

# Land Restoration /Reclamation Monitoring of Opencast Coal Mines of WCL Based On Satellite Data for the Year 2008-09



**CMPDI**  
A Miniratna Company

**Land Restoration /Reclamation Monitoring of Opencast Coal  
Mines of WCL Based On Satellite Data for the Year- 2008-09**

**Remote Sensing Cell  
Geomatics Division  
CMPDI, Ranchi**

## **CONTENTS**

1.0	Background	1
2.0	Objective	2
3.0	Work plan	2
4.0	Land Reclamation in WCL	4

## **1.0 Background**

- 1.1** All human activities are based on the land which is most scarce natural resource in our country. Per capita land availability in India is the lowest owing to high population density and less land mass. Out of total 329 million hectare (mha) land mass of the country, coal mining is limited to only on 0.10% (0.36mha) area. As per XI Plan, to meet the energy demand of the country, coal production would be raised to 680 million tonnes by the end of the year 2011-12 for which about 40,000 hectare of land would have to be acquired for coal mining projects. It has been envisaged that 85% coal production would be from opencast mines, which causes land degradation due to ground breaking. There is an urgent need to reclaim and restore the mined out land for its productive use for sustainable development of the coal mining. This will not only mitigate environmental degradation, but would also enable coal companies to offer the restored lands to displaced families which would help in creating a more congenial environment for land acquisition in future.
- 1.2** Keeping above in view, Coal India Ltd. requested Central Mine Planning & Design Institute (CMPDI), Ranchi who has well a equipped remote sensing facilities and capabilities to develop an effective system of surveillance for land reclamation/restoration for all the opencast coal mines with production of more than 5 million cu. m. per annum (coal + OB taken together) based on remote sensing satellite data, regularly on annual basis for sustainable development of mining operation within command area of CIL and its subsidiaries. The annual land reclamation/restoration status report of all such mines to be put on the website of CIL, ([www.coalindia.nic.in](http://www.coalindia.nic.in)), CMPDI ([www.cmpdi.co.in](http://www.cmpdi.co.in)) and the concerned coal companies in public domain. Detail report to be submitted to State Pollution Control Board and MoEF and concerned CIL's subsidiaries. Such monitoring would not only facilitate in taking timely mitigation measures against environmental degradation,

but would also enable coal companies to utilize the reclaimed land for larger socio-economic benefits in a planned way.

- 1.3** CMPDI undertook the above assignment, and the present report is embodying the finding of the study carried out during 2008-09 for the projects for WCL.

## **2.0 Objective**

Objective of the land reclamation/restoration monitoring is to assess the area of backfilled, plantation, OB dumps, social forestry, active mining area, settlements and water bodies, distribution of wasteland, agricultural land and forest land in the leasehold area of the project. This is an important step taken up for assessing the progressive status of mined land reclamation and for taking up remedial measures, if any, required for environmental protection.

## **3.0 Work Plan**

- 3.1** Opencast projects of WCL producing more than 5 million cubic m. (Coal + OB together) during the year 2008-09 have been taken up for land restoration / reclamation monitoring based on the *RESOURCESAT-1* satellite data using ERDAS Imaging digital image processing s/w on GIS platform. Land reclamation monitoring will be carried out regularly on annual basis to assess the progressive status of land restoration / reclamation in the above opencast mines. The report of this study has also been uploaded in the website of CMPDI, CIL & WCL in public domain.

## **4.0 Land Reclamation Status in Western Coalfields Ltd.**

**4.1** Following 10 OC projects producing more than 5 million cubic m. (Coal + OB together) of Western Coalfields Ltd. have been taken up for land reclamation monitoring on annual basis:

- Sasti
- Padmapur
- Durgapur
- Mugoli
- Umrer
- Ukani
- Niljai
- New Majri + Kawadi
- Pimpalgaon
- Ghugus

**4.2** Out of the above 10 projects, 8 projects viz. Sasti, Durgapur, Padmapur, New Majri, Umrer, Mugoli, Niljai, and Ukani have also been mapped during the year 2005 for assessing the status of land reclamation for compliance of the stipulations of MoEF.

**4.3** Area statistics of different land use class present in OC projects is given in Table 4.1. Land use maps derived from the satellite data is given in Plate no. 4.1 to 4.10. Changes in land use status are shown in Fig. 4.1 - 4.10.

**4.4** Study reveals that 78.59% of mining area has already been reclaimed by WCL out of which 41.12% area has been revegetated and 37.47% area are backfilled.

**4.5** After analyzing the satellite data of year 2008, it is evident that plantation carried out on backfilled area, OB dumps as well as under social forestry in all the mines of WCL has increased from 12.42 Sq. Km. to 17.18 Sq. Km. in span of last three years.



TABLE 4.1 STATUS OF LAND RECLAMATION IN WESTERN COALFIELDS LTD BASED ON SATELLITE DATA OF THE YEAR 2008-09

	Sasti OCP		Padmapur OCP		Durgapur OCP		Mugoli OCP		Umrer OCP		Ukni OCP		Niljai OCP		Jew Majri-II(A) OCP		Pimpalgaon OCP		Ghugus OCP			
	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%		
<b>Vegetation Cover</b>																						
Dense Forest	0.00	0.00	0.031	0.42	0.02	0.23	0.00	0.00	0.000	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.00	0.00	0.00
Open Forest	0.00	0.00	0.003	0.04	0.04	0.45	0.00	0.00	0.000	0.00	0.005	0.07	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.00	0.00	0.00
Scrubs	0.48	3.78	1.181	16.10	0.81	9.12	0.98	12.44	0.453	4.80	1.138	16.47	0.61	12.50	0.02	0.70	0.710	14.42	0.00	0.00	0.00	0.00
<b>Total Forest</b>	<b>0.48</b>	<b>3.78</b>	<b>1.215</b>	<b>16.56</b>	<b>0.87</b>	<b>9.80</b>	<b>0.98</b>	<b>12.44</b>	<b>0.453</b>	<b>4.80</b>	<b>1.143</b>	<b>16.54</b>	<b>0.61</b>	<b>12.50</b>	<b>0.02</b>	<b>0.70</b>	<b>0.710</b>	<b>14.42</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Social Forestry	0.32	2.52	0.691	9.42	0.50	5.63	0.26	3.30	1.357	14.38	0.100	1.45	0.08	1.71	0.00	0.00	0.210	4.27	0.80	13.44		
Plantation on Backfilled	0.34	2.68	0.000	0.00	0.00	0.00	0.00	0.00	0.508	5.38	0.000	0.00	0.00	0.00	0.08	2.80	0.000	0.00	0.00	0.00		
Plantation on OB Dump	1.95	15.37	0.289	3.95	1.63	18.36	0.84	10.66	2.377	25.18	1.542	22.32	1.29	26.49	0.88	30.77	0.380	7.71	0.76	12.72		
<b>Total Plantation</b>	<b>2.61</b>	<b>20.57</b>	<b>0.980</b>	<b>13.37</b>	<b>2.13</b>	<b>23.99</b>	<b>1.10</b>	<b>13.96</b>	<b>4.242</b>	<b>44.94</b>	<b>1.642</b>	<b>23.77</b>	<b>1.37</b>	<b>28.20</b>	<b>0.96</b>	<b>33.57</b>	<b>0.590</b>	<b>11.98</b>	<b>1.56</b>	<b>26.16</b>		
<b>Total Vegetation(A)</b>	<b>3.09</b>	<b>24.35</b>	<b>2.195</b>	<b>29.93</b>	<b>3.00</b>	<b>33.79</b>	<b>2.08</b>	<b>26.40</b>	<b>4.695</b>	<b>49.74</b>	<b>2.785</b>	<b>40.31</b>	<b>1.98</b>	<b>40.70</b>	<b>0.98</b>	<b>34.27</b>	<b>1.300</b>	<b>26.40</b>	<b>1.56</b>	<b>26.16</b>		
<b>Mining Area</b>																						
Coal Quarry	0.36	2.84	0.330	4.52	0.46	5.18	0.92	11.68	1.509	15.99	1.103	15.96	0.22	4.41	0.56	19.58	0.494	10.03	0.08	1.27		
Advance quarry site	0.00	0.00	0.000	0.00	0.20	2.25	0.00	0.00	0.211	2.24	0.361	5.22	0.26	5.43	0.49	17.13	0.147	2.99	0.18	2.99		
Barra OB Dump	0.31	2.44	2.662	36.29	3.44	38.74	1.24	15.74	1.283	13.59	1.101	15.93	0.42	8.69	0.41	14.34	1.183	24.03	0.16	2.66		
Barra backfilled area	1.16	9.14	0.033	0.45	0.12	1.35	0.00	0.00	0.618	6.55	0.000	0.00	0.83	16.93	0.04	1.40	0.000	0.00	0.65	10.97		
Coal Dump	0.08	0.63	0.080	1.09	0.01	0.11	0.29	3.68	0.075	0.80	0.034	0.49	0.00	0.00	0.00	0.00	0.027	0.55	0.00	0.00		
Waterfilled quarry	0.09	0.71	0.000	0.00	0.00	0.00	0.00	0.00	0.114	1.21	0.060	0.87	0.18	3.67	0.00	0.00	0.029	0.60	0.00	0.00		
<b>Total Mining Area(B)</b>	<b>2.00</b>	<b>15.76</b>	<b>3.105</b>	<b>42.35</b>	<b>4.23</b>	<b>47.63</b>	<b>2.45</b>	<b>31.10</b>	<b>3.810</b>	<b>40.38</b>	<b>2.659</b>	<b>38.47</b>	<b>1.91</b>	<b>39.13</b>	<b>1.50</b>	<b>52.45</b>	<b>1.880</b>	<b>38.20</b>	<b>1.06</b>	<b>17.89</b>		
<b>Agriculture</b>																						
Drop lands	1.46	11.51	0.000	0.00	0.00	0.00	0.00	0.00	0.123	1.30	0.005	0.07	0.00	0.00	0.00	0.00	0.273	5.54	0.00	0.00		
Fallow Land	4.25	33.49	1.317	17.97	0.07	0.79	0.74	9.39	0.122	1.29	0.499	7.22	0.00	0.00	0.00	0.00	0.453	9.21	0.00	0.00		
<b>Total Agricultural(C)</b>	<b>5.71</b>	<b>45.00</b>	<b>1.317</b>	<b>17.97</b>	<b>0.07</b>	<b>0.79</b>	<b>0.74</b>	<b>9.39</b>	<b>0.245</b>	<b>2.59</b>	<b>0.504</b>	<b>7.29</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.726</b>	<b>14.75</b>	<b>0.00</b>	<b>0.00</b>		
<b>Wastelands</b>																						
Wastelands	1.08	8.51	0.461	6.29	0.93	10.48	2.48	31.47	0.264	2.79	0.802	11.61	0.70	14.34	0.31	10.84	0.838	17.00	2.21	37.21		
Fly Ash Pond	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.00		
Sand Body	0.00	0.00	0.052	0.66	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.00		
<b>Total Wastelands(D)</b>	<b>1.08</b>	<b>8.51</b>	<b>0.513</b>	<b>6.95</b>	<b>0.93</b>	<b>10.48</b>	<b>2.48</b>	<b>31.47</b>	<b>0.264</b>	<b>2.79</b>	<b>0.802</b>	<b>11.61</b>	<b>0.70</b>	<b>14.34</b>	<b>0.31</b>	<b>10.84</b>	<b>0.838</b>	<b>17.00</b>	<b>2.21</b>	<b>37.21</b>		
<b>Settlements</b>																						
Urban Settlement	0.04	0.32	0.043	0.59	0.39	4.40	0.00	0.00	0.146	1.54	0.000	0.00	0.02	0.47	0.00	0.00	0.093	1.90	0.55	9.22		
Rural Settlement	0.10	0.78	0.089	1.21	0.00	0.00	0.05	0.63	0.000	0.00	0.005	0.07	0.00	0.00	0.03	1.05	0.019	0.39	0.22	3.74		
Industrial Settlement	0.19	1.50	0.042	0.57	0.07	0.79	0.08	1.02	0.062	0.66	0.154	2.23	0.26	5.37	0.04	1.40	0.054	1.10	0.22	3.78		
<b>Total Settlements(E)</b>	<b>0.33</b>	<b>2.60</b>	<b>0.174</b>	<b>2.37</b>	<b>0.46</b>	<b>5.19</b>	<b>0.13</b>	<b>1.65</b>	<b>0.208</b>	<b>2.20</b>	<b>0.159</b>	<b>2.30</b>	<b>0.28</b>	<b>5.84</b>	<b>0.07</b>	<b>2.45</b>	<b>0.166</b>	<b>3.39</b>	<b>0.99</b>	<b>16.74</b>		
<b>Waterbodies(F)</b>																						
Waterbodies(F)	0.48	3.78	0.031	0.43	0.19	2.14	0.00	0.00	0.217	2.30	0.001	0.01	0.00	0.00	0.00	0.00	0.013	0.26	0.12	2.00		
<b>Total(A+B+C+D+E+F)</b>	<b>12.69</b>	<b>100.00</b>	<b>7.335</b>	<b>100.00</b>	<b>8.88</b>	<b>100.00</b>	<b>7.88</b>	<b>100.00</b>	<b>9.44</b>	<b>100.00</b>	<b>6.910</b>	<b>100.00</b>	<b>4.88</b>	<b>100.00</b>	<b>2.86</b>	<b>100.00</b>	<b>4.924</b>	<b>100.00</b>	<b>5.94</b>	<b>100.00</b>		
Note : The colour of the classes correspond to the colours on the Land Use Map Area in Sq.km																						

