



# Design and Construction of a Communal Laundry Station in Monwabisi Park, Cape Town

An Interactive Qualifying Project submitted to the faculty of Worcester  
Polytechnic Institute in partial fulfilment of the requirements for the Degree of  
Bachelor of Science

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December 14<sup>th</sup> 2007

## **Abstract**

Located in Khayelitsha, an informal settlement outside of Cape Town, South Africa, the Indlovu Centre seeks to promote community development through ecologically mindful practices. Our group worked with the community to design and build a communal laundry facility to help alleviate the labour-intensive task of washing. In keeping with the ideas of permaculture and sustainability central to the planned development of an Eco-Village in all of Monwabisi Park, rainwater harvesting and an irrigation system were integrated for a final design capable of operating with no input of municipal water and no emitted waste.

## Acknowledgments

A number of people have helped us to make this project a success.

We would like to thank:

Dianne Womersley, our project liaison, for her accommodations and assistance throughout the project.

Professor Scott Jiusto and Professor Stephen J. Weininger, our project advisors, for their help, guidance, advice and suggestions during the project.

Michael Tremeer of Eco-Beam for his help in providing materials, transportation and endless advice.

Patrick Carrigan, volunteer at the Indlovu Centre, who gave us a great amount of advice and helped with transportation.

Buyiswa Tonono for introducing us to many community members and helping us find our way around the Indlovu Centre.

Opah Tonono and his team of workers for all of their help with the manual labour and construction of this project.

## Table of Contents

Acknowledgments.....	iii
List of Figures .....	vii
List of Tables .....	viii
Executive Summary .....	ix
Chapter 1: Introduction .....	1
Chapter 2: Background .....	4
<i>2.1 Monwabisi Park</i> .....	4
2.1.1 Apartheid: the Politics Responsible for Informal Settlements.....	5
2.1.2 Khayelitsha .....	6
2.1.3 The Shaster Foundation and Indlovu Centre .....	8
2.1.4 The Need for a Master Development Plan.....	10
<i>2.2 The Eco-Village as an Urban Model</i> .....	11
2.2.1 The Emerging Role of the Eco-Village .....	11
2.2.2 Sustainable Development.....	12
2.2.3 Permaculture .....	14
2.2.4 Case Studies .....	15
2.2.4.1 Besters Camp: a Focus on Resident Participation .....	15
2.2.4.2 Lynedoch: an Alternative Approach to Service.....	17
2.2.4.3 The Dead Sea Valley Permaculture Project.....	18
<i>2.3 Laundry Practices in Monwabisi and Consequent Implications</i> .....	20
2.3.1 Current Laundry Practices .....	20
2.3.2 Alternate Laundry Practices.....	21
2.3.2.1 Rainwater Harvesting.....	21
2.3.2.2 Biodegradable Detergents .....	24
2.3.2.3 Simple Laundry Devices.....	24
2.3.2.4 Irrigation .....	26
Chapter 3: Methodology .....	29
<i>3.1 Community Relations and Contributions</i> .....	30
<i>3.2 Information Collection</i> .....	32
3.2.1 Interviews.....	32
3.2.2 Rainwater Harvesting.....	33
3.2.3 Laundry Site Layout .....	35
<i>3.3 Design Process</i> .....	36

3.4 <i>Final Design</i> .....	37
3.4.1 Rainwater Harvesting System.....	37
3.4.2 Laundry Station.....	38
3.4.3 Irrigation System.....	39
3.5 <i>Implementation</i> .....	40
3.5.1 Preparing the Site.....	41
3.5.2 Rainwater Harvesting System.....	42
3.5.3 Wash Trough Stand.....	45
3.5.4 Fencing and Roof.....	46
3.5.5 PVC Fittings and Gutters.....	48
3.5.6 Irrigation System.....	53
Chapter 4: Results and Discussion.....	57
4.1 <i>Completed Laundry Station</i> .....	57
4.1.1 Functionality .....	57
4.1.2 Community Use .....	57
4.2 <i>Community Implications</i> .....	58
4.2.1 Community Reaction .....	58
4.2.2 Communal Washing Facility .....	58
4.2.3 Potential Laundry Business.....	59
4.2.4 Example for Community Centre.....	59
4.2.5 Replicability.....	60
4.3 <i>Potential Project Additions</i> .....	61
Chapter 5: Conclusion and Recommendations.....	62
5.1 <i>Community Relations</i> .....	62
5.2 <i>Obstacles</i> .....	62
5.3 <i>Unskilled Labour</i> .....	63
5.4 <i>Risks of Working in a Settlement</i> .....	64
5.5 <i>Concluding Remarks and Recommendations</i> .....	65
References.....	66
Appendix A: Annotated Bibliography.....	68
Appendix B: Key Informant Interviews .....	79
Appendix C: Original Methodology .....	89
Appendix D: Preliminary Water Collection and Filtration Methods Considered.....	101
Appendix E: Instructional Signs .....	105

Appendix F: Sponsor Assessment .....	106
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## List of Figures

Figure 1: AutoCAD Layout of the Indlovu Centre.....	xii
Figure 2: Isometric Drawing of the Laundry System .....	xiii
Figure 3: Completed Laundry Station.....	xiv
Figure 4: Informal Housing in Khayelitsha .....	7
Figure 5: Members of the Indlovu Centre Preparing for a Foundation .....	8
Figure 6: Filling Sand Bags .....	9
Figure 7: The Completed Eco-Cottage .....	10
Figure 8: Sustainable Development Priority Chart.....	13
Figure 9: Area of Impact Calculations.....	23
Figure 10: Rainwater Harvesting Diagrams .....	23
Figure 11: Manual Hand Wringer.....	25
Figure 12: Mop Wringer .....	25
Figure 13: Simple Home Drip Irrigation System.....	26
Figure 14: Soakaway Cross Section .....	27
Figure 15: A Woman Doing Laundry in Monwabisi Park .....	33
Figure 16: AutoCAD Site Layout .....	35
Figure 17: Rainwater Harvesting System .....	38
Figure 18: Wash Station.....	39
Figure 19: AutoCAD Drawing of Irrigation Layout.....	40
Figure 20: ProEngineer Drawing of Irrigation Layout .....	40
Figure 22: Laundry Site Before and After .....	41
Figure 21: Breaking Rocks .....	41
Figure 23: Cutting Posts.....	42
Figure 24: Tank Stand Components .....	43
Figure 25: Installing the Tank Stands .....	44
Figure 26: Raised Platform for Lower Tanks .....	45
Figure 27: Wash Trough Stand.....	45
Figure 28: Gathering Opinions on the Height of the Basins.....	46
Figure 29: Fencing Layout.....	47
Figure 30: Right Side Gutter.....	48
Figure 31: Left Side Gutter .....	49
Figure 32: PVC Connecting the Storage Tanks .....	50
Figure 33: Cover of Overflow Tank .....	50
Figure 34: PVC Configuration.....	51
Figure 35: Tap Configuration .....	52
Figure 36: Drainage Configuration.....	53
Figure 37: Trap Configuration.....	53
Figure 38: Drilling Holes in the Irrigation Pipe.....	54
Figure 39: AutoCAD Layout of the Irrigation System .....	55
Figure 40: Installing the Soakaway System.....	55
Figure 41: Methodology Flowchart .....	90
Figure 42: Gantt Chart of Project Tasks .....	100
Figure 43: Ferro-Cement Tank Building Procedures.....	101
Figure 44: Slow Sand Filtration.....	103

## List of Tables

Table 1: Potential Rainwater Harvesting Data.....	34
Table 2: Evaluation Criteria.....	94



## Executive Summary

Rapid population growth coupled with inefficient political, economic or social systems have resulted in the creation of informal settlements in developing countries around the world. As the city of Cape Town, South Africa moves forward in the post-apartheid era, the large number of settlements that surround the city still suffer from the effects of the country's previous political system. Monwabisi Park, the southernmost division of Khayelitsha, is a predominantly black township located 30 km from the center of Cape Town. Because of the lack of community resources as well as a high unemployment rate, residents of Monwabisi Park face social and economic concerns that have led to underprivileged communities (Berner, 2004). Two years ago, the Indlovu Centre was established in one such community as a vibrant centre of community development. Officially opened September of this year, 2007, the Indlovu Centre's network of community buildings served as the primary location of our project work.

In this project, our team assessed the current laundry practices of the residents of Monwabisi Park and designed and constructed a communal laundry station that addressed the issues of water conservation, washing-related ergonomics and sanitation. The project promoted resident participation as well as concepts of permaculture and sustainability, topics too often overlooked in both developing and developed countries (Zetter, 2006).

The poverty of the informal settlements has garnered the aid of many non-governmental organizations (NGOs), such as our sponsor, the Shaster Foundation. Shaster is the legal entity representing the community work of our liaison, Dianne Womersley (hereafter referred to as Di) in developing the Indlovu Community Project in Monwabisi Park. Di spent time in different communities of Khayelitsha working to establish crèches (day care centers), deciding to settle in Monwabisi after observing an unusually strong sense of pride and good spirit exhibited by the people. After raising funds and support to build a youth centre, guest house, and community clinic in addition to the crèche, she expanded her vision to the creation of a fully sustainable Eco-Village built on ecologically responsible practices (Irrgang, 2005).

In early 2007, the HCI foundation - a philanthropic organization created by Hosken Consolidated Investments Ltd. - offered R1.5 million to build 20 Eco-Cottage style homes (wood-framed structures with sandbags providing insulation and stability through mass). The inability of the community to decide who should receive the homes, indicative of the intricate political situation, has caused the Shaster Foundation to work towards the creation of a master

plan for turning the whole of Monwabisi Park into an Eco-Village, addressing issues such as sanitation, water conservation, public space and amenities, emergency access, and promotion of community relations.

In our preliminary interviews with Di we discussed how best we could concentrate our efforts to make a significant impact in our limited time on site. It became apparent that doing laundry posed many problems for the residents of Monwabisi, and had implications for some of the broader social and environmental issues facing the community. Water in the informal settlements is almost exclusively available through municipally installed taps, with an average of about 30 families sharing one water source. Water must be carried long distances to the home in many cases, and coupled with the task of washing and wringing dry each garment, laundry is a physically taxing chore that is left solely to women. Used wash water is simply dumped into the street, creating breeding grounds for disease, and also wasting a precious resource in a region with dry summers and arid soil. Our project focus was to find a practical solution to these interconnected issues that would promote our sponsor's vision of an ecologically responsible community.

Our team designed and constructed a communal laundry station at the Indlovu Centre which addressed the issues of water conservation and sanitation. There were three main components to our design: a rainwater harvesting system, a washing station and a greywater irrigation system.

To achieve our project goals, the team identified several main objectives:

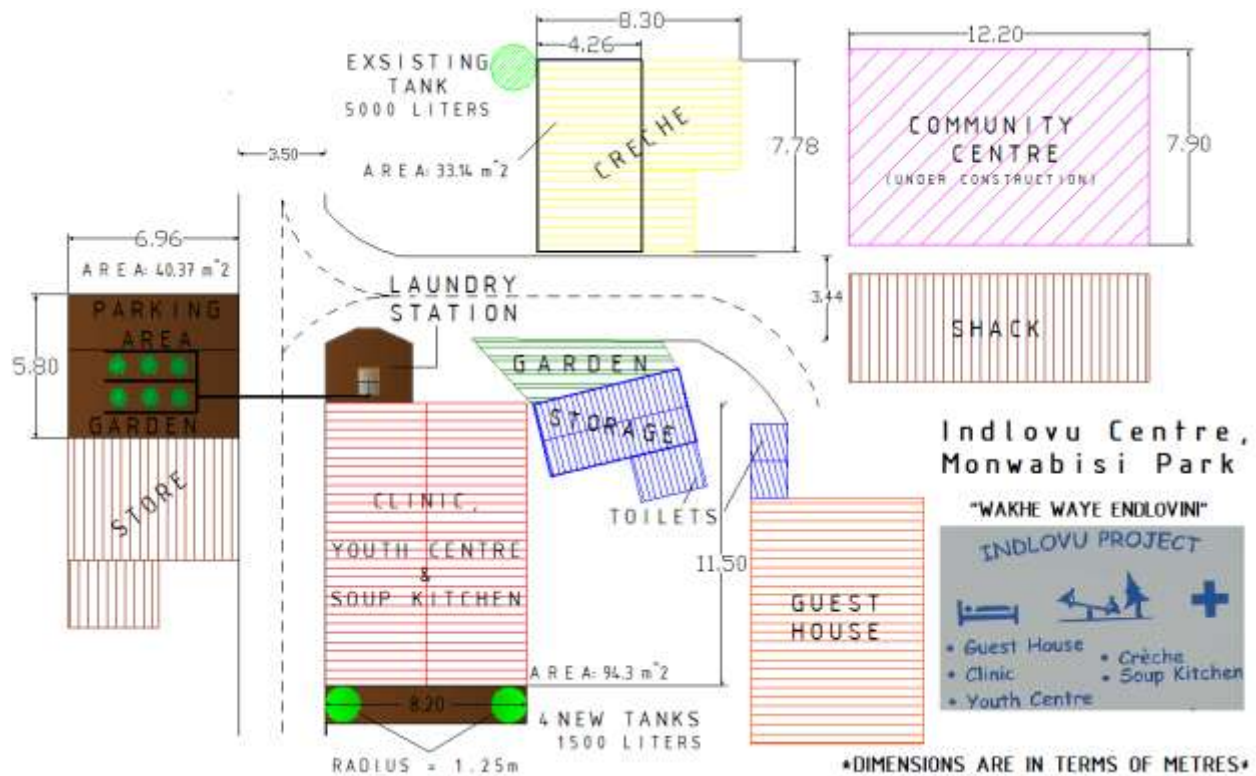
- Build strong relations within the community
- Gather information about laundry practices
- Explore options for water collection, laundry and irrigation
- Design laundry station
- Evaluate and revise proposed design
- Build laundry station

A major portion of our initial time in Monwabisi was spent interacting with members of the Indlovu Centre and gaining a better understanding of community dynamics. We spent time helping in the soup kitchen, interviewing community leaders and talking to local women about the task of washing clothes. We also spent time with members of the youth centre, helping them

with various projects such as making flowers out of recycled bottles for the Christmas tree display at the Civic Centre. The Mayor of Cape Town invited the community to the tree lighting ceremony where the Indlovu's male choir, the Khayelitsha United Black Mambazo, performed for the guests. Building strong relationships with members of the community was central to our project because those individuals played a key role in helping us with the design and construction of the laundry station. Also, it afforded the opportunity for cross-cultural exchange, sharing and friendship, all of which the Indlovu Centre considers critical to youth development and the future of the program.

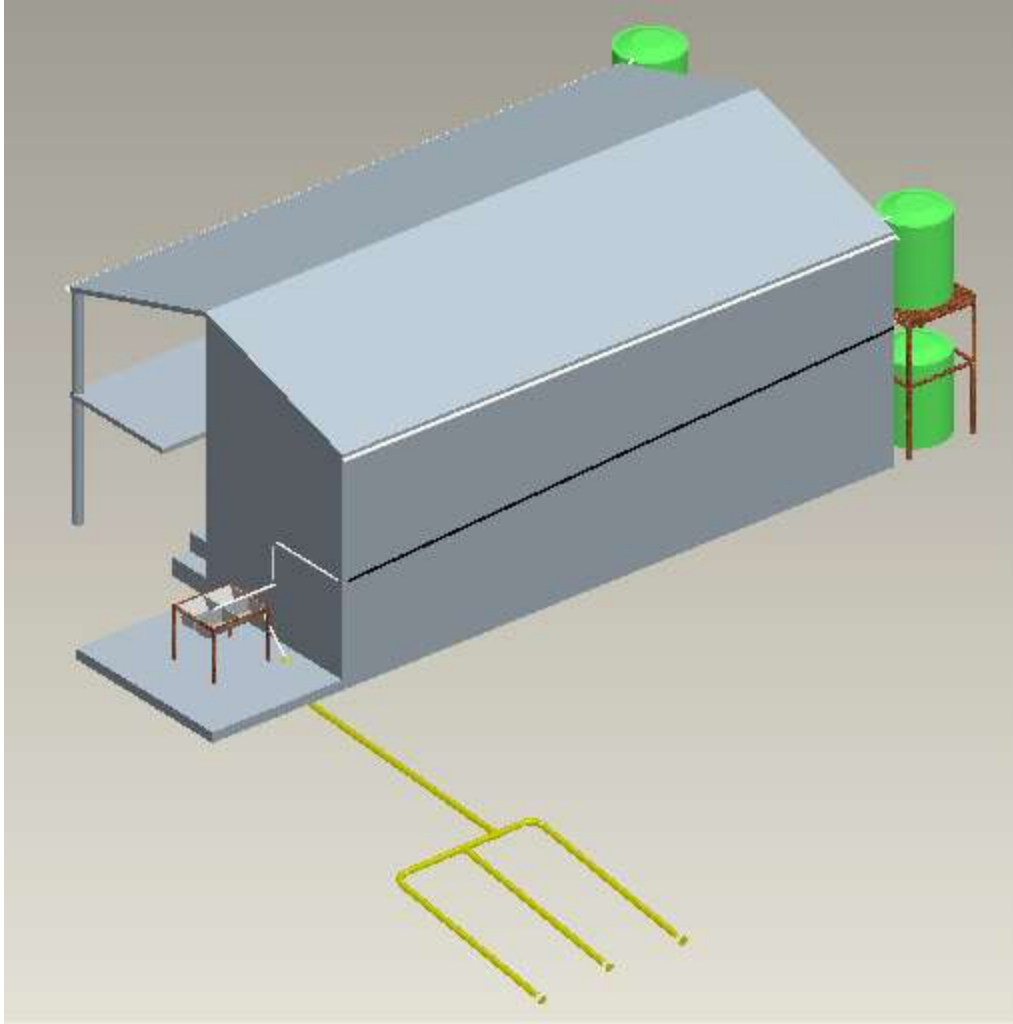
Because of the substantial amount of rainfall that Cape Town receives, our team decided to utilize a rainwater harvesting system for the laundry station. We assessed the potential amount of rainwater that could be harvested from the roof of the youth centre and organized that information into a chart based on monthly rainfall statistics. Using that information, our team determined the size and number of water storage tanks needed for the project. Research was also conducted in the area of irrigation systems. Soakaways, a slow drip irrigation method, seemed a fitting choice because of its low cost and simple design.

The design process was shaped by many considerations unique to the environment in which the system had to function. Though the existing laundry practices had many negative effects, they were extremely simple, and our design had to be at least as easy to use if it were to be successful, regardless of positive ecological impact. The social nature of the laundry process also had to be respected and preserved, requiring promotion of user interaction and minimal disturbance of existing thoroughfares and communal areas while still making efficient use of the scarce space available. A layout of the project site is shown in Figure 1. The final design evolved as a best fit to the observed opportunities and limitations present at the Indlovu Centre.



**Figure 1: AutoCAD Layout of the Indlovu Centre**

The resulting design consists of three main components: a rainwater harvesting system, a laundry station, and a greywater irrigation system. The rainwater harvesting system incorporates two 1500 litre water storage tanks fed by gutters from the roof of the youth centre and raised to a height of 2.4 meters to allow for a gravity feed of the collected water. Beneath the raised tanks are two identical 1500 litre tanks to serve as overflow containers during the winter months when our estimates suggest rainfall is likely to exceed regular water usage for laundry purposes. From the raised tanks, PVC tubing painted black to make best use of solar heating carries the stored water along the side of the centre to the laundry station in front. Four stainless steel wash basins (two sets of two facing one another) with individual taps and inclined ribbed edge are used for washing. The station is enclosed by an aluminium fence to prevent theft and irresponsible use of the water supply, and a roof of translucent corrugated plastic provides shade during the summer. From the basins, the greywater is carried by tubing which runs under the adjoining street and provides drip irrigation to a grove of six fruit trees. An isometric drawing of our final design is shown in Figure 2.



**Figure 2: Isometric Drawing of the Laundry System**

The construction of the laundry system was shared between our team and active members of the Indlovu Centre. Their labour manager organized volunteers for our project work and gave us access to all the tools that were available onsite. The water storage tank stands along with the wash basin stand were designed by our team and constructed at Eco-Beam, a company specializing in building houses out of sandbags and wood framing. The gutters were repositioned to drain into the upper storage tanks, and PVC fittings were used to route the water with ball valves used to control flow. Trenches were dug to lay the irrigation piping across the street to a small grove of three banana and three pear trees. Finally, a security fence was installed around the laundry station to prevent theft of components.

The resulting laundry facility, as illustrated by Figures 3, is an example of a sustainable system, capable of operating without input municipal water and producing no waste.



**Figure 3: Completed Laundry Station**

The finished laundry station both met and exceeded the original project goals. While serving as an example of sustainability and permaculture, the laundry system had further community implications which included a potential laundry business and low-cost replicability options for individual households. The excited reaction of those present when water was first run through the system was indicative of the positive community reception, from the women now able to do their laundry at the new facility to the workers with a place to wash up at the end of the day. In addition, the Shaster Foundation has decided to implement a similar greywater irrigation system in their coming community centre. Because the workers at the Indlovu centre took a hands on approach in the construction of this project, they have the knowledge and skills necessary to build similar systems in the future as well as a working example to follow. The project was an experience in the culture and customs of a South African township, as well as a lesson in the need for patience and flexibility throughout the design and construction process.

## Chapter 1: Introduction

Monwabisi Park, a settlement outside of Cape Town, South Africa, is one of many settlements left struggling in the wake of the country's apartheid history. The poverty faced by the residents of South Africa's informal settlements is shared by much of the developing world, where malnutrition, unemployment, and disease are among the daunting issues faced by poor and often fledgling governments. Aiding global poverty is a task that often falls to non-governmental organizations, and is the subject of much research among social scientists. It is an issue for which generally applicable solutions are hard to come by, and work is most often needed at the local level. In conditions where there is a scarcity of resources, the principles of conservation and sustainability have become increasingly useful in the effort to improve the living conditions of the disadvantaged.

Monwabisi Park was developed in the 1980's to accommodate the overflow of migrants from surrounding townships, and faces many of the same economic and social problems that have emerged in developing countries. Today, Monwabisi Park is home to over 15 thousand people with a 50% unemployment rate. The Household Subsistence Level, defined as the minimum income a family can live on in this particular area, is R1900 per month (256 USD)<sup>1</sup>, which 80% of the population fails to attain. The poor economic state of the settlement is evidenced by the fact that 67% of the population lives in informal housing. These dwellings are small, extremely basic in design and most lack running water. Sanitation systems, such as flush or chemical toilets, are a rarity in Monwabisi. Only 26% of the population has access to formal sanitation and it is estimated that on average 30 residents share one toilet (Cape Town Social Survey, 2005). A small portion of the population still disposes of human waste in buckets, a method which poses serious health risks to a community where the leading cause of infant death is poor sanitation (Interview with Di Womersley, Sept. 10<sup>th</sup> 2007). Developing a plan to address these needs and ensure public access to basic services would increase the standard of living in Monwabisi Park.

A viable solution to addressing the needs of the Monwabisi community is upgrading the settlement to a sustainable Eco-Village. This initiative was first proposed by the Shaster

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<sup>1</sup> All currency values are based on the exchange rate as of Oct. 1<sup>st</sup> 2007. 1 USD = 6.887 ZAR

Foundation, a non-profit organization that has been working in Monwabisi Park since 2005. In the past 2 years, Shaster's volunteer staff has been working hand in hand with residents to construct the Indlovu Centre, a network of community facilities that includes a health clinic, crèche, soup kitchen, youth centre and guest house. Programs have also been established to provide activities for local children, to teach unemployed women marketable crafts and to promote good personal and environmental health practices. The centre has also engaged the community in the initial stage of upgrading housing to sandbag eco-cottages. Earlier this year, the Hosken Consolidated Investments Foundation took interest in the efforts of the Shaster Foundation and offered R1.5 million to build 20 more eco-cottage style homes. Though a much needed gift, the issue of deciding which residents should receive new homes was not one that could be fairly decided by the governing body of the community, known as the Street Team. They have refused to accept any housing until a master plan has been created for the eventual improvement all homes in Monwabisi. The Shaster Foundation must now develop such a plan for the development of the Monwabisi Eco-Village, and address the concerns of the settlement while simultaneously engaging the community in the practices of sustainable development and permaculture.

