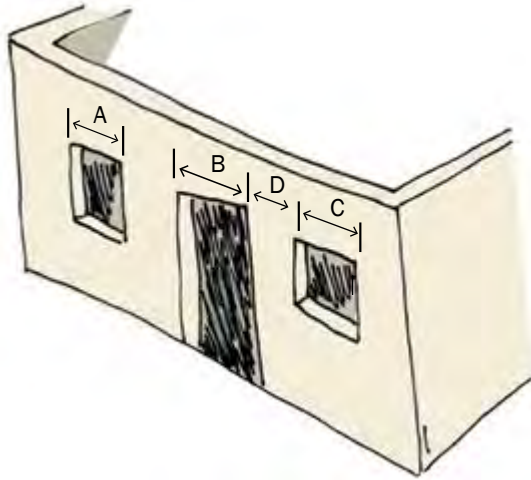
Ching, Francis. *Building Structures Illustrated: Patterns, Systems, and Design*. New York: John Wiley & Sons, 2009. Chapter 4: Vertical Dimensions. Print

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Desai, Rajendra and Rupal. *Manual on Hazard Resistant Construction in India: For reducing vulnerability in buildings built without engineers*. National Centre for People's - Action In Disaster Preparedness (NCPDP), 2007. Web. 08 April 2013. <http://ncpdpindia.org/Manual_on_Hazard_Resistant_Construction_in_India.htm>.

Tags: Construction Methods, Building Materials

SIZE AND AMOUNT OF OPENINGS



Sources

Brown, G. Z., and Mark DeKay. *Sun, Wind & Light: Architectural Design Strategies*. New York: John Wiley & Sons, 2001. Part 2: Design Strategies. Print

Ching, Francis. *Building Structures Illustrated: Patterns, Systems, and Design*. New York: John Wiley & Sons, 2009. Chapter 4: Vertical Dimensions. Print

Ching, Francis. *Building Construction Illustrated*, Fourth Edition. New York: John Wiley & Sons, 2008. Chapter 5: Wall Systems. Print

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Tags: Construction Methods, Building Materials

CONSTRUCTION METHODS

RECOMMENDATION: Roof Building Materials

Objective: Using proper roofing materials in order to ensure cooler interiors.

Issue: Current trends in concrete and Portuguese style home construction are leading to a hotter Agonda, both indoors and out. With erratic season lengths and hotter, drier Agondan summers, building material needs to be taken into account to provide cooler conditions.

Description

Knowing what materials should be used can provide many levels of comfort and stability to homes. Materials like stone, clay and concrete tend to slowly absorb heat throughout the day, and reemit it throughout the night, both outwards into the streets, and inwards to interiors, creating **heat island effect** and hotter interiors. The historic use of stone and clay throughout Goa utilizes these materials. Alternative construction use of cement and concrete (See 2.5 Concrete Guidelines) coupled with other roofing materials can provide marked drops in interior temperature.

Mangalore tile or Red Clay, has a Solar Reflectance Index of 41, which is not very good at diverting heat from incoming sunlight. A solar Reflective Index of at least 75 is necessary for reduction of interior heat (See Appendix A).

Application

See Appendix B for a detailed table that expresses how different roofing materials reflect the sunlight, how much heat it stores and emits, and the degree change that this heat means. A material and coating combination with a solar reflectance index of 75 or greater would provide the home with a cooler interior, and the surrounding air will be cooler as well.

Agonda uses Red Clay (mangalore) tile for the most part. This roofing material has been successful in the past, providing airy interiors, but other materials and coatings can provide for greater heat drop offs, see 2.7 Colors.

Benefits

Utilizing many of the more traditional home construction styles of wooden framed houses and mangalore roof tiles, many Agondans can have a cool home. Combined with light colors reflecting sunlight, the heat island effect would be lessened, and the reradiated heat over the course of a day would be diminished hugely.

Limitations

Many of the materials that have very high solar reflectance for roofing tend to be very expensive, or are processed elsewhere, requiring a huge transportation cost to bring it to Agonda. Tin and aluminum roofing, which is also found in Goa can provide for metal roofing, but require a lot of upkeep, and are much harder to patch, repair and maintain when there is smaller levels of damage.

Sources

Brown, G. Z., and Mark DeKay. Sun, Wind & Light: Architectural Design Strategies. New York.: John Wiley & Sons, 2001. Print.
Lauber, W. Tropical architecture. London, England: Prestel Publishing, 2005. Print.

See Also: Flood Mitigation: Mangrove Preservation, Planting Native Vegetation; Potable Water: Rainwater Collection

Tags: Construction, Heat, Walls, Roofs, Color

RECOMMENDATION: Hillside Construction Practice

Objective: When constructing on hillsides, there are many considerations to take into account in order to reduce the risk of damage to the structure and most importantly to people. By following these guidelines, many of the risks associated with hillside construction can be mitigated.

Issue

Hillside areas cover many parts of Agonda, especially Wards 1 and 7, and may be used as new construction areas when the more level areas of Agonda are fully built out. Living on slopes in Agonda can lead to increased flooding damage and potential for landslides.

Description

Landslides are caused by rapid slope instability due to heavy rain, erosion, surface runoff and heavy excavation. These actions can be mitigated through proper site planning and design. As seen in the figures, knowing how to build with the hillside allows for structural integrity and support such that water flows are controlled and sent away from the structural members of a home. Keeping the existing vegetation, while providing flood mitigation, also locks in the surface soil structures, providing resistance to land flows and slips. Making sure that the structure is anchored in bedrock, as well as having well designed retaining walls and water retention basins can provide for a safer, more stable home on the hillside.

Benefits

One of the biggest benefits is having a soundly designed structure to ensure quality of life for residents. Many of the earthworks that go into ensuring a stable structure also provides with many means of mitigating stormwater and flooding.

Limitations

The best practice for building in Agonda is to avoid hillsides, so that there is less of a risk of landslide. Encouraging development on these slopes can cause of more clearing of vegetation, allowing for faster water infiltration and increased surface runoff, often associated with new pavings.

See Also: Site Planning - Slopes

References:

Brown, G. Z., and Mark DeKay. Sun, Wind & Light: Architectural Design Strategies. New York.: John Wiley & Sons, 2001. Print

Tags: Construction, Heat, Roof

RECOMMENDATION: Repurpose materials and structures

Objective: To reduce cost, cut down on construction waste by reusing materials.

Issue:

In construction projects, existing buildings, closer to the central commercial area, are being overlooked in favor of land further from the center of town. As development projects increase in Agonda, more and more land could be lost to new construction as natural resources become limited and solid waste increases due to construction and demolition.

Description

In any construction project, it is recommended that existing available buildings be considered first to help cut down on cost of building and reduce the use of already limited resources.

of existing materials should also be considered when beginning a project.

Benefits

By incorporating **adaptive reuse** into construction methods Agondans will conserve land, reduce environmental impacts, and save costs on new construction. Most existing buildings are already in central locations, by reusing these buildings Agondans will maintain **central density**. In addition, by reusing existing older buildings, Portuguese architectural character will be better preserved. Many of these older buildings rely more heavily on passive cooling techniques, which also save costs on energy consumption.

Limitations

Not all buildings or materials will be viable options for projects. Buildings may be too structurally unsound or unusable. Sometimes the cost to repair damage may be higher than new construction.



Tags: Building materials, Adaptive Reuse , Waste Management

RECOMMENDATION: Building Structures with Concrete Bricks

Objective: The types of materials used for constructing housing can reduce damage to housing and provide passive ways to reduce energy use.

Issue

Concrete and cement have become more and more popular as a building material in Agonda in recent years. However, current concrete mixing techniques can lead to structures that can degrade quickly, and do not have the structural integrity to withstand years of heavy flooding. Similarly, thick, solid concrete bricks can cause increased interior heat, as well as warmer evenings and nights due to heat island effects.

Description

Knowing what materials should be used can provide many levels of comfort and stability to homes. By using lighter color coating and better material for walls and structures, Agondans can live a cooler lifestyle. **Heat island effect** is caused when latent heat that is absorbed during the hottest parts of the day is rereleased and heats the surrounding area. Some materials, such as concrete and stone can hold onto a lot of heat, and release it throughout the night, creating even warmer nights in dense areas. The proper use of color and materials can reduce the heating effects of the concrete used in so many structures in Agonda.

Application

Mixing sand and cement is often the technique to make concrete in Agonda. As suggested by the International Building Code, concrete mixes should be about 1 part cement to 4 parts sand. Using sand that is low in salt content can provide for stable concrete materials. Concrete with high salt content ends up disintegrating easily, and is susceptible to massive damage during rainy seasons, causing need for repair and replacement. Using other aggregates, such as crushed laterite gravel and pebbles, can provide concrete that can be structurally stronger, and withstand more damage from water. This kind of concrete would be ideal for making plinths and hollow blocks.

A specialized technique of making cement cavity blocks, or hollow cinder blocks, and using them as wall material can provide better thermal insulation, and inevitably a cooler interior. These hollow blocks can be made the same way as solid blocks, just utilizing a different mold in order to create the extra spacing. These spaces provide air pockets within the structure's walls that create greater insulation than solid concrete or laterite bricks.

Benefits

The proper utilization of concrete, such as hollow core concrete bricks, and properly mixed concrete can provide further cooling of households, and provide structural longevity for houses built with locally made concrete. Using hollow cement blocks as wall members can provide added thermal insulation to houses made of concrete, by trapping air within the wall, causing the stone to heat up much slower.

Limitations

Concrete blocks made in low cement to sand ratios, (less than 1 in 4) can lead to premature decay, or disintegration of the blocks. This is a common practice in Agonda, using beach sand, which has a great salt content in it, in order to mix for concrete. This type of concrete is not very good structurally, as they do not support buildings of greater than two structures. Using other types of aggregate that is mixed into the cement can provide stronger structural materials.

Concrete blocks that are at least 10 cm thick end up trapping more heat and contributing heavily to heat island effect. Solid body concrete blocks are easiest to make, and can create thick walls that trap and transmit heat to the interiors of buildings.

Sources

Brown, G. Z., and Mark DeKay. *Sun, Wind & Light: Architectural Design Strategies*. New York.: John Wiley & Sons, 2001. Print.

“Chapter 19 - Concrete.” International Building Code. Falls Church, VA: International Code Council, 2006.

Lauber, W. *Tropical architecture*. London, England: Prestel Publishing, 2005. Print.

Tags: Construction, Heat, Concrete, Walls

RECOMMENDATION: Reduce heat through exterior paint selection

Objective: To provide cooler conditions in structures, using paint.

Issue: Extreme heat and extended sunlight hours can create hotter interiors within Agondan buildings.

Description

By utilizing lighter color options, Agondans can deflect a lot of heat, reducing the heat island effect. Heat island effect is caused when latent heat that is absorbed during the hottest parts of the day is rereleased and heats the surrounding area.

Using lighter color coats of paint also increase the albedo of a structure. **Albedo** is how well a material or color reflects light and heat. Colors like white and light yellow have great albedo, as they reflect sunlight more than they absorb, so the heat does not get into the building materials and is not re-radiated out throughout the day. Dark colors, like blues and blacks have very low albedo, and absorbs heat steadily.



These materials, when the air becomes cooler reradiates the heat and causes heat to emanate throughout the night.

Application

The type of coatings mentioned below can give an idea of the spectrum of heating induced by darker colors (Gray, Dark Blue). When using color, Agondans should keep in mind that the lighter and brighter colors have higher solar reflectance, and lower temperature rise. These colors are often found through tropical communities, and already exist in Agonda.

Limitations

Many of the most efficient heat reflecting paints and colors are expensive to produce (polymer based paints may need to be imported). The other main thing is ensuring that the color is pretty uniform throughout the shell of the structure, and that areas that wear away are painted over in ensure the most effective use of color reflectivity.

Benefits

Usage of light and bright colors, like yellows, pinks and oranges can provide huge reflectance of the sun and its heat. Many of the materials used in Agondan construction can be coated with light colored paints, or light colored tiles can be pressed at time of manufacture. These lighter colored homes can have extensive cooling effects for more comfortable houses and homes.

Sources

Brown, G. Z., and Mark DeKay. *Sun, Wind & Light: Architectural Design Strategies*. New York.: John Wiley & Sons, 2001. Print.

Lauber, W. *Tropical architecture*. London, England: Prestel Publishing, 2005. Print.

Tags: Construction, Heat, Walls, Roofs, Color

3.0 WATER

Countries around the world are faced with the growing problem of providing safe, drinkable water to its people. With climate change, more frequent natural disasters, and dwindling resources it is more important than ever that Agonda adopts a more sustainable water management system. Agondans need to take advantage of strategies that provide a more reliable source of potable water. Having a supply of dependable water will be invaluable during tourist and monsoon seasons, when water supplies are scarce.



RECOMMENDATION: Rainwater Harvesting

Objective : To collect and store rainwater as an additional supply of **potable water**.

Issue

In Agonda, water scarcity is a major concern, especially during the tourist season (from November to early March). The scarcity of water is also worsened during the rainiest months of the monsoon season. Rainwater harvesting offers a sustainable and low cost alternative to reliance on the scarce and unreliable city water supply that will only become more unreliable as precipitation levels vary.

Description

Rain water harvesting is a system of collection and storage of rain water that runs off from roof tops, parks, roads, open grounds, etc. This water run off can be either stored or recharged into the below ground aquifers and used for agriculture etc. A rain-water harvesting systems consists of the following components.

1. catchment from where water is captured and stored or recharged,
2. conveyance system that carries the water harvested from the catchment to the storage/recharge zone,
3. first flush that is used to flush out the first spell of rain,
4. filter used to remove pollutants,
5. storage tanks and/or various recharge structure

Application

In order to determine the amount of rain that you will be able to collect, information about the area of the catchments and rainfall patterns will have to be collected.

The amount of rainfall that will be collected will depend directly on the area of the catchment-the larger the area, the more the water.

- The annual average rainfall: Provides an overall view of how much rainfall can be collected
- The pattern of rainfall over different months: Will tell you when the rainfall is available – is it available most of the year or only during a certain part of the year.
- Number of rainy days: Will give an indication to decide whether to store the rainwater or to recharge it. If most of the rainfall comes only in a short span of time, then it is better to recharge the aquifer.
- The peak rainfall intensity: Will give an indication to design the size of the storage or recharge structure. The sizing will be based on how much water will need to be stored or recharged during the most intense spell of rain.

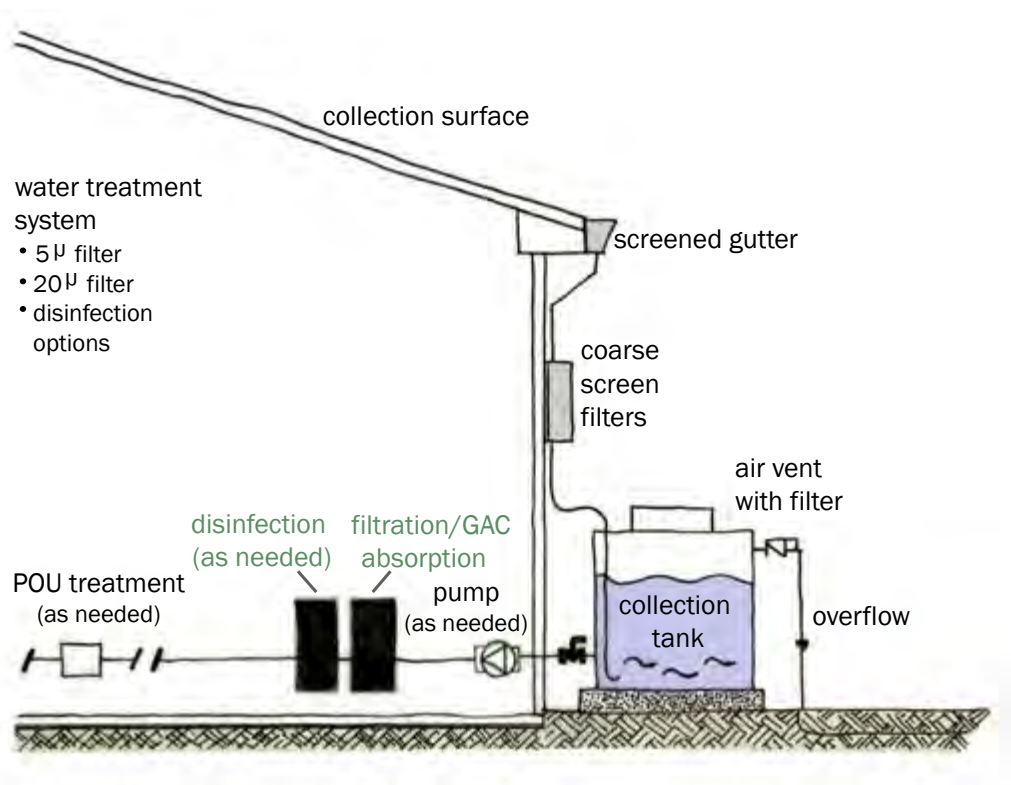
The following equation can be used to calculate water harvesting potential:

Water harvesting potential (Total volume of water) = Area x runoff coefficient x rainfall

Filtration and treatment: Filtration types vary depending on the use of the rainwater. For example, minimal filtration (sand, gravel) can be used for harvested rainwater that will be used for toilets and irrigation. Higher levels of filtration are needed in cases where harvested rainwater will be used for drinking.

