ACTION PLAN REPORT
FOR
DELINEATION SURFACE WATER BODY OF NICOBAR DISTRICT USING REMOTE SENSING AND GIS METHOD

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1. INTRODUCTION

The delineation of the surface water bodies is very important for the development of human life in the prospect of agriculture projects, industry development, and domestic purposes. It was estimated by different qualitative and quantitative data sources, which were collected by direct field surveys and indirect data sources such as Remote Sensing (RS) and Geo informatics. It includes skilled and trained manpower and the availability of data, which makes for more accurate data compilation as well as a reliable outcome.

This project work presents a comparative study of commonly used spectral indices that were developed for water detection for their suitability and effectiveness when applied on Landsat 8 images, raster images and tabular data. Commonly used techniques for surface water delineation from multispectral images analysis, spectral index based and spectral un mixing based methods. Commonly used spectral indices Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), Modified Normalized Difference Water Index (MNDWI), Water Ratio Index (WRI), Normalized Difference Forest Index (NDFI), Enhanced water Index (EWI), Weighted Normalized Difference Water Index (WNDWI), Automated Water Extraction Index (AWEI), Tasselled Cap Water Index (TCW), Global Water Index (GWI).

2. STUDY AREA

Nicobar District is the southern most district of the Union Territory of A&N islands and it is separated from South Andaman district by 100 channels in Indian Ocean. The district of Nicobar comprises three Subdivisions, three blocks/ Tehsils and a panchayat samiti. Car Nicobar is the district Headquarters of Nicobar district. There are jetties in all the inhabited islands. However, large ships can touch at Car Nicobar, Nancowry and Great Nicobar (Camp Bell bay) islands. Inter island as also mainland, i.e. Chennai bound ships run both by the A&N Administration and Shipping Corporation of India, ply at regular interval through all the inhabited as also the above major islands. There is regular Pawan Hans Helicopter service of A&N Admn. To all the inhabited islands and there is daily helicopter service to Car Nicobar.

The population of Great Nicobar Island combines aboriginal tribes that have inhabited this island for thousands of years with ex-servicemen that were settled here by the Government of India during the 1970s. The new residents came from Punjab, Maharashtra

and Andhra Pradesh. Thus, a 'Mini-India' exists in Great Nicobar Island, with Indians from all parts of the country harmoniously residing here.

Great Nicobar Island is inhabited by aboriginal mongoloid Shompen. The Shompens are hunter-gatherers and depend on the forest and marine resources for sustenance. They live where natural water source is available and use the surface water for drinking. Another Mongoloid Tribe, the Nicobarese, used to live in settlements along the west coast. After the tsunami in 2004, which devastated their settlement on the western coast, they were relocated to Afra Bay on the north coast and to Campbell Bay. They survive on fish caught from the sea. There are about 237 Shompen and 1,094 Nicobarese individuals.

The areas where the tribal dwell have been declared as Tribal Reserve. The Shompens move between the Core and Buffer Zones, while the settlers and Nicobarese live in settlements spread along the coast in the Transition zone. The area of the tribal reserve is 751.070 sq.km. Of this 84.10 sq.km falling under tribal reserve, is proposed to be denotified.

Table:-1

Great Nicobar Island Population

Tehsils	Persons	Male	Female	Literates	Illiterates
Car Nicobar	17841	9735	8106	12627	5214
NanCowry	10634	5967	4667	6796	3838
Great Nicobar	8367	5025	3342	5909	2458

Table:-2

Inhabited Islands

S.No.	Name	Area in sq.km.	Population
1.	Car Nicobar	126.9	17841
2.	Chowra	8.2	1270
3.	Teressa	101.4	1934
4.	Katchal	174.4	2685
5.	Kamorta	188.2	3688
6.	Nancowry	66.9	1019
7.	Little Nicobar	159.1	278
8.	Great Nicobar	1045.1	8069

9.	Tillang Chong Island	16.84	38
10.	Pulomillow Island	1.3	20

Separated from Andamans group of Island by 145 Kms, wide 10 degree channel, Nicobars District has an area of 1841 kms, comprising 22 Islands Twelve of which are inhabited. The maximum length of Nicobars is 310 Kms and maximum width is 57.96 Kms. The extreme Southern most 'Pigmalion Point' presently known as Indira Point which is also southern most point of India, is 310 Kms from Car Nicobar and barely 140 Kms from Sumatra Island (Indonesia).

Table:-3

Uninhabited Islands

S.No.	**Name**	**Area in sq.km.**
1.	Battimaly	2.01
2.	Meroe	0.52
3.	Teris	0.26
4.	Menchal	1.30
5.	Tark	0.26
6.	Cubra	0.52
7.	Bompuka	13.3
8.	Kondul	4.6
9.	Trinket	86.3
10.	Isle of Man	-
11.	Megapod	-
12.	pigeon	-

Occupation:

The Primary occupation of the tribal population is agriculture, which is basically limited to coconut, arecanut and banana plantations.

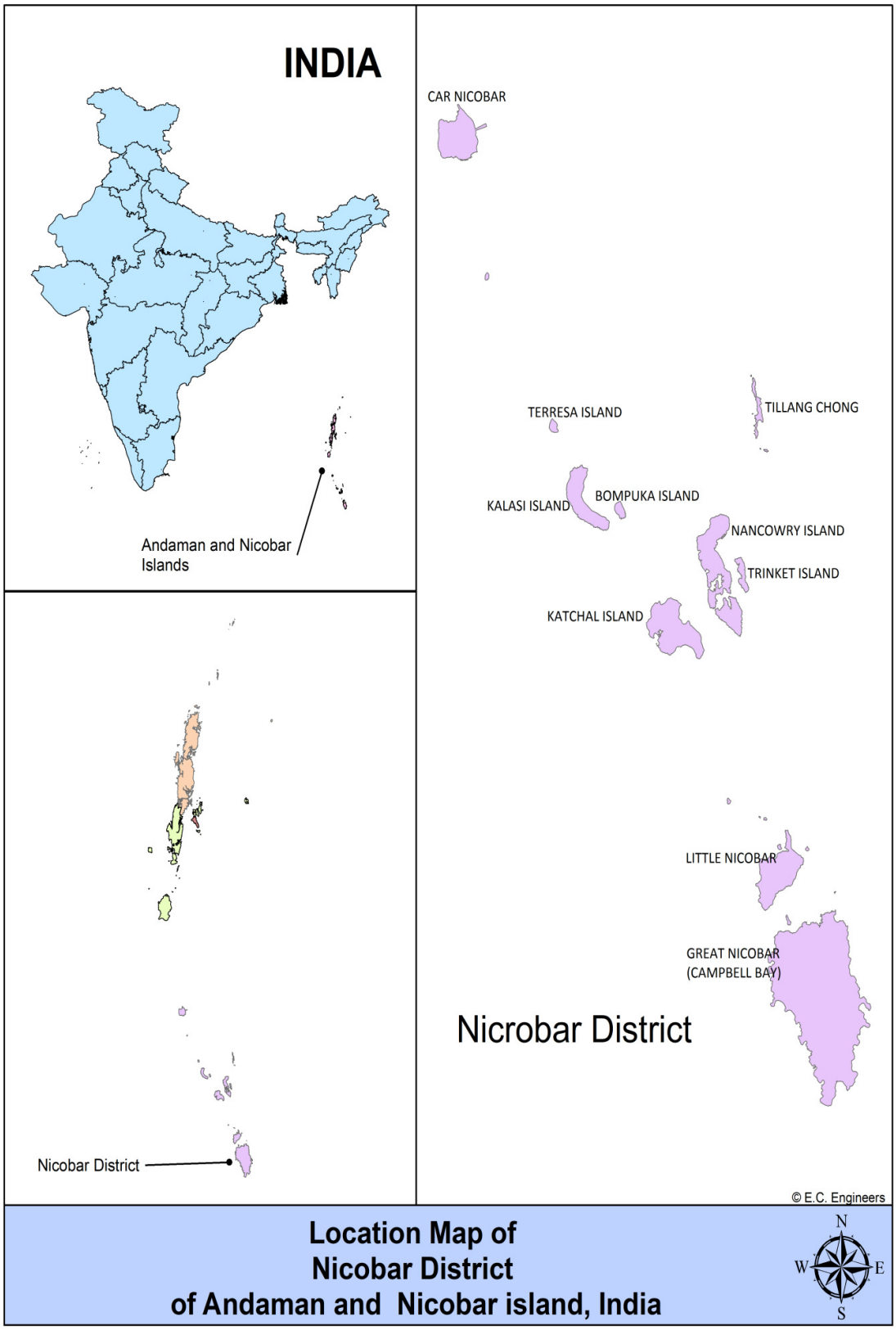


Fig:-1 Location map of Nicobar District

3. MATERIALS AND METHODS

Land features such as lithology, structural disposition, geomorphic arrangement, surface water condition, and vegetation influence surficial and sub-surficial water movement. A lake, pond, or stream is an occurrence on the surface of the earth. In order to identify it, some directly observable terrain features are analysed. Remote sensing (RS) can help in understanding them. Through the advent of Remote Sensing (RS) and Geographic information Systems (GIS), computing technology has revolutionized the way spatial data is handled and analysed, including delineating surface water bodies. Indicating surface water catchment zones through digital image analysis and visual interpretation of satellite data

1. Geological structure identification and hydrological properties analysis
2. The formation of water-bearing geological formations and the enrichment of water
3. Areas of recharge
4. Places of discharge
5. Nature of outlet of groundwater to the surface
6. Depth and conditions for the occurrence of groundwater and
7. Direction of movement etc.

The use of remote sensing (RS) data has been shown to be effective in groundwater exploration, even though it does not directly detect deeper subsurface resources. RS data aid in indirectly drawing inferences about the potential for groundwater in a given region. It is normally considered that freshwater surface resources constitute subsurface water resources. Satellite RS data can directly detect these sources of surface water because water absorbs the majority of the infrared radiation, helping in the delineation of even smaller bodies of water. Spectral reflectance can be used to detect vegetation, which is indicative of the soil's moisture and water saturation. Data from RS can be used indirectly to determine drainage catchment zones of an area by providing certain ground information.

Table:4 Thematic layers used for proposing and developing surface water body

Sl. No	Parameters	Data type	Resolution/ Scale	Source
1.	Drainage/Drainage density	To-	1:50,000	Survey of India

		posheet		
2.	Slope	SRTM DEM	30m × 30m	https://www.usgs.gov
3.	Aspect	SRTM DEM	30m × 30m	https://www.usgs.gov
4.	Geomorphology	Vector layer	1:50,000	Survey of India to-posheet
5.	Land Use Land Cover (LULC)	Sentinel-2	10m×10 m	https://www.usgs.gov
6.	Normalized Difference Vegetation Index (NDVI)	Sentinel-2	10m×10 m	https://www.usgs.gov
7.	Existing water bodies	Vector layer		https://www.google earth.com

The study area was surveyed using LANDSAT 8 ETM+ and SENTINAL 2 satellite images that have been enhanced digitally to determine land-use/land cover and geomorphology. Survey of India map (1:50,000) has been used to delineate the drainage and slope, aspect, and contour were analysed from the CARTOSET DEM from NRSC Bhuvan. Surface natural and manmade water bodies were digitised using GOOGLE EARTH PRO. The orders were designated for each stream following the Strahler stream ordering technique (Strahler 1964). Buffers were generated for each stream proportional to their water body prospects. The spatial database layers like geomorphology, lineament density, and slope in degrees, aspect, land use/land cover, rainfall data/maps and Normalized difference vegetation index (NDVI) type were used to delineate the surface water catchment zones. Appropriate weightage was assigned to each of the map layers based on their terrain prospects. Ranks were also assigned to each subclass of prepared maps (Table 4).

4. PRECIPITATION

Climate

The islands in Nicobar Island enjoy tropical humid climate because of their location in the equatorial zone surrounded by the Andaman Sea. Winter is virtually absent and the islands have only two season's viz. rainy Season and summer Season. The mean relative humidity of the islands is 79%.The mean maximum temperature is 30.2o C and means minimum temperature is 23.8°C. The relative humidity varies from 79% to 89% and wind speed varies from 7 km/hr to 10km/hr. The maximum and minimum temperatures in the islands fluctuate between 27 to 330c and 21 to 250c. Daily evaporation rate in the island is fairly high which cumulatively ranges from 1500-1800 mm. per annum. The geographical localization is responsible for high average evaporation rate to the tune of 1500-1800mm per annum. Climatic aberration is highly influential in matters of the availability of surface water and ground water in the islands. In few years in the past decade i.e. in 2002 and 2007 the water supply scenario in Nicobar Group was highly affected.

Rainfall

The Island of Nicobar receives on an average 3000 mm of rainfall per annum the rainfall is received in the district through South - West and North - East monsoons spans for the period from May to December. Average annual rainfall in these Islands is about 3000 mm while the normal annual rainfall of the islands as calculated at Port Blair is 3180 mm. The meteorological parameters of the islands are interpreted from the records of lone IMD station situated at Port Blair. Rain gauze stations were established in the Police radio offices of Car Nicobar, Nancowry and Kondul islands in Southern Group. However, the rain gauzing in Kondul Island was terminated after the tsunami devastation in 2004.

5. DRAINAGE/DRAINAGE DENSITY

The Great Nicobar Islands is known to be the only island on the Nicobar group which is having five perennial rivers. In the great Nicobar you can come across the rivers Alexandra, Amrit Kaur, Danes, Galathea and Dogmar and each of them has its origin in the Mount Thullier. Virtually, the rivers here flow in southern or southwesterly direction which is a clear indication that there is a general terrain slope across the island. Undulating hills which are spread throughout the island but the main range of it is running in

south-north orientation. The highest part of this range, the mount Thuillier is considered to be the highest elevation among all the points in Nicobar. The area is 642 meters above the level of sea. The southernmost point here, known by the name of Indira point was submerged in tsunami waves in the year 2004.

Nicobar District is endowed with stupendous rainfall. Facilitated by the flow from perennial springs as also the base flow and rainfall, perennial flow throughout the year could be observed in the streams .In Great Nicobar,Kamorta, Nancowry,Trinket, Tillonchong,Teressa, Bampooka, Katchal, Little Nicobar ,Pilllo millo,Kondul etc. drainage density is high, while in Car Nicobar,Chowra Islands drainage system is either absent or poor. However, potential springs are developed in Carnicobar because of cavernous condition in Limestone. At places copious emanation from springs also give rise to potential drainage in Car Nicobar. Because of relatively less areal extent and paucity of catchments in the islands of Nicobar, river systems are almost absent barring the Galathea, Amrit Kaur, and Alexandria Rivers in Great Nicobar. However, a few perennial streams such as Magar Nala IN Great Nicobar and numerous other streams in other islands drain the Nicobar district. All the nalas meet the sea in Bays through creeks. The general drainage pattern of the islands varies from dendritic to subdendritic. Land subsidences in the Post-tsunami have greatly influenced the tidal ingress along the streams of Nicobar Island.

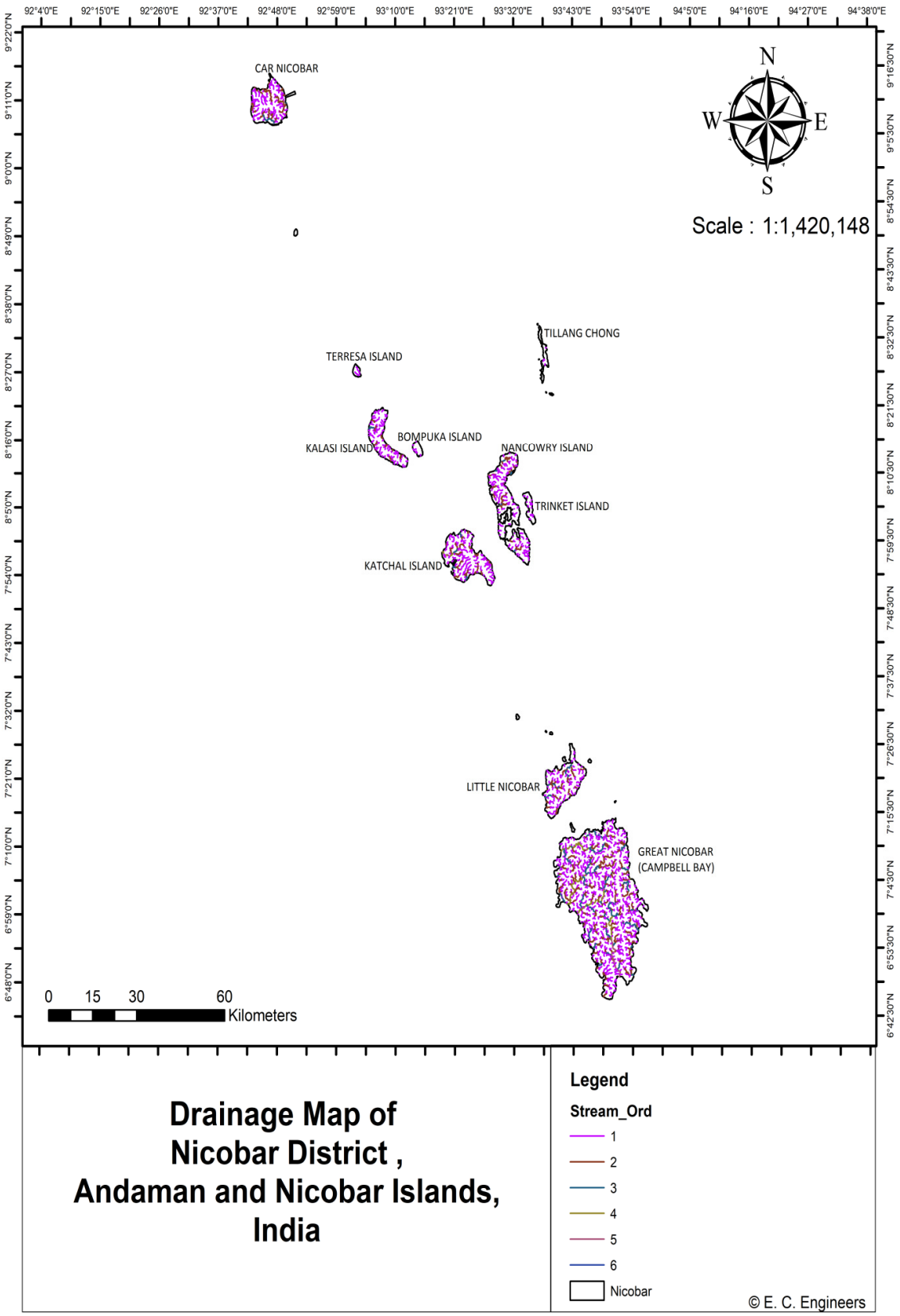


Fig:-2 Drainage map of Nicobar District

6. SLOPE

Inclination of the water surface, expressed as the difference in elevation of two points divided by their distance. Steep slopes are found in the area of Nicobar District.

Elevation: - **Highest elevation**: **614.65 m**

Minimum elevation: -1.03 m

Table:-5

Area wise Slope

SN.NO.	AREA	Slope
1.	**Car nicobar**	0 to 5%.
2.	**Tillang chong island**	North East side slope is above 20%, in the West and middle of the island slope is 0 to 5% and in the south side of the island slope is above 20%.
3.	**Terresa island**	Slope is 0 to 5% and in the south side of the island slope is above 20%.
4.	**Nancowry island**	North East side of the island slope is 0 to 5% and in the South West side slope is 15 to 20%.
5.	**Kalasi island**	Slope is 0 to 5%, in the north and middle of the island slope is 15 to 20%.
6.	**Bompuka island**	North East side of the island slope is above 20% and in the east side slope is 15 to 20%.
7.	**Trinket island**	Slope of the island is 0 to 5%.
8.	**Katchal island**	Middle of the island slope is 15 to 20% and south east side

		slope is above 20%.
9.	**Little island**	South East Side and Middle of the island slope is above 20%, in the west side slope is 10 to 15%, and in the north East side slope is above 20%.
10.	**Great island**	Slope is above 20% and in the south west side slope is 10 to 15%.

