An Example of CLIMATE PROOFING, ADAPTING TO CLIMATE CHANGE

&

REDUCING RISK

Through

Positive Bio-Engineering Interventions

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Background

- Richard Grimshaw and John Greenfield re-introduced the Vetiver grass to its mother country, India, as part of an effort initiated by The World Bank here in India, in the 1980s.
- Today, the rest of the world is way ahead of us in understanding our own plant.
- The entire world uses the Vetiver System, we have just about begun.
- In the last 8-10 years we have started believing in our own past and have adopted this system.
- I have , over the last 12 years pooled in a little experience of my own, in certain works, where Dick Grimshaw, Paul Truong and other colleagues from TVNI have helped with their respective experiences.
- One such multi faceted project was tackling the various problems being faced in completing a dream project “Virasat e Khalsa”. This is a museum depicting the Sikh History. The world renowned architect Moshe Safdie , creator of “Yad Vashem”, Jerusalam. Israel’s official memorial to the victims of the **Holocaust .**

Applications of VS in The Khalsa Heritage Museum, Anandpur Sahib; Situated in the Kandi Area of Punjab

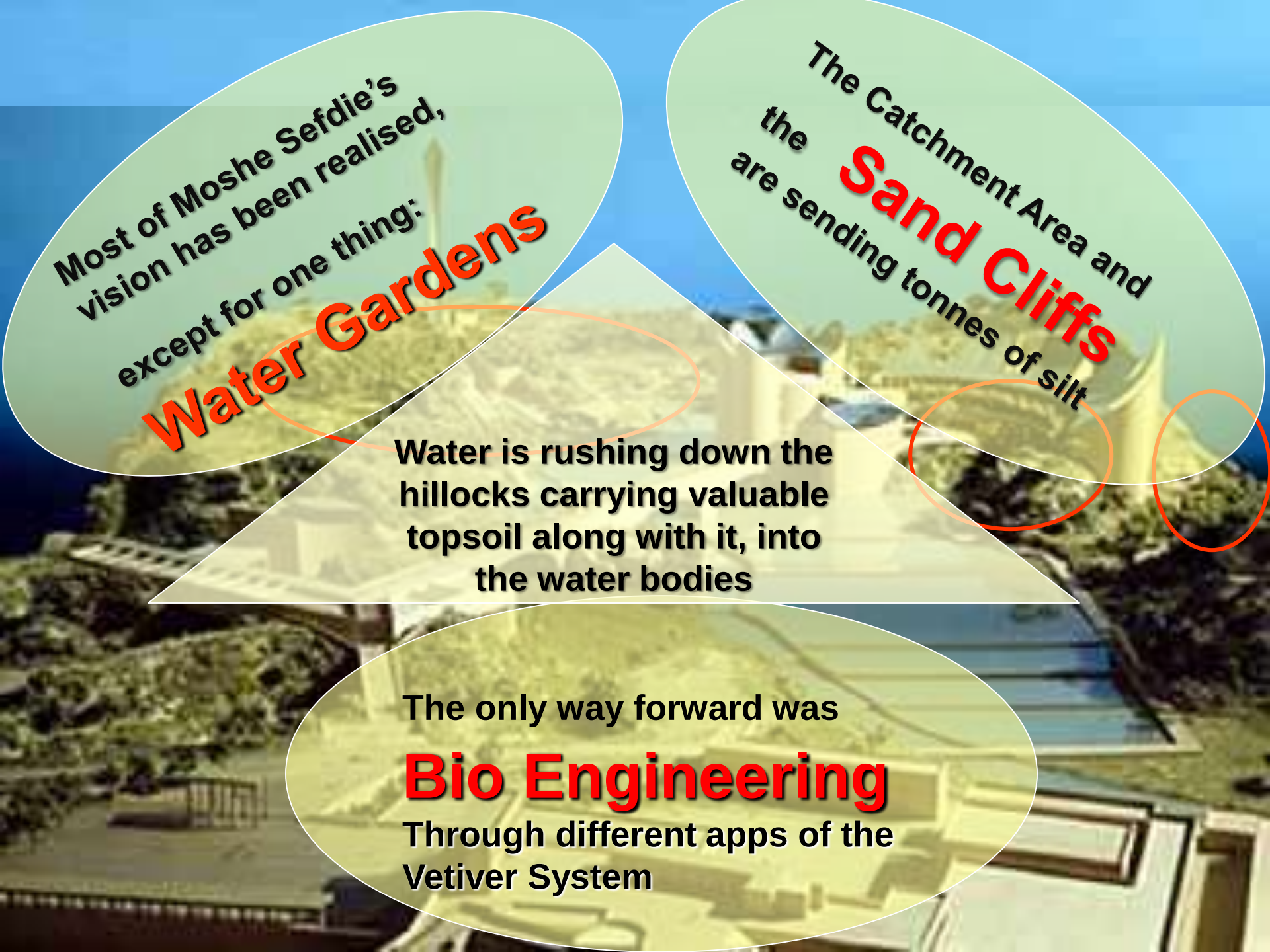
The Structures rise from the **Sand Cliffs.**