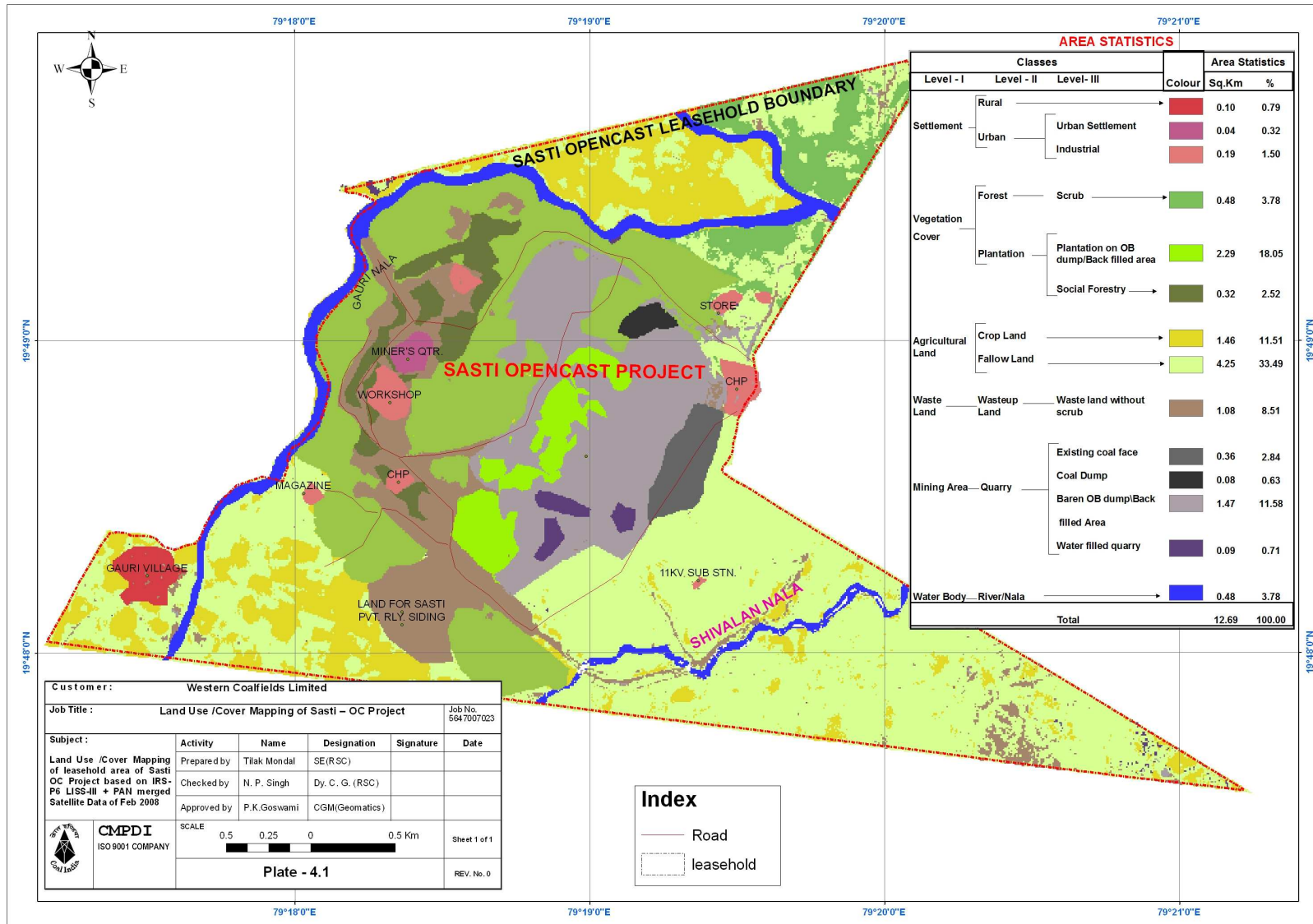


Plate 4.1



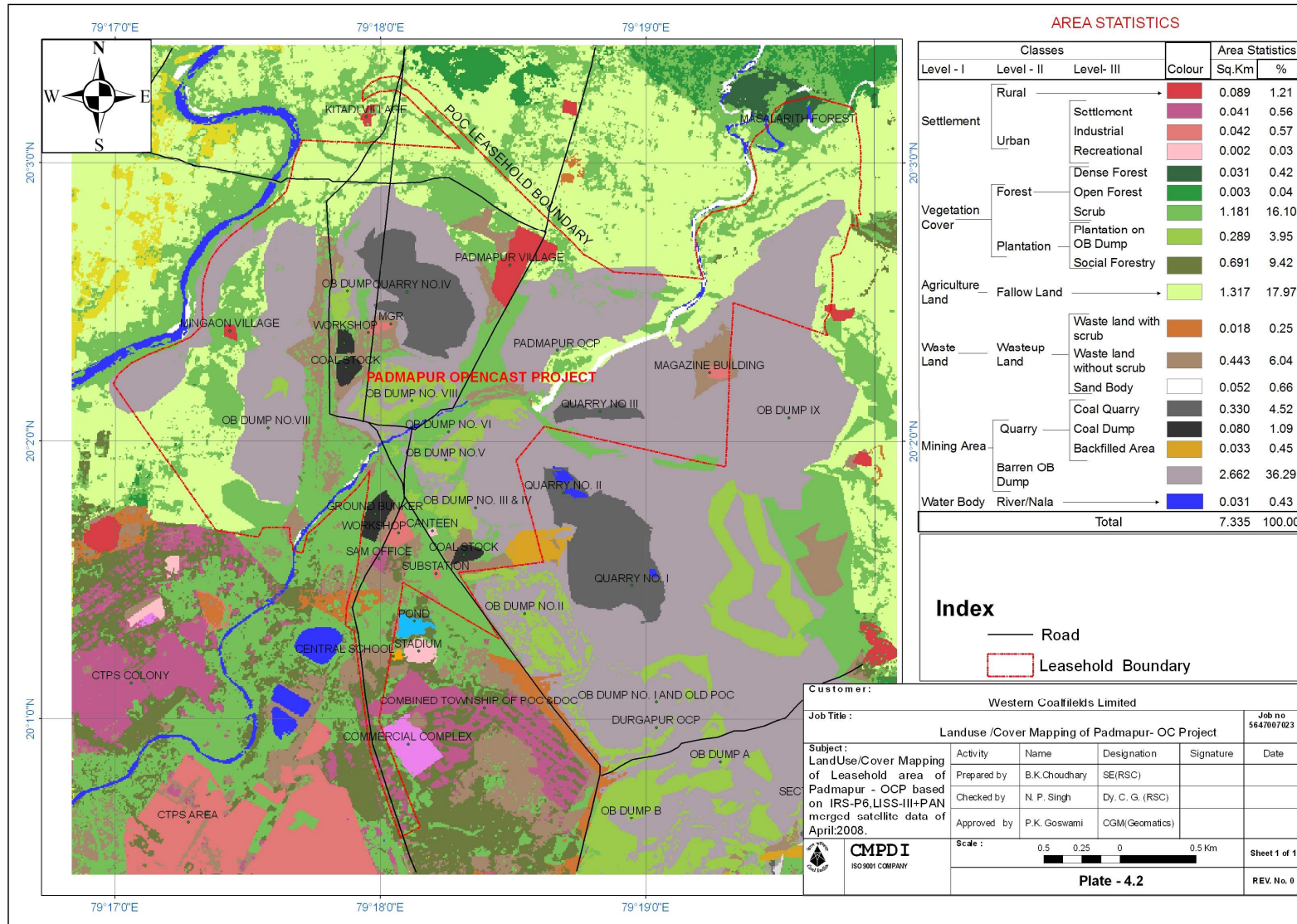


Plate 4.2

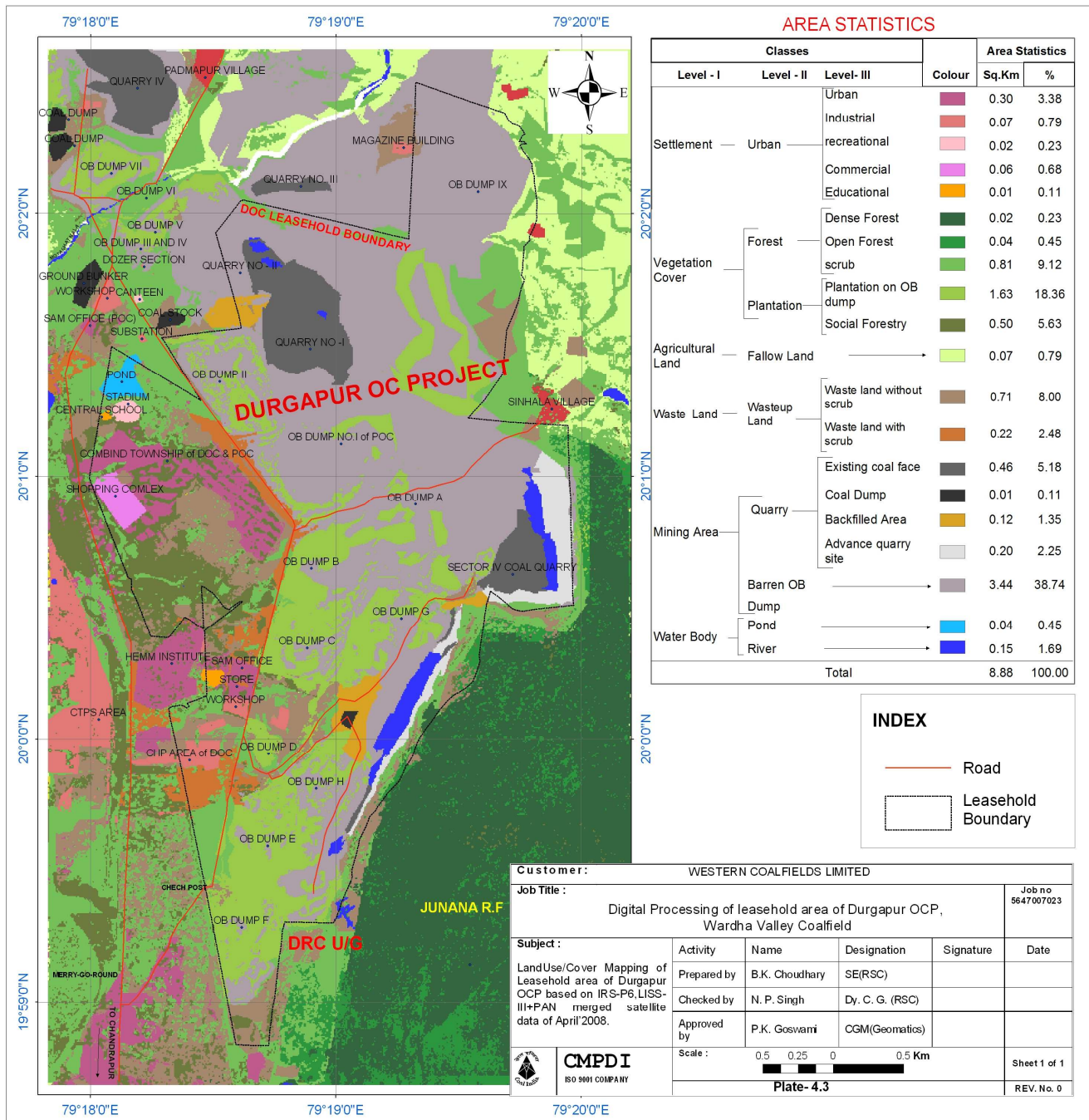


Plate 4.3



