Wise Water Use in Gurgaon

An action plan for HUDA, MCG and residents

Centre for Science and Environment

Four Steps to Water Security

- Recycle and reuse sewage: Badshahpur drain
- Maximise large-scale rainwater harvesting
- Create reserved areas for water conservation aka water sanctuaries
- Maximise protection of Ghata Jheel

Water summary

- Sewage recycling can save 55 million litres per day
- Restored Ghata Jheel can have a spread of around 12 hectares and water storage potential of 12 billion litres if catchment is treated and encroachments are prevented
- Rainwater harvesting potential in village ponds identified is about 90 million litres
- Water sanctuary can harness 21.6 billion litres

Gurgaon can meet about 50% of its current water needs from these measures

1

In-situ sewage treatment **Badshahpur Drain**


Badshahpur Drain
Proposed Wetland Site
Sector 103
Budhera
STP Dhanwapur
Sikandarpur Metro
Sikandarpur Pond
Sector 26
HUDA Metro
Sector 9B
Gurgaon
State Highway 13
Khandsa Site
Pataudi Rd
Sector 36
STP Behrampur
Sector 56
Sector 49
To Sohna Rd
2.11 mi
© 2013 Google
Image © 2013 DigitalGlobe
Google ear
Imagery Date: 4/2/2013 28°27'05.38" N 77°01'57.58" E elev 747 ft eye alt 51900 ft

Objective

To treat waste water from Badshahpur drain for reuse and to mitigate pollution in Najafgarh Drain

Rationale

- The groundwater levels in Gurgaon are dropping at an alarming rate of 2 m a year
- **Reusing** water from the drain lessens the need to extract groundwater, particularly for horticulture and construction purposes.
- Using natural groundwater **recharge** keeps water within Gurgaon's watershed.
- Potentially reduces **disease** and offensive smells derived from the drain while maintaining wetlands improve **biodiversity**.

Current Situation

- The Badshahpur Drain runs from southeastern Gurgaon toward the northwest, flowing into the Najafgarh Drain.
- Exposed areas of the drain from beginning to end emit offensive odors and contain floating globules of sludge, along with solid waste (plastics).

Current Situation: STPs

- HUDA's Sewage Treatment Plants (STPs)
- Between the 2 STPs, approximately 35 million gallons per month of treated sewage water is supplied through tankers to construction and other uses
- Behrampur STP effluent discharges directly into the drain. There is no visible difference in quality before and after the outfall.

STP Location	Capacity (MLD)	Type	Status
Dhanwapur	(1) 68	ASP	Operational since 2000
	(2) 100 (25 Tertiary)	ASP	Due June 2014
Behrampur	(1) 50 (10 Tertiary)	ASP	Operational since 2010
	(2) 120 (30 Tertiary)	SBR	Due June 2014

Water Quality

- Criteria for water reuse according to CPCB

Purpose	Criteria
Horticulture	BOD: 30 Fecal Coliform: 10,000
Construction	BOD: 2-3 Tertiary treated
Groundwater Recharge	Tertiary treated

Proposal for in-situ treatment

3 Treatment Sites

- Badshahpur Jheel
- Khandasa (Sector 37)
- Bhudera (at Najafgarh Drain)

Badshahpur Jheel

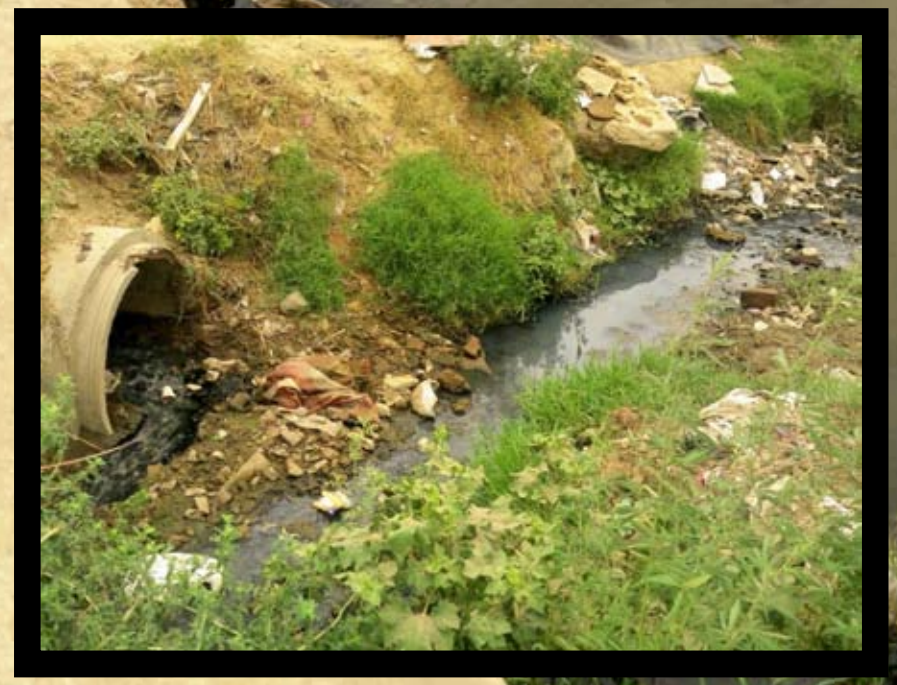
Proposed Constructed Wetland Site

- Approximate area: 23,200 sq m
- Situated in Dhani village in Sector 48
- Bordering Park View City 1 Housing Complex and Sohna Road
- 2.25 km upstream of Behrampur STP

Badshahpur Jheel

- A relatively flat area, with an elevated section in the center
- Presently used for dumping earth, making land uneven
- Large electric towers line the north side of the jheel
- Semi-encroached area

Badshahpur Jheel



- Receives drain water from the southeastern area of Gurgaon
- Particularly drainage along Golf Course Extension Road

Badshahpur Jheel

- Wetland-type area
- Birds, pigs, variety of vegetation

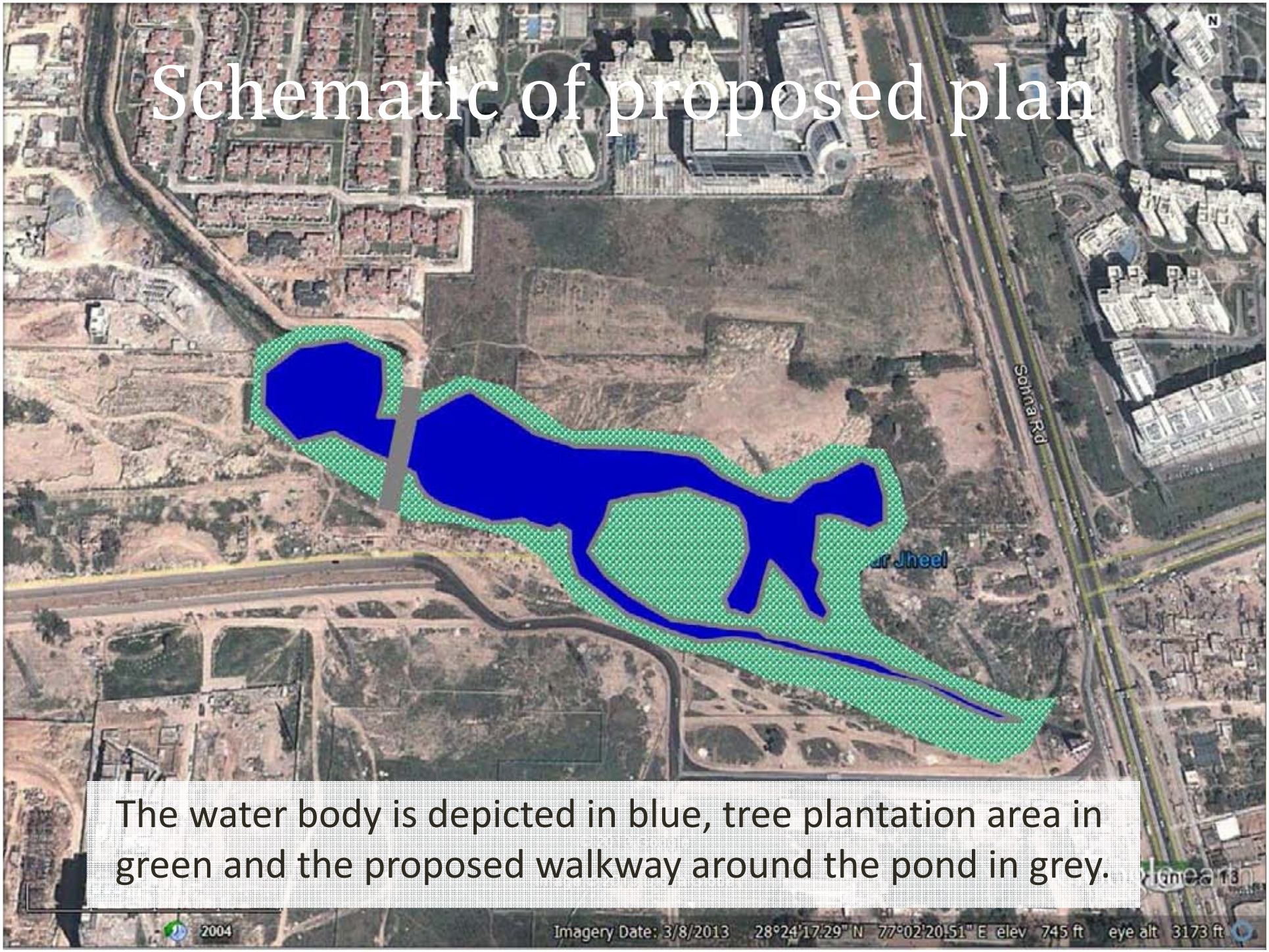
Badshahpur Jheel

Proposal

- Revive the jheel as per Sikandarpur pond
- Create a constructed wetland to improve the water quality
- Prevent dumping by surrounding population by demarcating the pond and mass awareness
- Deepen the jheel, if needed
- Connect treated water to proposed recycling pipeline

Badshahpur Jheel

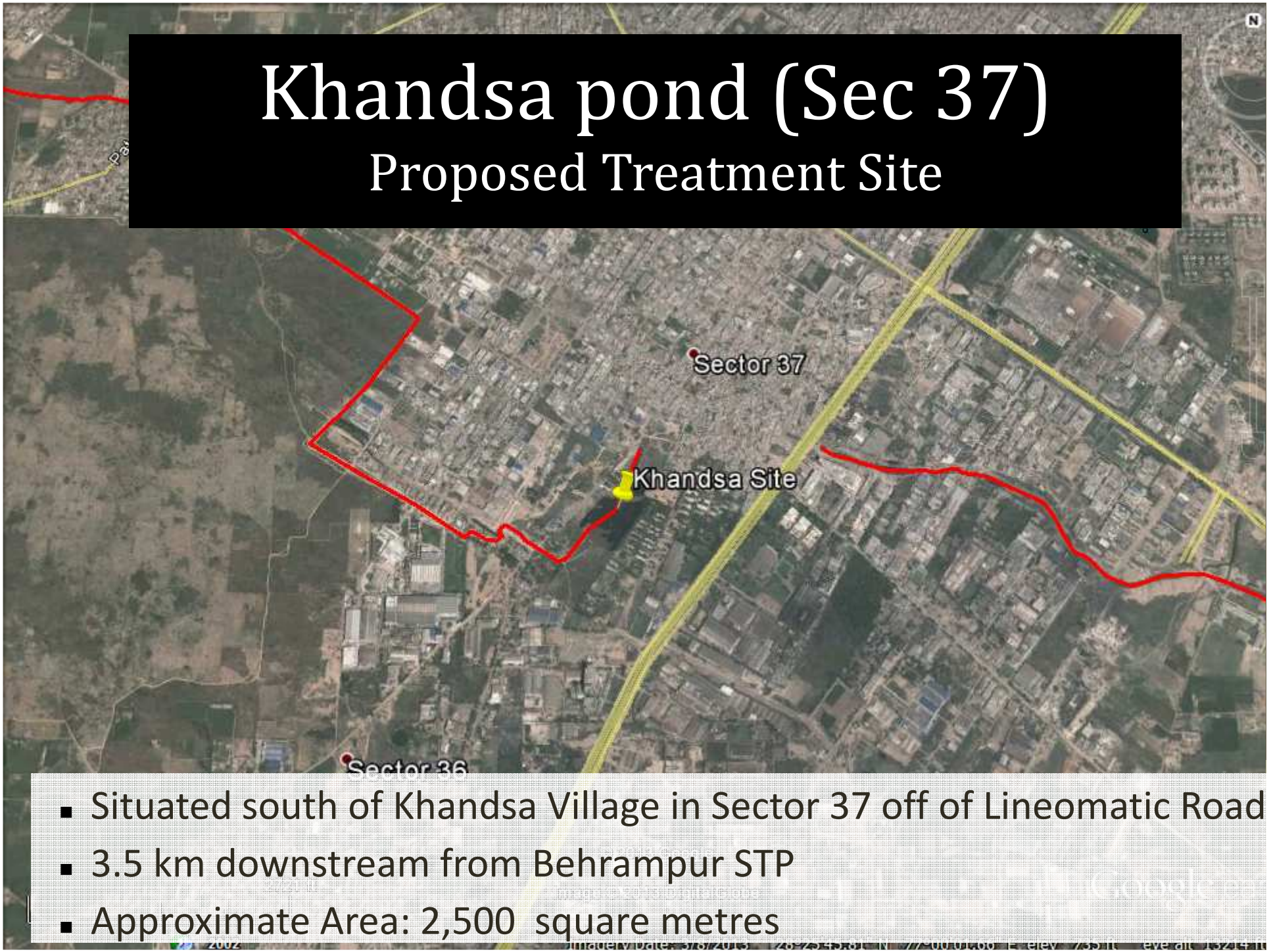
Schematic of proposed plan



The water body is depicted in blue, tree plantation area in green and the proposed walkway around the pond in grey.