The need for this master plan has presented the Shaster Foundation with much work to do. Their approaches to resource conservation must now be integrated into a plan for a functioning community, and must allow for the eventual expansion to all the residents of Monwabisi Park. Up to this point, the efforts of the Shaster Foundation have been primarily focused on addressing the expressed needs of the community, building towards sustainability by improving the status quo in a piecewise manner as opportunities present themselves. The task they face in developing the Eco-Village is not to ameliorate existing living conditions, but to design a community from the ground up, where the residents have the facilities and knowledge necessary to support themselves. This task is made all the more difficult by the conditions present in Monwabisi, which are not at all conducive to a working Eco-Village with proper sanitation, energy efficient facilities, a socially conscientious layout, and a means of producing for itself. Lessons learned and techniques developed in other Eco-Villages must be evaluated and adapted to the specific needs of the Monwabisi community. Much research is needed by the Shaster Foundation into what practical solutions are available to aid the development of their planned Eco-Village, and so it was necessary that our project team focused our efforts in order to



contribute to their more extensive development plan within the project timeframe. Through discussions with our liaison, the process of washing clothes was identified as an area of great improvement opportunity. Washing practices in Monwabisi had upstream and downstream interconnections to the broader issues of sanitation, water conservation and social interaction. Focusing on this issue allowed our team to make a considerable impact while narrowing our research domain.

The goal of this project was to assist the Shaster Foundation with their master development plan by contributing practical solutions to the related issues of water conservation, laundry practices and sanitation. A laundry station was designed and constructed using a rainwater harvesting system and an irrigation system for a resulting facility with the capability of operating with no input municipal water and no output waste. The team worked with the community through all stages of design and construction to build a system based not only on the principles of permaculture and sustainability, but on the expressed needs of the community.

## Chapter 2: Background

Informal settlements have become a common problem in developing countries around the world due to rapid population growth and inefficient political, economic or social systems. Because of limited resource availability and often minimal municipal support, these settlements face social and economic concerns that have resulted in underprivileged communities and poor living conditions. With the end of the apartheid era in South Africa, many urban upgrade projects have been initiated in the Cape Town area to address the concerns of local settlements (Engelbrecht, 2003). The Shaster Foundation is setting a precedent with their efforts to upgrade the township of Monwabisi Park to an Eco-Village and they enlisted our help to aid in the development of a master plan in order to advance the project. During the first few weeks of our project, we had several interviews with our liaison and the scope of our project narrowed from town planning to issues concerning communal laundry practices. The following section will provide a general framework for the Eco-Village upgrade project as well as more specific information on water harvesting and communal washing facilities. It will examine the history of Monwabisi Park and the work that the Shaster Foundation has done to initiate the settlement upgrade. It will explore the concepts of sustainable development and permaculture in relation to informal settlements and include an analysis of several urban upgrade case studies completed in southern Africa. Finally, it will investigate practical approaches to water harvesting and distribution and possible approaches to communal washing that could be taken in Monwabisi Park. By engaging the community and implementing a sustainable laundry system in Monwabisi, the Shaster Foundation moved closer to their ultimate goal of cultivating a thriving Eco-Village.

### *2.1 Monwabisi Park*

Monwabisi Park, situated on the coast of False Bay, is the southern-most division of Khayelitsha, a black township in South Africa. Located only 30 km from the centre of Cape Town, Khayelitsha is home to between 500,000 and 1,000,000 residents; determining the exact population is difficult given the unregulated occupation of the land. Despite its appealing coastal location and potential for development, Monwabisi faces pervasive social and economic

problems (Berner, 2004). To fully understand the context of the township, one must look at its history; a development linked closely to South Africa's political and social past.

### **2.1.1 Apartheid: the Politics Responsible for Informal Settlements**

During the apartheid era, black Africans were restricted from entering South Africa's urban areas by a set of laws and regulations known as influx control. These laws facilitated the exploitation of inexpensive black labour, while also decreasing the number of labourers in white urban areas (Maylam, 1995). However, with the gradual dismantling of those laws in the 1970s and with the eventual elimination of influx control in 1986, backyard shacks and informal settlements began to appear on the outskirts of major cities.

Unsure how to control the growing populations in formal residential areas and informal settlements, authorities resorted to 'urban renewal' projects which commonly entailed eviction or forced relocation by demolition. These drastic attempts to relocate large populations of black South Africans were met with strong opposition and eventually the government dropped their removal policies altogether (Engelbrecht, 2003).

The end of the apartheid in 1994 promised a more secure future for black South Africans and people began to move in even greater numbers from rural areas to cities in search of job opportunities. Large areas of public land were soon occupied by small, informal shacks. The government was unable to keep up with the demand for housing and populations in informal settlements continued to grow. These settlements, including Khayelitsha, were without schools, health clinics, community buildings and even formal roads due to government policies that prohibited construction on illegally occupied land. Basic amenities became luxuries to the unemployed residents of poor communities. Such conditions as these have led to a spike in crime rates and widespread substance abuse (Engelbrecht, 2003).

The system of apartheid made it possible for wealthy communities to exist alone, with almost isolated economies that require minimal contact with the poor. Due to this underlying historical economic segregation, informal settlements lack the resources necessary to remain sustainable and many residents are forced to commute to wealthier areas looking for work or begging for money (Swilling, 2006). Today, poor living conditions and the absence of basic

services in informal settlements are considered some of the biggest and most urgent issues facing South Africa.

### 2.1.2 Khayelitsha

Khayelitsha was established in 1983, four years prior to the complete elimination of influx control. When the surrounding townships of Langa, Guguletu and Nyanga were unable to support the masses of black Africans migrating to Cape Town, arrangements were made for Khayelitsha to be built. Planners strategically located the settlement between the coast and the N2 highway so that authorities could easily control the small number of entry points. They projected the settlement would house 250,000 people, less than half the population it is today. The layout of the township was structured solely for the development of small dwellings and no considerations were made for public access to basic services, community centres or health clinics (Berner, 2004).

Because of the context in which Khayelitsha was developed, the township still lacks the essential basic services and public facilities that the residents need. With little formal activity and few economic opportunities in Khayelitsha itself, over 50% of the population is unemployed. According to a survey conducted in three informal settlements in Cape Town, the average household consisting of 3 to 5 people has a monthly income of only R1315, about USD191, which includes state support grants that 41% of the population receives. The Household Subsistence Level is defined as R1900 per month which only 20% of the population reaches. The extreme poverty that many of the residents face is evident in the fact that 61% of households don't always have food to eat (Cape Town Social Survey, 2005).

With most residents belonging to the low-income economic group, 67% of the population in Khayelitsha lives in informal housing (Cape Town Social Survey, 2005). The physical infrastructure of these houses is very basic and they are built from an array of recycled materials. Although most of the dwellings have access to electricity, almost none of them have direct access to water. Most households have resorted to using paraffin for energy needs such as cooking. Although it is a cheaper alternative to electricity, it can be dangerous and few residents are informed of the safety issues. Paraffin stoves lead to hundreds of shack fires a year in

Monwabisi alone, leaving already hard-pressed families without homes (Interview with Di Womersley, Sept. 10<sup>th</sup> 2007). Typical informal housing in Khayelitsha is pictured in Figure 4.



**Figure 4: Informal Housing in Khayelitsha**  
(<http://www.isrg.info/sitebuilder/images/Khayelitsha-458x390.jpg>)

Formal sanitation, such as flush or chemical toilets, is only accessible to 26% of the population. It was estimated that on average 30 residents share one toilet (Cape Town Social Survey, 2005). A tenth of the population still relies on the bucket system, wherein residents dispose of human waste into a bucket that is emptied and reused. This method poses seriously health risks to the community. With poor sanitation conditions being the leading cause of infant death in the area, sanitation is one of the most pressing issues facing the settlement (Khayelitsha Population Profile, 2004).

Monwabisi, along with most of the informal settlements dotting the map of Cape Town, is in dire need of upgrading. The living conditions in the settlement are unacceptable by any standard. Addressing the needs of sanitation, water and electricity access, the lack of community centres, job opportunities and the poor infrastructure of the shacks is critical for the future well-being of the community.

### 2.1.3 The Shaster Foundation and Indlovu Centre

The information in this section and the one following was collected through the Shaster Foundation website and interviews with our project liaison and founder of the Shaster Foundation, Dianne Womersley.

Prior to beginning her work in Monwabisi, Di spent time in different communities in Khayelitsha working to establish much needed crèches, or daycare centres. Her decision to stay in Monwabisi Park was largely based on the capability and sense of pride exhibited by the community, who collectively raised R1000 as funding for their own crèche, a very large sum given the poverty of the area. Through a cooperative relationship with the Monwabisi residents, she helped to expand the crèche into a group of facilities dubbed the Indlovu Centre, including a community clinic, soup kitchen, guest house, and community garden. The centre offers the basic services most needed in Monwabisi, and runs programs to offer productive activities for local children, teach unemployed mothers marketable crafts, improve literacy and professional skills, and promote good personal and environmental health practices.



**Figure 5: Members of the Indlovu Centre Preparing for a Foundation**

Finding that many organizations would not donate to an unregistered cause owing to the lack of tax benefits, The Shaster Foundation was created as a legal entity to represent the efforts

of Womersley and a small team of volunteers. The Foundation asserts on its website that it is “a non-profit organisation staffed by volunteers who care passionately about Africa, traditional culture, the environment, and respect for all peoples.” In parallel with the creation of the Indlovu Centre, the Shaster Foundation has experimented with many techniques of resource conservation and waste management, reflecting Di’s background as a permaculturist. Examples are the earthworm toilet which converts waste to fertilizer for the community garden, biogas digesters used to collect methane from natural decomposition, solar ovens made from little more than cardboard boxes and aluminium foil that can be used in place of gas stoves, and a 5000 litre tank which collects rainwater from the roof of the crèche for use during the dry season. The Shaster Foundation has also developed an inventive relationship with the Cape Town film industry wherein old movie sets are donated and used as building materials at the Indlovu Centre.

The Shaster Foundation’s approach to helping the community is through assistance rather than administration. The community expresses a need, the Foundation seeks to find a solution, and the residents then provide the labour necessary to make it a reality. A principle achievement of this collaboration has been the construction of the first Eco-Cottage, a two story duplex-style home built of and sandbags and a wooden framework (pictured in Figure 6 and Figure 7).



**Figure 6: Filling Sand Bags**





**Figure 7: The Completed Eco-Cottage**

The community built structure serves as a potential model for the type of sustainable home that one day the Foundation hopes will serve as the primary dwelling in Monwabisi Park.

#### **2.1.4 The Need for a Master Development Plan**

Early in 2007, the HCI Foundation - a philanthropic organization created by Hosken Consolidated Investments Ltd. - took interest in the Shaster Foundation's efforts and offered R1.5 Million (~ \$217,800) to build 20 Eco-Cottage style homes. Though the donation was much appreciated, it posed the difficult question of who would be chosen to live in the new homes. The decision was left with the local governing group, known as the Street Team. A council of 8 respected community members, the Street Team is a body elected in each of the five subdivisions of Monwabisi Park to decide on disputes, carry out penance, and serve as the representing voice of the people. It was decided that there was no fair way to choose who should receive the new homes, and that none would be accepted until a plan was developed to guarantee the eventual inclusion of all the residents of Monwabisi in the upgrade.

The Shaster Foundation is now in an excellent position to make a difference in the community, but the challenges they face are significant. They have been given the opportunity to plan a sustainable community from the ground up, following the Eco-Village model (a concept to be explored in the following sections), but must find ways to adapt the theory to a system that will be able to function in the conditions specific to Monwabisi. A great deal of research and preparation is required to present a plan considerate of community layout, resource conservation,



emergency service access, renewable energy sources, waste management, public facilities, and utilization of common space, among others. Though we could not hope to ameliorate all of these issues during the project period, it was our goal to assist the Shaster Foundation by focusing on a practical solution involving the often overlapping problems of water conservation, communal laundry, and sanitation, which will be expanded upon later in this paper.

## ***2.2 The Eco-Village as an Urban Model***

In order to appreciate the Shaster Foundation's intent in planning an Eco-Village, it is necessary to understand the evolution of the idea and its underlying principles. This section will explore the Eco-Village as a potential model for upgrading informal settlements by exploring its development and current role, establishing the central ideas of sustainable development and permaculture, and evaluating case studies from which lessons may be learned.

### **2.2.1 The Emerging Role of the Eco-Village**

Urbanization coupled with global population increase has put tremendous strain on the modern city. Over 50% of the world's population now lives in cities, and the percentage is expected to rise to 75% by 2050, when the world population will be an estimated 9 billion (Irrgang, 2005). This influx brings with it a great demand for the resources, jobs, and living space that are already in high demand in urban centres. Without assertive action, the urban migration will become unmanageable, and thus the need for planning has become an increasing concern. Much research has therefore been dedicated to finding solutions sympathetic to the social, environmental, and economic considerations of urban development.

The solution central to our project, and one that has emerged as an urban model with considerable potential, is the Eco-Village. As its name implies, the concept of an Eco-Village is that of an ecologically mindful community emphasizing conservation and self-sufficiency to promote a lifestyle that is both environmentally maintainable and socially meaningful. Through inventive techniques of resource and energy management, Eco-Village residents seek to minimize the harmful effects of their habitation on the surrounding environment and reduce the need for purchasing externally produced goods and services (Irrgang, 2005). Eco-Villages draw

heavily in theory from the ideas of permaculture and sustainable development, both to be explored later in this report. An element common to any successful Eco-Village is a strong sense of community, promoted through both cooperative labour and housing layouts conducive to communal relationships (Gori, 2005).

The Eco-Village can trace much of its history to settlements founded out of a personal interest in conservation, rather than the need to improve a standard of living. Intentional communities such as the Findhorn Foundation Community Eco-Village in Scotland and Crystal Waters in Australia - designed from the ground up and backed by funding institutions - have led to a common view of Eco-Villages as elitist and even utopian ventures. The Eco-Village has, however, found a niche through necessity in the urban sprawl surrounding urban centres in many developing countries. The universality of the ideas of sustainable development and the variety of ways in which sustainable techniques can be applied by residents to their individual environment makes it an urban model that can be applied to many scenarios, from inner city Los Angeles to, as in our case, informal settlements (Irrgang, 2005).

Though the case studies explored later in this paper stand as proof that the Eco-Village concept is a viable one, it is essentially reliant on the willing participation of the community, and is unlikely to be successful if imposed upon the residents of impoverished areas without due introduction and a period of transitional learning. People's needs have differing priority depending on location, and each attempt at creating a working Eco-Village will be faced with unique hurdles. It is through adherence to the underlying principles on which Eco-Village theory is built that an ecological and societal balance may be sought, and the goal of economic advancement may be thereafter pursued.

### **2.2.2 Sustainable Development**

The concept of sustainable development is one that has held the attention of urban planners for the past two decades. In 1987, after the publication of a report by the Brundtland Commission, also known as the World Commission on Environment and Development, the idea became a popular and widespread notion. The central focus of sustainable development is utilizing and conserving natural resources, which is considerably important in developing countries where resources are limited (James, 1996).

Sustainable development is a strategy that ensures the permanence of resources that a community depends on while also allowing for their reproduction (James, 1996). There are three general focus areas: economic development, social development and environmental protection. The ultimate goal of sustainable development is finding a priority balance between those areas as well as private interest and public good. This accord is pictured in Figure 8. However, addressing the issues that arise when trying to find that balance is not always an easy task. Conflicts in property use, resource consumption and social justice are common concerns. Because of this, sustainability is a continual process that needs constant evaluation and modification (Campbell, 1996).



**Figure 8: Sustainable Development Priority Chart**  
(<http://www.dfes.gov.uk/aboutus/sd/images/image002.jpg>)

The political and social changes that are still affecting post-apartheid South Africa have forced urban planners to adapt their practices to a new society. The planned oppression of the previous government resulted in informal settlements and gated communities with social and economic inequities that contradict the core theory of sustainable development. In 2000, the new government took action by creating the Integrated Development Plan (IDP), which forces municipal governments to secure funds for infrastructure, service and delivery processes. The goal of the IDP's integrated approach is to reduce poverty, increase local economic activity, lower unemployment and encourage development. However, in most cases the secured funds are not sufficient and additional support is needed to help communities move toward sustainability (Zetter, 2006).

Determining the resource availability and consumption in a particular region is important to initiating the sustainable development process. In Monwabisi Park, it is clear that resources are limited, both physically and economically. In order to successfully upgrade the informal settlement to a sustainable Eco-Village, much consideration will need to be given to the allocation of resources in an effective manner, while still allowing for reproduction of those resources.

### 2.2.3 Permaculture

Mollison and Holmgren, co-originators of the concept “permaculture”, mapped out global principles to help instil people with a sense of responsibility for their ecological surroundings. Permaculture is a conjunction of the words “permanent agriculture” or “permanent culture,” stressing a relationship between the earth, humans, plants, and animals. Permaculture principles incorporate integrated and holistic aspects in design and analysis methodologies. They include three factors - care of the earth, care of people and setting limits to population and consumption. These principles bring environmental, ethical, logistical and physical components together to form a universally applicable framework for an environmentally sound lifestyle (Diver, 2005).

Lawton and Sindhu, international permaculture teachers and design consultants, have introduced the permaculture principles to the citizens of seventeen countries (see Section 2.2.4.3). By teaching the permaculture system as the foundation of their work, Lawton and Sindhu have helped teach the people in these countries how to provide for their needs in an environmentally responsible manner. Lawton and Sindhu did extensive work for a project based in the Middle East called the Dead Sea Valley Project which dealt with water shortages, highly salted lands, unsustainable housing and infertile soil. In the end, the application of the principles of permaculture exhibited positive results (Bell, 2004).

It should be noted that the permaculture philosophy is not always feasible. There is no direct approach to its application. Principles may be conceived differently by different people and the clarity of the principles may not always be apparent. A change that one person is willing to make may be difficult for other individuals to acclimate to. Because of this, permaculture principles may face resistance among members within a community. Our position as foreigners in Monwabisi Park caused minor scepticism among the residents. But this was soon changed

when we approached the community with an open-mind and began to interact with the children, adults and community leaders.

As our liaison is a trained permaculturist, some aspects of permaculture have already been integrated into Monwabisi Park. We continued our sponsor's efforts in encompassing the principles of permaculture in our project. Our group worked closely with Dianne Womersley to ensure that our ideas and plans follow a permacultural approach. The Indlovu team used the principles of permaculture to help encourage living in an environmentally friendly and safe manner.

#### **2.2.4 Case Studies**

One useful method of studying sustainable urban upgrading is to examine case studies - articles documenting approaches that have been taken in the past to deal with similar situations in different parts of the world. Case studies are a valuable tool when looking for a starting point to most projects because they explain a certain problem, what was done to fix it, and what did and did not work. Learning from what has been done in the past is a straightforward and effective way to further educate and prepare for a project.

##### ***2.2.4.1 Besters Camp: a Focus on Resident Participation***

The following information was taken from van Horen's (2000) *Informal settlement upgrading: Bridging the gap between the de facto and the de jure*.

Besters Camp is an informal settlement located on the edge of Inanda, the largest informal district in Durban, South Africa. Besters Camp is home to over 50,000 people and it is divided into four distinct sections, each with a population similar to that of Monwabisi. The upgrade of Besters camp was initiated by the Urban Foundation Informal Settlements Division after the removal of influx control in the late 80's and the effort continued well into the 90's. Although it was partially funded by the City of Durban, the central government was not involved with the upgrade, as is also the case in Monwabisi.

The main objectives of the upgrade included the delivery of basic services, strong resident participation in both planning and execution, dwelling upgrades and obtaining formal

land tenure. The first phase of the project focused primarily on meeting the needs of the community. This included the creation of roads, footpaths, a water drainage system, providing a ventilated improved pit (VIP) toilet at each site and an electricity connection in each residence. According to Basil van Horen, a member of the Besters Camp project team, one of the reasons the upgrade was so successful was the fact that there was little resident relocation while these improvements were completed. Like Monwabisi, there was little vacant land in Inanda to build on, but the planners managed to keep the relocation rate under 1%. Other outcomes of the initial development phase were the construction of several communal facilities including health and education centres, a training resource centre, and the implementation of various educational programs. During the initial stage of the Eco-Village project, the Shaster Foundation took a similar approach in developing the Indlovu Centre, a network of locally built facilities offering similar amenities.

What made the upgrade at Besters Camp so unique was the strong emphasis on resident participation. The planning process, which evolved over time, was carried out by residents of all economic and social levels. The involvement of the community members varied from decision making to advising on locations for facilities to be built. This process ensured results that were not only successful from a technological point of view, but also from a social point of view. Also, planners had a strong understanding of the dynamics of the settlement and took time initially to get a feel for how the settlement operated. Because perceptions, values and priorities are not always the same from one informal settlement to another, having an understanding of the social aspects of a community is critical in trying to plan its upgrade.

To facilitate public participation from the start, “representative local development committees” were created to serve as a liaison between UFISD and the residents of Besters Camp. These liaisons served as the voice of the residents and led public meetings that anywhere from 100 to 1000 community members attended. The development committees were organized into six different structures including informal liaisons with individuals and households, local committees delegated to specific regions, the coordinated development committee, functional committees (water, health and welfare, employment), mass public meetings and workshops. These leadership groups worked with other organizations to facilitate the upgrading process.

The approach to planning that was taken in the Besters Camp upgrade is one that could be considered when the master plan for the Eco-Village in Monwabisi Park is further developed.

The interest in providing basic services to the community based on their expressed and prioritized needs is one shared by Shaster Foundation. Also, the extent to which the public was involved with the decision making and the upgrading process itself should also be noted as an essential quality of any informal settlement upgrade.

#### ***2.2.4.2 Lynedoch: an Alternative Approach to Service***

The following information was taken from Swilling & Annecke's *Building sustainable neighbourhoods in South Africa: Learning from the Lynedoch case*.

Lynedoch, located in Stellenbosch near Cape Town, was the first Eco-Village built in South Africa. The project's primary focus was on balancing growth, equity and sustainability in relation to sanitation, waste removal, energy, building materials and food security. Development of the Eco-Village was initiated by the Lynedoch Development Company, a non-profit organization, and aided by the Sustainability Institute and the School of Public Management and Planning.

What was unique about the Lynedoch case was the approach that planners took to providing the community with basic services. Knowing that the design of the Eco-Village needed to be cost effective both in the present and the future, the project team did extensive research on the price of certain amenities and their projected costs in the future. The team found that the cost of most basic services would rise faster than the average rate of inflation over the next 20 years. To address this dilemma, the planners focused on two issues simultaneously – providing the community with the basic services needed while also focusing on reducing the scale of those needs. The primary areas that were addressed included “reducing water consumption in each house, treating all waste water on site and re-using it, reducing household energy consumption and eliminating the need for solid waste removal from the site.”

Having access to water was one of the most pressing needs of the community. The development plan ensured that each unit was supplied water from the main municipal water line and that recycled water would be used for flushing toilets and irrigation. Households were installed with two separate meters, one to track water drawn from the municipal water line and one to track recycled water. Recycled water was provided at a lower fee. When applicable,

water-saving taps or showerheads were used to reduce the amount of water used per household. Rainwater harvesting was encouraged and storm water run-off was channelled to a dam at the bottom of the site to keep the groundwater level high.