Calculation method for any area Slope:-

1. Q = (1.49/n)A(Rh^2/3)S^1/2
2. Q = the discharge.
3. A = is the area of the cross-section.
4. S = the slope of the waterway.
5. n = Mannings Roughness Coefficient.
6. Rh = the hydraulic radius of the cross-section.
7. A = the area of the cross section.
8. S = the slope of the water.

   Slope map of the 60 km area of the Nicobar District describe the value of the surface water slope.

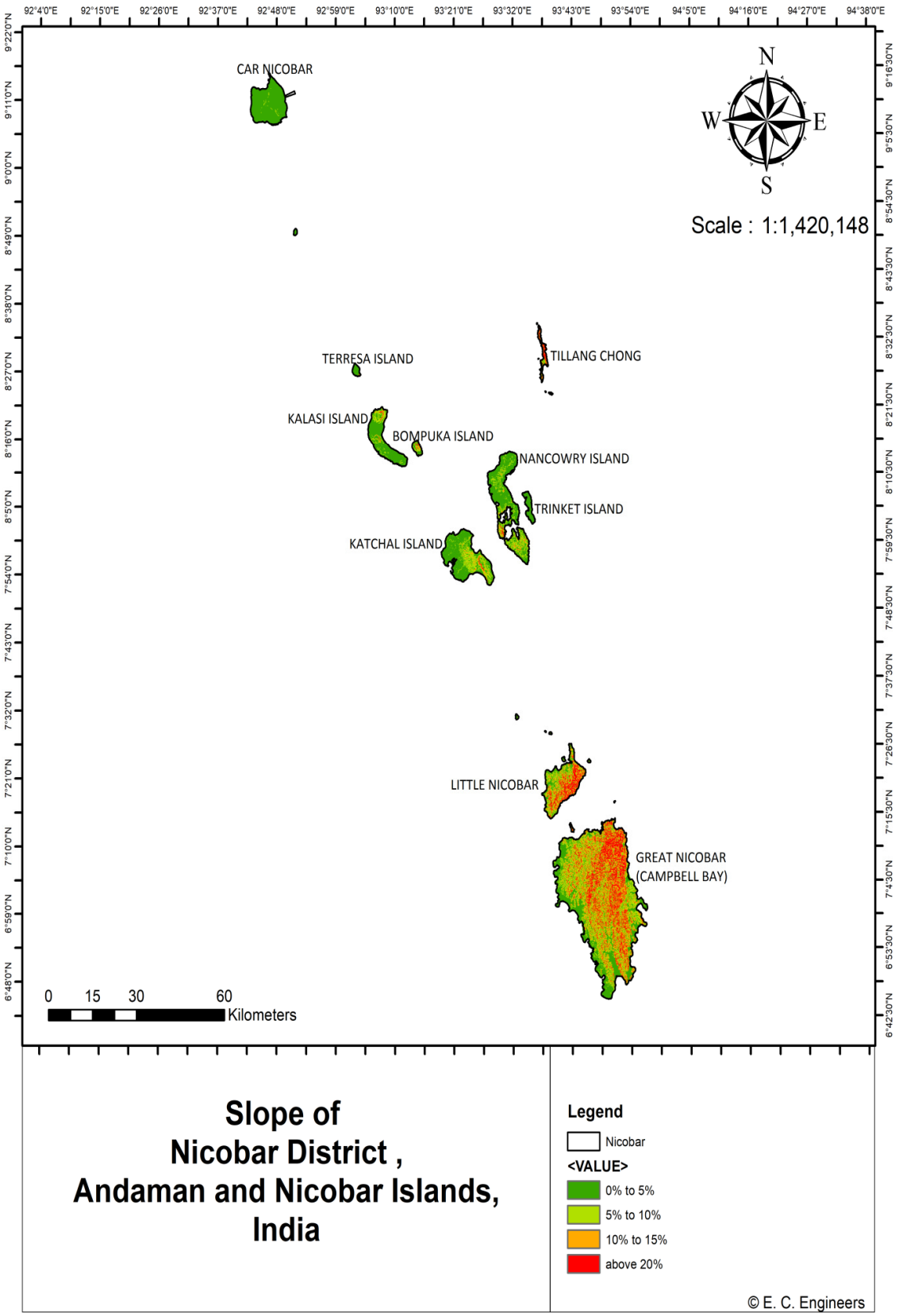


Fig:-3 Slope map of the Nicobar district

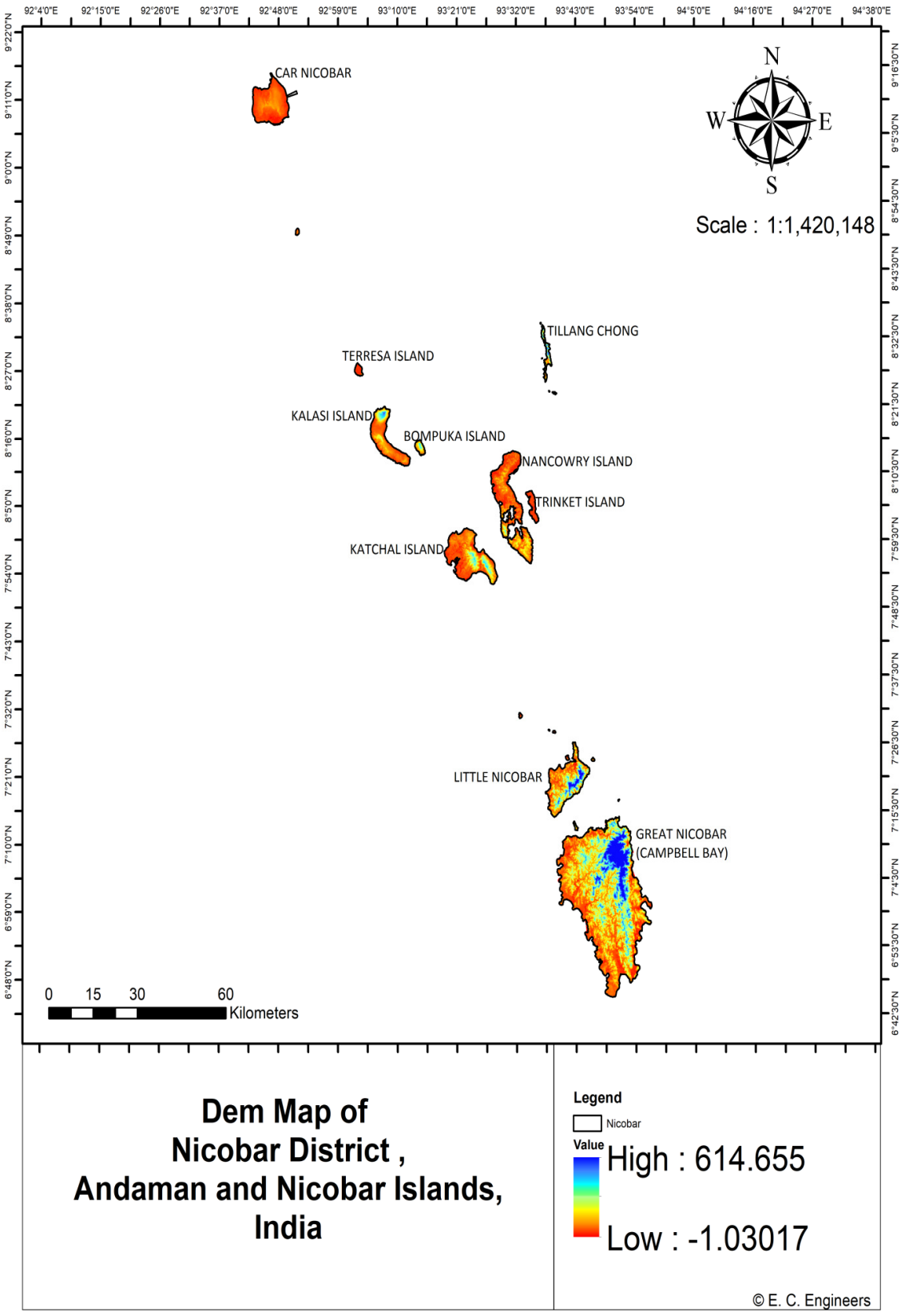


Fig:-4 Digital Elevation Model Map of Nicobar District

7. ASPECT

Multispectral and hyper spectral images captured by remote sensing satellites or airborne sensors contain abundant information that can be used to study and analyze objects of interest on the surface of earth and their properties. The potential of remotely sensed images for studying natural resources like water has been studied by researchers over the past many years. As water is an important natural resource that needs to be conserved, such studies have been of great interest to the scientific community. By employing appropriate digital image processing techniques on images taken from remote sensing satellites or airborne sensors, an effective system can be developed to study the quantitative and qualitative changes happening to surface water bodies over a period of time. Surface water detection and mapping is a crucial and necessary step in such studies and different automated and semi-automated methods have been developed over the years for mapping water in remotely sensed images. Remote sensing sensors capture images at multiple bands corresponding to different wavelength ranges in the EM spectrum. Digital image processing based techniques for water mapping falls predominantly into four categories; (i) single band based methods, (ii) spectral index based methods, (iii) machine learning based methods and (iv) Spectral mixture analysis based methods. This paper presents a review of techniques, methods, algorithms and the sensors/satellites that have been developed and experimented with to perform surface water body detection and delineation from remote sensing images.

Aspect map of the Nicobar District showing the slope of the surface water in different areas.

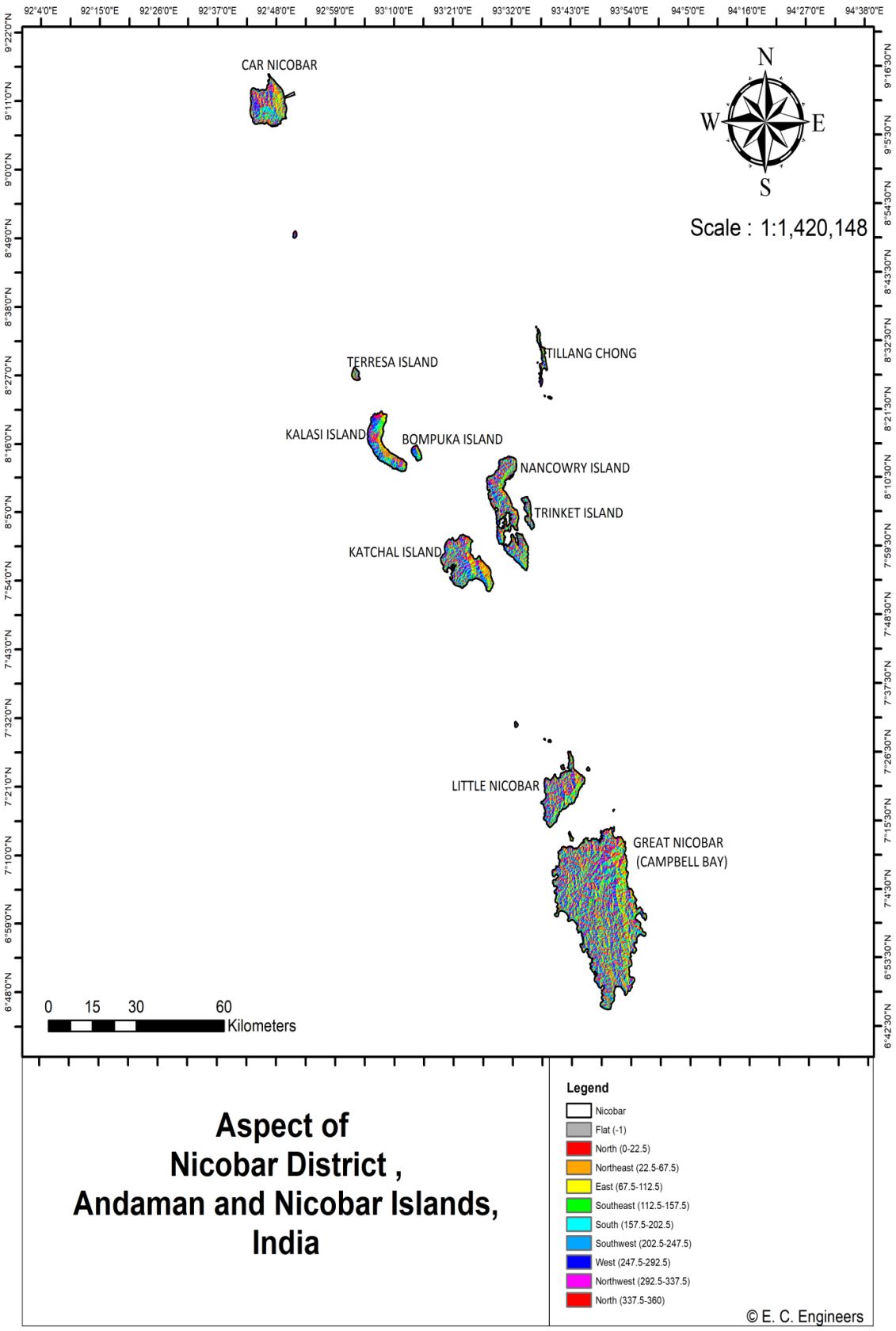


Fig:-5 Aspect map of Nicobar District

8. GEOMORPHOLOGY

Geomorphology of various islands in the district is highly varied. At places small to moderately high hills flanked by narrow coast could be seen as in case of Great Nicobar, Liitle Nicobar, Kamorta, Katchal, Teressa, Bampooka, Nancowry, Tillonchang islands where as small low lying to flat islands like Kondul, Pillow millow, Chowra etc. are also available in the district. Irrespective of the size of the islands, luxuriant coral growth occurs encircling the islands. Rugged topography, steep slope, low infiltration capacity and close proximity of hill to sea disallow creation of potential groundwater reservoirs in many of the islands except the Coralline (atoll) Islands like Car Nicobar which are endowed by bonanza of groundwater resources due to highly porous and permeable limestone underlying the island. Although the island of Chowra is water scarce, although underlain by porous shell limestone. Typical geomorphologic setup of the island is responsible for absence of fresh ground water lens developed in the island.

Springs: The characteristic geological and geomorphologic conditions of the islands have facilitated the origin of numerous springs in all the three major geological formations (i.e. Marine sedimentary group of rocks, volcanic and other igneous rocks and coralline limestone). The rural water supply in the entire district except Car Nicobar and coastal stretches of the islands of Nicobar (Water supply in Car Nicobar is done from the wells) is maintained either directly from the springs or spring or spring fed perennial streams. These springs are, in general, formed in high altitudes because of good fracturing in the rocks. For this they also may be termed as fracture springs. However, the springs are highly yielding and sustainable in, igneous rocks and limestone as seen in Teressa, Bampooka, and Tilonchang, Munak village of Kamorta underlain by igneous rocks and in Car Nicobar Island, underlain by coralline limestone.

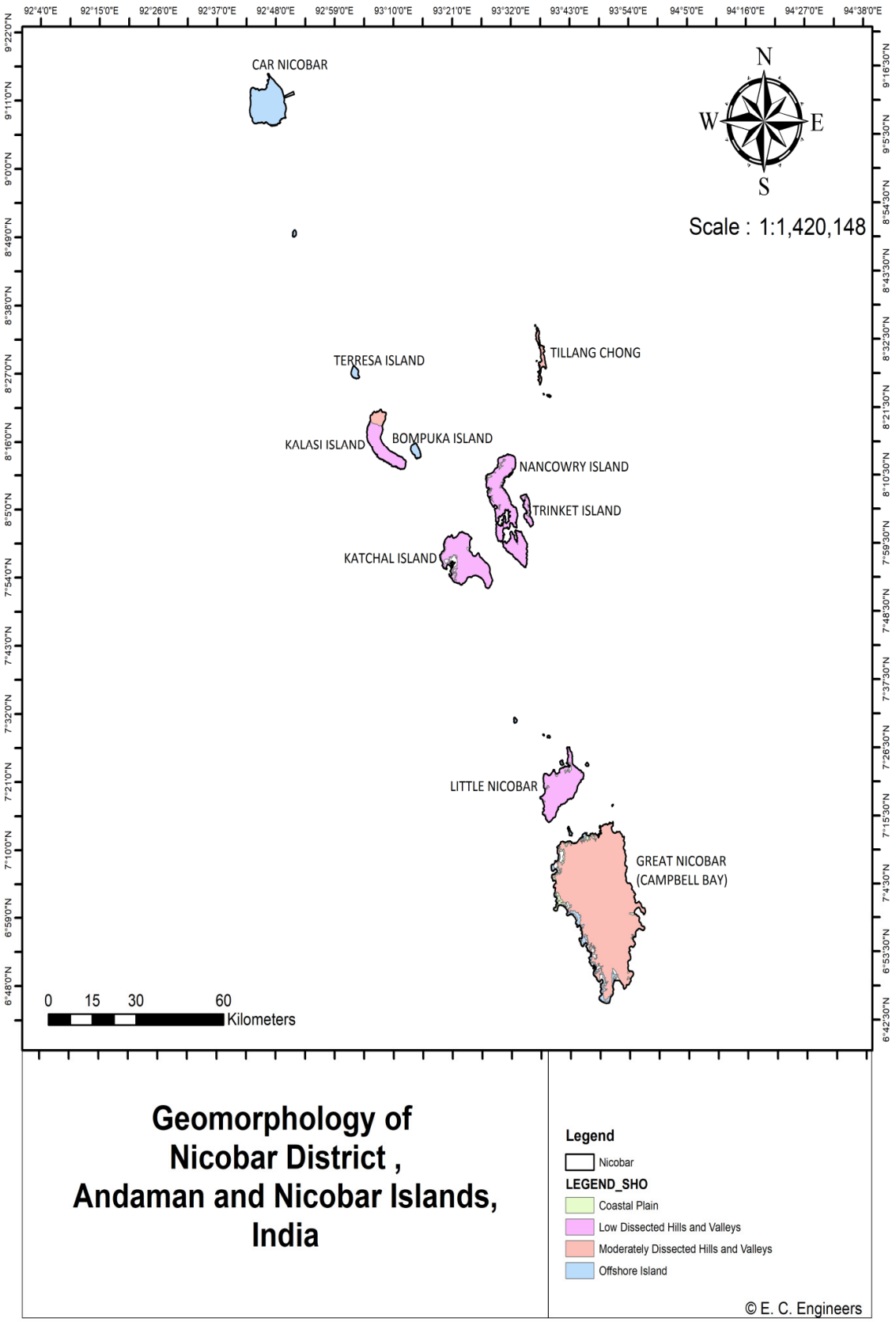


Fig:-6 Geomorphology map of Nicobar District

9. NORMALIZED DIFFERENCE VEGETATION INDEX (NDVI)

The normalized difference vegetation index (NDVI) is a simple graphical indicator that can be used to analyze remote sensing measurements, often from a space platform, assessing whether or not the target being observed contains live green vegetation.

The Normalized Difference Water Index (NDWI) is used to highlight open water features in a satellite image, allowing a water body to "stand out" against the soil and vegetation.

The NDWI equation:-

$$\mathbf{NDWI = (Green - NIR)/(Green + NIR)}$$

For Sentinel 2 data: NDWI= **(Band 3 – Band 8)/(Band 3 + Band 8)**

Normalized Difference Vegetation Index (NDVI) uses the NIR and red channels in its formula.

$$\mathbf{NDVI = \frac{(INR - Red)}{(INR + Red)}}$$

Landsat Normalized Difference Vegetation Index (NDVI) is used to quantify vegetation greenness and is useful in understanding vegetation density and assessing changes in plant health.