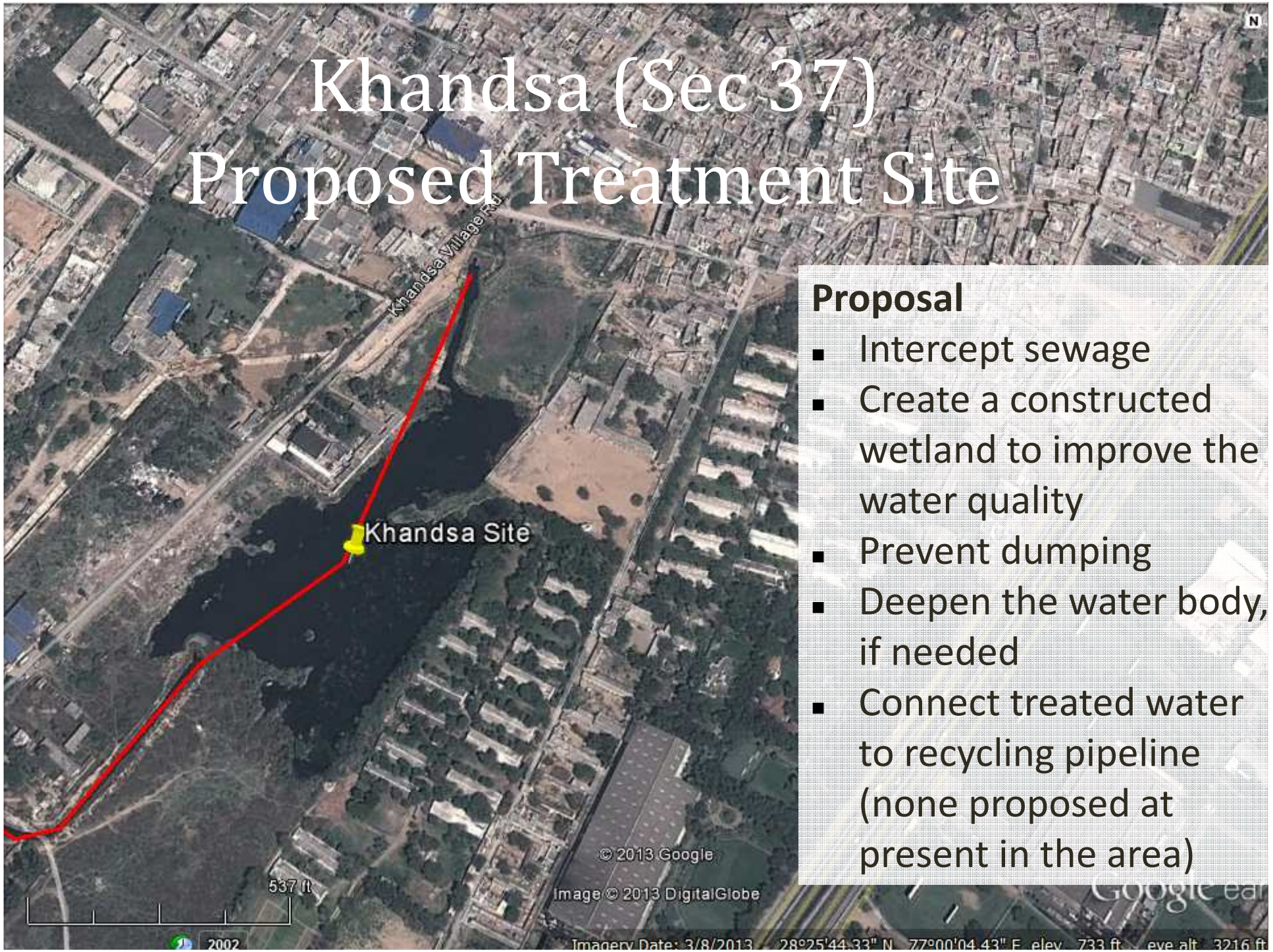
Khandsa pond (Sec 37)

Proposed Treatment Site



- Situated south of Khandsa Village in Sector 37 off of Lineomatic Road
- 3.5 km downstream from Behrampur STP
- Approximate Area: 2,500 square metres

Khandsa (Sec 37) Proposed Treatment Site

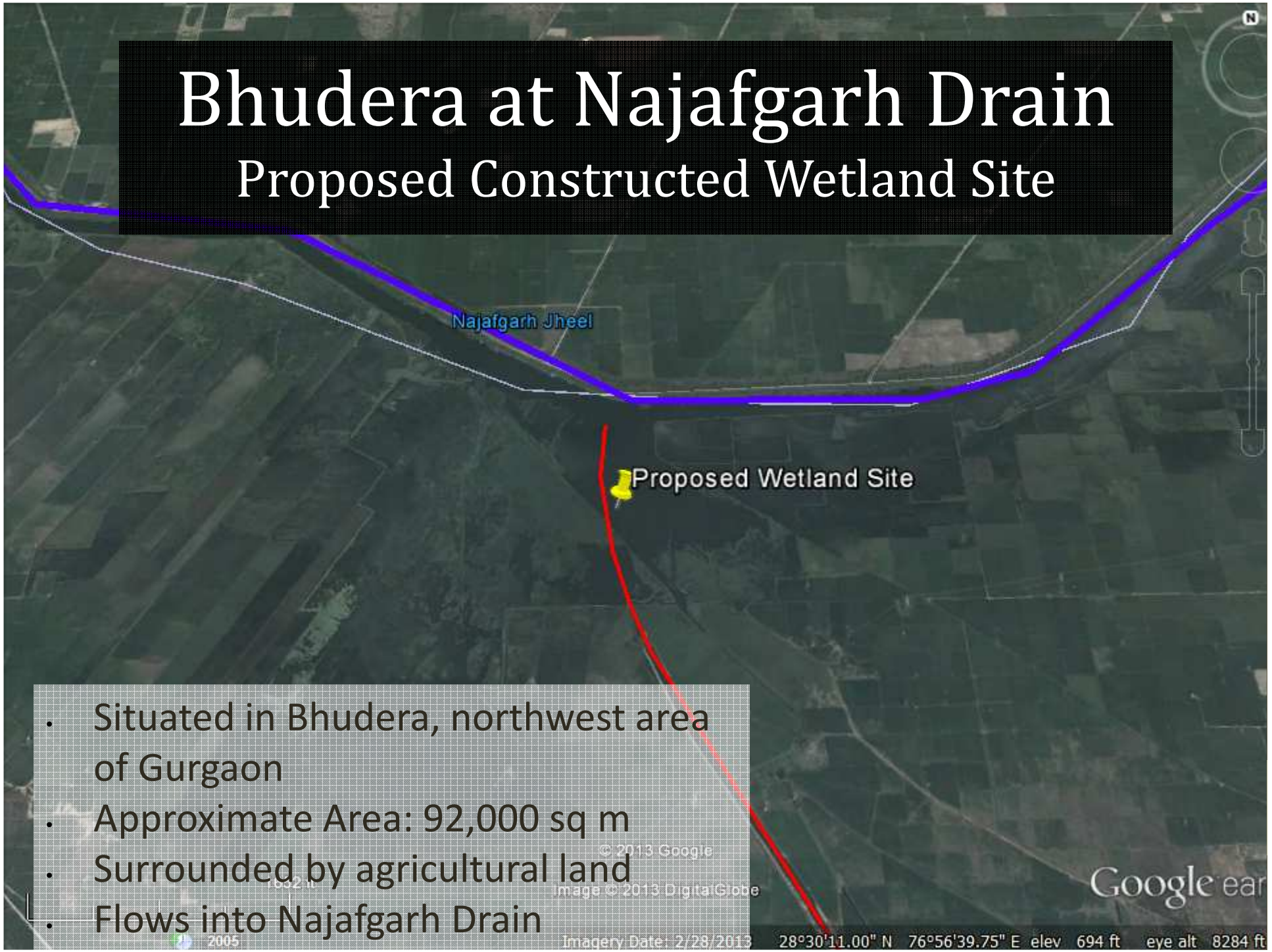


Proposal

- Intercept sewage
- Create a constructed wetland to improve the water quality
- Prevent dumping
- Deepen the water body, if needed
- Connect treated water to recycling pipeline (none proposed at present in the area)

Bhudera at Najafgarh Drain

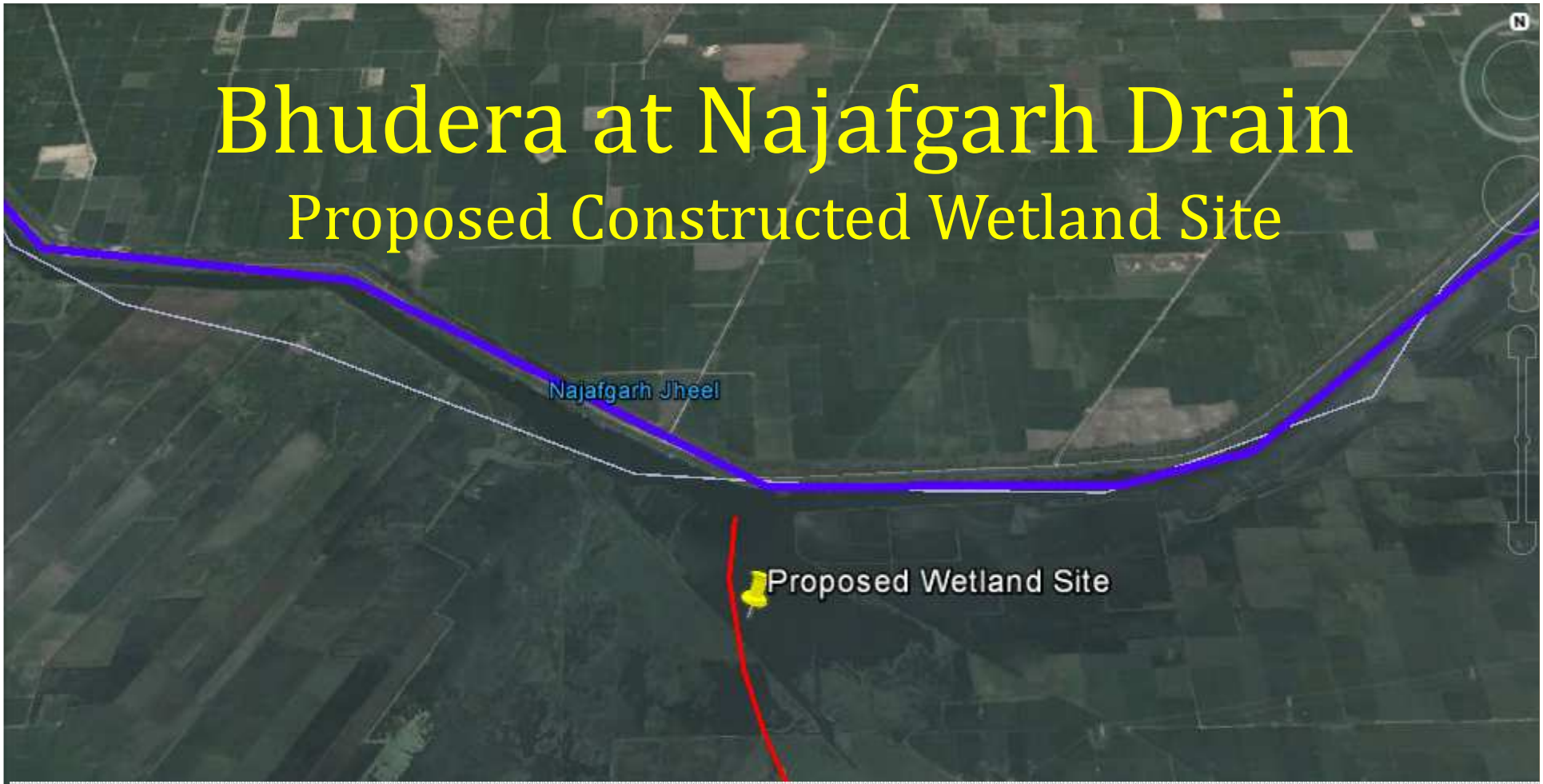
Proposed Constructed Wetland Site



- Situated in Bhudera, northwest area of Gurgaon
- Approximate Area: 92,000 sq m
- Surrounded by agricultural land
- Flows into Najafgarh Drain