Energy needs were also addressed in the Eco-Village development. Each house was provided electricity from the national grid but solar water heaters were installed to reduce electricity consumption by an estimated 60%. Also, cooking was done on low-pressure gas hobs, an alternative to electric stoves. Proper orientation of houses contributed to natural heating and cooling and roofs were designed to provide enough shade in the summer but allow enough light in the winter. Like the water-saving taps, low-energy light was installed where appropriate.

Finally, the issue of solid waste removal was addressed. A system was put into place where household waste could be passed through a septic tank that isolated the solids and passed the rest of the effluent to the bottom of the site where there was a “vertically integrated constructed wetland.” This wetland served as a multi-layered filter which cleaned the water so that it could be used in flushing toilets and for irrigation purposes. The solids were then sent to a Biolytix filter, similar to the earthworm toilets in Monwabisi, and those solids were in turn used as fertilizer. Like the earthworm toilets, the Biolytix filter is odourless and requires no chemicals so it is environmentally friendly. Biogas digesters were used in place of septic tanks in some areas to dispose of human and kitchen waste. The natural methane gas that resulted from the biogas digesters was then used to cook with, a technique that is also used in Monwabisi.

Although the overall success of the Lynedoch Eco-Village is still being debated, the approach that was used to simultaneously supply the community with basic services and to reduce the need for those services is one that should be considered when planning any type of urban upgrading. While having access to water, energy and adequate sanitation systems is critical for any development project, it is also important to look toward the future and make sure the systems implemented are in fact sustainable.

#### *2.2.4.3 The Dead Sea Valley Permaculture Project*

In August of 2000, the Dead Sea Valley project was initiated in Jordan, just east of the Jordan River. Lawton and Sindhu’s first trip to Jordan was spent designing sustainable housing for a ten acre piece of land that was highly alkaline and salted. They returned in December of



that same year and taught the men and women in the Dead Sea Valley area a 72 hour course on permaculture design, and then proceeded to direct the construction of water harvesting swales - ditches with an uncompacted earth mound on the lower side, usually used as a system for growing trees. To conserve water in an area where water evaporation was rapid, a deep dam was added to this design. Before Lawton and Sindhu's departure, instructions for building a fence and installing a drip irrigation system under layers of thick mulch were left for the local people to build. One thousand and fifteen trees were planted in a fenced-in area and in less than one year all trees had grown, with only seven lost.

A year after their initial visit to the project site, Lawton and Sindhu arrived in Jordan for a third time. Many farmers were surprised by the growth of the trees; their expectations of the growing fruits were low because of the overly salty soil. The summer of 2001 brought very harsh weather with low rainfall, but as a result of the growth system the trees soon flourished in December of that same year. The site had produced onions and winter barley which grew readily between the water harvesting swales. Fig, pomegranate and guava trees remained fruitful, all in soil with high pH and salt levels.

Lawton and Sindhu returned once again in April of 2002, a year after the initial planting of the trees. The site had started to resemble a small forest along the water harvesting system. An educational centre was built, with a self cooling system that operated without need for fuel. Their intention was to demonstrate to the local people that there was no real need for expensive, energy consuming housing designs. The positive outcomes of the project attracted numerous people including agricultural engineers and governmental officials as well as groups from academic institutions and professional bodies. Attraction to the permaculture way resulted in an organic research project set up by the Jordanian Agriculture Department (Bell, 2004).

Although the location of the Dead Sea Valley Permaculture project differs from that of the project in Cape Town, much can be learned from the successful permaculture methods used. When Lawton and Sindhu travelled to Jordan, they tailored the permaculture principles around the dry climate of the project site. We needed to take a similar approach in Monwabisi and tailor those principles to the rainy and dry seasons. In making constructive use of this case we related the practices introduced to some of our main research topics - climate issues in gardening, water shortages and water conservation.

Each case study displayed instances of success, failure and techniques to improve upon current situations. Main principles from each case have helped our team identify the most effective practices that were instituted. In all three cases the most common focus was on providing basic services – food, water, public facilities. Other priorities were centered on reducing community needs like water and energy consumption via sustainable development practices. In many instances, most positive results were seen through a high level of community involvement. Making practical use of this information helped to emphasize the importance of creating a project that touches upon all the principles mentioned.

### ***2.3 Laundry Practices in Monwabisi and Consequent Implications***

As our project team developed a working knowledge of Eco-Village principles and urban upgrading procedures, we came to realize that the original project objective of developing a master plan for the upgrade of Monwabisi Park was outside the scope and timeframe of our project. As we discussed this issue with both our liaison and our project advisors, we decided to focus our efforts on a more specific area where we could make a considerable impact. During initial phone interviews with Dianne Womersley, we noted that water supply and sanitation were areas of main concern in Monwabisi. As conversations with our sponsor continued, our project focus narrowed to the area of communal laundry practices. We decided to focus on this particular expressed need because the upstream and downstream effects of washing offer multiple improvement opportunities. By focusing our work on alternative water supplies, improving laundry practices and developing a filtration or irrigation system for reuse of greywater, our team contributed to the upgrade of Monwabisi Park in a manner that was congruent with our timeframe and engineering capabilities.

#### **2.3.1 Current Laundry Practices**

Information in the following section was taken from an interview with Dianne Womersley, October 5<sup>th</sup>, 2007.

The practice of washing clothes in Africa is considered more of a social event than a chore. In Monwabisi, like most other regions of Southern Africa, the task is completed by

women who use the opportunity to come together and share news, stories and song. Unlike westernized cultures where there is desire for personal space, African townships share a feeling of closeness and community spirit which is channelled in the communal washing activities of their women.

When the sun is out, women in Monwabisi travel to municipal water taps to collect water for washing in a bucket. There are about 20 to 30 households to one tap but the water is free. The women return to their homes and wash clothes completely by hand in big plastic tubs. When they finish, the water is thrown into the street and they return to the tap to collect water for rinsing. The clothes are hung to dry on whatever is available. There are washing lines strung between housing and on the outskirts of the settlement, and people utilize fences for hanging.

As areas of Khayelitsha move toward urbanization, the social fabric of the shared community begins to break down. This is a notion that the Shaster Foundation is aware of and trying hard to circumvent. Because of this, our team approached the improvement of laundry practices with care not to overlook the social aspects of the task. We spent a portion of our initial time in Monwabisi observing the current washing practices and looking for ways to improve them without jeopardizing their social value.

### **2.3.2 Alternate Laundry Practices**

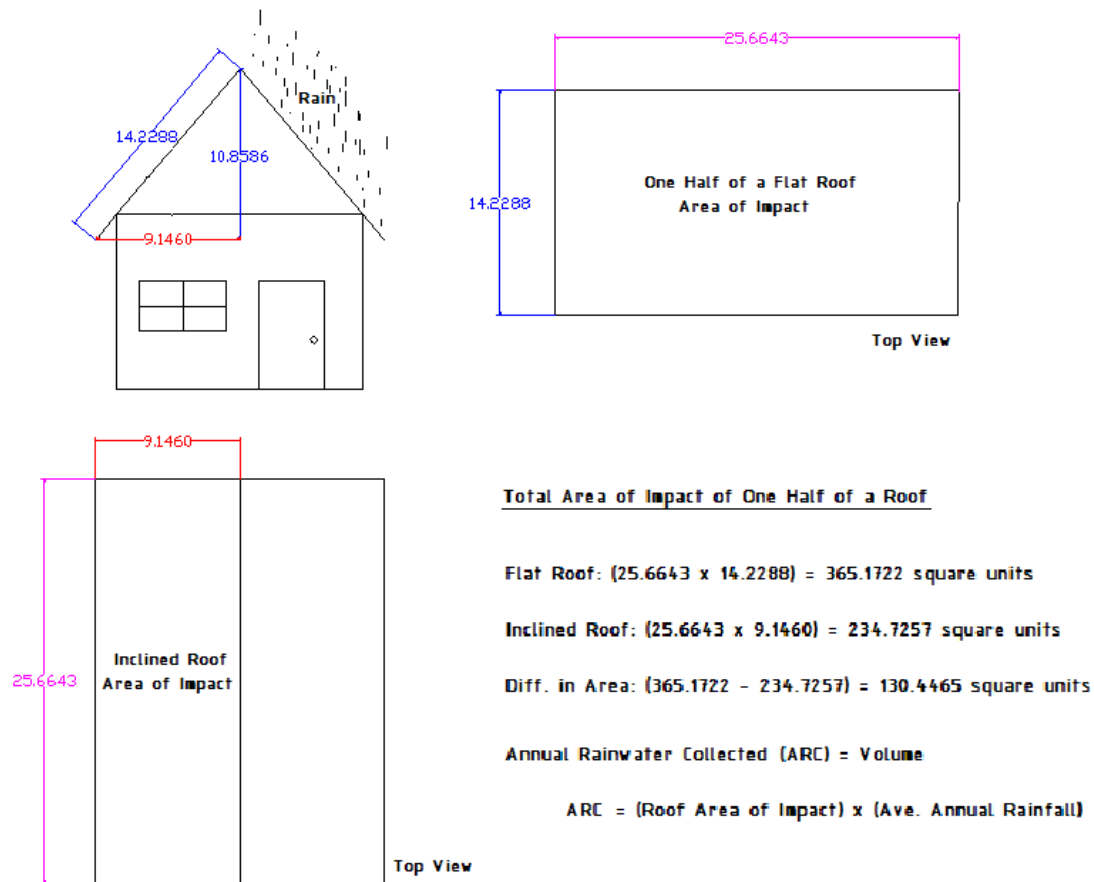
There are many improvement opportunities in the area of communal washing. The process of doing laundry can be broken into three activities: water collection, washing and water disposal. Our project team looked at utilizing alternative water supplies such as rainwater harvesting, improving the washing process by using biodegradable soaps and simple laundry devices, and making water disposal more efficient by filtering the greywater and using it for irrigation purposes. The following sections outline these ideas in greater detail.

#### **2.3.2.1 Rainwater Harvesting**

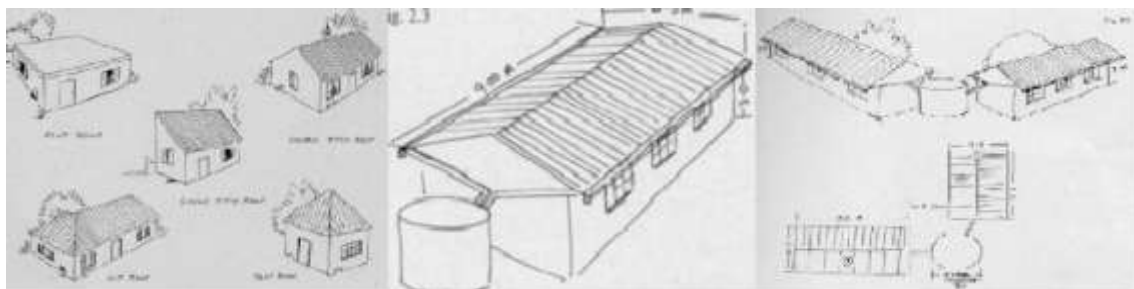
Residents of Monwabisi Park currently obtain free water for drinking, washing, and cooking from municipal taps which are shared between 20-30 households. They walk from their houses to the tap, collect the water in buckets, and bring it back to their houses. The Indlovu Centre has a direct water connection from the municipal tap to the clinic and guest house, and

also harvests rainwater from the roof of the crèche, which is channelled to a 5,000 litre storage tank behind the crèche. The water harvested from the roof is used by the neighbours, and the tank is conveniently situated for them. The problem with the storage tank is that no matter how much water is collected during the rainy season, there is not enough for the duration of the dry season, and having one tank becomes an unreliable source when there is a shortage of rainfall in a year. The rainy season is from April to August, and the dry season is from November to March. The youth centre has a large roof area that can be used for rainwater harvesting, but the space for collection tanks is limited since the shacks in Monwabisi are so close together (Interview with Dianne Womersley, September 24<sup>th</sup> 2007). One possibility for improvement that was discussed before arriving in Africa was to find ways to take advantage of the large roof area of the youth centre and potentially the surrounding shacks to harvest rainwater.

A practical method to calculate the amount of rainwater that can be collected from a roof can be applied by simply knowing the dimensions of the roof and the average annual rainfall of the particular region. This method consists of taking the dimensions of the roof to calculate its area of impact and multiplying that value by average annual rainfall. The area of impact is considered the area where the rain hits the roof. When using this method, the shape of the roofs needs to be taken into consideration. If the water is collected from a flat roof, the area of impact will be the same as the total surface area of the roof, but when the roof has an inclination the area of impact becomes smaller; the greater the tilt of the roof, the less the area of impact (Figure 9). The roof needs at least some inclination so the water can flow into the gutter and then into the tank through connecting channels as shown in Figure 10. Taking this into account, roofs that are almost flat are the best for harvesting rainwater, since more rainwater can be collected. (Gallardo, 2002)



**Figure 9: Area of Impact Calculations**



**Figure 10: Rainwater Harvesting Diagrams**  
<http://www.sociedadcivil.cl/nuevodiario/servicios/redir.asp?Id=667>

Tanks are available in different sizes ranging from 500 litres to 5000 litres. They are most commonly cylindrical and can be purchased to be positioned vertically or horizontally. Tanks can also be constructed such as the ferro-cement tanks (See Appendix D). Our team was able to determine the size and number of tanks needed to harvested water from the roof of the youth centre based on the calculations explained above.

### ***2.3.2.2 Biodegradable Detergents***

One of the obstacles to recycling greywater (defined as waste water from any source other than toilets, which is known as blackwater) produced from washing in Monwabisi is the presence of harmful chemicals in commercial laundry detergents, which as our sponsor has explained are bought with cost as the primary consideration. Commercial detergents contain chemicals used to lower the surface tension of water (surfactants), kill bacteria, enhance colour and add fragrance, and neutralize calcium and magnesium which causing water “hardness.” Some of these chemicals are often slow to biodegrade, and in many cases are unsafe to expose to the environment. Phosphates, though a nutrient important to many ecosystems, are commonly used as surfactants and can cause imbalance in naturally occurring levels when detergents are released into the environment. Other chemicals have been shown to be toxic and even carcinogenic to animal life, and potentially to humans in large enough quantities (laundry-alternatives.com, 2005).

The chemical composition of most commercially available detergents renders laundry water unusable for agricultural recycling. Harmful detergent components can hinder the growth of plants, or contaminate vegetables meant for human consumption. A possible solution to this is biodegradable detergents, made from natural ingredients. A variety of companies make these environmentally friendly detergents in both powdered and liquid form, which could serve as a replacement for those in current use. The feasibility of this option will depend on the relative cost between natural and synthetic detergents available in the Monwabisi area, but should be considered in comparison to potential yield in garden-grown food and the health benefits associated with the elimination of wastewater cesspools.

### ***2.3.2.3 Simple Laundry Devices***

Although installing modern appliances like washers and dryers in Monwabisi Park was not practical at the time of our project, we believed introducing simple devices to aid in the laundry process could prove beneficial to the community. As it stood, the laundry process was performed solely by women in the settlement and the intense labour put considerable strain on their bodies. With a simple device to relieve some of that effort, the women would benefit.

There were many potential devices that were explored to aid in washing practice. The simplest would be a scrub board, the earliest version of the washing machine (Canada Technology Museum, 2007). Our liaison also mentioned the possibility of obtaining tubs with built in scrub boards. This would make it easier for the women to remove dirt from the clothes.

Manual wringers were also explored to help improve the washing process and shorten the drying time. Hand wringers consist of two parallel rollers that are held in tension, as pictured in Figure 11. Clothes are run through the rollers to remove excess water. These devices are powered by a crank and reducing gears (Canada Technology Museum, 2007).



**Figure 11: Manual Hand Wringer**  
(<http://www.cover-yur-basics.com/wringer.html>)

An alternative approach to a hand wringer might be a design that mimics a mop wringer. This approach would ensure that no water was lost in the drying process. A mop wringer is a gated basket that sits on top of a water bucket, as pictured in Figure 12. Water can be wrung out directly into the bucket, and that water could in turn be filtered or used for irrigation purposes.



**Figure 12: Mop Wringer**  
(<http://www.uspto.gov/web/patents/patog/week20/OG/html/1318-3/USD0542992-20070515.html>)

Preliminary research into simple mechanisms such as these gave our team a starting point for our arrival in Cape Town. After careful observation of the current laundry practices, we better understood which approaches were most feasible.

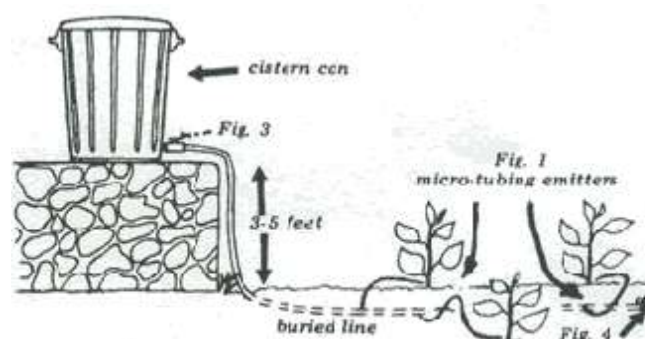
#### 2.3.2.4 Irrigation

##### Home Drip

The following information was taken from Ivie's *A Simple Home Irrigation System*.

Implementing an improved system of irrigation was a desire of the Monwabisi Community as expressed to us by our liaison. A possible system called simple home drip irrigation was created to make better use of greywater in the Virgin Islands. Since water supply can sometimes be a limiting factor for gardening purposes, an inexpensive and useful way of irrigating the gardens in informal settlements was considered.

There are three major components that comprise most irrigation systems: a source of water, a pressurization method, and a delivery system. In a drip irrigation system similar to the one pictured in Figure 133, the source of water was a plastic trashcan, the pressurization method is the gravity that pushes the water downstream, and the delivery system is a drip irrigation line with home-made micro-tubing emitters, small tubes connected to the main hose. The trash can holds the greywater that flows through a filtered screen and then into the drip irrigation line, where the micro-emitters then distribute the water into the soil of the garden. The micro-emitters are small enough that only a drop of water is released at a time, where the drips of water irrigate the roots of the plants. This type of drip system wastes little amounts of water due to evaporation or over watering.



**Figure 13: Simple Home Drip Irrigation System**  
(<http://rps.uvi.edu/CES/gf20.PDF>)



Any source of water that is not contaminated by waste products, whether it be from washing dishes, washing clothes, or showering, can be used in the drip irrigation system. This method of recycling greywater ensures that water used in daily chores is not wasted. In addition to conserving resources, this system allows for growth opportunities in community gardens. When the simple drip system is used to irrigate a vegetable garden, the food can be used for personal consumption or sale. At the Indlovu Centre garden, the produce grown is fed to the children of the community. Implementing the drip system in gardens within small neighbourhoods in Monwabisi could produce food to help feed many families.

### Soakaways

The following information was taken from (McCormack, 2007).

Another avenue our team investigated for irrigation was the use of soakaways. A soakaway is an infiltration device that disperses water, rather than collecting it. It is commonly referred to as a 'hole-in-the-ground' that gradually waters the surrounding area. With its punctured holes on all sides of the design, water seeps out similar to a drip irrigation system.

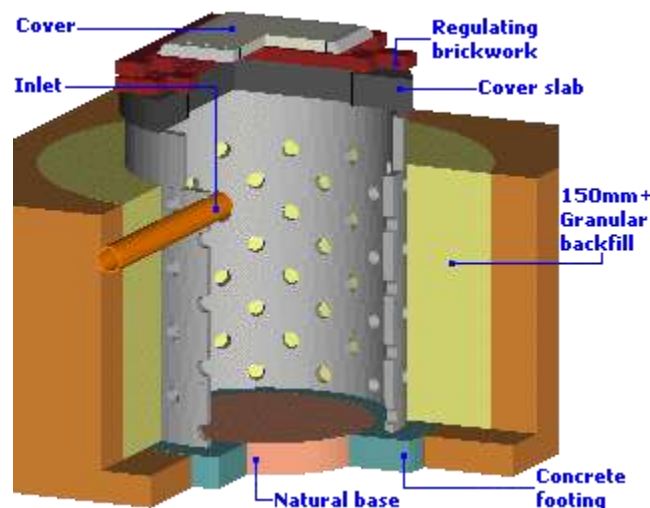


Figure 14: Soakaway Cross Section

The soakaway functions by a process of water flow. Water from the storage tanks flows into PVC pipes that then flow into the laundry station taps. From there the water is used for

washing clothes and the excess water flows into the drain, which flows into pipes underground. At the end of the pipes are soakaways, a short pipe with holes that water the ground.

A soakaway existed near a garden at the Indlovu Centre before our project team arrived onsite. It was proven to be a success in its construction and overall use. This prior knowledge known to the community is useful for the implementation of a soakaway near the laundry station. This soakaway was the method chosen to irrigate a garden across from the youth centre because it was inexpensive and very effective in watering fruit trees.

## Chapter 3: Methodology

The fundamental goal of this project was to help the Shaster Foundation promote the ideas of permaculture and sustainability in the community through the design and construction of an ecologically friendly communal laundry station. We designed a system integrating rainwater harvesting and drip irrigation techniques to address the issues of sanitation and water conservation associated with the existing laundry practices.

We established the following objectives to attain our goal:

- Build strong relations within the community
- Gather information about laundry practices
- Explore options for water collection, washing and irrigation
- Design a washing station
- Evaluate and revise proposed design
- Build laundry station

Before arriving in Cape Town, our team developed a proposed methodology for our work in Monwabisi Park. At that point in time, the focus of our project had just narrowed from town planning to improving laundry practices. Because of that, our original methodology was broad and changed dramatically upon initiating our work at the Indlovu Centre. The original methodology section can be found in Appendix C: Original Methodology.

There were five specific categories in our original methodology which included determining improvement opportunities, researching and developing practical solutions, evaluating proposed solutions, integrating solutions with the Shaster Foundation's master development plan and developing community involvement strategies. Although these steps were still relevant to our project work, some of them took priority over others. When we first spoke with our sponsor in person, we had already identified the improvement opportunity that we would be focusing on. Because the idea of a communal laundry station was so unique, researching practical solutions turned into gathering information about laundry from the community and designing a station layout that would fit with the social and spacial constraints of the area. This became a major focus of our project. Evaluating proposed solutions also shifted to evaluating proposed designs. During our work we made sure that our proposed solutions such

as rainwater harvesting and reuse of greywater fit with the master development plan of our sponsor. Finally, community involvement became a central focus of our work in Khayelitsha. From the beginning, our team put a heavy emphasis on building relationships with community members and involving them in our work.

### ***3.1 Community Relations and Contributions***

Our team has made a strong effort to contribute to the Indlovu Centre in as many ways as possible. In building our relations with the people in the community, we have interacted with the youth by playing billiards and casually conversing. The group has befriended many community figures like Glen, the nurse in the health clinic, Buyiswa, a community leader and the manager of the crèche, Opah, the manual labour manager, and other community members involved in the Indlovu Centre.

At the beginning of our work at the Indlovu Centre, our sponsor took us around some areas of Monwabisi Park and showed us houses, government toilets and municipal taps. On this trip we found that only two of the five taps in the entire area we visited were functioning. The roof on one of the houses we saw was collecting water and bellowing as a result. Through this trip, we saw a definite need for functioning communal taps and an efficient way of water harvesting. These needs only reinforced our conviction about the impact this laundry system might provide.

Group contributions to the Indlovu Centre have been made through different avenues. We began collecting plastic bottles at the Big Blue hostel. The bottles will be used for lights and ornaments that the community children make and sell out of recycled material. We have helped cut the plastic bottles in preparation for painting. The finished ornaments were used for the City Cape Town Christmas tree. Additional contributions at the Indlovu Centre have been through building a solar oven, helping build a patio for a community member, cleaning the site area for the upcoming community centre, and serving food at the soup kitchen. In building the patio we excavated rubble and trash from the ground to help even the surface. We continued the project by collecting sand from Muizenberg beach that was piled into the bed of the community truck (the “bakkie”) and taken back to the centre. The sand was used to even the ground for the patio and then cement tiles were laid to finish the project. Similar to the work done for the patio

site, we dug up rocks, bricks and trash at the community centre site in preparation for building. The group also helped serve soup and bread at the soup kitchen.

