REVISED DETAILED ESTIMATE OF AUGMENTATION OF WATER SUPPLY SCHEME OF S.A.S. NAGAR. (PHASE-V & VI)

PROJECT REPORT

1.1 INTRODUCTION

The development of SAS Nagar was taken up by the Deptt. of Urban Development, Govt. of Punjab as satellite town of city of Chandigarh during early 70's. The master plan of SAS Nagar covers sectors from 48 to 125, which are being developed in phases. Presently sectors 48 to 73 are fully developed and P.H. services in all sectors have been provided except in sector 62, which is still under planning. Besides this, land for sectors 76 to 80 and Aerocity has also been acquired and the development works have been taken in hand by GMADA. In addition to development being carried out by GMADA, a number of licenses have been issued to Mega Developers who are carrying out internal development works in their areas. However, the peripheral services are to be provided by GMADA.

1.1.1 Initially, SAS Nagar was planned with an ultimate population of 2.5 lacs, however due to rapid urbanization around Chandigarh, the rate of population growth in its satellite towns is unprecedented and the present population of SAS Nagar has already crossed the mark of 3 lac persons. The ultimate projected population of planned sectors up to Sec 81 including Aerocity of SAS Nagar will be around 6.5 lac persons.

1.1.2 The climatic conditions in SAS Nagar are hot in summer, temperature going up to 47^0C; and cold in winter, temperature dropping at times to 2^0C. From the point of view of demand of water, the year can be divided into the following distinct seasons: -

a) **Summer season:** From April to mid July. These are dry and hot months and demand of water during these months is very high both for domestic and irrigation requirements.

b) **Mon soon season:** From July to mid September.

c) **Winter and spring season:** From mid September to March.

1.1.3 SAS Nagar area experiences annual average rainfall of about 42" (1050 mm). The rain is mostly confined to the months of July and August. A small amount of it occurs in winter months of December and January also.

1.2 S.A.S. NAGAR WATER SUPPLY SCHEME:

While planning the new city of Chandigarh and its satellite towns, one of the most important points which received consideration at the hands of Engineers and Planners was availability of suitable and dependable source of water supply needed for domestic, industrial and irrigational requirements of the city. In an area like the proposed site for Chandigarh / SAS Nagar (Mohali), there could be only two sources of supply of water for city, these being "Surface water and subterranean water". No source of surface water was at that time within economic grasp of Capital Project. No authentic data with regard to subterranean source in this area had been available for the purpose of development of urban water supply and there was apprehension in the minds of planners as well as Engineers that the requisite quantity of water might not be available from that source. To dispel or confirm this doubt, detailed investigations of potential of underground water resources was entrusted to the Department of Geological Survey of India and extensive explanatory trial bores were made throughout the length and breadth of city site. As a result of these investigations a note was prepared by Department of Geological Survey of India. The salient features of this note are: -

a) The sub-terranean source of water supply was established to sufficient extent to meet the water requirement of Chandigarh's first phase development. This conclusion was

arrived at after having number of trial bores of which some were converted into production wells.

b) It was also accepted that for the development of second phase, the ground water source would not suffice. We have to look for surface water to meet the additional requirement of water supply. It was found that additional requirement could be satisfied in fully by Ghaggar Dam Project, which had at that time being envisaged by the erstwhile Punjab Government as a measure for irrigation and flood control. It was then anticipated that this project would start supplying water to Chandigarh before 1974.

1.2.1 Initially, therefore, the water supply of city Chandigarh was based on Sub-terranean water supply source. Accordingly, the work of installation of tube wells was taken in hand in early 50's and several tube wells were installed on the specially selected sites. Their number was increased from time to time to meet the city's growing needs.

1.2.2 According to the information given by the General Manager and Secretary to Government of Punjab, Beas Project in his letter dated 5.2.1964; the work on Ghaggar Dam was to begin in 1969 and was to be completed in 1973. The availability of water from Ghaggar Dam in 1973 would have obviated the need for providing more tube wells.

1.2.3 Meanwhile old Punjab state was reorganized on 1.11.1966 and site for Ghaggar Dam came under Haryana Territory. The inquires from Irrigation Department during 1966 and 1969 showed that the project had been downgraded and allotted a low priority. There was complete un-certainty about the future of the scheme and nobody knows if and when the Ghaggar Dam Scheme would be implicated on site.

