CHAPTER 7_TECHNICAL INVESTIGATION

7.1 Land Rehabilitation

Due to soil contaminants in the area and the significant amount of alien invasive species (as discussed on page 88 and 89), rehabilitation of the site is fundamental. Land rehabilitation is a long term process of returning the land in a given area to some degree of its former state, after some human or natural process has resulted in its damage. The rehabilitation process first begins with the removal of the contaminated soil. As stated previously, the top 150mm of soil needs to be removed. The amount of contaminated soil on site is calculated by multiplying the area, 51182.12m^2, by a soil depth of 150mm, resulting in 7677.318m^3 of spoiled soil. This soil needs to be shifted and capped as soon as it is removed to prevent further contamination. Capping of contaminated soil is a method whereby the compacted soil is placed and covered in an enviromat. An enviromat is a product that consists of a bitumen layer that is enclosed in geotextile. This product prevents the contaminants in the soil from moving into deeper soil layers. After this step, a reno mattress is placed above the enviromat. A reno mattress is a wire cage mattress packed with rocks and stones. The reno mattress is then filled with soil, assisting vegetation to stabilise. If lawn is a desired surface for the mound, hyson cells need to be placed above the reno mattress and each cell filled with soil, that breaks the slope into pockets that prevent the soil from sliding down. Illustration 145 illustrates the above description. After removing the contaminated soil and reusing it to shape the earth, vegetation now needs to establish in the area. The deeper layers of soil that have now been exposed on the site needs to be ameliorated for vegetation to grow. Soil amelioration is a method which turns poor soil into healthy, fertile soil. Soil amelioration is the process of modifying soils to provide what the native or existing soils do not naturally provide. To improve poor soils, nutrients need to be added to the soil and the soil needs to be given texture. This can be achieved by adding compost and plant material to the soil. These agents automatically activate organisms and bacteria in the soil. After the soil has been ameliorated the site can be further rehabilitated. Rehabilitation of this area requires the removal of all alien invasive vegetation (see site specie study, appendix 11.1) and the introduction of pioneer grass species. Pioneer species are species that are first established in an area where nothing is growing, or in an area that has been disturbed by human abuse of the land or natural disasters. These species are usually annuals, disappearing after the second year when perennials take over. The use of these pioneer species lead to ecological succession. Ecological succession, is the phenomenon or process by which a community progressively transforms itself until a stable community is formed.

The following pioneer grass species will be introduced:

- *Eragrostis rigidior*
- *Eragrostis curvula*
- *Paspalums*
- *Paspalum vaginatum*
- *Panicum maximum*
- *Cynodon dactylon*
- *Digitaria smutsii*
- *Digitaria eriantha*
- *Cenchrus ciliaris*

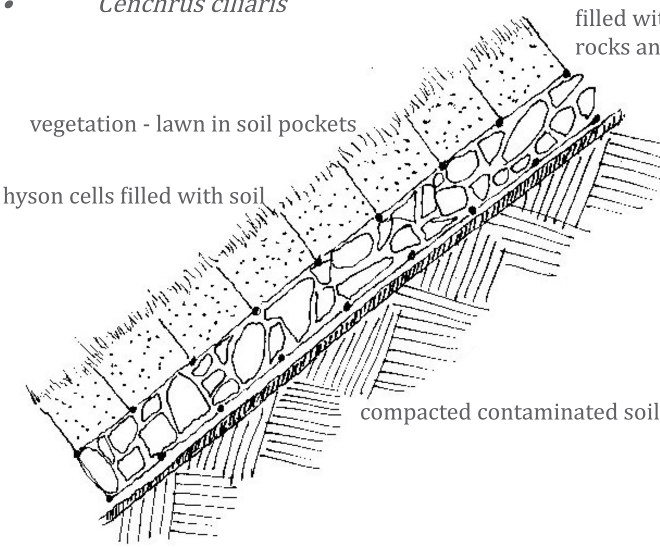


Illustration 145: Capping of contaminated soil

7.2 Stormwater investigation

In order to test the urban farming and retention pond functions proposed, catchment areas need to be calculated and a water budget needs to be done. The results of the water budget will indicate if all year round irrigation from stormwater is viable and practical. The urban farming and landscape design cannot depend on expensive potable water. The stormwater caught from catchments 2 and 3 will be retained and used on site (see illustration 146), while the stormwater from catchment 1 will be taken through stormwater inlets, past the proposed development on Skietpoort street and through to wild rivers in the proposed wilderness area. For this reason only stormwater in catchments 2 and 3 will be dealt with in detail.