They're built in concrete and **Sandstone**

The Roofs are Stainless Steel, facing the South and **Reflecting Light Towards the Temple**

Moshe Sefdie's Vision

To Flood the Valley into a Series of **Water Gardens**


Most of Moshe Sefdie's vision has been realised,
except for one thing:
Water Gardens
The Catchment Area and the Sand Cliffs are sending tonnes of silt
Water is rushing down the hillocks carrying valuable topsoil along with it, into the water bodies
The only way forward was
Bio Engineering
Through different apps of the Vetiver System

Overall view in 2002

Overall view in 2013

Applications of VS used at Anandpur Sahib

- Revegitation and Possible Reforestation
- Prevention of Soil Erosion and its migration

- Steep Filled up Slope Stabilization (Road Batter)
- Infrastructure Protection

- Silt Control in water body (Planting in the Catchment Area)

Vetiver application for Revegitation & Reforestation at Anandpur Sahib, Punjab (Hillock Slopes)

Before
&
After

Greening the Hillocks

- Work on the “Khalsa Heritage Museum started in the 1990s.
- For over a decade Millions were spent on greening the Hillocks, via the horticulture route. Nothing succeeded. Several species of trees were tried in vain.
- In 2009, I was given a row of most critical hillocks to do it the Vetiver way.
- Within a year , it was clear that Vetiver, acting in collaboration with nature was the golden key to several problems.
- Vetiver has transformed the whole area and taken care of several problems as will be seen in the following slides.


BEFORE
This hill has soil saver on it
This Swale receives silt
Road Batter
Freshly planted vetiver hedgerow
02 07 2009 14 46


AFTER
The hill with the soil saver
The swale is protected
Road Batter
07 10 2010 11:22


BEFORE
02 07 2009 14 40


AFTER
07.10.2010 11:24


BEFORE
Notice the bare hill. Various methods have been tried for several years
02 07 2009 14 41


Local Species have already started coming.
AFTER
07 10 2010 11 24


BEFORE
02 07 2009 15 27


Local Species have already started coming. Soon they will take over and the HERO would perish
AFTER
07 10 2010 11 57

AR Projects under CDM

- Vetiver is the only plant that can bring a totally wasted land back to life.
- Lands like vacated mine fields.
- After bringing the land back to life, it allows other local species to take over.
- Some other species can also be introduced to fit the local definitions of forests, submitted to the UNFCCC (*United Nations Framework Convention on Climate Change*)
- Vetiver will ultimately perish under the shade of the forest it has itself initiated.

Existing AR Methodologies under CDM

- **AR-ACM0001:** *Afforestation and Reforestation of degraded land.*
- **AR-ACM0002:** *Afforestation or reforestation of degraded land without displacement of pre-project activities*
- **AR-AMS0005:** *Simplified baseline and monitoring methodology for small-scale afforestation and reforestation project activities under the clean development mechanism implemented on lands having low inherent potential to support living biomass*

Existing AR Methodologies Cont'd

- **AR-AM0002**: *Restoration of degraded lands through afforestation/reforestation*

- **AR-AM0006:** *Afforestation/reforestation with trees supported by shrubs on degraded land*

Action Reqd.

- We need to propose amended methodologies to add *Vetiver as the initiater of the Reforestation process.*

- *Vetiver sacrifices itself , without this sacrifice, the AR project could not have begun*

Vetiver application for

Infrastructure Protection

Before
&
After

This was the look of the Location ‘A’ in July 2009, foundation was exposed

Location ‘B’

Location ‘A’ after laying soil filled bags

A process used in Congo was implemented with some variations:

(1) Hessian bags have been used, not plastic

(2) On Dr. Paul Truong’s advice, soil has been filled & not sand, as in Congo

Location ‘B’ in 2010

Location ‘A’ 2010, Vetiver planted

No water in water body

How should we Plant at Location A & Others?