Another consideration, which eliminated the Ghaggar Dam as a source of water for Chandigarh Water Supply Scheme, was the cost of the project. A meeting was held in 1973 between Shri K.S. Pathak Chief Engineer Haryana and Shri Kulbir Singh Chief Engineer Union Territory, Chandigarh. The former indicated that this scheme had at that time no priority with Haryana Government and Haryana Government had to take up the work in hand. However, they indicated to execute the project in case the Chandigarh Administration agreed to pay a share of Rs. 20 Crores towards the cost of Ghaggar Dam Project. The project cost was considered prohibitive by the authorities specially keeping in view that additional sum would be required for laying the canal from Ghaggar Dam to Treatment Plant Chandigarh and the cost of Treatment plant as well. In view of all these constraints, it was once for all decided that Chandigarh water supply would not be based on Ghaggar Dam project.

1.2.4 It was, therefore, clear at that time that another source of water would have to be developed; because Ghaggar water did not have to provide/augment the water supply scheme of Chandigarh to cater to its growing demands. However, further investigation of underground source of water supply was also considered necessary and this work was again entrusted to the Department of Geological Survey of India.

1.2.5 The department of Geological Survey of India after detailed investigations ruled out further installation of tube wells and recommended two sources of Augmentation of Water Supply, namely deep tube wells up to 1500 feet below the ground level and surface water supply. 5 nos. deep tube wells at specially selected sites at Chandigarh were drilled with assistance of Central Ground Water Board. The result was more discouraging. At present most of these tube wells had dried down. From the experience gained out of this, it was safely said there is no enough underground water at deeper depths. Moreover it was also noticed that the cost of deep

tube well was very high, as compared to the normal tube well vis-à-vis their life and cost of production per unit. In view of this, the proposal to drill deep tube wells was discarded.

1.2.6 The area in and around Union Territory Chandigarh fall in "Dark Area", as demarcated by the Central Ground Water Board. It was further ascertained by the Geological Survey of India that keeping in view the recharging of Underground water in and around Chandigarh, the safe yielding capacity of underground water reservoir is equivalent to 5 MGD and any further drawl from underground reservoir would have deleterious effect on the water table itself. They also advised Chandigarh Administration to stop withdrawing more than the amount, which is being recharged i.e. 5 MGD.

1.2.7 In spite of above warning/advice by the Geological Survey of India, the Chandigarh Administration had no other alternative; except to depend on the underground source of water supply. The demand of water supply in Chandigarh kept on increasing every year more than anticipated. The withdrawal of water was 5 times the safe yielding capacity of underground reservoir. This action of capital project had very damaging effects on existing tube wells. Large number of tube wells (i.e. 77 nos.) dried and were abandoned, during these years. The water table has gone down between 30' to 50' and the discharge of running tube wells has further reduced.

1.2.8 Chandigarh Administration started taking action to develop new source of water supply i.e. to bring water from Bhakhra Main Line, which is passing at a distance of 27 K.M. from Chandigarh. The level of canal is 170' below the ground level on the outside of city of Chandigarh. Therefore pumping from Bhakhra Main Line was required.

1.2.9 Like Chandigarh for the 1st phase of development, the water supply of the SAS Nagar was based on underground water as a source of supply. Accordingly numbers of tube wells were

drilled at various selected sites and more tube wells were added as and when the water supply demand of the city increased with the city's growth. In this system water supply scheme was designed taking sector as a unit and a number of small capacity water works were set up in almost every sector. The water available from tube wells of each sector was stored in a centrally located overhead service cum storage reservoir and the water was supplied to the distribution network. With the passage of time, the spring level of the area started going down, as the withdrawal of the water from the underground reservoir is comparatively more than the recharge. This resulted in drying of number of shallow tube wells. Like Chandigarh, the underground source of supply was not adequate to cater to the ultimate requirement of the Urban Estate and [illegible]sict compelled the authorities concerned to tap the other source of the water for the town. Chandigarh Administration prepared a project for bringing surface water from Bhakhra Canal running at a distance of about 27 kilometers from Chandigarh. While preparing this project, the water supply requirement of SAS Nagar was also taken into account.

