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DE-SILTING WORK OF GODAVARI RIVER IN NASHIK CITY FOR FLOOD MITIGATION MEASURES

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Abstract- *The city Nashik is known as the 'Kashi' of South India. The Godavari is the 7th largest river in India & 1st in Maharashtra, flows through this Nashik city. The rainfall of Nashik city & upstream portion of Godavari River is very heavy. In 2016 the High Flood Level 563.01 mm was marked. In last year 2019 severe flooding happens in Nashik. The main cause of flooding is reduced catchment area of river & the deposition of silt/sediments in river is prime cause of reducing natural stream area. The Government of India in 2015 declared 100 smart cities list from whole country & Nashik city is one of them. In smart cities projects Nashik smart city Development Corporation decided to desilting entire silt deposition of river on theme preserve & conserve Godavari River. In this study the cause of silt & river pollution is found that is open sewers waste water directly discharged in to the river. In this study we find solutions to rectify river environmental degradation issues. In this by using modern civil engineering surveying firstly carried entire silt bed load of river through DGPS & Bathymetric hydrographic surveying. Then through statistics compute volume of silt present in river. In this work is divide in to 4 stages in different lengths & started actual work. The main criteria is doing eco-friendly working. The quantity of extracted silt will be stacked at dumping yard & further used as a construction material if suitable. This project gives fresh water supply to Ramkund (Panchvati) & also smoothen the river water flow. The river gets its original shape & this results in to non-flood occurrence in city region especially.*

KEYWORDS: Nashik, Godavari River, High Flood Level, Flood, Bathymetric Hydrographic Surveying.

1. INTRODUCTION:

Rivers are natural channels to drain water from highlands to lowlands/seas. Erosion and aggradations are the most important geological processes which have brought down large amounts of sediments from the higher elevations to the plains and have formed large fertile plains, which were adopted by the hominoid races for their development and sustenance. Big towns were located on the banks of rivers to meet needs of water and navigation. Over the time, the high lands of an area get worn down. The material thus eroded is utilized further downstream to build banks and flood plains. As the river flows from high gradient to low gradient, momentum of the flow is reduced progressively by consumption of the kinetic energy in overcoming the flow resistance and consequently reducing its capacity to carry the sediments by tractive forces along the bed and suspension of coarser particles through turbulence, inducing thereby silt deposition en route. In general, there is erosion in the upper reach and deposition and erosion in the lower reach because of which morphological changes are manifest in middle and lower reaches of a river. Siltation process is subjected to several factors including physiography, geology, meteorology, hydrology and flow characteristics of the particular reach along with river stage (childhood, youth, mature stage, old age). When the bed slopes are high and consequently the energy gradient is more than available bed slope, the river has a tendency to erode the bed. When the flow velocities get reduced, the energy gradient becomes flatter and the river has a tendency to shed the sediment. To find the stable bed slope, the river path increases by meandering within the banks, depositing the sediment near the ends of the deep channel. Any development work creating human interference in flow of river has to take care of this phenomena and needs to restore the balance within a limited reach of the river on either side of the structure. A well designed structure has to take care of obstruction induced silting and proportionate withdrawal of silt with water so as not to affect the river regime beyond a controlled area upstream or downstream. Similarly, other human interferences such as removal of bed and bank materials through mining, dredging for removal of silt near outlets or for maintaining a specified depth of channel for navigation etc., should also conform to river regime.

2. OBJECTIVES:

1. To ensure effective abatement of pollution & rejuvenation of the river Godavari by adopting a river basin approach as – River cleaning retrofitting area.
2. To maintain minimum flow in the river Godavari with the aim of ensuring water quality at Ramkund kund, Laxman kund, environmentally sustainable development & consideration of CWPRS recommendation for smoothening of river bed. Activity will increase water holding capacity & removal of deposited silt will reduce the growth of water hyacinth.
3. Flood mitigation in Nashik City.
4. Increasing catchment area of Godavari River.
5. Smoothening water flow in catchment of Godavari River.
6. Construction of gabion walls for river water flow & flood control.
7. Local employment generation programme under river beautification scheme.
8. Deepening & Widening of Godavari River stretch as per quantity of sediments deposition.

2.1 Basic Principles:

1. Sediment management should become a part of integrated river basin management plans.
2. Erosion, movement and deposition of sediment in a river are natural regulating functions of a river. The river stream has to complete its geo-morphological cycles from youth, maturity to old age. A stable river is able to constantly transport the flow of sediments produced by watershed such that its dimensions (width and depth) pattern and vertical profile are maintained without aggrading (building up) or degrading (scouring down).
3. Justification for removal or disturbance of silt must be evidence based. Where justified, silt management actions must follow best practice to minimize damage to the environment/river morphology.
4. Annual Silt requirement at fast developing infrastructure project may be estimated and critically aggrading river reaches and their sections in the vicinity may be analyzed in their physical mode for supplementing. The same can be clubbed with silt removal as is given above wherever possible.

