ANNEXURE-III

WARD WISE DEVELOPABLE AREAS AND POPULATION PROJECTION

Ward No.	Developable Area (Ha)	2011 Popln.	2021 Popln.	uptodate coverage%	Crores. area in Ha	ongoing coverage %	Crores. area in Ha	balance coverage %	Crores. area in Ha
1	848	43459	88813	15	127.2	35	296.8	50	424
2	304	35684	66746	45	136.8	15	45.6	40	121.6
3	570	32312	59971	25	142.5	10	57	65	370.5
4	624	25724	65635	10	62.4	20	124.8	70	436.8
5	292	73019	125994	50	146	10	29.2	40	116.8
6	199	54741	103329	55	109.45	5	9.95	40	79.6
7	220	32496	52689	50	110	5	11	45	99
8	98	27363	37695	70	68.6	1	0.98	29	28.42
9	103	17663	26982	50	51.5	0	0	50	51.5
10	86	10853	15889	60	51.6	0	0	40	34.4
11	60	13022	23091	25	15	15	9	60	36
12	136	21907	38672	10	13.6	5	6.8	85	115.6
13	152	18812	32187	10	15.2	0	0	90	136.8
14	60	15650	31434	40	24	10	6	50	30
15	53	17928	27659	15	7.95	0	0	85	45.05
16	85	21373	35823	50	42.5	10	8.5	40	34
17	23	9513	11293	15	3.45	50	11.5	25	5.75
18	112	27070	41130	30	33.6	20	22.4	50	56
19	20	10187	10808	5	1	30	6	65	13
20	648	35652	48676	2	12.96	20	129.6	78	505.44
21	179	32428	39588	70	125.3	15	26.85	15	26.85
22	188	55527	70880	70	131.6	10	18.8	20	37.6
23	17.5	8171	10158	75	13.125	5	0.875	20	3.5
24	232	54058	68405	50	116	10	23.2	40	92.8
25	344	32094	40255	50	172	10	34.4	40	137.6
26	280	34854	50186	60	168	10	28	30	84
27	160	38664	80824	80	128	5	8	15	24
28	104	20676	33277	75	78	0	0	25	26
29	80	14562	23323	60	48	5	4	35	28
30	59	15248	27756	65	38.35	20	11.8	15	8.85
31	64	16555	27565	70	44.8	20	12.8	10	6.4
32	11	9923	11680	80	8.8	10	1.1	10	1.1
33	16	7389	9103	80	12.8	5	0.8	15	2.4
34	92	23752	29001	60	55.2	15	13.8	25	23
35	50	15136	19468	80	40	10	5	10	5
36	188	22976	32943	70	131.6	5	9.4	25	47
37	173	32799	53265	75	129.75	0	0	25	43.25
38	81	12012	16267	80	64.8	5	4.05	15	12.15

Ward No.									
39	53	11084	14498	80	42.4	5	2.65	15	7.95
40	50	12922	19399	95	47.5	0	0	5	2.5
41	92	16695	24567	60	55.2	0	0	40	36.8
42	190	35960	56565	50	95	5	9.5	45	85.5
43	305	21423	26144	40	122	5	15.25	55	167.75
44	245	44048	61764	75	183.75	2	4.9	23	56.35
45	144	37509	68281	40	57.6	20	28.8	40	57.6
46	43	12183	17383	80	34.4	5	2.15	15	6.45
47	29	8860	13415	90	26.1	5	1.45	5	1.45
48	205	21965	27063	75	153.75	5	10.25	20	41
49	28	9778	13269	90	25.2	5	1.4	5	1.4
50	36	12085	15295	70	25.2	10	3.6	20	7.2
51	25	13584	21842	80	20	15	3.75	5	1.25
52	55	28075	39021	70	38.5	10	5.5	20	11
53	33	24894	30390	90	29.7	5	1.65	5	1.65
54	24	9730	11556	90	21.6	5	1.2	5	1.2
55	22	13542	17861	90	19.8	5	1.1	5	1.1
56	125	24938	29619	79	98.75	25	31.25	5	6.25
57	200	50427	59907	40	80	50	100	10	20
58	175	20601	24251	75	131.25	5	8.75	20	35
59	20	11712	14298	55	11	5	1	40	8
60	92	23465	32036	20	18.4	5	4.6	30	27.6
61	192	21550	27032	65	124.8	5	9.6	30	57.6
62	95	18936	25013	80	76	5	4.75	15	14.25
63	53	11776	15018	90	47.7	0	0	10	5.3
64	38	13143	15750	70	26.6	0	0	30	11.4
65	15	6214	7518	65	9.75	0	0	35	5.25
66	7.5	5338	6338	70	5.25	0	0	30	2.25
67	28	11833	15770	80	22.4	10	2.8	10	2.8
68	50	17143	25514	80	40	10	5	10	5
69	18	7942	10315	80	14.4	10	1.8	10	1.8
70	21	7906	10906	80	16.8	10	2.1	10	2.1
71	19	5560	7037	80	15.2	0	0	20	3.8
72	12.5	6263	7509	80	10	0	0	20	2.5
73	13	8397	10160	50	6.5	0	0	50	6.5
74	12	7922	10328	75	9	0	0	25	3
75	26	11872	14493	80	20.8	0	0	20	5.2
76	16	8423	10284	70	11.2	0	0	30	4.8
77	8	8744	10010	80	6.4	0	0	20	1.6
78	102	21285	28130	80	81.6	2	2.04	18	18.36