Bhudera at Najafgarh Drain

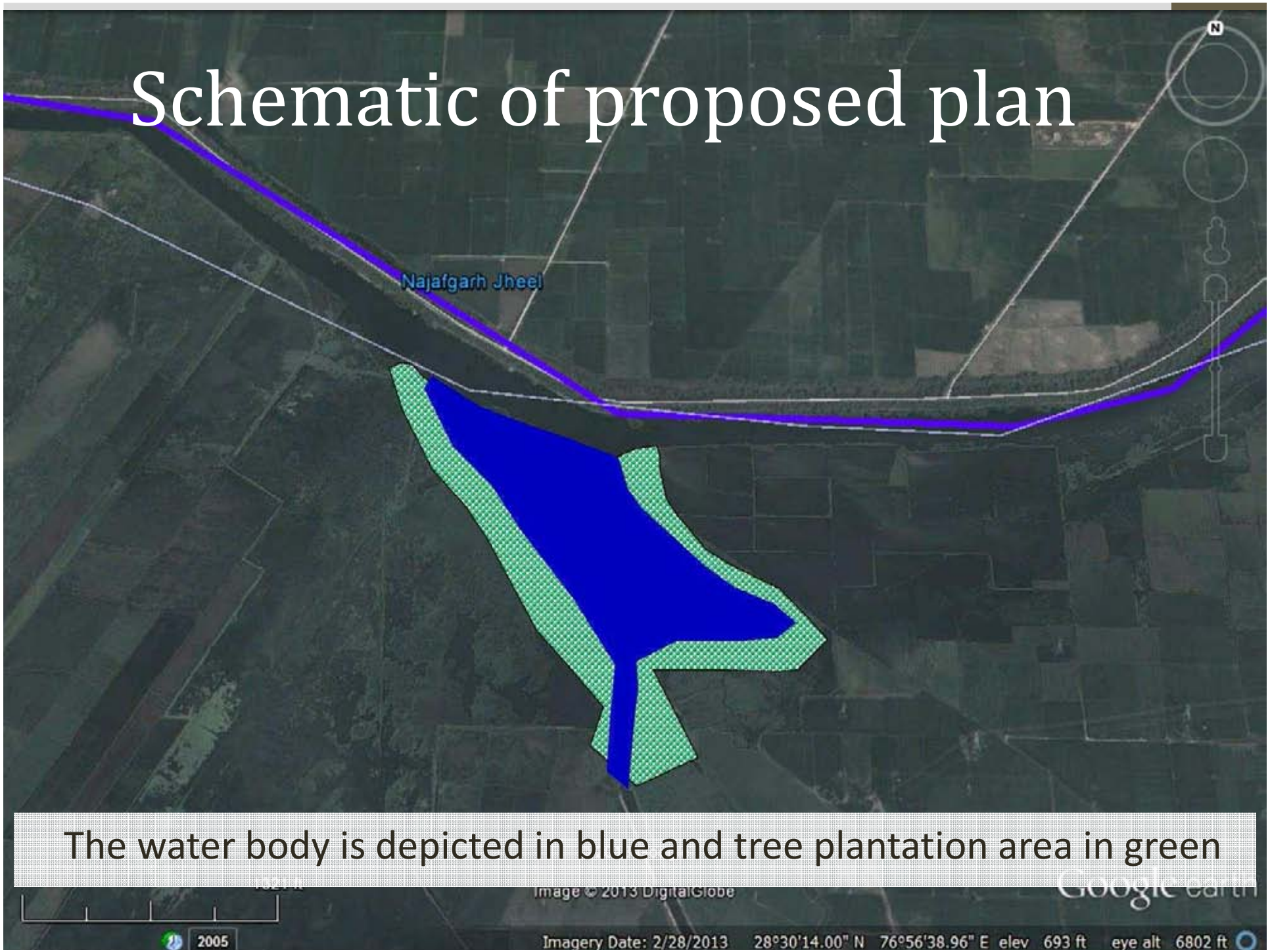
Proposed Constructed Wetland Site



Proposal

- Use biological means to improve the water quality
- Prevent dumping by surrounding population by demarcating the pond and mass awareness
- Deepen the waterbody, if needed
- Connect treated water to proposed recycling pipeline

Schematic of proposed plan



The water body is depicted in blue and tree plantation area in green

2

Rainwater Harvesting
Ghata Jheel


Objective: To revive the Ghata jheel which can act as city level rainwater harvesting system

Rationale

- More than **137 waterbodies** which are large scale recharge structures in the city have dried up
- Every year the city faces flood threat as many waterbodies are **concretised**
- According to the National Capital Region (NCR) Plan, 2021, it is mandatory for NCR towns to reserve **2-5 % area** under waterbodies (natural/constructed)

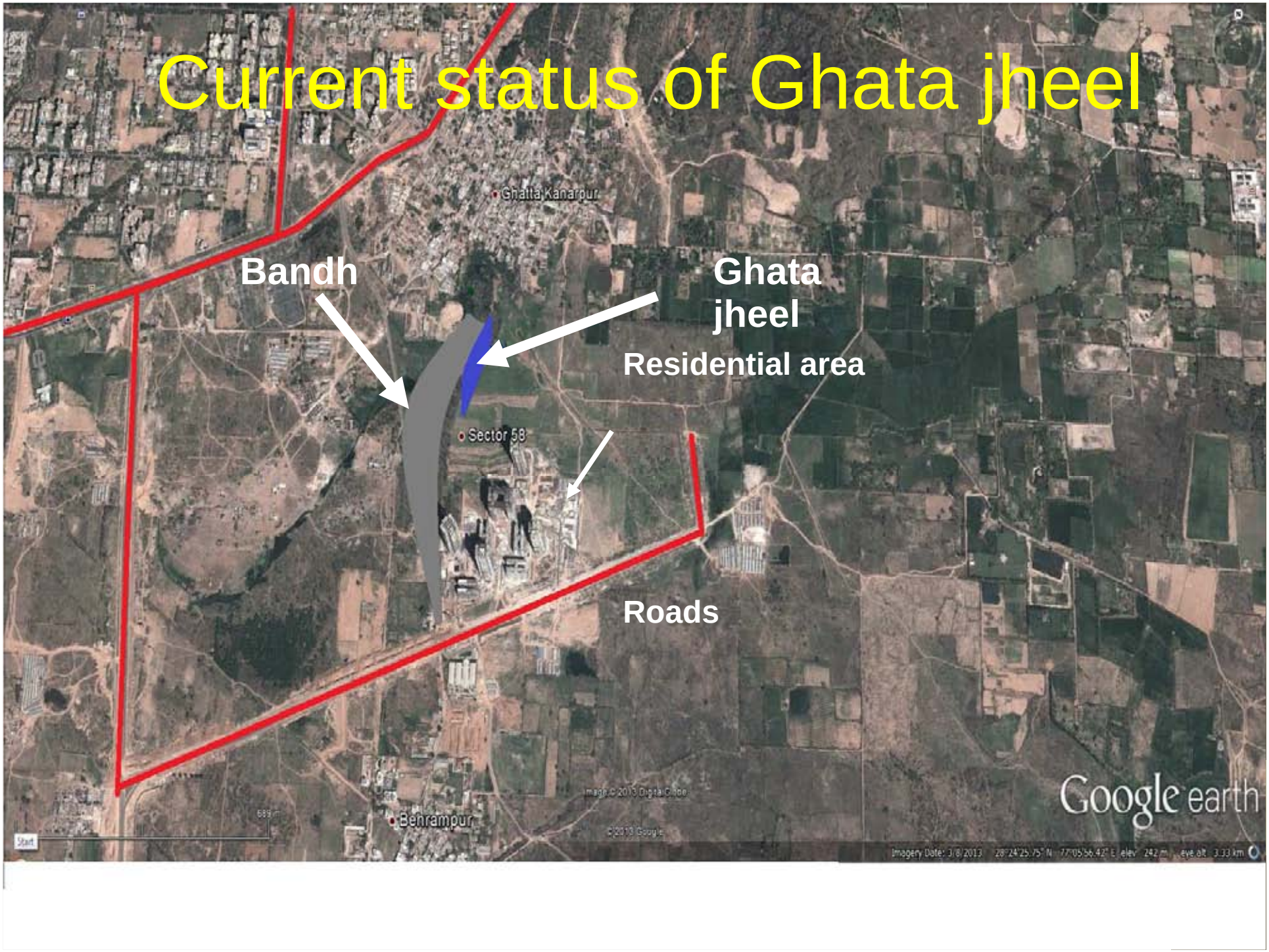
Rationale

- The jheel will act as large groundwater recharge structure in the area
- Development of the jheel will also help in creation a sponge in the area which will absorb flood in the area
- The jheel will also act as surface water reservoir which can provide water security to the agricultural activities in the surrounding area

Ghata jheel: Current situation

- The jheel occurs in Sector 58, Gurgaon
- It has been marked as seasonal lake in the Indian Gazeteer (1893)
- The jheel holds water from monsoon to middle of October
- The feeder channels and the catchment area has been blocked/concretised by new development and construction of road
- Only one such feeder channel can be revived

Current status of Ghata jheel

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सेक्टर 57
घाटा कानागरपुर
Ghata jheel
Sector 58
बलोला
अलाहवास
नाला
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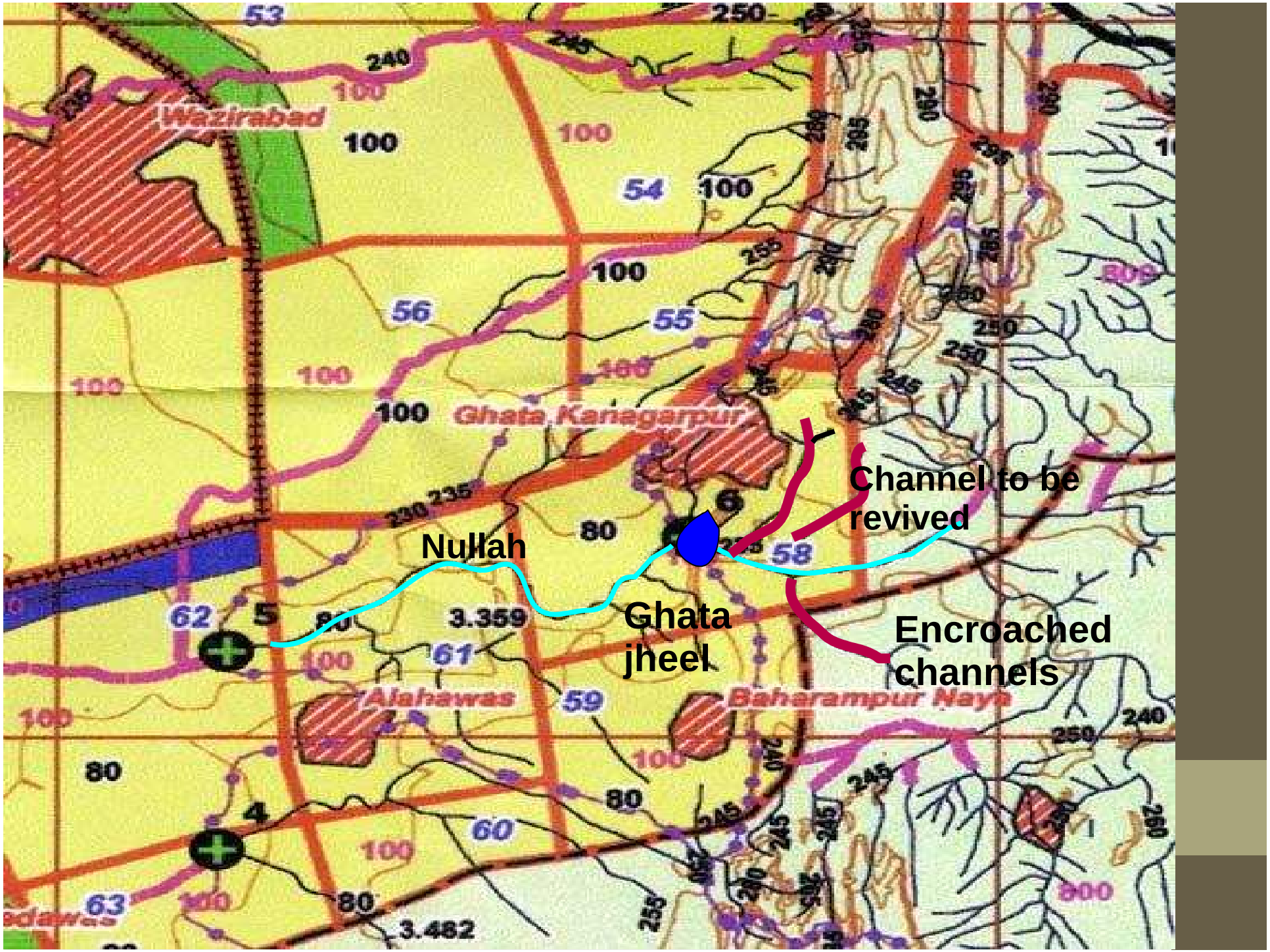
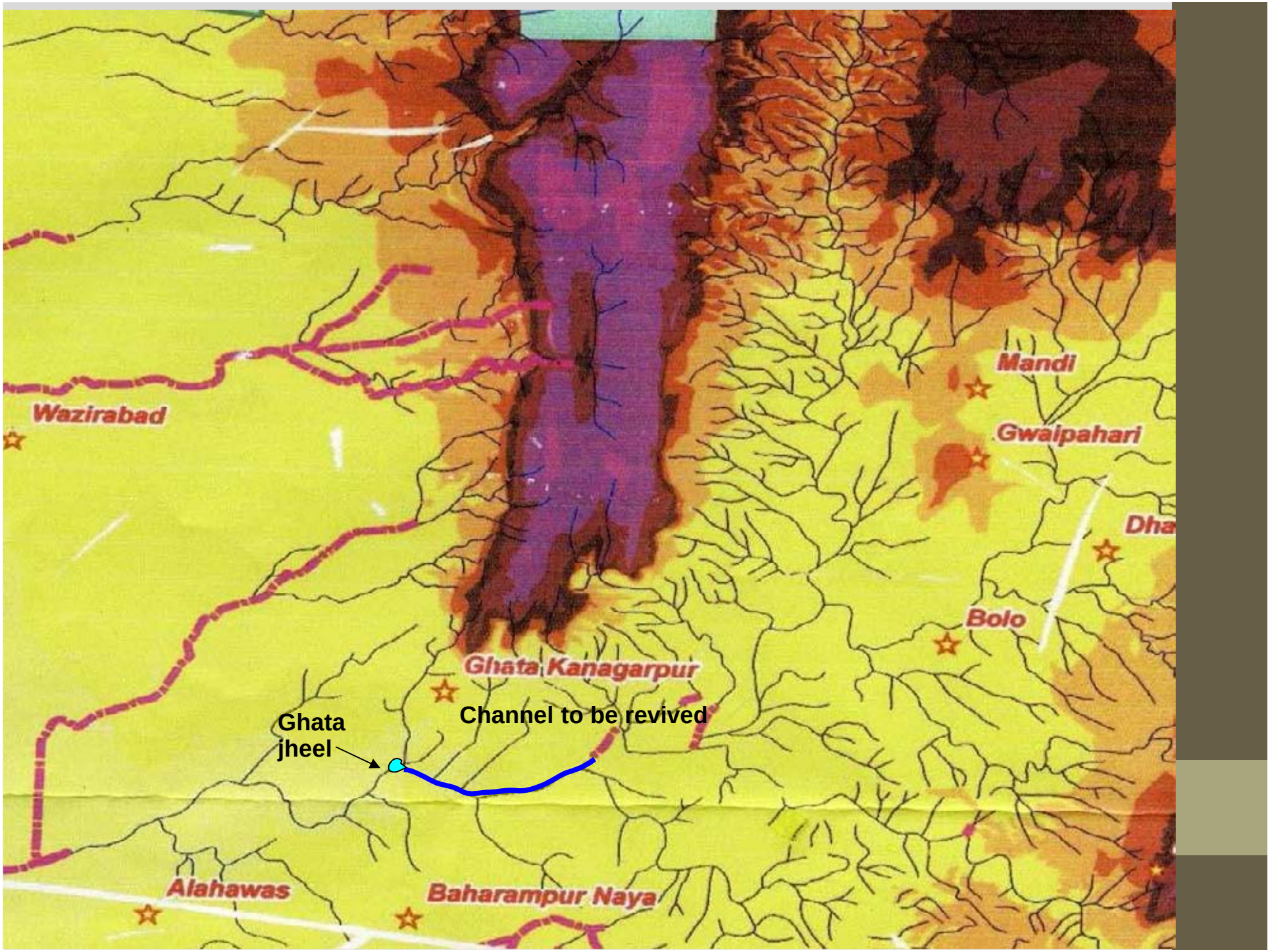