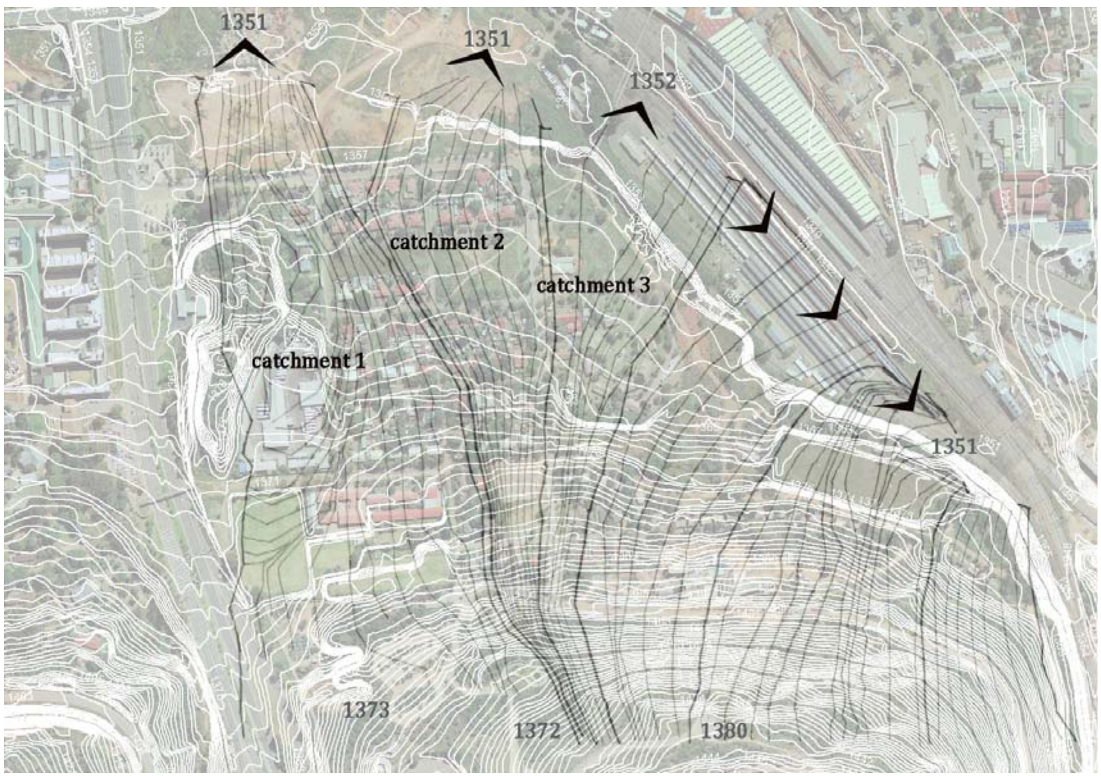


Illustration 146: Catchment areas

Catchment 2

Total area of catchment (m^2)	x	Month	Ave. Rainfall (m)	x	Runoff co-efficient	=	Harvestable water/month (m^3)
29842.0518	x	January	0.122	x	0.45	=	1638.328644
29842.0518	x	February	0.106	x	0.45	=	1423.465871
29842.0518	x	March	0.091	x	0.45	=	1222.032021
29842.0518	x	April	0.033	x	0.45	=	443.1544692
29842.0518	x	May	0.022	x	0.45	=	295.4363128
29842.0518	x	June	0.006	x	0.45	=	80.57353986
29842.0518	x	July	0.01	x	0.45	=	134.2892331
29842.0518	x	August	0.01	x	0.45	=	134.2892331
29842.0518	x	September	0.021	x	0.45	=	282.0073895
29842.0518	x	October	0.06	x	0.45	=	805.7353986
29842.0518	x	November	0.117	x	0.45	=	1571.184027
29842.0518	x	December	0.117	x	0.45	=	1571.184027

Table 1: Harvestable water caught from catchment two

Catchment 3

Total area of catchment (m^2)	x	Month	Ave. Rainfall (m)	x	Runoff co-efficient	=	Harvestable water/month (m^3)
71415.634	x	January	0.122	x	0.45	=	3920.718307
71415.634	x	February	0.106	x	0.45	=	3406.525742
71415.634	x	March	0.091	x	0.45	=	2924.470212
71415.634	x	April	0.033	x	0.45	=	1060.522165
71415.634	x	May	0.022	x	0.45	=	707.0147766
71415.634	x	June	0.006	x	0.45	=	192.8222118
71415.634	x	July	0.01	x	0.45	=	321.370353
71415.634	x	August	0.01	x	0.45	=	321.370353
71415.634	x	September	0.021	x	0.45	=	674.8777413
71415.634	x	October	0.06	x	0.45	=	1928.222118
71415.634	x	November	0.117	x	0.45	=	3760.03313
71415.634	x	December	0.117	x	0.45	=	3760.03313

