Chapter -V

Summary, Conclusion and Recommendations

5.1 Introduction

Sand has become a very important mineral for the expansion of society in the form of constructions, both in rural and urban environment. It is a naturally occurring granular material composed of finely divided rock and mineral particles. River sand is one of the world’s most plentiful resources (perhaps as much as 20 per cent of the Earth’s crust is sand) and has the ability to replenish itself. River sand is vital for human well being and for sustenance of rivers. As a resource, sand by definition is ‘a loose, incoherent mass of mineral materials and is a product of natural processes’. These processes are the disintegration of rocks and corals under the influence of weathering and abrasion. When sand is freshly formed the particles are usually angular and sharply pointed but they grow gradually smaller and more rounded as they become constantly worn down by the wind or water.

The degradation of river ecosystems is directly linked to development process. Indeed, no one can remain aloof from the issues related to environmental degradation of rivers. Among the various kinds of human interventions, indiscriminate mining for construction grade sand from the active channels and floodplains is the major cause for the degradation of rivers. Although the sand extraction is a destructive activity as far as river ecosystem is encamped, a proper assessment of its impact on various environmental components of the system is often difficult as many of the adverse effects are surfaced only after a long period of time. Hence, obtaining a standard set of spatial and temporal data related to the mining activity is a major hindrance in the process of Environmental Impact
Assessment (EIA). Therefore, considering all these and also the time bound nature of the present study, a method that involves original investigations to document the existing environmental conditions and selected case analyses of primary and secondary nature are appropriately blended in order to achieve.

5.2 Summary

Sand is also a habitat for crustacean species and other related marine organisms. Sand also plays an important role in our tourism industry as it is an integral part of our beach attractions. Each has its own requirements in respect of the quality of the sand. On average, people 'use' over 200 kg of sand per person per year. This is taken from river beds which are essentially non-renewable resources. Sand Mining is a coastal activity referring to the process of the actual removal of sand from the foreshore including rivers, streams and lakes. Sand is mined from beaches and inland dunes and dredged from ocean beds and river beds.

The river Cauvery flows the entire district in different names through its tributaries and branches viz., Grand Anicut canal, Vennar, Pannaiyar, Koraiyar, Vettar, Kodamuritiyar, Thirumalairajanan, Arasalar, Veerasozhanar, Mudikondan, Noolar, Vanjiar, Vikaraman, Nattar, Kirtimanar, Nandalar, Majalar, Mahimalayar, Palavar, Cholasudamani, Puthar, Valappar, Vadavar, pamaniar, Mulliyar, Ayyanar, Adappar, Harichandranathi, Vellaiyar, Pandavaiyar, Odambogiyar, Kattar, Kaduvaiyar and all these branch off into a number of small streams.

In this study, the sediment production rate of different watersheds of "Arasalar-Palavar watershed (4B1A4)" was determined by using Jose and Das formula. The sub watersheds were prioritized according to their sediment production rate. Hence, all the Sub watersheds must be treated with some structural and suitable vegetative measures according to their priority levels. The prioritization must be given first to the
Micro level watershed, which has high Sediment Production Rate. Small and medium gullies should be provided with detention dams to conserve the storm water and surface runoff and reduce the problem of floods. The study is a logical approach has been used successfully in prioritization of watersheds based on sediment production rate. This technique will be particularly useful, when data on the land use / cover, soil, slope information of the watershed is not available. In addition to the geometric map, land use/cover, rainfall data; water level data can also be used for specific recommendations.

The Kollidam river Sand Quarry location Places are Anaikarai, Neelathanallur, Thirumanur, Mathanathur, Annakaranpettai. A public hearing brings to light the serious threat sand mining, often illegal, poses to the environmentalists and human rights activists have repeatedly drawn public attention to the possible ecological impact of the indiscriminate mining of sand in the river basins, coastal areas and hill regions of Tamil Nadu.

Due to mining, the riverbed is exposed to sunlight leading to dry conditions. Hence water availability has fallen down and the available water turns into saline. This in turn affects fish breeding and catch, thus affecting the livelihoods of fisher folk. Sand mining affects irrigation and water supply also. The ecology of the lotic habitat is altered due to sand mining.

The study concluded with the problems associated with the uncontrolled sand mining for construction industries brings other social problems along the river beds. The study also indicate from the GPS maps about the legal and illegal sand quarrying, the illegal quarrying is in the abnormal limit due to higher black market prices. During high flood season the villages in the nearby area is worst affected along the Kollidam river places like Anaikarai, Vadapathi, Kudithangi, Vazhkkai,
Puthur, Pattugudi, Devangudi, Anaigudi, Tenkatchiperumalnattum, Annakaranpettai and Karuppur. Other obstructing activities along the Kollidam riverbank such as bricklin industries encroachments like permanent and semi permanent settlements and leased agriculture lands. This resulting, several breaches along the river during seasonal rainfall and heavy flooding several villages are inundated and affecting rural population. To overcome this type of problem a proper management of sand quarrying and elimination of encroachments along the river banks to reduce pressure of water along the riverbanks.