2.2 SCOPE OF WORK:

- **Godavari River Stretch:**
  Godavari River silt removal project will be taken into consideration from Ramwadi Bridge to Holkar Bridge in retrofit area and Forest Nursery Bridge to Ramwadi Bridge stretch in Greenfield area based development.
- **De-siltation of Godavari River:**
  (a) From many years due to deposition of silt, storage capacity of river has reduced. This water is used for religious activities at Ramkund. Silt is deposited in the river due to stagnation of water. Silts, sewage and organic matter that are carried away with water flow are accumulated in the river due to which river acts as lake and water ponds is created. The need of good water quality is increasingly being felt. The requirement of water for religious, social and ecological functions needs to be carved out.
  (b) Major issues for abatement of Godavari river pollution were identified for evaluation and immediate attention for rectification so that the river water quality improves and meets the stipulated standards by CPCB.

3. LITERATURE SURVEY:

1. Dangwei Wang, Anjun Deng, Zuwen Ji & Hongling Shi: In this paper he did study, Sediment deposition in the reservoir of run-of-the-river power station is severe, in this paper we take upper Marsyangdi reservoir as an example to analyse sedimentation and desilting process according field data measured from September 2016 when the reservoir had just been impounded in order to find strategy for managing reservoir sedimentation. In order to reduce sediment concentration into diversion channel a desilting should be done in flood season when flow rate is larger than 200m3/s and flow rate for impound should not be more than 1/10 of that into reservoir which can avoid deposition during impoundment near dam site.

2. Samad Emamgholizadeh & Hosien Samadi: In this paper they observed that, Dez dam is one of the many reservoirs in Iran which suffer from sedimentation. By constructing an underwater dam nearly 9 km upstream of the dam and a long tunnel of 15 km, it would be possible to flush sediments and discharge them to the gravel land near the Andimeshk region. There was no significant environmental impact and the flushed sediments can be used to increase the farm land in the region.

3. Mateusz Grygoruk, Magdalena Frąk and Aron Chmielewski: In this paper they did this by doing a comparative analysis and found, Ecosystem deterioration in small lowland agricultural rivers that results from river dredging entails a significant threat to the appropriate Eco hydrological conditions of these water bodies, expressed as homogenization of habitats and loss of biodiversity. The study revealed that at the high level of statistical significance (from p = 0.025 o p = 0.001), the total abundance of riverbed macro invertebrates in the dredged stretches of the rivers analysed was approximately 70% lower than in non-dredged areas.

4. Tao Ding, Ying-jie Tian, Jin-bao Liu, Jing Hou, Zhen-ni Guo & Jia-yi Wang: In this research they found that, Sediment contamination by heavy metals can result in significant damage to the ecological water environment. To determine the critical risk depth for dredging, the heavy metal concentrations at different sediment depths and their potential ecological risks must be tested and evaluated. Finally, the recommended environmental dredging depths are calculated based on the potential risk for change in the vertical distribution and the given threshold level for the potential critical risk from heavy metals. Because of the accumulation effect of heavy metals in sediments, the heavy metal contents tend to decrease with sediment depth, but this trend may change as a result of human activities and other river dredging events.

5. Kyung Soo Jun & Jin Soo Kim: In this case they raised the issue, the ongoing Four Major Rivers Restoration Project will drastically change the river environment of South Korea. Historical floods were simulated for the changed river environment as well as for the current river condition to investigate the flood mitigation effect of the project. The simulation results show that once the project is completed, the flood water level of the entire reach of both rivers will fall because water level decline due to the channel dredging dominates water level rise due to the presence of weirs. The increase in flow travel time of the Nakdong River after the completion of the project will be more significant than that of the Han River.

6. Praveen K. Thakur, Chalantika Laha & S. P. Aggarwal: This study has been carried out to analyse and report the river bank erosion hazard due to morphometric change of the Ganga River (also called Ganges in English) in the upstream of Farakka Barrage up to Rajmahal. This study has found that bank failure is because of certain factors like soil stratification of the river bank, presence of hard rocky area (Rajmahal), high load of sediment and difficulty of dredging and construction of Farakka Barrage as an obstruction to the natural river flow.

7. Abdul Malek & M.Hossain: In this they conclude that For Sustainable river management in Bangladesh dredging and river training works has become an important issue which is also stressed in The National Water Policy of Bangladesh. Under the CDRSB project "Feasibility Study of Capital Dredging and Sustainable River Management in Bangladesh" total 24 major and important rivers such as Ganges, Brahmaputra-Jamuna, and Meghna etc are studied for sustainable river management. The physical components involved: (1) 2 km Pilot Dredging of Jamuna Right Bank at Nalin Bazar, (2) 14 km Capital (Pilot) Dredging from Upstream of Sirajganj Hard Point (SHP) to Upstream of Bangabandhu Bridge.