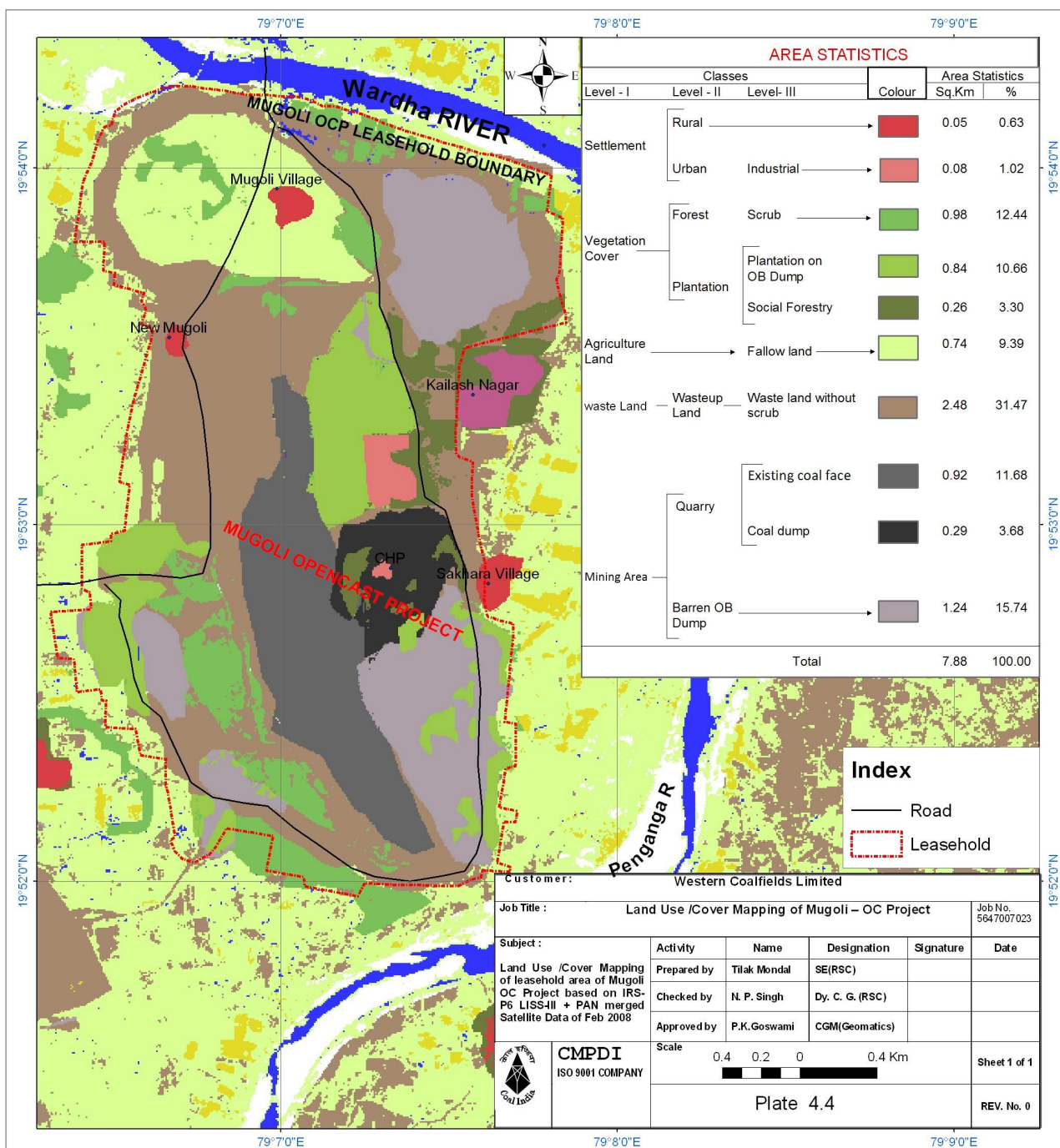


Plate 4.4

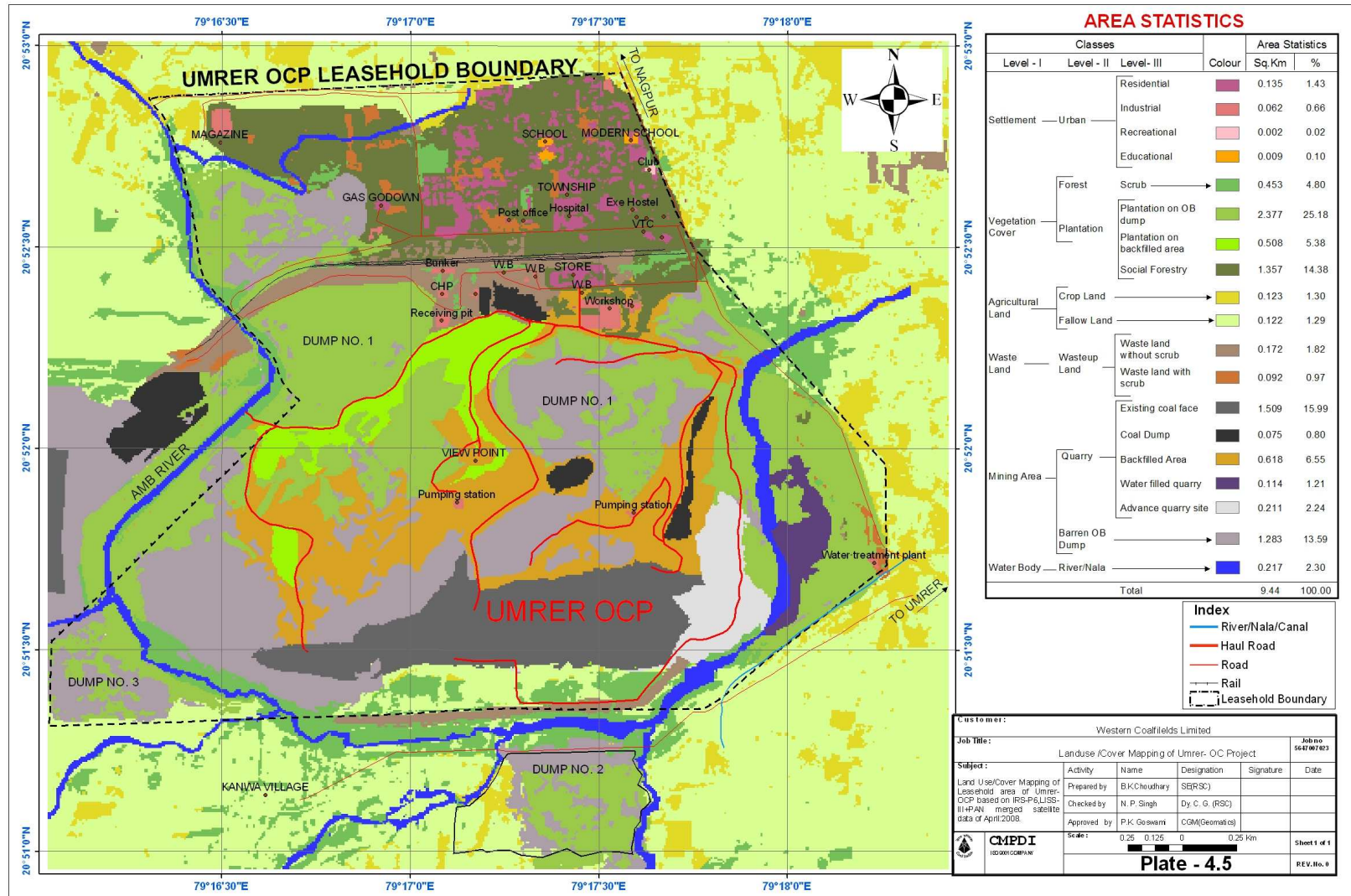


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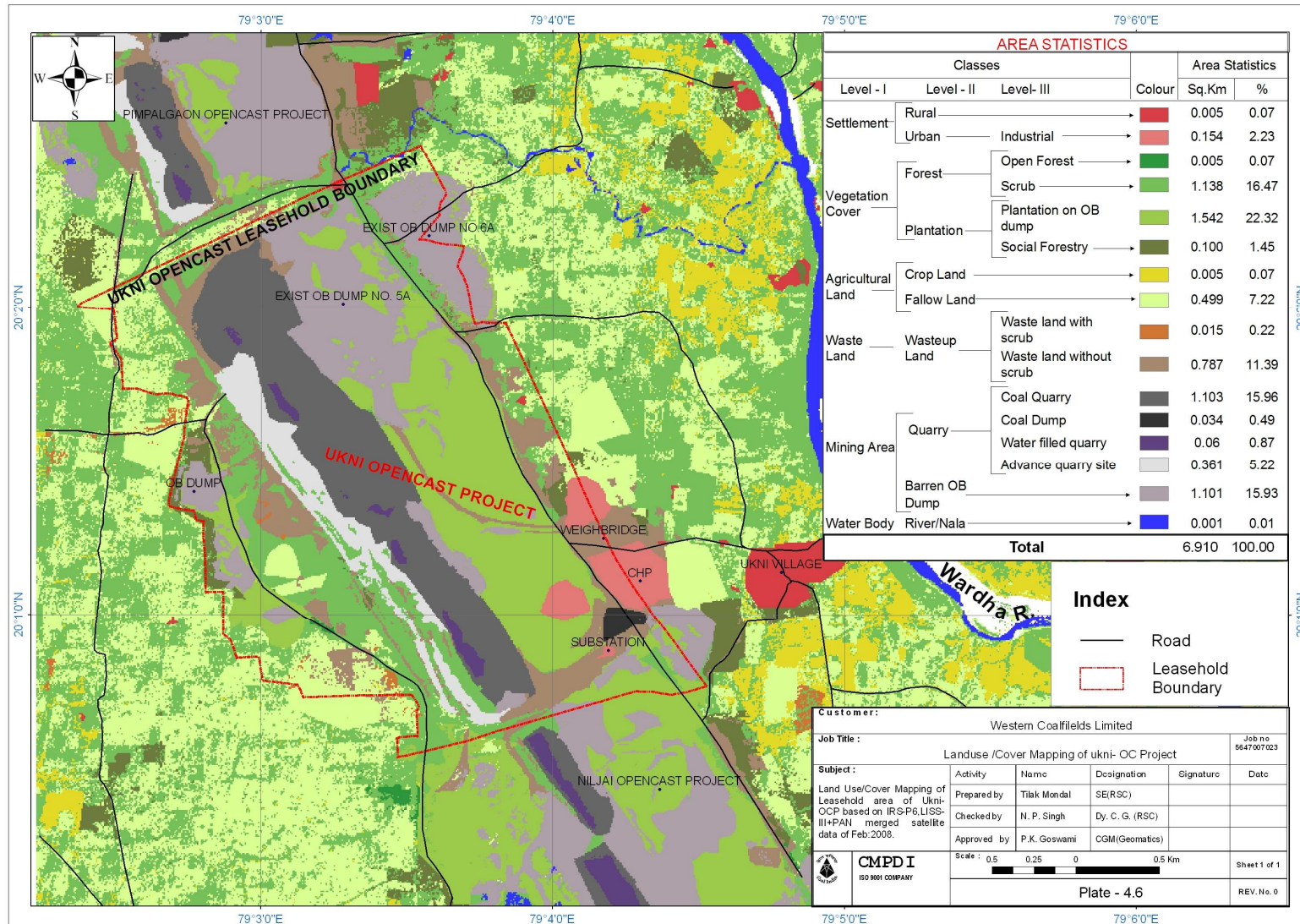