Study

The present study site, is one of the important district of Andaman & Nicobar archipelago, a group of green islands, found floating in deep blue Indian Ocean. The terrain is rough with hills enclosing narrow longitudinal valleys formed of territory sand stone, lime stone and shale. Soils are derived from sandstones, serpentines, conglomerates and are acidic non calcareous with low organic matter and high nitrogen content. Lush forest vegetation is found in these islands due to continuous rainfall brought by monsoons with a short dry period. As per the champion & Seth (1968), the study area has been classified as Andaman evergreen (1A/C2), Andaman semi evergreen (2A/C1), Andaman moist deciduous (3A/C1), Littoral (4A/L1) and Mangrove forest (4B/TS2).

Results

The ultimate result of the classification is to distinguish the area into various forest and non-forest categories. Important vegetation types of the study area include evergreen, semi evergreen, moist deciduous, littoral, dense, degraded and open mangrove. Water class was excluded from the total area statistics. Semi evergreen forest observed as dominant vegetation type of the north Andaman by both the interpretation methods. Visu-

al technique helped in the delineation of additional stunted evergreen / southern hill top evergreen forest class (later merged with evergreen), and various sub classes within mangrove forest based on their species composition as Rhizophora, Brugeria community etc., due to the variation in spectral values and prior knowledge of the area which could not be achieved by digital method.

The accuracy as well as delineation of various classes in visually interpreted map was found to be high (85%) and this was achieved mainly by the supportive information obtained from the digital technique. The hybrid classification approach using both digital and visual methods along with the ground phytosociological data aided in producing better vegetation map of the study area. Accuracy assessment was performed only for the predominant vegetation types, since coastal vegetation (Mangroves and littoral) are easily separable.

Observations

- Overall there was a difference of 35 Sq.km in area between the two methods adopted for classification.
- A comparison of area statistics in visual and digital classification methods showed that the extent of total forest area is nearly similar. But for non-forest classes higher area interpretation was observed (about 40 sq.km) by visual method.
- There is also a wide range difference in the moist deciduous class.

Table-6

Interpretation Key for Visual Interpretation of predominant vegetation types:-

Vegetation classes	Tone	Texture	Association
Andaman tropical evergreen forest	Deep red	coarse	Mostly on hill tops
Southern tropical evergreen forest	Reddish	Smooth/hazy	Aspect based vegetation class
Tropical semi evergreen forest	Pinkish red	Smooth/ coarse	On the slopes of hill
Tropical moist deciduous forest	Bluish /blackish blue	coarse	On hill slopes and lowland area
mangroves	Dark red velvety	smooth	Fringing muddy

			creeks
Littoral forests	Bluish pink/pinkish	Less coarse	Along seashores and Fringing sandy beaches.

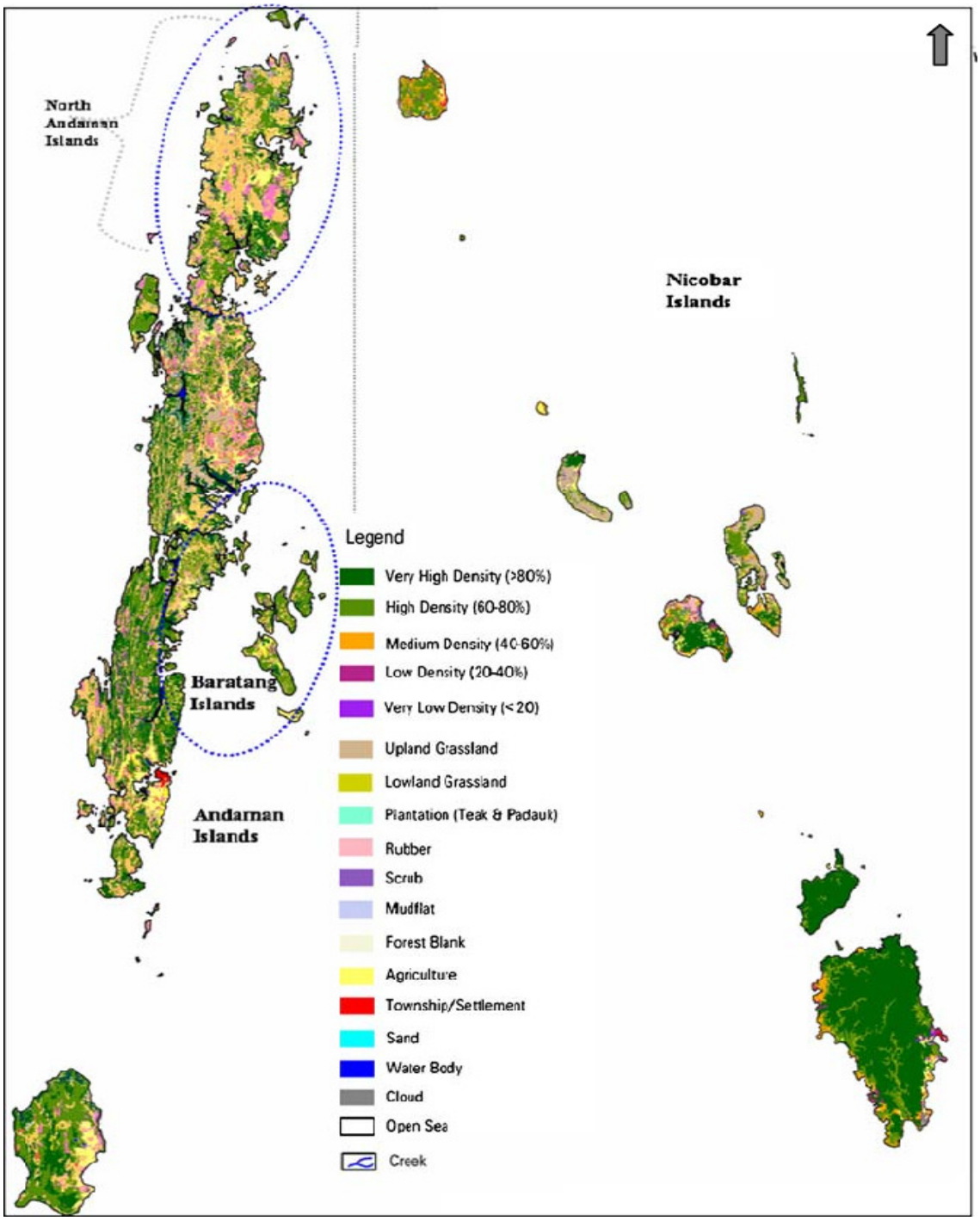


Fig:-7 NORMALIZED DIFFERENCE VEGETATION MAP

10. LAND-USE/LAND COVER (LULC)

The Great Nicobar Island is rich with the presence of dense forests, abundant flora and fauna, and two national parks (Campbell Bay National Park in north and Galathea National park in South). The project area (166.1 sq.km) is outside of the national parks and the area frequented by the Shompen. It includes the revenue villages, the only developed portion of the island. This project area includes low density residential and small-scale commercial development, as well as community facilities and services.

Of the total 166.1 sq.km project area, the revenue land area is 44.2 sq.km, which comprises of the following:-

Table- 7

Land use in South Andaman District

ITEM	LAND USE IN Sq. Km.
Revenue land (allotted)	23.53
Revenue land (vacant)	6.62
Revenue (encroached)	2.0
Others (road and water bodies)	3.16
Revenue land (Deemed Forest)	8.88

This revenue land was allotted to settlers on the island as tenants. They have occupancy rights but not ownership of the land. There is no lease and no time limit. Households can sell/transfer their rights of land in lieu of payment. They cannot change land use without permission. At present, tenants can only make improvements, but it requires approval by Deputy Commissioner.

1.65 sq.km of Defense land is falling under the proposed Port at Galathea bay; 7.849 sq.km. of Defense area is near Indira Point in the south and 1.43 sq.km. is at Campbell bay. The forest land in the project is 121.87 sq.km, alongwith Deemed forest of 8.88sq.km. These are Tropical Evergreen and Tropical Semi Evergreen forests. There is agricultural land in the villages and few types of grassland as well.

Land use and land cover map:-

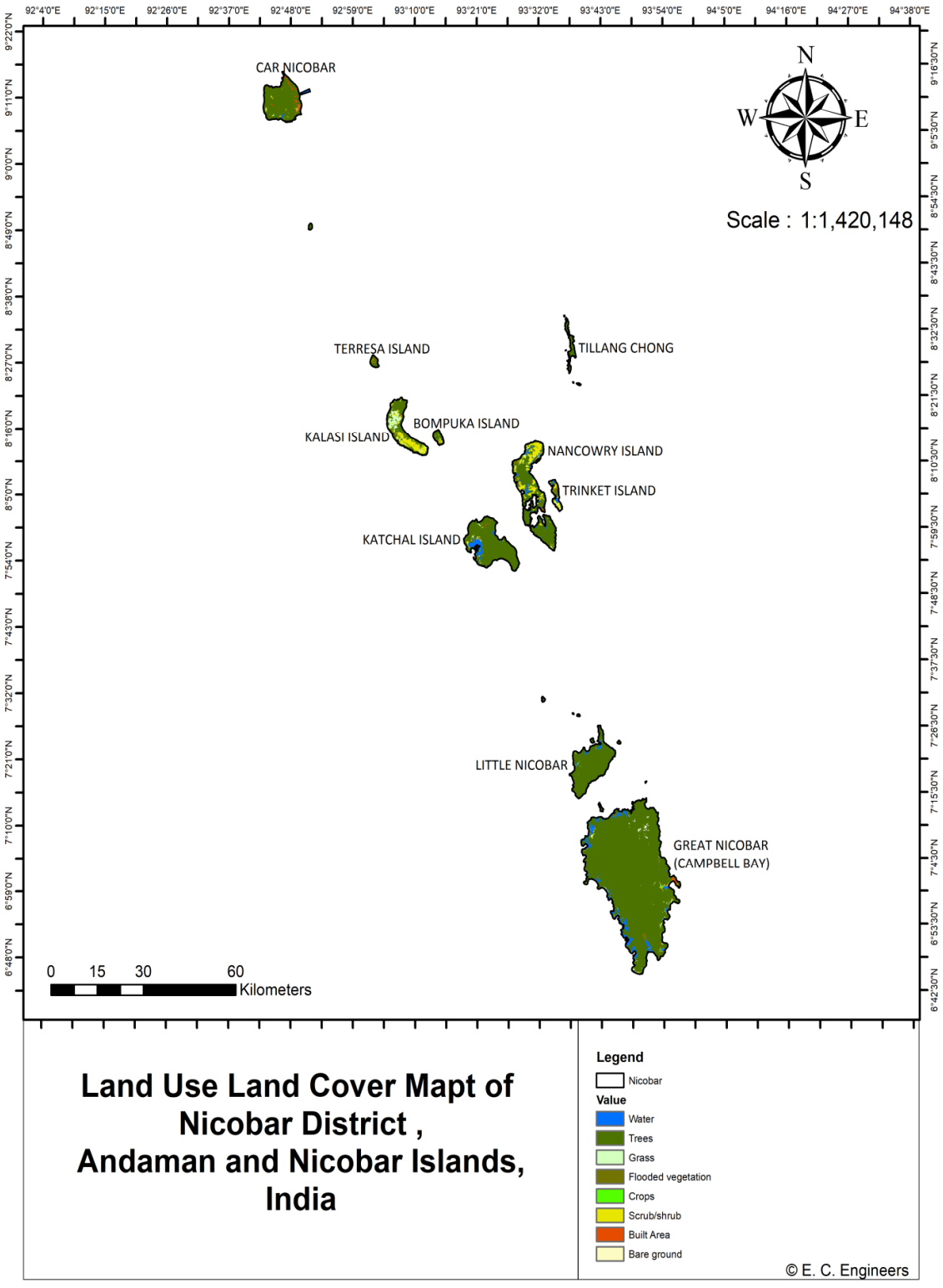


Fig:-8 Land use and land cover map

11. EXISTING WATER BODIES

Table-8

Water Quality of existing water bodies of Nicobar District is as below:-

SR.NO.	Odour	Taste	Turbidity	pH	Total Hard-ness mg/l	Iron mg/l	Chloride mg/l	Fluoride mg/l	TDS_Max mg/l	Calcium mg/l	Copper mg/l	Sulphate mg/l	Nitrate mg/l	Latitude	Longitude
1.	Agreeable	Agreeable	< 1 NTU	6.5	160	0.01	8	0.02	340	75	0.01	2	1	9°13'21.78"N	92°48'04.99"E
2.	Agreeable	Agreeable	< 1 NTU	7.5	162	0.02	8.2	0.01	305	78	0.03	4	2	9°13'08.55"N	92°48'23.77"E
3.	Agreeable	Agreeable	< 1 NTU	7	170	0.01	8.4	0.02	346	80	0.04	5	3	9°12'59.01"N	92°48'30.43"E
4.	Agreeable	Agreeable	< 1 NTU	7.8	175	0.04	8.5	0.01	400	82	0.05	7	4	9°12'40.49"N	92°48'23.84"E
5.	Agreeable	Agreeable	< 1 NTU	8	180	0.04	8.7	0.02	380	86	0.02	6	4	9°12'45.87"N	92°48'21.47"E
6.	Agreeable	Agreeable	< 1 NTU	8.2	182	0.03	8.8	0.02	389	90	0.03	3	2	9°12'44.26"N	92°48'22.96"E
7.	Agreeable	Agreeable	< 1 NTU	8.4	194	0.02	9	0.01	390	98	0.01	4	2	9°11'52.14"N	92°49'02.64"E
8.	Agreeable	Agreeable	< 1 NTU	8.5	185	0.01	10	0.02	345	100	0.02	5	3	9°11'15.68"N	92°49'12.43"E
9.	Agreeable	Agreeable	< 1 NTU	7.8	186	0.04	9.2	0.02	360	102	0.05	2	1	9°11'10.24"N	92°49'13.90"E
10.	Agreeable	Agreeable	< 1 NTU	7.7	194	0.02	9.4	0.01	365	104	0.04	4	2	9°11'06.36"N	92°49'06.44"E
11.	Agreeable	Agreeable	< 1 NTU	7.9	192	0.03	9.5	0.01	385	106	0.03	3	2	9°11'05.64"N	92°49'06.56"E
12.	Agreeable	Agreeable	< 1 NTU	6.8	194	0.01	9.6	0.01	378	110	0.02	6	4	9°11'06.29"N	92°49'22.50"E
13.	Agreeable	Agreeable	< 1 NTU	6.7	187	0.04	9.7	0.01	380	112	0.01	7	4	9°10'32.78"N	92°49'17.70"E
14.	Agreeable	Agreeable	< 1 NTU	6.6	188	0.02	9.8	0.02	389	115	0.05	5	3	9°10'09.83"N	92°49'28.19"E
15.	Agreeable	Agreeable	< 1 NTU	7	185	0.01	9.9	0.01	395	116	0.04	4	2	8°27'24.83"N	93°03'16.50"E
16.	Agreeable	Agreeable	< 1 NTU	8	182	0.03	10	0.02	378	118	0.02	2	1	8°27'11.26"N	93°02'47.16"E
17.	Agreeable	Agreeable	< 1 NTU	8.2	186	0.04	8.6	0.02	386	120	0.03	3	2	8°26'37.25"N	93°02'55.30"E
18.	Agreeable	Agreeable	< 1 NTU	8.4	164	0.02	8.3	0.01	378	122	0.01	6	4	8°26'12.63"N	93°37'21.68"E
19.	Agreeable	Agreeable	< 1 NTU	8.3	147	0.03	8.7	0.01	380	125	0.04	5	3	8°15'20.62"N	93°07'13.82"E
20.	Agreeable	Agreeable	< 1 NTU	8.5	175	0.01	8.4	0.02	389	142	0.05	4	2	8°14'10.94"N	93°09'10.70"E
21.	Agreeable	Agreeable	< 1 NTU	8	178	0.02	8.5	0.02	400	140	0.02	7	4	8°06'19.89"N	93°29'27.66"E
22.	Agreeable	Agreeable	< 1 NTU	7.4	180	0.04	8	0.01	405	145	0.03	2	1	8°02'46.96"N	93°32'27.54"E
23.	Agreeable	Agreeable	< 1 NTU	7.2	185	0.03	10	0.02	410	150	0.01	4	2	8°02'41.97"N	93°32'31.23"E
24.	Agreeable	Agreeable	< 1 NTU	7.3	184	0.01	9.2	0.01	412	156	0.04	5	3	8°01'24.04"N	93°32'54.81"E

25.	Agreeable	Agreeable	< 1 NTU	8	200	0.01	10	0.01	450	162	0.02	2	1	7°53’21.25”N	93°22’54.44”E
26.	Agreeable	Agreeable	< 1 NTU	8.2	206	0.03	9.8	0.02	455	164	0.03	7	4	7°53’23.05”N	93°23’01.21”E
27.	Agreeable	Agreeable	< 1 NTU	8.4	208	0.02	9.7	0.02	462	165	0.05	5	3	7°53’19.08”N	93°22’22.69”E
28.	Agreeable	Agreeable	< 1 NTU	7.5	210	0.04	9.4	0.02	463	140	0.01	4	2	7°25’05.11”N	93°43’06.70”E
29.	Agreeable	Agreeable	< 1 NTU	7.6	215	0.01	8.2	0.01	467	142	0.04	2	1	7°24’15.80”N	93°42’58.82”E
30.	Agreeable	Agreeable	< 1 NTU	7.7	218	0.02	8.3	0.01	468	147	0.02	7	4	7°22’18.64”N	93°39’32.06”E
31.	Agreeable	Agreeable	< 1 NTU	7.8	220	0.03	8.5	0.01	470	178	0.03	4	2	7°21’52.52”N	93°39’00.08”E
32.	Agreeable	Agreeable	< 1 NTU	7.2	230	0.02	8.6	0.01	475	155	0.01	2	1	7°17’32.06”N	93°41’13.25”E
33.	Agreeable	Agreeable	< 1 NTU	7	225	0.04	8.8	0.02	456	75	0.04	6	4	7°15’29.86”N	93°38’25.00”E
34.	Agreeable	Agreeable	< 1 NTU	6.8	227	0.01	8.9	0.02	468	80	0.05	5	3	7°00’19.86”N	93°54’47.88”E
35.	Agreeable	Agreeable	< 1 NTU	6.7	228	0.02	9	0.02	480	86	0.02	4	2	7°00’25.80”N	93°54’48.99”E
36.	Agreeable	Agreeable	< 1 NTU	6.9	230	0.03	9.5	0.01	485	89	0.03	2	1	7°00’25.05”N	93°54’50.16”E
37.	Agreeable	Agreeable	< 1 NTU	7	232	0.02	9.6	0.01	486	90	0.01	7	4	7°00’32.99”N	93°54’56.82”E
38.	Agreeable	Agreeable	< 1 NTU	7.4	235	0.04	9.8	0.01	456	180	0.02	4	2	7°00’31.42”N	93°54’54.41”E
39.	Agreeable	Agreeable	< 1 NTU	7.3	241	0.01	9.3	0.02	465	182	0.05	2	1	7°00’52.43”N	93°55’44.00”E
40.	Agreeable	Agreeable	< 1 NTU	7.5	250	0.03	9.1	0.02	467	184	0.03	6	4	7°00’21.18”N	93°56’02.54”E
41.	Agreeable	Agreeable	< 1 NTU	7.6	231	0.02	9.4	0.01	468	190	0.01	5	3	7°00’25.93”N	93°55’58.16”E
42.	Agreeable	Agreeable	< 1 NTU	7.8	223	0.01	9.2	0.02	470	185	0.04	4	2	6°59’57.48”N	93°54’34.30”E
43.	Agreeable	Agreeable	< 1 NTU	8	226	0.03	9.7	0.01	478	154	0.03	2	1	6°59’55.34”N	93°54’28.94”E
44.	Agreeable	Agreeable	< 1 NTU	8.1	236	0.02	9.8	0.01	482	167	0.01	7	4	7°00’03.27”N	93°54’04.48”E
45.	Agreeable	Agreeable	< 1 NTU	8.2	237	0.04	9.9	0.01	486	170	0.05	4	2	7°00’07.68”N	93°53’53.68”E
46.	Agreeable	Agreeable	< 1 NTU	8.4	238	0.01	10	0.02	489	172	0.02	2	1	7°00’05.72”N	93°53’53.97”E
47.	Agreeable	Agreeable	< 1 NTU	8.3	239	0.04	8	0.02	490	178	0.04	5	3	6°59’41.58”N	93°53’28.71”E
48.	Agreeable	Agreeable	< 1 NTU	7.9	240	0.03	9	0.02	495	180	0.01	6	4	7°00’28.03”N	93°53’11.52”E
49.	Agreeable	Agreeable	< 1 NTU	8	244	0.02	10	0.02	488	185	0.05	4	2	7°00’30.08”N	93°53’21.94”E
50.	Agreeable	Agreeable	< 1 NTU	7.5	241	0.03	9	0.01	490	192	0.05	2	1	7°00’28.86”N	93°53’23.95”E
51.	Agreeable	Agreeable	< 1 NTU	7.6	215	0.02	8.8	0.01	492	185	0.03	4	2	7°00’28.21”N	93°53’24.85”E
52.	Agreeable	Agreeable	< 1 NTU	7.3	220	0.01	8.7	0.02	458	187	0.01	7	4	7°00’20.18”N	93°53’10.58”E
53.	Agreeable	Agreeable	< 1 NTU	7	226	0.04	8.3	0.01	462	174	0.02	3	2	6°59’57.58”N	93°53’44.60”E
54.	Agreeable	Agreeable	< 1 NTU	7.8	228	0.02	10	0.01	465	175	0.05	5	3	6°59’48.15”N	93°53’41.80”E