8. K.Rasheed & A.N.Balchand: In this study they found that, dredging which counter acts sedimentation, brings about innumerable environmental impacts — both positive and negative. As a case study, this paper reports the impacts of dredging conducted at Cochin harbour which is the second largest port along the west coast of India; the harbour operation mainly depends on maintenance form of dredging bringing about impacts which have both direct and indirect effects in the long term. The current practice on dredging is conducive to harbour operations, regulating the material made available to the near shore areas and highlights the possible venues for utilization of spoil for reclamation of land and wetland development.

4 . METHODOLOGY:

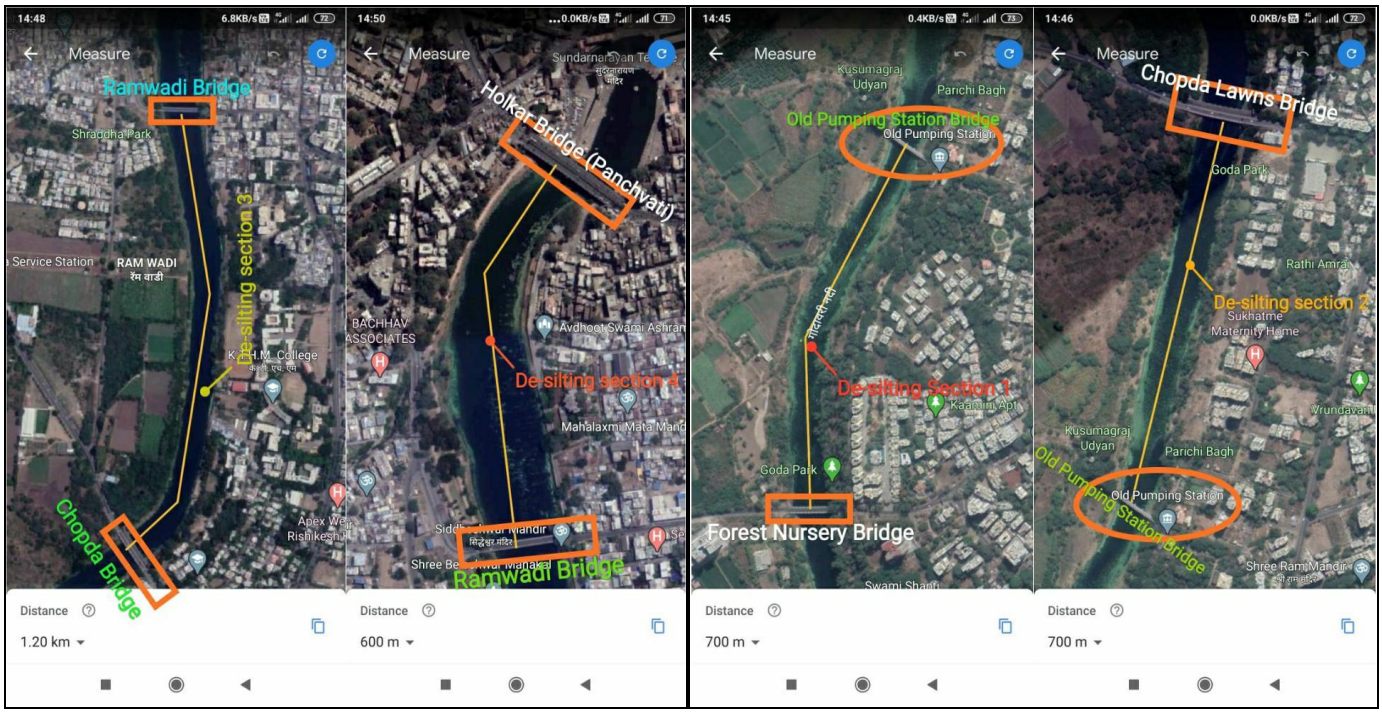
1. Conducting Bathymetric hydrographic surveying Godavari river with DGPS
2. Preparation of L-section & Cross-section of river
3. Excavation & embankment volume computation through statistics
4. Raw water pipeline laying to supply fresh water to Ramkund (Panchvati)
5. Actual De-silting & dredging work by mechanical equipment's & machineries
6. Construction of gabion walls along both sides of Godavari River.