Plate 4.6



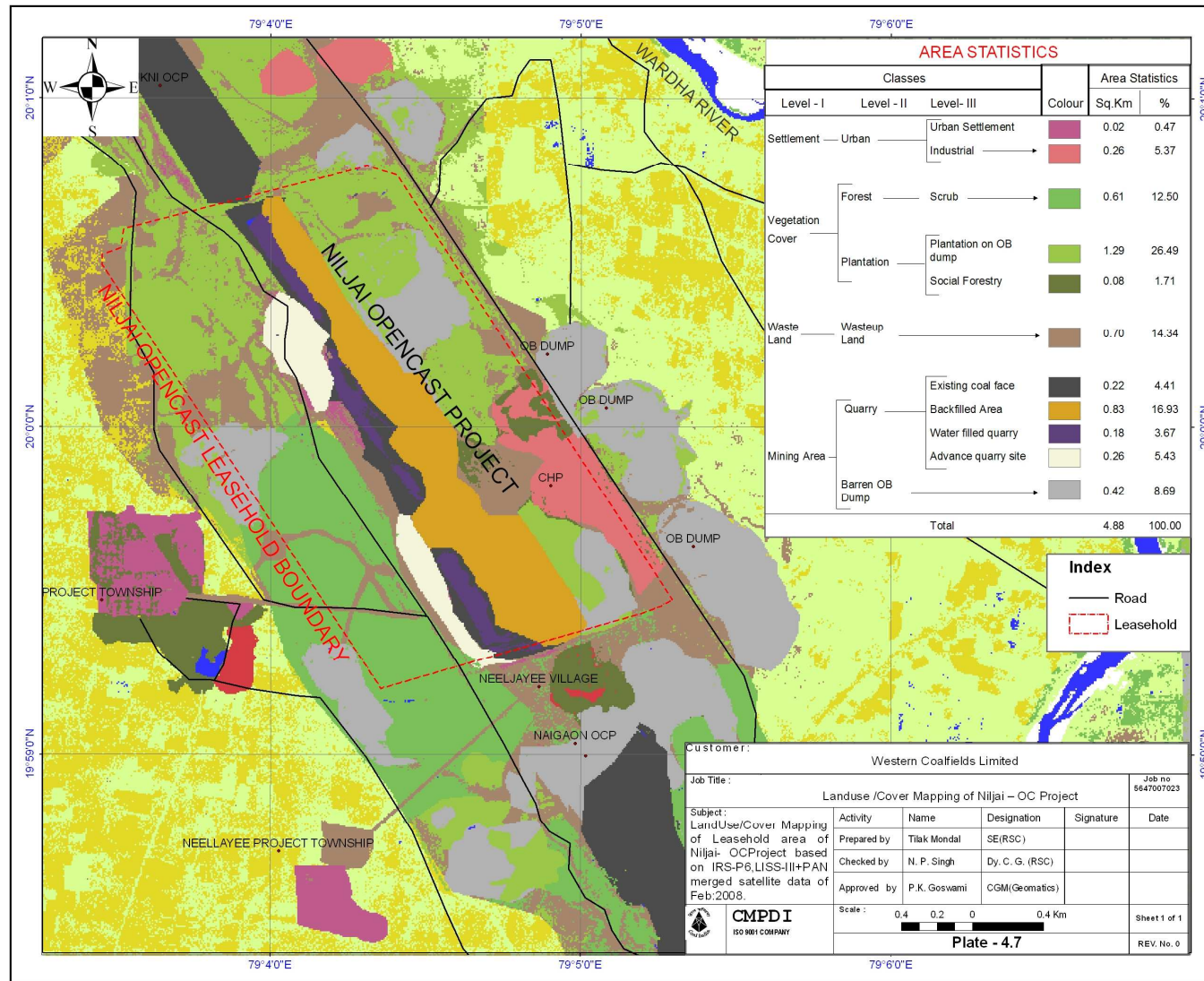


Plate 4.7

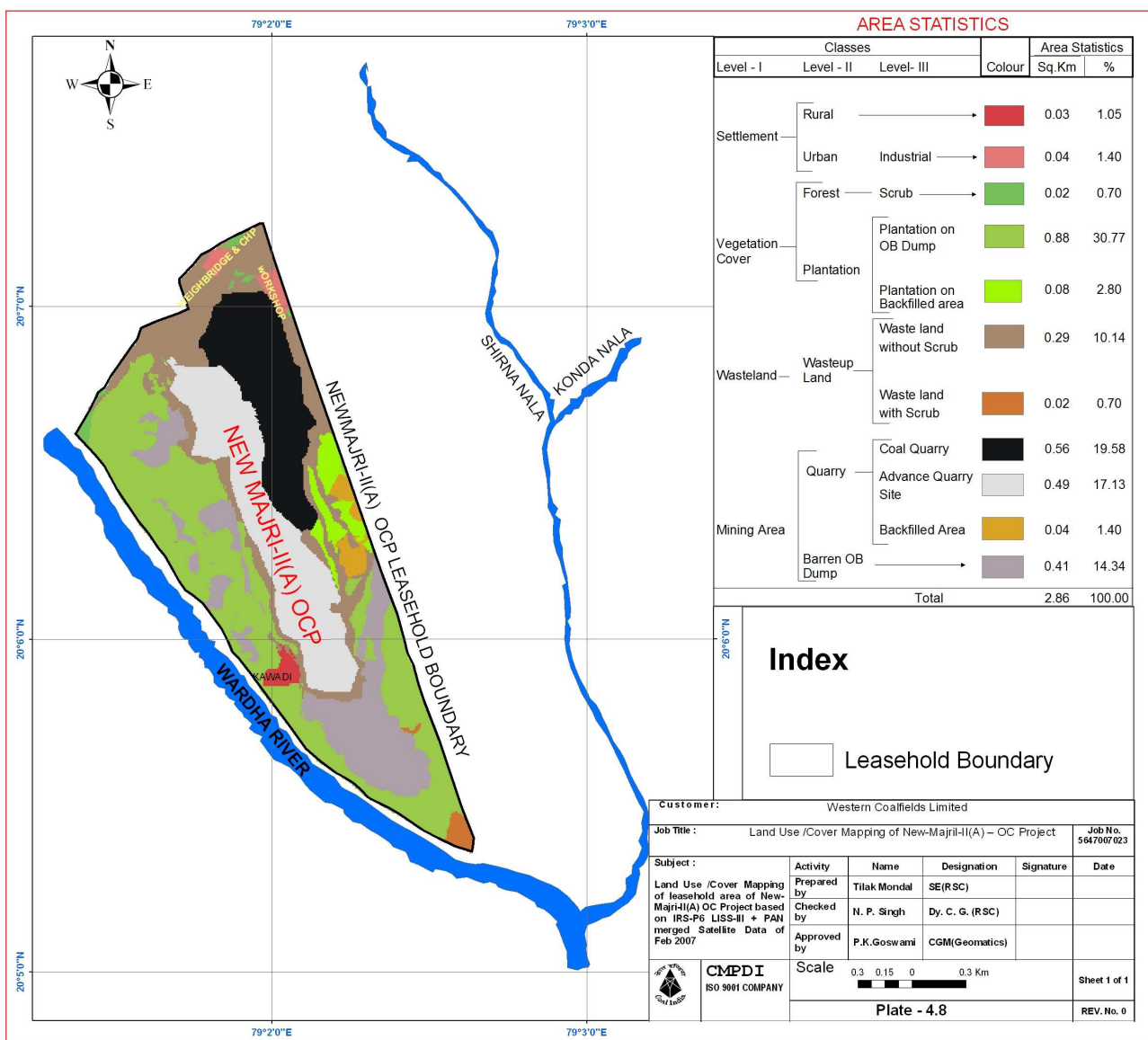


Plate 4.8

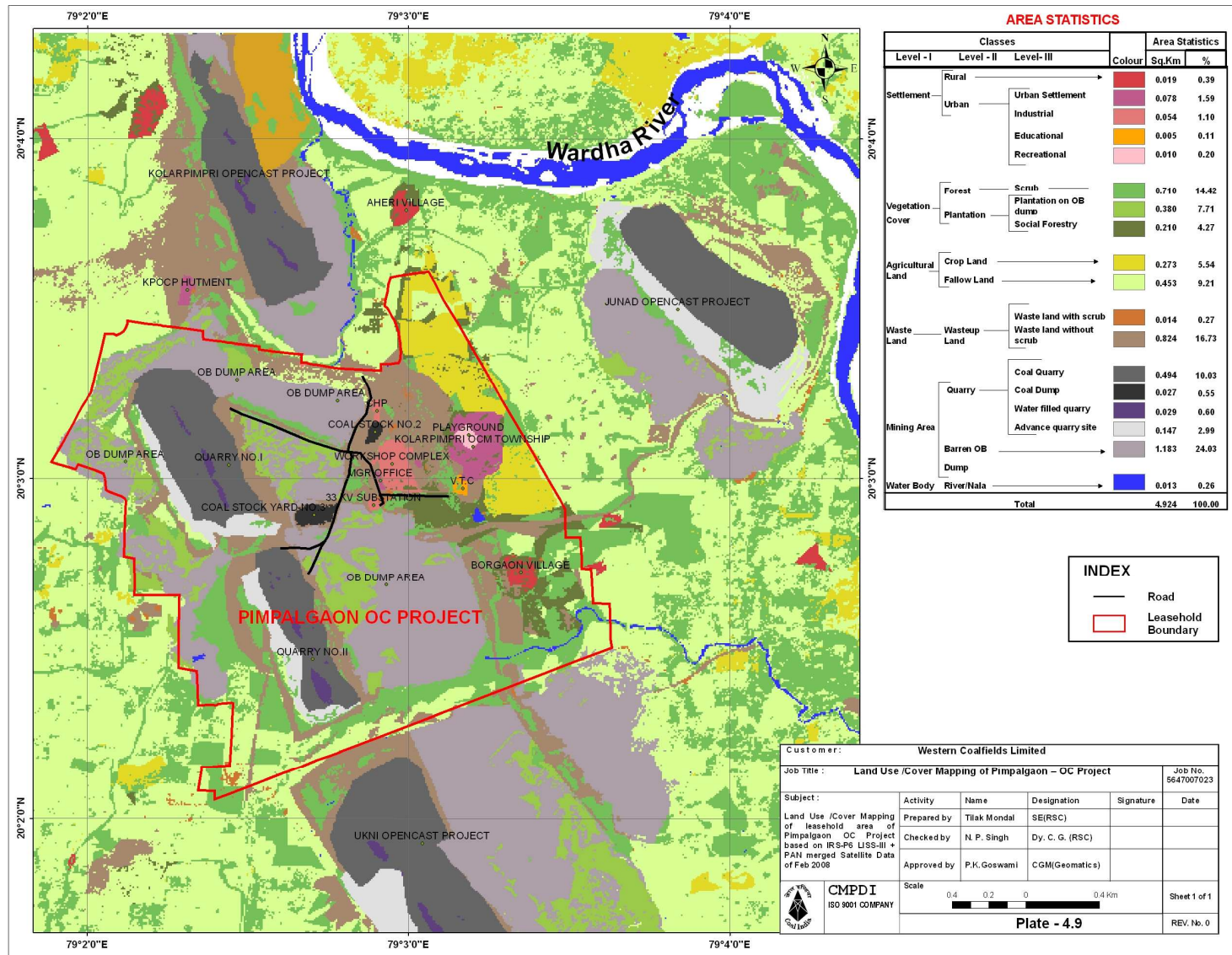