The Transparent Thought Process: Exchange of Mails with Experts

The initial response

Dear MP,
You can't put enough vetiver on that slope. I would plant 3 to 4 slips in every sandbag.
This will tie the whole caboodle together, You will need to fertilize and irrigate. Here are some images from Congo, using the same technique.
Dick

Dear MP,
I agree with Dick
You need a lot more than 3 rows. The bags will last only 1 year. The most you can save is every second or 3rd bags.
Paul

My Question:

Dear Paul & Dick,
What is your opinion on Lantana? Surely that would do a little bit of binding.. They are not sand bags, they are earth filled bags, maybe, even clayey.
MP

MP,
Lantana is a disaster - in some countries it is a scheduled weed..PIER rates it with a risk assessment of 21 compared to vetiver's 8.
See: http://www.hear.org/pier/species/lantana_camara.htm
Dick

Dear MP,
No Lantana, they are shallow rooted and shade V out in the long term. Soil is better than sand but will be washed down eventually if not anchored in.
Paul

Dear All,
I agree with that Paul had said about Lantana between Vetiver hedgerow, it's not good idea……
Alain Ndona

Dear MP,

---- even if you start off with 100% vetiver, over time native species will self set and eventually dominate the vetiver. ---------- later most of the vetiver will have been taken over by natives. However the vetiver did the intended job. **On your project slope stability must be the number one concern.**

Dick

My Comment:
Dear Dick,
The Management will not agree to 100% Vetiver. I can at best convince them on 1m VI. In between they will have Lantana.
MP

MP,
OK, 1 m VI should be OK, the lantana will be slow in the beginning but will wipe out the vetiver eventually. Why the fixation on Lantana?
Dick

Dear Dick,

We all know that Lantana

Is the biggest enemy of farmers of this region,

Actually increases runoff in the long run and, therefore, accelerates erosion,

Cannot disturb established forests, but, if it sneaks into reforestation area, you can put paid to that forest,

Despite all this, in the present case, *Lantana is there and we got to accept it.*

Under the circumstances, my proposal is as under:

- I must insist on planting vetiver, as discussed and at the Vertical Interval of Im. I ask for three month delay in planting of Lantana, in between rows.
- By the time the Lantana really grows, Vetiver roots would be at least two sand bags deep.
- Eventually, as we all know, Lantana will take over.
- Hopefully, by then Vetiver would have accomplished whatever it had to.

Please fine-tune with your inputs.

MP

Dear MP,

Your suggestion is workable, three months delay is not.

Vetiver should be in the ground for at least a year before planting any other species.

If they won't accept that - **don't do it.**

If they do accept it, then hopefully they might realize that they don't need the lantana.

My preference would be to let native species colonise naturally, as in China and elsewhere.

If you do the job you had better do it well, and give the vetiver plenty of TLC

Dick

Conclusion of Discussion


Vetiver to be planted at Vertical Interval of 1m Now
LANTANA CAMARA
LANTANA CAMARA
LANTANA CAMARA
LANTANA CAMARA
Lantana can be planted after a year, the Vetiver will look like this, untrimmed


Vetiver has handed it back to Nature, 2012
Location A 2012
LANTANA Beaten
The image in the clear Water Body

Vetiver application for Prevention of Soil Erosion & its Migration

Before & After

SOIL ERODED FROM THE CLIFFS SPREADS ON THE ROADS

ZERO SOIL MIGRATION DESPITE RECORD RAIN

Vetiver application for Steep Filled up Slope Stabilisation (Road Batter) Before & After


BEFORE
The rains did this. Maybe the road drainage system collapsed


Total Washout


The earth has given way from under the geo-textile
The Geo-textile needs to be removed and the earth refilled, remoulded and compacted
31 07 2009 15 1


The Vetiver that we grew on top has survived
31 07 2009 15 16


vetiver rows on top of road batter have survived heavy rains, have multiplied and have taken root speedily and well
03 10 2009 13 23


AFTER
07 10 2010 11 22
07 10 2010 11 24


AFTER
Vetiver has retained moisture within the slope enabling other vegetation to grow.
07 10 2010 11:25

Hillocks, Swales and Road Batter Imagery October 16, 2013

Road Batter Imagery October 16, 2013

Vetiver application for Silt Control in water body

(Planting in the Catchment Area and handling gullies and rain cuts)