Ward No.									
79	110	12758	18987	70	77	0	0	30	33
80	55	16669	20352	75	41.25	0	0	25	13.75
81	52	8430	10481	70	36.4	0	0	30	15.6
82	24	10764	13142	75	18	0	0	25	6
83	13.5	7178	8528	70	9.45	0	0	30	4.05
84	9	9590	11083	65	5.85	0	0	35	3.15
85	9	6119	6875	65	5.85	0	0	35	3.15
86	25	12055	14717	80	20	0	0	20	5
87	14.5	9678	11498	75	10.875	0	0	25	3.625
Total	10241	1750215	2599674		4787.61		1244.85		4175.60

FORECAST

Sr. No.	Year	Arithmatic Method	Incremental Increase Method	Geometric Progression Method	Average of incremental Increase & Geometrical progression method
1	2011	1344821	1476195	1697795	1586995 Souls
2	2021	1612405	2006529	2675838	1586995 Souls
3	2031	1879990	2668237	4217298	3442768 Souls

Population forecast

For every City planning anticipation of future population is much necessary. Parameters of infrastructure are directly or indirectly dependent on the population. No. of indicators are related to the population. Demand assessment of the population can indicate the facilities that are existing and those are to be created. Money and manpower inputs are decided on the future population. The study of population increase is not limited to the number but also on the status of the inhabitants within the infrastructure limitations and the satisfaction shared by them in the lifestyle they are willing to continue. It is not important to provide the infrastructure facilities to the public, but it should extend happiness by dealing with efficient management.

As the decisions of importance are to be taken by the management based on the analysis of the population growth. Anticipated population at various stages of the development is very important parameter to decide the dimension of the developing infrastructure. It is very interesting phenomenon that demand always supersedes the provisions till the saturation stage is achieved. Apart from the increase in the existing g population in natural way migrants are attracted to the City because of better living. Industries and commerce also gets larger inputs in the better-managed City. Hence, for the Developing City infrastructure should be planned on higher side.

Level of service is one of the indicators of satisfaction. For example take the case of water supply.No.of households having house connection is the indicator. A 100 % house connection is targetted parameter. It indicates average economic status also. Further, hours of supply is another such indicator. Having a 24-hour water supply for the whole City is a landmark. It not only indicates the abundance of available water but also indicates the good habits of the people that use it. Creating such facilities is not a simple thing. It requires advance planning. It requires good management, planned infrastructure and capacity to run through the transition stage. It takes time to establish the system in a transformed stage. However, increase the

population and demand continue. To cope up with the change initial planning should be conservative. This is mainly true for the Developing Cities.

Nashik city is a very expanding and the growth pattern of existing since last four decades has been used in the total anticipated population as as given bellow,

Year	Population	Increment
1971	274482	
1981	432044	157562
1991	656925	224881
2001	1077236	420311
	Total	**802754**
	Average	267585

Arithmetical increase method

Increase in the population in these decades is predominant and it can be seen that average increase in the population shows the trend of fast development. It may be due to number of following reasons,

Nearness to Mumbai and Pune.
Very good all season climate.
Holy place and pilgrimage center.
Good infrastrcture.
Good communication through road and rail.
Atmosphere of industrialization.
Good education Center.
Good cultural activities.
Commissionerate and District head quarter.
Agricultural produce market.