Plate 4.9



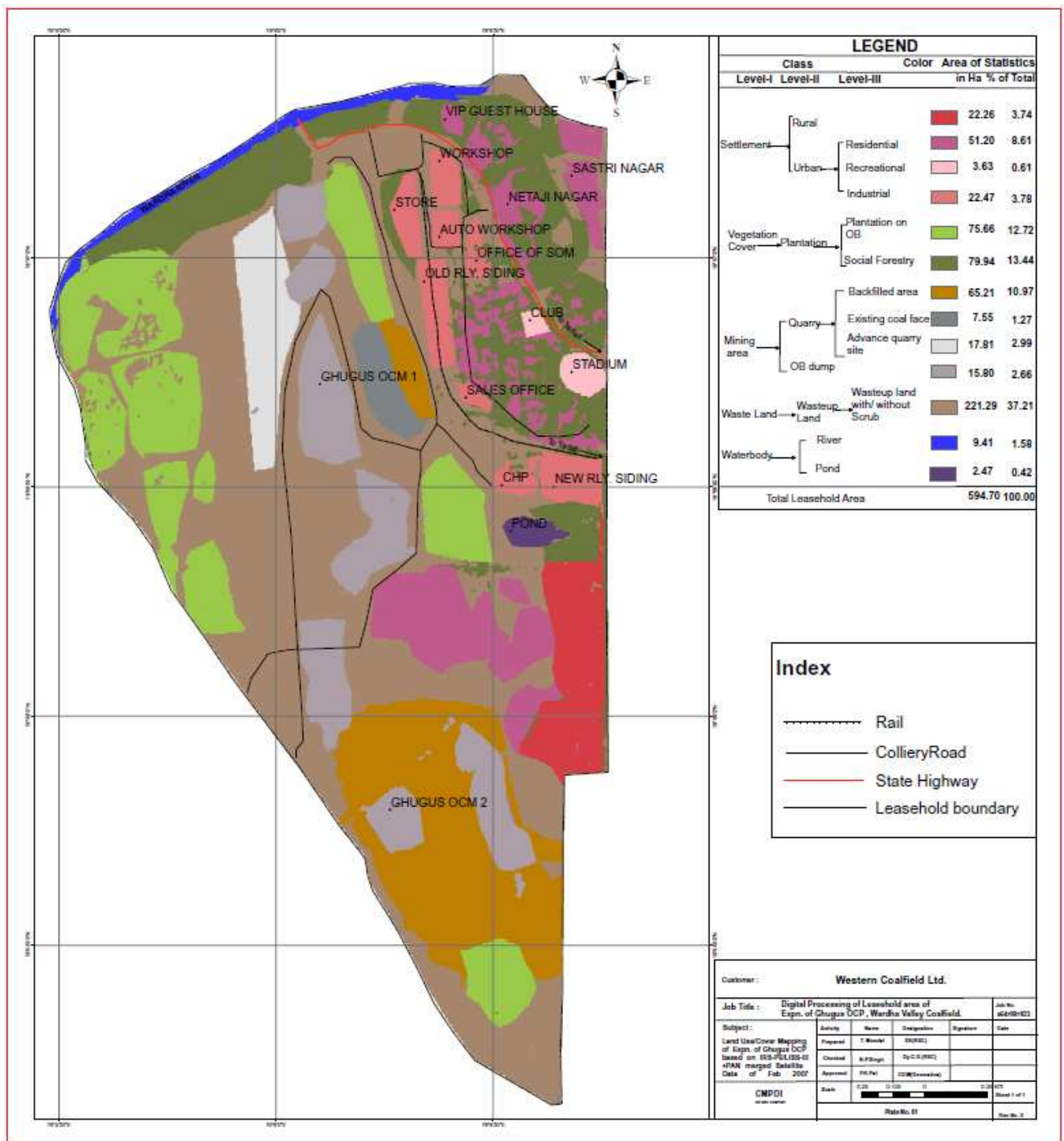


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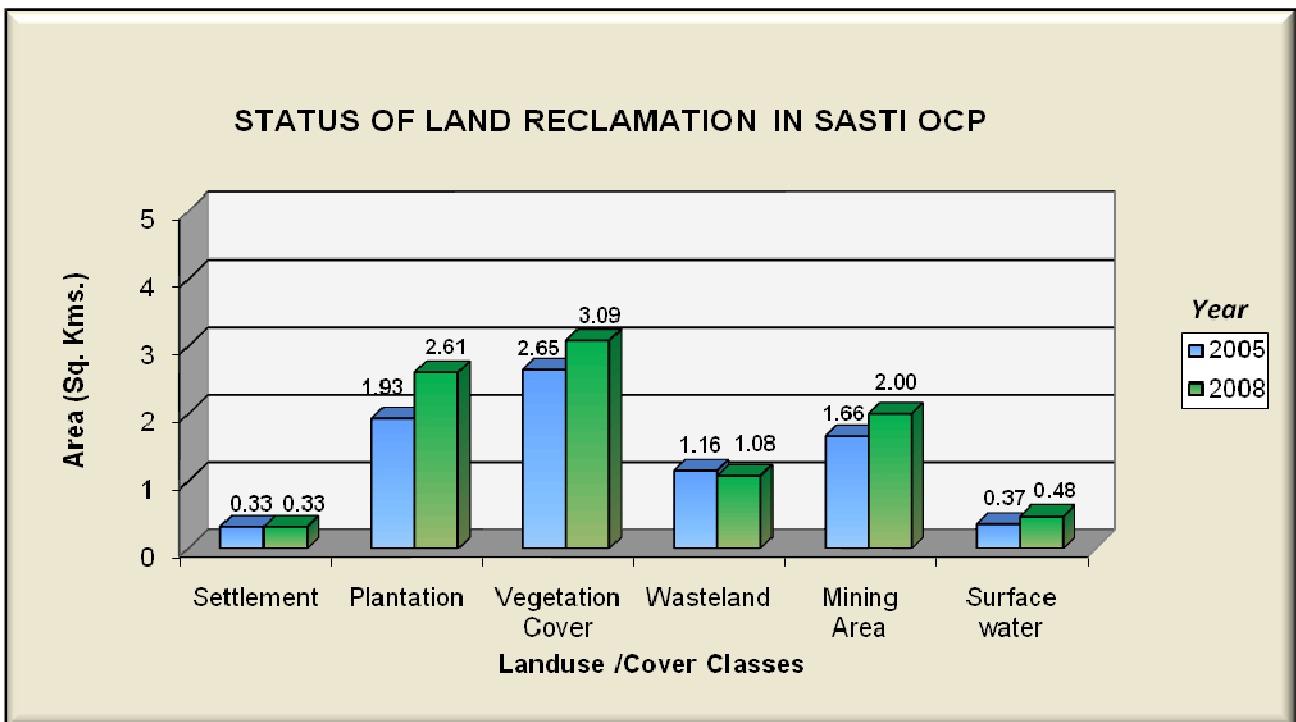