Building strong relations with community leaders and members helped bring about various positive results in this project. We found that in strengthening our relationships with the community we formed respect and dual cooperation for the main task at hand. Implementing this laundry station meant having the help and input from the community as well as ourselves. Ensuring the community that our work at the Indlovu Centre was intended to help, provided more appreciation and acceptance on their behalf.

As a group it was essential to help and engage ourselves within the community whenever possible. These contributions, in addition to the laundry system, helped our team strike a balance between work and socialization with the community. By having continued to contribute our time and effort to the community, we hoped to maintain strong relations with the people of the Indlovu Centre as well as spread the Eco-Village concepts that Di has already planted in the area.

## **Cast of Characters**

The following individuals have been involved with the project and have been of great help and assistance. The help we have been provided with range from community leaders to volunteers to the owner of a successful South African business.

Buyiswa Tonono is the manager of the crèche. She helped to familiarize our team with community members, Xhosa tradition and language.

Opah is the manual labour manager of the Indlovu workers. He and his team that include Kolani, Obugile, and Sean have helped with the manual labour portion of our project.

Kolani is Opah's brother who has helped with the labour of the project.

Obugile is a young worker who has also helped with the labour.

Sean is another young worker who has also helped with the labour.

Mike Tremeer is the owner the company ‘Eco-Beam’ who donated various supplies (like the products for the tanks stands and fence). He also lent us many tools to use onsite at the Indlovu Centre as well as opened the Eco-Beam factory for us to work out of.

Pat Carrigan is a volunteer who was living at the Indlovu Centre guest house while we were working there. He provided us with advice about safety and life in Monwabisi Park. He also transported us to hardware stores to pick up items for the construction on the laundry station.

### ***3.2 Information Collection***

Before beginning the design process for the laundry station, our team collected information on laundry practices in Monwabisi Park by conducting informal interviews with community members. This included multiple conversations with our sponsor, the Endlovini volunteer staff, local women and community leaders.

#### ***3.2.1 Interviews***

One of our initial interviews was with Moses, a member of the executive sub-council of the local street committee. He gave us a tour of several sections of Monwabisi Park and introduced us to women who were doing laundry next to a municipal stand pipe. We were able to observe the women as they did their washing and get a better feel for the labour involved in the process. Typical washing practices are pictured in Figure 15. We also had a short interview with Moses where we explored different ideas for the laundry station. The full interview is detailed in Appendix B: Key Informant Interviews. Moses emphasized the importance of education – both teaching people how to do laundry correctly as well as utilizing a community station as a place to inform people of topics such as HIV prevention.



**Figure 15: A Woman Doing Laundry in Monwabisi Park**

Another interesting suggestion that came from our interview with Moses was the idea of starting a laundry business. Although Moses was focused on building laundromats, which are outside of the context of our project, it sparked the idea of employing local women to use the laundry station to do washing for other families. We presented this concept to our sponsor who was excited about the idea. Once the Community Centre is built, the Indlovu Centre will have the capacity to host up to 27 people between the hostel and guest house. Di suggested that a business could be started to take care of the washing for those visitors.

Because of the context of our project, most interviews were informal and often spontaneous. Frequently, ideas were tried out on people who were simply working in the vicinity of the Indlovu Centre. As we started to draw up preliminary designs, we shared them with our sponsor as well as volunteers such as Pat Carrigan. Their input was valuable in maintaining the momentum of the design process, which is further detailed in the following section.

### **3.2.2 Rainwater Harvesting**

Taking advantage of alternative water supplies was one of the major goals of this project. Because Cape Town receives a substantial amount of rain during winter months, our team decided to harvest rainwater to serve as the main source of water for the laundry station.

Rainwater will be harvested from the roof of the Youth Centre, which stands adjacent to the laundry station, and run from the gutters to large water storage tanks.

Determining an appropriate size for the water storage tanks involved calculations based on annual rainfall data. Our team measured the dimensions of the Youth Centre and used those figures to compute the total surface area of the roof. By simply multiplying the area of the roof by the average monthly rainfall in the City of Cape Town, we were able to estimate the potential amount of rainwater that could be harvested off of the building. The results are shown in the Table 1.

Month	Average	Potential Rainwater Harvesting (L)		
	Rainfall (cm)	Total	Left Side	Right Side
January	1.5	1,311	656	656
February	1.7	1,486	743	743
March	2.0	1,748	874	874
April	4.1	3,583	1,792	1,792
May*	6.9	6,031	3,015	3,015
June*	9.3	8,128	4,064	4,064
July*	8.2	7,167	3,583	3,583
August*	7.7	6,730	3,365	3,365
September	4.0	3,496	1,748	1,748
October	3.0	2,622	1,311	1,311
November	1.4	1,224	612	612
December	1.7	1,486	743	743
Year	51.7	45,186	22,593	22,593

\* Rainy Season

**Table 1: Potential Rainwater Harvesting Data**

<http://www.weathersa.co.za/Climat/Climstats/CapeTownStats.jsp>

During the height of the rainy season the roof of the Youth Centre has potential to collect upwards of 8000 litres of water per month. By taking this information into account as well as the fact that people would be using water on a daily basis, our team decided that having the capacity to store 6000 litres of water at one time would be appropriate for the harvesting system. Because the roof is double pitched, there will be a tank placed at the end of each gutter. Due to spacial limitations as well as the desire to store water in separate tanks not being used for the laundry station, we chose to purchase four 1500 litre tanks; two of which would be elevated and serve as



the gravity fed water source for the laundry system and two of which would be on ground level and available as a water supply during the summer.

### 3.2.3 Laundry Site Layout

AutoCAD is a Computer Aided Design software application for designing and sketching in 2D and 3D. The CAD drawing of the Indlovu Centre in Monwabisi Park was created to facilitate our team having a clear view of the location of the buildings and the open spaces in the centre that could be used for our project. We used this to provide the actual dimensions of the site and to perform the necessary calculations for designing our project. Every dimension of the items in this drawing was measured by the members of our team. The drawing includes the existing buildings such as the crèche, storage house, clinic, youth centre and soup kitchen. This sketch also includes the spaces where the community centre, fruit-vegetable garden, and laundry station were built. Now that our project is completed, the Shaster Foundation can use this drawing as a reference for further plans in the development of the Eco-Village.

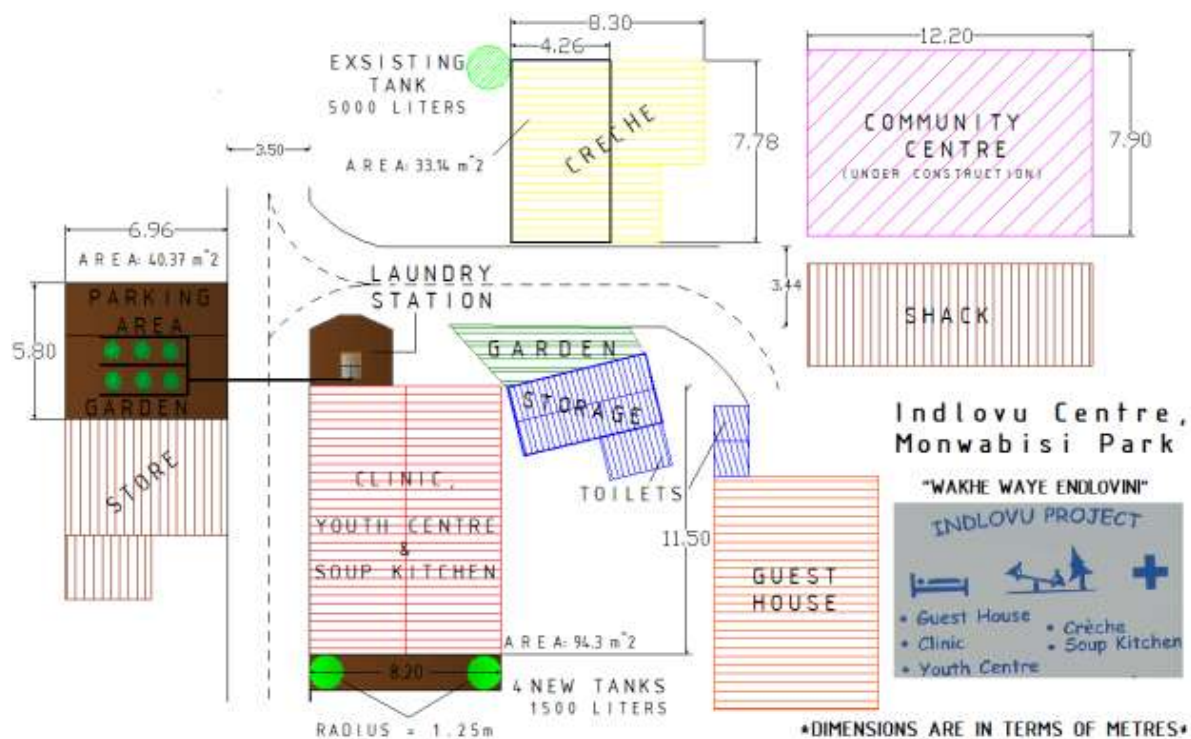


Figure 16: AutoCAD Site Layout

### *3.3 Design Process*

The design process was ongoing in the early stages of our time on site, with observations and interviews both giving inspiration and presenting obstacles to be worked around. This section will explain the various concerns and consequent design parameters that were encountered, and the following section will detail the final system design that arose as a best fit to these issues.

Ergonomic constraints and superfluous labour became apparent very early. Though water conservation techniques are beneficial in many ways, if a means of implementing them is more difficult than the conventional method, the people simply won't use it. Washing laundry at the station would need to be at least as easy as at the water taps, a simple task for some parts of the process but not for others. One of the main advantages of a laundry station as envisioned in the earlier stages of our project was that water would not have to be carried long distances, but as we found out on site, many residents remedy this by simply doing their laundry at the municipal water taps. It was therefore desirable for water delivery to be at least as simple as turning on a faucet (making a manual pump or even a particularly slow feeding tap unlikely options), and for the wash basins to be conveniently placed. Disposing of water in the street, though unsanitary and wasteful, is extremely easy, and a system component that would force users to deposit wash water at a certain location or in a certain more time or energy intensive manner might very likely be skipped altogether. Constructive use of wastewater (a very important design consideration from a permaculture standpoint) would have to be nearly automatic to ensure use.

In order to preserve the social nature of the laundry process, the layout of the site would need to be conducive to conversation and interaction. Though orienting wash basins in line or against a wall would be more space efficient, these layouts separate individuals and make the site less welcoming, whereas room to move around and places to sit add to the communality of the design. Also important was not to obstruct already existing thoroughfares and communal spaces. As shown in Figure 16, the site selected by our sponsor is bordered by the street on two sides and the stairway to the Youth Centre as well as the common waiting area for the soup kitchen on the other. Above, the porch of the Youth Centre is common area for people to spend time, and would be obstructed if crossed by a gutter or blocked by a storage tank. This was characteristic of the common interaction between functional, social, and spacial design concerns.

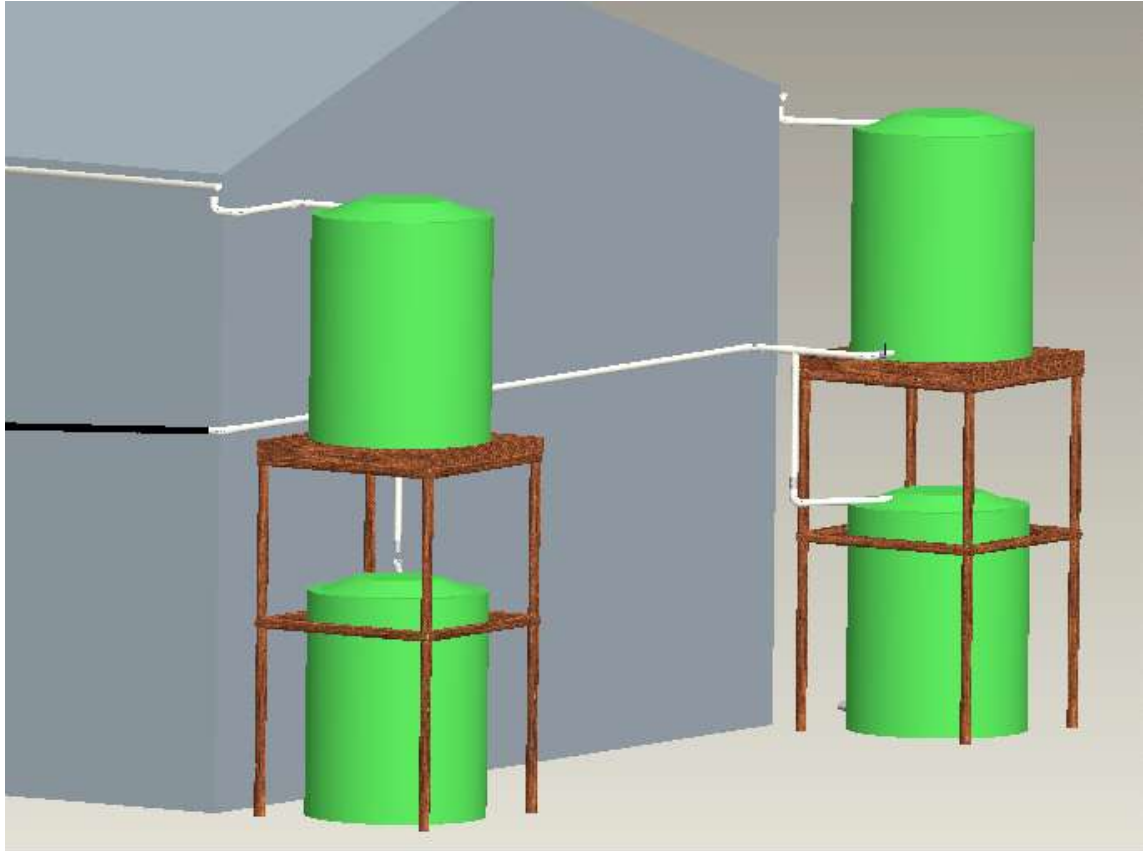
Because the system was to be designed specifically for the Indlovu Centre, the priority of build cost changed from what we had planned before our time on site. Though minimizing cost was important, the station was envisioned by our sponsor (as with most of the features of the centre) to stand as an example of what can be accomplished using ecologically friendly means and as an alternative to government sponsored amenities. The system to be designed specifically at Indlovu did not have the same budgetary constrictions as would be encountered by the average household in Monwabisi, which was excellent for opening design options, but did not encourage the reproducing of the system in the community. Suggestions for building a more basic, low cost system are discussed in the results section.

### **3.4 Final Design**

The final design consists of 3 main physical and functional components: a rainwater harvesting system, a laundry station, and an irrigation system for dispersion of the used wash water. This section will detail each of these and the functioning of the system as a whole.

#### **3.4.1 Rainwater Harvesting System**

As previously mentioned, two 1500 litre storage tanks placed behind the building are raised to a height of ~2.4 meters - level with the first floor of the centre – to provide the elevation necessary for the gravity feed to the laundry station. Water from the pre-existing gutters is routed to these tanks, and beneath each are identical 1500 litre storage tanks at ground level which serve as overflow containers for the heavy rain of the winter months. Water can be drained from the upper tanks to the lower tanks (individually) by a simple valve when they become full or when water is desired in the lower tanks for any reason. The lower tanks are fitted with a tap at the base, and are accessible to the neighbouring community in the same manner as the existing 5000 litre tank utilized by the crèche. Placing the tanks behind the centre maximizes the space for the laundry station in front, keeps the view from the deck of the centre free of obstruction, and puts the tanks safely away from areas where people will commonly pass to avoid the risk of injury should one of them fall. A model of this setup is shown in Figure 17.



**Figure 17: Rainwater Harvesting System**

### **3.4.2 Laundry Station**

The water from the raised storage tanks is carried along the sides of the building to the front through an 11.5 meter length of PVC tubing, painted black to make best use of solar heating. Two double wash basins are arranged facing one another (for a total of four basins), each with a tap from the water line. The basins are stainless steel and have an inclined edge that is ribbed to act as a washboard. The water tap from the municipal line will be connected to the basins for use during the dryer summer months when the storage tanks will often be empty, with a one-way check valve used to prevent backfilling of the storage tanks. The water from the basins is drained away to a connecting central line which carries the water to the irrigation piping. This section of the design is illustrated in Figure 18.



**Figure 18: Wash Station**

### **3.4.3 Irrigation System**

The water from the laundry station is carried through burial-grade PVC piping under the street next to the youth centre to six fruit trees in an adjacent plot. As pictured in Figure 19 the trees are arranged in 2 rows of 3 with a  $1.25\text{m}^2$  area allotted for each. The water is carried through three perforated pipes running down the centre and sides of the trees, buried at a depth of .5 meters to reach the tree roots and avoid saturation of the surface soil. Figure 20 illustrates the configuration of the irrigation piping.

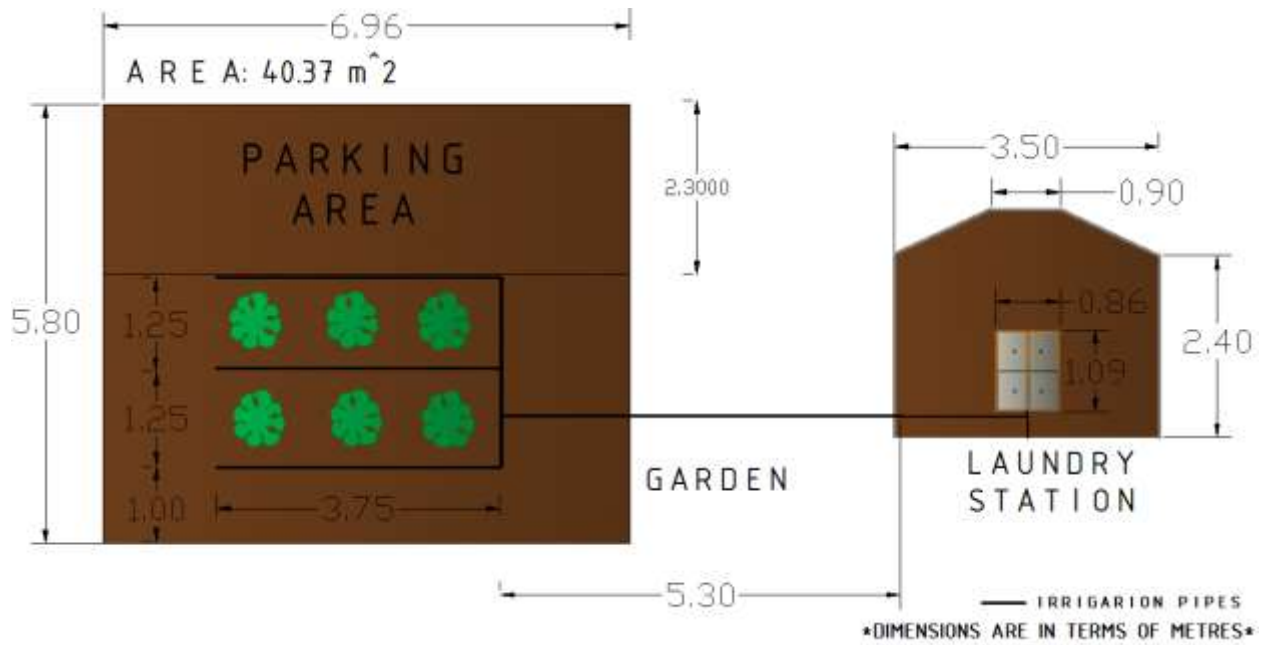


Figure 19: AutoCAD Drawing of Irrigation Layout

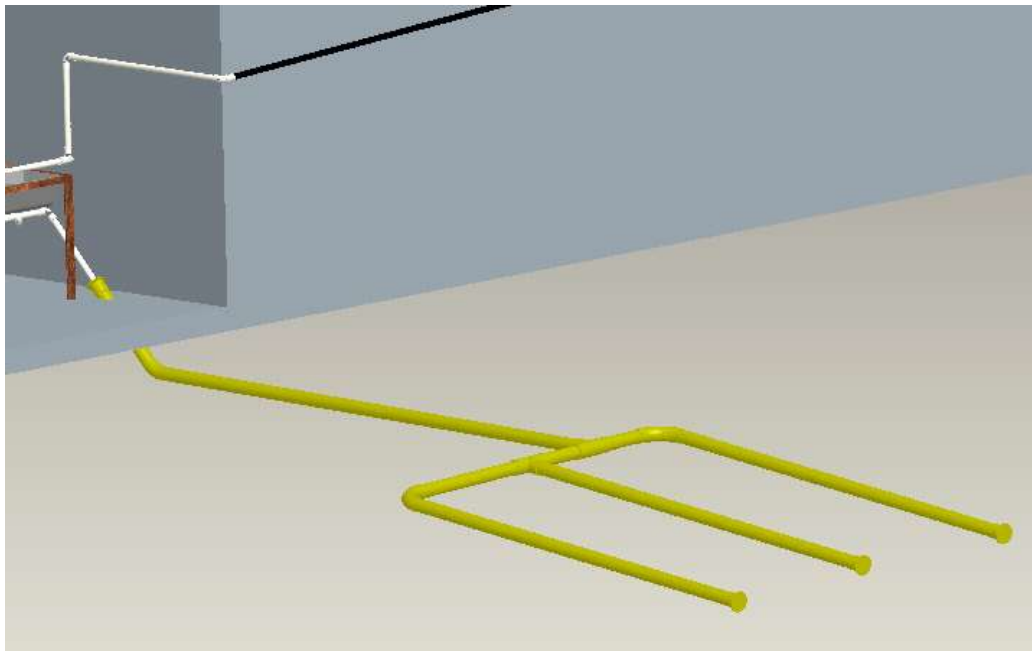


Figure 20: ProEngineer Drawing of Irrigation Layout

### 3.5 Implementation

The following section outlines the approach our team took in constructing the rainwater harvesting system, communal washing station and greywater irrigation system.



### 3.5.1 Preparing the Site

Once we felt we had a strong grasp on our final design for the laundry station, we began preparing the site for construction. When we arrived, the site was littered with rocks, broken bricks, gravel and garbage. With the help of local teenagers, we spent several days clearing the site and breaking up rocks and bricks with the gravel crusher onsite. The gravel that was produced was then used to fill in a trench at a nearby standpipe to make water drainage to the road more efficient. Before and after photographs of the site are shown in Figure 22.



**Figure 21: Breaking Rocks**



**Figure 22: Laundry Site Before and After**

As shown in the photographs, a municipal standpipe was situated at the center of the laundry station site. After digging down around it, we discovered that the base of the pipe was a tire filled with concrete. The standpipe was dug out of the ground and the city was contacted to reposition it a few meters to the right.

### 3.5.2 Rainwater Harvesting System

Four 1500 litre tanks were ordered from Jo Jo Tanks, a local company, for the rainwater harvesting system. Because two of the tanks needed to be raised and the tank stands available through Jo Jo Tanks were not the necessary dimensions, our team worked with Mike Tremeer of Eco-Beam to custom design and build tank stands. The design consisted of four posts with a raised deck for the tank to sit on. The dimensions of the deck were gauged by the diameter of the tank as listed on the Jo Jo tank website. Four cross pieces were added to the four posts of the structure for added strength. Mike not only let our team use his factory, but gave suggestions for the type of materials best suited for the project and donated all of the building supplies used.



**Figure 23: Cutting Posts**

To prepare for the installation of the tank stands, holes were dug where the posts would be cemented into the ground. After beginning the preparation work, our team was approached by the owner of the strip of land where the stands were being installed. He had concerns about what the space was being used for and we were advised to stop digging until further notice. To appease the landowner, we shifted the location of one of the tank stands so it would not be on his land. After multiple conversations between Buyiswa and the owner of the shack, there were still concerns and the issue was brought in front of the street committee. There, a deal was worked out to hire the land on a monthly basis for R50.00.