Several factors affect how much rainfall can be collected from a particular catchment. Different catchments have different levels of efficiency depending on its material. In addition, the area of the catchment and the annual rainfall also influence the amount of rainfall that will be collected.

RAIN WATER HARVESTING



Benefits

Rainwater Harvesting is an extremely sustainable and cost effective strategy of meeting the demand for water. In addition, it improves the quality and quantity of groundwater and can have the added benefit of reducing flooding (See also: Section 5.0: Flood Mitigation).

Limitations

Rainwater harvesting is preferred, more sustainable, and less expensive when used to collect non potable water.

Sources:

Centre for Science and the environment, "Rainwater Harvesting", <<http://www.cseindia.org/node/1162>>

See Also: 5.0 Flood Mitiation

Tags: Potable Water, Rainwater Harvesting, Green Infrastructure, Flood Mitigation

RECOMMENDATION: Well Boring Practices

Objective : To utilize properly designed water wells to ensure household potable water security.

Issue

Potable water supply is often at issue in Agonda. Between water shortages during the tourist season, to an outright lack of water during the rainy season, Agondans are on their own for drinking water supply. Climate change can only exacerbate these supply issues, along with saltwater intrusion into the aquifers of Agonda from the Arabian Sea.

Description

Well water is a highly localized source of potable water, which can provide for one or a few households, depending on depletion rates of the wells, and what extent the area has been contaminated by salt water. Having a properly bored well can provide water security for many years, until municipal supplies catch up.

Appplication

Well Siting – A new well should be dug under the following conditions:

Distance Away from ...Source of Pollution	
3m (10ft)	Areas of stagnant water
20m (50ft)	Pump pits Septic Tanks
30m (100ft)	Septic Tank Drainfields

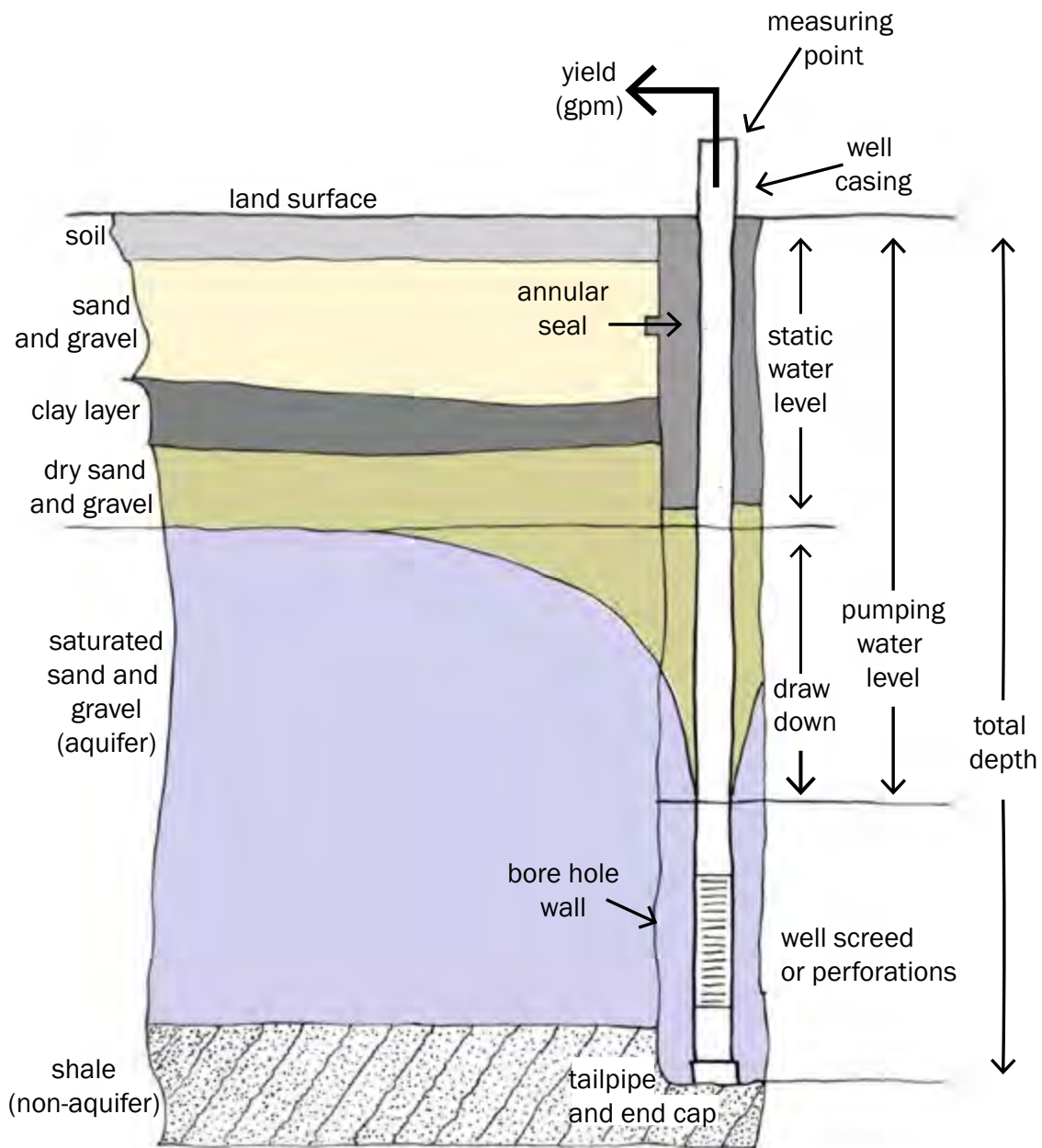
Limitations

Wells should be used in concert with other distributed water collection systems, as the limiting factors of having to deal with saltwater intrusion can severely damper the effectiveness of these wells. The water should only be used as drinking water, or for cooking. It is important to have a well monitoring program in place, as aquifer recharge can be heavily impacted with seasonal rains and water usage. Because of these needs, rainwater harvesting should be tried and practiced first, before boring more wells. The well water usage should be done to complement rainwater and municipal use. Usage programs can be based on the table shown in 3.1 Rainwater Harvesting.

Benefits

Wells are very local, and each household has complete autonomy over the water supply. Each home can care for these wells, and ensure water quality for the family unit. Providing this autonomy can allow for homes to store water for rainy seasons, and would be on a separate system from the municipal supply that ends up being depleted during tourist season. A proper well can also be sealed against untreated water entering from above during rainy seasons.

WELL CROSS SECTION



See Also: 3.1 Rainwater Harvesting

Tags: flooding, greywater system, solid waste, composting for agriculture

RECOMMENDATION: Grey Water Recycling System

Objective

To conserve the supply of clean drinking water by recycling used water or greywater for other uses.

Issue

Water shortages during monsoon season, peak tourist season, and overall in government supply.

Description

Greywater gets its name from its cloudy appearance and from its status as being between fresh, potable water (known as “white water”) and sewage water (“black water”). In a household context, greywater is the leftover water from baths, showers, hand basins and washing machines only. Some definitions of greywater include water from the kitchen sink. Any water containing human fecal waste is considered black water.

Application

Recycled water is most commonly used for nonpotable (not for drinking) purposes, such as irrigation of plants, toilet flushing, dust control, construction activities, and concrete mixing. Use of greywater instead of potable water is recommended for these activities mentioned. This saves clean water for more urgent needs like drinking and cooking.

Toilet & Sink System:

Clean water is commonly used to flush toilets, which is unnecessary. Save this water to use when you require clean water.

1. Turn off the water being supplied to your toilet tank.
2. Collect the used water from your shower or sink to fill up your toilet tank. Or connect a pipe from your sink pipe to feed into your toilet tank.

3. You can now flush the toilet using grey water instead of clean water.

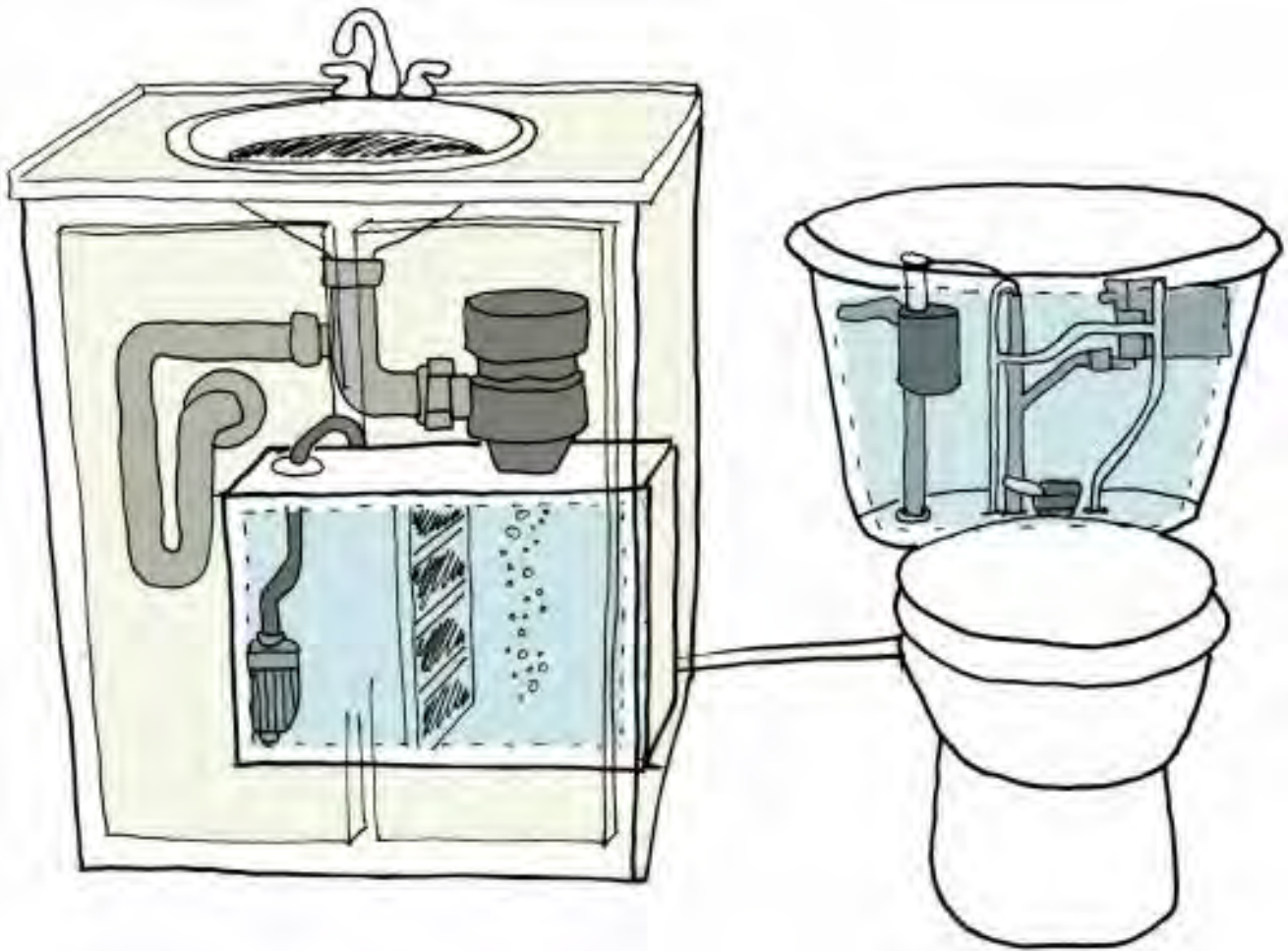
Limitations

Because gray water has not been disinfected, it could be contaminated. A careful, commonsense approach to the use of gray water, however, can virtually eliminate any potential hazard. The following precautions are recommended:

1. Never use gray water for direct consumption.
2. Gray water should not be used directly on anything that may be eaten.
3. Gray water should not be sprayed, allowed to puddle, or run off property.
4. Use only water from clothes washing, bathing or the bathroom sink. Do not use water that has come in contact with soiled diapers, meat or poultry, or anyone with an infectious disease.

Benefits

Recycling waste water can stretch your water budget during the hot summer months by providing an additional source of water. Other benefits include decreasing wastewater discharges and reducing and preventing pollution. Recycled water can also be used to create or enhance wetlands and riparian habitats.



Sources

Jett, John W. "Recycling Grey Water." West Virginia University Extension Service. September 2008. <http://www.wvu.edu/~agexten/hortcult/homegard/graywate.htm>

"Water Recycling and Reuse: The Environmental Benefits." Water Division Region IX - EPA 909-F-98-001. United States Environmental Protection Agency. <http://www.epa.gov/region9/water/recycling/#whatis>

Tags: Green Infrastructure, construction, ecological conservation

RECOMMENDATION: Composting Toilet System

Objective: To create more sustainable and manageable on-site waste treatment.

Issue

With unsuitable water supply, no local waste treatment facility and a high number of temporary structures, Agonda relies on septic systems to capture waste. These septic systems, particularly tanks associated with commercial buildings, are often overburdened by waste loads from increased tourism and run the risk of overflowing when low-lying areas flood. Additionally, because of the preventative upkeep required to maintain the septic tanks' efficiency, much of Agonda's sewage is dumped directly into the local streams. This has led to increased flooding due clogged waterways.

Description

A composting toilet is a dry toilet that uses little or no water to manage waste. The waste is typically mixed with sawdust, coconut coir or moss to reduce odor, increase airflow and absorb liquids so that the waste can break down further and decompose. This process, known as aerobic processing, is generally faster than the decomposition that takes place in wet sewage treatment such as septic tanks.

Application

1. Waste is collected in a sealed chamber beneath the toilet seat.
2. Extra organic matter such as sawdust, coconut coir, moss or vegetable scraps is added to create composting environment.
3. Organic waste breaks down material with about three quarters of it being converted to carbon dioxide and water vapor.

4. Air* is drawn through ventilation pipe and removes gasses and assists in creating ideal living environments for micro-organisms in organic material.

*Helpful to have window in bathroom for more cross ventilation.

5. Left-over solid material slowly moves down sloping floor as more waste is added to pile.
6. Solid material can then be removed out of chamber door and used as fertilizer for garden.
7. Excess liquid either flows into the greywater stream, which includes all other wastewater generated in the bathroom, kitchen and laundry, or is directed to a separate land application area.

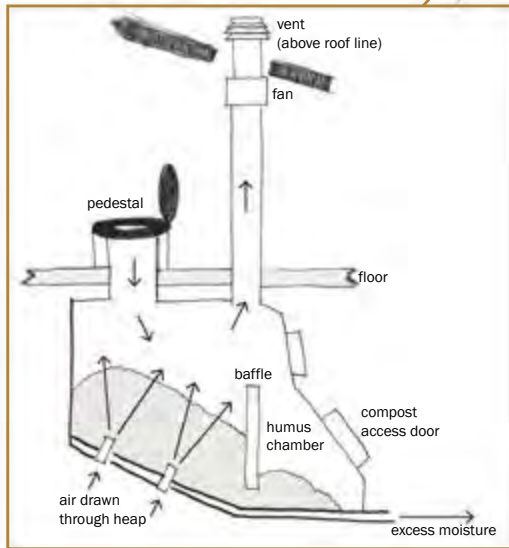
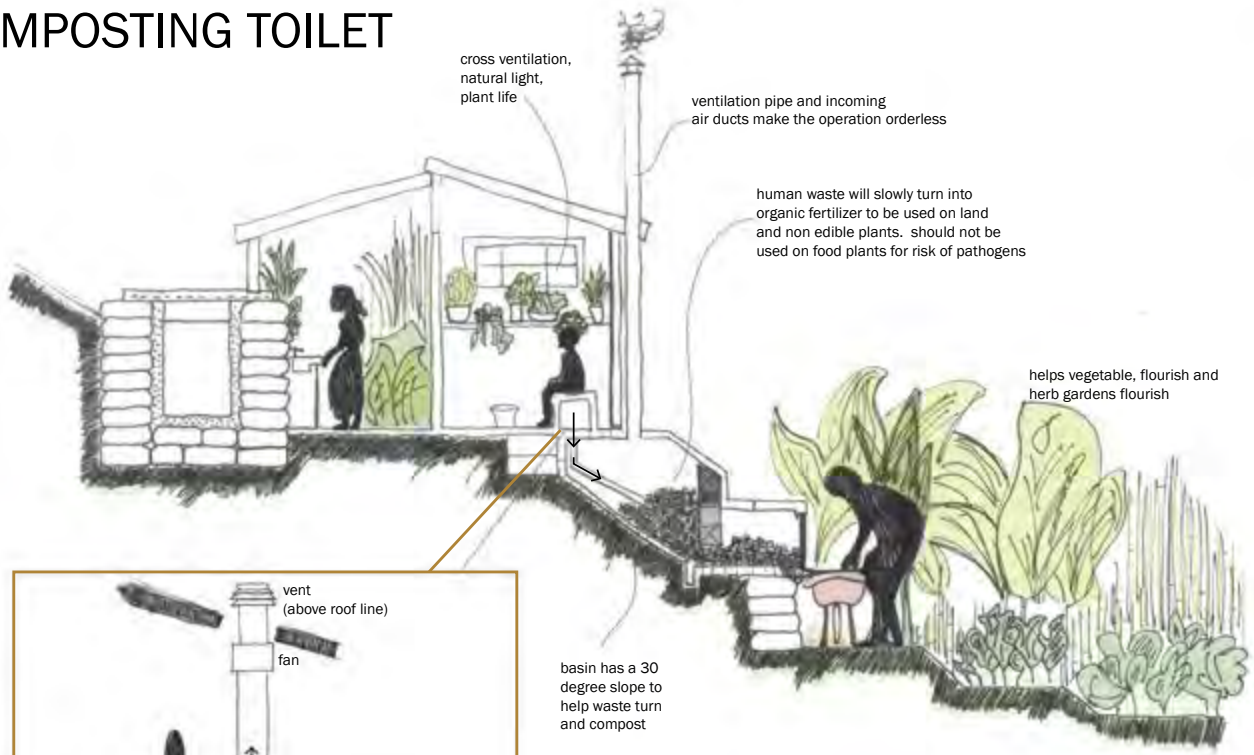
Benefits

Low cost, low maintenance requires little to no water use resulting in water use reduction; less environmental impact.