The present study is based on questionnaire survey by direct observation method, 700 public people who reside along and near the Kollidam River have been selected based on the random sampling procedure. The questions are related to socio-economic, demographic, environmental, health and psychological characters with reference to sand mining activities. The information collected through the questionnaire has been transformed into 62 selected variables and entered into SPSS for the application of statistical technique to find out the association. These variables are assumed to be the important to analyze the existing social problems of sand mining. Factor analysis was employed for the present data structure and accordingly matrixes of 700 x 62 were subjected to dimension reduction process. 9 out of 62 variables were extracted for the interpretation purpose of present study. So the data were reduced to 9x9 inter correlation matrix to facilitate for easy interpretation. In addition to the above the factor loading matrix was used to explain the strength of relationship and the variance of each variable with all other variables.

The application of factor analysis for the present study is extremely constructive in separating the major dimensions towards the perception of sand mining and its impact on environment. Accordingly, five foremost dimensions were
identified and contributing a total variance of 75.27 per cent. An Eigen value of 1 is taken as a cut-off point (Yeats 1974) to determine the number of dimensions to be extracted. Correlation matrix revealed the presence of many coefficients of 0.4 and above.

5.3 Conclusion

The study concluded with the problems associated with the uncontrolled sand mining for construction industries brings other social problems along the river beds. The study also indicate from the GPS maps about the legal and illegal land quarrying, the illegal quarrying is in the abnormal limit due to higher black market prices. During high flood season the villages in the nearby area is worst affected along the Kolli dam river places like Anaikarai, Vadapathi, Kudithangi, Vazhkkai, Puthur, Pattugudi, Devangudi, Anaigudi, Tenkatchiperumalnattum, Annakaranpettai and Karuppur. Other obstructing activities along the Kolli dam riverbank such as bricklin industries encroachments like permanent and semi permanent settlements and leased agriculture lands. This resulting several breaches along the river during seasonal rainfall and heavy flooding several villages are inundated and affecting rural population. To overcome this type of problem a proper management of sand quarrying and elimination of encroachments along the river banks to reduce pressure of water along the riverbanks. In the meantime the Government of Tamil Nadu has allotted Rs. 30 crores of rupees to the Public Works Department for the repair works, damaged during the recent floods. The work relating to strengthening bunds, removal of encroachments and monitoring the illegal sand mining had been in progress.

a. Sand is required but at what cost needs to be answered – a sound basin wide assessment of resource replenishment rates to be monitored and revised with
the rapid changing climate and hydrological cycle. An article “A Sandy Solution for Nitish’s Revenue Coffers” reflects the other situation

b. Alternative to sand for use in coal mines, rationalization of construction activity with optimal usage of alternative but equivalent sturdy materials. Material research should be given emphasis to test in different uses and environments.

c. Demarcation of quarry lease boundaries and to be brought up in public domain to strengthen monitoring and checking violations. Rivers being common property have several tangible and non-tangible benefits to different stakeholders, monitoring thus cannot happen without taking into account these stakeholders. This could become part of the environment management plan itself.

d. State Empowered and Coordination committees exist and formed in several states, emphasis to bring implementable options at the forefront.

e. Primary joint analysis of ecological regime of different river zones if made mandatory will enrich understanding from the existing level and also make states more accountable to resource protection. State’s auction rates thus could be rationally increased and dedicated to such conservation efforts and implementation with a dedicated team.

f. Enabling provisions in the cooperative legislations to enable mining of minor minerals wherever feasible by local cooperatives and reviving the traditional cooperative societies at state level and working with such cooperatives on systematic mining practices to draw out a mining framework through understanding local’s perceptions on various facets of extraction and damages.
The degeneration of Indian environment is detrimental to the global environment also and so, it warrants serious attention from the environmentalists across the globe. Since environment remains the livelihood resource for the people at grassroots level and downtrodden masses, the national agencies, with the assistance of the international agencies, must undertake a study on the impact of mining on the social life of Indian people. Therefore, a big level, socio-scientific research on the adverse effect of illegal mining in Kollidam must be made and the inferences must be brought to the knowledge of the world. Certainly, scientists and environmentalist from UN bodies must be a part of this research team. A state level public hearing must be convened at Puthur, Karuppur and near by villages, with the entire communities affected by the illegal mining and the miners. This will be the right way to expose the other side of the culprits and the government officials – which is certainly ugly. The persons responsible for the irreversible damage caused to the environment must be made to pay for retrieving the loss of natural resources. A high level lobbying committee must be formed with the participation of the affected people and certainly, AREDS that tied the bell to the cat against illegal mining in Kollidam River in Thanjavur district. It is evident that the sand mafias and their cliques form a league to swindle the miner minerals all over the nation. The rulers connive over this, as they get the lion’s share of benefit from illegal sand mining and the government plays spoilsport. Therefore, purging of the Indian legislation and the administration is needed.