4.1 EXECUTION METHODOLOGY:

Table- 1: Execution Methodology

Sr.No.	Section	Details	Chainage	Length
1	1	Forest Nursery Bridge to Pumping Station Bridge	Ch. 12480 to Ch. 13170	700 Rmt
2	2	Pumping Station Bridge to Chopda Lawns Bridge	Ch. 11790 to Ch. 12480	700 Rmt

3	3	Chopda Lawns Bridge to Ramwadi Bridge	Ch. 10590 to Ch. 11790	1200 Rmt
4	4	Ramwadi Bridge to Ahillyabai Holkar Bridge	Ch. 10000 to Ch. 10590	1200 Rmt



Source: http://www.Googleearthpro.com

Fig -1: Four Stages of Godavari River Desilting Project Execution

4.2 MAJOR ACTIVITIES:

Table- 2: Major Activities

Sr.No.	Activities
1	After the water is drained from the gates of K.T. Weir at Ahillyabai Holkar Bridge, Section 1 & 2 will get dry. Work of de-silting to commence from u/s section 1.
2	Central Channel of sufficient width will remain for maintenance of flow of the river for which water will be released from Anand Vally Weir.
3	Taking out silt from section 1 & Section 2 to Northern side of the river
4	As per our survey, we expect two major pools which will be drained by dewatering from river bed using pumps.
5	Wet silt will be drained at site. Drained silt will be transferred to dumping area.
6	After completion of section 1 & 2 and section 3 & 4 will be undertaken
7	Necessary Coffer dams will be taken in all four sections as per site condition to train the central channel.

5 .TECHNIQUES:

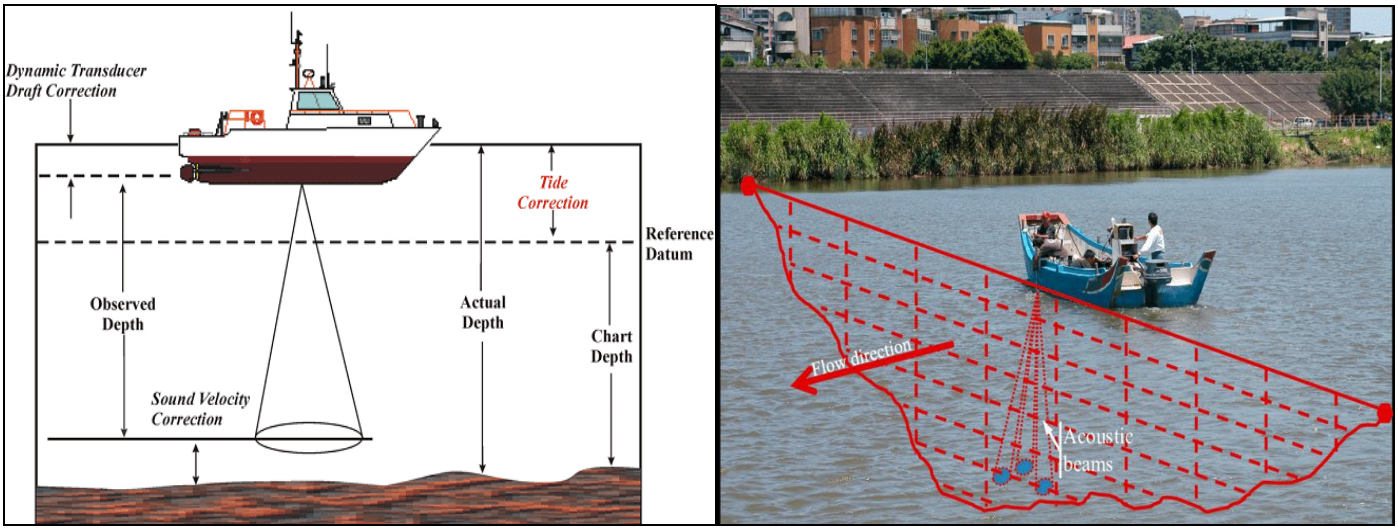
5.1 Hydrographic & Bathymetric Surveying: Hydrographic surveying or bathymetric surveying is the survey of physical features present underwater. It is the science of measuring all factors beneath water that affect all the marine activities like dredging, marine constructions, offshore drilling etc.

(a) The information obtained from hydrographic surveying is required to bring up nautical charts which involves,

- Available depths
- Improved Channels

- Breakwaters
- Piers
- The aids to navigation harbour facility

(b) These survey also take part in necessary data collection relating to construction and developments of port facilities, such as pier construction. This help in finding the loss in capacity due to silt and many uncertainties.