55.	Agreeable	Agreeable	< 1 NTU	7.9	230	0.03	9	0.02	468	185	0.03	4	2	6°59'21.91"N	93°53'39.15"E
56.	Agreeable	Agreeable	< 1 NTU	8	235	0.01	8.9	0.02	467	186	0.02	2	1	6°59'19.52"N	93°53'41.25"E
57.	Agreeable	Agreeable	< 1 NTU	8.1	234	0.03	10	0.01	488	163	0.04	3	2	6°59'15.49"N	93°53'43.45"E
58.	Agreeable	Agreeable	< 1 NTU	8.2	247	0.02	8	0.02	489	170	0.01	5	3	6°59'11.77"N	93°53'44.36"E
59.	Agreeable	Agreeable	< 1 NTU	8.4	250	0.04	8.2	0.02	489	184	0.05	6	4	6°59'05.99"N	93°53'40.40"E
60.	Agreeable	Agreeable	< 1 NTU	8.5	235	0.02	8.8	0.01	486	189	0.02	6	4	6°58'34.80"N	93°55'34.16"E
61.	Agreeable	Agreeable	< 1 NTU	8	238	0.03	8.7	0.01	463	190	0.03	4	2	6°57'24.03"N	93°55'33.50"E
62.	Agreeable	Agreeable	< 1 NTU	7.3	247	0.01	8.6	0.01	466	192	0.01	7	4	6°57'18.40"N	93°55'20.25"E
63.	Agreeable	Agreeable	< 1 NTU	7.5	236	0.04	8.5	0.02	465	195	0.04	5	3	6°57'13.25"N	93°55'13.89"E
64.	Agreeable	Agreeable	< 1 NTU	7.6	225	0.02	10	0.02	470	186	0.02	2	1	6°57'6.92"N	93°55'13.14"E
65.	Agreeable	Agreeable	< 1 NTU	7.9	230	0.03	8	0.02	478	187	0.05	3	2	6°57'11.35"N	93°55'06.15"E
66.	Agreeable	Agreeable	< 1 NTU	6.5	243	0.01	9.1	0.01	488	188	0.03	4	2	6°57'9.56"N	93°55'01.52"E
67.	Agreeable	Agreeable	< 1 NTU	6.8	241	0.04	9.2	0.02	485	162	0.02	2	1	6°57'10.75"N	93°55'02.62"E
68.	Agreeable	Agreeable	< 1 NTU	6.9	240	0.02	9.6	0.02	486	164	0.04	3	2	6°56'57.82"N	93°54'55.00"E
69.	Agreeable	Agreeable	< 1 NTU	6.7	236	0.03	9.7	0.02	489	168	0.05	2	1	6°56'53.63"N	93°54'28.89"E
70.	Agreeable	Agreeable	< 1 NTU	7	238	0.01	9.3	0.01	490	173	0.03	5	3	6°56'59.75"N	93°54'24.46"E
71.	Agreeable	Agreeable	< 1 NTU	7.4	226	0.02	9.9	0.01	492	178	0.01	4	2	6°50'35.57"N	93°48'37.27"E
72.	Agreeable	Agreeable	< 1 NTU	7.1	230	0.03	9.8	0.01	493	174	0.02	7	4	6°50'58.38"N	93°53'30.30"E
73.	Agreeable	Agreeable	< 1 NTU	8	241	0.04	9	0.02	456	177	0.02	6	4	6°49'53.01"N	93°53'39.43"E

Water body map:-

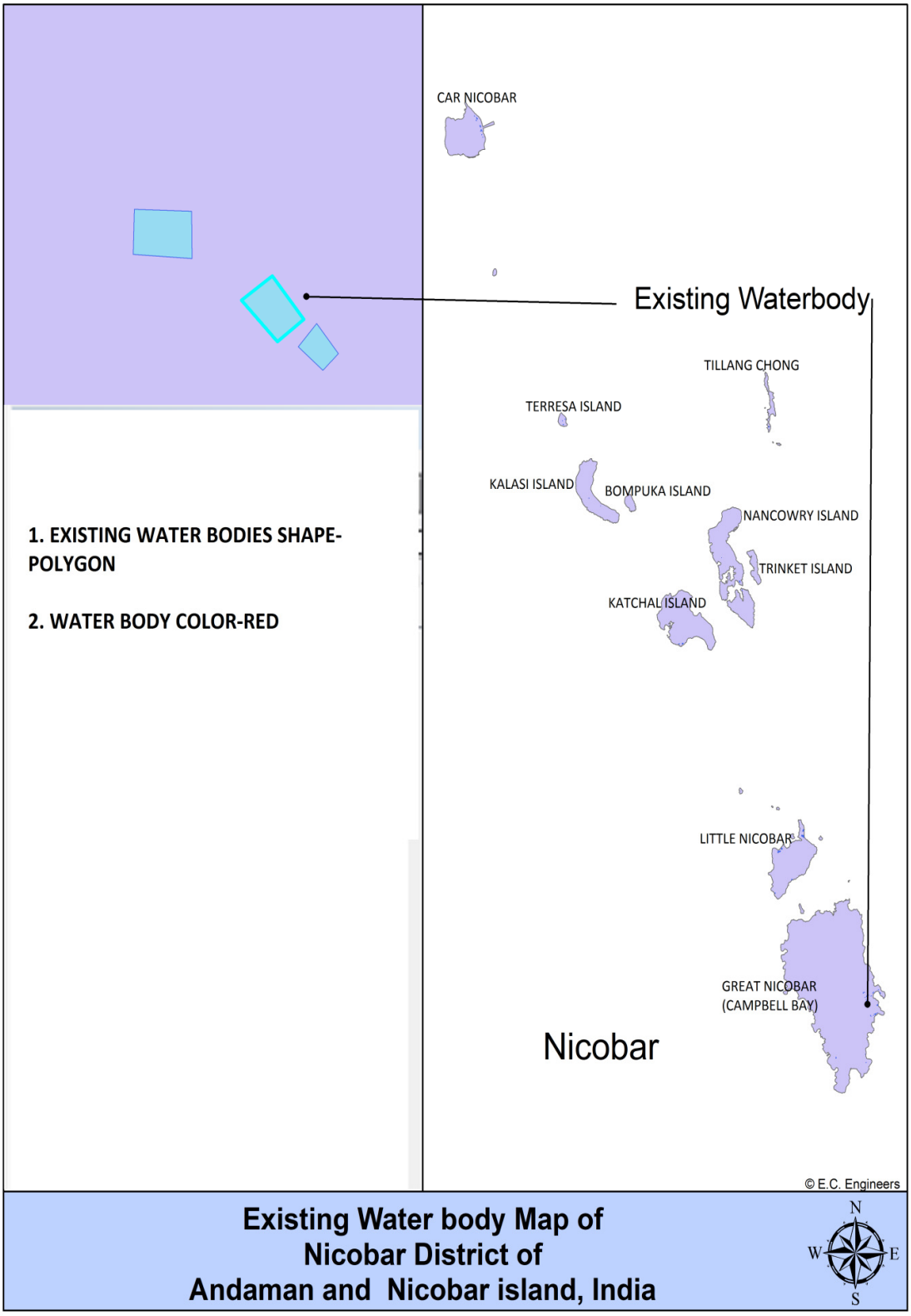


Fig:-9 water body map of Nicobar District

12. OTHER BASIC TOOLS REGARDING WATERSHED DEVELOPMENT

The eight tools are:

- **Tool 1.** Land Use Planning
- **Tool 2.** Land Conservation
- **Tool 3.** Aquatic Buffers
- **Tool 4.** Better Site Design
- **Tool 5.** Erosion and Sediment Control
- **Tool 6.** Stormwater Best Management Practices
- **Tool 7.** Non-Stormwater Discharges
- **Tool 8.** Watershed Stewardship Programs

Tool1. Land Use Planning

Land use planning techniques:-

i. Watershed base zoning
ii. Overlay zoning
iii. Floating zones
iv. Incentive zoning
v. Urban growth boundaries
vi. Large lot zoning
vii. Infill community redevelopment
viii. Transfer of development rights

Tool2. Land Conservation

Five types of land may need to be conserved in a subwatershed:-

i. Critical habitats
ii. Aquatic corridor
iii. Hydrologic reserve area
iv. Water pollution hazards
v. Cultural areas

Tool3. Aquatic Buffers: An area of trees that blocks noise pollution.

Benefits of Aquatic Buffer:-

i. Regulates light and temperature conditions, improving the habitat for aquatic plants and animals.
ii. Effective in removing sediment, nutrients, and bacteria from stormwater.
iii. Helps to stabilize and protect the streambank

Tool4. Better Site Design

Three categories:

i. Residential streets and parking lots
ii. Lot development
iii. Conservation of natural areas

Tool5. Erosion and Sediment Control

Ten elements of an effective ESC plan:-

i. Minimize needless clearing and grading
ii. Protect waterways and stabilize drainage ways
iii. Phase construction to limit soil exposure
iv. Stabilize exposed soils immediately
v. Protect steep slopes and cuts
vi. Install perimeter controls to filter sediments
vii. Employ advanced sediment settling controls
viii. Certify contractors on ESC plan implementation
ix. Adjust ESC plan at construction site
x. Assess ESC practices after storms

Tool6. Stormwater Best Management Practices

Goals of stormwater best management plan:-

i. Maintain groundwater recharge and quality
ii. Reduce stormewater pollutant loads
iii. Protect stream channels
iv. Prevent increased overbank flooding
v. Safely convey extreme floods

Most stormwater best management practices can be grouped into five general categories:

i. Ponds
ii. Wetlands
iii. Infiltration
iv. Filtering systems
v. Open channels

Tool7. Non-Stormwater Discharges

1. Septic systems
2. Sanitary sewers
3. Other

i. Industrial NPDES discharges
ii. Urban “return flows”
iii. Water diversions
iv. Runoff from confined animal feeding lots

v. miscellaneous

Tool8. Watershed Stewardship Programs

i. watershed advocacy
ii. watershed education
iii. pollution prevention
iv. watershed maintenance
v. indicator monitoring
vi. restoration

13. DELINEATION & PRIORITIZATION OF WATERSHEDS

1. Criteria for selection of watershed projects:-

The following criteria may broadly be used in selection and prioritisation of wa tershed development projects:

a. Acuteness of drinking water scarcity.

b. Extent of over exploitation of ground water resources.

c. Preponderance of wastelands/degraded lands.

d. Contiguity to another watershed that has already been developed/ treated.

e. Willingness of village community to make voluntary contributions, enforce equitable social regulations for sharing of common property resources, Common Guidelines for Watershed Development Projects 34 make equitable distribution of benefits, create arrangements for the operation and maintenance of the assets created.

f. Proportion of scheduled castes/scheduled tribes.

g. Area of the project should not be covered under assured irrigation.

h. Productivity potential of the land.

2. Project Management:-

The major activities of the Watershed Development Projects will be sequenced into (I) Preparatory, (ii) Works and (iii) Consolidation and withdrawal Phase. In view of the expanded scope and expectations under the watershed development programme, the project duration could be in the range of four to seven years depending upon the activities and Ministries/Departments. The DPR should mention the detailed justification for the proposed project duration. The project

duration may be spread over 3 different phases as decided by the Nodal Ministry and as given below:

Table:-9
Project Management Duration

Phase	Name	Duration
I	Preparatory phase	1-2 years
II	Watershed works phase	2-3 years
III	Consolidation and withdrawal phase	1-2 years

I Preparatory phase:-

The major objective of this phase is to build appropriate mechanisms for adoption of participatory approach and empowerment of local institutions (WC, Common Guidelines for Watershed Development Projects 35 SHG, and UG). WDT will assume a facilitating role during this phase. In this phase, the main activities will include:

a. Taking up entry point activities to establish credibility of the Watershed Development Team (WDT) and create a rapport with the village community. The entry point activities, inter-alia, will include:

i. Works based on urgent needs of the local communities such as revival of common natural resources, drinking water, development of local energy potential, augmenting ground water potential etc.

ii. Repair, restoration and up gradation of existing common property assets and structures (such as village tanks) may be undertaken to obtain optimum and sustained benefits from previous public investments and traditional water harvesting structures.

iii. Productivity enhancement of existing farming systems could also be an activity that helps in community mobilization and building rapport.

b. Initiating the development of Village level institutions such as Watershed Committees (WCs), Self- Help Groups (SHGs) and User Groups (UGs) and Capacity Building of different stakeholders on institutional and work related aspects.

c. Environment building, awareness generation, undertaking of intensive IEC activities, creating involvement and participatory responses.

d. Baseline surveys needed for preparation of Detailed Project Report (DPR), selection of sites and beneficiaries. Every effort must be made to collect Common Guidelines for Watershed Development Projects 36 gender-disaggregated data to adequately reflect the situation and priorities of women.

e. Hydro-geological survey of the watershed to map out zones of potential groundwater recharge, storage and sustainable groundwater utilisation.

f. Building up a network of technical support agencies.

g. Preparation of the DPR, including activities to be carried out, selection of beneficiaries and work-sites and design and costing of all works, ensuring that the interests, perceptions and priorities of women, dalits, adivasis and the landless are adequately reflected in the DPR.

h. Working out detailed resource-use agreements (for surface water, groundwater and common/forest land usufructs) among User Group members in a participatory manner based on principles of equity and sustainability.

i. Participatory monitoring of progress and processes.

II Watershed Works Phase:-

This phase is the heart of the programme in which the DPR will be implemented. Some of the important activities to be included in this phase are:

a. Ridge Area Treatment: All activities required to restore the health of the catchment area by reducing the volume and velocity of surface run-off, including regeneration of vegetative cover in forest and common land, a forestation, staggered trenching, contour and graded bunding, bench terracing etc.

b. Drainage line treatment with a combination of vegetative and engineering structures, such as earthen checks, brushwood checks, gully plugs, loose boulder checks, gabion structures, underground dykes etc.

c. Development of water harvesting structures such as low-cost farm ponds, Common Guidelines for Watershed Development Projects 40 nalla bunds, check-dams, percolation tanks and ground water recharge through wells, bore wells and other measures.

d. Nursery raising for fodder, fuel, timber and horticultural species. As far as possible local species may be given priority.

e. Land Development including in-situ soil and moisture conservation and drainage management measures like field bunds, contour and graded bunds fortified with plantation, bench terracing in hilly terrain etc.

f. Crop demonstrations for popularizing new crops/varieties, water saving technologies such as drip irrigation or innovative management practices. As far as possible varieties based on the local germplasm may be promoted.

g. Pasture development, sericulture, bee keeping, back yard poultry, small ruminant, other livestocks and other micro-enterprises.

h. Veterinary services for livestock and other livestock improvement measures i. Fisheries development in village ponds/tanks, farm ponds etc.

j. Promotion and propagation of non-conventional energy saving devices, energy conservation measures, and bio fuel plantations etc.

III Consolidation and Withdrawal Phase:-

In this phase the resources augmented and economic plans developed in Phase II are made the foundation to create new nature-based, sustainable livelihoods and raise productivity levels. The main objectives under this phase are:

a. Consolidation and completion of various works.

b. Building the capacity of the community based organizations to carry out Common Guidelines for Watershed Development Projects 41 the new agenda items during post project period.

c. Sustainable management of (developed) natural resources and

d. Up-scaling of successful experiences regarding farm production systems / off-farm livelihoods.

14. AQUIFER & THEIR ROCKS TYPES

Hydrogeologically this island formed a bonanza of fresh water resources through higher infiltration in the porous corralline limestone formations. Depths to water level in the coastal areas vary from 2m to 3m during post-monsoon time and 3 m to 4 m during pre-monsoon times. The rainfall infiltration used to occur from the top of the hills through the fissures and fractures in Marl formation and the porous coralline formations and the recharged water was forming a lens of 25 to 30 m thickness below the ground surface and it used to be discharged into the sea in the low lying areas. The study by CGWB in the area revealed that the fresh – sea water front used to remain away from the tidal line and consequently good quality fresh water also was available in the shallow wells along the coast line as also in the wells in the near shore areas constructed by APWD, A&N Administration and MES for water supply in the Civil and Defense areas. Two wells inside IAF campus (constructed by Japanese by explosives) under use by MES was yielding 6 lakh litres or more with a draw down of only 0.2m with out any quality deterioration. These wells are located only 200 m away from the shoreline, similar observations were made from the other pumping wells of APWD. APWD had 9 larger dia dug wells (0.5 to 6 m dia and 4.5 to 10 m depth) for pumping of fresh water for drinking water supply in the pretsunami . Similarly ALHW, Govt. of India had two pumping wells at Mus and Kinmai for their campus use and supply to the ships. The depth to water level at higher elevations at Mus, Kinmai and Perka area used to vary from 7.5 to 9 Mtrs. In various reasons (pre and post-monsoon). However, in low lying areas at higher elevations depth to water lever varies from 2 to 3 m in all seasons and at places good springs (discharge 0.4 to 10 LPS) are also developed.

The earthquake and tsunami had devasted the island significantly.The coasts were damaged along with the destruction and contamination of many wells in the coastal stretch. It is noteworthy in this context that the Nicobari population in the entire Nicobar district had an inherent liking to dwell along the coast. As per the easier availability based on hydrogeologic condition, the wells were also constructed consequently along the coast. Sedimentary rocks in valleys and adjacent to Bays, depths of dug wells are restricted to 3.5 to 4 m bgl. A map showing the Geology and Hydrogeology of Nicobar Islands is given in Fig no.-10.