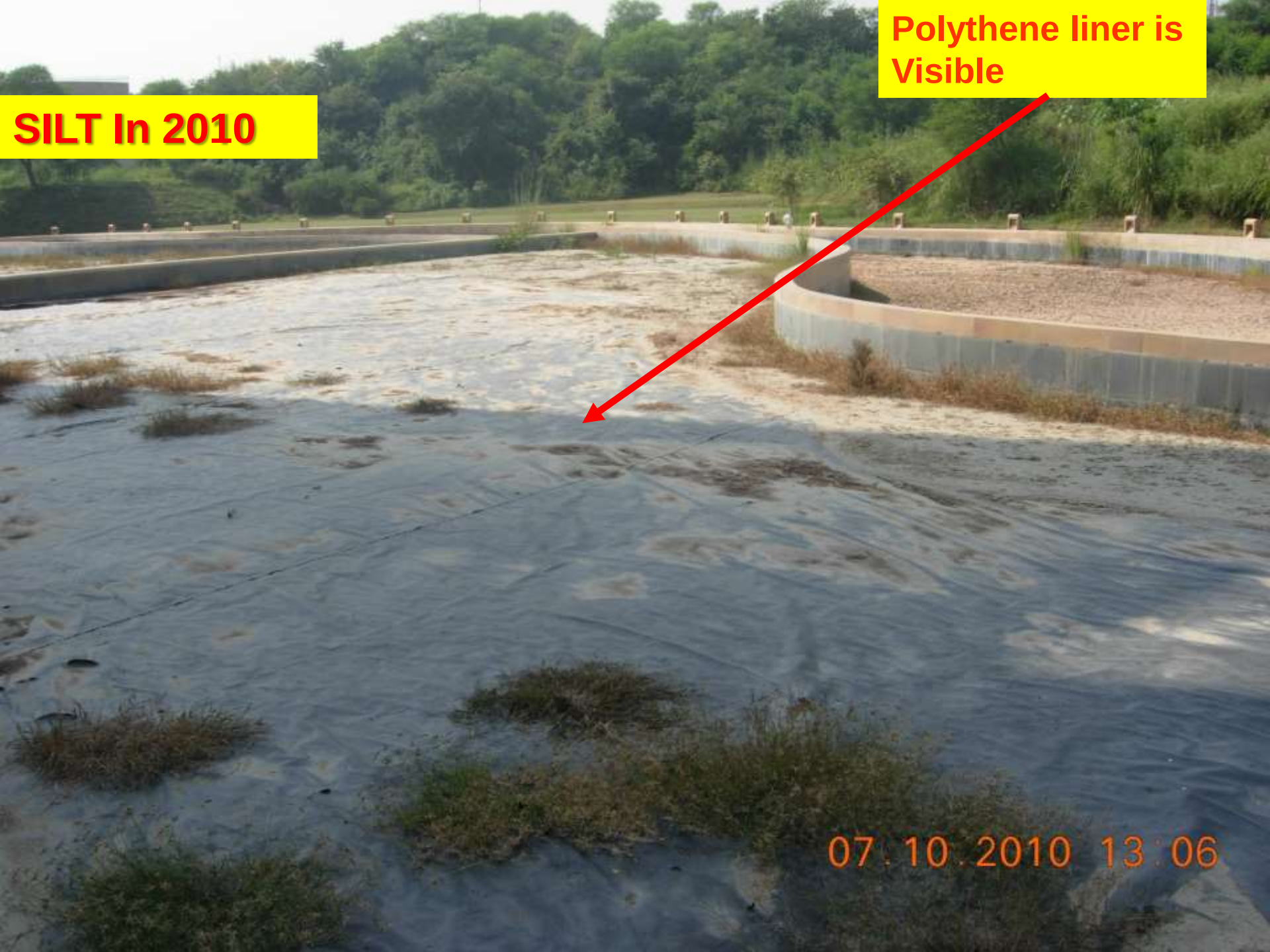
Silt Before

and

Silt After

SILT IN OCT 2009

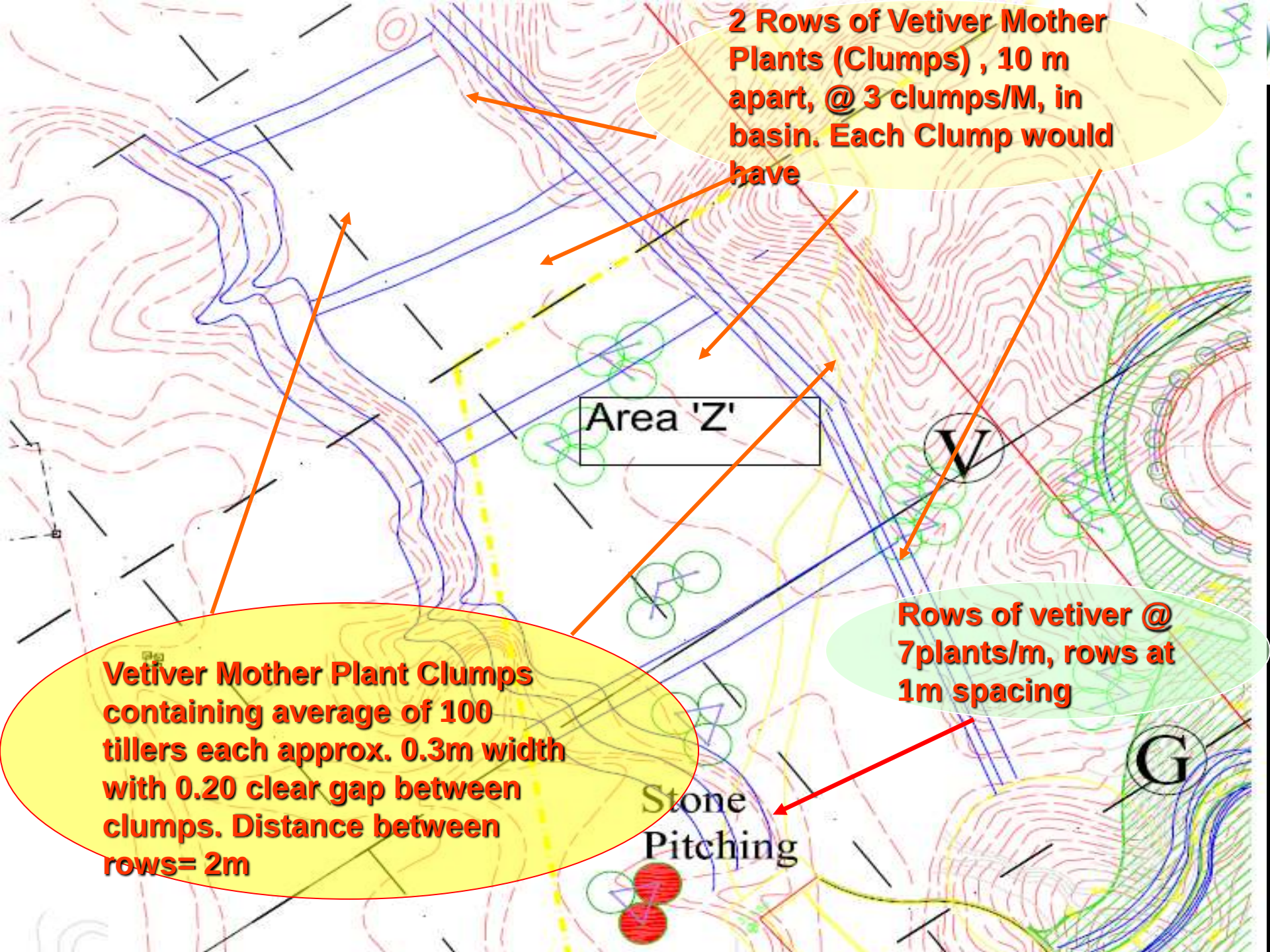

Polythene liner is Visible
SILT IN 2010
Catchment Area Protected with Vetiver
07 10 2010 14:25


Polythene liner is Visible
SILT In 2010
07.10.2010 13:06


SILT IN 2010
First Cell:
Zero Silt
07.10.2010 12:14


Location ‘V’
(Behind Debris Hill)
Water Body
Gully/ Rain Cut
Area Z
29 04 2010 13 06


Rows of vetiver @ 7plants/m, rows at 1m spacing quantity as per measurement at site
Stone Pitching
29.04.2010 13:06


2 Rows of Vetiver Mother Plants (Clumps) , 10 m apart, @ 3 clumps/M, in basin. Each Clump would have
Area 'Z'
V
Rows of vetiver @ 7plants/m, rows at 1m spacing
G
Vetiver Mother Plant Clumps containing average of 100 tillers each approx. 0.3m width with 0.20 clear gap between clumps. Distance between rows= 2m
Stone Pitching

Our Intervention: Clumps of Vetver strategically Planted in the rain to Prevent Silt Carried by the same rain to the Water Body.

The Silt was reduced by 99% at the end of the same monsoon as planting


This is a hillock of Debris
Location ‘V’
Rain Cuts & Gullies
Huge source of silt


The same hillock of Debris.
Now lush Green
No question of silt

Catchment Area and debris hill Imagery June 2010

Catchment Area and debris hill Imagery October 16, 2013

Khalsa Heritage Museum 2009-2010

Khalsa Heritage Museum: latest from wikipedia

Thank You