Wazirabad
Ghata Kanagarpur
Alahawas
Baharampur Naya
Nullah
Channel to be revived
Ghata jheel
Encroached channels
3.359
3.482

Ghata jheel at the start of the rain

Residential area blocking the flow of rainwater into the jheel

The original extent of the jheel as viewed after intense rain


Ghata jheel after intense spell of rain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Ghata Kanagarpur
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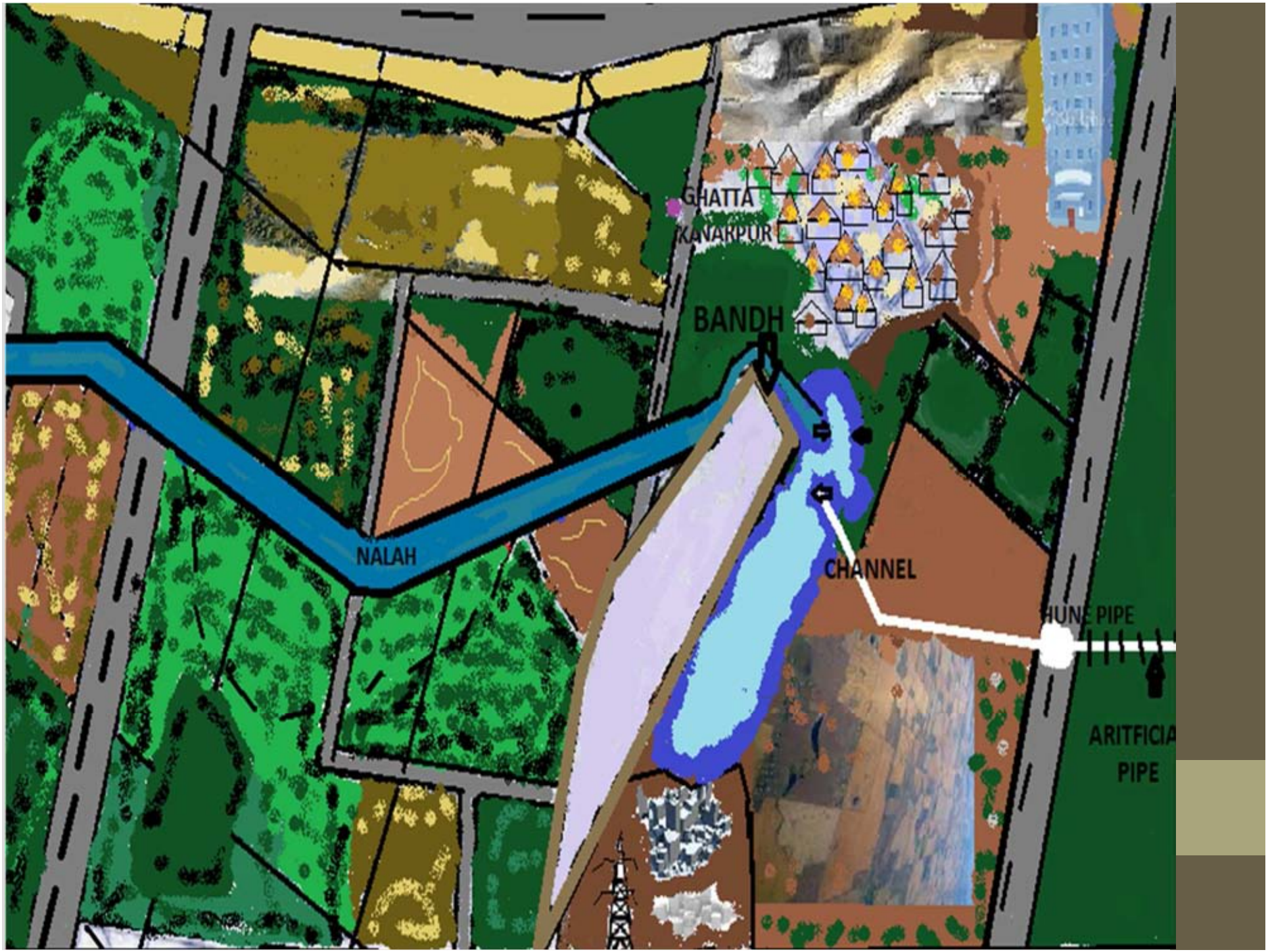
Ghata
jheel
Alahawas
Baharampur Naya


GHATTA
KANARPUR
BANDH
NALAH
CHANNEL
HUME PIPE
ARITFICIA
PIPE


Channel entering the jheel


Channel after peak intense rainfall

Ghata jheel: Plan for revival

- No more construction in the area near the jheel or on the feeder channel (to be revived)
- Widening of channels (present length and width 1.2 m x 1.5 m) to up to 2 times
- Deepening of the existing jheel by approximately 1 m
- Planning of no-construction zone of up to 2 m on both sides of the nullah entering from sector 58 to 61. Thus excess of water from the jheel can be accomodated into this nullah and prevent flooding in the area
- For maintenance of the jheel, HUDA can create a committee with representatives from communities, government officials and other stakeholders

Ghata jheel: Further activities for detailed revival plan

Survey of the following:
A) Physiography, Soil and Drainage pattern
B) Geological, Geophysical and Hydrogeological
C) Land use
D) Flood data
E) GIS and remote sensing data

Data can be collected from:
I. Research and newspaper articles
II. Government departments
III. Pre-independence and post independence gazeteer
IV. National Remote Sensing Centre

Time frame: Six months
➔ Data collection and compilation : Two months
➔ Analyses and inference drawing : Four months

3

Revival of village ponds
Rainwater Harvesting

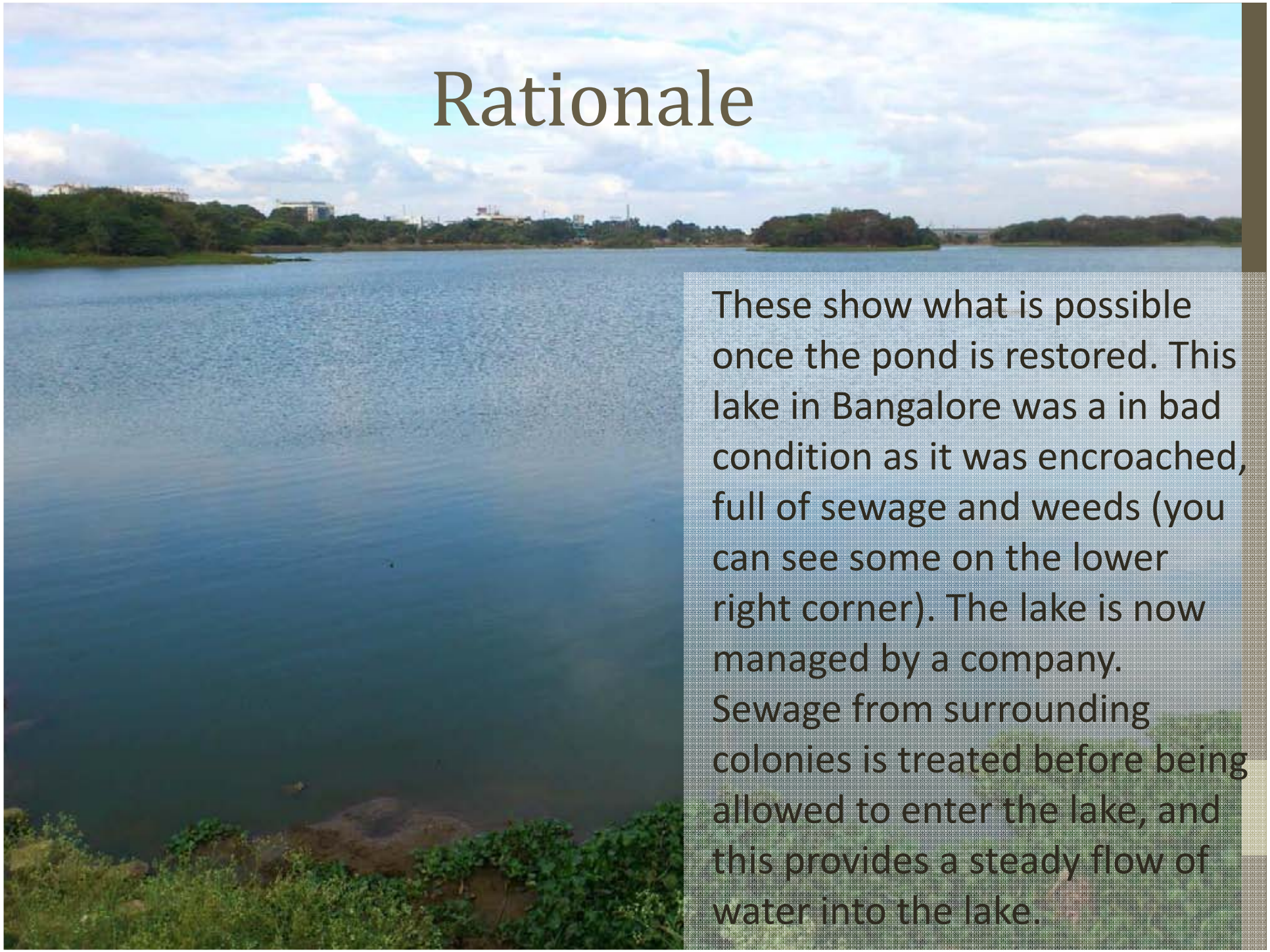
Sikandarpur Pond

To develop the Sikandarpur pond and surrounding watershed into a wetland and groundwater recharge zone.

Rationale

- This pond and watershed are critical for maintaining the **groundwater levels** in surrounding areas that are heavily populated.
- Improving the watershed will improve **water security**.
- Cleaning the wetland will improve the **ecology** of the area and **reduce diseases**.
- It will become a **recreation centre** for the local people.