Limitations

Requires proper airflow to keep odors from seeping into the home; if not properly managed, build-up of bacteria could raise a health issue and threaten the water table below.

COMPOSTING TOILET



basin has a 30 degree slope to help waste turn and compost

Tags: flooding, greywater system, solid waste, composting for agriculture

4.0 ENERGY

Countries around the world are faced with the growing problem of energy use. In Agonda, energy use has drastically increased as tourism has grown. In some cases, the competition for energy has led to illegal theft. This underground consumption further strains an already overworked system, leading to more frequent power shortages. Villagers are faced with no power as tourists enjoy air-conditioned rooms on the beach.



Image:
Guardian, UK

Agonda's weak energy system also leaves it susceptible to environmental hazards like soil erosion, falling trees, and flooding which cuts off the village from the electricity supply for indefinite periods of time. The following chapter provides recommendations on more sustainable energy use practices that can be incorporated into current and future building design in Agonda. By installing solar panels or wind turbines to power the village, relying on passive ventilation to cool homes or utilizing existing resources like cow manure to produce biogas, Agonda will be able to meet its energy needs now while not compromising the village's needs in the future.

RECOMMENDATION: Biogas

Objective: To provide a clean alternative to fuel

Description

Biogas is a gas produced by anaerobic digestion (in the absence of oxygen) of organic material, largely comprised of methane (about two-thirds). Basically, it breaks down wet organic matter like animal dung (cow manure), human sewage or food waste into a reusable gas. As a gas, it can be used as fuel for cooking and generating electricity.

Application

- The components of a biogas system are a container to hold the decomposing organic matter and water (slurry), another to collect the biogas, feed in the organic matter (the feedstock), to take the gas to where it will be used, and to remove the residue.
- For a fixed biogas dome (the most common type), the slurry container and gas container are combined, so that the gas collects under a rigid dome over the slurry.
- As the slurry breaks down, the biogas which is produced pushes some of the slurry into a separate reservoir. When the biogas is taken off, the slurry flows back.

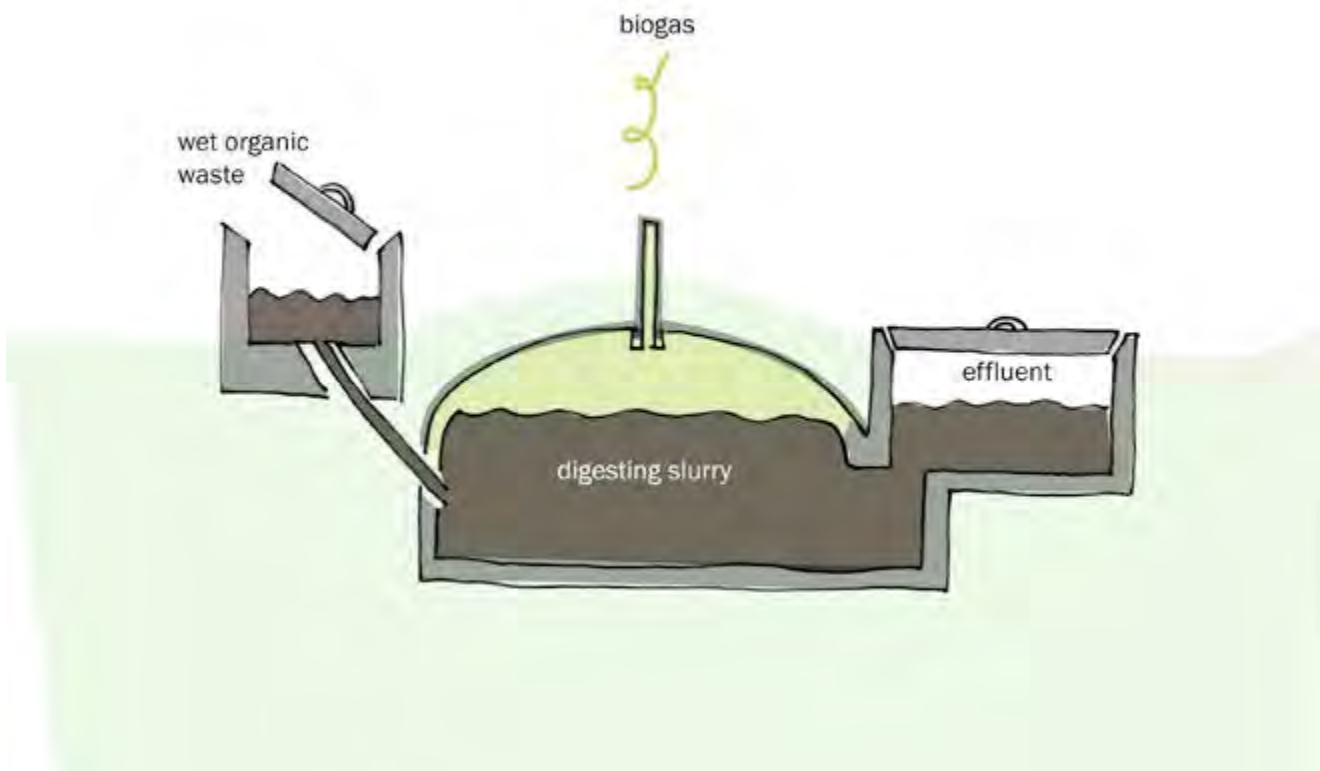
Limitations

Potentially high initial costs and investment

Benefits

Converting cow manure into methane biogas can produce gas for cooking and electricity. Food waste is another option to use as a feedstock. It breaks down quicker than the dung and appropriate as a small system for homes. Secondly, it can generate enough to fuel between 25 % and 50 % to use as cooking fuel. The gas burns as a clean flame therefore it reduces indoor air pollution. Every year, an estimated 1.6 million deaths are caused from breathing in wood smoke. The decomposing waste can be sent to a composition system to divert it from the waste stream.

BIOGAS



Sources

“Biogas.” Ashden: Sustainable solutions, better lives, n.d, n.p. Web. 08 April 2013. < <http://www.ashden.org/biogas>>.

U.S. Department of Energy Federal Energy Management Program (FEMP). “Biogas.” Whole Building Design Guide: A program of the National Institute of Building Sciences, 04 August 2011. Web. 08 April 2013. < <http://www.wbdg.org/resources/biogas.php>>.

Tags: Flood mitigation, Construction methods, Green Infrastructure, Public health

RECOMMENDATION: Passive Cooling

Objective: To apply natural ventilation strategies to help reduce energy consumption and improve indoor air quality. It is dependent on the sun's energy and simple elements such as a window or an opening and materials to create a comfort zone temperature.

Issue: As energy use in Agonda is increasing, production and availability has not met the demand. In addition not every Agondan can afford the increased price for electricity therefore simple measures should be implemented to help allow for energy independence, and alleviate reliance on carbon based fuels.

Description

Wind driven ventilation depends on wind behavior and it interacts with the openings within the building or home. The location of the fenestration can vary and will produce different results. The cooling effect is produced by certain strategies such as single-sided, cross and passive stack.

Application

- Single sided ventilation is predominantly wind driven ventilation turbulence and can adequately ventilate smaller rooms with average occupancies. Achieves penetration depths of up to 2.5 times the room height.
- Cross ventilation uses the wind pressure to drive air through openings in the building. Air enters on one side of the building, and exits another side. Achieves penetration depths of up to 5 times the room height.
- Cross-ventilation is most effective when the inlets are placed in the higher pressure and the outlets in the lower pressure.

- Passive Stack ventilation is driven by the Wind Effect and can be aided by a “stacking” effect, a difference in heights between two openings. Will achieve up to double the penetration of cross ventilation

- The more the opening area is distributed, the more likely it is that there will be a pressure difference between openings to drive the flow – i.e. many small openings are better than one large opening.

- Consider the use of clerestories. A **clerestory** will provide an opening for stale air to escape in a buoyancy ventilation strategy.

- Naturally ventilated buildings should be narrow if possible. The maximum width that one could expect to ventilate naturally is estimated at 13 meters.

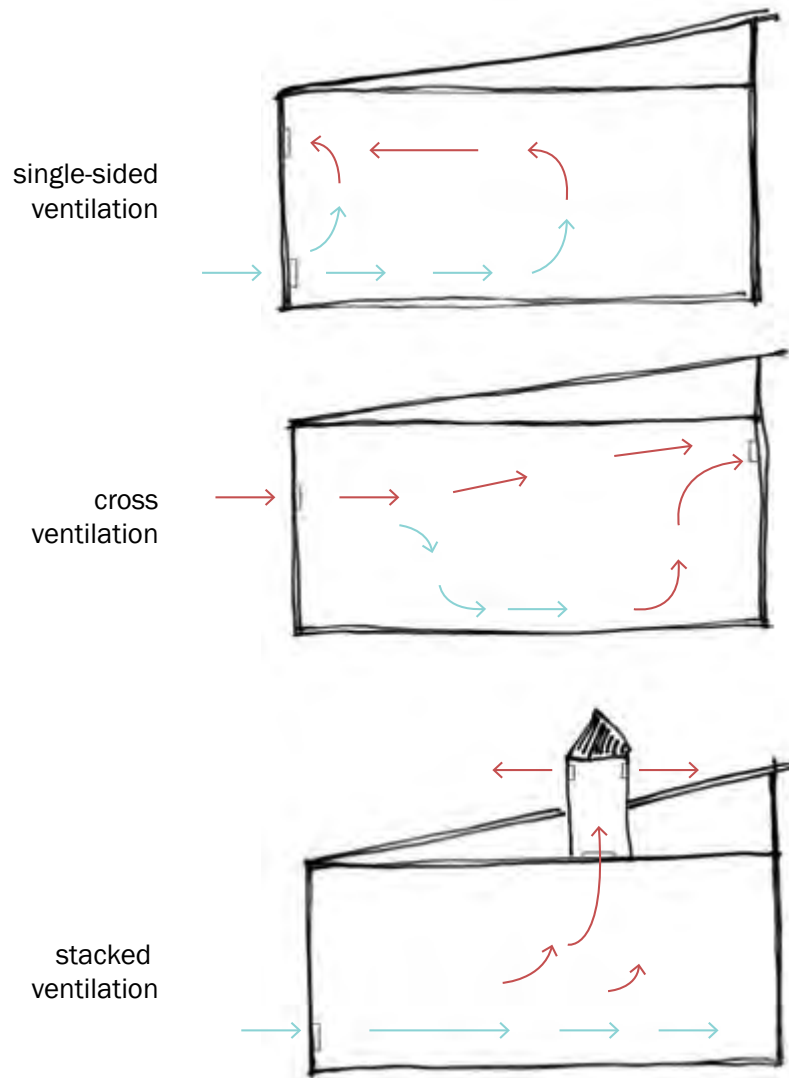
Benefits

It is low maintenance, cost effective consumes zero energy and provides a cleaner indoor air quality. It is also healthier, connects with the natural environment and has a psychological benefit on the individual.

Limitations

For existing buildings with openings, air will flow through however it will not be as effective. To implement such strategies into an existing building would require the retrofitting the wall. It is entirely based on the velocity of the wind which is unpredictable and varies. If the building is situated adjacent to polluted areas then the quality of the air is problematic.

PASSIVE COOLING



Brown, G. Z., and Mark DeKay. Sun, Wind & Light: Architectural Design Strategies. New York: John Wiley & Sons, 2001. Part 2: Design Strategies. Print

“Strategies – Wind Driven Ventilation.” Natural-Vent. Web. 08 April 2013. <<http://www.natural-vent.co.uk/strategies.asp>>. Note – also image source

Walker, Andy. “Natural Ventilation.” Whole Building Design Guide: A program of the National Institute of Building Sciences, 07 September 2012. Web. 15 June 2010. <http://www.wbdg.org/resources/retro_sustperf.php>.

Objective: To provide a reliable source of power

Issue

Electricity in Agonda is scarce on the everyday basis and worsens during the monsoon season. The capacity of the transformers has not increased to accommodate increased usage. Agondans are always left in the “dark” since commercial activities consume a significant amount of electricity; the cost per household has increased and unreliable.

Description

Solar power is an energy source based on the solar cell technology, which converts energy obtained from the Sun into electricity.

Application

- Solar panels are roof or ground mounted and composed of solar cells which generate electric power.
- Each typically ranges from 100 to 320 watts.
- For best results, the solar panels should have direct access to the sun.
- In addition to providing electricity for the home, solar panels can be used for street lighting. Solar powered lights can reduce power consumption by 40- 70% than traditional light sources.
- Lastly provides bright white light which improves color recognition and night visibility from 400 – 1000 % over traditional light sources.

Benefits

For the individual, solar panels provide power without the cost of a grid infrastructure. During power outage or shortage, solar panels will still generate electricity. The solar energy can be used to power other equipment such as small home appliances, water pumps and heat hot water. Solar street lights benefits the individual and the community. It provides to isolated areas which is certainly a need after natural disasters. The installation process is minimal, convenient and applicable to most street conditions in Agonda. Overall the benefits are limitless.

Limitations

Potentially high initial costs and lower output in cloudy weather

Sources

Brown, G. Z., and Mark DeKay. Sun, Wind & Light: Architectural Design Strategies. New York: John Wiley & Sons, 2001. Part 2: Design Strategies. Print

U.S. Department of Energy Federal Energy Management Program (FEMP). “Photovoltaics.” Whole Building Design Guide: A program of the National Institute of Building Sciences, 24 August 2012. Web. 08 April 2013. <http://www.wbdg.org/resources/retro_sustperf.php>.

“Solar panels.” 3R Care (India) Private Limited, LIGHT UP LIFE, n.d. Web. 08 April 2013



Image: Think Solar Power, Solar Power in India

**Tags: Renewable Energy, Passive Cooling,
Green Infrastructure, Public Safety,**

Recommendation: Solar Water Panels

Objective: To provide access to water to use for irrigation or portable drinking water.

Description

Solar water pumps can supply water to locations which are beyond the reach of power lines. The water supplied by the solar water pump can be used to irrigate crops, water livestock or provide potable drinking water. A solar water pump system is essentially an electrical pump system in which the electricity is provided by one or several PhotoVoltaic (PV) panels.

Application

- A typical solar powered pumping system consists of a solar panel array that powers an electric motor, which in turn powers a bore or surface pump.
- The water is often pumped from the ground or stream into a storage tank that provides a gravity feed, so energy storage is not needed for these systems.
- The pump can potential delivers about 140,000 liters of water/day from a total of 10 meters.
- The size of the storage tank can accommodate 3-5 days of water demand.