After the conflict with the landowner was solved, we proceeded to excavate the eight holes to a depth of .6 metres, where the main posts of the wood structures supporting the upper tanks were to be placed. Each wood structure was built using:

- 1- (4) 3.6m long cylindrical post, .80m diameter.



- 2- (4) 1.42m long cylindrical beam, .60m diameter
- 3- (2) 2.0m long cross brace, .6m diameter.
- 4- (3) 2.0m long cross brace, dimensions (2 X 2)cm.
- 5- (7) 1.42m long decking boards, dimensions (10 X 4) cm.

The numbers 1-5 refer to Figure 24.



**Figure 24: Tank Stand Components**

The wood members were either bolted or screwed together, depending on the weight to be carried in the given junction. Also, the deck used to support the upper tank was pre-built by us at Eco-Beam.

For installing the tank stands, we placed the four posts (1) inside the holes, verified appropriate spacing, and checked their vertical level. We then partly backfilled the holes so that the posts could stand alone. To place the pre-built base at the appropriate level, we nailed a wood beam between two posts and another beam between the two opposite posts, checking the horizontal level for both (Figure 25). Next, we mounted the deck on the beams, drilled the holes, and bolted the deck to the posts, and screwed one of the cross braces (4) to steady the structure. Cement was mixed and poured around the base of each post and left to cure overnight. When the structure was ready, we screwed the remaining three cross braces and the two horizontal beams (2). We then placed the tanks in their position and tied them with aluminium cable and eye-bolts to keep them from being dislodged.



**Figure 25: Installing the Tank Stands**

The lower tanks were also raised slightly to ensure the taps at the bottom of each tank were at a reasonable height for use by the neighbours. The ground was levelled and a platform was made from cinderblocks. The blocks were laid in a square configuration, two blocks high. Once positioned and level, the outside holes were filled with cement to protect the structure from shifting as well as theft. The finished platform is pictured in Figure 26. Once dry, the tanks were situated on top of the platforms and secured in place with cable.



**Figure 26: Raised Platform for Lower Tanks**

### **3.5.3 Wash Trough Stand**

A custom designed stand was also built at Eco-Beam for the laundry station's double basin wash troughs. The basins, which had been purchased from a local hardware store, were mounted back to back and drilled into a rectangular wooden cradle running under the lip of the sinks. The structure was supported by four posts positioned at each corner. The bottom of the posts were connected by two beams running perpendicular to the basins to give the structure added strength as well as provide a solid anchor for the cement. The finished stand is pictured in Figure 27.



**Figure 27: Wash Trough Stand**

Once our team was back onsite, trenches were dug for the posts of the stand. We gauged the depth of the trenches based on the standard sink height of 0.72 meters as well as the height of retaining blocks which would serve as the platform of the laundry station. When the trenches were approximately the right depth, the stand was positioned and we asked women from the centre to give us their opinion of the height of the basins. One such volunteer is pictured in Figure 28. After a few slight adjustments a consensus was reached on a suitable height.

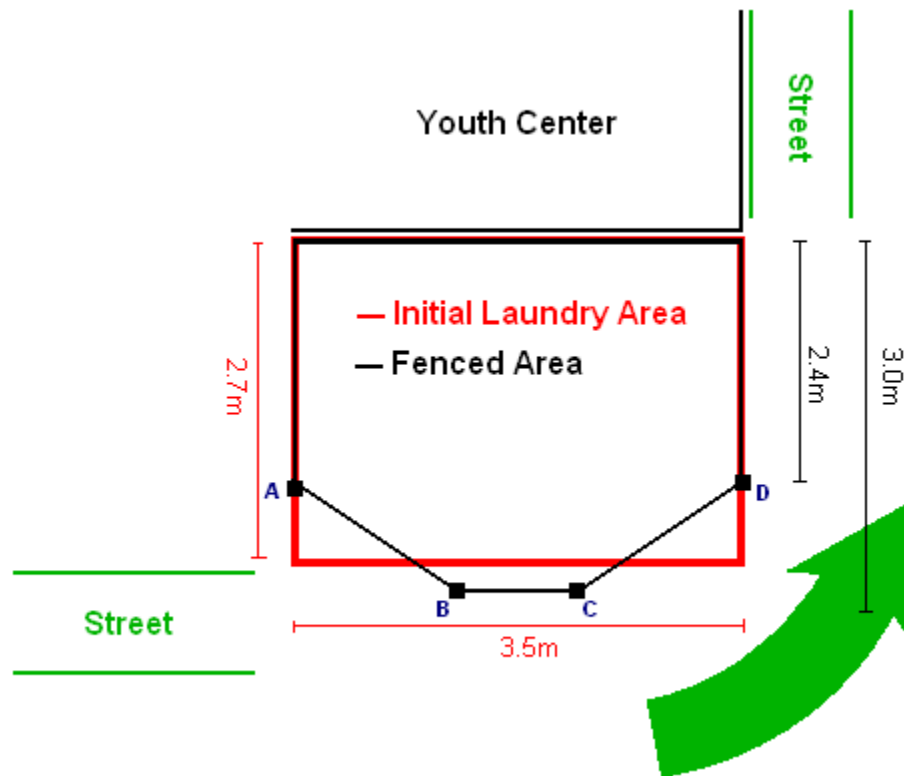


**Figure 28: Gathering Opinions on the Height of the Basins**

### **3.5.4 Fencing and Roof**

During the installation of the wash basins, Buyiswa and Glen both expressed concerns about the safety of leaving the basins and taps openly accessible. At R1000 each, the double basin sinks were almost certain targets of theft, as well as the valves used to control the water flow. A decision was quickly made that a security fence would be needed, and we arranged to spend the following day at Eco-Beam measuring for an Eco-Fence (another of Mike Tremeer's inventions consisting of interlocking pointed aluminium posts that can be constructed with no use of welding equipment). Instead of enclosing the rectangular area allotted, the front length of fence was angled out to the gate (section B – C in Figure 29), allowing for better movement around the wash basins while actually improving clearance for vehicles turning onto the street

next to the youth centre. We decided it would be most practical to include the roof structure in the design, and cut posts A and D long to act as supports, as well as cutting the appropriate lengths of wood to frame the roof. With help from the workers at the Indlovu Centre, the fence was erected and cemented in place over a two day period. Because of late delivery time of the corrugated plastic intended to be used as covering, we were not able to construct the roof within the project duration, but all necessary materials were left with the workers at the Indlovu Centre, who have experience in this type of construction.



**Figure 29: Fencing Layout**

After adjusting the design of the station with an Eco-Fence, our team decided that the original plan to build a raised platform was also no longer feasible due to time constraints. Instead, we would plan on laying slabs at ground level to compensate for the flooring. The depth of the trenches for the basin stand was also adjusted before the stand was cemented into the ground.



### 3.5.5 PVC Fittings and Gutters

The existing gutters of the youth centre were angled towards the front of the building and required remounting to provide the necessary inclination towards the storage tanks in back. The gutters were then connected to the tanks, requiring a different configuration on either side of the building. The right side tank which had been moved at the landowner's request required only a 90° elbow and a length of 80mm PVC piping as pictured in Figure 30. The left side tank required two 90° elbows to round the corner of the building and a third to connect to the tank, two lengths of PVC, and a mounting bracket for stability, pictured in Figure 31.



**Figure 30: Right Side Gutter**



**Figure 31: Left Side Gutter**

The majority of the plumbing work used 40mm PVC tubing, a common size that was easy to work with. Using lengths and fittings bought at a local hardware store and a plumbing supply store in the city, the system was equipped to control water flow. Each tank was fitted with a ball valve to control water flow, and two additional valves were installed to empty the raised tanks into the overflow tanks. 90° elbows and T-joints were used to direct water flow, the final configuration pictured in Figure 32.



**Figure 32: PVC Connecting the Storage Tanks**

The removable plastic covers were cut to fit closely around the incoming pipe as pictured in Figure 33, preventing dust and garbage from entering.



**Figure 33: Cover of Overflow Tank**



As shown in Figure 34, the pipe running along the side of the building was spray-painted black, with a matte finish for least reflectivity and thus most efficient absorption of solar heat. The water line is then directed downwards at the front of the building and out to the four basins.



**Figure 34: PVC Configuration**

As shown in Figure 35, the taps for the sinks use three T-joints and a 90° elbow at the end (staggered) to divert water from the main 40mm pipe. At each of these outlets, 40mm to 20mm adapters connect the 20mm ball valves used to control flow. Four 20mm elbows are used to direct the flow downwards into the basins.



**Figure 35: Tap Configuration**

Figure 36 and Figure 37 show the drainage assembly. Each basin was fitted with a 50mm grated drain and PVC adapter (certain fittings were only available in 50mm diameter and were thus used for this portion of the system). Two four-way connectors were used to connect the basins to a single drain line (the fourth opening of the end connector was capped). From this point, an adaptor was used to reduce to 40mm piping, and a trap was added to provide an air seal against potential odour. From the trap, a 90° elbow was attached to route the water downwards to the opening of the irrigation tubing.



**Figure 36: Drainage Configuration**



**Figure 37: Trap Configuration**

### **3.5.6 Irrigation System**

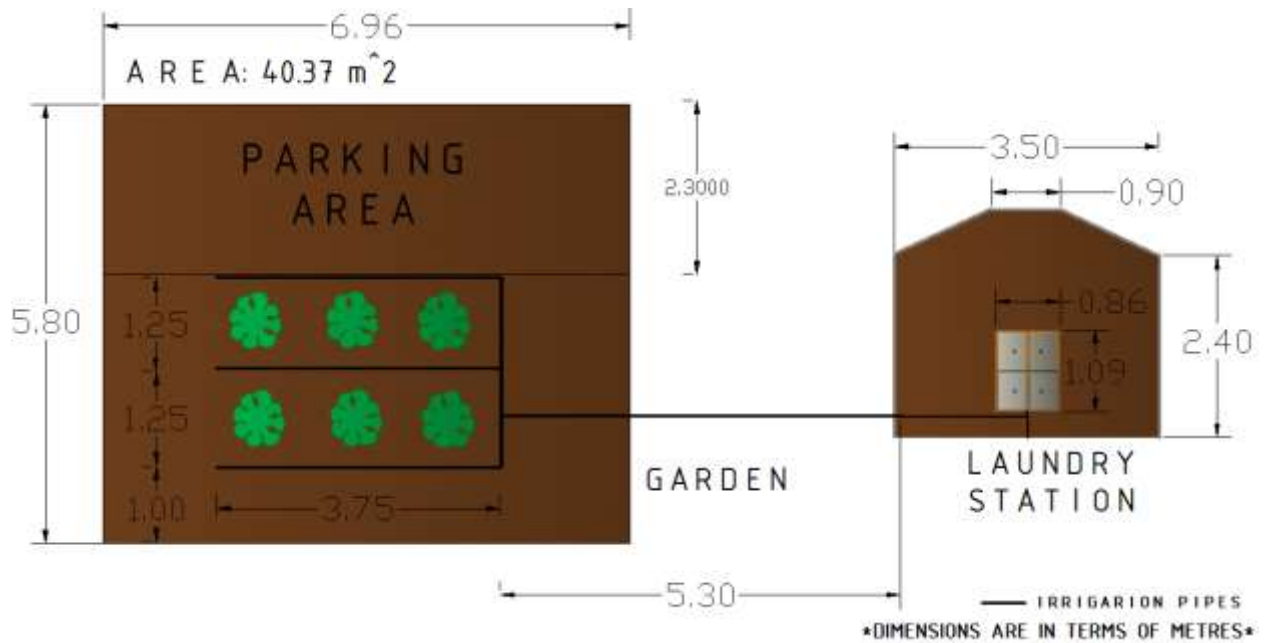
Burial grade PVC was purchased for the soakaway irrigation system. At 110 mm, the piping would supply adequate space for the greywater from the wash basins to travel and

disperse. To allow the water to seep out and saturate the ground, two lines of holes were drilled into the PVC. The holes were set 90 degrees apart and staggered laterally, as pictured in Figure 38.



**Figure 38: Drilling Holes in the Irrigation Pipe**

Large trenches were dug to allow for the installation of the soakaway. A six meter length of piping was cut to size and run half a meter below a dirt road to connect the trap of the wash basins to the decided location of a tree garden across the street. At the start of the garden, the pipe split into three channels running in parallel 1.25 meters apart. Two rows of trees would be planted between the channels to allow efficient irrigation from two sides. An AutoCAD drawing of the irrigation layout is shown in Figure 39.



**Figure 39: AutoCAD Layout of the Irrigation System**

The trenches for the irrigation pipes were dug half a meter down in what used to be a garbage dump. The rubbish, which included everything from shoes to tires, made digging extremely difficult and the process took two more days than predicted. Before the irrigation pipes were positioned, the trenches were lined with gravel from the gravel crusher to ensure the soakaway holes would not get clogged with dirt. The installation of the soakaways is pictured in Figure 40.



**Figure 40: Installing the Soakaway System**



The end of each line was capped and the trenches were filled in with dirt. Three banana trees, three pear trees, mint and bags of manure were purchased by our sponsor to be planted in the garden. Although we were not able to plant the trees because of several delays in the delivery of the irrigation PVC, workers at the Indlovu Centre were able to finish the garden under our instructions.

## Chapter 4: Results and Discussion

Many of the implications of the laundry system were not evident until its completion. This section will discuss some of the issues and opportunities encountered once the system had been built and introduced as a functioning addition to the Indlovu Centre.

### *4.1 Completed Laundry Station*

#### **4.1.1 Functionality**

Once the whole system was in place, one of the raised storage tanks was filled with water from a hose connected to a nearby municipal tap for testing. When the tank was approximately half full, the ball valve connected to the tank was opened and water was free to flow from the tank. Two students stood at the basins and opened the faucet valves. Within a few seconds, water started to run into the basins with a pressure comparable to that of a kitchen sink. All four valves were tested and all worked equally well. The water drained into the PVC connections underneath the sink and out into the irrigation piping.

After the valve from the storage tank was shut and the water finished draining through the basins, our team assessed the various components of the entire system. We discovered that several PVC joints were leaking slightly, including the large valves connected to the water storage tanks. The following day, once all the PVC was completely dry, we went through and added additional PVC welding valves and joints.

#### **4.1.2 Community Use**

The communal laundry station will be open to the community of Monwabisi Park after the Christmas Holiday. Triple Orange, a biodegradable laundry detergent, will be available for purchase at Indlovu Centre for R2.00 (approximately USD0.29). Triple Orange is less expensive than OMO, a detergent commonly used in Monwabisi Park, which serves as an additional incentive for the community to use the laundry station. The detergent will be dispensed from the clinic, which is located immediately next to the laundry site.

To convey the rules and regulations of the laundry station to the community, our team made a visually-based sign to hang above the basins. Because it is crucial that only

biodegradable soap is used for washing, the sign created displayed a picture of triple orange, the Xhosa word for ‘use’ – sebenzia, and R2.00. This sign is available in Appendix E.

## **4.2 Community Implications**

The finished laundry station both met and exceeded the original goals of the project. An alternative source of water was utilized with the rainwater harvesting system, the labour intensive task of washing clothes was made easier with the construction of a communal washing facility, and the soakaway irrigation system made the whole configuration a zero-waste system. While serving as an example of sustainability and permaculture, our laundry system had further community implications which are outlined in the following sections.

### **4.2.1 Community Reaction**

The laundry station was received by the community with even more excitement than our team had anticipated. When the taps were turned on for the first time, kids came running from all directions to see the system in action. Having a sink with running water was something almost foreign to them. Workers from the Indlovu Centre also shared in the excitement. They had been helping with the construction from day one, but they finally had the chance to see what they had been working toward. They all smiled and laughed as they washed their hands in the wash basins.

Our sponsor was also impressed with the finished product. Her assessment of our project work is outlined in Appendix F.

### **4.2.2 Communal Washing Facility**

After seeing the excitement of the Indlovu workers at the working faucets, our sponsor suggested that the laundry station could serve an additional purpose. Since there is no running water in the shacks, this laundry station could be used as a location where the workers clean up after work. The dirt and grime can be washed away and all waste water will irrigate the trees, which is completely safe as long as only biodegradable soap is used. Our communal laundry



station transformed into a community washing facility. As time goes by perhaps more innovative ideas for the usage of this laundry station will be thought of.

#### **4.2.3 Potential Laundry Business**

Early next year, the construction of the Indlovu community centre will be complete. The centre will have a bakery and soup kitchen on the first floor and a hostel for volunteers and guests on the second. Between the guest house and the hostel, the Indlovu Centre will have the capacity to host up to 27 people at one time. Having a community washing stations presents the opportunity of creating a laundry business where one or two women in the community offer washing services to visitors. This will not only provide job opportunities to local residents, but it will also strengthen the internal economy of the community. As with any job opportunity in Monwabisi, the street committee will be in charge of deciding who is best suited for the position.

#### **4.2.4 Example for Community Centre**

Because water drainage is a problem in Monwabisi Park (as is the case in most settlements) the Shaster Foundation has decided to implement a greywater-irrigation system for their coming community centre. The hostel, which will have multiple showers, will dispatch greywater into pipes that run along the walls of the building and feed to soakaways. The soakaways will then irrigate two tree gardens.

Now that the workers at Indlovu Centre have seen how our system functions, they have a working example to follow when building the community centre. Because they took a hands-on approach in building, they have the knowledge and skills necessary to build similar systems in the future. Our rainwater harvesting/irrigation system also serves as a practical example of sustainability and permaculture, two of the fundamental goals of all Shaster Foundation initiatives.

### 4.2.5 Replicability

#### **Planned Youth Centres**

As communicated by Di, the Shaster Foundation has received funding to build youth centres in the four remaining sections of Monwabisi Park furthering the Eco-Village effort. The buildings are planned to be two stories and similarly sized to that centre at Indlovu, with a youth centre upstairs and a community centre downstairs. Much of the methodology as were used in this project is likely to be applicable at the new sites, which will be in need of laundry facilities for the visiting guests at the community centre. A laundry station also has the potential to show an at first sceptical community the practical advantages of eco-conscious practices.

#### **Low-Cost Options**

While the system built at the Indlovu Centre is complex, a rainwater harvesting laundry system can be built very simply. The necessary elements are only a way of collecting roof water, a means of elevated storage, and a container for washing. Using the greywater for watering plants does not require a buried irrigation setup as we built, only the initiative to plant a garden and water it. This section will give suggestions for building a simple system.

A gutter need only be a channel for carrying water laterally, which can be easily built in a variety of ways. A simple option is plastic tubing or even a length of hose cut open lengthwise and fixed around the edge of corrugated roof, the corrugation allowing water into the opened tubing. If one does not have a corrugated roof, gutters made from plastic tubing cut in two or strips of aluminium sheeting or corrugated zinc (both commonly available) bent lengthwise can be hung easily using inexpensive wire and nails or screws placed at intervals along the roof's edge.

An elevated water storage container could be as simple as a bucket on a platform fixed to the builder's home. A 50 litre container - a volume reasonable for laundry water usage – would weigh only 50kg (~110 lbs), and could be supported with a simple wood-framed stand. If a larger tank is desired, Appendix D provides information on inexpensive ferro-cement tanks built of only cement and reinforcing chicken wire. Larger tanks of this variety can be elevated by simply building up soil or possibly cinderblocks if available.

Once an elevated storage tank has been assembled, distributing the water can be accomplished through making a small outlet hole that can be plugged, or even buying a simple

sink tap available at Cashbuild from R50 ( ~USD7.50). From this point, laundry can be done in conventional containers, with the used water carried to the garden.

### ***4.3 Potential Project Additions***

Other possible additions to the laundry station include a roof, patio floor, a bench, a shelf and stepping stairs. Materials were purchased to construct a roof out of corrugated plastic but our team was not able to erect it during our time onsite. The roof, which will be built by the workers of the Indlovu Centre at a later date, will provide shelter from the intense sun and rain and provide further security for the wash basins and taps.

Our team had also wanted to install a proper floor but we did not get a chance to. Across the street from the laundry station is a patio floor made from durable tiles that our team helped lay. We had hoped to provide a similar type of flooring for the station, but simply ran out of time. This style of patio flooring could keep the laundry station floor from becoming uneven or muddy and would be generally aesthetically pleasing.

Other small additions, such as a bench, a shelf or steps, could be made to make the laundry station more inviting. A bench could be located on the left side of the station where extra space exists. This bench could be used for sitting and/or placing laundry baskets upon to hold clothes while using the sink basins. There is also a space between the wall of the clinic and the wash basins that could serve as the location of a shelf. Stepping stairs could be placed next to the laundry posts for people to stand on while doing laundry. Additions such as these would add to the functionality of the station as well as to its aesthetic value.

We have provided the community with these suggestions for further implementation, but now the project is in the hands of the community to do with it as they please. It is an opportunity for them to make the laundry station truly their own.

## Chapter 5: Conclusion and Recommendations

Our time at the Indlovu Centre was a unique experience in many ways. Working in a low-income area where the primary form of housing was shacks served as a constant reminder of the lasting effects of apartheid in South Africa and the poverty in the developing world. Knowing that our project would have a lasting effect on the people of Monwabisi drove us to make our project something more than just the design and construction of a laundry station. We engaged ourselves with the community and incorporated their ideas and thoughts into the final construction of our project.

### *5.1 Community Relations*

Early on we identified the need to build strong relations with the people of Monwabisi Park. According to our sponsor, relationships were essential in gaining the respect and trust of the residents. For the first few weeks, we invested a great deal of time getting to know community figures like Buyiswa, Glen, and Opah. Spending time with these community leaders allowed us better understand the complex dynamics of the settlement as well as meet other individuals within the community. By forming these relationships, a more relaxed and comfortable environment and workplace was created. Building a strong relationship between our team and the community proved beneficial to both parties. We designed a community laundry station and in return the labour of constructing it was shared amongst our team and a number of Indlovu residents under Opah's management. This method of building relations and making sure both sides benefited from those relations proved very successful for our project.

### *5.2 Obstacles*

Along with the ease of some aspects of our project came the inevitable roadblocks that the team faced. Many of these problems stemmed from scheduling issues. 'Africa Time,' as our sponsor called it, is a relaxed sense of time that many people in Africa work by. On multiple occasions we faced unforeseen delays in our project work and because of this our team had to be flexible and ready to adjust to varying timelines. Where the laundry station is now located used to be a non-functioning municipal tap, which was to be moved before our construction on the

laundry station. After a great length of time passed and no one came to reposition the tank, we ended up having to remove the tap ourselves in order to start building.

Another issue arose when we were informed that the tank stands in the back of the youth centre could not be built in our proposed location. It was then that we discovered that anything built in Monwabisi Park had to go through the street committee. We had to postpone the installation of the tank stands until the street committee met to resolve the issue. Along with construction problems were security issues that involved the construction of a fence surrounding the laundry station to protect the basins from theft. Although this was not in the original plan, our team adjusted the design to ensure the security of the laundry station.

Flexibility was used throughout this project. On a few occasions there were power outages, so the group had to change plans and find alternative work. In addition, the team was fortunate enough to have supplies and tools donated by Eco-Beam owner Mike Tremeer. Transportation to buy products for the laundry station and fence was provided by an Indlovu volunteer. In the future, supplies and transportation may not be as readily available as it was to us.