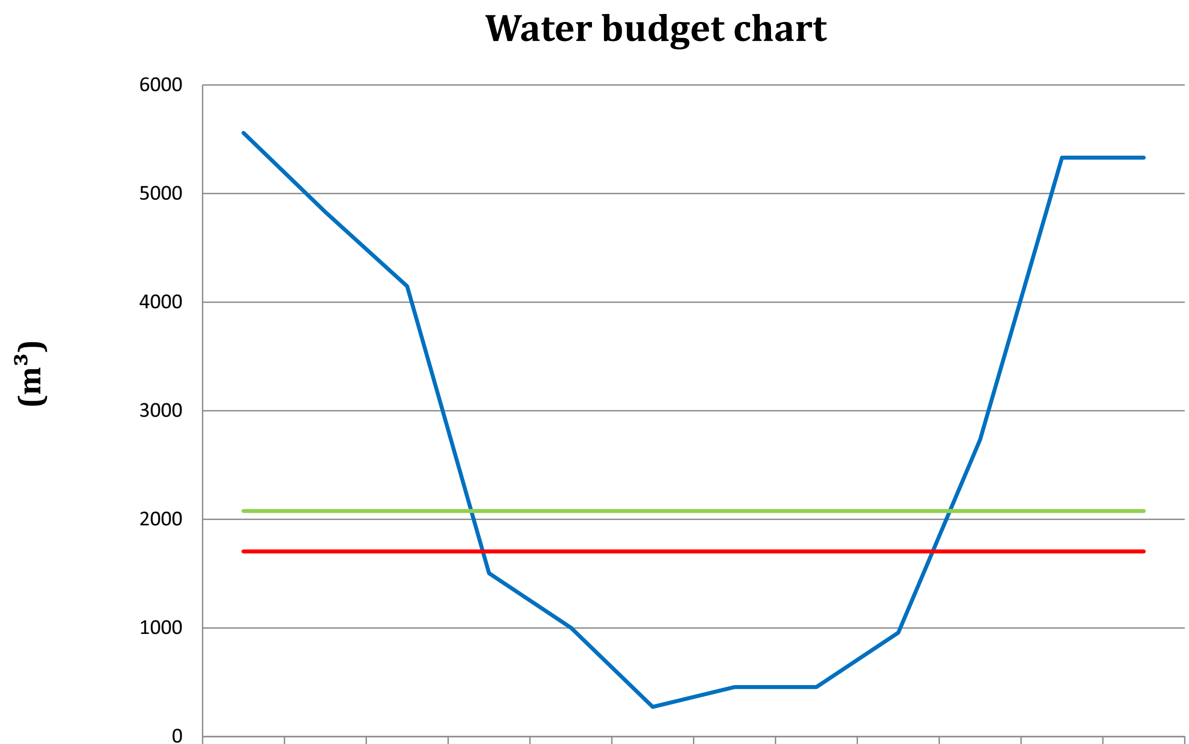
Table 2: Harvestable water caught from catchment three

Demand for urban farming/month depth (m)	x	Largest area of urban farming (m^2)	=	Volume of water required/ month (m^3)
0.16	x	10652.39	=	**1704.3824**

Evap./ month (m)	x	Area of urban farming (m^2)	=	Total Evap./ month (m^3)
0.035	x	10652.39	=	**372.83365**

Catchments 2 & 3	**Total harvestable water/month (m^3)**	-	**Irrigation required/ month (m^3)**	-	**Evap./ month**	=	**Total (m^3)**
January	5559.04695	-	1704.3824	-	372.83365	=	3481.8309
February	4829.991613	-	1704.3824	-	372.83365	=	2752.7756
March	4146.502234	-	1704.3824	-	372.83365	=	2069.2862
April	1503.676634	-	1704.3824	-	372.83365	=	-573.5394
May	1002.451089	-	1704.3824	-	372.83365	=	-1074.765
June	273.3957517	-	1704.3824	-	372.83365	=	-1803.82
July	455.6595861	-	1704.3824	-	372.83365	=	-1621.556
August	455.6595861	-	1704.3824	-	372.83365	=	-1621.556
September	956.8851308	-	1704.3824	-	372.83365	=	-1120.331
October	2733.957517	-	1704.3824	-	372.83365	=	656.74147
November	5331.217157	-	1704.3824	-	372.83365	=	3254.0011
December	5331.217157	-	1704.3824	-	372.83365	=	3254.0011

Table 3: Water budget calculations



	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Harvestable water/month	5559.05	4829.99	4146.5	1503.68	1002.45	273.39	455.66	455.66	956.89	2733.96	5331.22	5331.22
Irrigation required/month	1704.38	1704.38	1704.38	1704.38	1704.38	1704.38	1704.38	1704.38	1704.38	1704.38	1704.38	1704.38
Evaporation/month	2077.22	2077.22	2077.22	2077.22	2077.22	2077.22	2077.22	2077.22	2077.22	2077.22	2077.22	2077.22