Benefits

- Low maintenance
- No fuel costs or spills
- Easy to install
- Simple and reliable
- Unattended operation
- System can be made to be mobile

Limitations

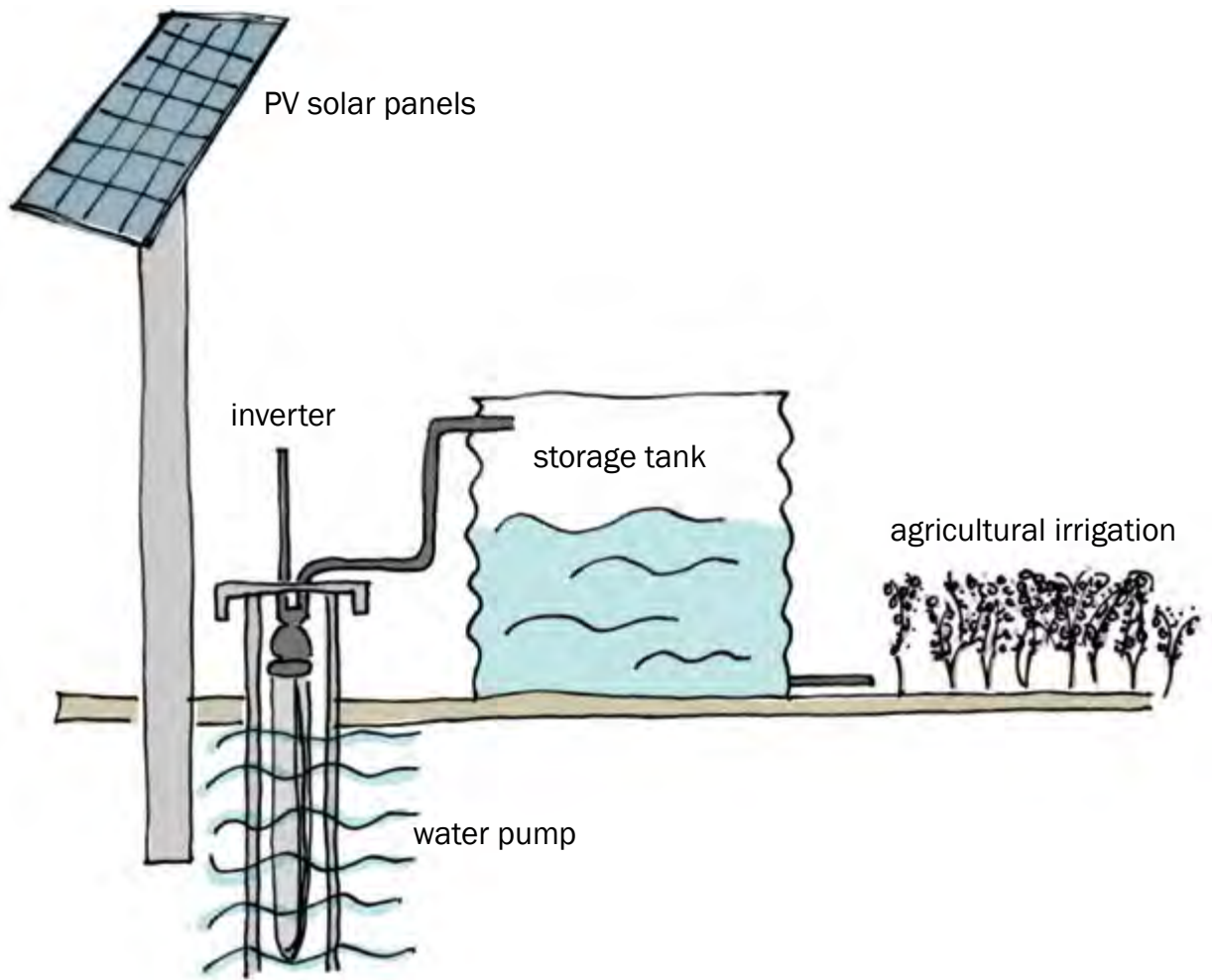
- Potentially high initial costs
- Lower output in cloudy weather
- Must have good sun exposure between 9 AM and 3 PM
- **Repairs often require a skilled technician.**

Sources:

“Solar Water Pumping System.” Conergy, n.d, n.p. Web. 08 April 2013. <http://www.suntechnics.in/desktopdefault.aspx/tabid-139/331_read-273/>.

“Solar Photovoltaic Waterpumping.” Pratical Action, n.d,n.p. Web. 08 April 2013. <<http://practicalaction.org/solar-photovoltaic-waterpumping-1>>.

SOLAR WATER PANELS



Tags: Renewable Energy, Solar Energy, Green Infrastructure, Potable Water

Reccommendation: Wind Turbines

Objective : To provide energy on the community level

Description

A **wind turbine** converts kinetic energy from the wind to produce electricity. A wind turbine works the opposite of a fan. Instead of using electricity to make wind, like a fan, wind turbines use wind to make electricity.

Application

The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity. The amount of watts produced depends on the type and size of the wind turbine. Small wind turbines are capable of up to 100 kilowatts and suitable for the home. Larger turbines are capable of producing much more however requires additional elements such as space.

Limitations

The initial cost is significantly high. It's probably best as a community investment. Larger turbines and longer transmission lines are requires a remote location to operate. Agonda may not the physical space required to place a wind turbine although it varies in size.

Benefits

A clean fuel source equals a clean air. Unlike power plants that rely on combustion of fossil fuels, wind turbines do not therefore improves air quality and one of the cheapest forms of renewable energy. Depending on the average wind speed and amount of kilowatt used within the home, the wind turbine can typically lower the cost of electricity by 50 to 90% for six/ten months of the years.

Sources

“Wind Turbines.” 3R Care (India) Private Limited, Light up Life, n.d, n.p. Web. 08 April 2013 < <http://www.lightuplife.net/wind-turbines.html>>.

“How do wind turbines work?” U.S. Department of Energy: Energy Efficient and Renewable Energy, n.d, n.p. Web. 08 April 2013. < http://www1.eere.energy.gov/wind/wind_how.html>. Treacy, Megan. “Small Roof-Mounted Wind

Turbines Could Power Rural India.” Ecogeek., 07 June 06 2013. Web. 08 April 2013 < <http://www.ecogeek.org/component/content/article/3218-small-roof-mounted-wind-turbines-could-power-rural>>.



Image: NewsPost India

Tags: Renewable Energy, Green Infrastructure, Clean Source of Energy

5.0

FLOOD

MITIGATION

Flood Mitigation is an important prevention and management tool that will greatly alleviate the impacts of flooding especially during times of crisis. Implementing design techniques early on will help residents, commercial owners, and the entire village of Agonda become more prepared and safe. Flooding is an annual occurrence that affects many aspects of daily life. Flooding contaminates your water supply, causes damage to your homes, cuts your supply of power, and aggravates pollution. And, although Agonda has adapted to flooding, with sea-levels rising and more intense storms we can anticipate that flooding will worsen therefore protective measures must be a top priority.



RECOMMENDATION: Plant Native Vegetation

BUFFERS

Objective: Ecological conservation is a very important aspect when developing your site. Maintaining the ecological health of your site will help preserve the types of plants that grow, the animals that live and in general benefit the appearance of your site and village. Existing ecologies also help in protection from storms and flooding.

Issue

A decrease in biodiversity due to climate change, new developments, disregard for the environment, and pollution can create a more vulnerable environment during storms and flooding.

Description

Trees, shrubs, and smaller plants have root systems that structurally reinforce and support slopes (similar to rebar reinforcing concrete in building construction), bind soils, and reduce their susceptibility to erosion from wind or rain.

Landowners can mimic nature by planting native coastal plants to protect property from storm damage and flooding.

Application

Native plants found in Goa are best.

Here are some examples:

Sand stabilizing plants that are found along Goa's coastline like: *Spinifex*, *Ipomea*, *Acanthus*, *Clerodendron*, *Vitex*, *Spermacosea*, *Urginea*, *Dioscorea*, *Pandanus*, *Crotolaria*, *Duranta*, and *Leucus*.

Herbaceous plants: *Ipomea pes-caprae*, *Cyperus sp.*, and *Spinifix Littoreus*.

Shrub-like plant: *Duranta*

Benefits

By taking up the water directly from the ground, absorbing it through their leaves, and breaking the impact of raindrops or wave-splash, plants slow down the rate and quantity of water runoff that can lead to erosion.

Using native coastal plants also enhances the visual appeal of coastal property, protects property values, preserves the natural character of the coastal environment, provides habitat for wildlife, and helps to filter pollution.

Limitations

Cost of plants, minimal maintenance and care is required

Sources

Sources: Alvares, Claude Alphonso, Vidyadhar Gadgil. "Fish Rice and Curry, Chapter 5: The Coastal Region" Goa Foundation. 2002. Pg. 39

Landscaping to Protect Your Property from Storm Damage and Flooding." Massachusetts Office of Coastal Zone Management (CZM). January 2009. http://www.mass.gov/czm/stormsmart/resources/stormsmart_landscaping.pdf



Tags: biodiversity, flood, construction, public health, ecological conservation

RECOMMENDATION: Wetland Protection

Objective: Preserving and reconstructing coastal marshes to reduce storm damage.

Issue

Wetlands are transition zones between uplands and deeper water. They are unique ecosystems characterized by their hydrology, soil, sand, and vegetation. They function like natural tubs, storing floodwaters that overflow riverbanks and surface water that collects in depression areas.

Description

Wetland Hydrology and Flood Control Wetlands are transition zones between uplands and deeper water, unique ecosystems characterized by their hydrology, soil sand vegetation. They function like natural tubs, storing floodwaters that overflow riverbanks and surface water that collects in depression areas.



Benefits

Wetlands can help protect adjacent and downstream property from flood damage. Preserving wetlands, along with other flood control measures, can offer a degree of protection against flooding that is often more effective and costs less than a system of traditional dikes and levees. If more communities protect existing wetlands and increase the quantity of wetland through restoration projects, they will be better protected against the consequences of floods.

Coastal wetlands serve as storm surge protectors when hurricanes or tropical storms come ashore. Forested wetlands and other features of the coastal landscape can provide a significant and potentially sustainable buffer from wind wave action and storm surge generated by tropical storms and hurricanes.

Sources

“Wetlands: Protecting Life and Property from Flooding.” United States Environmental Protection Agency. May 2006. <http://water.epa.gov/type/wetlands/outreach/upload/Flooding.pdf>

Tags: Biodiversity, Ecological conservation, Flood, construction, Public Health

RECOMMENDATION: Mangrove Restoration

Objective: Existing ecologies help in protection from storms and flooding.

Issue: Mangroves can serve as buffers and mitigate the effects of coastal erosion and flooding.

Description and Benefits

Mangroves grow between land and sea in the intertidal areas and mouths of estuaries. They have **aerial roots** (grow above ground) that filters salt and leaves that excrete salt, which makes them salt tolerant.

Mangroves can reduce storm surge water levels by slowing the flow of water and reducing surface waves. Therefore mangroves can potentially play a role in coastal defense and disaster risk reduction, either alone or alongside other risk reduction measures such as early warning systems and engineered coastal defense structures (e.g. sea walls).

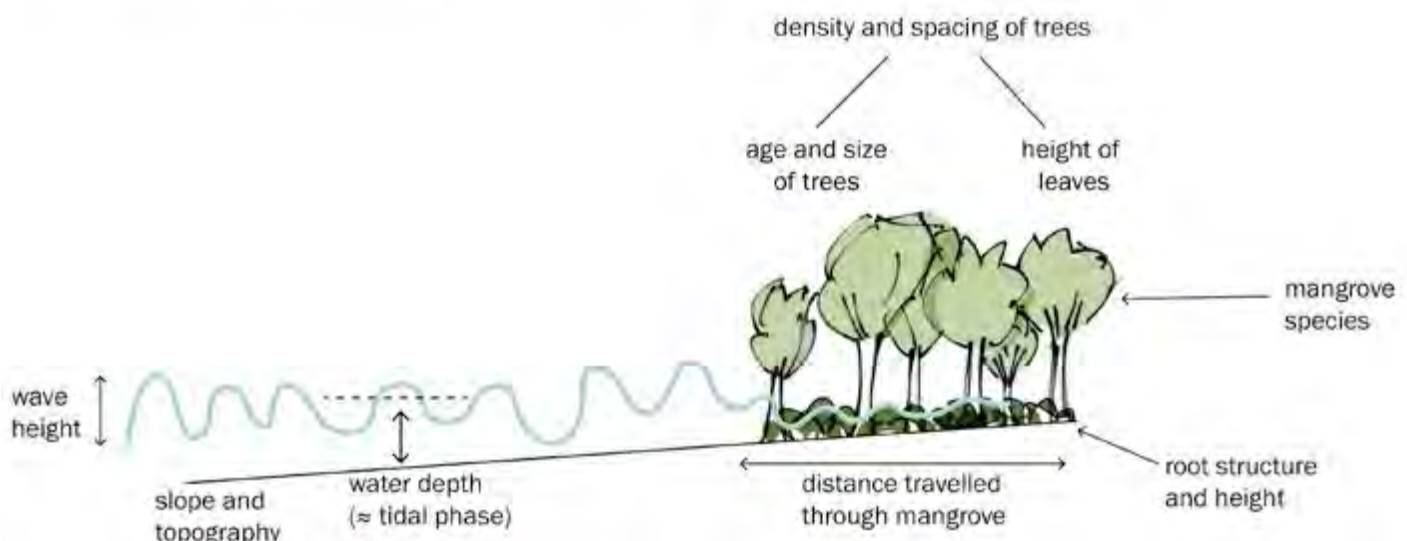
Application

Measured rates of storm surge reduction through mangroves range from 5 to 50 centimeters water level reduction per kilometer of mangrove width. In addition, surface wind waves are expected to be reduced by more than 75% over one kilometer of mangroves.

Sources

“Reduction of Wind and Swell Waves by Mangroves.” Natural Coastal Protection Coastal Ecosystems Reducing Risks From Natural Hazards & Climate Change. August 2012. <http://.org/workspaces/naturalcoastalprotection/documents/mangroves/view.html>

MANGROVE PRESERVATION



Tags: biodiversity, public health, ecological conservation

RECOMMENDATION : Earthen Dikes

STORMWATER MANAGEMENT

Objective

New channels should be constructed or the capacities of existing channels should be expanded to divert stormwater runoff away from elevated areas and agricultural lands.

Issue

Surface water accumulates during the monsoon season in areas that are lacking natural or man-made drainage systems. As flooding events become more unpredictable and frequent in Agonda, it may become necessary to divert stormwater runoff away from elevated areas that may be subject to erosion and landslides, and away from sensitive flood-prone agricultural land.

Description

An **earthen dike** is a temporary ridge of compacted soil that can be used to divert runoff to a desired location.

Application

Some applications include:

- Diversion of **sheet flows** away from disturbed areas and away from unprotected slopes.
- Diversion of water away from sensitive agricultural lands which are prone to **salinization**.
- Slope drains can also prevent erosion and landslides in elevated areas. Runoff can be diverged away from these areas and then directed towards sediment basins or traps.
- Earthen dikes can also be installed along roadways subject to flooding and along the river to lower the water level.

See Appendix C for suggested dike design criteria.

Benefits

Earthen dikes are a low-impact strategy for diverting runoff and stormwater away from flood prone areas (See also: Ecozones pages XX, 5.5 Bioswale pages XX).

Limitations

- Earth dikes must be stabilized immediately, which adds cost and maintenance concerns.
- Diverted stormwater may cause downstream flood damage.

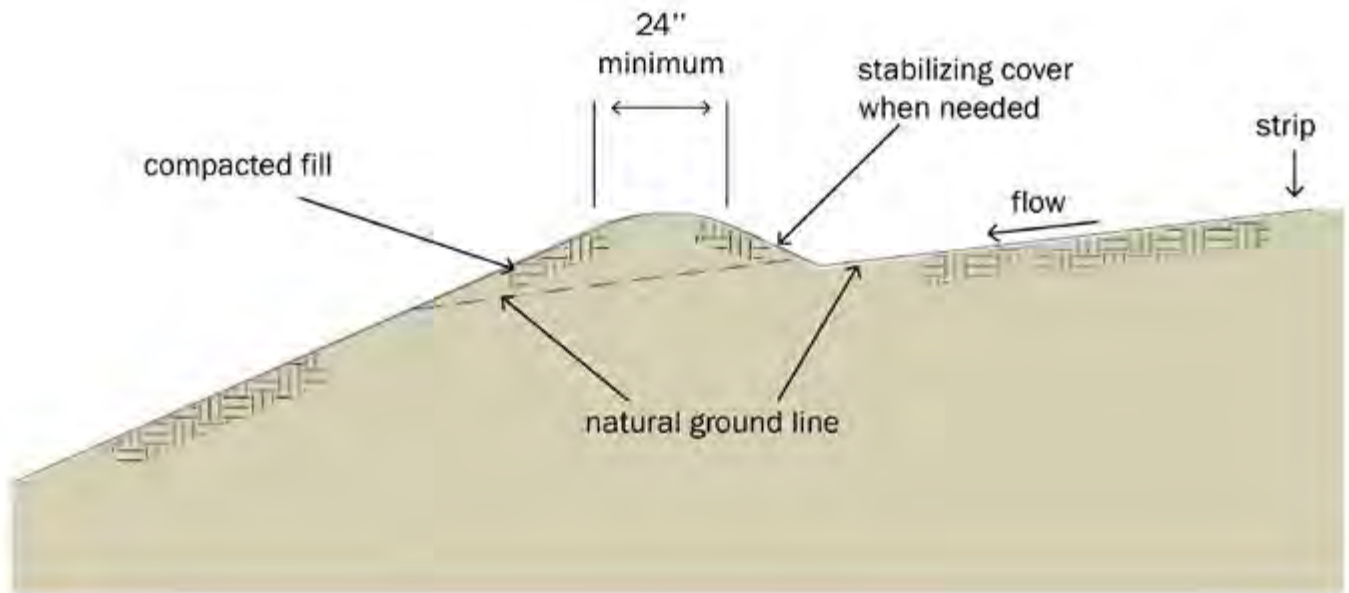
See Also: Bioswale, Rainwater Harvesting

Sources:

IDEQ Storm Water Best Management Practices Catalog, September 2005, <http://www.deq.idaho.gov/media/617962-41.pdf>

California Stormwater BMP Handbook January 2003, <http://www.cabmphandbooks.com/documents/construction/ec-9.pdf>

TYPICAL EARTHEN DIKE



Tags: Construction, Flood, Public Health, Green Infrastructure

RECOMMENDATION: BIOSWALE

Objective

Slow, spread, and absorb stormwater runoff to minimize the threats of flooding, increase **groundcharge** for well water supply, and minimally treat water pollution.