Great Nicobar is the island is situated in the southern most end of Indian Subcontinent and occupying a geographical area of 1044.54 Sq.Km. Physiography , high rainfall and geology facilitates formation of highly perennial drainage system which sustains significant flow through out the year. However after the current tsunami and devastating earth quake the area has been hit hard for being very close to the epicenter at Banda Aech in Sumatra. The island is underlain by sandstone, silt stone, shale, and conglomerate of Mithakhari Group and does not favour good potential of groundwater both in the shallow and the deeper horizon. Because of this the groundwater exploration carried out in the island was not successful. However, coralline formations are available in the coastal areas which sustain good groundwater in wells. However, with the subsidence of land to the tune of 1.8 to 2.5m salinity ingress in subsurface is noticed.

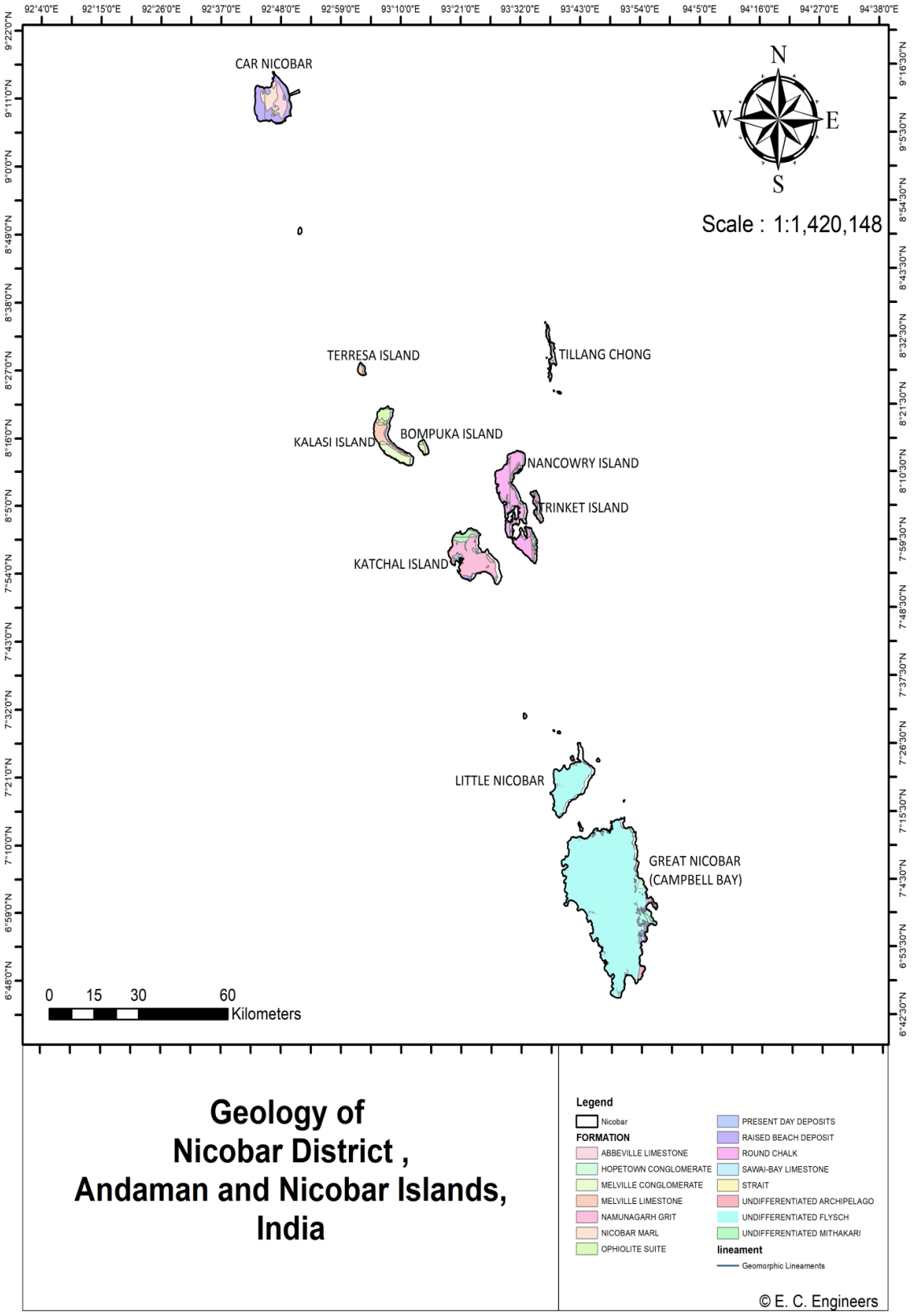


Fig:-10 Geology Map of Nicobar District

15. INTEGRATED WATERSHED DEVELOPMENT PLAN

Integrated watershed management (IWM) is the process of managing human activities and natural resources on a watershed basis, taking into account social, economic and environmental issues, as well as local communityinterests and issues such as the impacts of growth and climate change.

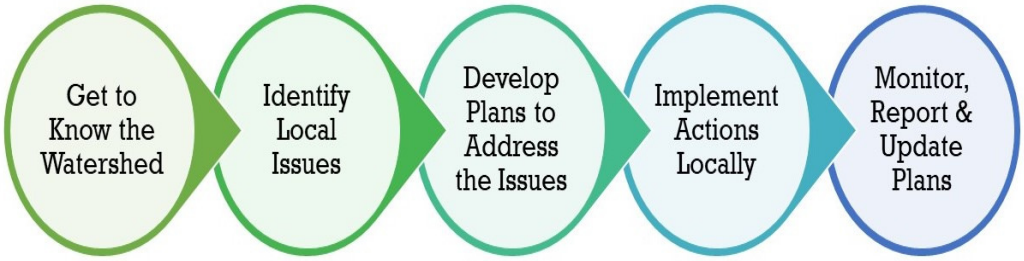
In 2019, a new Integrated Watershed Management Plan (IWMP) was released. It will guide efforts to maintain and enhance the watershed's natural heritage resources. The plan was approved by the NVCA's board of directors at their June 2019 meeting.

IWM allows conservation authorities and municipalities to sustainably manage our water resources in complex and sometimes uncertain environments. By taking an IWM approach, we can develop plans that support:

- improved water quality and quantity
- flood and erosion management
- biodiversity and resilient habitats
- sustainable economic and recreation opportunities
- improved quality of life and communities
- greater ability for the watershed to adapt to the impacts of climate change, urbanization and other stressors

IWM is put into action through an IWM Planning Process.

Integrated Watershed Management Planning Process:-



A. **Step One - Get to Know the Watershed:**

This first step in the IWM planning process involves collecting and analyzing large amounts of data about the watershed, including details on:

- water quality and quantity
- aquatic and terrestrial environments
- groundwater
- flood and erosion hazards
- economic and recreational land uses
- ecological assets
- climate and the effects of climate change

B. Step Two - Identify Watershed Issues, Opportunities and Constraints

In step two of the IWM planning processes identify the issues, opportunities and constraints facing the watershed. Working with municipalities, indigenous communities and sector stakeholders, with opportunity for input from interested members of the public, these issues may include:

- Climate change - including risks of increased extreme weather and flooding, unpredictable weather patterns, changing ecosystems, invasive species, etc.
- Land use changes - growth and development, use of resources, etc.
- Tourism and recreational uses of environmental features.

C. Step Three - Develop Strategies and Plan

In the final step of developing the IWM plan look to craft solutions or adaptive strategies to address watershed issues. Again, this will be done in concert with municipalities, indigenous communities and stakeholders, with input from the public.

Once it is drafted, the plan will be reviewed and considered for approval by the NVCA board of directors. Pending approval, the final plan will be circulated to municipalities, counties and others for incorporation into their planning decisions (steps four and five of the IWM planning process).

D. Step four-Implement actions locally

A path forward is critical to ensure the plan's goal is achieved. The recommended strategies represent the management priorities for maintaining and enhancing the watershed to protect the natural resources and provide resiliency to stressors such as climate change and urban growth. The Implementation Strategy will need to include direction on reporting and review required under the adaptive management ap-

proach. NVCA and its partners in this IWMP will need to ensure that there is strong communication among the implementers of the strategy and that each partner incorporates the implementation measures into their respective planning, funding and capital works programs.

Talking to other groups and gathering their input is an important part of the IWM planning process. Municipalities, counties and indigenous communities were invited to engage in the process. Key stakeholders from a variety of sectors including, but not limited to, agriculture, development, environment and business are being consulted throughout the process.

E. Step five-monitor, report & update plan

After the completion of all four steps, finally monitoring of all processes to identify, existing issues and deficiencies (if any) in implementation of the programmes will be done. If any deficiency occurs in above given for steps then we will update the plan.

16. ACTION PLAN PREPARATION

On the suitability of a location for artificial recharge depends on a variety of elements, including the climate, topography, soil, land use, and hydrogeologic conditions. While terrain determines the extent of run-off and retention, the climatic conditions mostly dictate the spatial and temporal availability of water for recharging. While the hydrogeologic parameters control the occurrence of potential aquifer systems and define whether they are suitable for artificial recharge, the prevailing soil and land use variables dictate the extent of infiltration.

Basis of rainfall, catchment area, geomorphology, drainage network, and LULC, Slope, and ASPECT Map, a development action plan for Nicobar District created. Mini percolation tanks, percolation tanks, and Pakka check dams, micro irrigation tank, Anicut dams are suggested.

A. Percolation Tanks & mini tanks

One of the most popular runoffs harvesting structures in India is the percolation tank, which is based on concepts similar to those of nalah bunds. In order to make surface runoff percolate and refuel the ground water store, a percolation tank is defined as an

artificially formed surface water body that submerges a highly permeable land region. Their greater reservoir areas set them apart from nalah bunds. For releasing water from the tank for irrigation or other uses, they are not equipped with sluices or outlets. However, in order to prevent the tank bund from overflowing, they may be given provisions for disposing of any excess water that may enter the tank.

If there is sufficient surplus runoff available and the site conditions support artificial recharge through such structures, it is conceivable to have more than one percolation tank in a watershed. When this occurs, each tank in the group shares in the overall catchment's yield, which is referred to as

1. Combined catchment, which is the size of the entire catchment above the tank
2. Free catchment, which is the catchment area that only flows into the tank under consideration. The area of the catchment intercepted by the tanks located upstream of any tank is determined by the difference between the combined and free catchments. Each drainage's tallest tank's entire catchment area must be considered its free catchment. Additionally, each tank will get the entire runoff from its free catchment, but just the remaining runoff from the rest of its catchment after the upper tanks have been filled.

Mini percolation tanks are advised where rainwater from at least 10 hectares has accumulated, the rock type is sandstone, and the first order slope of the river is less than 5%. A tiny percolation tank is advised if there has been an accumulation of rainwater from at least 20 hectares, the geology is sandstone, and the river order has a 2nd order slope that is less than 5%.

B. Pakka Check dams

These structures are made across gullies, nalahs, or streams to slow down the flow of surface water in the stream channel and to hold onto water for longer periods of time on the surface of permeable soil or rock. Nalah bunds and check dams are built over larger streams and in places with softer slopes than gully plugs, which are often built across first-order streams.

These may be temporary constructions made of locally accessible materials such brush wood dams, loose/dry stone masonry check dams, gabion check dams, and woven wire

dams, or permanent structures made of stones, brick, and cement. Permanent check dams should be designed, laid out, and built using expert civil and agro-engineering techniques to provide correct storage and adequate outflow of excess water to prevent scours on the downstream side for long-term stability of the barrier.The location for the check dam has the right amount of permeable soils or weathered material to speed up the process of recharging the water that has been stored. These structures typically have a height of less than 2 metres and hold water that is primarily contained to the stream course. The surplus water is permitted to flow over the wall because these were planned depending on stream width. On the downstream side, water cushions are constructed to prevent scouring from excessive runoff. Such check dams can be built in a sequence to have recharge on a regional scale, allowing for the harnessing of the stream's maximum runoff.

A pakka check dam is advised if the accumulated river has a minimum 30 hectare with a third order river slope of less than 5%.

C. Anicut dam

A dam is simply a barrier built across a river or any large water source. Its function is diverting water; to prevent flood or for irrigation and also to retain water for domestic use and power supply. Anicut is a dam built across a stream or river for maintaining and regulating irrigation.

The water stored behind an anicut can be used for irrigation of crops or drinking water for humans and livestock. They also are used to increase the residence of water to recharge groundwater, especially wells located downstream.

Table:-8
Total Suggested Structure

No	Structure name	River Order	Total no of structure
1	**Mini Percolation tank**	1 st	538
2	**Percolation tank**	2 nd	254
3	**Pakka check dam**	3 rd	59
4	**Anicut tank**	4 th	19

Table:-10

Details of the suggested structures:-

Structure ID	Latitude	Longitude	Stream_Order	Structure type
NIC1	9.23429264682	92.79415300980	1	Mini percolation tank
NIC2	9.22777537266	92.77818150720	1	Mini percolation tank
NIC3	9.22343780050	92.80197980670	1	Mini percolation tank
NIC4	9.22311076141	92.80372865060	1	Mini percolation tank
NIC5	9.22194999763	92.77568543830	1	Mini percolation tank
NIC6	9.22038608910	92.78833341220	1	Mini percolation tank
NIC7	9.22638445042	92.78807957770	1	Mini percolation tank
NIC8	9.23025750700	92.78314484150	1	Mini percolation tank
NIC9	9.21202205969	92.80095470490	1	Mini percolation tank
NIC10	9.21026944200	92.77111972750	2	Percolation tank
NIC11	9.21275176723	92.76605310150	2	Percolation tank
NIC12	9.21170306310	92.81129831410	2	Percolation tank
NIC13	9.21377842028	92.81504257010	2	Percolation tank
NIC14	9.21156769565	92.72782648820	1	Mini percolation tank
NIC15	9.21075972797	92.73658128620	2	Percolation tank
NIC16	9.21427985631	92.73161084150	2	Percolation tank
NIC17	9.20834532153	92.76340276730	2	Percolation tank
NIC18	9.21214217823	92.75978953530	2	Percolation tank
NIC19	9.20529642704	92.75087961360	2	Percolation tank
NIC20	9.20715247990	92.74490060420	2	Percolation tank
NIC21	9.20197587114	92.81734819020	1	Mini percolation tank
NIC22	9.20119271275	92.73531003970	1	Mini percolation tank
NIC23	9.20537829980	92.73311945430	1	Mini percolation tank
NIC24	9.20949501296	92.72936150150	1	Mini percolation tank
NIC25	9.21497510360	92.73111072690	1	Mini percolation tank
NIC26	9.20110750643	92.74387263500	1	Mini percolation tank
NIC27	9.20600307713	92.74303687630	1	Mini percolation tank
NIC28	9.19936010237	92.76611038680	1	Mini percolation tank
NIC29	9.19687110770	92.79400493170	1	Mini percolation tank
NIC30	9.19374447089	92.80041532730	2	Percolation tank
NIC31	9.19338591300	92.75985441700	1	Mini percolation tank
NIC32	9.19388383567	92.78162956910	2	Percolation tank
NIC33	9.19941068722	92.77885069930	2	Percolation tank
NIC34	9.20414839114	92.77751101780	2	Percolation tank
NIC35	9.19152242873	92.81463603460	1	Mini percolation tank
NIC36	9.19555021627	92.81688656960	1	Mini percolation tank
NIC37	9.18893131976	92.80421047940	2	Percolation tank
NIC38	9.18558709016	92.76506851020	1	Mini percolation tank
NIC39	9.19116502799	92.76323969430	1	Mini percolation tank
NIC40	9.19557015574	92.75891207430	1	Mini percolation tank
NIC41	9.18451183776	92.73929954910	1	Mini percolation tank

NIC42	9.18634350498	92.73673285870	1	Mini percolation tank
NIC43	9.18705798922	92.73066343300	1	Mini percolation tank
NIC44	9.18601364958	92.72477073000	1	Mini percolation tank
NIC45	9.19195043747	92.72384795340	1	Mini percolation tank
NIC46	9.19753430623	92.72312008470	1	Mini percolation tank
NIC47	9.18234305378	92.81876085500	1	Mini percolation tank
NIC48	9.18461968201	92.79651542940	1	Mini percolation tank
NIC49	9.18335332635	92.80162086250	1	Mini percolation tank
NIC50	9.18003271506	92.72883409820	1	Mini percolation tank
NIC51	9.18064372545	92.72350220940	1	Mini percolation tank
NIC52	9.18437888309	92.78299125390	2	Percolation tank
NIC53	9.18857113286	92.77933131580	2	Percolation tank
NIC54	9.17911979287	92.80402492300	2	Percolation tank
NIC55	9.18076719414	92.80846704960	2	Percolation tank
NIC56	9.18061676523	92.81280919280	2	Percolation tank
NIC57	9.18173399046	92.81828716230	2	Percolation tank
NIC58	9.17791006689	92.75239377680	1	Mini percolation tank
NIC59	9.18402595138	92.75247041790	1	Mini percolation tank
NIC60	9.19002333634	92.75068333870	1	Mini percolation tank
NIC61	9.19534696441	92.75302166780	1	Mini percolation tank
NIC62	9.17580995541	92.81999280340	2	Percolation tank
NIC63	9.17746814224	92.76333661650	1	Mini percolation tank
NIC64	9.18299168642	92.76233366450	1	Mini percolation tank
NIC65	9.18805057687	92.76090893100	1	Mini percolation tank
NIC66	9.19316103435	92.75842727170	1	Mini percolation tank
NIC67	9.17787848070	92.78290783960	1	Mini percolation tank
NIC68	9.17654434180	92.72335935210	2	Percolation tank
NIC69	9.17213386664	92.80442152100	1	Mini percolation tank
NIC70	9.17541219198	92.80879528540	1	Mini percolation tank
NIC71	9.17051700232	92.73993634310	1	Mini percolation tank
NIC72	9.16698416056	92.73495977600	1	Mini percolation tank
NIC73	9.16726738367	92.72873691840	1	Mini percolation tank
NIC74	9.16880446909	92.80957463240	1	Mini percolation tank
NIC75	9.16875936090	92.81524858890	1	Mini percolation tank
NIC76	9.16732633911	92.81914933690	1	Mini percolation tank
NIC77	9.16735386105	92.72412989590	2	Percolation tank
NIC78	9.16805564554	92.82189838260	2	Percolation tank
NIC79	9.17282302794	92.82588695850	2	Percolation tank
NIC80	9.16068725656	92.72160244630	2	Percolation tank
NIC81	9.15908503189	92.73908269750	1	Mini percolation tank
NIC82	9.15577619350	92.73396077220	1	Mini percolation tank
NIC83	9.15333803925	92.72899047910	2	Percolation tank
NIC84	9.15669950914	92.76084564940	1	Mini percolation tank
NIC85	9.15243275618	92.81316081300	2	Percolation tank
NIC86	9.15587695583	92.81723596520	2	Percolation tank