### ***5.3 Unskilled Labour***

For the construction aspect of this project, we relied on the help of about 14 people total. Among these people, there were two men, about seven teenagers, and a few children between the ages of 9 and 13. The number of people helping each day ranged from one to five volunteers. The lack of skills and working experience of the helpers from the community was sometimes unfavourable to the building processes. Because we were not able to assign jobs to people while we were working in other areas, we had to do most of the work ourselves or we had to be there to make sure nothing went wrong. An example of this occurred the day we were installing the frame for the basins. Everything was ready, we just needed to make the concrete mixture and then fill in the holes. Before we could finish, our team got called to the youth centre. When we returned, people were already mixing the cement, sand, gravel, and water without measuring the amount of added ingredients. When we asked how much of each material they had added, they started guessing, and finally concluded to have mixed four wheel barrels of sand, one bag of cement, and probably less than one wheel barrel of gravel, when it should have been a proportional mixture with a cement:sand:gravel ratio of 1:2:3. We had to complement the

mixture they already started with more cement and gravel to make it useable. That instance demonstrated the great working attitude local people have and their willingness to help, but it also showed what the lack of certain skills and work experience can cause in construction. This simple mistake, like others made without intention, took time to fix. However, there is always something useful that one can learn from these setbacks. The fact that we had to delegate work carefully gave us an incredible insight into how other, less fortunate people live. The life for these people is not easy, yet they were very welcoming and able to enjoy their work and share with one another. We were able to experience certain aspects of their everyday lives and the tasks necessary to be able to maintain an acceptable quality of life.

#### *5.4 Risks of Working in a Settlement*

Working in a settlement can be interesting and educational, but at the same time it poses certain risks. Similar to other places, in the settlements you will find those people that will treat you as a friend and as part of the community, as well as those who will look for opportunities to take advantage of you. Because we come from a different place, have a different social status, speak a different language, and have a different skin colour, this made us an ideal target. Even though we didn't have any issues of that sort in Monwabisi, we always took appropriate precautionary measures. Because there were two shebeens (local pubs) between the centre and bus drop off, we always had someone from the Indlovu Centre walk us to the centre in the mornings and to the bus in the afternoons.

While working in the settlement, another risk we faced was the possibility of work-related accidents. Sometimes when working with the children, the construction site became a social area or a playground. Instead of being focused on the work, the children often got distracted which allowed for more opportunities for accidents to occur. For example, two members of our group had the experience of being hit by a wood bar while mounting the stands for the tanks that one of the younger helpers dropped on two separate occasions. Fortunately, no injuries resulted but the incident could have been worse. Children were frequently playing near our construction site, so we had to keep a watchful eye at all times.

### ***5.5 Concluding Remarks and Recommendations***

Overall, our project was an immense learning experience. We experienced the Xhosa culture, both in daily life and in special rituals. We dealt with triumphs and trials. The team has made a few recommendations based upon what we have learned for future project groups. Being self-reliant is essential; depending on outside sources is not always the safest or surest way of getting the job done. The need for flexibility is also important. Throughout this project many plans were changed, eliminated or added to. The key to dealing with such change was to always have an alternative route. Being able to accept a change in plans and adjust quickly is critical. Finally, keeping an open mind throughout the entire IQP process will help ensure a successful and valuable project experience.

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- Bell, T. (2004). *The Dead Sea Valley Permaculture Project*. Retrieved September 22, 2007, from <http://permaculture.org.au/?p=253>
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## Appendix A: Annotated Bibliography

### Case Studies

- [1] Arbon, K. (2007). *An Ecovillage Existence*. Retrieved September 3, 2007, from <http://www.celsias.com/2007/08/27/an-ecovillage-existence/>

Useful source. The author explains the process by which Eco-Villages are created and why they are advantageous to residents of the communities. The article conveys this by showing a physical map of what an Eco-Village should look like. The maps will help in designing ways to set up the most resourceful Eco-Village. The author concludes that different set ups are best for different types of environments. That advice is a helpful reminder in paying special attention to the environmental differences between different case studies and Monwabisi Park.

*Submitted by Augustina Mills*

- [2] Gulyani, S., & Connors, G. (2002). *Urban Upgrading in Africa: A Summary of Rapid Assessments in Ten Countries* Retrieved September 7, 2007.

Very useful resource. The authors discuss what aspects of the projects worked, what parts didn't work, and most importantly, *why*. Author concludes that upgrades are most successful when they focus either on obtaining formal tenure OR increasing the accessibility of basic services. When trying to do both, it often becomes too complicated or too expensive and the upgrade is put on hold.

*Submitted by Lauren Alex*

- [3] Robins, S. (2002). Planning 'Suburban Bliss' in Joe Slovo Park, Cape Town. [Electronic version]. *Africa: Journal of the International African Institute*, 72(4), 511-548.

This article will serve as a useful source in deciding key social issues that must be addressed when creating a master development plan for Monwabisi Park. The author's main interest was the Joe Slovo Park in Cape Town - a failed attempt at supplying low-income families with free housing. Because of a lack of attention to social issues, the planner's efforts to increase the standard of living were unsuccessful and the brick-building community they created quickly resembled an informal settlement. Taking into account social and cultural issues will be major part of our project planning.

*Submitted by Lauren Alex*

- [4] Swilling, M., & Annecke, E. (2006). Building Sustainable Neighbourhoods in South Africa: Learning from the Lynedoch Case. [Electronic version]. *Environment and Urbanization*, 18(2), 315-332.

This article thoroughly explained the planning process for the Lynedoch Eco-Village, a community located near Cape Town. The author described the delicate balance between growth, sustainability and equity needed for the Eco-Village to work. Planners focused the village around children; they built schools and youth centres in the middle of the settlement. Also, the

author explained the guidelines for households living in the Eco-Village and the way they reduced the need for external services such as waste removal by recycling as much as they could. The eco-friendly ideas discussed in this paper will be useful in planning process for Monwabisi Park.

*Submitted by Lauren Alex*

## **Khayelitsha**

- [1] *A Population Profile of Khayelitsha: Socio-economic Information from the 2001 Census* (2005). Cape Town, SA: Information and Knowledge Management Department. Retrieved 15 Sept. 2007, from [http://web.capetown.gov.za/eDocuments/A\\_Population\\_Profile\\_of\\_Khayelitsha\\_1052006142120\\_359.pdf](http://web.capetown.gov.za/eDocuments/A_Population_Profile_of_Khayelitsha_1052006142120_359.pdf)

Although a little dated, this site provides a good overview of the population of Khayelitsha and Monwabisi Park. Compiled from a South African census, the information on this site addresses population size, distribution, economic activity, education and various other aspects of life. Information such as this is essential for understanding the context of the site which we will be working in.

*Submitted by Lauren Alex*

- [2] Berner, I., Hofmann, B., & Spangenberg, K. (2004). *The Development of Monwabisi: A Situational Study*. Cape Town: (Monwabisi Park) Retrieved 8 Sept. 2007, from Google Scholar database. from [http://www.aachen-kapstadt.de/projekte/asa\\_project\\_study\\_monwabisi.pdf](http://www.aachen-kapstadt.de/projekte/asa_project_study_monwabisi.pdf)

This report examines all aspects of life at Monwabisi Park including its history, the environment, tourism, and future building plans such as a golf complex. The authors also discuss a proposal for an Eco-Village in Monwabisi Park with recommendations and pros and cons. This will be very useful our IQP team, as it will provide us insight into Monwabisi life.

*Submitted by Lauren Alex*

- [3] *CITY OF CAPE TOWN SOCIAL STUDY 2004 SURVEY OF RESIDENTS OF JOE SLOVO; NONQUBELA K-section; SWEET HOME*(2005). Cape Town.

This is a key source for understanding informal settlement life in townships surrounding Cape Town. The report is a compilation of information gathered from a resident survey which covered all aspects of life – sanitation, employment, income, housing, hunger, flooding, and more. Reporters conclude that the temporary services in informal settlements such as standpipes and toilets are inadequate and that services should be addressed first in most communities.

*Submitted by Lauren Alex*

- [4] Maylam, P. (1995). Explaining the Apartheid City: 20 Years of South African Urban Historiography. [Electronic version]. *Journal of Southern African Studies*, 21(1, Special Issue: Urban Studies and Urban Change in Southern Africa), 19-38.

This article explores the effects that the apartheid had on urban development in South Africa over the past century. The author discusses different laws that were put in place to restrict the migration of black Africans into South Africa and the resulting consequences of these harsh regulations. This information will be essential in understanding the origin of informal settlements as well as the social and political dynamics of the communities.

*Submitted by Lauren Alex*

## **Permaculture**

- [1] Bell, G., Bellamy, D. & Mollison, B. (2005). *The Permaculture Way: Practical Steps to Create a Self-sustaining World*. Retrieved September 9, 2007, from <http://books.google.com/books?hl=en&lr=&id=9sb-PG2osiAC&oi=fnd&pg=PA11&dq=permaculture+principles&ots=okKxC92bdV&sig=BCJvT8j9Igu69P4g-8geWwYmR1c#PPA2,M1>

Useful resource. The author shows the benefits of using the concepts of permaculture in everyday life. The author emphasizes the importance of following these concepts in order to preserve our land in the future. He even goes on to point out the advantages of permaculture in that one can capitalize by being resourceful. This is an important point to be made to the people of Monwabisi Park; if the people are resourceful they can cut down on costs.

*Submitted by Augustina Mills*

- [2] Bell, G. & Clarke, J (1992). *Permaculture Way*. Thorsons. Retrieved September 9, 2007, from [http://books.google.com/books?hl=en&lr=&id=9sb-PG2osiAC&oi=fnd&pg=PA11&dq=permaculture+AND+\(design+OR+planning+OR+development\)&ots=okKxC9Z6bV&sig=Bi9YVBkaUmcfwmABtjLABUNTm4k](http://books.google.com/books?hl=en&lr=&id=9sb-PG2osiAC&oi=fnd&pg=PA11&dq=permaculture+AND+(design+OR+planning+OR+development)&ots=okKxC9Z6bV&sig=Bi9YVBkaUmcfwmABtjLABUNTm4k)

In this article, the authors attempt to give a firm base to the readers on sustainable development and permaculture. The information provided is helpful for understanding better the principles of permaculture, and consequently to understand better our project. "This book is about creating wealth without environmental damage," (Bell and Clarke, 1992)

*Submitted by Alejandro Sosa*

- [3] Bell, T. (2004). *The Dead Sea Valley Permaculture project*. Retrieved September 22, 2007, from <http://permaculture.org.au/?p=253>

Very useful for background section. This site explains an example of what permaculture activists/teachers Geoff Lawton and Sindhu did on a project in the Middle East. This website had information regarding other cases in the seventeen countries the activists had visited. This information can be useful in showing cases of what to research more upon based on certain climates and areas of the world.

*Submitted by Augustina Mills*

- [3] Diver, S. (2002). *Introduction to Permaculture: Concepts and Resources*. Retrieved September 3, 2007, from <http://attra.ncat.org/attra-pub/perma.html>

The author outlines the main objectives and points of permaculture. Several sources from books to databases to other websites were used in an effort to provide a broad range of definitions and examples of what permaculture is. The application of how to apply permaculture in everyday society was very interesting. This research will help me to grasp an even broader perspective of what I only dreamed was possible with permaculture.

*Submitted by Augustina Mills*

- [4] Gori, E. (2005). *The Application of Permaculture Design Concepts for Sustainable Housing Environments*. Retrieved September 9, 2007, from <http://www.sustainablebuiltenvironments.com/sbe/Documents/2005/2005%20-%20Gori.pdf>

Very useful for methodology. This paper analyzes the use of sustainability concepts in urban development, with excellent detail on the effects of physical community layout. It offers suggestions for the design of a sustainable community, and the social and economic advantages.

*Submitted by Jessy Cusack*

Same source:

Very useful source. This paper can be used in the permaculture section of the proposal. This paper demonstrates the benefits when applying Permaculture design principles to create sustainable housing settlements. There are two models within this .pdf file that show pictures of the difference between what a healthy/safe housing set up looks like and what a non-healthy/dangerous housing set up looks like. "This paper uses Permaculture design concepts to show how sustainable and holistic green field housing developments can be designed to cater for more functional and safer housing with greater opportunities for urban agriculture, open space systems and community facilities."

*Submitted by Augustina Mills*

- [5] Goldring, Andy (2005, January 20). *Permaculture Explained*. Retrieved September 4, 2007, from Permaculture Association - Designing for Sustainability Web site: <http://www.permaculture.org.uk/mm.asp?mmfile=whatispermaculture>

I believe this source could be helpful for our project because it contains information on permaculture and how it is implemented for a sustainable development.

*Submitted by Alejandro Sosa*

- [6] Holmgren, D. (2004). *Essence of Permaculture*. Retrieved September 22, 2007, from <http://illdill.org/Permaculture.pdf>

Very useful for methodology. There is an amazing chart in here about the Permaculture Ethical & Design principles and how they relate. This will be very useful in illustrating the relationship between the goals we have for the project and how we plan to incorporate the principles of permaculture.

*Submitted by Augustina Mills*

- [7] Mars, R. (2005). *The Basics of Permaculture Design*. Retrieved September 12, 2007, from

[http://books.google.com/books?hl=en&lr=&id=bxyJlMjKsQsC&oi=fnd&pg=PR3&dq=THE+APPLICATION+OF+PERMACULTURE+DESIGN+CONCEPTS+FOR+&ots=cCUigOA89\\_&sig=J7unfdsEYsnYTYiERkekTWpDVxY#PPP1,M1](http://books.google.com/books?hl=en&lr=&id=bxyJlMjKsQsC&oi=fnd&pg=PR3&dq=THE+APPLICATION+OF+PERMACULTURE+DESIGN+CONCEPTS+FOR+&ots=cCUigOA89_&sig=J7unfdsEYsnYTYiERkekTWpDVxY#PPP1,M1)

Useful source for methodology. This book contains very in-depth information regarding the physical necessities for creating various permaculture-based objects, like farms and houses. There is a guide to which materials are best for different climates, showing the most durable and cost efficient products. This information may useful in informing the people of Monwabisi Park of what products will be most practical and advantageous for use in building shacks. This type of information can only aid in efforts to build another eco-cottage.

*Submitted by Augustina Mills*

## **Practical Solutions**

- [1] *Canada Science and Technology Museum*. (2007). Retrieved October 4, 2007, [http://www.sciencetech.technomuses.ca/english/collection/washing\\_machines.cfm](http://www.sciencetech.technomuses.ca/english/collection/washing_machines.cfm)

This source has detailed information on the history of the washing machine. Simple devices used in the 1800's and 1900's might be useful to aid in washing in Monwabisi Park. Scrub boards and manual wringers are discussed.

*Submitted by Lauren Alex*

- [2] Franceys, R, & Dean, P (1997). Ferro-cement Tank. *Footstep 30: WATER, SANITATION AND HYGIENE*, Retrieved September 30, 2007, <http://tilz.tearfund.org/Publications/Footsteps+21-30/Footsteps+30/Ferro-cement+tank.htm>.

Since we are dealing with water conservation issues, I consider this a very valuable source because it provides a very practical solution to build a tank for collecting rain water from the roofs. This peculiar tank is called Ferro-cement tank since its internal structure is made of iron, and it is covered with cement. The authors of the article provide a very descriptive process for building the tank using textual and graphical descriptions, including the quantity of the materials needed for the construction. Combined with the methodology for calculating the amount of rain water that can be collected annually from a roof in Monwabisi Park, the required size of this tank can be estimated and built.

*Submitted by Alejandro Sosa*

- [3] Gallardo, V (2002). Cosecha y Almacenamiento de Aguas Lluvia. *Documentos de Trabajo*, Retrieved September 27, 2007, <http://www.sociedadcivil.cl/territoriosur/01038.htm>

This is a technical document written in Spanish by the Civil and Biochemical Engineer Vicente Gallardo Montecinos. The title of this document is "Rain water collection and storage". In this document he explains a method to determine the amount of rain water that can be collected from a roof. He also refers to the different types of roofs that influences in the amount of water that can be collected depending on the shape they have. I consider this a useful document because, with the information provided, we can estimate the amount of water that can be collected

annually from a roof, and use those calculations to determine the size of the recipients that can be used to collect the water. It also provides graphical examples of the roofs and the recipients used, which help us understand better how this system works.

*Submitted by Alejandro Sosa*

- [4] Gallardo, V, & Hecke, F (2002). Unidades Sanitarias Secas: Una Solución Económica y Ambientalmente Sustentable para el Saneamiento Básico. *Documentos de Trabajo*, Retrieved September 27, 2007, <http://www.sociedadcivil.cl/territoriosur/01038.htm>.

-This document is divided in three sections. The first section contains textual information, and the second and third sections contain the annexed graphical information.-

In this document, entitled “Dry sanitary units: an economically and environmentally sustainable solution for basic sanitation”, Gallardo and Hecke talk about sanitation techniques used in Chile such sewer systems, cesspools (pit latrines), and septic fosses. They mention the reasons that make these techniques a bad solution for an informal settlement, whether they are expensive, complicated to build, or not eco-friendly. They also mention three good practical solutions for the toilet problems, such as the Vietnamese Latrine, the “dry-fertilizer-family latrine” which has been successfully used in Guatemala, and the Tambour Latrine used in Chile. The authors provide a technical description of each of the elements of the devices, instructions for its use and maintenance, and drawings of the processes for building the devices.

*Submitted by Alejandro Sosa*

- [5] Ivie, M. A. (1994). *A Simple Home Irrigation System*. Retrieved October 5, 2007, <http://rps.uvi.edu/CES/gf20.PDF>

Very resourceful. This source shows an actual example of a simple irrigation system implemented in the Virgin Islands. A highlight of this example is the cost, ten to fifteen American dollars. This specific irrigation system stood out simply because of the price. This system might be a more feasible approach that could be added in Monwabisi Park. Several pictures are included that illustrate the physical appearance of what a drip system would appear look like. A picture from this document will be included in our proposal (Figure 6).

*Submitted by Augustina Mills*

- [6] Laundry Detergent Ingredients. (2005). Retrieved October 3, 2007, <http://www.laundry-alternative.com/detergentsinfo.htm>

Useful for background. This article contains a list of the common ingredients in commercial laundry detergents, with a review of the environmental impacts of production and (important to our project) exposure to the environment. Specific chemicals and general additives such as colour enhancers and perfumes are covered.

*Submitted by Jessy Cusack*

- [7] Lausch, V. (2006). How Water Filter Technology Affects Your Drinking Water. Ezilon Infobase. Retrieved October 2, 2007, <http://www.ezilon.com/articles/articles/339/1/How-Water-Filter-Technology-Affects-Your-Drinking-Water>



Useful for background. The article gives basic information on the components of modern drinking water filtration systems. The use of certain filtration media types is explained, and a comparative overview is given of chemical vs. physical filtration.

*Submitted by Jessy Cusack*

- [8] Ludwig, A. (1997). Slow Sand Filtration. Retrieved October 1, 2007, <http://www.oasisdesign.net/water/treatment/slowsandfilter.htm>

Very useful for background. The author, who has written several books and maintains a website pertaining to slow sand filtration, details in this article the theory behind their operation, their basic components, and the parameters important to their proper functioning. Data is given for SSF systems of various sizes, such as the flow rate and sand particle size for ideal operation. –

*Submitted by Jessy Cusack*

- [9] McCormack, A. (2007). *Soakaways*. Retrieved November 7, 2007, from <http://www.pavingexpert.com/drain08.html>

Useful for irrigation section. I found out the brunt of the information for soakaways on this webpage. Explanations are given, along with principles and safety precautions which help aid in our knowledge of the purpose and functions of soakaways.

*Submitted by Augustina Mills*

- [10] Ng, K. (1999). Treatment of Greenhouse Recirculation Water. British Columbia Ministry of Agriculture. Retrieved October 1, 2007, <http://www.agf.gov.bc.ca/resmgmt/publist/500series/512000-2.pdf>

Useful for background. This reference is a factsheet prepared by the British Columbia Ministry of Agriculture offering general operating information and different system designs for bio-sand filters. It includes excellent information on fast and slow sand filtration, and recommended system components based on application.

*Submitted by Jessy Cusack*

- [11] Sijali I V. Drip irrigation: options for smallholder farmers in eastern and southern Africa. 2001. RELMA Technical Handbook Series 24. Nairobi, Kenya: Regional Land Management Unit (RELMA), Swedish International Development Cooperation Agency (Sida). 60 p. + x p.; includes bibliography

Very useful for methodology. This technical handbook shows the entire workings of several different types of irrigation systems. There are systems ranging from home-made to crop-length devices. This document shows the irrigation structure work and how to create them. This will be particularly useful in learning how to create a system that can be useful for the Monwabisi community. The township is in need for a productive method of using greywater. One of the proposed devices may work for this particular area in Cape Town.

*Submitted by Augustina Mills*



- [12] Skinner, B, Franceys, R, & Carter, I Planning a pit latrine. *Footstep 30: WATER, SANITATION AND HYGIENE*, Retrieved September 30, 2007, <http://tilz.tearfund.org/Publications/Footsteps+2130/Footsteps+30/Planning+a+pit+latrine.htm>.

In this Magazine article, the three authors suggest things to be considered when planning to build a latrine such as where to build it, the conditions of the land, the type of latrine to be built, the covering slab material. They also give suggestions to improve the pit latrines by adding ventilation to the pits, and by building two pits next to each other so when one gets filled, it can be sealed while the other one is in use. Even though not much information is provided about the construction of the latrine, it contains helpful information to get started, and a good image that could be used to communicate our ideas to the community of Monwabisi Park.

*Submitted by Alejandro Sosa*

## **Sustainable Development**

- [1] Birkeland, J (2002). *Design for Sustainability: A Sourcebook of Integrated, Ecological Solutions*. London: Earthscan Publications, Limited.  
<http://site.ebrary.com/lib/wpi/Doc?id=10128847>

The author talks about sustainability related to construction, environmental management, economic growth, and social goals as well as wastes, environmental degradation, and system designs. I believe this is a good source because has information about sustainability related to many other concepts that can be applied to our project as well.

*Submitted by Alejandro Sosa*

- [2] Education for Sustainable Development. Retrieved September 3, 2007, from UNESCO Web site: [http://portal.unesco.org/education/en/ev.php-URL\\_ID=27234&URL\\_DO=DO\\_TOPIC&URL\\_SECTION=201.html](http://portal.unesco.org/education/en/ev.php-URL_ID=27234&URL_DO=DO_TOPIC&URL_SECTION=201.html)

I consider this site helpful for our project because it contains information about integrating the principles, values, and practices of sustainable development into all aspects of education and learning. Since we are working on town planning based on sustainable development principles, it would be good to know some ways to implement those principles.

*Submitted by Alejandro Sosa*

- [3] James, V. U. (1996). *Sustainable Development in Third World Countries : Applied and Theoretical Perspectives*. Westport, Conn: Praeger.

This will be a useful resource for our group when we try to define the principles of sustainability. The book provides a good overview of the theory of sustainable development as well as various sections of African case studies. The author provides summaries and recommendations at the end of each chapter which are good places to start for finding ideas to address the needs of Monwabisi.

*Submitted by Lauren Alex*

- [4] Zetter, R., & Watson, G. B. (2006). *Designing Sustainable Cities in the Developing World*. Aldershot, England ; Burlington, VT: Ashgate.

Excellent source on sustainability. The book dedicates an entire chapter to urban planning and sustainability in South Africa. The authors discuss the legacy of the apartheid system in informal settlements and the social challenges low-economic areas face. There is also a useful section on participatory design methodology which lays out workshop structures.

*Submitted by Lauren Alex*

## **Urban Upgrading**

- [1] (1993, May 1). Africa Tames the Town Planners: How do you provide seven million people with homes that they want to live in? Retrieved September 4, 2007, from Science news and science jobs from New Scientists Web site:

<http://www.newscientist.com/article/mg13818714.100-africa-tames-the-town-planners-how-do-you-provide-sevenmillion-people-with-homes--that-they-want-to-live-in--south-africasarchitects--and-town-planners-have--got-to-learn-quickly.html>

This source might be helpful since it contains a background on informal settlements (squatter camps) in South Africa, and also information on town planning.

*Submitted by Alejandro Sosa*

- [2] Abbott, J., & Douglas, D. (2003). The use of longitudinal spatial analyses of informal settlements in urban development planning. *Development Southern Africa*, 20(1), 3-19.