Issue

Stormwater runoff happens when a heavy downpour or prolonged rain unleashes more water than the ground can absorb. Then the excess water travels overland until it finds a river, lake or ocean to call home. Along the way, it picks up dirt and debris as well as pesticides, fertilizers and other contaminants, all of which end up in our waterways.

Description

Bioswales are vegetated open channels specifically designed to help treat storm water runoff in defined water volumes. Like open ditches, they move larger stormwater volumes from a source to a discharge point, but unlike ditches, they intentionally promote slowing, cleansing and infiltration along the way. A sloped base to facilitate this water movement distinguishes bioswales from rain gardens.

Application

There are some design variations of the bioswale, including grassed channels, dry swales and wet swales. These designs may also include an underlying rock reservoir, with or without a perforated underdrain. The specific design features and treatment methods differ in each variation, but all are considered improvements on traditional drainage ditches. Each type of swale incorporates modified geometry and other design features to allow it to treat and convey stormwater runoff.

STORMWATER MANAGEMENT

A typical swale bottom is flat in cross section, 600 to 2400 mm wide, with a 1-2% longitudinal slope, or dished between weirs on steeper slopes. Bioswale side slopes are usually no more than 3:1, horizontal to vertical.

Bioswale vegetation is a combination of grasses, perennials, shrubs, groundcover and trees.

Maintenance requirements are similar to those for ditches: inspecting for bank slumping & erosion, replanting any bare patches where vegetation has been unsuccessful or removed, maintaining ideal vegetation heights by mowing, and removing garbage. Additionally, sediment build-up within the bottom of the swale should be removed once it has accumulated to 25% of the original design volume.

Benefits

Even where soils have very poor hydraulic conductivity (around 1 mm/h), a 4 m long swale/trench can reduce the volume of runoff from a typical local road to about 25% of total rainfall. In general, infiltration facilities along roads are more effective than on-lot infiltration facilities because there is typically less concentration of runoff (i.e. the ratio of impervious area to infiltration area tends to be lower).

As stormwater runoff flows through bioswales, pollutants are removed through filtering by vegetation and soils. Above ground plant parts (stems, leaves, and stolons) slow flow and thereby encourage particulates and their associated pollutants to settle. The pollutants are then incorporated into the soil where they may be decomposed. In particular, bacteria within healthy soils can help break down carbon-based pollutants like motor oil.

Grassed channels and dry swales provide some groundwater recharge if a high degree of infiltration is achieved by the practice.

Siting

Grassed swales can be applied in most development situations, including residential areas, office complexes, rooftop runoff, parking and roadway runoff, parks and green spaces. Swales are well-suited to treat highway or residential road runoff because of their linear nature and because they are designed to receive stormwater runoff.

Limitations

If designed improperly, bioswales will have very little pollutant removal. They also do not seem to be effective at reducing bacteria levels in stormwater runoff.

While some sources recommend that bioswales should be used on sites with relatively flat slopes (i.e., less than 4%), others note that the use of properly spaced weirs can allow siting on slopes up to 10%. When slopes become too steep, runoff velocities become fast enough to cause erosion, and prevent adequate infiltration or filtering in the channel.

Sources

“Regulating Stormwater Discharges.” Capital Regional District. CRD Watershed Best Practices. Website. Accessed March 2013.

“What is a Bioswale?” Capital Regional District. <<http://www.crd.bc.ca/watersheds/lid/swales.htm#>>. Website. Accessed March 2013.>

Tags: flooding, construction, biodiversity, public health

RECOMMENDATION: Plinth construction

Objective : Construction of more resilient plinths with heights that correspond to zones

Issue

Many of the buildings located by the riverbank and canal are not built high enough to withstand rising flood levels. Often, the present plinths are cracked and damaged which leaves them more vulnerable to weakening over time.

Description

Increase the height of Plinths, use materials that last longer, and apply techniques that protect your construction.

Application

- Plinth height should be determined according to location: flood zone, coastal, flatlands, hillside

- Height and width of plinth should be determined based on height of whole structure and proportionate to weight of the building..

plinth height = height of zone's high water mark + natural occurrences + 1 meter

- Treat exposed concrete plinth surface with water repellent.
- When building plinth, construct cavity wall between plinth and home foundation to protect masonry from moisture
- Grout seams and cracks between plinth and building.

Benefits

Reduces risk of first floor flooding

Limitations

Cement can become weakened over time.

Tags: Construction Methods, Flood Mitigation, Materials, Public Health

APPENDIX

APPENDIX A

Application Roofing Material	Solar Reflectance	Infrared Emmitance	Temperature Rise (C)	Solar Reflectance
Coatings				
White Polymer	0.7-0.85	0.86-0.91	5-13	88-107
Light Yellow	0.79	0.91	9	99
Gray	0.40	0.91	31	47
Dark Blue	0.12	0.91	46	9
Aluminized	0.61	0.25	27	56

APPENDIX B

Roofing Material	Solar Reflectance	Infrared Emmitance	Temperature Rise (C)	Solar Reflectance Index
Tiles				
Metal, white	0.67	0.85	16	82
Clay, Red	0.33	0.90	34	41
Concrete, Red	0.18	0.91	43	23
Cement, Unpainted	0.25	0.90	39	31
Concrete, Light Brown	0.42	0.90	29	49
Fiber Cement, earth brown	0.26	0.90	38	28
Coatings				
White Polymer	0.7-0.85	0.86-0.91	5-13	88-107
Light Yellow	0.79	0.91	9	99
Gray	0.40	0.91	31	47
Dark Blue	0.12	0.91	46	9
Aluminized	0.61	0.25	27	56

APPENDIX C

Suggested Dike Design Criteria		
Criteria	Drainage area < 5 acres	Drainage area between 5 to 10 acres
Dike Height	18 in	3 ft
Dike Width	2 ft	3 ft
Flow Width	4 ft	6 ft
Flow Depth in channel	8 in.	15 in.
Side Slopes	2:1 or flatter	2:1 or flatter
Grade	0.5% - 20%	0.5% - 20%

SUSTAINABILITY AND CLIMATE RESILIENCY ACTION LIST

Instructions: The following actions items are provided to help guide your development and construction practices to include sustainable design and climate preparedness strategies. Use this Action List to help you monitor your development’s progress and to ensure that your development is sustainable and prepared for emergencies. Use the comments section to include additional information of what work is still in progress and details explaining alternative applications. Each number corresponds to a recommendation described in detail.

1.0 SITE PLANNING

		YES	NO	COMMENTS/OTHER CONSIDERATIONS
1.2	Did you establish a safe foundation? (i.e. not on steep slopes)			
1.2	On a slope: Are you excavating or filling in land for your structure?			
1.2	Have you sited your structure where it would have the most benefits cooling from shade?			
1.2	Has a soil composition study been done?			
5.2	Have you taken precaution to remove the least amount of existing vegetation?			
5.4	Are you using native plants for landscaping?			

2.0 Materials and Construction

		YES	NO	COMMENTS/OTHER CONSIDERATIONS
2.1	Is your wall stable? Did you consider the relationship between length, height and thickness?			
2.2	Are the door (s) and windows symmetrical?			
2.2	Are the lintel level for all openings and the windows the same size?			
2.3	Did you secure the roof to the frame and wall?			
2.6	Have you considered the best use of the materials you’ve decided to use?			
2.7	Have you thought of what colors the outer walls / roof are of your building?			
2.8	Have you considered retrofitting?			
	Have you considered which materials for your structure would provide the coolest interior?			
5.1	Is your foundation high enough in preparation for flooding?			

SUSTAINABILITY AND CLIMATE CHANGE ACTION LIST CONTINUED

3.0 WATER

		YES	NO	COMMENTS/OTHER CONSIDERATIONS
3.1	Are you harvesting rainwater?			
3.2	If you have a well, did you take steps to protect your water from salt water intrusion?			
3.3	Are you taking steps to conserve water?			
3.4	Are you taking steps to treat your own waste water?			
	Do you have a supply of drinking water for emergencies?			

4.0 ENERGY

		YES	NO	COMMENTS/OTHER CONSIDERATIONS
4.1	Are you passively heating and cooling your building?			
4.2	Are you preparing for renewable energy sources in the future?			
4.3	Are you conserving your energy use?			
4.4	Did you use one of the wind driven strategies?			
	Do you have an energy source in case of emergencies?			

5.0 FLOOD MITIGATION

		YES	NO	COMMENTS/OTHER CONSIDERATIONS
1.1	Are you building in CRZ?			
5.1	Are you building on elevated ground or using construction techniques that elevate your foundation?			
5.4	Does vegetation make up at least 20% of your site?			
5.5	Are you using techniques that will help slow, spread, and soak up storm water runoff?			
	Are you using flood and mold resistant materials?			
	Have you planned to store water supplies, critical infrastructure, and cleaning supplies above the high water mark?			

Proposed Development / Location _____

Name _____

Contact Information _____

Phone / Fax _____

Email _____

Date _____

STEPS FOR WASTE MANAGEMENT IN AGONDA

Steps to Waste Management for Agonda

I Introduction

This is a document which explores the existing waste streams in Agonda, and offers possible steps and processes which will allow Agonda's waste to be handled in a sanitary and environmentally friendly way. Waste has been identified by the community as a major problem in Agonda in the 2009, 2010, and 2012 Pratt Institute, Sustainable Goa studio. Waste management is not a unique problem to Agonda, many municipalities of all sizes in India and around the world struggle with ways to effectively manage waste.

This document is intended to be used by the Panchayat of Agonda in conjunction with the working citizens group identified at the end of the 2012 community workshops along with any involved NGO's.

Steps to Waste Management for Agonda provides information on how Agonda could develop a Solid Waste Management Plan (SWM). These steps include: identifying what data is necessary for a SWM and how to collect it, existing conditions of population growth, density, road conditions and existing waste management practices. The major limitation of this plan is the lack of concrete data on waste in Agonda, and Goa. A waste survey must be conducted within the village of Agonda in order to accurately understand the amount and type of waste generated by residents and businesses.

The steps and recommendations in this document are based on the development of a decentralized SWM where all waste would be transported outside of Agonda, except for wet (organic) waste. Currently, Agonda does not have a landfill or waste transfer station, aside from the Panchayat office where plastic is collected and transported to Panjim. Ideally, recyclables would be transported out of Agonda to mills where they can be sold and processed into new materials. This would leave a smaller portion of non-biodegradable and non-recyclable waste that would be transported to sanitary landfills or waste to energy stations for proper disposal. Organic and bio-degradable waste would be processed in Agonda through anaerobic digestion or composting.

Up to date information on the monetary value of recyclables, waste, and compost must be collected to assess the costs and potential benefits of transporting waste outside Agonda. An index of recycling and waste facilities in the region must also be developed in order to understand where different waste streams can go upon transfer from Agonda.

Steps involving community engagement should also be taken, ensuring that any waste management plan that is developed is suitable and usable for the people of Agonda. Stakeholder groups, public meetings and other types of community engagement could be held in order to develop a waste management plan. Any plan that is developed must be approved of by the community before implementation.

II Waste Stream

This document refers often to what is called the "waste stream". The waste stream is the flow and composition of all material that is discarded by humans in one form or another.

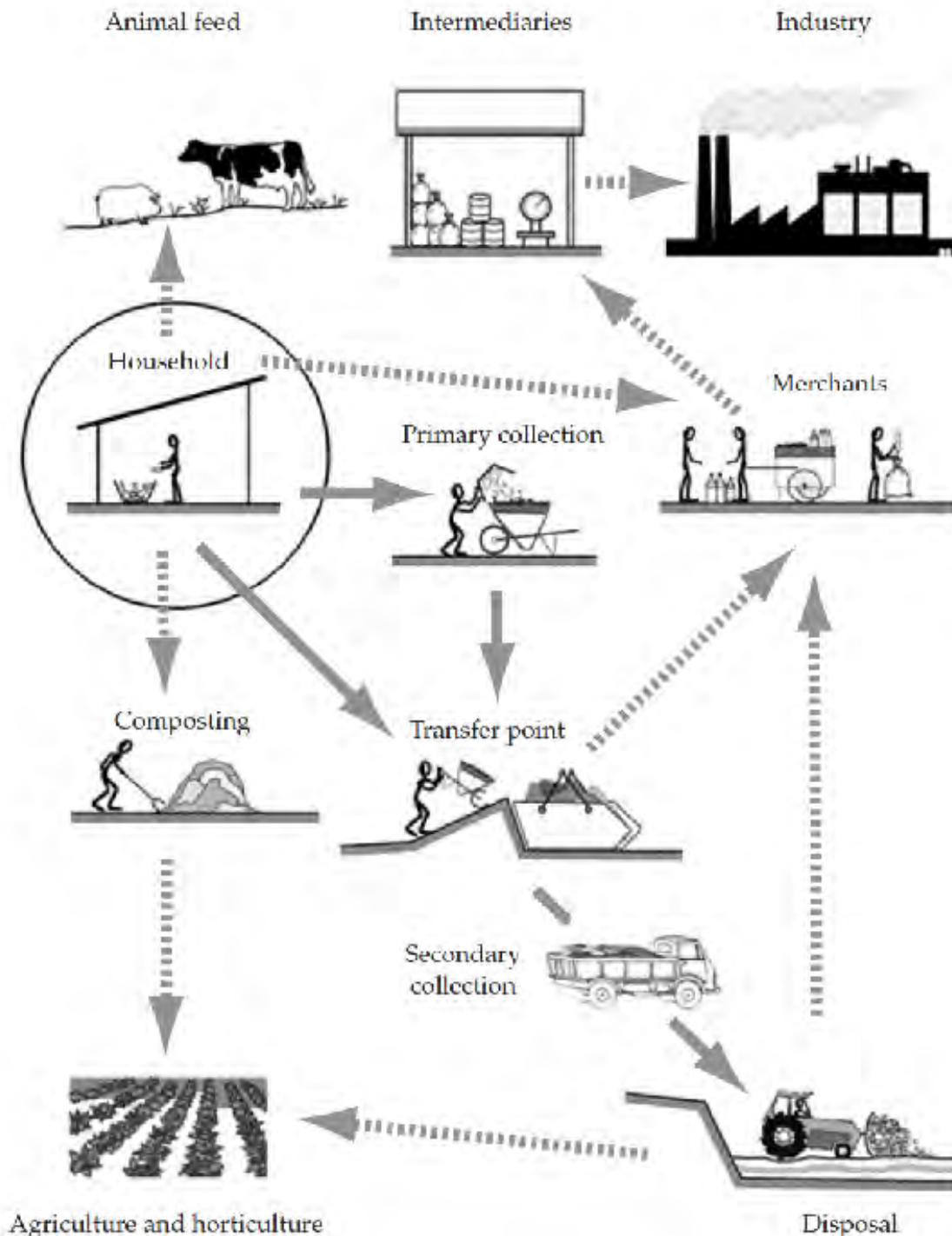
The waste stream is fed by the production and consumption of goods. Those goods could be anything from clothing and food to household cleaners and construction materials. When the goods are

consumed to a point where they no longer are valuable or provide a service they are discarded and enter the waste stream. What happens to those goods after they enter the waste stream is what a solid waste management plan aims to address.

100% sustainability would be a result of a circular waste stream, where all discarded materials are able to be transformed into another use and then recycled again. Products and materials that are unable to be reused would be excluded from entering the market.

Chart 1: The Waste Stream

Taken From "Improving Municipal Solid Waste in India" Zhu, 132.



Source: Sandec 2004.

1. Waste Survey

1.1 Purpose of Survey

The first step to implementing a waste management plan is developing and implementing a waste survey. A waste survey aims to quantify how much waste is generated over a certain time period in a given population, and what the waste composition is. In Agonda, this information can be used to inform decisions such as: type of vehicle(s) to be used in collection and transportation of waste, frequencies of pick up, sizes and types of storage units at transfer stations, and needed capacity for municipal land fill. A waste survey provides the existing conditions of the waste stream for a geography or population.

The survey should be administered by the Panchayat of Agonda in conjunction with the working citizen's advisory board identified at the end of the 2013 community workshop.