Accordingly, a combined scheme was prepared by Chandigarh Administration and Govt. of Punjab to bring 120 MGD of water from Bhakhra Main Line at Kajauli to Chandigarh and Mohali through 6 no. rising mains of 20 MGD capacity each. Out of these 6 lines, 4 were meant for Chandigarh and 2 for SAS Nagar depending upon the ultimate water requirement of Chandigarh and SAS Nagar envisaged as 150 Cusecs (80 MGD) and 75 Cusecs (40 MGD) respectively. Accordingly the regulator and intake structure was planned and constructed at BML for 120 MGD capacity and 50 feet wide strip of land for laying 6 rising mains along with land for Kajauli water works was acquired. Keeping in view the share of water in the scheme, 2/3rd cost of land acquisition and intake structure was paid by Chandigarh Administration and 1/3rd

cost by Govt. of Punjab. Chandigarh Administration has already laid 4 pipe lines of their share and has already utilized 2/3rd portion of the land.

1.2.10 After the completion of 1st Phase by Chandigarh Administration, Punjab and Haryana Governments refused to spare water for Chandigarh water supply as Chandigarh has no share of water in Bhakhra Main Line (BML). There had been protracted correspondence and discussions among three administrations. Ultimately, a decision was taken in the meeting chaired by the then Hon'ble Home Minister of India; on dated 6.7.1983 (Copy of minutes enclosed at Annexure-A), wherein it was decided that the Punjab and Haryana will release 40 cusecs (20 MGD) of water from Bhakhra Main Line free of cost in the ratio of 24:16 cusecs respectively. In lieu thereof, the raw water at water works sector 39 would be shared in the following ratio: -

a)	Union Territory Chandigarh	:	29 Cusecs (14.5 MGD)
b)	Punjab (For Mohali)	:	5 Cusecs (2.5 MGD)
c)	Haryana (For Panchkula)	:	3 Cusecs (1.5 MGD)
d)	Chandimandir Cantonment	:	3 Cusecs (1.5 MGD)
	Total		40 cusecs (20 MGD)

Further, it was decided in the meeting held on 10.3.1989 under the chairmanship of Sh. R.P. Ohja, I.A.S., the then Chief Secretary, Govt. of Punjab that the same pattern of distribution of water will be adopted for Phase II & III (minutes of meeting enclosed at Annexure-B). Similarly, the same pattern of distribution was adopted for the 4th Phase.

This shows that SAS Nagar will get total 50 MGD water from over all Kajauli Scheme i.e. 40 MGD from 2 lines exclusively meant for SAS Nagar and 2.5 MGD each from four lines meant for Chandigarh. At present all the 4 lines meant for Chandigarh have been laid and are in operation & Mohali is getting its 10.0 MGD share from these lines.

1.3 FORECAST OF POPULATION

1.3.1 SAS Nagar being planned city, it is possible to estimate the ultimate population of the planned sectors of SAS Nagar on the basis of number of dwelling units in each sector. On this

basis the ultimate planned population of Sec. 48, 53 to 81, Aerocity and villages falling in SAS Nagar area has been calculated as per Annexure-E, which is about 6.35 lac persons. Initially SAS Nagar was planned with an ultimate population of 2.5 lacs, however due to rapid urbanization around Chandigarh, the rate of growth of population in its satellite towns is unprecedented and present population of SAS Nagar has crossed the mark of 3.00 lac persons. The present population has been estimated on the basis of actual development in sectors of SAS Nagar, which has been taken after surveying the sectors, as below : -

S.No.	Sectors	Projected ultimate population	Development	Estimated present population
1.	Sec. 53 to 61	150415	90%	135374
2.	Sec. 62	20000	10%	2000
3.	Sec. 63 to 65	77950	90%	70155
4.	Sec. 66	5750	90%	5175
5.	Sec. 67	13750	70%	9625
6.	Sec. 68	21480	70%	15036
7.	Sec. 69	21030	70%	14721
8.	Sec. 70	28025	75%	21019
9.	Sec. 71	25105	75%	18830
10.	Sec. 77 to 80	107790	5%	5390
11.	Sec. 48	3420	90%	3078
	TOTAL			300403

1.3.2 Secondly present population can be estimated on the basis of water consumer connections. As per byelaws prevailing in SAS Nagar only one water connection is permissible to one plot. Presently there are about 37500 water connections in SAS Nagar. Assuming that on an average 1½ to 2 dwelling units are constructed in each house for which connections have been released i.e. 8 persons are being served by each water connection. According to this calculation also the present population of SAS Nagar is about 3.00 lac persons.