Projected population for every five years has been calculated on the basis of average increase in the decades under considerations and they are tabulated below,

2006	1211028
2011	1344821
2016	1478613
2021	1612405
2026	1746198
2031	1879990

Geometrical increase method

This method uses the geometric mean for the increase in the population. Normally the projected figures are more in this method.
It has been mentioned in the CPHEEO manual that the graphical method gives much

higher values and it is mostly applicable to the growing towns and cities having vast scope for expansion. Nashik has a very strong trend of growing town, hence, the predictions of population for the city has been done with graphical and geometric mean method.

Rate of growth ® Rate of increase in population divided by basic population

Year	Population	Increment	r
1971	274482		
1981	432044	157562	0.57
1991	656925	224881	0.52
2001	1077236	420311	0.64
	Geo.Mean		0.58

Geometric mean = $n\sqrt{(r1*r2*r3*\ldots\ldots rn)}$

And ,Pn = Population*(1+rg)^n

Projection of population with Geometrical increase method has been tabulated below,

2006	1353744
2011	1701227
2016	2137904
2021	2686667
2026	3376289
2031	4242925

Incremental increase method

This method calculates increments as usual and also calculates increase in the increments as x and y.

Year	Population	Increment	Incremental increase
		x	y
1971	274482		
1981	432044	157562	
1991	656925	224881	67319
2001	1077236	420311	195430
	Total	802754	262749
	Average	267585	131375

Population =P1+ax+(a(a+1)*y)/2

Projection of population is calculated by the above formula. The results are tabulated as below,

2006	1260294
2011	1476195
2016	1724940

2021	2006529
2026	2320961
2031	2668237

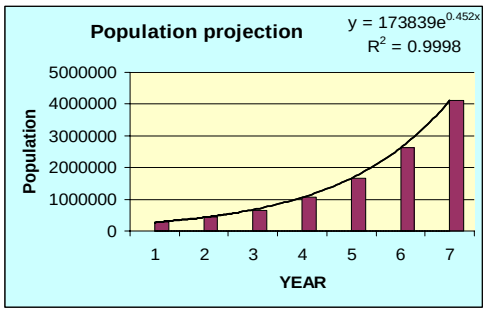
After calculation of the projection of population it is interesting to set a comarison of thedse projections. They have been tabulated as below,

Year	**Arithmetical**	**Geometrical**	**Incremental**
	Mean method	**Mean method**	**Increase method**
2006	1211028	1353744	1260294
2011	1344821	1701227	1476195
2016	1478613	2137904	1724940
2021	1612405	2686667	2006529
2026	1746198	3376289	2320961
2031	1879990	4242925	2668237

Graphical method

This method uses the same data as for the other methods. The graph of the decadewise population is plotted against the decades. The graph shows the trendline. The computer generates equation of the trendline by various methods. The equation that gives maximum RMS value shall be selected to arrive at the most logical approximation of the trends of increase in the future years. This is a very reliable method.

1971	274482
1981	432044
1991	656925
2001	1077236
2011	**1665282**
2021	**2617865**
2031	**4116271**



Observations

Arithmetical projection is not showing the population of highly growing city.
Geometric and graphical projections are fairly tallying.
Incremental increase method keeps the rising trend but does not highlight the aggressive growth.

Considering the migrations in the city and likely increase in the use of vacant land available it is more appropriate to give **weighted average** of the Geometric and Incremental method.

Moderation are necessary in the projections as the trend of migrations continue for some duration with the same rate till the attractions prevail. Opportunities continue to generate in the same speed. Standard of education continues to be on higher level. Then the rate slightly goes down or tries to stabilize. Incremental increase starts picking up. The process is very slow but anticipation is dependent on the deciding authority. Nashik is also going in the same stage. An input of appropriate funding is planned. The planning itself gives rise to the rise in population migration. The living standard , comfort and peace of mind, climate, cleanliness, greenery, efficiently managed systems, social and cultural life, everything matters to the City Development. People do compare the environment in other comparable cities. The preference of selection given by them to the City in question is the blank receipt of the token in acceptance of the fact that it is a true and positive development and one must honour the same.