1.2 Waste Survey Methodology

1.2.1 Design of Survey

The survey accompanying this report could be used by the village of Agonda to collect waste data. It allows for responses of households, hotels, retail locations, and restaurants. It is designed to gather data on weight of waste by type and location of respondent. It also includes questions on preference of disposal of wet waste ie. kitchen waste. The data regarding type and weight of waste will inform the previously mentioned decisions regarding transportation, capacity of storage sites, and frequencies of pick up. The information regarding preferences on disposal of wet waste will help guide the Panchayat in when considering how to best deal with wet waste. If one method of wet waste disposal experiences more positive reaction than the other, it may be an indicator that the method will be used more by the community.

1.2.2 Timeframe

Each household survey respondent will be asked to hold and separate all waste generated for a week. Each respondent should only be surveyed one time. After the week period each type of waste will be collected by a member of the administering group and transferred to a central processing location where each type of waste will be weighed and recorded individually.

In order to facilitate efficient collection and recording of waste, the administering group of the survey may consider staggering the days that individuals begin collecting their waste. For example, if there are 50 households ready to engage in the survey, the administering group could choose to have 10 begin collecting waste on Monday, 10 on Tuesday and so on. When the week has passed for the first group, the next group will still have one more day. In this way the administering group can better deploy resources and time to ensure prompt collection, recording and disposal of the waste.

For restaurants and hotels the survey may need to be administered in a shorter timeframe as storing larger quantities of waste for an extended period of time could be unsanitary. An adequate time period should be discussed with business owners prior to administering the survey. A similar staggering technique could be implemented with restaurants and hotels.

1.2.3 Population Sample

The current population of Agonda is estimated at 3,600. The waste survey should aim to include a representative population of Agondan households and commercial establishments.

Table 1: Required Household Sample Size Allowing a 95% Confidence Level

Source: Decentralised Composting for Cities of Low and Middle Income Countries 22

Total Number of Households in the Community	Respondents Needed for Low Sampling Error	Respondents Needed for Medium Sampling Error	Respondents Needed for a Still Acceptable Sampling Error
100	50	50	49
250	152	110	70
500	217	141	81
750	254	156	85
1,000	278	164	88
2,500	333	182	93
5,000	357	189	94
10,000	370	192	95
25,000	378	194	96
50,000	381	195	96
100,000	383	196	96
1,000,000	384	196	96
100,000,000	384	196	96

To establish this representative sample size we can calculate what number of respondents are needed in order to provide results that are indicative of the larger population. According to the Indian census average household size is 5, so we can divide the estimated population of Agonda, 3600, by 5 to get an estimated number of households, 720. Using table 1 above we know that in order to get a 95% confidence level of the amount of waste generated by households with a low sampling error, the size of the sample would need to be between 217 and 254.

Accuracy could be further increased by stratifying the sample by geography. See section 2.4 on population density of Agonda. Ensuring a representative percentage of each ward is included in the survey based on population density could be done by multiplying 254 by the population percentage of each of the seven wards.

1.2.4 Participation and Facilitation

Participants for the survey should be briefed on the process prior to the week they collect their waste. The physical collection of the waste could be done with plastic buckets or large bags, labeled for each type of waste, which could be cleaned and reused. The collection receptacle should be weighed prior to use in the survey and that weight should be subtracted from the total weight of waste after collection.

Collecting survey waste and bringing it back to a central location may be the best option for weighing as it will allow the administering group to get a feel for how much time collection takes and what local

challenges may be presented. It will also expose Agondan's to what having a collection system would be like, which may help increase use and productivity of the SWM when enacted. Returning waste to a central location will allow for a controlled environment for weighing of waste which may improve accuracy, as opposed to weighing waste in the field.

1.2.5 Field Testing the Survey

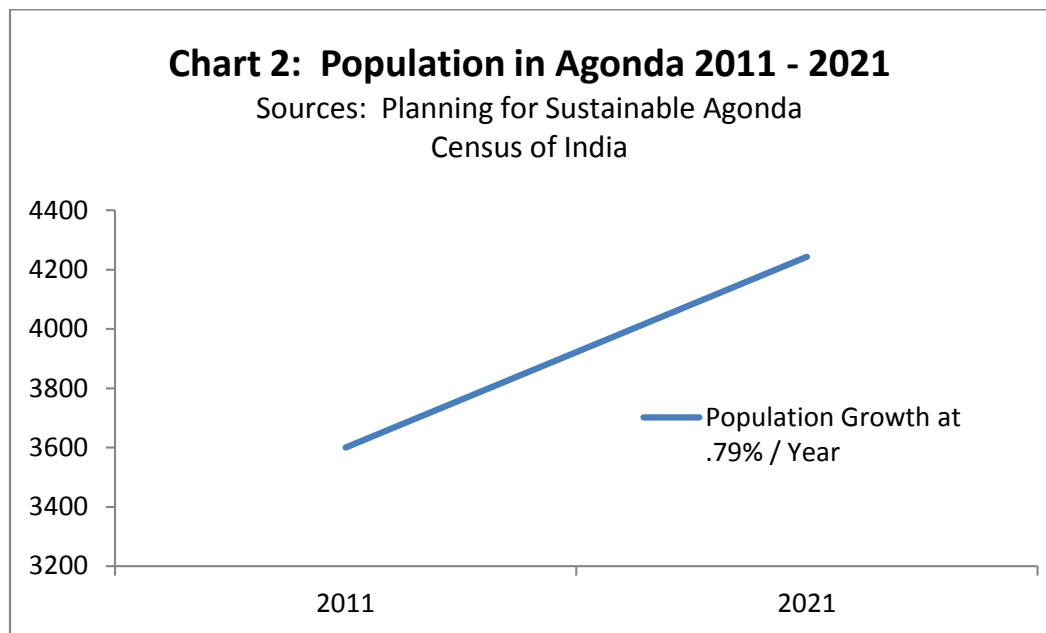
In order to ensure the survey is functional to its purpose prior to wide use, it is recommended that it is piloted with a small population first. The citizens advisory group could act as the first round of participants and take note of any faults or shortcomings in the survey and make adjustments as needed.

1.2.6 Collection and Analysis

The information collected from the Waste Survey should be entered, coded, and stored in the digital spreadsheet that accompanies this document. A codebook detailing how to enter the data can be used during input. Individual survey responses can be aggregated and analyzed based on type of respondent, geography, amount of waste generated and so on. This collection and analysis will lead to the development of mean percentages of waste stream makeup by waste type. Further, it could be used to assess preference of wet waste disposal type by geography.

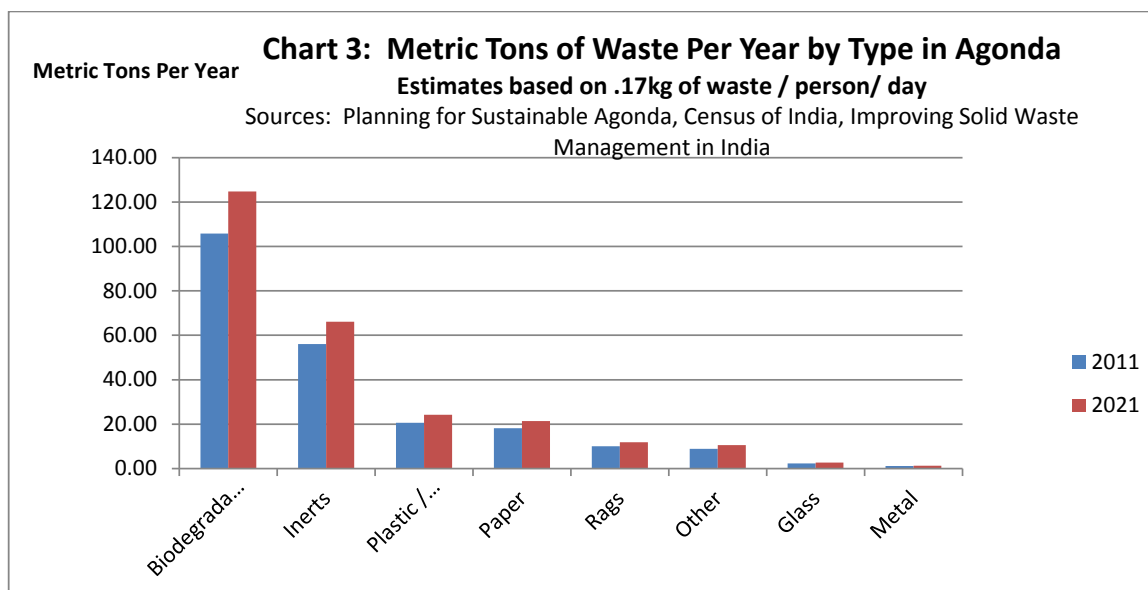
2. Existing Conditions

2.1 Population:



According to Census of India data, exponential growth rate of Goa was .79%. If we accept this number as a representative measure of growth for all towns and villages in Goa we can estimate the population in Agonda will grow from 3600 in 2011 to 4,244 in 2021.

Waste Stream



Using the population projection above and estimates on solid waste composition from the World Bank it is possible to estimate the quantities of waste by type generated now and in the future. The waste composition estimates from the World Bank are representative of an urban population, which may have different waste streams and compositions than that of Agonda, which is a rural population. They are used here to illustrate estimates of waste generation by type and to give a sense of how much waste could possibly be generated each year in Agonda. Estimates that Agonda's generate .17kg's of waste a day are based on preliminary research done by the 2011 Pratt Studio. When developing an official municipal waste plan for Agonda, the waste survey results should be used to identify kilograms of waste by type by day. The graphics and charts here are for illustrative purposes only.

Table 2: 2011 Estimates based on Agonda Population of 3,600				
Source: 2011 Planning for Sustainable Agonda, 45				
Improving Municipal Solid Waste Management in India				
Based on x kg/day per person (x*3600*365/1000)				
Does not account for hotels or institutions				
Waste Type	% If Waste Stream (World Bank 2005)	Metric Tons / Year (Based on .6kg/day/person)	Metric Tons / Year (Based on .4kg/day/person)	Metric Tons / Year (Based on .17kg/day/person)
Biodegradable	47.43%	373.75	249.01	105.77
Paper	8.13%	64.06	42.68	18.13
Plastic / Rubber	9.22%	72.65	48.41	20.56
Metal	0.50%	3.94	2.63	1.12
Glass	1.01%	7.96	5.30	2.25
Rags	4.49%	35.38	23.57	10.01
Other	4.00%	31.52	21.00	8.92
Inerts	25.16%	198.26	132.09	56.11

Total	100.00%	788.00	525.00	223.00
Table 3: 2021 Estimates based on Population of 4,244				
Source: 2011 Planning for Sustainable Agonda, 45				
Improving Municipal Solid Waste Management in India				
Based on X kg/day per person (x*4244*365/1000)				
Does not account for hotels or institutions				
	% Of Waste Stream (World Bank 2005)	Metric Tons / Year (Based on .6kg/day/person)	Metric Tons / Year (Based on .4kg/day/person)	Metric Tons / Year (Based on .17kg/day/person)
Biodegradable	47.43%	440.62	294.07	124.74
Paper	8.13%	75.53	50.41	21.38
Plastic / Rubber	9.22%	85.65	57.16	24.25
Metal	0.50%	4.65	3.10	1.32
Glass	1.01%	9.38	6.26	2.66
Rags	4.49%	41.71	27.84	11.81
Other	4.00%	37.16	24.80	10.52
Inerts	25.16%	233.74	155.99	66.17
Total	100.00%	929	620	263

2.3 Road Conditions

Infrastructure must be taken into consideration when developing a waste management plan. Road widths and conditions along with topography and settlement patterns may determine what sort of collection vehicle can be used.

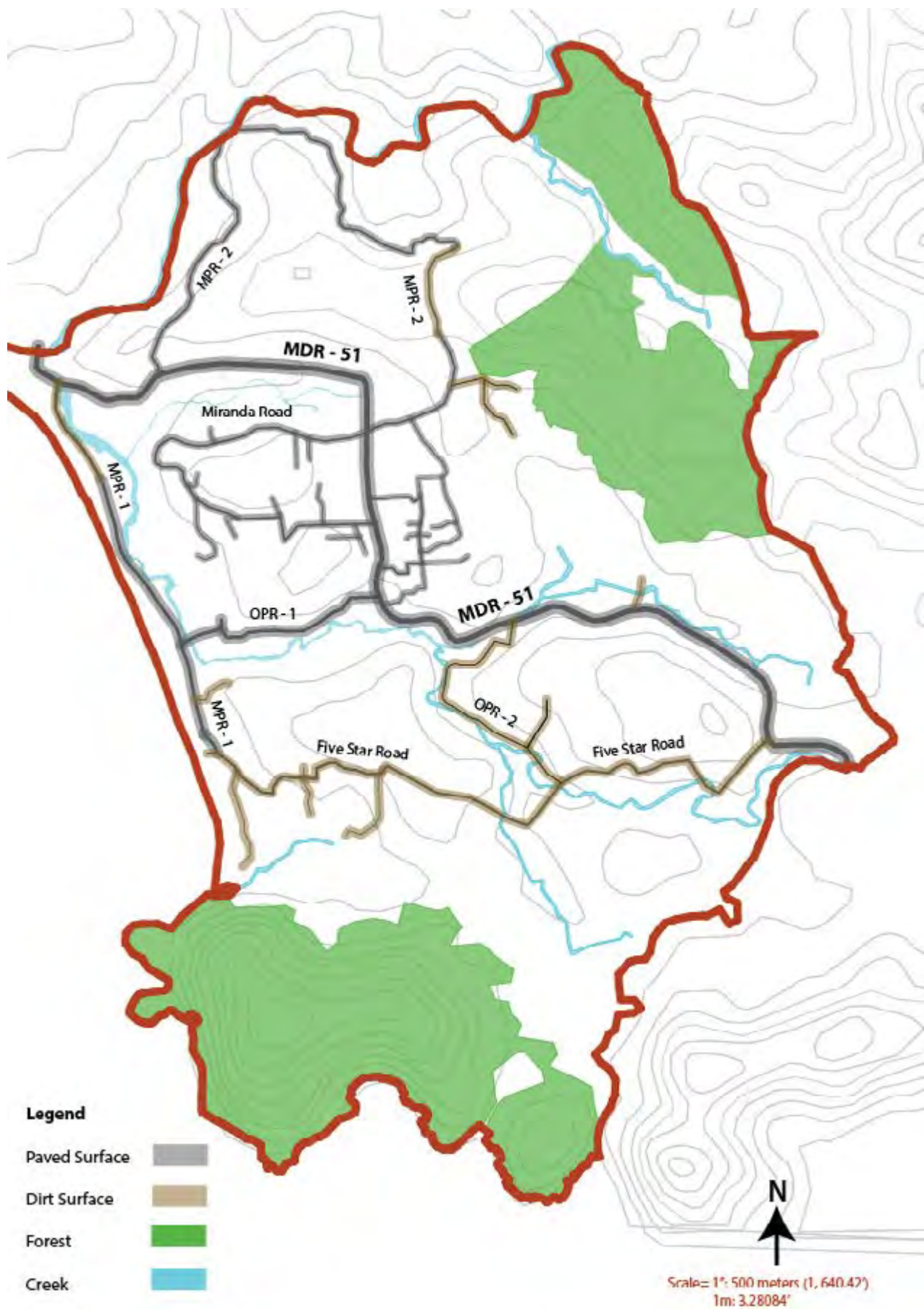
In Agonda the Main Panchayat Roads (1 and 2) measure between 3-4 meters wide for two way traffic (Sustainable Agonda 41). The Other Panchayat Road widths are unidentified, but are presumably as narrow or narrower than the Main Panchayat Roads. Non-paved roads, like the northern end of MPR-1 and Five Star Road, are narrower than 3 meters at certain points (Sustainable Agonda 28). A complete survey of road conditions and widths may be advisable in the future. See Chart 5 for graphic representations of road types.

Topography is important to consider when selecting a vehicle to collect waste as well. Areas with drastic topography may not be conducive to human powered vehicles as once the vehicles are loaded with waste they will be heavy and possibly difficult to control when descending steep inclines. Sections of Agondan roadways where topography could be an issue are along the Five Star Road and MPR 2 (See Chart 5).

Waste collection vehicles should be of appropriate size so they do not block traffic during collection runs. They should also be able to navigate unpaved and sometimes rough roads. Possible collection methods could be small tipper trucks, handcarts, tricycle units, or mid sized tempo trucks. Table 4 gives estimated costs of vehicles and equipment from 2006. Some Indian municipalities use handcart and tricycles to collect waste door to door and then transport the waste to neighborhood containers which are then emptied by a motorized vehicle (such as a truck or auto-richshaw) and taken to a storage location (Solid Waste Management in India, 53). Whatever the transportation method, Indian law requires that vehicles engaged in the transportation of waste must have a cover preventing waste from falling out of the vehicle (Solid Waste & Waste Water Management 27).