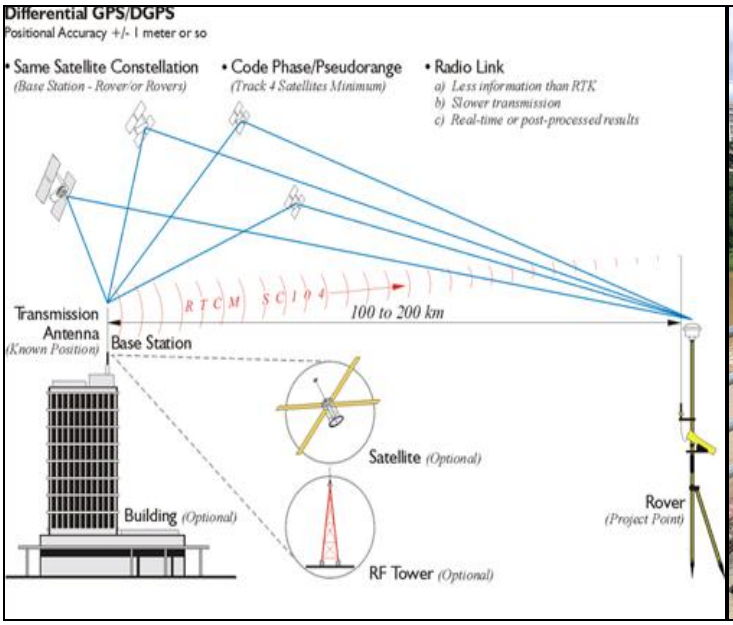
Source: http://www.Googleimages.com

Fig- 2: Hydrographic & Bathymetric Surveying Concept

Source: **Actual Project Site Photos**

Fig- 3: Hydrographic & Bathymetric Surveying Application In Godavari River Basin

5.2 DGPS Surveying: A Differential Global Positioning System (DGPS) is an enhancement to the Global Positioning System (GPS) which provides improved location accuracy, in the range of operations of each system, from the 15-meter nominal GPS accuracy to about 1–3 cm in case of the best implementations. Each DGPS uses a network of fixed ground-based reference stations to broadcast the difference between the positions indicated by the GPS satellite system and known fixed positions. These stations broadcast the difference between the measured satellite pseudoranges and actual (internally computed) pseudoranges, and receiver stations may correct their pseudoranges by the same amount. The digital correction signal is typically broadcast locally over ground-based transmitters of shorter range.



Source: http://www.Googleimages.com

Fig- 4: Concept Of DGPS Surveying

Source: **Actual Project Site Photos**

Fig- 5: DGPS Survey Conducted On Project Site

5.3 De-silting of River by Using Amphibious Excavator:

An amphibious excavator is a type of excavator that can perform dredging while afloat in shallow water. An amphibious excavator is better adapted for removing silty clay, clearing silted trenches, swampland operation, and shallow water operation than traditional barge-mounted dredgers.

5.3.1 Walking & Working:

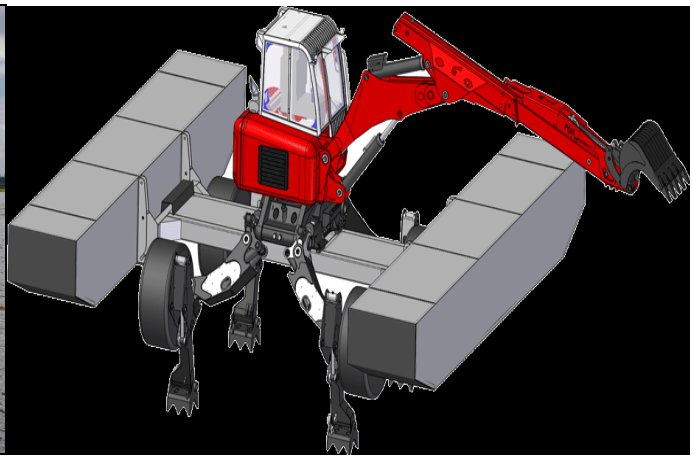
The pontoons are manufactured from high tension steel and they are atmospheric corrosion- and Saltwater-resistant. Each pontoon has 5 independent water tight compartment with maintenance hole. The bottoms of the pontoons are reinforced for rough terrain operation. The power for the pontoon tracks is provided by an excavator engine and main hydraulic pumps with traveling motors.