NIC87	9.16131231086	92.82006015030	2	Percolation tank
NIC88	9.15170212795	92.76326000820	1	Mini percolation tank
NIC89	9.14834211155	92.78582022610	1	Mini percolation tank
NIC90	9.16168665104	92.78896262980	1	Mini percolation tank
NIC91	9.15611167164	92.79090345690	1	Mini percolation tank
NIC92	9.15223339611	92.78691656380	1	Mini percolation tank
NIC93	9.15592453659	92.75542317670	1	Mini percolation tank
NIC94	9.15071174163	92.75229297450	1	Mini percolation tank
NIC95	9.14559395320	92.75551629630	1	Mini percolation tank
NIC96	9.14920442929	92.75533883690	2	Percolation tank
NIC97	9.14962485511	92.78069580200	1	Mini percolation tank
NIC98	9.14502450984	92.78065192460	1	Mini percolation tank
NIC99	9.14612365725	92.78181848960	2	Percolation tank
NIC100	9.15485168193	92.77404690240	2	Percolation tank
NIC101	9.14928426814	92.77484367750	2	Percolation tank
NIC102	9.14352916464	92.77418351790	2	Percolation tank
NIC103	9.13367086660	92.79511043050	2	Percolation tank
NIC104	9.15413902803	92.79441651470	1	Mini percolation tank
NIC105	9.14983826189	92.79175474180	1	Mini percolation tank
NIC106	9.14473614970	92.79022908130	1	Mini percolation tank
NIC107	9.14017925565	92.78813569400	1	Mini percolation tank
NIC108	9.14739246136	92.74017561680	1	Mini percolation tank
NIC109	9.14387460836	92.73561759610	1	Mini percolation tank
NIC110	9.14430016568	92.73035329700	1	Mini percolation tank
NIC111	9.14082849932	92.74915307300	2	Percolation tank
NIC112	9.14330953455	92.75400204440	2	Percolation tank
NIC113	9.13964144226	92.77352896120	2	Percolation tank
NIC114	9.13965141254	92.75910550080	3	Pakka Check Dam
NIC115	9.13936905494	92.79735089360	1	Mini percolation tank
NIC116	9.13640520408	92.79985248960	1	Mini percolation tank
NIC117	9.14374823083	92.81224934030	1	Mini percolation tank
NIC118	9.13709319979	92.81581607790	1	Mini percolation tank
NIC119	9.13590324942	92.74449726710	1	Mini percolation tank
NIC120	9.13481493372	92.75928333450	1	Mini percolation tank
NIC121	9.13802829120	92.78356336700	2	Percolation tank
NIC122	9.13125009268	92.76511236710	3	Pakka Check Dam
NIC123	9.12846837442	92.79335034420	2	Percolation tank
NIC124	9.12848802987	92.79703972070	1	Mini percolation tank
NIC125	8.46202077440	93.04916666670	1	Mini percolation tank
NIC126	8.45586824086	93.05169370570	1	Mini percolation tank
NIC127	8.45250000000	93.05375000000	1	Mini percolation tank
NIC128	8.44817685131	93.04515648200	1	Mini percolation tank
NIC129	8.44469874034	93.05043658350	1	Mini percolation tank
NIC130	8.44458333333	93.05437500000	1	Mini percolation tank
NIC131	8.34048128780	93.11441483860	1	Mini percolation tank

NIC132	8.33525583342	93.13811060090	1	Mini percolation tank
NIC133	8.33342228468	93.10233778110	1	Mini percolation tank
NIC134	8.32750000000	93.10041666670	1	Mini percolation tank
NIC135	8.32458333333	93.11458333330	1	Mini percolation tank
NIC136	8.32151061977	93.10947941040	1	Mini percolation tank
NIC137	8.31916666667	93.10442840060	1	Mini percolation tank
NIC138	8.31901737861	93.09992832600	2	Percolation tank
NIC139	8.31937500000	93.12687500000	1	Mini percolation tank
NIC140	8.31250042763	93.12525611420	1	Mini percolation tank
NIC141	8.30750000000	93.12083333330	1	Mini percolation tank
NIC142	8.30055211132	93.10530561870	2	Percolation tank
NIC143	8.30218074101	93.09463966870	3	Pakka Check Dam
NIC144	8.29625000000	93.11375000000	1	Mini percolation tank
NIC145	8.29836125636	93.10809056220	1	Mini percolation tank
NIC146	8.29449790828	93.10755350380	1	Mini percolation tank
NIC147	8.29001714223	93.10134293640	1	Mini percolation tank
NIC148	8.27958333333	93.11458333330	1	Mini percolation tank
NIC149	8.28125000000	93.12125000000	1	Mini percolation tank
NIC150	8.27853353488	93.09646646510	1	Mini percolation tank
NIC151	8.28117659551	93.09325869430	1	Mini percolation tank
NIC152	8.28198681957	93.08775542050	1	Mini percolation tank
NIC153	8.27503326584	93.12375865440	2	Percolation tank
NIC154	8.26618622642	93.09844154810	1	Mini percolation tank
NIC155	8.26047693679	93.11069542650	1	Mini percolation tank
NIC156	8.25574303598	93.10407578720	2	Percolation tank
NIC157	8.25166666667	93.13050258020	1	Mini percolation tank
NIC158	8.25350887490	93.13653549960	1	Mini percolation tank
NIC159	8.24965446719	93.13718929960	2	Percolation tank
NIC160	8.24558766782	93.14338370710	1	Mini percolation tank
NIC161	8.24623669950	93.13351759080	1	Mini percolation tank
NIC162	8.24409352153	93.11126173290	1	Mini percolation tank
NIC163	8.24188359118	93.14814372860	1	Mini percolation tank
NIC164	8.26083333333	93.10833333330	2	Percolation tank
NIC165	8.24520349589	93.12020349590	1	Mini percolation tank
NIC166	8.23916666667	93.11958333330	1	Mini percolation tank
NIC167	8.23459439791	93.11889626530	1	Mini percolation tank
NIC168	8.22802908826	93.16732171430	1	Mini percolation tank
NIC169	8.23256661232	93.12423327900	1	Mini percolation tank
NIC170	8.22165329608	93.14591007800	1	Mini percolation tank
NIC171	8.22482849136	93.17403141250	1	Mini percolation tank
NIC172	8.22332545858	93.14698960590	1	Mini percolation tank
NIC173	8.21632372600	93.15017881910	2	Percolation tank
NIC174	8.21554149762	93.15588808940	2	Percolation tank
NIC175	8.21854673597	93.15449288470	1	Mini percolation tank
NIC176	8.21792050203	93.15768176310	1	Mini percolation tank

NIC177	8.21750000000	93.52000000000	2	Percolation tank
NIC178	8.21750474197	93.18222461850	2	Percolation tank
NIC179	8.22068653018	93.18419415330	2	Percolation tank
NIC180	8.21202027230	93.53272748360	1	Mini percolation tank
NIC181	8.21467327626	93.52811238360	1	Mini percolation tank
NIC182	8.20876332979	93.51404828240	2	Percolation tank
NIC183	8.20731152235	93.54254504250	1	Mini percolation tank
NIC184	8.20608723864	93.51764474040	1	Mini percolation tank
NIC185	8.19739392914	93.50536972270	1	Mini percolation tank
NIC186	8.19970567967	93.51034325890	1	Mini percolation tank
NIC187	8.20166666667	93.50666666670	1	Mini percolation tank
NIC188	8.19001094717	93.50028186890	1	Mini percolation tank
NIC189	8.18692554370	93.51711168450	1	Mini percolation tank
NIC190	8.18530967913	93.48375756730	1	Mini percolation tank
NIC191	8.18299781494	93.47760807360	3	Pakka Check Dam
NIC192	8.18229535996	93.48515263680	1	Mini percolation tank
NIC193	8.17841359166	93.49319274150	1	Mini percolation tank
NIC194	8.18083193159	93.48885363090	1	Mini percolation tank
NIC195	8.17355292356	93.46923823740	2	Percolation tank
NIC196	8.16999400566	93.45970017830	2	Percolation tank
NIC197	8.16769933673	93.48860464290	1	Mini percolation tank
NIC198	8.16750000000	93.48250000000	1	Mini percolation tank
NIC199	8.16825965867	93.47682852180	1	Mini percolation tank
NIC200	8.16683924887	93.45734242040	1	Mini percolation tank
NIC201	8.16771987994	93.47152303260	1	Mini percolation tank
NIC202	8.17166666667	93.46986188780	1	Mini percolation tank
NIC203	8.16088375196	93.48301501820	1	Mini percolation tank
NIC204	8.16470601392	93.47856852220	1	Mini percolation tank
NIC205	8.16666666667	93.47500000000	1	Mini percolation tank
NIC206	8.15988785153	93.49983955750	1	Mini percolation tank
NIC207	8.15421690966	93.47342441670	1	Mini percolation tank
NIC208	8.15173127741	93.46869725880	1	Mini percolation tank
NIC209	8.14830607447	93.46750000000	1	Mini percolation tank
NIC210	8.14605615043	93.47105615040	1	Mini percolation tank
NIC211	8.14187357405	93.47892158480	2	Percolation tank
NIC212	8.12955268084	93.49326596690	1	Mini percolation tank
NIC213	8.13100301975	93.48722725510	1	Mini percolation tank
NIC214	8.12650449592	93.48310179840	1	Mini percolation tank
NIC215	8.11999476622	93.50951655870	2	Percolation tank
NIC216	8.11750000000	93.48083333330	1	Mini percolation tank
NIC217	8.11375485361	93.50784263720	1	Mini percolation tank
NIC218	8.11333333333	93.50358461230	1	Mini percolation tank
NIC219	8.10291666667	93.50729166670	1	Mini percolation tank
NIC220	8.12142865923	93.49247626070	1	Mini percolation tank
NIC221	8.11476703973	93.49037635040	1	Mini percolation tank

NIC222	8.10971176298	93.48772916590	1	Mini percolation tank
NIC223	8.10465728162	93.48851828460	1	Mini percolation tank
NIC224	8.11467054310	93.50267441520	2	Percolation tank
NIC225	8.09493542680	93.51555307740	1	Mini percolation tank
NIC226	8.09294434340	93.51434418130	1	Mini percolation tank
NIC227	8.09333333333	93.51083333330	2	Percolation tank
NIC228	8.08003516003	93.49960504810	1	Mini percolation tank
NIC229	8.03498338853	93.49412658770	1	Mini percolation tank
NIC230	8.03834133223	93.49081626340	1	Mini percolation tank
NIC231	8.02083845015	93.48834701830	1	Mini percolation tank
NIC232	8.01341444487	93.55595248130	1	Mini percolation tank
NIC233	8.01555259629	93.39084574950	2	Percolation tank
NIC234	8.01212827121	93.36789988100	3	Pakka Check Dam
NIC235	8.00356281045	93.36070236380	1	Mini percolation tank
NIC236	8.00915603069	93.39110756580	1	Mini percolation tank
NIC237	8.00344537439	93.37364554430	2	Percolation tank
NIC238	8.00376710112	93.56012445160	1	Mini percolation tank
NIC239	8.00128688653	93.33469711140	1	Mini percolation tank
NIC240	8.00615305663	93.33591326420	1	Mini percolation tank
NIC241	8.00186118090	93.37232147120	2	Percolation tank
NIC242	7.99437776503	93.34677797800	1	Mini percolation tank
NIC243	7.99906352326	93.34781270470	1	Mini percolation tank
NIC244	8.00388599812	93.34526332390	1	Mini percolation tank
NIC245	8.00630557231	93.34103046050	1	Mini percolation tank
NIC246	7.99166999984	93.37829215180	1	Mini percolation tank
NIC247	7.99465108264	93.37511630580	1	Mini percolation tank
NIC248	7.99126649464	93.52833315870	2	Percolation tank
NIC249	7.98747739809	93.57932017310	1	Mini percolation tank
NIC250	7.98691818456	93.37734702580	1	Mini percolation tank
NIC251	7.98506435379	93.32838467700	1	Mini percolation tank
NIC252	7.98247082397	93.35502944670	2	Percolation tank
NIC253	7.98299890992	93.35827142520	1	Mini percolation tank
NIC254	7.98270412536	93.37652075170	2	Percolation tank
NIC255	7.98100236144	93.51956402460	1	Mini percolation tank
NIC256	7.97814127289	93.54060654720	1	Mini percolation tank
NIC257	7.98099831153	93.55721523380	1	Mini percolation tank
NIC258	7.97754821650	93.55842985210	1	Mini percolation tank
NIC259	7.97541666667	93.57416666670	1	Mini percolation tank
NIC260	7.97588642469	93.34202741130	1	Mini percolation tank
NIC261	7.97363047787	93.35833333330	2	Percolation tank
NIC262	7.98316074632	93.36805361870	2	Percolation tank
NIC263	7.97794304190	93.36669414750	2	Percolation tank
NIC264	7.97320103011	93.36304442350	2	Percolation tank
NIC265	7.97348023536	93.52748913010	1	Mini percolation tank
NIC266	7.97040239762	93.32376532090	1	Mini percolation tank

NIC267	7.97285307974	93.53971144240	2	Percolation tank
NIC268	7.97262307582	93.55519740240	2	Percolation tank
NIC269	7.96997791485	93.55093247840	2	Percolation tank
NIC270	7.97065532663	93.54550821880	2	Percolation tank
NIC271	7.96757958723	93.39939295760	1	Mini percolation tank
NIC272	7.96551195334	93.57523172990	1	Mini percolation tank
NIC273	7.96759967348	93.38600319590	1	Mini percolation tank
NIC274	7.97003269135	93.38075873560	1	Mini percolation tank
NIC275	7.96873382915	93.37490201270	1	Mini percolation tank
NIC276	7.97266627444	93.36700117670	1	Mini percolation tank
NIC277	7.96533811503	93.40309104010	1	Mini percolation tank
NIC278	7.96135231002	93.36628820740	2	Percolation tank
NIC279	7.96300628375	93.56699371630	1	Mini percolation tank
NIC280	7.95936027497	93.57487036420	1	Mini percolation tank
NIC281	7.95262127914	93.37645508890	1	Mini percolation tank
NIC282	7.95764639464	93.37168632330	1	Mini percolation tank
NIC283	7.95402237342	93.36764979450	1	Mini percolation tank
NIC284	7.95218108055	93.41750747810	2	Percolation tank
NIC285	7.95863394324	93.56646233160	1	Mini percolation tank
NIC286	7.95295167121	93.56871499550	1	Mini percolation tank
NIC287	7.95298747052	93.57465087460	1	Mini percolation tank
NIC288	7.94503581501	93.43887187210	1	Mini percolation tank
NIC289	7.94375285615	93.44258972590	1	Mini percolation tank
NIC290	7.94040396792	93.41659156250	1	Mini percolation tank
NIC291	7.94734911973	93.38761207630	1	Mini percolation tank
NIC292	7.94753797565	93.38133895440	1	Mini percolation tank
NIC293	7.94847001814	93.37600636610	1	Mini percolation tank
NIC294	7.94417918990	93.37583560420	1	Mini percolation tank
NIC295	7.93884507106	93.37385691120	1	Mini percolation tank
NIC296	7.93283822733	93.42085414650	1	Mini percolation tank
NIC297	7.93628932092	93.45772475680	2	Percolation tank
NIC298	7.93746140479	93.45390382410	1	Mini percolation tank
NIC299	7.93685104005	93.36894100080	2	Percolation tank
NIC300	7.92876666161	93.44766974110	1	Mini percolation tank
NIC301	7.93122473559	93.45350244380	1	Mini percolation tank
NIC302	7.92373154895	93.41906533360	1	Mini percolation tank
NIC303	7.92677229683	93.42262139450	2	Percolation tank
NIC304	7.94259123558	93.39242461050	1	Mini percolation tank
NIC305	7.94066851757	93.38647174640	1	Mini percolation tank
NIC306	7.93500736419	93.38443070170	1	Mini percolation tank
NIC307	7.93072610187	93.37998247240	1	Mini percolation tank
NIC308	7.92551024455	93.37644495260	1	Mini percolation tank
NIC309	7.92168287808	93.37249079190	1	Mini percolation tank
NIC310	7.91612500997	93.36706486570	2	Percolation tank
NIC311	7.91943909218	93.45397112670	1	Mini percolation tank

NIC312	7.92274982872	93.45800421740	1	Mini percolation tank
NIC313	7.92743227579	93.45924852850	1	Mini percolation tank
NIC314	7.92481443047	93.39626178560	1	Mini percolation tank
NIC315	7.91989414261	93.39222071940	1	Mini percolation tank
NIC316	7.91441649111	93.39156200970	1	Mini percolation tank
NIC317	7.91492023649	93.39430410850	1	Mini percolation tank
NIC318	7.91985100963	93.43040471370	1	Mini percolation tank
NIC319	7.91358024471	93.43232007530	1	Mini percolation tank
NIC320	7.91784590591	93.42159122950	2	Percolation tank
NIC321	7.91204488825	93.41955031100	2	Percolation tank
NIC322	7.90829887312	93.46105022910	1	Mini percolation tank
NIC323	7.90790105028	93.39295518470	1	Mini percolation tank
NIC324	7.91025727082	93.40775437790	1	Mini percolation tank
NIC325	7.90252820434	93.38072364940	1	Mini percolation tank
NIC326	7.93368572676	93.39315749720	1	Mini percolation tank
NIC327	7.92942457944	93.38851122480	1	Mini percolation tank
NIC328	7.92374908560	93.38749935290	1	Mini percolation tank
NIC329	7.91871086920	93.38497277290	1	Mini percolation tank
NIC330	7.91313760099	93.38288311620	1	Mini percolation tank
NIC331	7.90917359239	93.37904912910	1	Mini percolation tank
NIC332	7.90368016996	93.38138345590	1	Mini percolation tank
NIC333	7.90107045648	93.36540276310	1	Mini percolation tank
NIC334	7.89927632589	93.38497397280	2	Percolation tank
NIC335	7.90630136698	93.38664039530	2	Percolation tank
NIC336	7.90111127545	93.38754074890	2	Percolation tank
NIC337	7.89722182704	93.35342395290	2	Percolation tank
NIC338	7.89472454442	93.46502298940	1	Mini percolation tank
NIC339	7.89443476357	93.38869089470	3	Pakka Check Dam
NIC340	7.88939049385	93.37092424710	1	Mini percolation tank
NIC341	7.88663761213	93.46102438440	1	Mini percolation tank
NIC342	7.88341372267	93.46614961620	1	Mini percolation tank
NIC343	7.37380209910	93.72031259460	1	Mini percolation tank
NIC344	7.37416666667	93.71541666670	1	Mini percolation tank
NIC345	7.37539414697	93.74238184440	2	Percolation tank
NIC346	7.36917226833	93.71356167980	2	Percolation tank
NIC347	7.37415988694	93.71118167200	2	Percolation tank
NIC348	7.36806880931	93.69317363620	3	Pakka Check Dam
NIC349	7.36335472510	93.68512632990	2	Percolation tank
NIC350	7.36936062056	93.68479421300	2	Percolation tank
NIC351	7.36202835650	93.69649364150	3	Pakka Check Dam
NIC352	7.36137943234	93.69599891040	1	Mini percolation tank
NIC353	7.35749573602	93.70336803700	1	Mini percolation tank
NIC354	7.35881551703	93.71799363570	2	Percolation tank
NIC355	7.35229103589	93.70004476500	2	Percolation tank
NIC356	7.34720784919	93.65283093600	1	Mini percolation tank