Figure 4.1

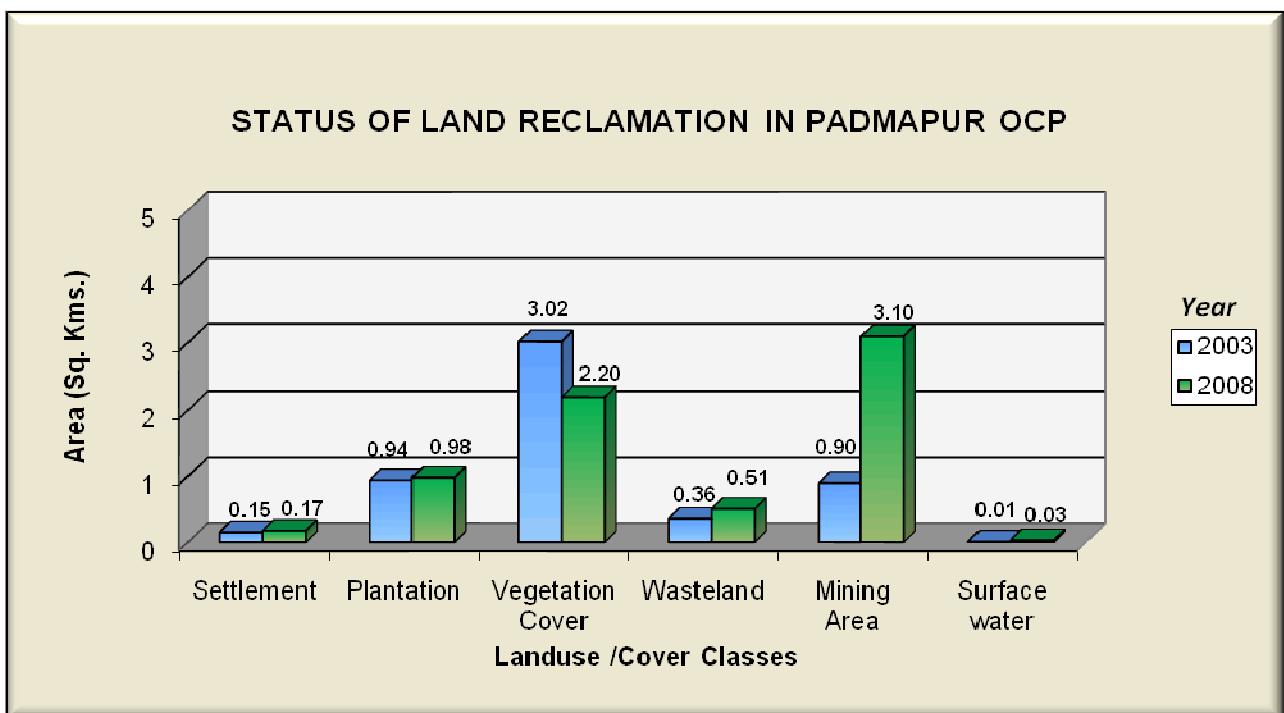


Figure 4.2



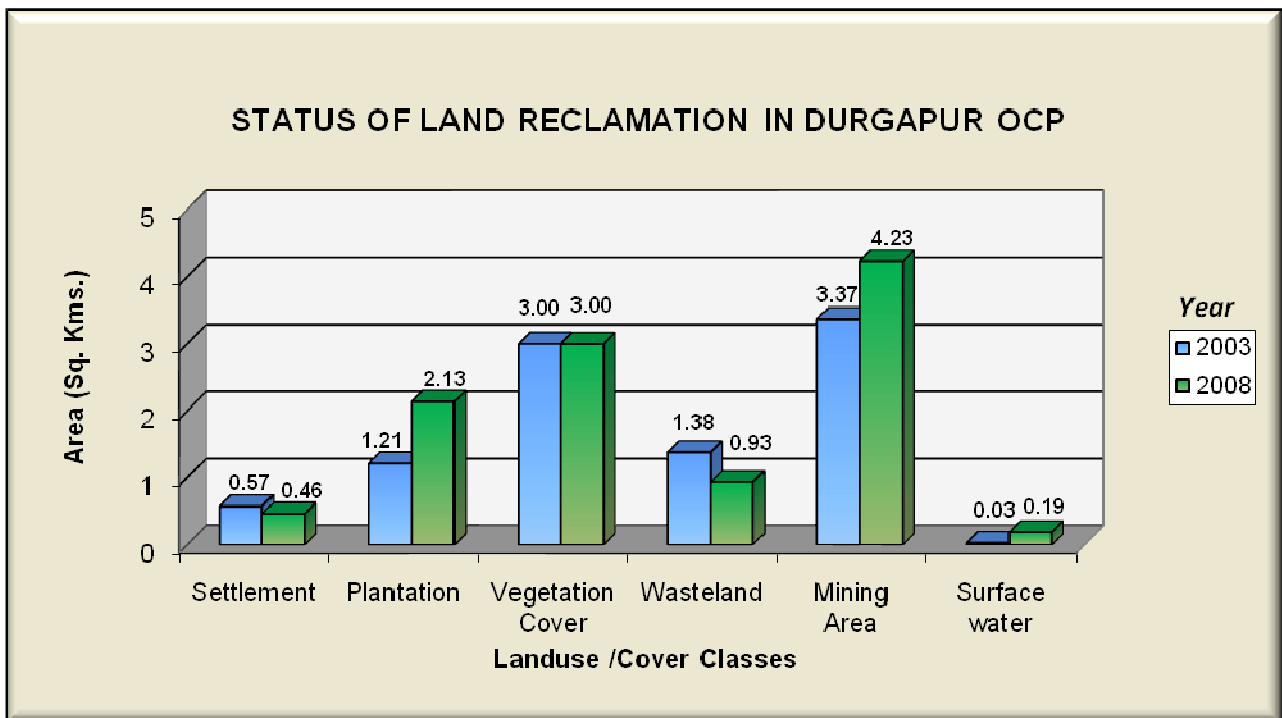


Figure 4.3

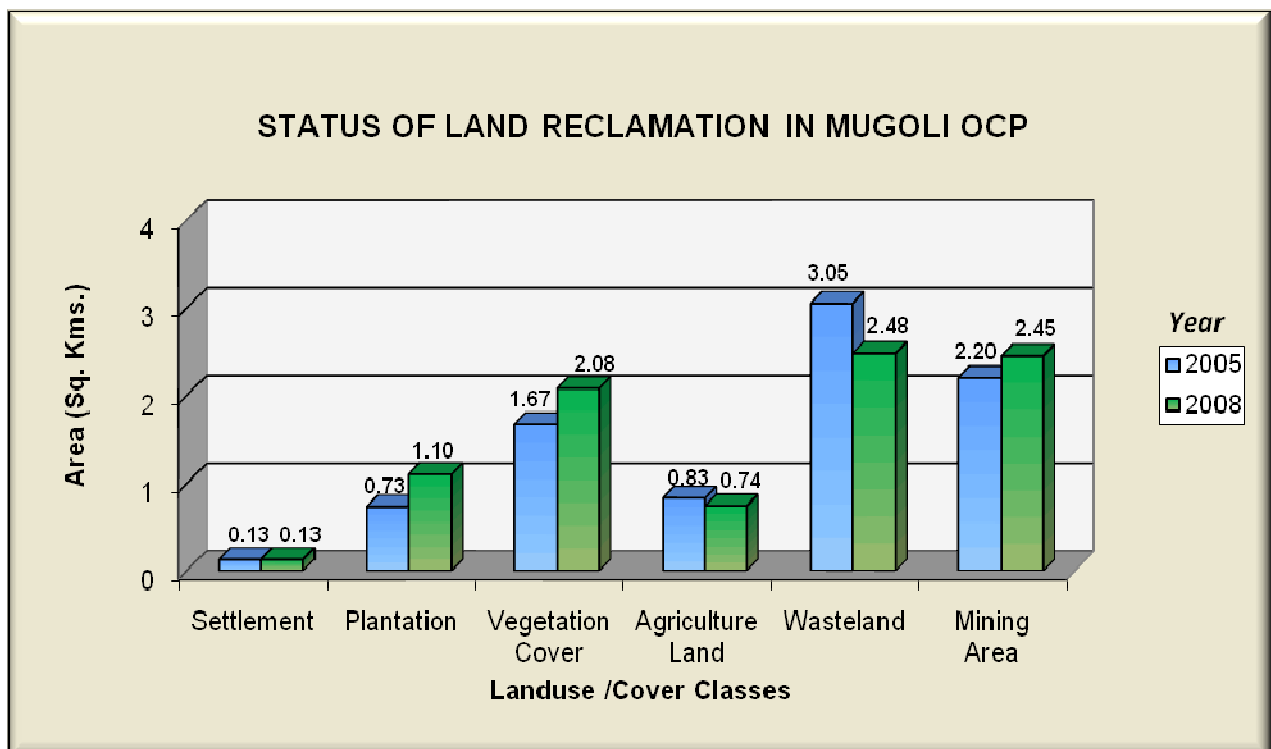


Figure 4.4