5.3.2 Accessories:

- Side pontoon—increase flotation
- Piling vibrator
- Excavation bucket
- Clamshell
- Demolition sorting grab

Source: **Actual Project Site Photos**

Fig- 6: Amphibious Excavator Machine



Source: http://www.Googleimages.com

Fig- 7: Isometric (Mechanical Drawing) View of Amphibious Excavator

5.4 De-silting of River by Dredging & Dredger Machine:

- Dredging is a displacement of soil, carried out under water. It serves several different purposes. One of the applications meets the need to maintain minimum depths in canals and harbours by removing mud, sludge, gravel and rocks. Maintenance dredging is now only a basic task, while other fields are growing in demand much faster: creating new land for port and industrial development; trenching, backfilling and protection work for offshore pipelines, coastal outfall pipelines and for cables laid on the sea bed; environmental dredging and clean-up of contaminated sediments; replenishment of beaches and coastlines, not only for coastal protection, but also for recreational uses.
- There are two methods of dredging: mechanical excavating and hydraulic excavating. Mechanical excavating is applied to cohesive soils. The dredged material is excavated and removed using mechanical means such as grabs, buckets, cutter heads or scoops. Hydraulic excavating is done with special water jests in cohesion less soils such as silt, sand and gravel. The dredged material which has been loosened from the sea-bed is sucked up and transported further as a mixture (solid material and water) using centrifugal pumps.

Source: http://www.Googleimages.com

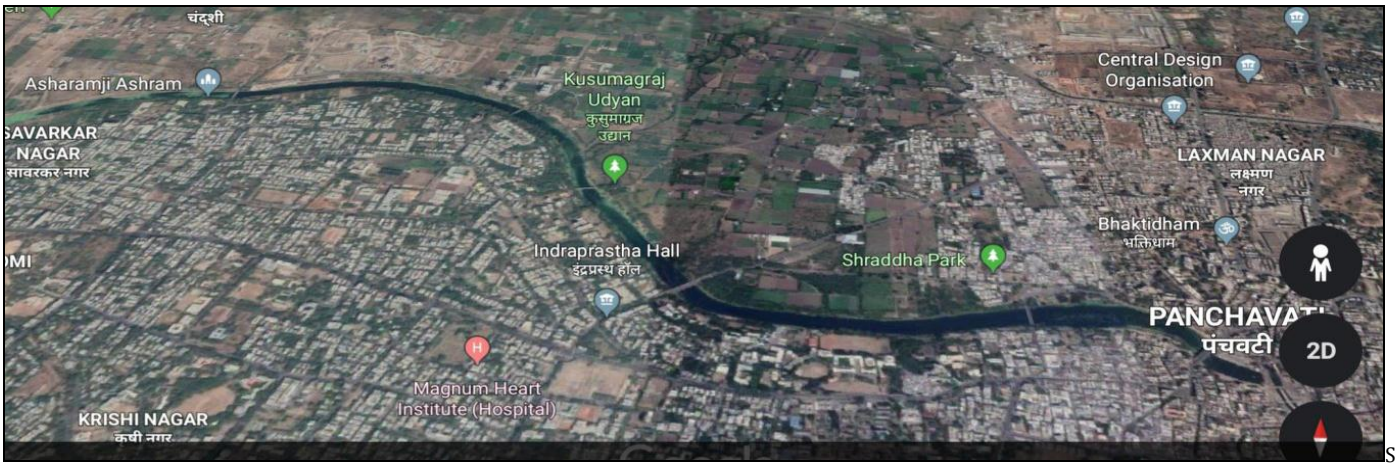
Fig- 8: Dredging Drawing (Mechanical View)

Source: **Actual Project Site Photos**

Fig- 9: Dredging Machine

6. STUDY AREA DETAILS:

In Nashik city the area considered for project is from Ramkund (Panchvati) area 20.0095° N, 73.7919° E to Forest Nursery Bridge 20.0159° N, 73.7718° E respectively. The length of entire Desilting project is 3.2 Km. the width of river is varying due to existing river width pattern. The width of river is fixed with reference to river center line. This 3.2 Km length again subdivided in to 4 sections, as above mentioned.