Rationale

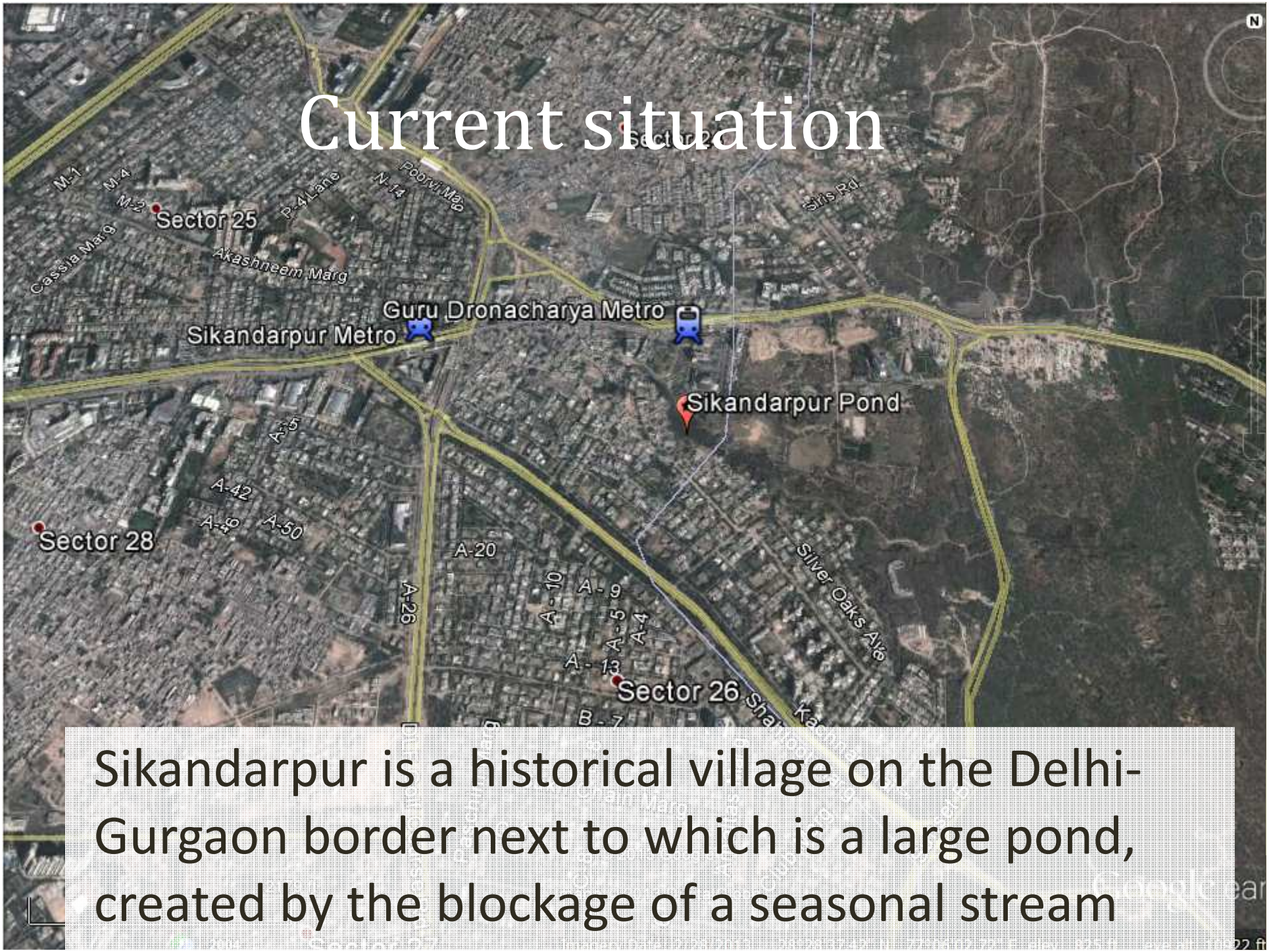


These show what is possible once the pond is restored. This lake in Bangalore was a in bad condition as it was encroached, full of sewage and weeds (you can see some on the lower right corner). The lake is now managed by a company. Sewage from surrounding colonies is treated before being allowed to enter the lake, and this provides a steady flow of water into the lake.

Rationale

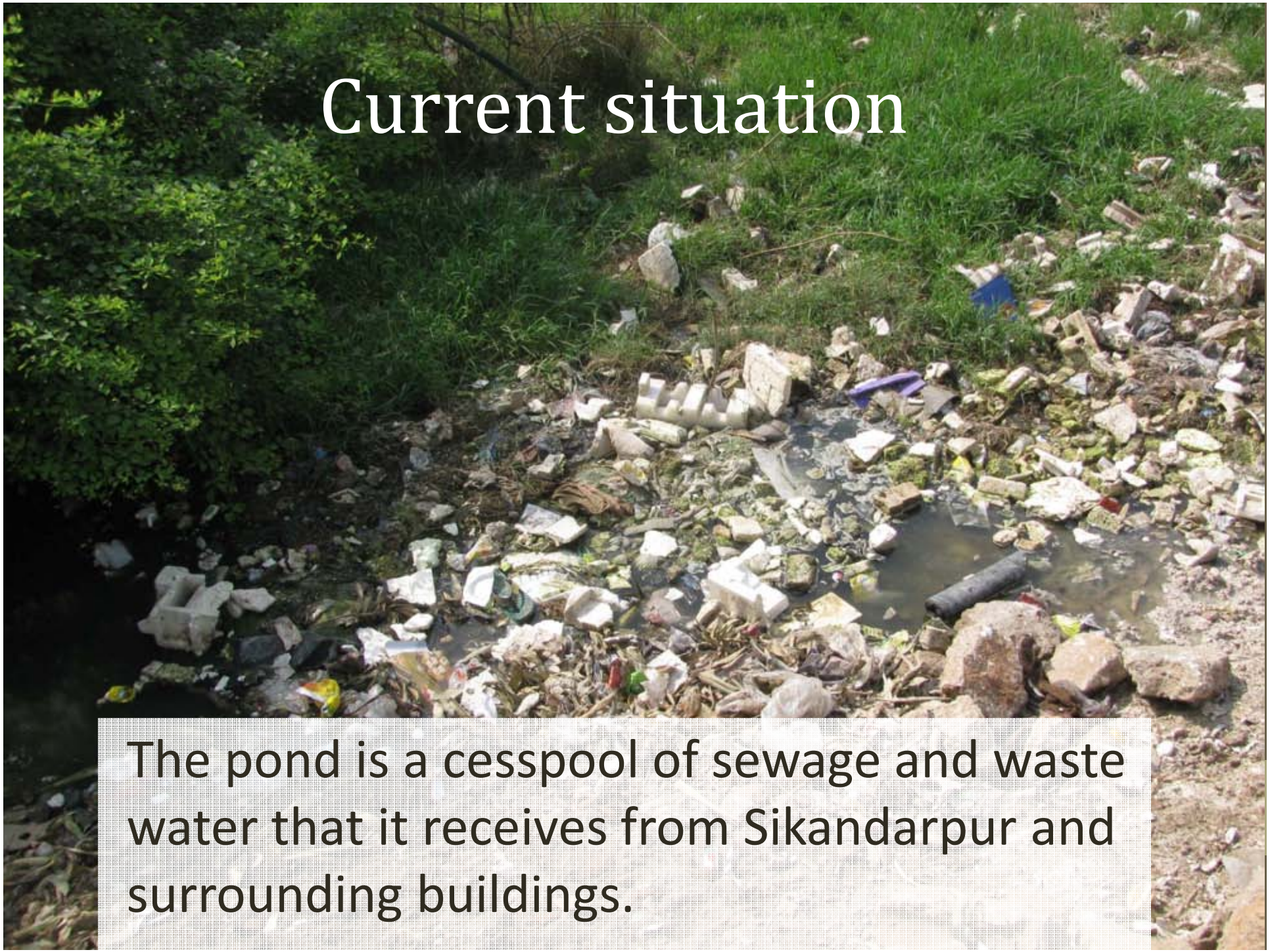
This constructed wetland is a sample of what we can make at the site. This is a wetland in the Indian Agricultural Research Institute, Delhi and is planted with local species of grass that clean sewage as it flows through the plant bed. This is a cost-effective model that can be maintained by local people.

Current situation

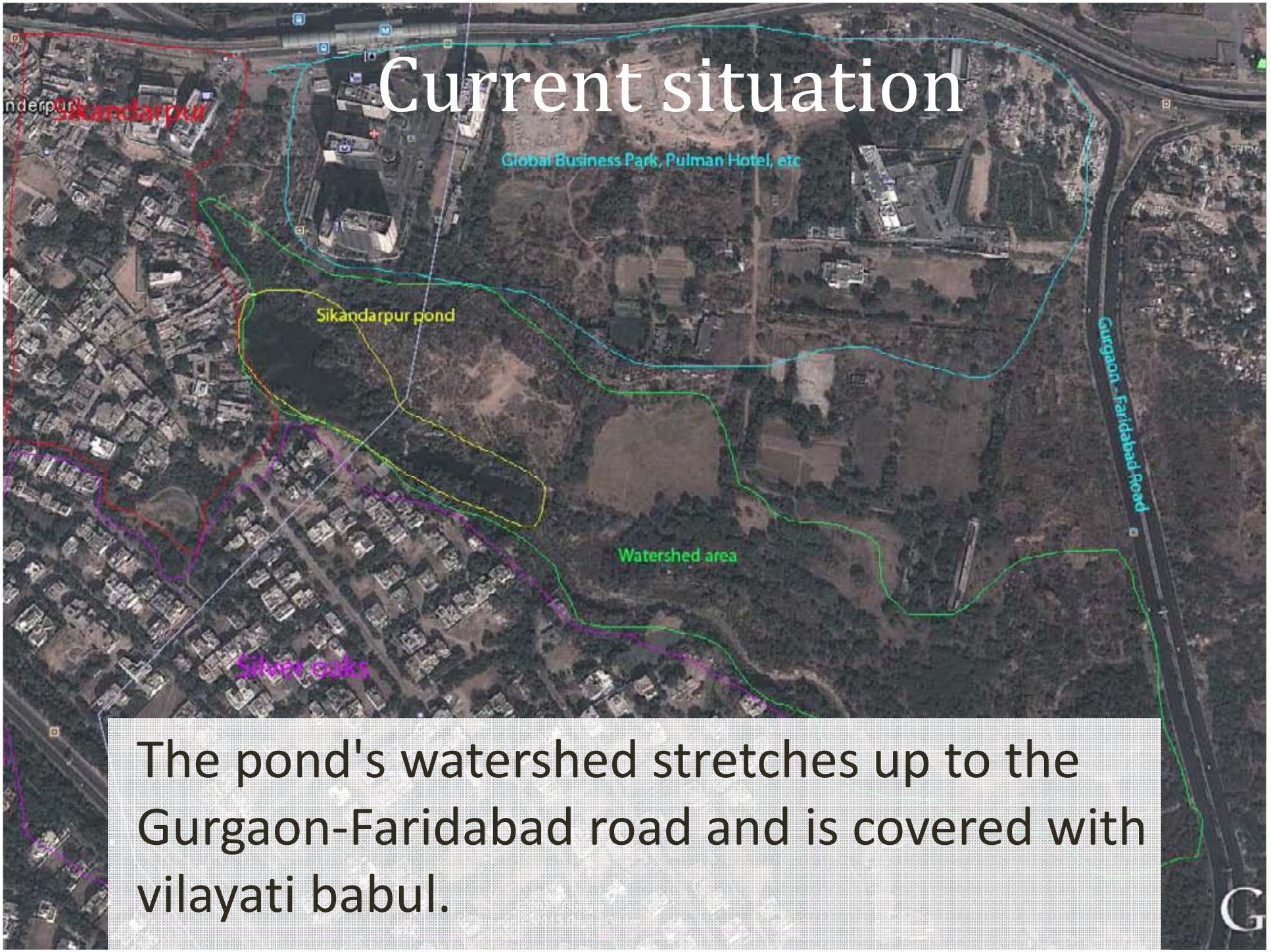


Sikandarpur is a historical village on the Delhi-Gurgaon border next to which is a large pond, created by the blockage of a seasonal stream

Current situation



The pond is a cesspool of sewage and waste water that it receives from Sikandarpur and surrounding buildings.


Current situation
Sikandarpur
Global Business Park, Pulman Hotel, etc
Sikandarpur pond
Gurgaon - Faridabad Road
Watershed area
Silver oaks
The pond's watershed stretches up to the Gurgaon-Faridabad road and is covered with vilayati babul.


Sikandarpur
Global Business Park, Pulman Hotel, etc
Sikandarpur pond
Gurgaon - Faridabad Road
Watershed area
Silver oaks
© 2013 Google
Image © 2013 DigitalGlobe

Proposal to restore wetland

1. Improve the quality and quantity of water in the pond

- Intercept all sewage entering the pond, construct reed beds/constructed wetlands
- Use biological means to improve the water quality in the pond
- Remove water hyacinth on on-going basis
- Prevent dumping by surrounding population by demarcating the pond and fencing if needed and mass contact programme with residents
- Deepen the pond, if needed
- Creation of irrigation infrastructure
- Constructing check-dams, contour bunding and gully-plugs
- Rainwater harvesting in surrounding areas

Proposal to restore wetland

2. Improve the local biodiversity of plants and avi-fauna

- Identify local specifies of trees and shrubs and develop a nursery.
- Conduct an extensive replantation of the watershed to replace the invasive species with native plants.
- Provide facilities for watering the plantation from the existing pond and using treated waste water from the Global Business Park.
- Ensure the plantation is protected from grazing and cutting for a period of 5-7 years till the trees mature to ensure their survival.

Schematic of proposed plan

The water body is depicted in blue, tree plantation area in green and the proposed walkway around the pond in grey.

Activities

- Demarcate the area and mark the boundary with posts. Include a ground survey that will identify locations for different activities.
- Demarcate and construct sewage interception zones. Create reed beds.
- De-weed the pond
- Conduct community education and awareness drive.
- Introduce cultured bacteria/enzymes. Requires aeration methods.