NIC357	7.34703595286	93.66883171660	1	Mini percolation tank
NIC358	7.34215989520	93.66756164220	1	Mini percolation tank
NIC359	7.33990873849	93.66791857390	1	Mini percolation tank
NIC360	7.34174497216	93.68076780970	1	Mini percolation tank
NIC361	7.33789700825	93.68355595210	1	Mini percolation tank
NIC362	7.34069798619	93.64874188200	2	Percolation tank
NIC363	7.33759302912	93.65689538840	2	Percolation tank
NIC364	7.33794287932	93.65063431390	2	Percolation tank
NIC365	7.33907438317	93.70638538170	1	Mini percolation tank
NIC366	7.33828146198	93.70423833560	1	Mini percolation tank
NIC367	7.33615928416	93.65498641340	3	Pakka Check Dam
NIC368	7.33195918715	93.65241207450	2	Percolation tank
NIC369	7.32655502429	93.66786680490	1	Mini percolation tank
NIC370	7.32498370934	93.66912520360	3	Pakka Check Dam
NIC371	7.32583333333	93.72500000000	2	Percolation tank
NIC372	7.32675239408	93.66368571600	2	Percolation tank
NIC373	7.32333839875	93.68730764140	1	Mini percolation tank
NIC374	7.31747738185	93.63890053100	1	Mini percolation tank
NIC375	7.31620656263	93.66748595050	1	Mini percolation tank
NIC376	7.31476021061	93.67477810570	1	Mini percolation tank
NIC377	7.31710245434	93.67003220560	1	Mini percolation tank
NIC378	7.31827271645	93.70351122590	2	Percolation tank
NIC379	7.29817932570	93.67659635600	1	Mini percolation tank
NIC380	7.29927630611	93.66529610890	2	Percolation tank
NIC381	7.29491734200	93.67207966600	2	Percolation tank
NIC382	7.30338886643	93.69059257760	1	Mini percolation tank
NIC383	7.29495063615	93.65697299620	1	Mini percolation tank
NIC384	7.30083333333	93.65416666670	1	Mini percolation tank
NIC385	7.29416502491	93.67079582710	1	Mini percolation tank
NIC386	7.28518905739	93.64048642720	2	Percolation tank
NIC387	7.28750000000	93.64750000000	1	Mini percolation tank
NIC388	7.28844677829	93.64395644690	1	Mini percolation tank
NIC389	7.27311804537	93.64380261210	2	Percolation tank
NIC390	7.27308365356	93.63789911190	2	Percolation tank
NIC391	7.27570245365	93.66926376610	1	Mini percolation tank
NIC392	7.27134165739	93.66661596810	1	Mini percolation tank
NIC393	7.25691358616	93.65499052380	1	Mini percolation tank
NIC394	7.25565811086	93.65021032710	1	Mini percolation tank
NIC395	7.25791040802	93.64507562600	1	Mini percolation tank
NIC396	7.26000000000	93.64166666670	1	Mini percolation tank
NIC397	7.23166666667	93.82083333330	1	Mini percolation tank
NIC398	7.21515803623	93.83730701720	1	Mini percolation tank
NIC399	7.20560662863	93.84229154200	1	Mini percolation tank
NIC400	7.20598671803	93.83603081360	1	Mini percolation tank
NIC401	7.20920195596	93.83062814850	1	Mini percolation tank

NIC402	7.20741575087	93.85511374550	1	Mini percolation tank
NIC403	7.20712197421	93.82362591570	2	Percolation tank
NIC404	7.19667807370	93.81994844900	2	Percolation tank
NIC405	7.20009570850	93.86810496030	1	Mini percolation tank
NIC406	7.19606647877	93.82890381690	2	Percolation tank
NIC407	7.19163960900	93.80500844730	3	Pakka Check Dam
NIC408	7.19427293332	93.79967757290	3	Pakka Check Dam
NIC409	7.18915806532	93.81250453220	1	Mini percolation tank
NIC410	7.18886982366	93.77059736510	1	Mini percolation tank
NIC411	7.18507518127	93.81992299480	1	Mini percolation tank
NIC412	7.19087252211	93.81832313680	1	Mini percolation tank
NIC413	7.17596621312	93.85597512900	2	Percolation tank
NIC414	7.17624699292	93.87379879960	1	Mini percolation tank
NIC415	7.17659495190	93.73647155610	1	Mini percolation tank
NIC416	7.17687286620	93.77477643750	1	Mini percolation tank
NIC417	7.17126683638	93.77530936420	1	Mini percolation tank
NIC418	7.17177987263	93.77721349510	1	Mini percolation tank
NIC419	7.17279785245	93.87069865550	2	Percolation tank
NIC420	7.16912180596	93.87535484960	2	Percolation tank
NIC421	7.17133304761	93.82195613890	2	Percolation tank
NIC422	7.17324562061	93.84477281920	1	Mini percolation tank
NIC423	7.17579332925	93.84998077670	1	Mini percolation tank
NIC424	7.16903342145	93.77370231090	1	Mini percolation tank
NIC425	7.17493409652	93.73559001950	4	Anicut
NIC426	7.16687989024	93.74727114960	1	Mini percolation tank
NIC427	7.17113224646	93.72418079390	4	Anicut
NIC428	7.16471453426	93.71754090110	4	Anicut
NIC429	7.17125000199	93.79124999670	2	Percolation tank
NIC430	7.16587578530	93.78338130540	2	Percolation tank
NIC431	7.16311346523	93.77536420990	2	Percolation tank
NIC432	7.16581976735	93.80750416480	3	Pakka Check Dam
NIC433	7.16533781588	93.70414139610	4	Anicut
NIC434	7.16486836446	93.73439441720	1	Mini percolation tank
NIC435	7.16089114829	93.81014490010	1	Mini percolation tank
NIC436	7.16034527173	93.76025131980	4	Anicut
NIC437	7.16218734014	93.71427926920	2	Percolation tank
NIC438	7.16392055579	93.74477508100	4	Anicut
NIC439	7.16047773196	93.86738350990	1	Mini percolation tank
NIC440	7.15648039292	93.80312093310	3	Pakka Check Dam
NIC441	7.15853825000	93.86679617520	3	Pakka Check Dam
NIC442	7.15860605804	93.77110936310	3	Pakka Check Dam
NIC443	7.15259619270	93.79416679750	1	Mini percolation tank
NIC444	7.15474156696	93.71738119120	2	Percolation tank
NIC445	7.16012361617	93.71520472320	2	Percolation tank
NIC446	7.15169749203	93.88328646080	1	Mini percolation tank

NIC447	7.15345556248	93.71169035380	1	Mini percolation tank
NIC448	7.15333534798	93.78013324050	3	Pakka Check Dam
NIC449	7.14887355907	93.80199750340	1	Mini percolation tank
NIC450	7.14966358667	93.79619465470	1	Mini percolation tank
NIC451	7.14976923455	93.73113268110	1	Mini percolation tank
NIC452	7.14931406831	93.74521951170	1	Mini percolation tank
NIC453	7.14296089682	93.83778760670	2	Percolation tank
NIC454	7.14226184750	93.75358845150	1	Mini percolation tank
NIC455	7.14832169256	93.75250799610	1	Mini percolation tank
NIC456	7.13827239364	93.81396267780	2	Percolation tank
NIC457	7.13980518270	93.76505587670	1	Mini percolation tank
NIC458	7.13926100659	93.76383315000	1	Mini percolation tank
NIC459	7.14146656146	93.71777113960	2	Percolation tank
NIC460	7.13949075358	93.70722513060	2	Percolation tank
NIC461	7.13568513763	93.70141525490	2	Percolation tank
NIC462	7.13577157682	93.77006884140	2	Percolation tank
NIC463	7.13616715112	93.77230167240	2	Percolation tank
NIC464	7.13207300471	93.81202097480	1	Mini percolation tank
NIC465	7.12884650782	93.69961559630	3	Pakka Check Dam
NIC466	7.13024569357	93.73542179930	1	Mini percolation tank
NIC467	7.12521012859	93.76520871470	1	Mini percolation tank
NIC468	7.12572510968	93.71174707970	1	Mini percolation tank
NIC469	7.13540470123	93.79253853080	1	Mini percolation tank
NIC470	7.12947002849	93.79046641920	1	Mini percolation tank
NIC471	7.12685480874	93.78529953480	1	Mini percolation tank
NIC472	7.13203881527	93.77766634040	1	Mini percolation tank
NIC473	7.12684377021	93.77490685530	1	Mini percolation tank
NIC474	7.12460278789	93.77051599670	1	Mini percolation tank
NIC475	7.12306370602	93.73285635590	1	Mini percolation tank
NIC476	7.12408671092	93.88099101480	1	Mini percolation tank
NIC477	7.12413683443	93.69106875810	1	Mini percolation tank
NIC478	7.12606743724	93.81263601980	2	Percolation tank
NIC479	7.12166984437	93.80986156090	2	Percolation tank
NIC480	7.12553193391	93.80174425500	2	Percolation tank
NIC481	7.12081379527	93.78021574710	2	Percolation tank
NIC482	7.12428572055	93.70693452150	3	Pakka Check Dam
NIC483	7.11919589449	93.77327851050	2	Percolation tank
NIC484	7.11921981230	93.76758316300	2	Percolation tank
NIC485	7.12332988904	93.83754286080	1	Mini percolation tank
NIC486	7.12532835459	93.84196966020	2	Percolation tank
NIC487	7.11975853382	93.71916770870	1	Mini percolation tank
NIC488	7.11666667571	93.72114284770	2	Percolation tank
NIC489	7.11746569931	93.73038419690	2	Percolation tank
NIC490	7.12497870309	93.75167940910	1	Mini percolation tank
NIC491	7.12348181290	93.75597089740	1	Mini percolation tank

NIC492	7.11975322986	93.75941870200	1	Mini percolation tank
NIC493	7.11895435111	93.68596087490	1	Mini percolation tank
NIC494	7.11508742201	93.82366541850	2	Percolation tank
NIC495	7.11105923944	93.76289057170	3	Pakka Check Dam
NIC496	7.11668509968	93.79767130370	2	Percolation tank
NIC497	7.11076708280	93.80958097230	2	Percolation tank
NIC498	7.11341916316	93.73075634990	1	Mini percolation tank
NIC499	7.11124018037	93.80055425010	2	Percolation tank
NIC500	7.11046286836	93.79533613630	2	Percolation tank
NIC501	7.11608526287	93.86579307410	2	Percolation tank
NIC502	7.11402922272	93.71992022910	1	Mini percolation tank
NIC503	7.11662121240	93.84673379590	1	Mini percolation tank
NIC504	7.10843846886	93.83891430000	1	Mini percolation tank
NIC505	7.10663314845	93.82322225620	1	Mini percolation tank
NIC506	7.10918186816	93.81788876310	1	Mini percolation tank
NIC507	7.10500000000	93.69583333330	2	Percolation tank
NIC508	7.10750819529	93.68838082230	2	Percolation tank
NIC509	7.10819098666	93.87296609950	3	Pakka Check Dam
NIC510	7.11083837448	93.75021247570	1	Mini percolation tank
NIC511	7.10979961778	93.75476166140	1	Mini percolation tank
NIC512	7.10461291521	93.75312765120	1	Mini percolation tank
NIC513	7.10726154369	93.75733758310	3	Pakka Check Dam
NIC514	7.10172471198	93.71472355430	2	Percolation tank
NIC515	7.10654798621	93.71660982220	2	Percolation tank
NIC516	7.11655718534	93.71382723430	2	Percolation tank
NIC517	7.11053542679	93.74174263270	1	Mini percolation tank
NIC518	7.10532155985	93.74326974040	1	Mini percolation tank
NIC519	7.10070917441	93.74673610270	1	Mini percolation tank
NIC520	7.09954781977	93.75215261050	1	Mini percolation tank
NIC521	7.11374751437	93.79028227760	3	Pakka Check Dam
NIC522	7.10573998015	93.78594914010	3	Pakka Check Dam
NIC523	7.09942470795	93.78496148990	3	Pakka Check Dam
NIC524	7.10192362452	93.84761637030	1	Mini percolation tank
NIC525	7.09636022115	93.84573250740	1	Mini percolation tank
NIC526	7.09535308120	93.68289242810	1	Mini percolation tank
NIC527	7.09480524841	93.84087731220	2	Percolation tank
NIC528	7.09580385157	93.78600662770	2	Percolation tank
NIC529	7.09394171276	93.79747605050	1	Mini percolation tank
NIC530	7.09222173527	93.79149900500	1	Mini percolation tank
NIC531	7.09339061447	93.87426039680	2	Percolation tank
NIC532	7.09400095223	93.88000605870	2	Percolation tank
NIC533	7.09358351101	93.75522669660	3	Pakka Check Dam
NIC534	7.09251730149	93.67580581600	2	Percolation tank
NIC535	7.09703214733	93.73468586760	1	Mini percolation tank
NIC536	7.09084173544	93.73473585340	1	Mini percolation tank

NIC537	7.09223130224	93.73933317970	1	Mini percolation tank
NIC538	7.08763788576	93.73736378010	1	Mini percolation tank
NIC539	7.08946479580	93.81657436750	1	Mini percolation tank
NIC540	7.09342839362	93.81891026470	1	Mini percolation tank
NIC541	7.08723170219	93.81817028160	1	Mini percolation tank
NIC542	7.08557074513	93.72379709210	2	Percolation tank
NIC543	7.08921246198	93.69162532590	1	Mini percolation tank
NIC544	7.09327678998	93.68679789950	1	Mini percolation tank
NIC545	7.08437633911	93.74571960270	1	Mini percolation tank
NIC546	7.08622054935	93.74705111410	4	Anicut
NIC547	7.08589925666	93.82403337080	1	Mini percolation tank
NIC548	7.08842956818	93.78492540130	1	Mini percolation tank
NIC549	7.09103060380	93.83337754270	2	Percolation tank
NIC550	7.08297698290	93.84139703470	1	Mini percolation tank
NIC551	7.08663236837	93.77501439450	1	Mini percolation tank
NIC552	7.09217066887	93.77386139500	1	Mini percolation tank
NIC553	7.08096616837	93.84262725890	1	Mini percolation tank
NIC554	7.07626394032	93.68152086230	1	Mini percolation tank
NIC555	7.08366485079	93.74525111500	3	Pakka Check Dam
NIC556	7.07655956931	93.87527652610	2	Percolation tank
NIC557	7.07738836931	93.88011749110	1	Mini percolation tank
NIC558	7.07667025244	93.67405733800	2	Percolation tank
NIC559	7.07848182389	93.81405796250	1	Mini percolation tank
NIC560	7.08004805962	93.81500784860	2	Percolation tank
NIC561	7.07925062468	93.72280978810	2	Percolation tank
NIC562	7.08174413511	93.73879336920	2	Percolation tank
NIC563	7.07747427756	93.73686167160	2	Percolation tank
NIC564	7.08091556727	93.86242192470	1	Mini percolation tank
NIC565	7.07900948013	93.82228556230	3	Pakka Check Dam
NIC566	7.07533042718	93.86445915230	1	Mini percolation tank
NIC567	7.07397091753	93.75455630610	1	Mini percolation tank
NIC568	7.06988276212	93.72181452790	4	Anicut
NIC569	7.07455255548	93.75084084670	3	Pakka Check Dam
NIC570	7.07980826455	93.71750341580	2	Percolation tank
NIC571	7.07480220921	93.71742643210	2	Percolation tank
NIC572	7.06915962667	93.71865313320	2	Percolation tank
NIC573	7.07342923604	93.73978769160	1	Mini percolation tank
NIC574	7.06678401946	93.70291989830	1	Mini percolation tank
NIC575	7.07198460102	93.69179335610	1	Mini percolation tank
NIC576	7.06693270940	93.84269344510	1	Mini percolation tank
NIC577	7.07217481730	93.71219853380	1	Mini percolation tank
NIC578	7.06576254140	93.71322755900	4	Anicut
NIC579	7.06644077371	93.75009322840	3	Pakka Check Dam
NIC580	7.06625196565	93.88609396580	3	Pakka Check Dam
NIC581	7.06834509641	93.80987385960	1	Mini percolation tank

NIC582	7.06416325280	93.81416736240	1	Mini percolation tank
NIC583	7.06666165491	93.83249822200	1	Mini percolation tank
NIC584	7.06181393887	93.82854846870	1	Mini percolation tank
NIC585	7.06348868334	93.83644521540	2	Percolation tank
NIC586	7.06328750035	93.71087797460	2	Percolation tank
NIC587	7.06298808365	93.75775132490	3	Pakka Check Dam
NIC588	7.06782236575	93.78395664960	1	Mini percolation tank
NIC589	7.06185189174	93.78441514670	1	Mini percolation tank
NIC590	7.05929065993	93.68181562530	2	Percolation tank
NIC591	7.06087919623	93.89063252650	1	Mini percolation tank
NIC592	7.05689335223	93.77583720700	2	Percolation tank
NIC593	7.05639601496	93.77134726190	2	Percolation tank
NIC594	7.06086591156	93.76760169150	2	Percolation tank
NIC595	7.06557006400	93.79437900800	1	Mini percolation tank
NIC596	7.06082113751	93.79617818170	1	Mini percolation tank
NIC597	7.05521154342	93.79810124900	1	Mini percolation tank
NIC598	7.06717250524	93.80593032660	1	Mini percolation tank
NIC599	7.06170379748	93.80763586380	1	Mini percolation tank
NIC600	7.05672853523	93.81247877480	3	Pakka Check Dam
NIC601	7.05908743699	93.72832152540	1	Mini percolation tank
NIC602	7.05351943676	93.72639313870	1	Mini percolation tank
NIC603	7.05481957047	93.73335750190	2	Percolation tank
NIC604	7.05320316342	93.72934779900	2	Percolation tank
NIC605	7.05239973671	93.80722476100	3	Pakka Check Dam
NIC606	7.05577462797	93.86915417050	2	Percolation tank
NIC607	7.06054494083	93.87015936820	2	Percolation tank
NIC608	7.05347246491	93.67895929650	1	Mini percolation tank
NIC609	7.04757691916	93.67754686650	1	Mini percolation tank
NIC610	7.04492300587	93.67814281700	1	Mini percolation tank
NIC611	7.05333329915	93.71639304630	4	Anicut
NIC612	7.04821303798	93.72359481470	2	Percolation tank
NIC613	7.05070050313	93.86598776770	1	Mini percolation tank
NIC614	7.04988205371	93.88678273750	3	Pakka Check Dam
NIC615	7.04358441938	93.71933947060	2	Percolation tank
NIC616	7.04166666667	93.75416666670	2	Percolation tank
NIC617	7.05457061800	93.67283075150	2	Percolation tank
NIC618	7.04866748658	93.67258352690	2	Percolation tank
NIC619	7.04271430451	93.67412366670	2	Percolation tank
NIC620	7.04668356430	93.82012292280	2	Percolation tank
NIC621	7.04020387178	93.78015199630	1	Mini percolation tank
NIC622	7.03946889092	93.78254784310	1	Mini percolation tank
NIC623	7.04115061538	93.71369898490	2	Percolation tank
NIC624	7.04096256154	93.77662555440	1	Mini percolation tank
NIC625	7.04833026018	93.69166580580	2	Percolation tank
NIC626	7.04309468776	93.68908212000	2	Percolation tank

NIC627	7.03758525640	93.69157827170	2	Percolation tank
NIC628	7.03931946493	93.69357138530	1	Mini percolation tank
NIC629	7.03743639032	93.74824277760	1	Mini percolation tank
NIC630	7.03662125801	93.69339297300	1	Mini percolation tank
NIC631	7.03952530804	93.82569219840	1	Mini percolation tank
NIC632	7.04571065320	93.82592914410	1	Mini percolation tank
NIC633	7.03871863434	93.81071507420	4	Anicut
NIC634	7.03382614459	93.84575764510	2	Percolation tank
NIC635	7.03367274408	93.84608846390	1	Mini percolation tank
NIC636	7.03762476192	93.71652978270	1	Mini percolation tank
NIC637	7.03235293604	93.87437401210	2	Percolation tank
NIC638	7.03529762789	93.87980837300	2	Percolation tank
NIC639	7.03665812158	93.75414553000	2	Percolation tank
NIC640	7.03762224074	93.89056151940	2	Percolation tank
NIC641	7.03898776532	93.89630278460	2	Percolation tank
NIC642	7.03578117711	93.83565740810	1	Mini percolation tank
NIC643	7.04521548165	93.83345022910	1	Mini percolation tank
NIC644	7.02841761076	93.74583333330	3	Pakka Check Dam
NIC645	7.03062328100	93.68064478470	3	Pakka Check Dam
NIC646	7.03749093800	93.70896779650	4	Anicut
NIC647	7.02998170909	93.79471337060	2	Percolation tank
NIC648	7.03447194019	93.90619108680	1	Mini percolation tank
NIC649	7.02929042276	93.70768775430	1	Mini percolation tank
NIC650	7.03068782735	93.69324552540	2	Percolation tank
NIC651	7.02735624563	93.77503599730	2	Percolation tank
NIC652	7.03148346066	93.88944385040	2	Percolation tank
NIC653	7.02960861254	93.88539732120	1	Mini percolation tank
NIC654	7.02384421757	93.79339868340	2	Percolation tank
NIC655	7.02283691898	93.70043723030	2	Percolation tank
NIC656	7.03261693297	93.73028604080	1	Mini percolation tank
NIC657	7.02919769280	93.72738328250	1	Mini percolation tank
NIC658	7.02346518099	93.72551686830	1	Mini percolation tank
NIC659	7.02195427935	93.78629422880	4	Anicut
NIC660	7.02117671793	93.77208880170	2	Percolation tank
NIC661	7.02171764875	93.82418136780	1	Mini percolation tank
NIC662	7.01858905449	93.80190174610	4	Anicut
NIC663	7.02697618100	93.84583333330	2	Percolation tank
NIC664	7.02137186791	93.74157780360	3	Pakka Check Dam
NIC665	7.01694499631	93.84620962440	2	Percolation tank
NIC666	7.01773582740	93.73950956420	1	Mini percolation tank
NIC667	7.01536418300	93.81835682840	2	Percolation tank
NIC668	7.01931739683	93.71768375960	2	Percolation tank
NIC669	7.01570421675	93.75336822830	1	Mini percolation tank
NIC670	7.01384930624	93.74759133730	1	Mini percolation tank
NIC671	7.01447618100	93.77166666670	2	Percolation tank