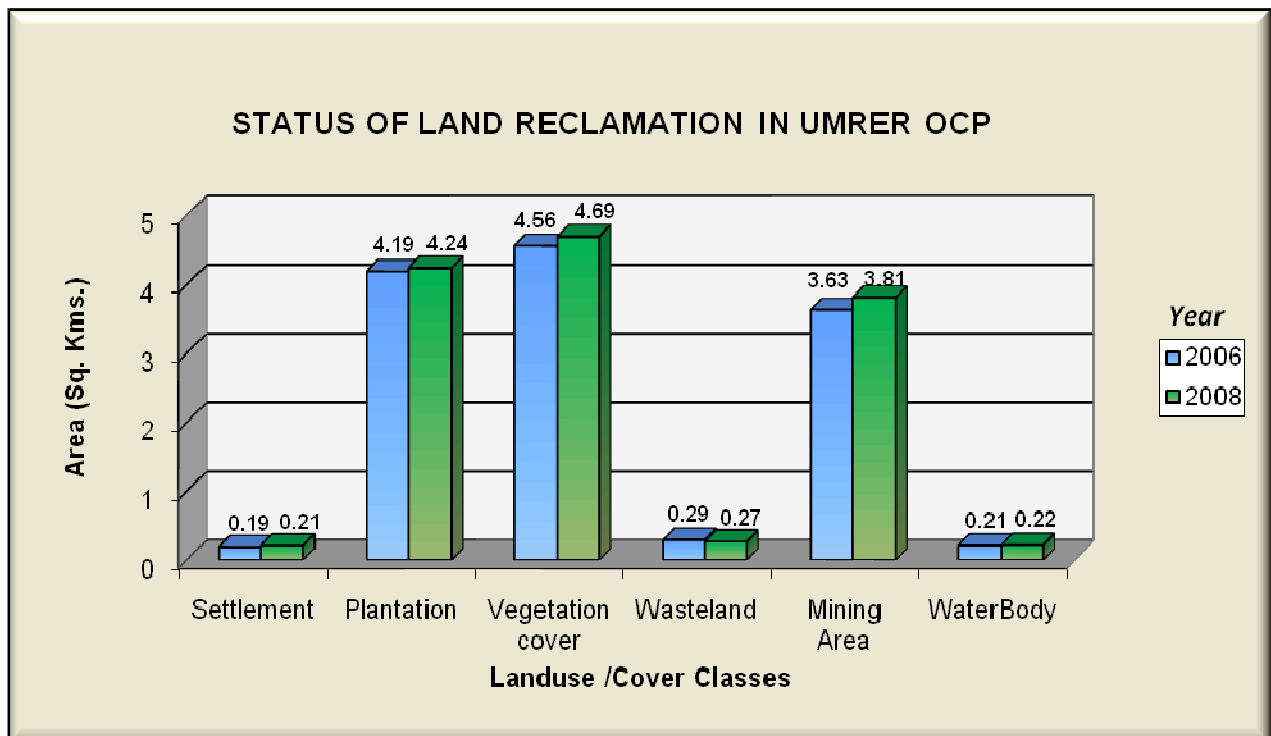


Figure 4.5

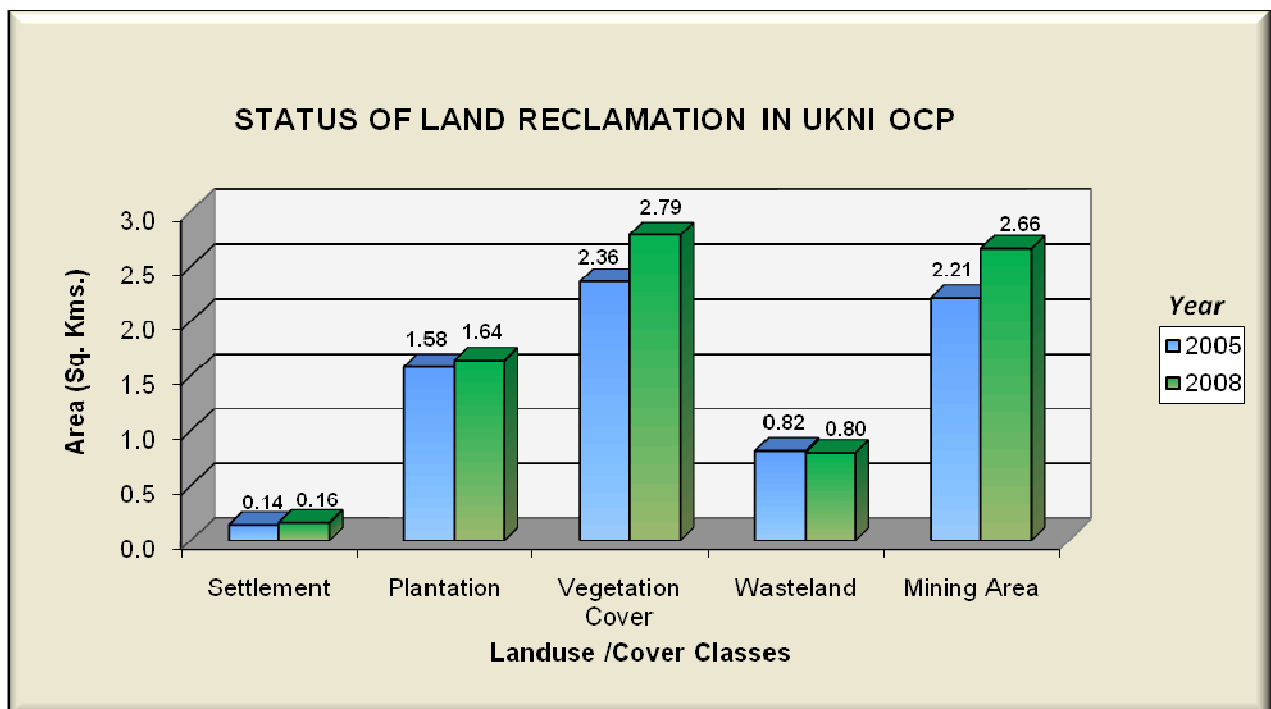


Figure 4.6

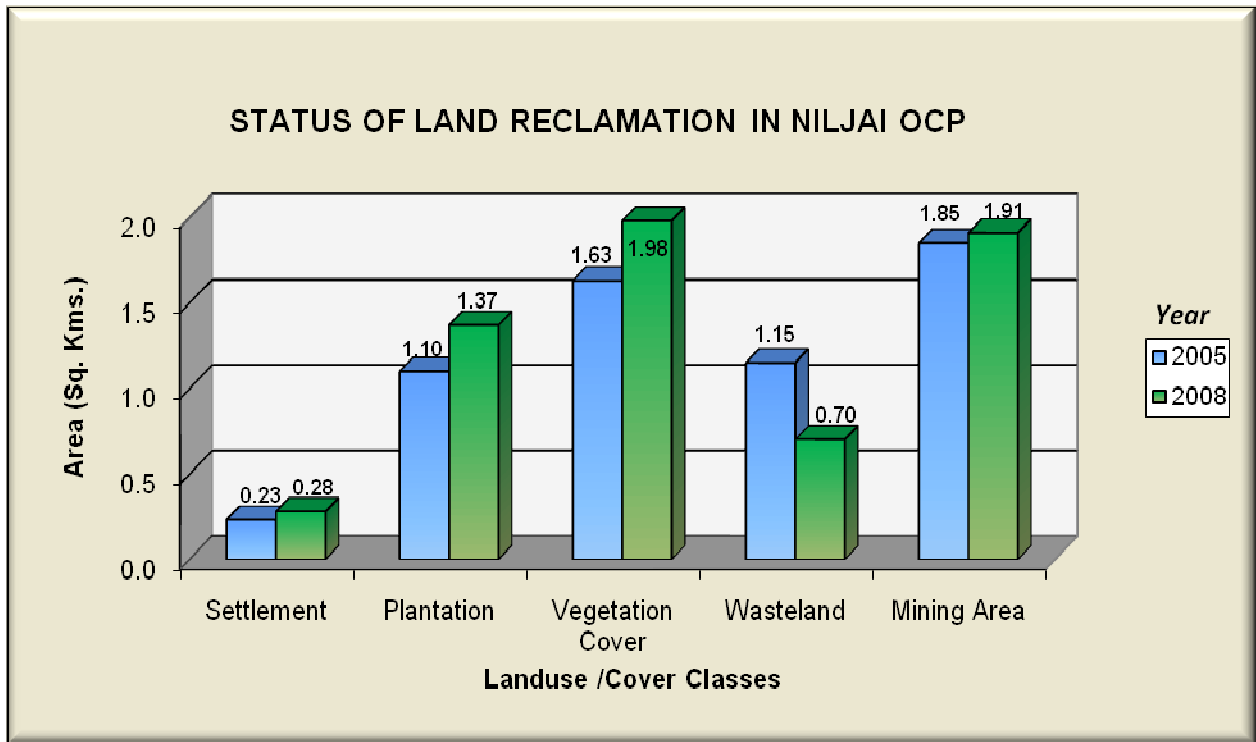


Figure 4.7

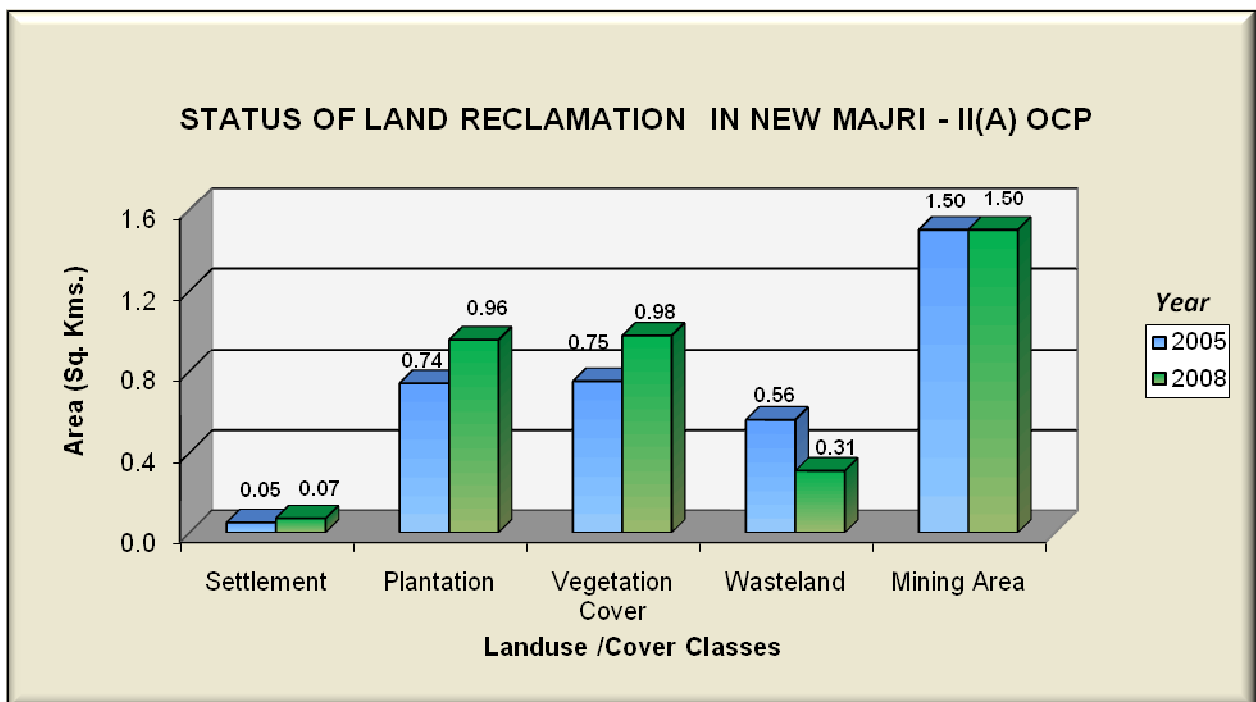