Activities

- Construct watershed structures on the entire watershed area.
- Develop nursery for local plants
- Plantation of local plants in the entire watershed
- Develop recreation zones, include unpaved walking tracks, benches, sit-outs
- Develop irrigation infrastructure
- Develop a management committee, comprising of people from Sikandarpur, local residents from DLF and the authorities for long-term maintenance of the area

Preliminary Survey

- A preliminary survey of the area is required to establish the area, and the following parameters:
- Physical size of the area and main physical features
- Geophysical investigations of the project site
  - Depth to water level, Water fluctuations, Water quality test
- Hydro-geological investigations
  - Soil and rock test, Mapping aquifer, Terrain mapping
- Watershed mapping
- Vegetation mapping
- Preparing a water balance
- Demarcation of land use
  - Residential, institutional, forest, water, etc.

Preliminary Survey

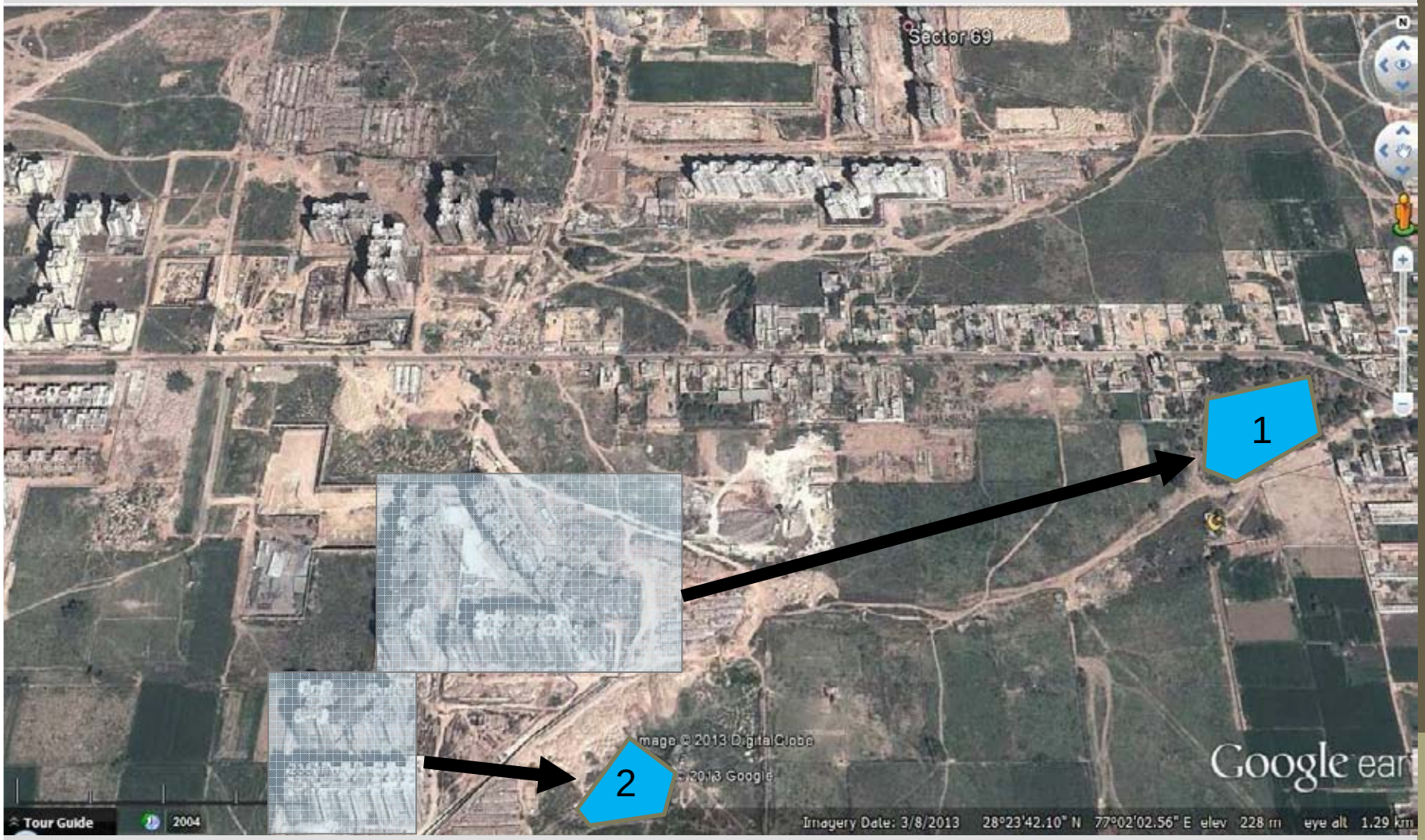
The survey will help us to bring out maps of the area with the following characteristics:

- **Contour map with physical features:** For number and size of watershed structures
- **Water region map:** For extent of the water body, the inflow points of sewage and location and size of treatment zones
- **Vegetation map**: For amount and kind of plantation required
- **Aquifer map:** For underlying aquifers and where recharge zones can be planned
- **Land use map:** For land use and design a rainwater harvesting system
- **Survey also helps to determine:**
  - Total number, size and characteristics of the watershed structures
  - The rainwater harvesting system required
  - The waste water treatment systems needed
  - The type and quantity of plantation required

RWH in other village ponds

- Each village has ponds/johads
- Municipality has identified around 50, CSE 12-13 that can be used for large scale rainwater harvesting
- These must be protected and converted into rainwater collection units
- Rainwater from the nearest planned development must be channeled here, kept free of contamination
- Reason – in villages, rainwater and sewage mix and are impossible to separate
- If required, pond may be deepened or expanded

Badshahpur johads



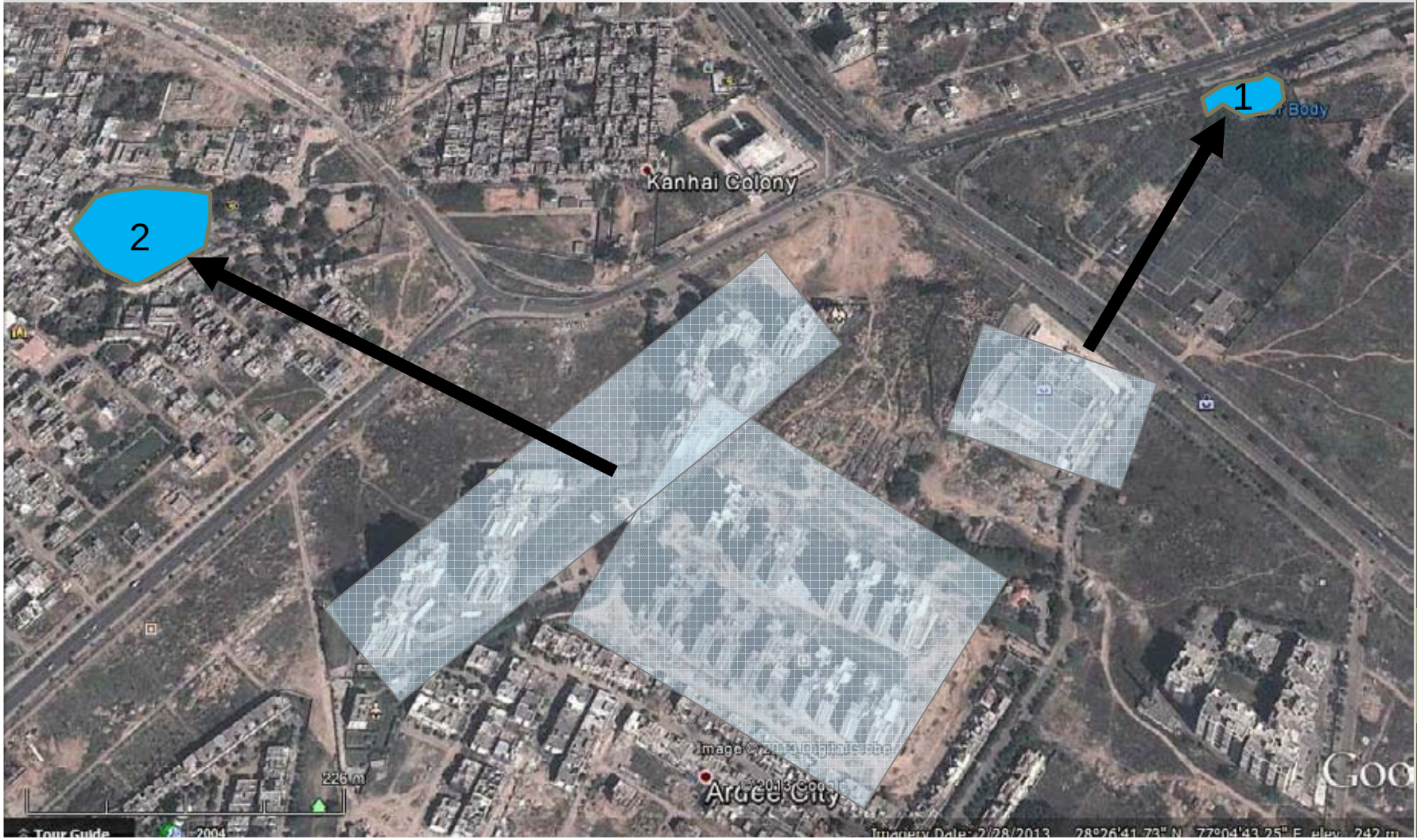
Badshahpur johads

- Johad 1:
  - 60X100 m
  - Approx depth 1.5 m
  - Storage capacity 9000 cubic metres
  - Construct pipeline of 550 m from apartment complex to Johad
- Johad 2
  - 40X65 m
  - Approx depth 1.5 m
  - Storage capacity 4,000 cubic metres
  - Construct pipeline of 130 m to Johad

Badshahpur johads

- Rooftop area approximately 9648 sq m
- 0.6 m annual rainfall
- Collection efficiency 80%
- Potential for RWH = 4631 cubic metres

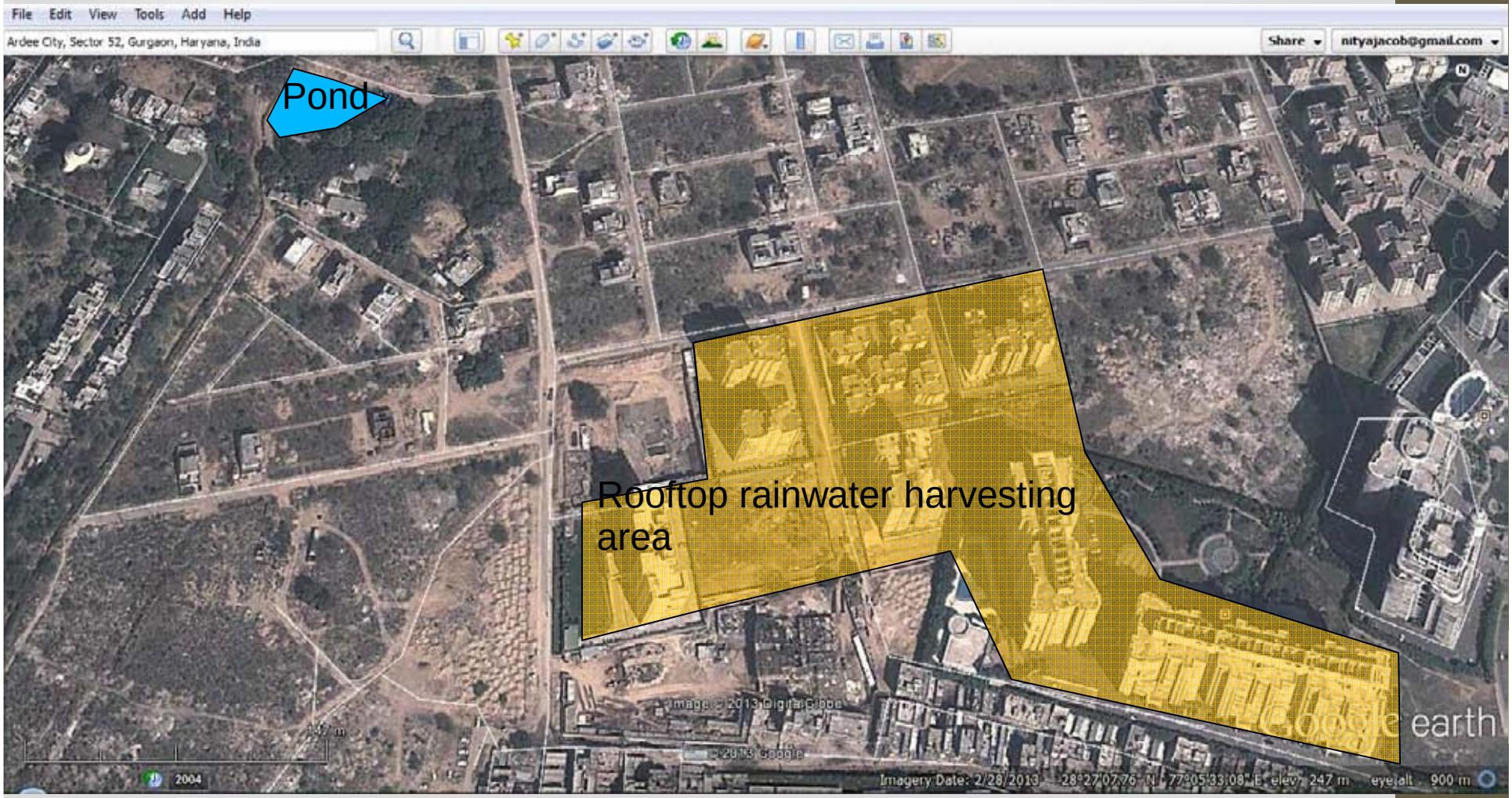
Kanhai Colony Johads



Kanhai Colony

- Johad 1
  - Size 50X90 m, approx depth 1 m, storage capacity 4500 cubic m
  - Ardee Mall rainwater collection potential 4000 cu m
  - Pipeline length 320 m
- Johad 2
  - Size 7000 sq m, approx depth 1 m, storage capacity 7000 cu m
  - Ardee City multistoreyed apts collection potential 6000 cu
  - Pipeline length 400 m, may need to be stored above ground as johad is at higher altitude than apartments