Fairly useful source. Provided good background information about the growth of informal settlements in Cape Town. The author's main interest was addressing the fact that settlement growth cannot be contained and a method of managing that growth must be developed. This is related to our project because we need to take into consideration growth when we look into town-planning. The journal introduced the integrated Serviced Land Project (iSLP), a program which focused on the relocation and rollover upgrading of informal settlements. This is a topic that I think would be worth researching more.

*Submitted by Lauren Alex*

- [3] Irrgang, B. (2005). *A STUDY OF THE EFFICIENCY AND POTENTIAL OF THE ECO-VILLAGE AS AN ALTERNATIVE URBAN MODEL*. Unpublished master's thesis, University of Stellenbosch.

Extremely useful resource. This paper gives a complete analysis of the Eco-Village as a model for urban development. The author studied at the Sustainability Institute in Stellenbosch SA, and so includes valuable lessons from the Lynedoch Eco-Village associated with the institute. The paper also includes other case studies and an excellent summation of literature relevant to the Eco-Village concept.

*Submitted by Jessy Cusack*

- [4] Engelbrecht, C. (2003). *People and Places: An Overview of Urban Renewal* (pp. 29-89). Johannesburg: South African Cities Network.

This book thoroughly examines the different elements of informal settlement upgrading. The author describes the origin of informal settlements, the policies that govern them and the financial options available for supporting an upgrade. Engelbrecht uses case studies to support his ideas, including one from Mitchell's Plain. Included in the appendix is a useful summary of informal settlements.

*Submitted by Lauren Alex*

- [5] van Horen, B. (2000). Informal settlement upgrading: Bridging the gap between the de facto and the de jure. [Electronic version]. *Journal of Planning Education and Research*, 19(4), 389-400.

Extremely useful source. Author discusses the link between upgrading informal settlements and altering legal rules and planning procedures. The main focus of the article is an overview of the planning process used for the successful upgrade of an informal settlement in Durban. The upgrade included a pedestrianized network of asphalt lanes, systemized garbage collection, electricity and more. The article also addresses planning for even further upgrading. This source will serve a good guide for addressing the problems in Monwabisi Park.

*Submitted by Lauren Alex*

- [6] Peattie, L. & Aldrete-Haas, J. A. (1981). "Marginal" Settlements in Developing Countries: Research, Advocacy of Policy, and Evolution of Programs. [Electronic version]. *Annual Review of Sociology*, 7, 157-175.

Useful for context. This article gives a history on informal, or "marginal" settlements in various places throughout the world, and importantly the strategies and political ideologies they have been met with. The author extracts from other works and traces the different paradigms concerning the role of the informal settlement.

*Submitted by Jessy Cusack*

- [7] Pugh, C. (2000). Squatter Settlements: Their Sustainability, Architectural Contributions, and Socio-economic Roles. [Electronic version]. *Cities*, 17(5), 325-337.

Good theory and possible planning ideas. The author's main objective was to explore and expand upon the social implications of squatter settlements and theory behind their economic role. Of particular use is the suggestion of small, local changes that have an immediate effect on the perception and morale of residents, such as communal spaces and aesthetic improvements.

*Submitted by Jessy Cusack*

- [8] Richards, R., Leary, Brian, Mutsonziwa, K. (2007). Measuring Quality of Life in Informal Settlements in South Africa. [Electronic version]. *Social Indicators Research*, 81(2), 375-388.

Very useful reference. The author surveyed residents of South African informal settlements in Buffalo City, Durban, and Alexandra, Johannesburg as to their feelings on quality of life. Percentage level of satisfaction is given for areas such as housing and basic services, public facilities and amenities, leisure activities, and overall satisfaction with life. The article gives insight to the perception of residents as to various aspects of daily life, and how logistical improvements can affect quality of life.

*Submitted by Jessy Cusack*

[9] *Upgrading Urban Communities: A Resource for Practitioners*. (2001). Retrieved 7 Sept. 2007, from <http://web.mit.edu/urbanupgrading/index.html>.

This website is a really neat interactive tool developed for people planning urban upgrading projects. Sections of the site explain how to get started planning, what issues to address, what questions to ask, how to structure the plan and how to carry it out. This site also includes useful case studies and links to other websites dedicated to urban upgrading.

*Submitted by Lauren Alex*

## Appendix B: Key Informant Interviews

### Interviews with Dianne Womersley

Interview 1: September 10, 2007

#### Phone Interview

**Interviewee: Dianne Womersley**

**Interviewers: Lauren Alex, Jessy Cusack, Augustina Mills, and Alejandro Sosa**

Topics Discussed:

#### Monwabisi Park

- Situation in the area is complex – Monwabisi Park is an informal settlement and people are not legally allowed to live there.
- People have been living there for 12 years
- People live in shacks without water, facilities or sanitation
- There are no public facilities w/in informal settlements which have created problems in for the youth
- drug and alcohol abuse
- rate of teenage pregnancy
- In need of educational and social facilities
- Biggest Health Problem: sanitation
- Biggest cause of infant death – diarrhoea

#### Indlovu Centre:

- Indlovu Centre is the heart – Eco-Village is the body
- Already established crèche, youth centre (built of recycled materials from film set), etc.
- Many places use the bucket system with a truck that comes by every 2 weeks to collect waste
- Have 2 dry composting toilets; they recycle greywater; 1 biogas digester
- Second eco-cottage with biogas digester were finished only a few months ago
- \*\*Must be sensitive to people in the area – a variation of the composting toilet was rejected by another informal settlement because they felt it wasn't good enough for them
- Shaster foundation responded to the EXPRESSED needs of the people of Monwabisi Park
- Needs expressed by house committee
- Once the hostel and community centre are finished, there will be no more vacant land to build on.
  - the committee will take over running the community at this point
- Finances are taken care of – funding is available
- Government, low-cost housing is like a cement box – terrible! Bad quality and dehumanizing
- Eco-cottages – people came from all over to see it while it was being built. They thought it was odd but once complete, the design was widely accepted.

- General Perceptions: Brick houses are desirable
  - Changed that perception with sand-bag cottage
- Flush toilets are desirable
  - Changed that perception with composting toilet (odourless)

#### Eco-Village Case Studies

- Ivory Coast (Johannesburg) – informal settlement upgraded to eco-village
- Need to change the perception of what an eco-village actually is – you don't need to wear sandals and eat leaves
- PURPOSE OF ECO-VILLAGE: Provide people with healthy housing and a sustainable food source
  - Vegetable gardens – neighbours are starting to grow their own food and recycle their own waste
- Different organizations have come out to see it and they loved it. They offered to give R1.5 million in order to build 20 additional eco-cottages with biogas digesters
  - Went to the community – caused huge problems
  - Who should get the houses?
  - Strong syndrome: anyone who raises their head above the masses will have it chopped off immediately
  - Concluded that until everyone can get a house or a plan with a time frame for housing, no one gets a house

#### Progress in Monwabisi and Work Ahead

- Community working together and understanding recycling and sustainable food source
- Biggest Need: Plan to work toward
  - Input on PRACTICAL steps the community needs to take in order to bring about the eco-village in the area
    - Di has no technical background and currently is the only one free to help development plan
- Different ways of approaching problems and situation - bureaucracy has no vision
- Terrain
  - Ridge with steep drop
  - Other side is a valley
  - Either rocky or sandy
    - Looking for ideas of how we go about development of changing the land for 15 to 20 thousand people
- Bypassing the bureaucracy side
  - Waste of time
  - Eventually after the eco-village is complete, they will try to obtain formal land ownership
- Come up with alternative ways to handle waste/ water (which is rationed in the summer)
- Come up with different way of planning the eco-cottages – sandbag houses are very time consuming
  - Now they are using wooden walls on the outside
  - Must use local labour

- Vegetable gardens – neighbours are starting to grow their own food and recycle their own waste
- Look into water harvesting
  - Daycare already harvests water off the roof
- Currently using a hand operating crushing machine – crush gravel to fill cracks in ground due to drought
- Local nature reserve – heartbreaking to see rubble
- Reusing waste – open to any suggestions
- Hopefully there will be funding for experimental housing – but unsure if there will be land available to build on
  - Could be worked out with residents
- Mayor of Cape Town is formally opening the eco-village on September 29<sup>th</sup>.
  - Di would love to be able to get her to meet with us when we go
    - We can present our proposal
  - Mayor runs the city and could potentially provide funding for the project
- Public transport in Cape Town is problematic – Shaster has a small van we can use if necessary

**From the information we gathered from the interview, our next step was to send out a follow-up email which is included below.**

### **Follow-Up Email with Dianne Womersley**

The following is the email Dianne Womersley sent back to the Indlovu Team on September 11, 2007 in response to our questions:

*Dear all of you...my answers.*

Could you elaborate on the street committee?

*In informal settlements social order is kept by elected representatives who are resident in the community. They are usually elders and are generally well respected by the community. The street committee fulfils the function of keeping the peace, settling disputes, reprimanding wrongdoers (sometimes having to beat them). They liaise with local authorities and councillors for the area.*

How many people are involved?

*The street committee for our area is made up of 8 people.*

What is their primary function?

*See above.*

You mentioned that once the hostel and the community center are complete, a committee will take over running the Indlovu Centre and developing the Eco-Village. Is that committee already set-up, and if so, who is it comprised of?

*The Indlovu Community Project committee will be made of the representative responsible for each element of the project - namely the day care centre; the clinic; the youth centre; the soup kitchen and the guest house. This committee is already in place. As we have just acquired a vehicle, the only outstanding thing we need is a telephone connection. (Very difficult to achieve in a squatter camp!) But we have ways and means of getting what we want so by the end of the year we hope to be full operational from Monwabisi. Then the process of handing over will take place at a speed determined by the committee. Once they realize that they will have to fund each element of the project themselves it may dismay them, but we also have in place the means for bringing in sufficient funding to do this - the guest house, hostel, bakery, craft centre, tourist venue and community centre.*

On average, what kinds of community participation do you see at the Indlovu? Centre?

*The project provides facilities for day care for babies and young children under 7 years; a youth centre for children under 21; a soup kitchen that feeds mainly pensioners and a clinic that is free for all children, unemployed, and residents of the area. Membership of the youth centre is dependant in part on volunteer work done in the community - so for example a group of youngsters is busy with a rubble crusher filling in holes in the roads. (Needed desperately as flooding is a serious problem in heavy rains.)*

Do many people consider it a big change for the better and an important part of their lives?

*I suppose so - we have helped quite a few families, and we feed many people.*

*The kids in the day care centre also get vitamins, healthy food and medical care, and they have all got fat and shiny. You will have to ask residents that when you come over.*

What portion of Monwabisi residents are regularly involved with the centre?

*Monwabisi Park is a large area of about 3,000 shacks. The area is divided into 5 sections, each one 'ruled' by its own street committee. We are based in section C1, but we have people coming from all over to the clinic and the youth centre and the soup kitchen.*

Can you suggest other people we might use as resources to contact? In what area? Housing? Environment? Health? *Please elaborate.*

What was the organization that offered to fund you 1.5 million rand to build 20 new houses?

*The HCI Foundation - the CEO is a personal friend of mine.*

*Talk to you again on Friday - my voice is already much better!*

*Di*

## **Interview 2: Friday, September 14, 2007**

### **Phone Interview**

**Interviewee: Dianne Womersley**

**Interviewers: Lauren Alex, Jessy Cusack, Augustina Mills, and Alejandro Sosa**



## Topics Discussed:

### Lynedoch Eco-Village

- pitiful excuse for an Eco-Village
- No cohesion – just houses built around the same area
- No sense of a community
- No food gardening

### Ivory Park

- project in Johannesburg
- Recycling (e.g. waste recycling)
- Focused on food gardening

### Sanitation

- Number 1 problem is sanitation - # 1 killer of infants
- Bad toilet systems, problems dealing with waste water, community stand pipes, huge pot holes in the street because women just empty the bucket water in the street
- Standstill water
- Malaria from mosquitoes

### Laundry

- system is stationed outside the village
- Goal: to research ideas for a simple laundry system
- Perhaps use a mangle (a simple hand-operated wash system)
- Focus on waste management
- Laundry & human waste
- Disposal of waste water
- An easier method for women – very tiring task

### General Information on Community

- Youth is amazing and willing to work
- Design a simple workable solar over (sturdy) – there's lots of sunshine there
- Levels of education are low
- Design a practical windmill: generate energy/electricity
- Available materials:
  - Boards, timber, plywood
  - Rubble
  - Waste paper (ideas for over to burn?)
- Paraffin stoves (many shack fires) – Dutch oven
- Reusing of cardboard and paper waste
- Fuel (LPG gas) is VERY expensive
- Evolverment

- Crèche – daycare center
- Entire community (Eco-Village) built based upon expressed needs
- Community driven everything
- 50/50 partnership

### **Interview 3: September 24, 2007**

#### **Phone Interview**

**Interviewee: Dianne Womersley**

**Interviewers: Lauren Alex, Jessie Cusack, Augustina Mills, and Alejandro Sosa**

#### Topics Discussed:

##### Water Harvesting

- Rainy season is from April to August
- November to March is very dry – causes water shortages
- Currently have 5k tank behind the crèche fed roof of the building
  - Used by neighbors
- Want to harvest water from roof of youth center, but space is limited. They have the funding.

##### Laundry System

- Had plan but came to grinding halt
- Currently people use a communal standpipe for water (~30 families per pipe)
- In India they have pedal powered washing machines
- Disposing of water – thrown in street. They don't bother to dig a hole, minimal effort in everything.
- Washing power – green bars of soap – no chemicals
  - They use what is cheap which isn't always biodegradable
- Piping – special issues because shacks are close together
- Look into underground greywater system

##### Toilets

- Popular approaches
  - Long Drop: dig a hole and put a bucket to sit on
  - Bucket System: cause public protests

##### Funding

- Some from the government
- Shaster does not want municipal involvement at all
- People come to help – but often hijack for hidden agenda
- Water conservation scheme could be back by the Dept. of Agriculture or Dept. of Social development
- People hear about the project, come to see it and often donate

### History of Shaster Foundation

- Started by Di
- Early 90's Dianne was involved in a TB outreach project, that's when she first visited a township
- Pre-94 – whites were not allowed in townships
- Di was horrified by living conditions and lack of child care
- For 3-4 years she collected donations
- Shaster – comes from Shaster daisies
- Legal entity – tax exempt organization registered in 97
- Worked in crèches in various townships
- 2 years ago – started in Monwabisi Park
- Noticed that the community was different – street committee approached Di with 1000 Rand collected within the community to help her efforts
- Everything donated was logged in a book
- Community – ownership, pride, skills, but a lack of self-esteem
- A few months ago, the HCI offered funding for low-cost housing
  - Needs workable plan so everyone knows they'll get a house in a given time frame

### Municipal Taps

- Free water collected in buckets
- 20-30 households to one standpipe
- There is a direct water connection to the clinic and the guest house
- Shaster would like to harvest rainwater – large roof surface area
- Currently, water from the crèche is channeled to a 5k liter tank (no filter)

### Laundry

- Done by women – go to the taps and collect water in buckets to bring back to their house
- Wash everything by hand in big plastic tubs
- Return to taps to collect rinsing water
- They wash when the sun is out, especially on weekends
- Washing lines – hung wherever possible (lines between houses, fences, etc)

### Electricity

- Most households have electricity
- People buy electricity vouchers
- The crèche has electricity – costs about 200 Rand/month
- Typically used for lighting and TV, wealthy have refrigerators and stoves

### Water Disposal

- Women get together and talk – very social event – share work and news
- Urbanization – breaking down social fabric
- Need to encourage social and communal activities – focus on community not individuals
- The settlement has a feeling of closeness and community spirit

- Not a feeling of personal space like in America
- Consider tubs with built in washboards
- They currently ring out all the water – perhaps make a device to help

#### Gardens

- Currently irrigated by hand with buckets
- Urine from the crèche is watered down and used to water vegetables
- Liquid waste from the biogas digester is also used to irrigate
- The dirt is like sand – there is no organic material
- Description of biogas digester :
  - Two toilets suspended above plastic tank. Gas is collected and sent to an outlet. Input of waste (including vegetable and biodegradable waste). When liquid reaches a certain level, it flows to another tank where there are enzymes to break it down

#### Water Harvesting

- Research what has been done in India – Fan shaped cement structure that collects water and channels it to an underground tank. May not work in Monwabisi because of the strong winds

#### **Interview 4: October 5, 2007**

##### **Phone Interview**

**Interviewee: Dianne Womersley**

**Interviewers: Lauren Alex, Jessie Cusack, Augustina Mills, and Alejandro Sosa**

#### Topics Discussed:

##### Municipal Taps

- Free water collected in buckets
- 20-30 households to one standpipe
- There is a direct water connection to the clinic and the guest house
- Shaster would like to harvest rainwater – large roof surface area
- Currently, water from the crèche is channeled to a 5k liter tank (no filter)

##### Laundry

- Done by women – go to the taps and collect water in buckets to bring back to their house
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- Need to encourage social and communal activities – focus on community not individuals
- The settlement has a feeling of closeness and community spirit
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- They currently ring out all the water – perhaps make a device to help

#### Gardens

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- Urine from the crèche is watered down and used to water vegetables
- Liquid waste from the biogas digester is also used to irrigate
- The dirt is like sand – there is no organic material
- Description of biogas digester :
  - Two toilets suspended above plastic tank. Gas is collected and sent to an outlet. Input of waste (including vegetable and biodegradable waste). When liquid reaches a certain level, it flows to another tank where there are enzymes to break it down

#### Water Harvesting

- Research what has been done in India – Fan shaped cement structure that collects water and channels it to an underground tank. May not work in Monwabisi because of the strong winds

### **Key Informant Interview**

**Interviewee: Moses**

**Interviewers: Lauren Alex, Jessy Cusack, Augustina Mills, and Alejandro Sosa**

**October 26<sup>th</sup>, 2007**

**Indlovu Youth Centre**

#### Topics of Discussion:

##### Education

- Teach people how to wash clothes
  - Wash white first
- Teach people how to dispose of the water
- Use a communal laundry station as a place to inform people of other topics such as HIV prevention

### Laundry Business

- Consider creating an informal laundry business
- People would bring their laundry there in the morning and pick it up later that day or the following morning
- Building would be equipped with washers, dryers, shelves and hangers
- Utilize a number system for dropping off clothes
- Perhaps start small – use simple technology and start to add other services
- Consider teaching people how to press clothes
- This would create jobs for people and ease the load of those who could afford the service

## Appendix C: Original Methodology

The fundamental goal of this project is to assist the Shaster Foundation with the development of a master plan to upgrade the informal housing in Monwabisi Park to an Eco-Village built on the principles of sustainability and resident participation. We will need to identify improvement opportunities relative to the issue of laundry and its implications for sanitation and water conservation, and develop practical solutions that must integrate with our Sponsor's development effort, which will continue beyond our time in Cape Town.

We have established the following objectives to attain our goal:

- Determine improvement opportunities
- Research and Develop practical solutions
- Evaluate proposed solutions
- Integrate with master development plan
- Develop community involvement strategies

These objectives are shown as a flowchart in Figure 41.

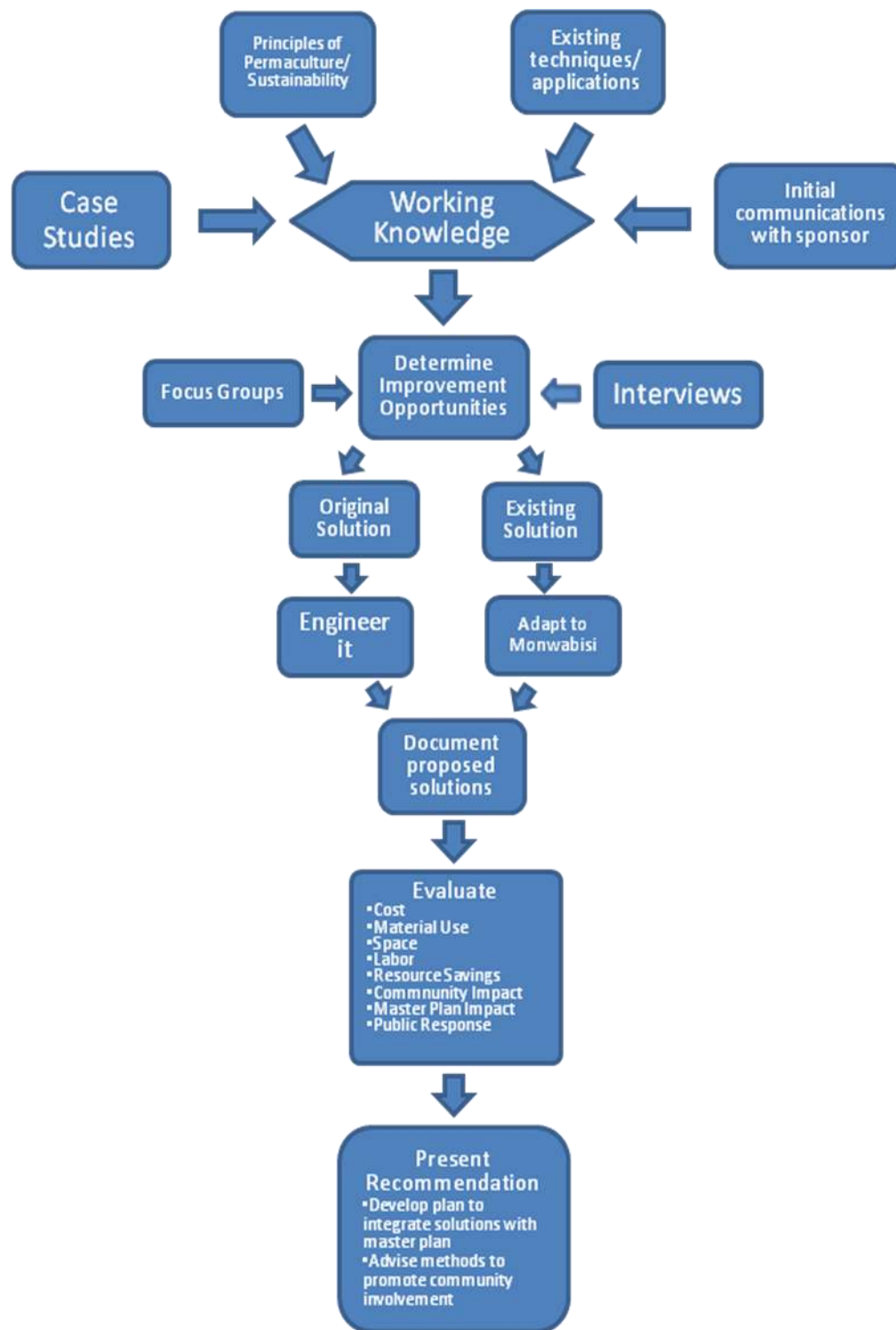


Figure 41: Methodology Flowchart



## **Determine Improvement Opportunities**

Literature, interviews, and focus groups will be useful resources in accomplishing our proposed objective of determining improvement opportunities in Monwabisi Park. All three components contribute to the working knowledge that serves as the foundation of this project and will provide insight into the topics discussed in this paper. The literature gives a basis for understanding important concepts and principles. Interviews will help to advance our understanding of the situation from both a personal and communal point of view. Focus groups will help our group to obtain a general knowledge of what the Monwabisi residents feel about certain issues such as housing or sanitation. This section will discuss how we will use these to determine improvement opportunities.

### **Literature Review**

Throughout our project work at WPI, we have analyzed literature about sustainable development, permaculture, sanitation, and water conservation. Sources from the internet, books, and academic papers have been used to help center our attention on the main project objectives. These sources are useful in grasping the meaning and general ideas of the topics we plan on addressing in our project. The literature section is important because concepts must be well understood in order to be successfully communicated and applied. As an example, we need to understand the principles of permaculture in order to emphasize them in the Monwabisi community. Literature research is the first step to identifying improvement opportunities.