Figure 4.8

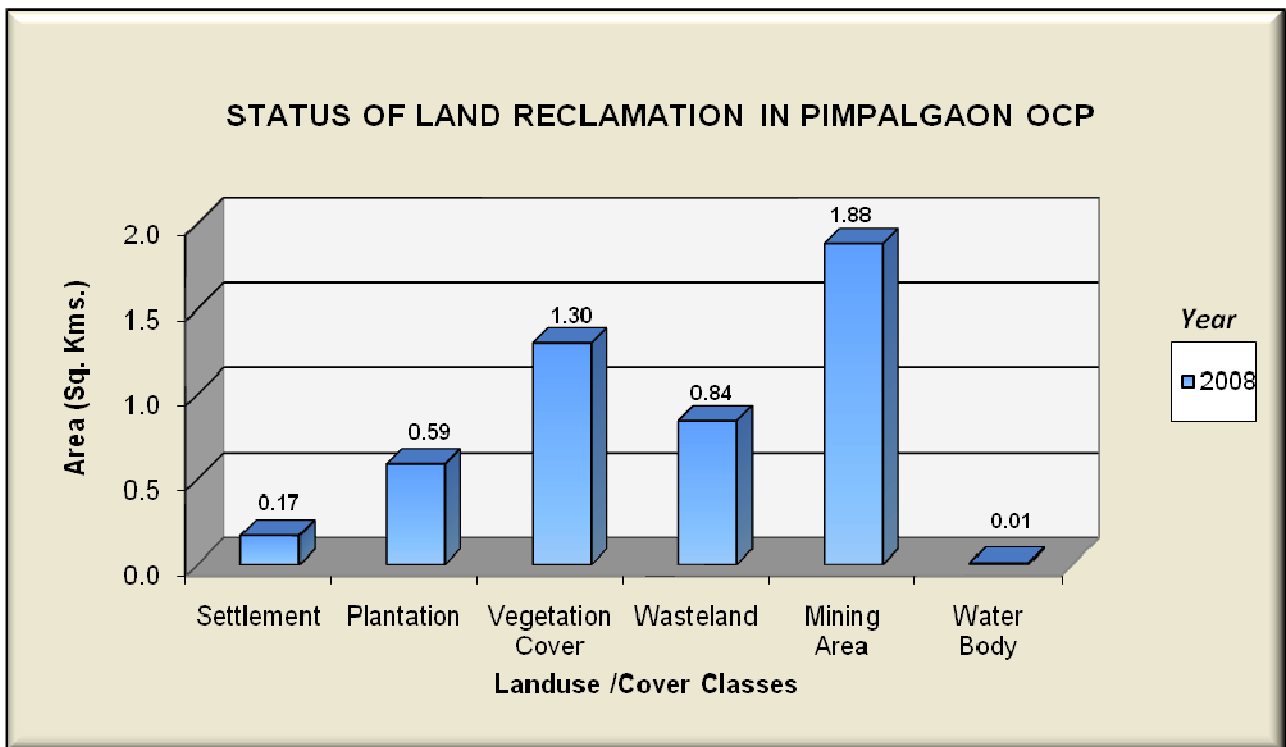


Figure 4.9

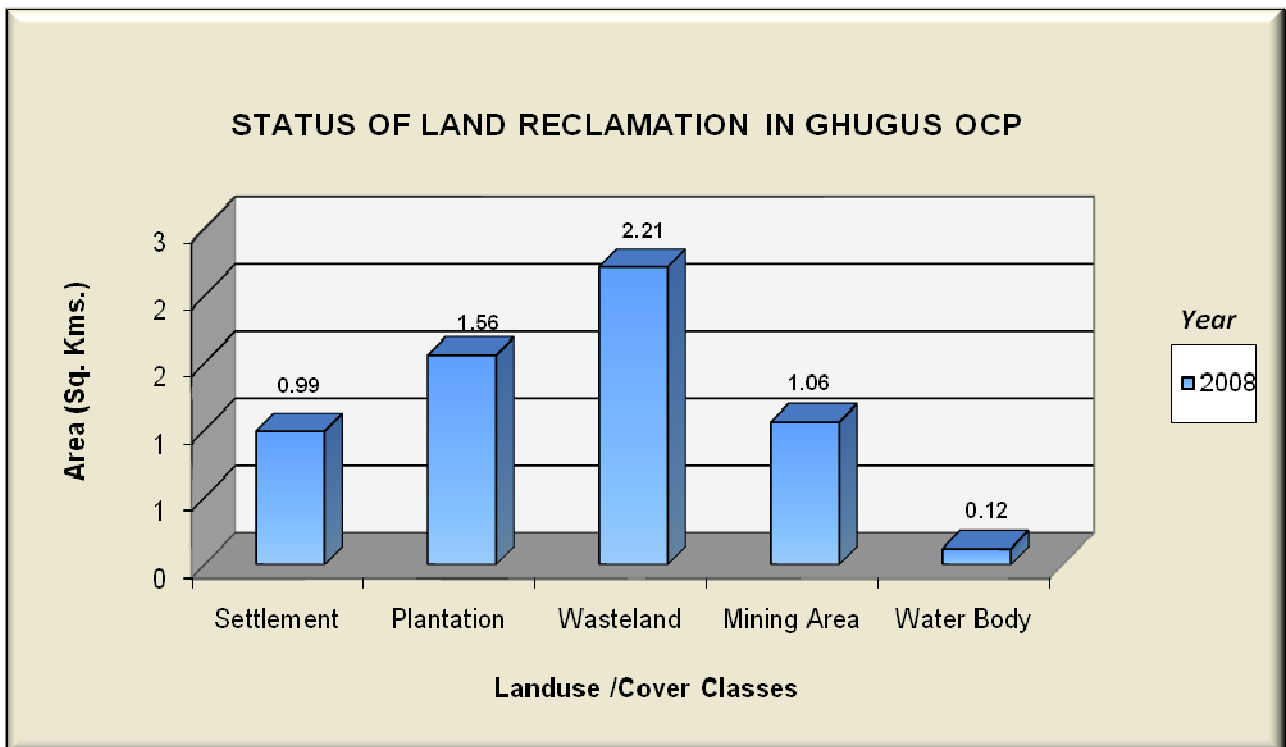


Figure 4.10



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