1.3.3 Moreover, the department of Town Country Planning, Punjab has intimated that as per regional plan prepared by Govt. of India for Chandigarh region the prospective population of SAS Nagar is 2.5 lac persons in the year 2001.

1.3.4 From the perusal of above, it is apparent that the present population of SAS Nagar is 3.00 lac persons. The prevailing rate of growth of population in SAS Nagar is about 10% per year but the rate of development in the GMADA area is unprecedented as no. of new Urban Estates are such as Aerocity, Green city & Mullanpur are planned to be developed by GMADA and licenses have been issued around SAS Nagar to Colonizers and Mega Developers. Moreover, the demand of water in the neighboring towns such as Kharar, Mullanpur and Zirakpur etc. is also increasing day by day. Keeping in view this pace of development of the area, it is expected that the requirement of water would cross mark of 50 MGD in next five years.

1.4 REQUIREMENT OF WATER

SAS Nagar has been planned as one of the most modern cities of India. Whole of the city is covered with well-planned network of water supply and sewerage system. Under the byelaws, every house built in SAS Nagar has to have properly laid water supply and sewerage, which is to be connected with city sewerage network.

1.4.1 While planning SAS Nagar, every emphasis has been laid for providing green spaces, throughout the city. In every sector about 15% of the total planned area has been left as open space. In addition to this people maintain lawns in their houses and road berms in front that cover almost 20% of the plotted area. Total irrigable area has been calculated on the basis of above norms and is appended as Annexure-F.

1.4.2 In view of above stated factors, it has been decided that it is possible to follow as assumed lump sum norms on the basis of per capita for working out requirement of water.

1.4.3 The requirement of water for various needs have been worked out on the basis of norms approved by the Govt. of India /CPHEEO, which are indicated as below: -

a)	Domestic	150 Lt. (33 gallons)/head/day.
b)	Industrial	4000 gallons/acre/day
c)	Commercial/institutional	4000 gallons/acre/day
d)	Irrigation of public parks/ lawns.	5400 gallons/acre/day

1.4.4 The ultimate requirement of water for SAS Nagar has been calculated on the above basis and is indicated in Annexure-E. It will be seen from the table that the requirement of water for the planned sectors up to sector 81, Aerocity and villages falling with in this area would be 48.667 MGD when the population will be 657690 persons i.e. 74 gallons/head /day. The Chandigarh Administration has taken gross per capita requirement of water as 100 gls/head /day while designing their Augmentation of water supply schemes.

1.4.5 If the consumption of water remained steady throughout the year, supply of 74 would suffice. Actually the consumption varies. It reaches its lowest mark in cold months i.e. in months of December and January, when the demand is reduced to about 60 gls/head/day. Thereafter demand starts rising and in hot and dry summer months of May and June, it reaches a peak much in excess of the average demand to the tune of 110 gls/head/day. During this period shortage is experienced in any city. In order to overcome this situation, the supply needs to be raised to meet the maximum daily demand of the city.

1.4.6 The present availability of water in SAS Nagar is only 13 MGD against a average demand of 23.1 MGD (3.00 Lac population @ 77 gls/head/day). The present gap between the requirement and availability of water is 10.1 M.G.D. The shortage of water is felt extremely. Large area in SAS Nagar do not get sufficient water supply; especially during summer in spite of fact that water supply is made during morning and evening hours and is not continuous one. The

shortage of water has, caused great harassment to the normal, commercial and domestic activities; open spaces and gardens have suffered during present drought and due to non-availability of sufficient quantity of water, from water supply system. Moreover, the tube wells are not a dependable source as per prevailing underground water table and their discharge reduces by 20 to 25% during dry summer months when there is maximum demand.

1.4.7 In view of above facts, it is apparent that in order to eliminate the gap between the requirement and availability of water, the only dependable source of water is canal. It is right time to take up this scheme in hand because it will take at least three years to commission this scheme and if started now, will be completed by year 2013, when gap between demand and supply will be huge around 40 MGD. Otherwise, to supply the required water to residents a large number of tube wells will be required to be drilled which will be an in fructuous expenditure as tube wells are not dependable source of water in this region.