Figure 4: Water budget

Excess harvestable water (summer months) - loss of harvestable water (winter months)

Excess (m^3)		Loss (m^3)		Excess (m^3)
15468.63633	-	-7815.56852	=	**7653.06781**

Table 1 and 2 illustrate the amounts of harvestable water that can be caught per month from catchments 1 and 2. Table 3 and 4 illustrate a calculated water budget for the urban farming and retention pond proposed. From table 3 and 4, a conclusion can be made that stormwater caught from catchments 2 and 3, is more than sufficient to fill the proposed retention pond, and to irrigate the largest possible area for urban farming.

After establishing that sufficient amounts of stormwater can be caught to irrigate the proposed urban farming, an irrigation system needs to be investigated. The most appropriate and practical solution in this area is to use a controlled flood irrigation system which moves stormwater from a high point on the site to a low point. In more detail, stormwater moves from an irrigation dam into a sluice (see illustration 147 and 148), which is then manually controlled to flood different parts of the farming, each for a certain amount of time. Due to capturing and reuse, use of all stormwater, ponds and swales proposed in the design need to be lined to prevent any loss thereof. This can be achieved by using enviromats and reno mattresses (see illustration 148). Earth walls that surround the dam also need to consist of a clay core wall in order to prevent leakage.

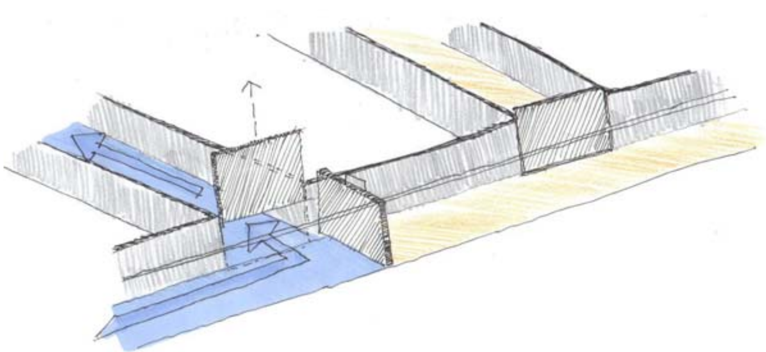


Illustration 147: A typical sluice system used for flood irrigation of urban farming

7.3 Conclusion

The technical investigation informs the design in terms of land rehabilitation and stormwater systems. The investigation into land rehabilitation informs the long term phases of the project and provides amounts of contaminated soil which can be used to shape mounds in the design. The stormwater investigation informs the type of stormwater systems that need to be put into place on the site and also how to maximise the use of the stormwater. This investigation confirms that the design proposals following the spatial explorations are possible and feasible.

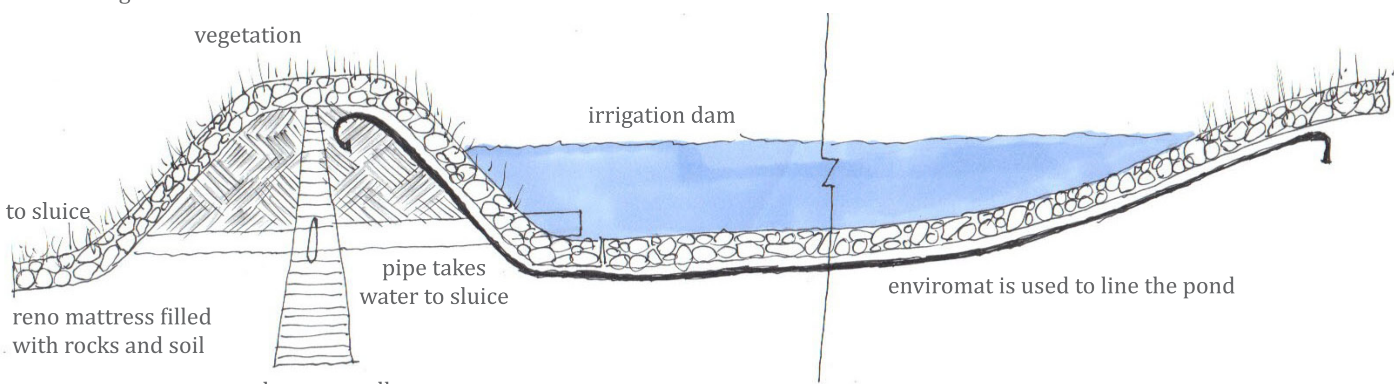


Illustration 148: Lined irrigation pond with earth walls