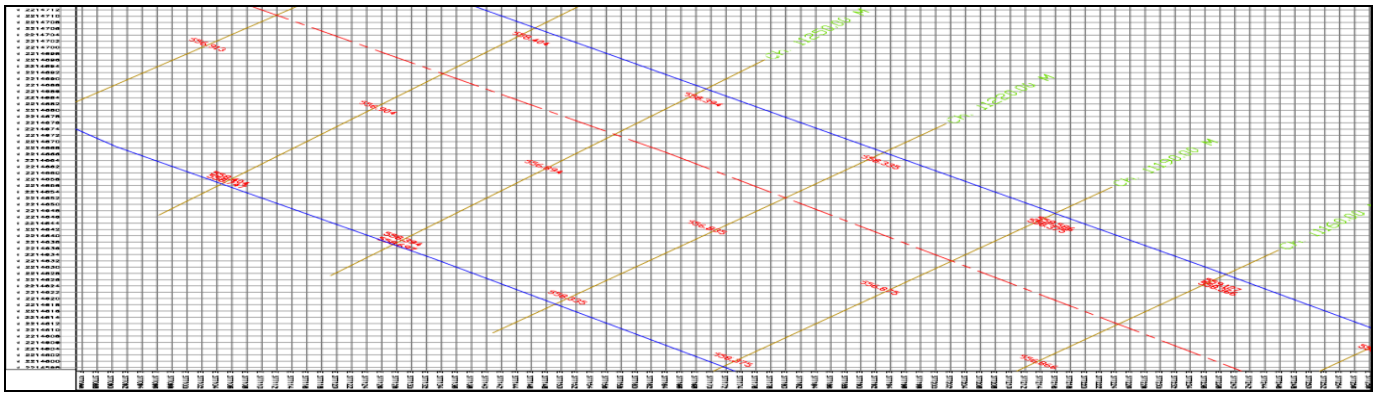


ource: http://www.Googleearthpro.com

Fig- 10: Area Undertaken For Study from Forest Nursery Bridge to Ahillyabai Holkar Bridge

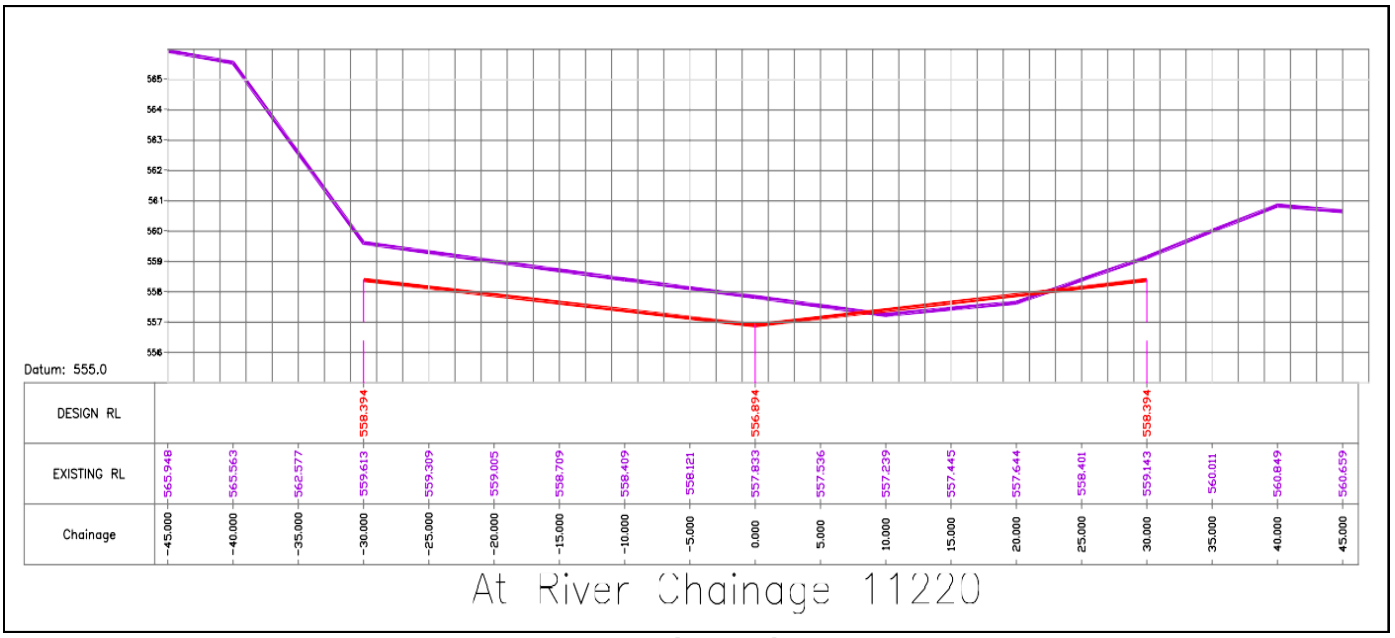
6.1 Drawings:

Like a topographic survey, a route survey maps the contours and features within an area of interest, which is generally long and thin, often centered along an existing or proposed centerline with the survey focused on a strip either side of that centerline. Sections can be produced from the resulting data to profile the rise and fall of the terrain along the route (long section) and cross sections can be extracted to show the change in grades and cross falls perpendicular to the centerline at regular intervals along the proposed route. The survey results of a route, long and cross section survey can be used for the suitability assessment of existing routes or for detailed design and subsequent construction of new utilities or infrastructure within that route, or in the case of a river for flow or flood modelling.