Year	Geometrical	Incremental increase	Weighted average	Adopted figures
	0.9	0.1		
2006	1353744	1260294	1344399	**1350000**
	0.9	0.1		
2011	1701227	1476195	1678724	**1700000**
	0.8	0.2		
2016	2137904	1724940	2055311	**2100000**
	0.8	0.2		
2021	2686667	2006529	2550640	**2600000**
	0.7	0.3		
2026	3376289	2320961	3059691	**3100000**
	0.7	0.3		
2031	4242925	2668237	3770519	**3750000**

As per CPHEEO manual that the graphical method gives much higher values and it is
mostly applicable to the growing towns and cities having vast scope for expansion.
Nashik has a very strong trend of growing town, hence, the predictions of population for the city has been done with graphical and geometric mean method.
However, projection is further moderated by applying logical factors to original growth
patterns indicated by geometric and Incremental methods.
Increase

This projections have been checked for method of densities in various areas, for the
year 2021 and 2031.It is indicated in the table of wardwise densities as depicted in the Census 2001.

Accomadating the population in the available land and some new land will be done automatically and vacant lands will be partially or fully utilized.

Development in last two decades with population density zoning

Sr.No.	Ward No.	Developable	1991		Growth Rate	2001	
		Area (Ha)	Popln.	Density		Popln.	Density
1	77,32,84,66,85,74,	179	89605	501	Approx. 20%	108889	608
	55,87,73,59,						
	53,19						
2	76,83,23,33,72,69, 52,75	174.5	61335	351		76039	436
3	67,51,17,65,70,54, 86	161	52182	324	Approx. 30%	59172	368
4	75,47,46,49,82,64,	564	88889	158		132933	236
	68,50,15,35,						
	45,40						
5	31,80,30,60,63,29, 8,39	2756	191436	69	Approx. 100%	370986	135
	16,11,81,38,						
	28,34,78,57,						
	14,6,62,24,						
	22,41,44,42,						
	56						
6	18,9,5,37,79,10,37, 12,	3067	129290	42	Approx. 80%	234206	76
	21,7,13,36,						
	2,18,61,48,						
	26						
7	25,43,3,20,1,4	3339	44188	13	Approx.120%	95011	28
		10240.5	656925			1077236	

Sr.No.	Ward No.	Developable	2001		**2011**	
		Area (Ha)				
			Popln.	Density	Popln.	Density
1	77,32,84,66,85,74,	179	108889	608	125300	700
	55,87,73,59,					
	53,19					
2	76,83,23,33,72,69,52 ,75	174.5	76039	436	87250	500
3	67,51,17,65,70,54,86	161	59172	368	72450	450

4	75,47,46,49,82,64,	564	132933	236	197400	350
	68,50,15,35,					
	45,40					
5	31,80,30,60,63,29,8,39	2756	370986	135	757900	275
	16,11,81,38,					
	28,34,78,57,					
	14,6,62,24,					
	22,41,44,42,					
	56					
6	18,9,5,37,79,10,37,12,	3067	234206	76	276030	90
	21,7,13,36,					
	2,18,61,48,					
	26					
7	25,43,3,20,1,4	3339	95011	28	233730	70
		10240.5	**1077236**		**1750060**	

All ward population densities are increasing as per census figures. There will be a limit to maximum density and beyond that people will prefer going in some distance away from the city centers.

Sr.No.	Ward No.	Developable	**2021**		**2031**	
		Area (Ha)				
			Popln.	Density	Popln.	Density
1	77,32,84,66,85,74,	179	130312	728	135324	756
	55,87,73,59,					
	53,19					
2	76,83,23,33,72,69,52,75	174.5	91612.5	525	95975	550
3	67,51,17,65,70,54,86	161	76475	475	82110	510
4	75,47,46,49,82,64,	564	214320	380	253800	450
	68,50,15,35,					
	45,40					
5	31,80,30,60,63,29,8,39,	2756	895700	325	1129960	410
	16,11,81,38,					
	28,34,78,57,					
	14,6,62,24,					
	22,41,44,42,					
	56					
6	18,9,5,37,79,10,3	3067	644070	210	1073450	350

	7,12,					
	21,7,13,36,					
	2,18,61,48,					
	26					
7	25,43,3,20,1,4	3339	534240	160	985005	295
		10240.5	**2586730**		**3755624**	

Thus it can be seen that increase in population as per projections is possible to be accommodated. In the years to come infrastructure has to be planned and land in question has to be released for the development. Infrastructure potential automatically attracts the population, industries and commerce. However, management or the authorities can direct the shape of the development in the designed manner. For that purpose authorities can have sector plan concept which can be in line with the possible further development. Competent authority can take up development of such sector development thorough town planning experts. Further they can giver the statutory status to such plans for the benefit of the city.