Table 4: Waste Management Vehicle and Equipment Costs, 2006	
Source: Solid Waste Management in India, 54 (Based on cost estimates of the central workshop of the Ahmedabad Municipal Corporation.)	
1 lakh equals 100,000 Rs.	
Equipment or vehicle	Approximate cost per unit (2006)
3.0 cubic meter garbage container	Rs 20,000
Twin-container dumper placer (Light Commercial Vehicle)	Rs 8.5 lakhs
Twin-container dumper placer Heavy Commercial Vehicle)	Rs 10 lakhs
Tractor with lifting device	Rs 3.75 lakhs
1.1 cubic meter garbage container (Galvanized Steel):	Rs 19,000
1.1 cubic meter garbage container (Mild Steel):	Rs 9,000
14 cubic meter refuse collector	Rs 18 lakh
2 cubic meter ride-on road sweeper	Rs 15 lakhs
Truck-mounted road sweeper	Rs 30 - 45 lakhs
Tractor-attached road sweeper	Rs 11 lakhs without tractor
Large hauling vehicle 30 Cubic Meter Capacity with Truck:	Rs 20 lakhs
Large hauling vehicle 20 Cubic Meter Capacity with Truck:	Rs 14 lakhs

Chart 5: Agonda, Road Types and Topography



2.4 Population Density

Population density is an important component of a waste management plan as it helps to inform the collection capacity, routes and amount of area that can be covered by a collector depending on type (hand cart, tricycle, auto-rickshaw, truck, or other).

The higher the population density in a given area, the more waste is generated. Agonda is composed of 7 wards, which could be used as natural geographies for waste collection. The best approximation available for population density by ward is the 2009 Sustainable Agonda Economic Survey. The survey attained 2700 respondents of Agonda's approximate population of 3600. The limitations of using this survey to approximate population density are that it is not a complete count of residents in Agonda, and some wards may have had higher response rates than others, which would skew the data. In the future, a more complete count of Agonda's residents by ward may be advisable to better inform decisions based on population density.

However, for the purposes of this document we can use the 2009 economic survey as a way to estimate population density.

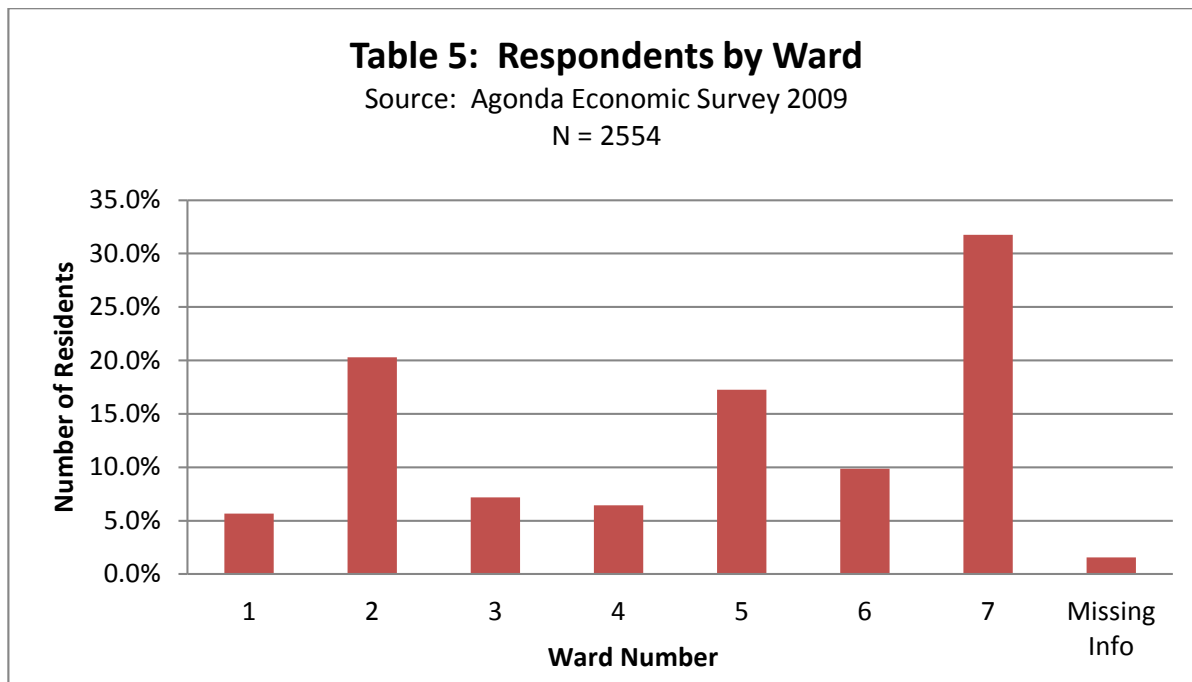
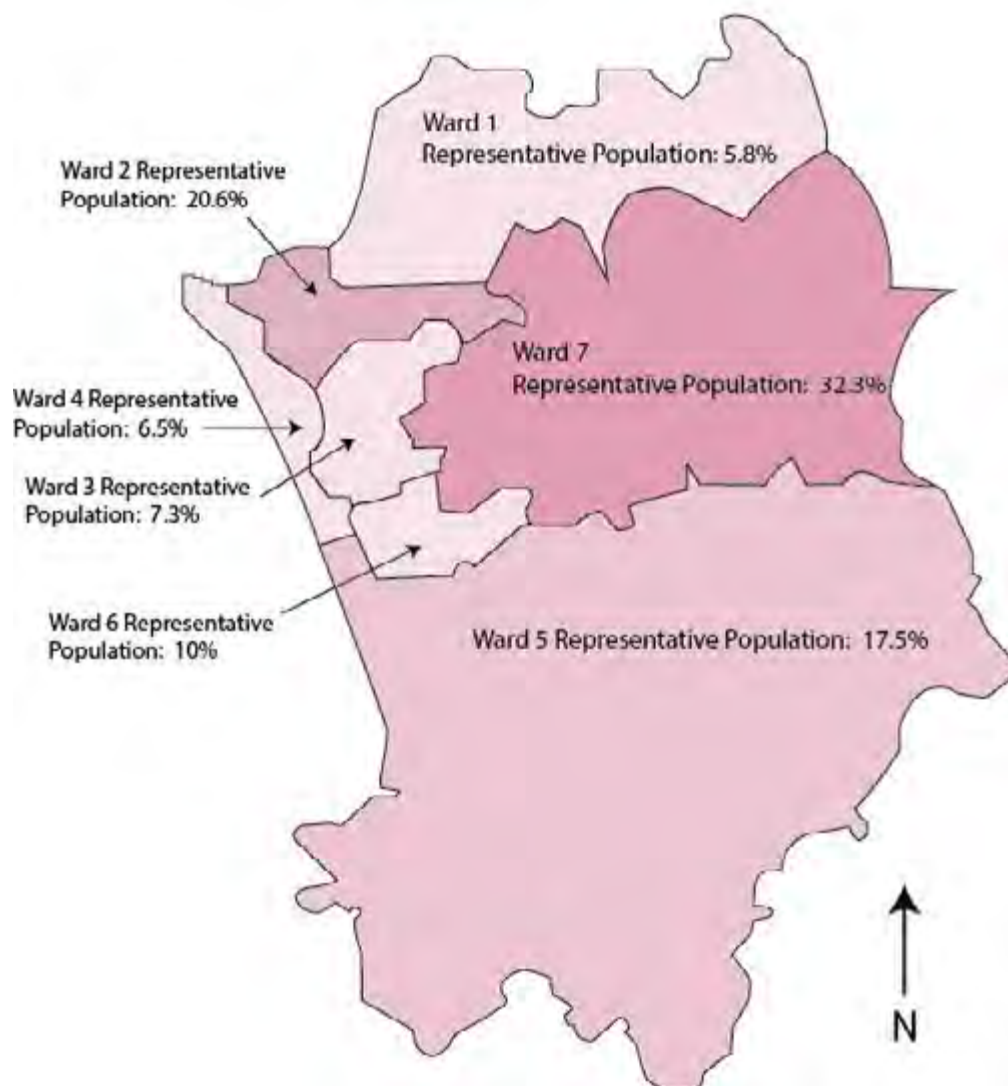


Chart 6:

Agonda Population Density by Ward

Source: 2009 Agonda Economic Survey



2.5 Regional Waste Facilities

Further research should be undertaken to understand where the closest recycling and garbage facilities are located in relation to Agonda. The Panchayat currently sends the plastic it collects to be processed in Panjim (72Km north of Agonda), and there is anecdotal evidence of a garbage dump in Chaudi. Using the internet to locate recycling and garbage facilities in the area revealed possible locations in Margao, however they should be site verified in order to understand capacity and type of waste that can be handled.

Sustainability should be the primary factor in choosing location for disposals. If recycling facilities for waste generated in Agonda are accessible they should be first choices in transfer over a landfill or waste to energy.

2.6 Current Waste Management Practices

Plastic and glass bottles are the only types of waste that have a formal disposal system in place to deal with them. The Panchayat collects plastics from households and businesses for transportation to a

recycling center in Panjim (72 Km North of Agonda). According to the Sarpanch's office the trucks come to Agonda four times a week but it was unclear what the frequency of plastic pick up per household or business was. The Sarpanch's office stated that the plastic collection service has been in operation for 3 years. The Panchayat pays 2 garbage men R9,000 per month (R4,500 per garbage man) to provide this service.

Despite the service provided by the Panchayat plastic bottles are easily spotted in drainage ditches, on the sides of roads, and other visible areas throughout Agonda.

In addition to the Panchayats service, some plastics are collected by distributors. For example the large kingfisher water jugs are collected for re-use. Similarly, glass bottles (ex. Beer bottles) are collected by distributors for re-use.

Some hoteliers have taken it upon themselves to hire private waste collectors to pick up trash and recyclables. However, they do this at their own initiative and not because of any mandate for a cleaner Agonda. These business owners are the minority in Agonda, as the free method of dump and burn is economically preferable to paying for a service but degrades air quality and causes other health issues for residents and visitors.

Additionally, what appears to be an informal recycling collection and transfer station exists at the intersection of OPR-1 and MDR-51. Metal, rubber and other types of waste materials were observed to be segregated and organized at the site. Investigation into the operation of this facility should be undertaken by the Panchayat or working citizens group to understand the destination of the materials viewed here and there value.

3. Plan

Agonda's rural composition and low population density must be accounted for in determining a waste management plan. Because of scale, it may be impossible for Agonda to develop the facilities necessary for waste processing within the village. Until the construction of a sanitary landfill occurs, all waste generated in Agonda must be taken outside the village for proper disposal and recycling, except for wet waste which can be handled locally.

An essential component of a waste management plan is waste segregation (Solid Waste and Waste Water Management 22). Containers must be provided to households and businesses in Agonda for wet waste, recyclables, and non-recyclables. Separating these waste streams at the source allows for easier transfer, disposal, and resale if applicable to the waste type. Once properly segregated all waste streams should be brought to a waste transfer location for storage until appropriate time for transport to an end stream facility.

Agonda has identified a site to be used as a waste management location in the south-east section of the village along the Five Star Road. This location should be reviewed and analyzed taking into account the results of the waste survey and SWM. If this location is to be kept as the village's waste management site upgrades to the road may be necessary in order to accommodate increased vehicle traffic. A more centrally located site along the MDR 1 may be a better location as it is on a major road connecting to larger towns and cities where waste may ultimately need to be taken.

3.1 Wet Waste / Kitchen Waste

Wet waste / kitchen waste is the waste left over from cooking and eating in households, restaurants and hotels as well as any organic material byproducts from agriculture or livestock. Estimates from the world bank are that wet waste makes up approximately 50% of waste composition in India (see table 2). Because wet waste is bio-degradable it is the one waste stream that could be handled locally by either composting or bio-digestion in Agonda. This is because the processing of wet waste does not require machinery for chemical or physical transformation, the transformation occurs naturally. Either method of composting or bio-digestion turns organic waste into a useful substance by returning it back to the natural cycle and avoiding landfills. Composting produces fertile compost to be used in agriculture, and bio-digesters produce bio-gas that can be used to power stoves as well as nutrient rich sludge that can be used in agriculture.

Determining whether to participate in composting or bio-digestion should be based on Agonda's preferences and ability to pay.

Table 6: Bio-Digester / Composting: Challenges and Benefits		
	Bio Digester	Compost
Byproduct	Bio Gas, Nutrient Rich Sludge	Compost
Benefits	Reduces need for cooking fuel, sludge can be used as fertilizer in agriculture	Low Cost to install, compost can be used in agriculture
Challenges	Higher cost to implementation	Labor intensive

3.1.1 Bio - digesters

Bio-digester units could be installed at individual households, restaurants and institutions in Agonda which would allow them to be self-sufficient in cooking fuel. Handling wet waste on site with bio-digestion units would drastically reduce the amount of waste to be managed by the Panchayat, as it is presumed that the majority of waste produced in Agonda is wet waste.

Installing household bio-digesters to every home in Agonda (R18,000 per unit, including installation) will be more costly than creating municipal or ward level composting stations.

However, household bio-digesters make homes self-sufficient in terms of cooking fuel. These savings will eventually pay for the cost and installation of the bio-digester unit (The current price of subsidized LPG is R 406/14.2Kg of LPG. Average annual use of lpg per household in India is 140.4kg annually (Chandrasekhar 1). This comes out to an annual savings of R 4014/year. A household bio - digester could possibly pay for itself within 5 years.

3.1.2 Composting

In the 2012 waste management workshop 52% of participants favored a Panchayat level composting system over other options, and 25% opted for ward level composting. Anecdotal evidence from

interviews with residents showed a resistance to the idea of composting on site, and as most Agonda's don't participate in agriculture at their homes, it makes sense to implement a larger scale system.

3.2 Public Facilities

A second component to a comprehensive solid waste management program is public facilities placed at strategic sites to ensure that residents, tourists, or passers through always have a way to get their waste to the appropriate place. Only one public trash can was observed in Agonda at the intersection of MPR-1 and MPR-2, but many more are needed. Placement of bins along the beach road at regular intervals as well as inland in corridors that experience significant foot traffic could reduce litter along roads. See Planning for Sustainable pg 38 for indicators on foot traffic connections to MDR 51. Another strategy would be to look at where dumping occurs regularly and place bins in those locations. See Planning for Sustainable Agonda pg 48 for map of observed dumping locations in Agonda.

Public bins should have options for users to separate waste types. Plastics, food/organic (wet) waste, paper, and general garbage should all have individual containers. This program may need to be pilot tested before town wide implementation in order to gauge use and frequency of pickup needs. Modular bin units may be advisable here as bins may need to be moved depending on season.

To encourage use of public waste facilities, a community outreach campaign could be undertaken to explain what the facilities are and how they are used. Signage, literature, and town meetings are all possible methods of communicating this information and should be discussed by the working citizens group.

3.3 Waste Collection and Transfer

Door to door pick up of waste was cited in the 2013 waste management workshop as most desirable form of pick up. Door to door pick up may be the best way to ensure that residents participate in the Panchayat waste management plan, however it is also the most labor intensive form of waste collection as it requires workers to visit every house and business on at least a weekly basis.

Table 7: Wet Waste Storage Bin Size and Type	
Source: CoE on Solid Waste & Waste Water Management 22	
*LDPE = Low Density Polyethylene Plastic	
*HDPE= High Density Polyethylene Plastic	
	Size and Type of Wet Waste Container
Households	10 - 15 litres capacity bin with lid
Hotels & Restaurants	60 litres capacity - LDPE/HDPE bins
Shops & Offices	Suitable container not exceeding 60 litres
Market Stalls	40-60 litres bin - LDPE/HDPE
Marriage / Town Halls	Dumper Skip
Hospitals	60 litres bin for food & bio-degradable waste

The size and type of container recommended table 7 are based on the waste stream of an urban population in Kerala. The results of a waste survey in Agonda will better inform needed sizes and types of containers.

Door to door collection may not be feasible in some parts of Agonda because of road conditions, depending on what vehicle is used for collection. For example, auto rickshaws fitted to perform collection may not be able to access some of the rough and steep terrain in Agonda. Similarly large heavy waste collection vehicles may not be able to fit on narrow roads while allowing traffic to pass.

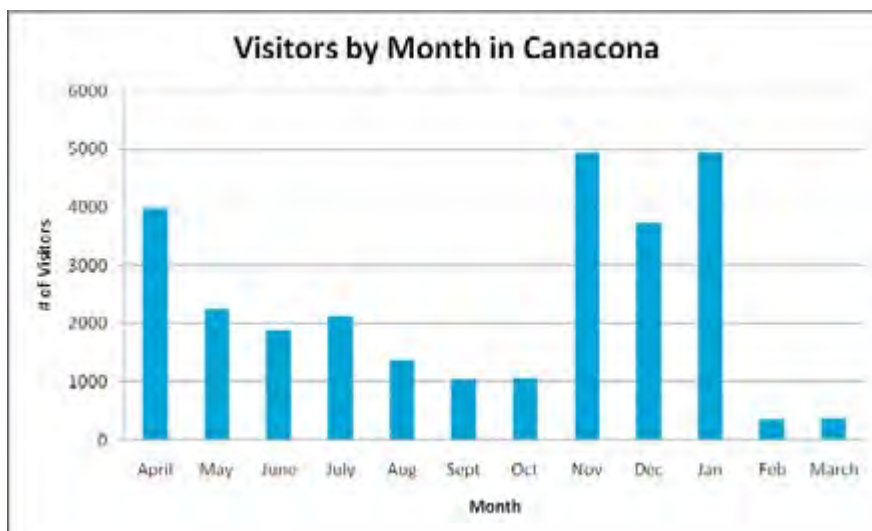
For these scenarios alternative methods of collection may need to be implemented. Where door-to-door collection is not possible, neighborhood collection facilities fed by residents or Panchayat employees moving ahead of trucks to retrieve waste may be alternatives.