NIC672	7.01489430161	93.77206307960	4	Anicut
NIC673	7.02011905388	93.79389881190	2	Percolation tank
NIC674	7.01370464600	93.83183733380	3	Pakka Check Dam
NIC675	7.01246556868	93.84005875250	3	Pakka Check Dam
NIC676	7.01609748449	93.80238868950	3	Pakka Check Dam
NIC677	7.00960078817	93.88177532140	1	Mini percolation tank
NIC678	7.02047175084	93.87126382670	1	Mini percolation tank
NIC679	7.01672132762	93.87603142080	1	Mini percolation tank
NIC680	7.01675304593	93.88077392580	1	Mini percolation tank
NIC681	7.01379554528	93.71658304860	1	Mini percolation tank
NIC682	7.01070835537	93.73741924250	3	Pakka Check Dam
NIC683	7.01156446561	93.81105952310	1	Mini percolation tank
NIC684	7.01001679493	93.75662051160	4	Anicut
NIC685	7.01160660815	93.80584919490	2	Percolation tank
NIC686	7.01028088958	93.83814558290	1	Mini percolation tank
NIC687	7.00989859721	93.79577428590	1	Mini percolation tank
NIC688	7.00745073482	93.89689167290	2	Percolation tank
NIC689	7.00275563175	93.86840844840	1	Mini percolation tank
NIC690	7.00406942541	93.74878631220	4	Anicut
NIC691	7.00254536403	93.86195496210	2	Percolation tank
NIC692	7.00333457522	93.76737621130	3	Pakka Check Dam
NIC693	7.00243516556	93.77994136660	1	Mini percolation tank
NIC694	7.00106943909	93.77390227650	1	Mini percolation tank
NIC695	7.00295351322	93.74151971220	3	Pakka Check Dam
NIC696	6.99924668664	93.82978496080	3	Pakka Check Dam
NIC697	7.00113936887	93.76090506110	1	Mini percolation tank
NIC698	7.00771733609	93.72744414780	1	Mini percolation tank
NIC699	7.00274836868	93.72926978460	1	Mini percolation tank
NIC700	7.00174659513	93.73461477090	1	Mini percolation tank
NIC701	6.99659499459	93.85992602820	2	Percolation tank
NIC702	6.99755183219	93.76309969460	1	Mini percolation tank
NIC703	6.99807533941	93.87035887070	1	Mini percolation tank
NIC704	6.99458333961	93.74083333860	2	Percolation tank
NIC705	6.99165728331	93.81220977680	1	Mini percolation tank
NIC706	6.99497174033	93.83155643680	1	Mini percolation tank
NIC707	6.98858422556	93.74568519210	2	Percolation tank
NIC708	6.99256101483	93.80281572410	1	Mini percolation tank
NIC709	6.98739774713	93.81293261490	1	Mini percolation tank
NIC710	6.98727414805	93.75175989080	2	Percolation tank
NIC711	6.98924644659	93.86142921800	2	Percolation tank
NIC712	6.98439517883	93.75825088650	2	Percolation tank
NIC713	6.98248800940	93.76430143840	1	Mini percolation tank
NIC714	6.97824661508	93.80541310520	1	Mini percolation tank
NIC715	6.97845600528	93.81181744490	2	Percolation tank
NIC716	6.98103979276	93.84831694770	3	Pakka Check Dam

NIC717	6.98072397527	93.78431742640	2	Percolation tank
NIC718	6.98468566095	93.78652269760	2	Percolation tank
NIC719	6.97712144241	93.80075839060	2	Percolation tank
NIC720	6.97892629351	93.83623958540	3	Pakka Check Dam
NIC721	6.97995177069	93.92014622100	1	Mini percolation tank
NIC722	6.97511597211	93.78131121280	1	Mini percolation tank
NIC723	6.97348062017	93.89056225450	1	Mini percolation tank
NIC724	6.96628835246	93.76107355570	1	Mini percolation tank
NIC725	6.96671175992	93.89252474280	2	Percolation tank
NIC726	6.96899493622	93.82524513510	3	Pakka Check Dam
NIC727	6.96345830777	93.90699673150	1	Mini percolation tank
NIC728	6.96111327361	93.91235949720	1	Mini percolation tank
NIC729	6.96458826867	93.91266220690	1	Mini percolation tank
NIC730	6.96197435294	93.75457817330	1	Mini percolation tank
NIC731	6.96237814585	93.83731697870	1	Mini percolation tank
NIC732	6.95997007392	93.88722408640	3	Pakka Check Dam
NIC733	6.95881031619	93.85056370140	1	Mini percolation tank
NIC734	6.95914374180	93.84091744900	2	Percolation tank
NIC735	6.96059662357	93.87794521120	3	Pakka Check Dam
NIC736	6.96019303182	93.80907146850	1	Mini percolation tank
NIC737	6.95663802373	93.81354949440	1	Mini percolation tank
NIC738	6.95743162917	93.78835310130	1	Mini percolation tank
NIC739	6.95624562585	93.91397691550	1	Mini percolation tank
NIC740	6.95896285218	93.86568138610	1	Mini percolation tank
NIC741	6.95829897373	93.77892350730	1	Mini percolation tank
NIC742	6.95384210478	93.78179654670	2	Percolation tank
NIC743	6.95422448926	93.83378831640	2	Percolation tank
NIC744	6.95384289238	93.89798957790	3	Pakka Check Dam
NIC745	6.94894512532	93.80678228500	1	Mini percolation tank
NIC746	6.95090371570	93.89171834530	1	Mini percolation tank
NIC747	6.95633392958	93.90671806880	3	Pakka Check Dam
NIC748	6.94828417678	93.84064752810	2	Percolation tank
NIC749	6.94643287431	93.85111132590	1	Mini percolation tank
NIC750	6.94956690000	93.87054097960	1	Mini percolation tank
NIC751	6.95451162195	93.87257845420	1	Mini percolation tank
NIC752	6.95453327600	93.76888259350	1	Mini percolation tank
NIC753	6.95101734071	93.77401416710	1	Mini percolation tank
NIC754	6.94552468290	93.77489785390	1	Mini percolation tank
NIC755	6.94809190178	93.81492125400	2	Percolation tank
NIC756	6.95329839821	93.81802020020	2	Percolation tank
NIC757	6.94797817244	93.81733179780	2	Percolation tank
NIC758	6.94697103946	93.78321700970	2	Percolation tank
NIC759	6.94570407301	93.81409967210	1	Mini percolation tank
NIC760	6.94269053008	93.76967329450	1	Mini percolation tank
NIC761	6.94080571322	93.85351643210	1	Mini percolation tank

NIC762	6.94487635575	93.85095051630	1	Mini percolation tank
NIC763	6.94291562801	93.78857659090	1	Mini percolation tank
NIC764	6.93769480388	93.78863588580	1	Mini percolation tank
NIC765	6.93655296904	93.87729034590	1	Mini percolation tank
NIC766	6.93830850588	93.77826441550	1	Mini percolation tank
NIC767	6.93492431507	93.88543199620	2	Percolation tank
NIC768	6.93348020753	93.89410230040	2	Percolation tank
NIC769	6.93732107731	93.76852242990	3	Pakka Check Dam
NIC770	6.93364284767	93.83416666670	4	Anicut
NIC771	6.93535794360	93.78861846380	2	Percolation tank
NIC772	6.92753739961	93.89571145920	2	Percolation tank
NIC773	6.92438438926	93.90001979340	2	Percolation tank
NIC774	6.93863431874	93.90178101100	1	Mini percolation tank
NIC775	6.92544804356	93.89399418540	1	Mini percolation tank
NIC776	6.92158273869	93.89709964290	1	Mini percolation tank
NIC777	6.93321691402	93.80483295310	1	Mini percolation tank
NIC778	6.92904910644	93.80764282310	1	Mini percolation tank
NIC779	6.92348009735	93.80919450600	1	Mini percolation tank
NIC780	6.92236855556	93.80397680050	1	Mini percolation tank
NIC781	6.91976418870	93.78118259980	1	Mini percolation tank
NIC782	6.91864510782	93.80788968430	2	Percolation tank
NIC783	6.92159522673	93.82755455790	1	Mini percolation tank
NIC784	6.91729143501	93.82082622040	2	Percolation tank
NIC785	6.91880096793	93.82601938650	2	Percolation tank
NIC786	6.92378252505	93.86296834490	1	Mini percolation tank
NIC787	6.92830203918	93.82019554610	3	Pakka Check Dam
NIC788	6.91584879978	93.83249589190	3	Pakka Check Dam
NIC789	6.91477879382	93.78336548640	1	Mini percolation tank
NIC790	6.91731114593	93.83425354290	4	Anicut
NIC791	6.91332136522	93.85155841210	1	Mini percolation tank
NIC792	6.91243519227	93.85317685460	2	Percolation tank
NIC793	6.91549733252	93.86591566130	1	Mini percolation tank
NIC794	6.91329104460	93.82403895880	2	Percolation tank
NIC795	6.91824541620	93.82733969500	2	Percolation tank
NIC796	6.91270153597	93.86072796550	1	Mini percolation tank
NIC797	6.91587303626	93.88482542840	2	Percolation tank
NIC798	6.90983142253	93.88802030880	2	Percolation tank
NIC799	6.91387564226	93.84345397860	2	Percolation tank
NIC800	6.90622572561	93.89118418800	2	Percolation tank
NIC801	6.90582095732	93.88331049920	1	Mini percolation tank
NIC802	6.90342778106	93.79521866860	2	Percolation tank
NIC803	6.90180746632	93.79574002370	2	Percolation tank
NIC804	6.90081530966	93.84026374160	3	Pakka Check Dam
NIC805	6.89750673992	93.80238000170	1	Mini percolation tank
NIC806	6.89288526598	93.88215746960	1	Mini percolation tank

NIC807	6.89030951433	93.85583333330	2	Percolation tank
NIC808	6.89645302101	93.85980980750	1	Mini percolation tank
NIC809	6.89148657828	93.85621333490	1	Mini percolation tank
NIC810	6.89100620855	93.88856524520	2	Percolation tank
NIC811	6.89257137842	93.81437576830	1	Mini percolation tank
NIC812	6.88875915970	93.81628689070	1	Mini percolation tank
NIC813	6.89161364176	93.88129984200	1	Mini percolation tank
NIC814	6.88666783983	93.83165510310	1	Mini percolation tank
NIC815	6.88922220006	93.86565092860	1	Mini percolation tank
NIC816	6.88718482101	93.86006402230	1	Mini percolation tank
NIC817	6.88245588880	93.84479302910	2	Percolation tank
NIC818	6.88036191185	93.80868913970	1	Mini percolation tank
NIC819	6.88093903784	93.81486132510	1	Mini percolation tank
NIC820	6.88276923838	93.81648584580	2	Percolation tank
NIC821	6.87967375998	93.82219963090	3	Pakka Check Dam
NIC822	6.88151080245	93.83585053660	2	Percolation tank
NIC823	6.88187495282	93.85562215540	1	Mini percolation tank
NIC824	6.88495899265	93.85013610200	1	Mini percolation tank
NIC825	6.87517615606	93.82834570650	3	Pakka Check Dam
NIC826	6.87743582165	93.86179114090	1	Mini percolation tank
NIC827	6.88314790065	93.85945644220	1	Mini percolation tank
NIC828	6.88664627041	93.85432854540	1	Mini percolation tank
NIC829	6.87437295659	93.88489332360	1	Mini percolation tank
NIC830	6.87632595976	93.89022409540	2	Percolation tank
NIC831	6.88200270758	93.88969216780	2	Percolation tank
NIC832	6.87517214797	93.82273511730	1	Mini percolation tank
NIC833	6.87689411220	93.81129252690	1	Mini percolation tank
NIC834	6.86904932652	93.83738830640	1	Mini percolation tank
NIC835	6.86625815674	93.83336809660	1	Mini percolation tank
NIC836	6.85912131475	93.87090927050	1	Mini percolation tank
NIC837	6.86000184144	93.85510801250	1	Mini percolation tank
NIC838	6.85937113852	93.85818702930	1	Mini percolation tank
NIC839	6.85894712678	93.82900876100	1	Mini percolation tank
NIC840	6.85841077889	93.86367611350	2	Percolation tank
NIC841	6.85369401236	93.86137764390	2	Percolation tank
NIC842	6.85301981263	93.81485413810	1	Mini percolation tank
NIC843	6.85180544641	93.85894523790	2	Percolation tank
NIC844	6.85068524934	93.88657295430	1	Mini percolation tank
NIC845	6.83928595139	93.87429990770	1	Mini percolation tank
NIC846	6.84546163890	93.85747705290	3	Pakka Check Dam
NIC847	6.84386759604	93.82078067250	1	Mini percolation tank
NIC848	6.83916922315	93.81872977220	1	Mini percolation tank
NIC849	6.83674171965	93.81457488610	1	Mini percolation tank
NIC850	6.83321751103	93.82602727930	1	Mini percolation tank
NIC851	6.83119162157	93.82099778510	1	Mini percolation tank

NIC852	6.82683203774	93.81803765220	1	Mini percolation tank
NIC853	6.82161034763	93.88216375510	1	Mini percolation tank
NIC854	6.82077404456	93.88839081850	1	Mini percolation tank
NIC855	6.83016899958	93.87976849230	2	Percolation tank
NIC856	6.82633897370	93.88225819130	2	Percolation tank
NIC857	6.82395475777	93.88597730500	2	Percolation tank
NIC858	6.82496515876	93.83021145380	1	Mini percolation tank
NIC859	6.82366609976	93.82448820090	1	Mini percolation tank
NIC860	6.81420241255	93.83215953120	1	Mini percolation tank
NIC861	6.80993529049	93.82791239580	1	Mini percolation tank
NIC862	6.80590511291	93.83073540040	1	Mini percolation tank
NIC863	6.80759269060	93.82468737030	1	Mini percolation tank
NIC864	6.79203111601	93.82063988270	2	Percolation tank
NIC865	6.79020284176	93.84323830920	1	Mini percolation tank
NIC866	6.77186922004	93.81649226900	1	Mini percolation tank
NIC867	6.76489779504	93.83215676360	1	Mini percolation tank
NIC868	9.21382089307	92.80499116380	1	Mini percolation tank
NIC869	7.06371538567	93.68775581180	1	Mini percolation tank
NIC870	7.08500509343	93.71205148790	1	Mini percolation tank

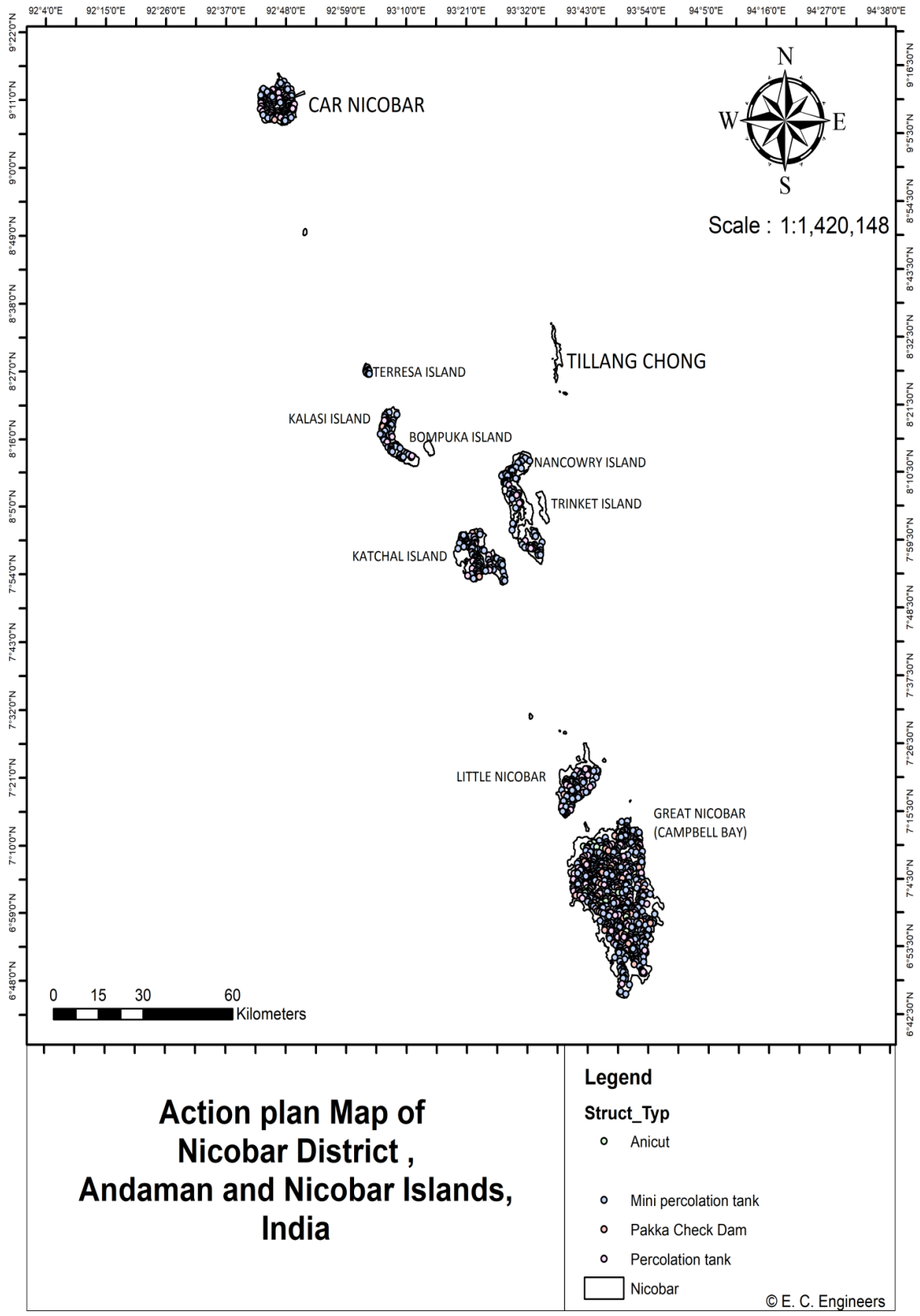


Fig:-11 Action plan map of Nicobar District