### **Interviews**

Interviews will be necessary in order to identify the needs and wants of the individuals of Monwabisi Park. Interviews have already played an important role in our team's overall project focus as the decision to focus on the issue of laundry was decided based upon several interviews with our liaison. Interviews will be used to gain information from targeted individuals - those knowledgeable and involved on issues relating to Monwabisi Park, such as community leaders, municipal officials, and professional contacts provided by our sponsor. Interviewing will be most useful in obtaining information from different individual perspectives.

## **Focus Groups**

By setting up focus groups and interviewing small crowds of residents, we hope to gain a better understanding of the community needs of Monwabisi, the residents' hopes for the future of their community, and their opinions on improvements that we suggest for new laundry systems. This method of gathering and sharing thoughts might be particularly useful in receiving more open responses from individuals, building ideas and comments based on other's responses, and offering an opportunity to hear unique perspectives from different community members. Perhaps the most important reason for conducting focus groups is to determine the community's thoughts regarding our proposed ideas for the implementation of a new sanitation-based laundry system. The focus groups will be used as a preventative measure against miscommunication of our plans for the community and to gain their support for our proposed ideas.

## **Research and Develop Practical Solutions**

As specific improvement areas are identified through various types of interactions with the Monwabisi community, many ideas will be generated as potential solutions to water and sanitation needs. These solutions will be the result of the extensive background research conducted in Worcester as well as the time spent with the community pinpointing problem areas. All solutions will stem from the concepts of sustainability and permaculture addressed earlier in our proposal.

The case studies compiled during the initial stage of our project will serve as a starting point for addressing the identified problem areas. We will need to address the following questions: *What practical solutions have worked in the past for a similar situation? Could a similar approach be taken in Monwabisi? What alterations or expansions should be made to help integrate this solution into the community?* In addition to looking at case studies, our project team will brainstorm original ideas and work with community members to develop potential solutions. We also hope to travel to other settlements to observe how other communities are handling comparable situations.

Because community perception plays such a critical role in determining the success of a project, it will be important for our project team to maintain constant communication with the members of the community. As stated above, this will be initiated by interviews and focus

groups, but as ideas develop we will seek feedback from residents as well as our sponsor to ensure the ease of integration of the proposed solution. Developing an understanding of the social dynamics of Monwabisi will be a central focus of our time in the settlement.

Resource availability will be another important factor to consider when looking at the potential approaches. Because of the nature of the settlement, having access to certain materials, even basic building supplies, will be limited. Shortly after arriving, we will need to determine what resources are available as well as the specific budget for our work. Through conversations with our sponsor, we have already determined that there is an excess of paper products available in Monwabisi. If we could find a way to utilize that material in our project, it would be beneficial in multiple ways.

Recording ideas as they develop and evolve will be helpful in deciding what approach is best. Documents will be kept on each potential approach including the foreseeable advantages and disadvantages of each. These documents will need to be carefully analyzed before a finalized solution can be proposed.

## Evaluate Proposed Solutions

While the aim of the development process is to create a system that is functional, there are many other factors outside of physical engineering concerns that our team will need to be mindful of as we refine our recommendations. Regular evaluation and subsequent alteration of a design will be necessary to create a final product tailored to the specific conditions in Monwabisi. To do so, an evaluation tool such as Table 2 may be used to assess each component of a system under development by several criteria important to the context of the project. Each of the criteria is expanded upon below.

Evaluation Criteria	System Components			
	1	2	3	4
Cost				
Net Material Use				
Space Requirements				
Unproductive Labour Savings				
Productive Labour Opportunities				

Resource Savings				
Impact on Community				
Impact on Development Plan				
Public Response				

**Table 2: Evaluation Criteria**

- Cost

As Shaster's goal is the eventual inclusion of all of Monwabisi in the Eco-Village project, the cost of a single system will be incurred many times as the project progresses. Recommendations that involve investments by the residents themselves must be considerate of the very small income percentage that can be spared for non-essentials. Opportunities to reduce initial and maintenance cost must therefore be researched and employed to maximize the effective use of available funds.

- Net material use

An idea under development is likely to have both an expenditure and potential savings of materials associated with it. Useful materials may be saved through the changing of an existing process, or re-use of a material formerly disposed of. This will be compared to the materials needed for implementation for an overall assessment of the material usage. Shaster's cooperation with the Cape Town film industry offers the availability of certain materials which a design should incorporate whenever possible, as well as the resources with high availability already existing in the area. Materials that must be purchased from elsewhere should be used only when necessary.

- Space Usage

The distribution of dwellings in informal settlements is entirely unregulated, resulting in high density populations and very little space for public use (Huchzermeyer, 2002). Designs must therefore facilitate efficient use of space, with systems that are modular being preferable to those of large scale. As one of the pillars of the Eco-Village concept is community-friendly layouts, designs that encourage communal activity and sharing of facilities are advantageous.

- Unproductive Labour Savings

Designs that reduce the time spent on menial labour are favourable, freeing up time for more productive activities or involvement in educational programs. Similarly, designs that reduce the difficulty of tasks are beneficial, easing the daily labour of participants. Such designs that save

time and energy on chores are also likely to carry certain popularity with the community, and serve as a promotion for our efforts.

- Productive Labour Opportunities

The high unemployment rate in Monwabisi makes time a readily available resource for many residents, and designs should take advantage of productive labour opportunities whenever possible. Through proper selection of building techniques and materials, owner-labour can save up to 50% on construction costs (Irrgang, 2005). Also, processes requiring skilled labour may offer potential learning opportunities to residents, opening avenues of economic advancement.

- Resource Savings

Conservation of resources is fundamental to a sustainable method of living, reducing negative impact on the environment, reliance on external supply, and importantly in the case of informal settlements, the cost of replacing commodities such as fuel, food, and other necessities. A design may reduce expenditure of a variety of resources, and should be evaluated to identify means of furthering its conservation potential.

- Impact on Community

The effect that an idea will have on the community is an important consideration in prioritizing focus areas. The work required of our team, and later on required of our sponsor and the community, must be proportionate to the service it will provide. A proposed solution should have an effect that is visible to the community, and building and maintenance should be an activity the residents can administer themselves and take pride in.

- Impact on Development Plan

Our efforts should be kept in parallel with the mission of our sponsor – the expedient design of an Eco-Village development plan. Though many ideas may benefit the community, it is important that they advance the development plan by addressing a specific barrier to its implementation. A system should be forward thinking, designed to work in an Eco-Village setting and not as a resolution solely to a problem presented by the logistics of the current situation.

- Public Response

An idea with excellent theoretical potential may not be well received by the community in practice. An illustrating case of this relayed to us by our liaison involved the implementation of a new chemical toilet in Monwabisi. Though functional, the sterile, box-like design was perceived

by the community as substandard, and people refused to use it. The reaction of the community to a proposed idea is one that is hard to predict, and will require regular input by residents. The summing goal of our efforts and those of our sponsor is to improve quality of life, and in the end, the degree to which an idea may achieve rests with the community.

For our project to be successful, we must adhere to the working conditions specific to Monwabisi. The categories of evaluation are likely to change as our work on site progresses and will require additions and updates with each iteration of the review process.

### **Integrate with Master Development Plan**

After careful consideration of the proposed recommendations and a thorough evaluation of the possible advantages and disadvantage of each, our project team will decide on one approach that exhibits the most potential for addressing the needs of Monwabisi Park. We will consult with our sponsor, community members, and municipal officials to facilitate collective decision making. It is important that we work closely with our liaison on this matter to ensure that the proposed recommendation is one that can be easily integrated into the Shaster Foundation's master development plan and one that will be well received by the community.

To do this, our plan will need to incorporate the principles of sustainable development and permaculture. As we begin to look closer at the laundry practices in Monwabisi, ideas our final design might include a water harvesting system, a device to aid in washing and possibly a filtration or irrigation system to utilize the greywater. These solutions will need to utilize the available resources, be somewhat modular and easy to recreate. With a settlement of 5000 families, it will be impossible to implement a water harvesting system on every roof, but if our design can be taught to community members, work can continue after our seven week project timeframe.

With a solution in mind, our team will develop an implementation plan to incorporate the recommendations into Monwabisi Park. We will document this plan and record our progress to observe how the original ideas develop and change. Depending on what approach we take, it might be beneficial to build a prototype to present to the community. Our implementation plan will be further developed once our team has spent time in the settlement and decided on a

practical solution, but it is certain that community involvement will be at the centre of our efforts.

### **Develop Community Involvement Strategies**

Engaging the Monwabisi Park community is an important aspect in obtaining a positive result from this project. Gaining the acceptance of the community in relation to our proposed solutions is a factor that will determine our overall effectiveness. In our efforts to make improvements in the areas of water conservation, laundry, and sanitation, it is essential to find appropriate communication methods. Establishing a good relation with the community members will allow for productive communication for both parties. Effective communication between our project group and the community will help us to learn and better understand the problems we will address. Our group will work with the community to ensure the proposed solutions are appropriate. If sound communication methods are properly implemented, it will be easier to maintain the motivation of the community and their willingness to become involved in the development of the project. Our goal is to work with as many people of the community as possible in order to obtain their support and involvement in this project.

One approach to establishing community involvement is to set individual or group meetings with community leaders to discuss the most prevalent problems facing the community, and most importantly, listen what they have to say. This method will give us the opportunity to communicate our ideas and proposed solutions to the community leaders and will help in receiving feedback from residents, giving us a greater understanding of their outlook on issues dealing with the community. Also, we can gain insight into ways to involve the community in our project. The purpose of these meetings will be to discuss our plans with the leaders so they are able to communicate that information to the other members of the community. This will hopefully get more people involved in the project. By working with community members and having them actively engaged in the project, they will be able to value the work as their own since they have been part of it. When changes are made without any effort or work on the part of who is the beneficiary, the results are usually not valued and are lost in a short time. But when the people in the community participate in resolving their own situation, the results are more likely to be appreciated and thus sustainable, continuing well into the future (Scrimshaw, Gleason, 1992).

A great sense of pride can fill the community in knowing that their efforts created something very treasured and useful.

By working with the Shaster Foundation's founder, Dianne Womersley, we hope that the community will be receptive to our presence. We would like to have an informal introduction with community members upon arriving and give a short presentation as to why we are there and what we hope to do. We will explain that our purpose is not to impose on their land, but rather to help improve their quality of life. We are not coming with all the answers, but with an open mind and a willingness to learn. We could proceed by setting up focus groups with various members of the community for the purpose of having interactive conversations and learning more about their culture. This will make determining ways of involving the community in the entire process of this project easier.

Establishing a bond with members of the community and gaining their trust will be essential in maintaining community involvement throughout this project. A possible challenge for the group in communicating our ideas to the members of Monwabisi Park is the difference in language. According to our liaison, the education level of the community members is varied and many residents receive little to no formal education. With this in mind, we have brainstormed some possible ways of helping to make the communication between our group and the people more effective. A way to get involved with the people might be to participate in some cultural activities with the community. We want to show the people of Monwabisi Park our personal interest in their culture and traditions. A major component of this project is to take in the culture of South Africa and embrace it. We desire to immerse ourselves in their culture and ideals, and we can only hope to convey these feelings to the people of the community. Our experience will be mutually beneficial; we plan to give as much of ourselves to this project as we plan on getting out of it. In giving back, we plan to build a prototype of one of our proposed solutions, such as a washing device, a tank, etc. with the help of the members of the community. The community will then see our interest and commitment in helping them. They will see a physical example of our efforts, and that will hopefully motivate them to take action and desire to become a part of the solution process.

Knowing that there are a great number of people in the community who do not speak English and do not know how to read or write, it is essential that we develop other means to communicate with them, such as easy to read graphical descriptions. For example, we can

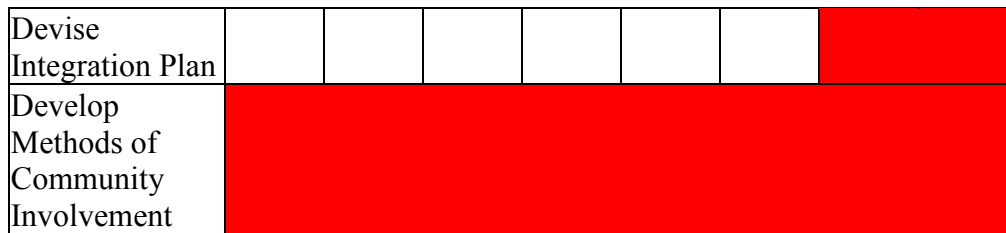


provide a building manual for a proposed recommendation which might contain drawings that display how to build the necessary components. This would be a practical solution to overcoming the language barrier. Also, to ensure that this collaborative effort continues after our departure, it is important that we leave behind visual-based documents so the community can continue the work on their own.

## Proposed Timeline

Figure 42 shows a Gantt chart of the proposed project timeline. The timeline as presented is preliminary, and can be adjusted as we begin work on site. Our preliminary work in Worcester will be continued into the beginning of our time in Cape Town, when we hope to compare our initial ideas with the expectations of our sponsor. Also important initially will be the identification of specific improvement opportunities in the first two weeks, after which we will progress with the development of practical solutions for the large part of our project time. Evaluation of these designs should begin as soon possible, and documentation for the final report should be started once ideas have been sufficiently finalized, though not necessarily all at once. When a clear model of our recommendations has been developed, specific considerations will be devised for integration with Shaster's development plan. The process of developing community involvement strategies will be ongoing during our time on site, as these ideas will be derived from our regular interaction with the community.

Task	Week							
	PQP	1	2	3	4	5	6	7
Develop Working Knowledge								
Identify Improvement Opportunities								
Develop Practical Solutions								
Evaluate and Refine Solutions								
Document Solutions								



**Figure 42: Gantt Chart of Project Tasks**

## Conclusion

The main goal of this project is to contribute to the Shaster Foundation's master development plan by improving laundry practices in Monwabisi Park while simultaneously engaging the community in the process. By focusing on communal washing, this project will address the issues of water conservation, sanitation and social interaction. The above research and proposed methodology allow us to meet the goals of the Shaster Foundation's efforts while preserving the culture and traditions of the Monwabisi community.

## Appendix D: Preliminary Water Collection and Filtration Methods Considered

### Ferro-Cement Tanks

By knowing the amount of rainwater that can be collected annually from a given roof, a tank with the required capacity can be designed and built. The “ferro-cement tank” design is a good practical solution for the harvesting of rainwater since it can be built without having much knowledge of construction procedures. As shown in Figure 43, the steps to build this particular tank include marking the circumference of the base of the tank on the ground, placing wooden poles separated by a constant distance from each other along the circumference, and covering the floor of the tank with cement mortar mix. Next, the wooden poles are surrounded from the outside with a wire mesh to create the outer surface of the tank. After the wire mesh is positioned, the cement mortar mix is added to the outer and inner surfaces. One day later, the wooden poles can be removed and the holes in the ground can be covered with stones. After the cement mortar mix hardens, the tank is ready for storing water (Franceys, Dean, 1997).

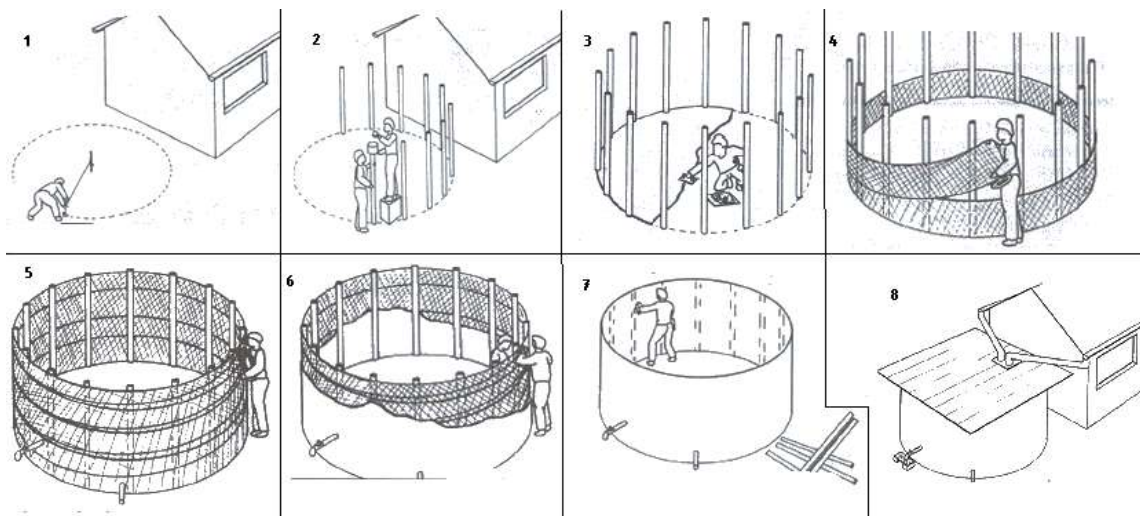


Figure 43: Ferro-Cement Tank Building Procedures  
(<http://tilz.tearfund.org/Publications/Footsteps+21-30/Footsteps+30/Ferro-cement+tank.htm>)

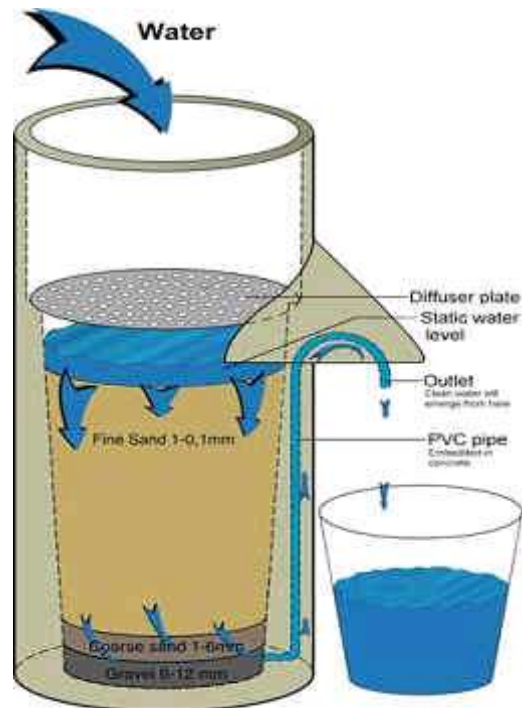
### Filtration

An excellent way of eliminating the problems associated with the current method of disposing of water while simultaneously conserving it as a valuable resource is by conditioning it for reuse through filtration. Depending on the intended use of the filtered water, there are many established processes available, with varying cost and complexity. For the purposes of implementation in Monwabisi, systems that were simple to maintain and could be built from readily available materials were considered most effective. The process we encountered on site was the filtration of laundry greywater to be used for irrigation of community gardens, although methods for reuse as wash water were also considered. The latter purpose, which would have reduced the labour required to collect water from municipal taps and conserve available water during the dry season, required more complicated filtration not feasible for the resources available to our project team.

Two widely known techniques that had considerable potential for our project were fast and slow sand filtration, collectively termed bio-sand filtration. Fast sand filtration (FSF) uses the simple concept of removing physical impurities from water by gravity-feeding through a layer of fine sand. Usually enclosed in a tall cylindrical or rectangular housing, raw water enters the top of the filtration unit where it then trickles through a layer of sand which removes unwanted particulates. At the bottom, a layer of gravel covers a collecting basin from which the filtered water exits. FSF is mainly used for the removal of material impurities, as opposed to the improvement of chemical or bacterial properties of water, so the filtered product is of a quality best suited to use in irrigation (Ng, 1999).

For reuse as laundry water, it is likely that a system of slow sand filtration (SSF) will be necessary. SSF involves the regular supply of a comparatively low flow rate of input water, which allows for biological activity to develop on the surface of the filtering sand layer. This layer, known as the “schmutzdecke,” facilitates bacterial growth which serves to block the passage of certain particulates and actively neutralize undesirable chemicals and other impurities. Beneath this is a layer of fine sand on top of a gravel base, acting in the same manner as an FSF unit. The biological action of SSF systems results in a more finely filtered result, often able to produce water clean enough for human consumption depending on input quality. A mesh filter or a gravel “roughing” layer is commonly used to remove large obscurities before water is passed to the schmutzdecke. SSF systems also often incorporate equipment to control input and output flow, which change in design depending on application (Ludwig, 1997). A conventional SSF

system is pictured in Figure 44. The need for continuous input of water to an SSF unit makes it a challenging design for Monwabisi, where laundry is done opportunistically and not in a manner conducive to a regulated filtration input. The use of communal basins however, and possibly the tying of the system to rainwater collection tanks could supply enough water to give a regular flow, even if perhaps necessitating the use of subsequent collection tanks for storage of filtered water not immediately needed for use.



**Figure 44: Slow Sand Filtration**  
(<http://www.lboro.ac.uk/well/resources/fact-sheets/fact-sheets-htm/Househ2.jpg>)

The sequential nature of these processes allows them to be enhanced by the addition of extra filtering media. This can be as simple as a cloth or mesh layer to remove large physical contaminants, or can involve commercially produced media engineered to have a specific altering effect on water under filtration. Commonly available as granular minerals or porous inserts, these filtration media introduce chemical filtration, or the use of ionic charge to remove bonded impurities or change chemical makeup. Such media can be used to remove targeted constituents of water, alter pH levels, or even adjust colour and taste. Adding media to a filtration system is a practical way to increase output quality, but incurs additional cost and

requires replacement at certain intervals (Lausch, 2006). Design incorporating commercially bought media will need to be considerate of these issues.

## Appendix E: Instructional Signs

Sebenzisa:



R2.00



## **Appendix F: Sponsor Assessment**

### **AN ASSESSMENT OF THE WPI LAUNDRY PROJECT**

*By Mrs Dianne Womersley, Indlovu Project Director*

**The need for a labour-saving laundry in the Monwabisi Park squatter camp is dire. Women have to carry water from distant taps and hand-wash their laundry in plastic buckets.**

**We requested assistance for the planning and installation of a laundry that works according to the principles of permaculture from the WPI team assigned to work with us in the Indlovu project. After consultation a plan was drawn up that fulfilled our requirements (water conserving and zero waste generated).**

**The laundry has been completed and tested by the WPI team and my observations are as follows:**

#### **THE WPI TEAM**

- 1) The team worked very well together at all times, and worked extremely well with the community who subsequently rallied around to help when necessary. Without the social integration so well managed by the Indlovu team they would have been working in a vacuum with the community members acting only as observers, and consequently having no ‘ownership’ of the laundry.**
- 2) The team planned all material needs aspects of the project well so that minimal expense was incurred with practically no excess material left over. This has saved our organisation unnecessary expense.**
- 3) The WPI team worked in very difficult circumstances i.e. non-delivery of essential items caused massive delays in the construction; it was hot and dirty on site; many onlookers were children who often got in the way of the work.**

#### **BENEFITS OF THE LAUNDRY**

- 1) Women now have a facility where they can do laundry without the back-breaking task of fetching and carrying water to their homes. It has been designed as a communal place for socialising as well as work.**
- 2) The men who work in the project do some fairly heavy manual labour, and they are very happy that now they have somewhere to wash off the dirt at the end of the day. No shacks have running water, so having sinks and taps is a great boon to them.**



- 3) The water run-off from the roof of the youth centre is now channelled into holding tanks eliminating waste.
- 4) The waste water management system is simple and workers from the community were included in the installation so that they would learn from it and be able to do the same for our community centre that is due to be constructed in the New Year. In this community new ideas are often viewed with some scepticism until they have been proved. The laundry system has shown the community that there is an easy and efficient way to manage waste water without merely throwing it out onto the street.
- 5) Fruit trees have been planted to help soak up the waste. This has many advantages – not only beautifying the vicinity, but providing a source of food and shade as well.

In conclusion I would say that this laundry built by the WPI students serves many purposes other than that for which it was built. This is perfectly in keeping with the principles of permaculture where one element should have many functions; conserve valuable natural resources; eliminate waste and help people.