Soils mining significantly affect the soil properties. A high level lobbying committee must be formed and the stockpiled materials should be selectively placed and protected from erosion, compaction and contamination. Weak governance and rampant corruption are facilitating illegal mining posing depletion of water resources.
needs to enforce laws in an efficient and unbiased way. Restoration, Rehabilitation, Re-vegetation and Afforestation measures with correct choice of tree species, planting techniques and appropriate proportions of soil amendments can restore soil quality overtime.

5.4 Solutions

The Ministry of Natural Resources and Environment recognizes the threats that unsustainable sand mining poses on the environment and society. Now a day’s sand borrowing from most of our rivers has been temporarily stopped which created impasse and panic on construction front. Mining of sand from the former is not freely permitted globally because of the very sensitive and dynamic nature of the coastal zone.

This situation has warranted the need for exploring alternatives for granular sandy material. Sandy material, available in the coastal and near shore environment forms a potential source. This problem is now solved to some extend by substituting river sand with crusher sand. Further, adulterated sands, which is a mixture of sand from estuary and coastal land, also is freely used for the construction.

5.4.1 Other Alternatives: Sand Produced by Crushing Quarried Rock

Crushing rock produces sand or "crusher dust" provides a potential alternative to river sand in Tamil Nadu because of the abundant hard rock exposures constituting the Western Ghats. Number of crushing plants operating in different parts, supply sufficient quantity of crusher sands to the construction sites. Nevertheless fascination for river sands is not yet over. Although crusher sands appear to be acceptable alternative, energy spent for making this aggregate as well as the environmental damage causes to neighborhood through dust and sound is enormous. Although Sand is required for development of Human being, but at the
same time the threats posed due to sand mining can’t be ignored. Hence decisive steps are to be taken & alternate solution to be found out for sand mining, without disturbing the environment.

Alarming increase in indiscriminate sand mining has caused serious damage to the river system. But at the same time the demand of sand is increasing. The assessment of sand inflow through bed load transport model helps to find out a solution to this crisis. The main conclusions of this assessment are:

a. There is a gradual decrease of size of sand
b. The stretch where the size of the sand is large shows more sand inflow.
c. There is a seasonal variation of sand inflow.
d. Monsoon period shows more sand inflow than summer.

The secondary stage of this project is optimization. Using the results of this model an attempt is made to optimize the sand removal. The area is divided into five stretches on the basis of sand size and meandering. The optimal sand that can be removed from each stretch

5.4.2 Steps for Action

As per this study the following important steps shall be taken to solve the environmental problems at this stretch.

A. Control over sand removal

It is found that extensive sand dredging. Therefore sand removal must be controlled based on the results obtained so far.

B. Uniform dredging over the entire width of the river

This is an important step which will reduce the effect of sand removal on the river bed to a greater extent. Dredging concentrated over a smaller area result in a
sudden drop of bed level in that area so that the cross-section of river becomes uneven.

**C. Avoid dredging near the banks**
Dredging near the banks of river must be prevented, because it may affect the stability of the banks and the banks may fail.

**D. Avoid continuous dredging**
This will help in making equilibrium between sand removed and sand deposited.

### 5.5 Recommendation
Maintenance of stable section is the prime objective of operation. So the major recommendation of this project study is that build check dams at regular intervals of each stretch of the river, thus helps to determine a specific reference line for the bed profile. The sand deposition above this check dam can be permitted for sand mining. The local authorities such as Panchayath should take the responsibility of maintenance of this reference line strictly and should be penalized for sand mining below this check dam or reference line.

The values of sand inflow in the present study can be used as a baseline data for defining this reference line. Based on this the recommendations are pointed out below:

- **A.** Divide each sand mining stretches of the river into several sections of 0.3-0.5 km.
- **B.** Construct Check dams at these sections.
- **C.** Construct side walls if necessary.
- **D.** Fix some bench marks of river bed.
- **E.** Give permission by authorities to external agencies to maintain the cross section of river for a particular period say 3 to 5 year.
F. Provide openings into safe structures for navigation and for aquatic organisms.

a. Give permission for the agency to scoop the sand above the specified level of river (which can be taken as the level of check dam).

b. Agency should be penalized if the bed level goes below the specified level in each year.

c. Maintenance of the check dam for the respective periods should be laid on the agency.