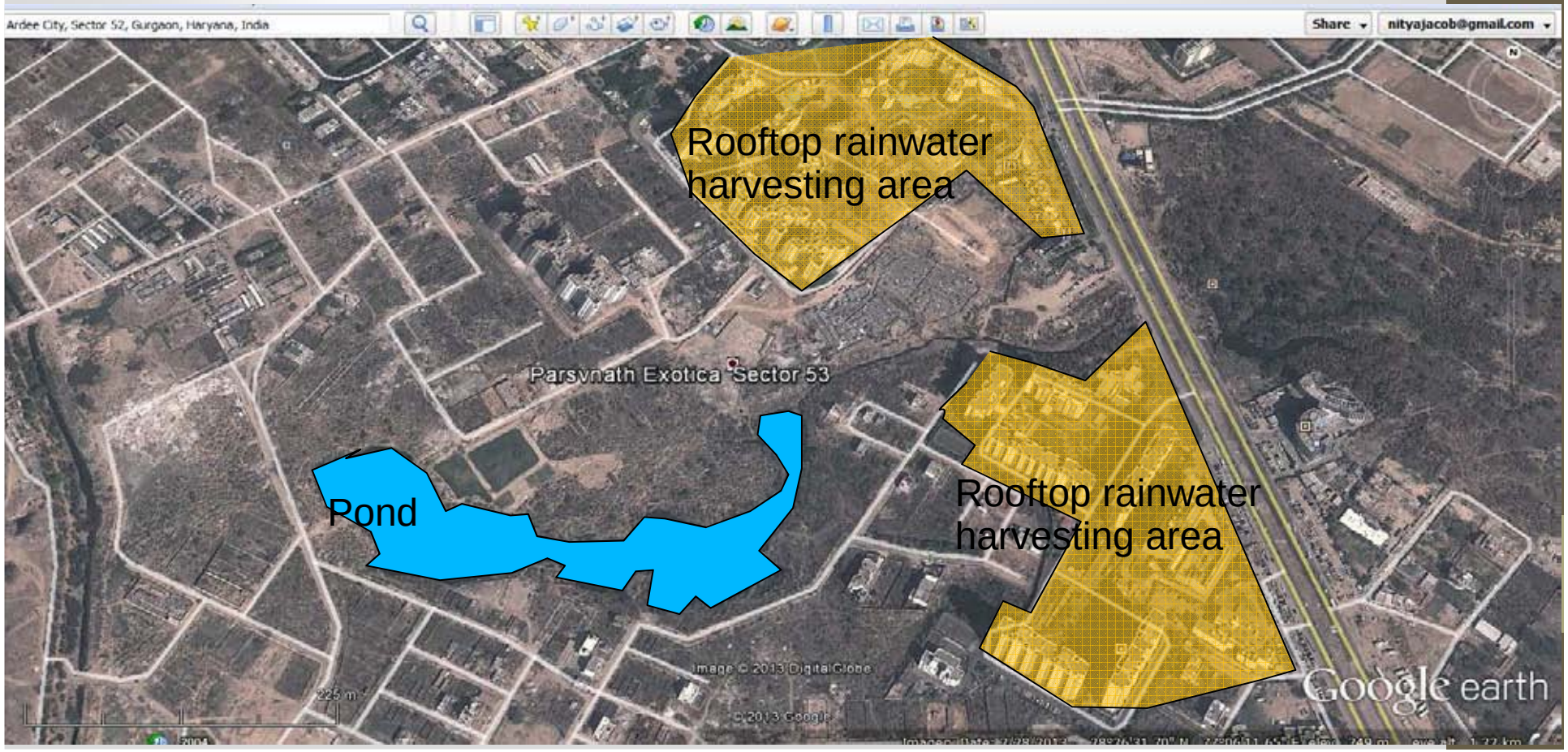
Sector 43


File Edit View Tools Add Help
Ardee City, Sector 52, Gurgaon, Haryana, India
Share
nityajacob@gmail.com
Pond
Rooftop rainwater harvesting area
Image © 2013 DigitalGlobe
© 2013 Google
Google earth
2004
Imagery Date: 2/28/2013 28°27'07.76" N 77°05'33.08" E elev 247 m eye alt 900 m

Sector 43

- Pond size 1750 sq m, average depth 2 m, capacity 3500 cu m
- Rooftop rainwater harvesting potential from multistorey apartments is about 3,800 cubic metres
- Pipeline length about 300 m
- Recommend overground storage
- Recommend development of alternate pond in area marked in red as that is lower than apartment complex, will solve waterlogging and flooding. Larger capacity and can collect water from other developments

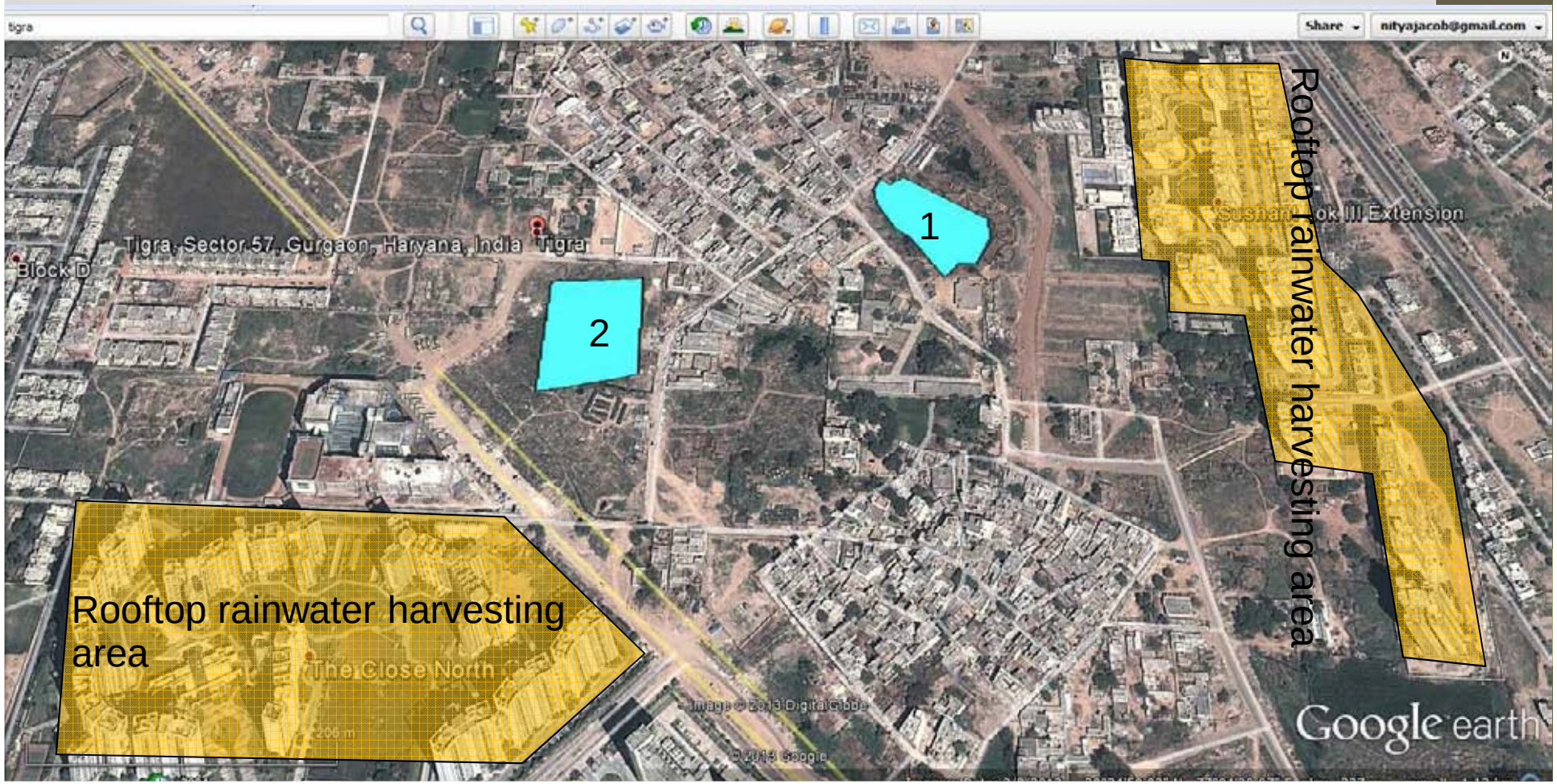
Sector 53, Parasvnath



Sector 53, Parasvnath

- Size of pond 21640 sq m, average depth 1 m, storage 21640 cu m
- RWH potential 6791 cu m from multistorey developments
- Several short pipelines needed to carry rainwater to ponds

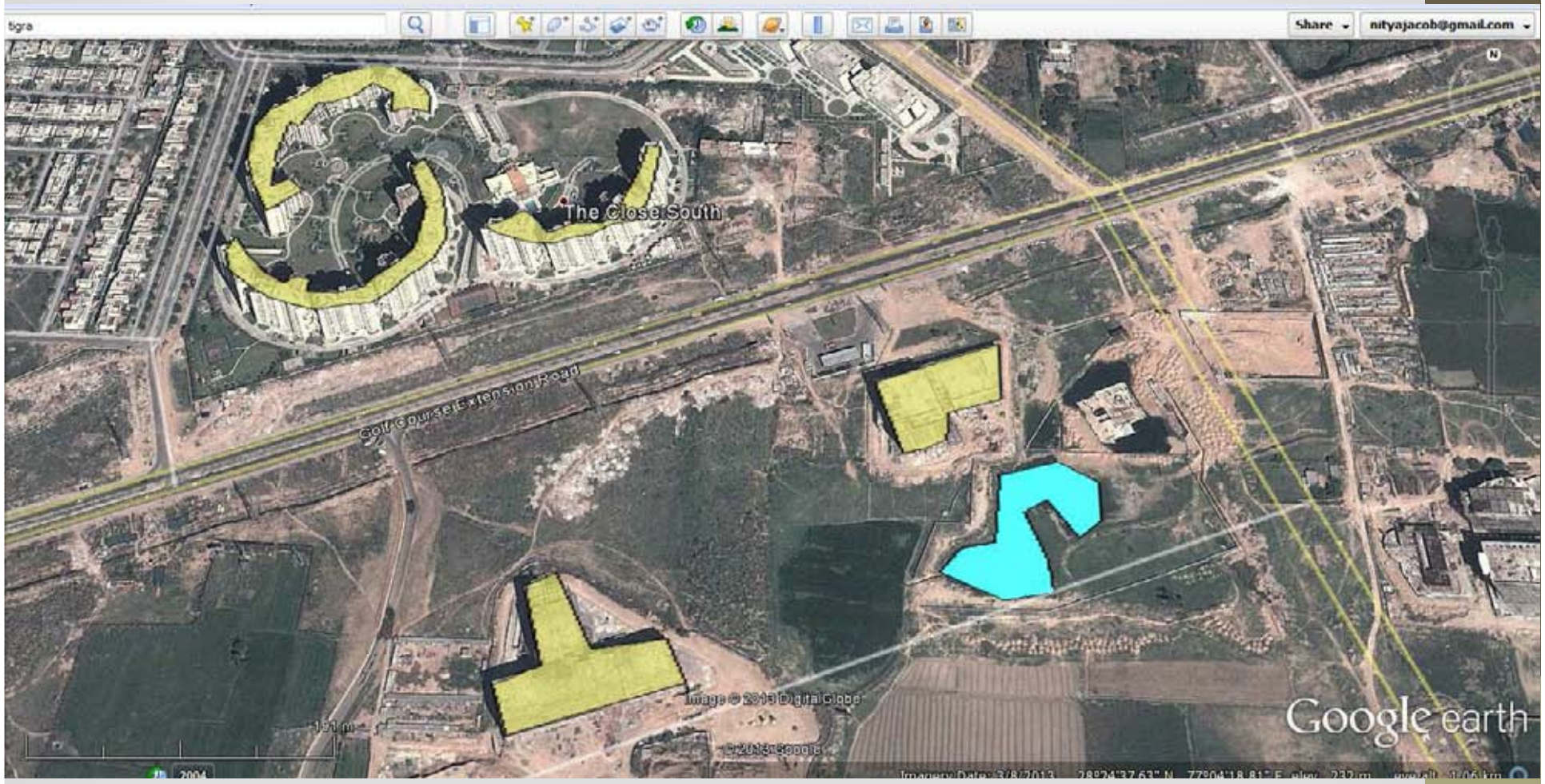
Tigra johads



Tigra johads

- Two ponds, total size 5200 sq m
- Average depth 2 m, storage potential 10400 cu m
- Multistoreyed developments rooftop rainwater potential 9120 cu m
- Pipelines needed about 500 m in three sections connecting
  - The Close North to pond 2
  - Sushant Lok 3 extension to pond 1