Source: **AutoCad Prepared Drawing**

Fig- 11: Ch.11220 Plan Made In Autocad (Sample)



Source: **AutoCad Prepared Drawing**

Fig- 12: Ch.11220 Section Made In Autocad (Sample)

7. RESULTS & DISSCUSSION:

Table- 3: Result (Volume of Silt/Sediments)

Sr.No.	Total Volume		Unit	Difference	Suitability
	Cutting	Filling			
	(a)	(b)		[c]=(a)-(b)	
1	207687.652	15523.716	Cum	192163.936	Beneficial

The above figures shows the quantity of silt which is to be cutting & filling. The quantity of cutting is more than quantity of filling, hence this cutting material as per there suitability we use as a raw material constituent in construction industry or for any another use. In this quantity of filling is 15523.7 16 cum is filled as volume of silt to be extracted i.e. Cutting. That result in our importing filling quantity charges gets cancelled & we have save money.

8. Estimating & Costing:

Table- 4: Result (Volume of Silt/Sediments)

Sr.No.	Particulars	Cost (In Rupees)
1	Basic Cost (Including all necessary items)	96131714.01
2	Desilting material & Gabion box stones	2737647.00
*	GST 18%	17303708.52
*	Total Cost	116173069.53
*	Contingency 5 %	4806585.75
#	***Total Cost***	***120979656.00***

In this construction of Gabion wall is separately added to give proper path & flood control access to Godavari River. In this budget if GOI, GOM & NMC gives funding with cooperation then the costing load also partly distributed & we achieve our desired objectives.

9. Conclusion:

In smart city the main objective of development is developing existing things of every city. The entire Nashik city is situated on banks of Godavari River. In every 12 years kumbhmela is also arranged in shrine Nashik. Nowadays due to increasing silt/sediment deposition Godavari River, rivers catchment area get reduced. This results in the flood. As per central water commission data is concern in 2016 the 563.01 m is the Highest Flood Level recorded in Nashik.as per as smart city smart development is concern 'Godavari river beautification & conservation' is the most vital criteria among all.

The following are the point wise study **conclusions**:

i. The catchment area of Godavari River is increased.
ii. The flow of water is smoothened in river.
iii. All open sewerage released in the river get connected through the new sewer line & results in the fresh supply of water.
iv. The gabion walls give proper shape and way to flowing of river water.
v. Beautification of Godavari River & banks of river is done.
vi. This project create lots of employment generation & also increasing standard of Nashik city

"SAVE RIVER, SAVE ENVIRONMENT & SAVE LIVES"

10. REFRENECES:

1. "Sediment Yield Assessment Using SAGA GIS and USLE model: A Case Study of Watershed – 63 of Narmada River, Gujarat, India.", "Snehakumari S. Parmar", International Journal of Engineering Trends and Technology
2. "Siltation and Desilting Practices in A Runoff Reservoir on Heavy Sediment-Laden River", "Dangwei Wang, Anjun Deng, Zuwen Ji and Hongling Shi", MATEC Web of Conferences
3. "Monitoring and modelling concept for ecological optimized harbour dredging and fifine sediment disposal in large rivers", "Marlene Haimann ,Christoph Hauer ,Michael Tritthart,
David Prenner , Patrick Leitner, Otto Moog, Helmut Habersack", Hydrobiologia (Crossmark)
4. "Expert Committee Report Summary Guidelines for works on desiltation of river Ganga", "Dr.M.A.Chitale & Committee", PRS Legislative Research **(**Institute for Policy Research Studies)
5. "Draft Policy On Sediment Management", "Ministry Of Water Resources, River Development & Ganga Rejuvenation", Draft Policy By Government of India
6. "Desilting Of Deposited Sediment At The Upstream Of The Dez Reservoir In Iran", "SAMAD EMAMGHOLIZADEH and HOSIEN SAMADI", Journal of Applied Sciences in Environmental Sanitization (Practical Case Study)
7. "Downstream Impact Investigation of Released Sediment from Reservoir Desilting Operation", "Fong-Zuo Lee , Jihn-Sung Lai1, Hui-Ming Hsieh, Cheng-Chia Huang, Yih-Chi Tan", 12th International Conference on Hydroscience & Engineering Hydro-Science & Engineering for Environmental Resilience
8. "Role of Siltation in declining major indian carp (IMC) in the river Ganga,India", "Kalpana Shrivastava and Venktesh R.Thakur", Research Gate
9. "Design of Desilting Works for Irrigation Systems", "Floyd E. Dominy", Journal of the Irrigation and Drainage Division
10. "Calculation of the environmental dredging depth for removal of river sediments contaminated by heavy metals", "Tao Ding,Ying-jie Tian, Jin-bao Liu, Jing Hou, Guo, Jia-yi", International Earth Sciences Article Volume-54
11. http://economic times.in/maharshtra/north maharashtra
12."http://www.nashiksmartcity.in"
13."Central Water Comission"
14. "Ministry of Water Resources & Ganga Rejuvination,Government of India"
15. "Ministry of Jalshakti, Government of India"
16. "http://googleearthpro.com"
17.http://googleimages.com

18.*http://googlescholar.com*

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