Evaluation of road types and collection vehicle selection should be taken into account when developing the waste management plan to account for these types of scenarios.

4. Tourist Season Waste Management Plan

4.1 Tourist Industry Waste Survey

Agonda is increasing in popularity as a tourist destination. The tourists that visit Agonda during the high season of November – January add to the waste stream in Agonda, and this additional waste should be planned for in Agonda’s SWM. However, without knowing how much waste the tourist industry produces it is difficult to plan how to deal with it. The Agonda Waste Survey should be used to identify the quantities of waste associated with these types of facilities.



4.2 Tourist Industry Collection System

Because the tourist industry is almost exclusively concentrated along the beach road (MPR-1) collection of waste could be executed for many or all the tourist operations in one sweep with the correct vehicle.

The amount of organic waste generated each night by hotels and restaurants in Agonda is enough that not disposing of it on a daily basis could lead to unsanitary conditions. It could also provide significant inflows for bio-fuel producing anaerobic digesters or composting stations. Organic waste collection

from hotels and restaurants could be handled by a larger collection vehicle and could take place in the evening after the businesses have shut down or early in the morning so as to not block traffic along the narrow road.

4.3 Tourist Industry Waste Management Financing

Additional resources that will need to be dedicated to managing excess waste created by tourists in Agonda will incur additional costs on the program and Panchayat. An option to finance the waste operations during tourist season would be to implement a tax on tourist businesses.

For hotels the tax could be on the number of rooms available and for restaurants the tax could be based on the square footage of the establishment. In this way these businesses would pay their fair share of waste management costs.

91% of Agondan's that participated in the 2013 community workshop cited that they either strongly agreed or agreed with implementing a tax on tourist based industries to pay for waste management.

Other financing models could be discussed and developed by the citizen's advisory working group in conjunction with the community.

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Survey ID Number: _____

Surveyor Initials: _____

Date _____

Address: _____

Respondents Name: _____

Panchayat of Agonda Waste Survey

Respondents Ward: _____

Wards of Agonda

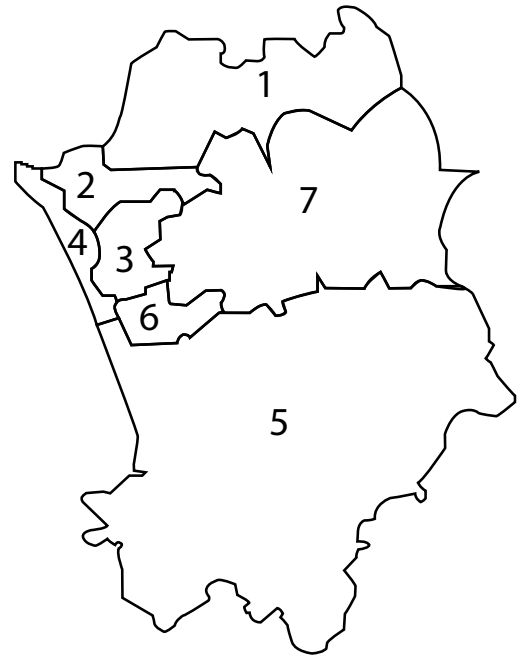
Respondent Type:

Household

Hotel

Restaurant

Retail



If Household, Number of People Living in Household: _____

If Hotel, Number of Rooms: _____

If Restaurant or Retail, Sq / M: _____

Waste Weights:

	Organic (Wet)	Glass	Metals	Textiles	Paper	Plastic	Other	Total
Kg's								

Wet Waste Management Preference:	Not Interested	Somewhat Interested	Interested	Very Interested
Would be interested in installing a household bio-digester:				
Would be interested in contributing to a Panchayat scale bio-digester:				
I would be interested in installing household composting:				
I would be interested in contributing to a Panchayat scale composting system:				

RECOMMENDATIONS FOR SUSTAINABLE TOURISM IN AGONDA



INCREDIBLE AGONDA

SUPPORTING THE EXPANSION OF SUSTAINABLE TOURISM IN AGONDA

PREPARED BY THE PRATT INSTITUTE GOA STUDIO >> SPRING 2013



SUSTAINABLE TOURISM

*The following guide comes directly from the field work and workshops conducted in Agonda in the past three years. (*2010, 2011, 2012) They identify tourism as a major industry projected to continue growing in the years to come. By formulating a Business Plan for Sustainable Tourism, Agondan residents can guide development that ensures a positive experience for local peoples, businesses, and the tourists themselves.*

WHAT IS SUSTAINABLE TOURISM?

Sustainable tourism is tourism attempting to make as low an impact on the environment and local culture as possible, while helping to generate future employment for local people. It is tourism that aspires to protect and sustain the world's natural and cultural resources, while ensuring tourism meets its potential as a tool for conservation and poverty alleviation.

Agonda has traditionally been a fish and farming community but over the past ten years, tourism has generally outpaced these industries. It is now estimated that there are more residents employed in the hospitality and service sector than fishing and farming combined.

TOURISM IN AGONDA: TODAY

As a poster child for 'Incredible India,' Goa is promoted as a tourism destination. It is scenically situated between the Sahyadri Hills to the East and Arabian Sea to the West. With its coastal villages, paddy fields and hospitable people, it is seen as a place of happiness and celebration. Unfortunately, Goa is also a victim of its own popularity. Infrastructure has not kept up with rampant development and tourism has brought with it undesirable social and environmental ills. This awareness figures strongly in people's mind and has given cause for alarm.

Tourism plays a major part of not only the Goan economy, but also accounts for 15% of India's annual foreign exchange. Goa alone reaps Rs 1,500 Crores per year from Tourism and has 21 Lakh domestic and 3.8 Lakh international visitors per year (RPG 2021). However, according to RPG 2021 Sec. 3.8, there is no State Tourism Plan, policies, land use regulations, or strong Tourism Administration. Coupling this with numerous unethical operations and Goa's environmental degradation related to Tourism (RPG 2021), *it is essential that communities can control and develop Tourism on their own terms.*



ACTION STEPS

By tapping in to an abundance of natural and cultural resources, Agonda can begin to direct a rapidly growing tourism industry into a viable and sustainable direction, encouraging direct revenue into the community and preserving a significant way of life.

FORM a Sustainable Tourism Management Organization
Agonda as a Sustainable Destination can only come about if a mixed, representative group of residents, business owners, and local community members come together to form a regulatory agency, intended to **craft Sustainability Guidelines**, and usher Agonda into a Sustainable future.

ESTABLISH a tourism strategy that is publicly available, suited to its scale, that considers environmental, economic, social, cultural heritage, quality, health, and safety issues, and was developed with public participation.

DEFINE responsibilities for the management of environmental, economic, social, and cultural heritage issues within the organization.

REACH OUT to national and international organizations with the resources to help guide Agonda's Sustainable Tourism Strategy. These organizations include:

The Global Sustainable Tourism Council: www.gstcouncil.org

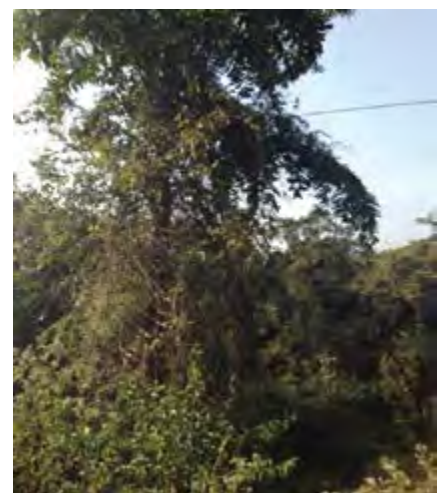
The International Centre For Responsible Tourism: www.icrtourism.org

CREATE A CATALOG of key tourism assets and attractions including natural, historical, archaeological, religious, spiritual, and cultural sites. Make this catalog publicly available and begin to label these destinations within the village.

BUILD a system to conserve key natural, historical, archaeological, religious, spiritual, and cultural sites, including scenic, cultural, and wild landscapes through visitor management.

ADAPT a strategy that encourages visitors to volunteer or contribute to community development, cultural heritage, and biodiversity conservation.

REFERENCE the Panchayat's land-use requirements and guidelines when considering any additions to infrastructure in the tourism industry.



ATTRACTIONS

Agonda has the potential to capitalize on a growing tourism industry by encouraging the development and creation of sustainable tourist attractions that utilize the existing natural beauty, cultural heritage, and environment of the community.

ENCOURAGE the expansion of economic benefits from tourism to traditional industries:

AGRICULTURAL TOURISM is a form of niche tourism that brings visitors to local farms for tours and activities.

Successful examples within Goa include **Sahakari Spice Farm**: www.sahakarifarms.com

BECOME ADVOCATES for the preservation of coastal resources by regulating boating and fishing tours that encourage traditional practices and include an element of education and awareness of a sensitive environment.

EMBRACE the concept of the fisherman as a tour guide and conservationist.

REINVIGORATE the production of traditional crafts by building educational programs open to both youth and tourists.

Classes in traditional pottery, weaving, textiles, dance, music and art help sustain the cultural heritage of a place from generation to generation.

PROMOTE the sale of goods made and manufactured in Agonda.

This includes the sale of Agondan Feni in local restaurants, Agondan made coconut oil in beach lined shops, and traditional clothing marketed to tourists and locals alike.

CONSIDER the creation of a central market for the sale of local goods.

CREATE a local steward program staffed by community docents to lead village tours.

Tourists can pick from an array of guided tours advertised to them in restaurants, shops, and beach accommodations.

Docent lead tours into the lush and underutilized Adondan interior help encourage and regulate movement throughout the whole of the village.

Docent positions are ideal for women and youth seeking local career opportunities.



A CLEAR VISION

With tourism slated to continue growing in the coming years, planning for sustainability requires developing a clear vision; easily accessible to the Agonda community and its visitors. Several early interventions can help steer tourism in a more sustainable direction.

DESIGNATE roads and paths for pedestrian use.

ENSURING walk-ability in Agonda helps preserve the natural environment.

Additionally, designated walking paths help direct the flow of tourists through the village, avoiding locations and guiding tourists through unfamiliar terrain.

IMPLEMENT a system of signs intended to act as a form of way-finding within the village.

CLEAR SIGNS can mark paths, point to the location of tourist attractions, and provide important information as to the history and rules that govern a particular place.

MAKE information on Agonda easily accessible to tourists.

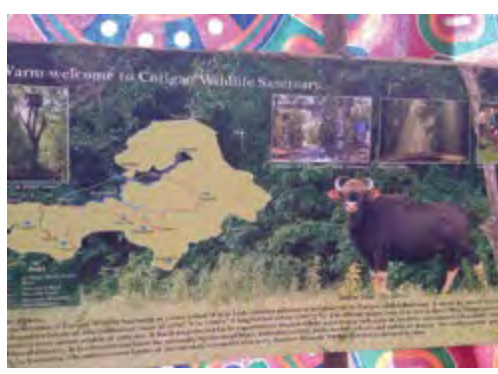
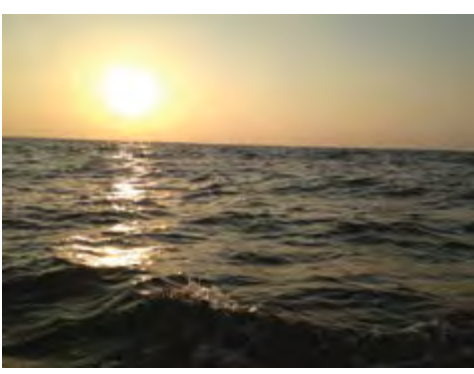
CONSIDER the creation of informational kiosks, or a visitor center.

Informing visitors can increase cultural sensitivity, encourage a more respectful tourism experience, and bring revenue to advertised businesses.

ENSURE ACCESS by local residents to natural, historical, archaeological, religious, spiritual, and cultural sites.

MONITORING and SAFEGUARDING local resident access to community attractions is essential. This can be achieved through the implementation of visitation hours to sensitive locales and clearly designated expectations for visitors.





LET'S WALK AGONDA

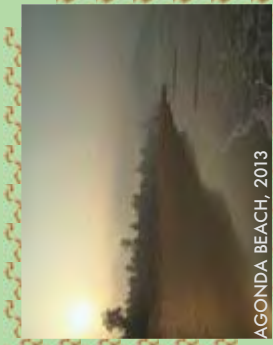
Namaskar! Hello Agonda Visitor and Friend!

Let's Walk Agonda is a collection of **sustainable tourism activities and walking tours** prepared by Agondans in a series of participatory planning workshops. The activities attempt to **promote and preserve the beautiful environment and culture** of the village. We hope that you enjoy, experience and go beyond these suggestions in your stay and future visits.

Let's Walk Agonda is a collaboration with Agonda residents and urban planning graduate students at Pratt Institute based on a series of community participatory planning workshops in 2013.

"Sustainable tourism development requires the informed participation of **all relevant stakeholders**, as well as strong political leadership to ensure wide participation and consensus building. Achieving sustainable tourism is a **continuous process** and it requires constant monitoring of impacts, introducing the necessary preventive and/or corrective measures whenever necessary."
- **World Tourism Organization, 2004**

Purchase and enjoy locally-made coconut oil!



AGONDA BEACH, 2013

Agonda Beach was voted the #1 beach in all of India and #2 in all of Asia!
- **Traveller's Choice 2013, TripAdvisor**



"Explore and appreciate the natural beauty of Agonda without exploiting its natural resources and culture. Respect the laws of the land."
- **Participatory Planning Workshop, 2013**

Try our local dish Fish Curry Rice!



Sunny Beach Walk

- 1 Take a boat trip with a local Fisherman
- 2 Enjoy a Fish, Curry and Rice at Madhu's Huts
- 3 Sip on a coffee, tea or drink at Jardim a Mar
- 4 Play a game of volleyball
- 5 Have dinner and drink at Simrose

Fun and Shopping Walk

- 1 Visit the Cola Village fish market
- 2 Take a walk down the dirt road with stellar palm trees
- 3 Shop for fashions and other beach necessities
- 4 Freshen up with some natural coconut water
- 5 Buy some coconut oil at Fabiola's store
- 6 Rent a scooter and tour the village
- 7 Join "Friends of Agonda" at Palms Beach Resort

Hiking and Architecture Walk

- 1 Tour the beautiful houses of Agonda
- 2 Hike alongside the river and views of the valley
- 3 Visit local crop and farm lands

Abandoned Hotel Walk

- 1 Tour around more beautiful houses of Agonda
- 2 Hike in the forest
- 3 Visit the Abandoned Hotel

Organic Walk

- 1 Have a fresh organic lunch at Blue Planet
- 2 Walk alongside beautiful paddy fields

Exercise Walk

- 1 Play a game of cricket
- 2 Run next to beautiful farmlands

Boat Trips

- 1 Wake up early for a fishing trip
- 2 Ride the waves to Butterfly and Honeymoon Beaches
- 3 Take a spooky nighttime trip to the river and bat palace
- 4 Dive off of boats into the deep ocean for a sunset swim
- 5 Swim and mingle with dolphins



THANK YOU!






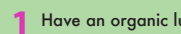





















The suggested activities in Let's Walk Agonda are meant to be used as guidelines on how to enjoy the village to the fullest. From delicious meals to secret hikes in the forests, Let's Walk Agonda intends to promote sustainable tourism practices among tourists and residents.

IMPORTANT CONTACTS

OFFICE OF THE PANCHAYAT - +91-0832-2647357
GOA OFFICE OF TOURISM - +91-0832-2438750
GOVERNMENT OF INDIA, TOURIST OFFICE,
PANJIM - +91-0832-223412

LET'S WALK AGONDA!



- | | | |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
|  Forest |  Support Local Businesses Walk |  Agricultural Walk |
|  St. Annes Church |  Architecture and Hiking Walk |  Boat Trip |
|  Religious Places |  Abandoned Hotel Walk |  Exercise Walk |
|  Rural Medical Dispensary |  Agonda Beach Walk |  1 Have an organic lunch at Blue Planet |
|  Schools |  1 Cola Fish Market |  2 Walk alongside patty fields |
|  Playgrounds |  2 Purchase locally-produced coconut oil |  1 Go fishing with the local fishermen |
|  Panchayat Ghar |  3 Experience the natural hiking trails |  2 Travel to Butterfly beach |
|  Agonda Beach Walk |  4 Rent a scooter |  1 Play cricket |
|  3 Have a lobster dinner at Simrose |  5 Join Friends of Agonda | |
| |  6 Purchase locally-produced coconut oil | |
| |  7 Visit the abandoned hotel | |