Tigra South johads

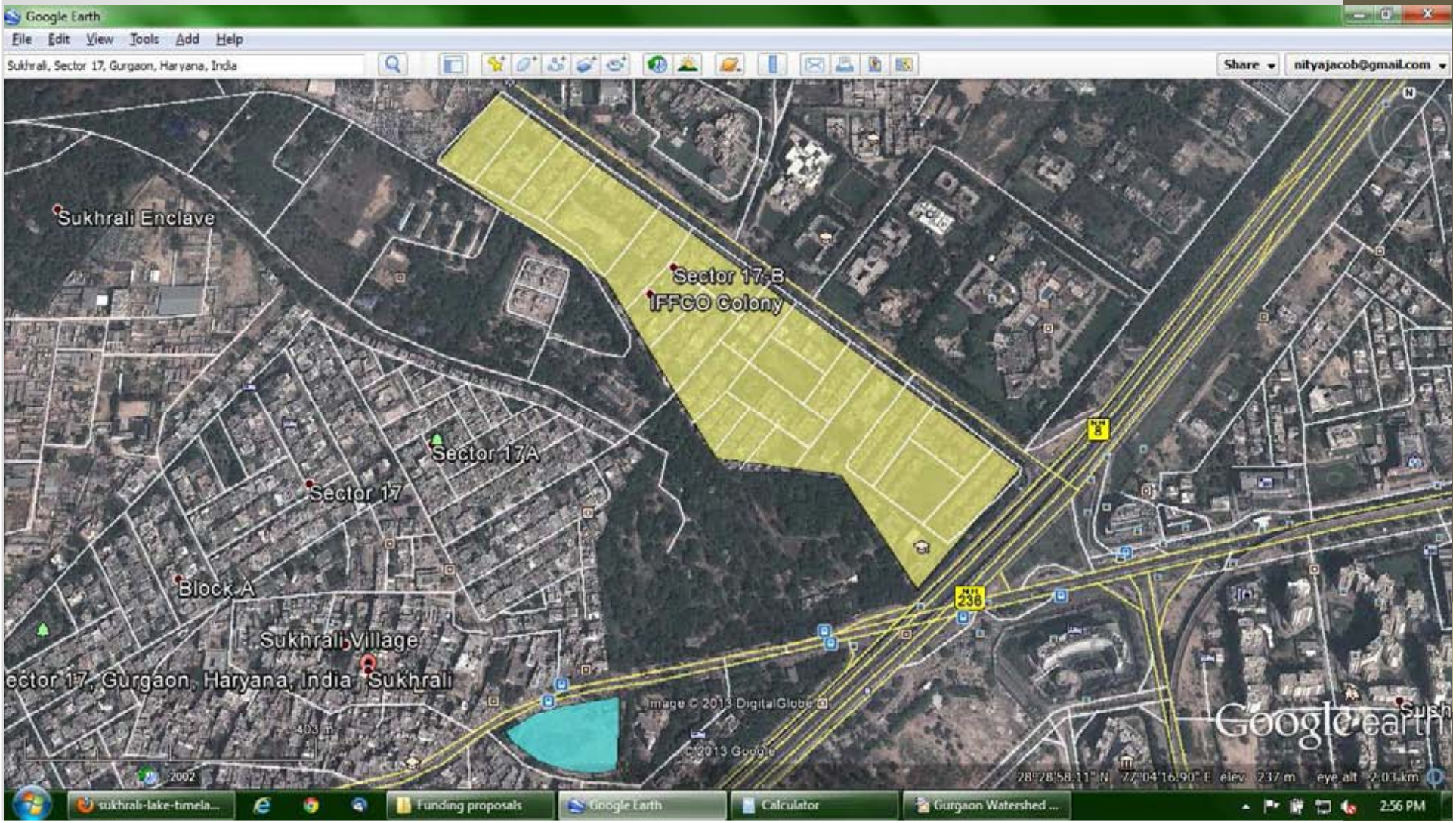


Water body in blue, roofs of multistoreyed developments in yellow

Tigra South johads

- Water storage potential in pond is 10,000 cu m, that can be enhanced to 15,000 cu m by restoring dried parts of the pond to the west
- Rainwater harvesting potential from marked areas is 7,400 cu m
- Pipeline length needed to convey water is 580 m in three pieces

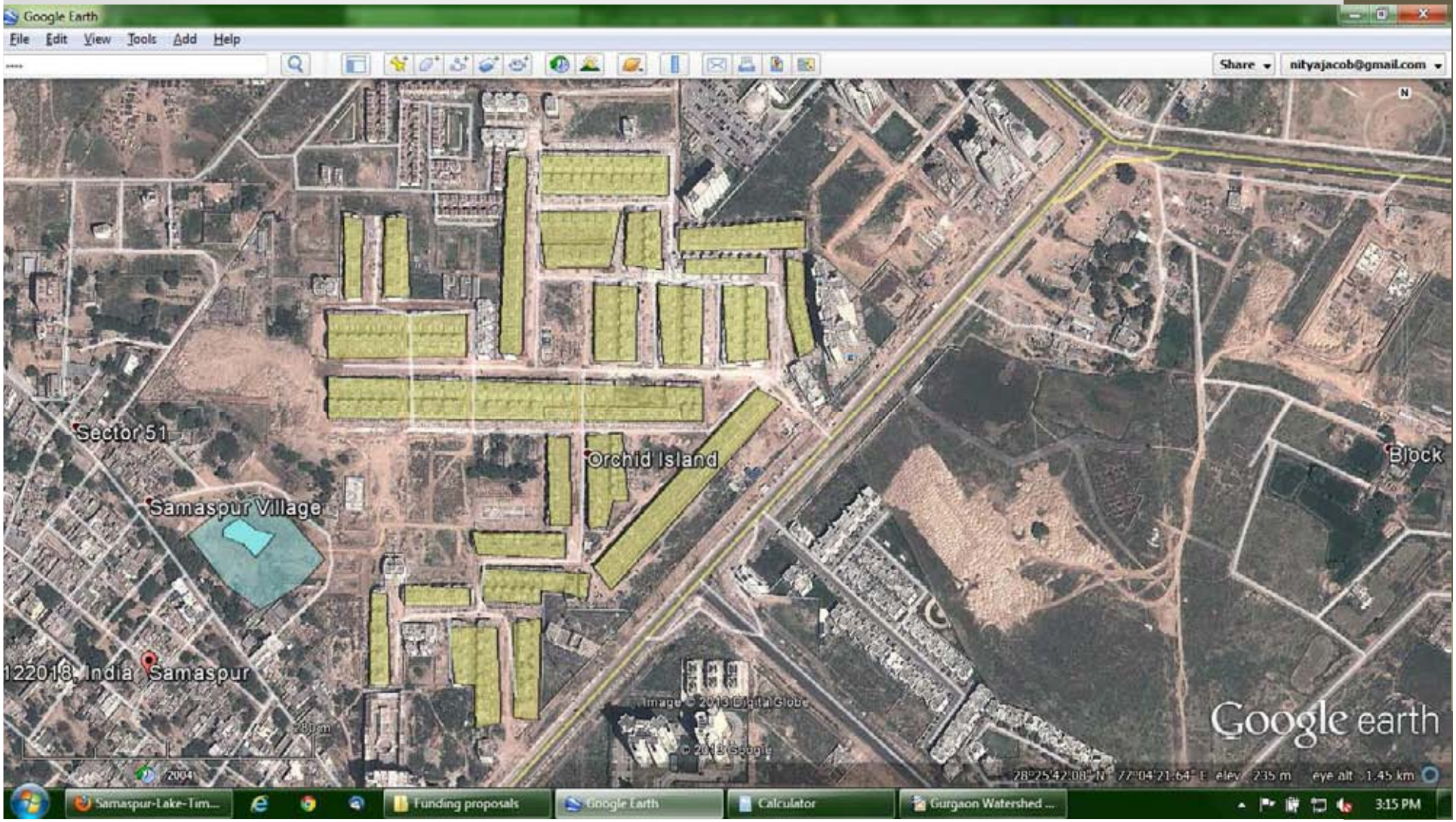
Sukhrali, Sector 17 johad



Sukhrali, Sector 17 johad

- Capacity of jheel = 15,000 cubic metres
- Rainwater harvesting potential from IFFCO Colony = 37,000 cubic metres
- Length of pipeline = 400 m
- Natural gradient is present, storage can be on the surface or at grade

Samaspur johad



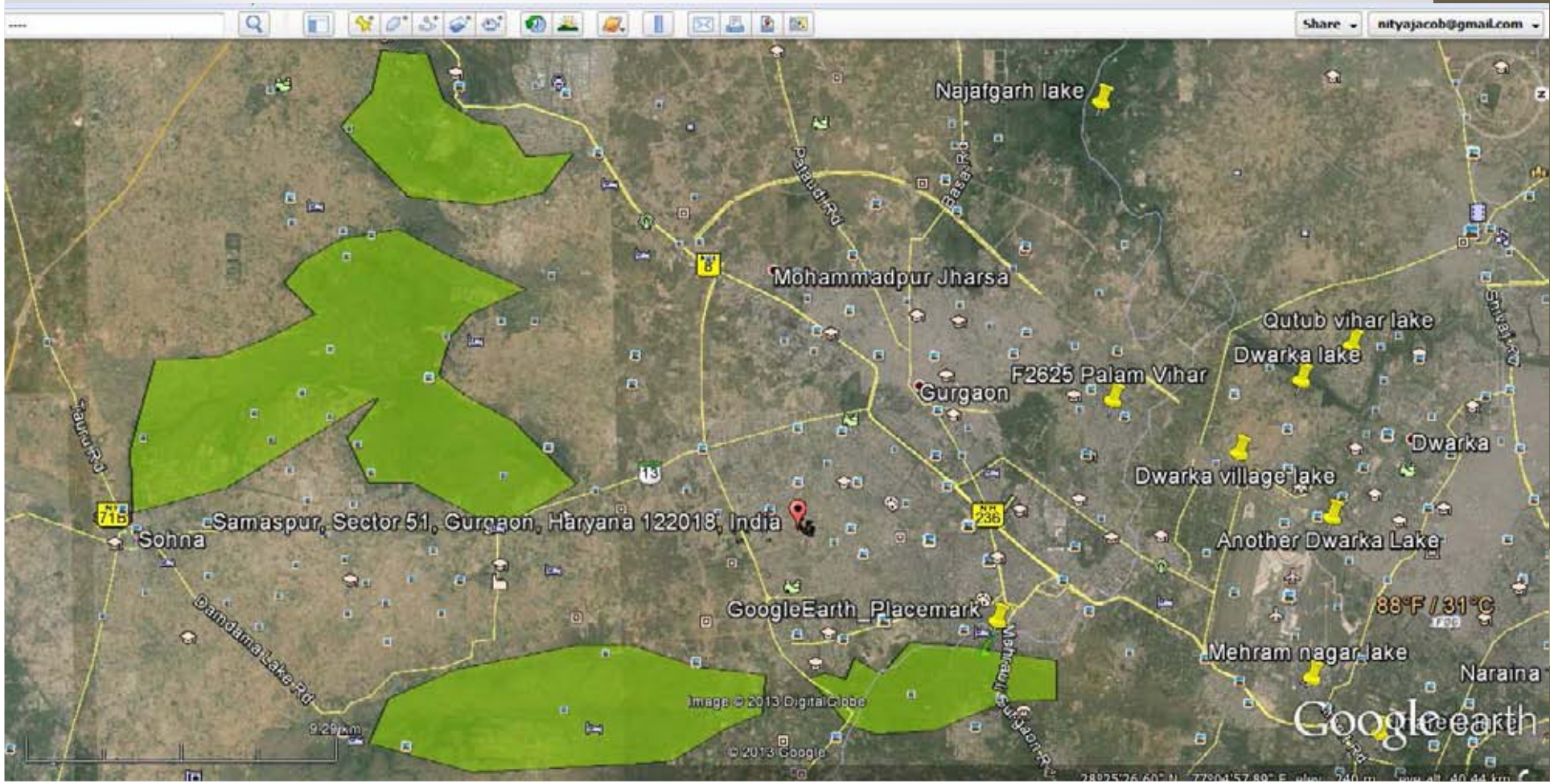
Samaspur johad

- Existing pond is 800 sq m, can be expanded to 4,000. Average depth 1.5 m can be deepened to 2 m. Potential storage capacity 8,000 cu m.
- Rainwater harvesting potential = 18,720 cu m.
- Will need surface storage since pond is higher than apartment areas
- Several small pipelines needed, main one 120 m

4

Water Sanctuary

Water Sanctuary



Water sanctuary

- Purpose is to provide dedicated rainwater harvesting and groundwater recharge zones. Approx area is 90 sq km of Aravali hill areas
- Rationale: Land slopes from south and east towards the north and west, that is the populated part. Protecting this will ensure a good measure of groundwater security
- Method is to maximise water retention through intensive watershed improvement
  - Construction of check dams, gully plugs, gabion structures, contour bunding and trenching
  - Plantation of native species and phased replacement of vilaiti babul from these areas
  - Prevention of lopping, felling trees; permit grazing and collection of minor forest produce
  - No land use change: protection from future conversion as residential, commercial, institutional, agricultural, etc

Water sanctuary

- Rainwater harvesting potential is approx 21,600,000,000,000 litres per year (or 60 MLD)
- That is about 1/3 daily water demand of Gurgaon at present

Thank you

We hope you take these up on a war footing and seriously