1.4.8 A meeting was held on 12-06-2010 at 5.00 PM under the chairmanship of Hon'ble Chief Minister Punjab regarding the Kajauli scheme in which senior officers of all concerned departments were present. The minutes of meeting are placed at Annexure-C. In the meeting following decisions were taken:-

1. The Nodal Department for this Project would be Department of Housing and Urban Development, Govt. of Punjab.
2. GMADA should initiate the process of laying single rising main of 40 MGD capacity under Phase V & VI from Kajauli to Mohali for which strip of land is already available and should start with the process of construction of Pumping Station at Kajauli for which land is also available at Kajauli. Further, process to acquire land for Water Treatment Plant and Pumping Station at SAS Nagar should also be initiated.
3. This project would be executed by GMADA from EDC and its own resources.

4. It was also decided that since this 40 MGD water shall only be sufficient for next five years for GMADA area and therefore alternative source of Canal / surface water shall be needed to be explored for fast growing GMADA area for future requirements.

5. Chandigarh being a joint Capital of States of Punjab & Haryana, future water requirements of this Capital city is to be met from the available surface water sources of Punjab and Haryana, as underground water source is not dependable source in this area. As per the report submitted under JNNURM by UT Administration for Augmentation of Kajauli Water supply under Phase V & VI, it has been brought out by them that present availability of water for domestic, institutional and commercial needs of Chandigarh is sufficient for next five years. Further, population projections in the same report are not realistic because there is very little scope available with Chandigarh for further expansion as its boundaries are restricted by State boundaries on all sides. However, after five years there shall certainly be some additional demand for Chandigarh. Hence, keeping in view, the future requirements of Chandigarh, it was decided that Chandigarh Administration may go ahead with Phase 7 & 8 for which process for land acquisition for pipe lines as well as Pumping Station at Kajauli shall be initiated accordingly by UT Administration. Punjab Govt. shall render all necessary co-operation for expediting the land acquisition. The cost of the land shall be borne by UT Administration. However, for drawing additional raw water beyond 120 MGD from BML and for its sharing, a decision shall be taken by all concerned parties / Governments jointly.

6. For meeting with requirements of water after five years when need for GMADA area shall be beyond the available water from Phase 5 & 6, it was further decided that possibility shall be explored now for laying Phase 9 to 12 from BML for GMADA area and accordingly land shall be acquired for laying pipes as well as Pumping Station at Kajauli.

1.4.7 Subsequently, the agenda regarding the Kajauli Scheme was put up before the GMADA Authority in the 7th meeting held on 01-09-2010 vide Agenda Item No. 7.05. The agenda is placed at Annexure -D. The Authority approved the proposal.

MAJOR COMPONENTS OF THE PROJECT

1.5.1 **INTAKE WORKS:** Provision has been made for M.S. pipe of 2500mm i/d of 14mm thick made out of MS plate having capacity of 80 cusecs (40 MGD) capacity to take the raw water from BML to raw water tanks in Head works Kajauli. This pipe will be laid on the 50' wide land strips already acquired from Off take point to Head Works Kajauli. The 2 Nos. pipe line 40" dia were laid during the construction of Augmentation Scheme Phase I & II and 2 mtrs. X 2 mtrs. Box channel were laid during the execution of Augmentation Water Supply Scheme Phase III & IV. Similarly single conduit has been proposed to be provided keeping in view the availability of site. The total length involved is about 500 meter including bends etc. This con . will cater to the requirement of Phase-V & VI. The provision has been made for fixing of inlet sluice valves of 1800mm dia near the feeding chamber of irrigation department for isolation to carry out the repair etc. and monitor the supply. The raw water pipe will be terminated in the RCC Suction Storage Sump through 2 No. 2500mm dia MS pipe lines.

1.5.2 **STORAGE SUMP AND SUCTION HEADERS AT KAJAULI WATER WORKS:** 2 No. RCC raw water storage tanks of 0.50 MGD capacity each having 15 minutes pumping capacity has been provided. The pumping capacity would be 1.67 MG /hour. The submergence of suction header all the time is required to avoid air locking into the pumps to work efficiently at rated capacity. These storage sumps will act as suction sumps for maintaining the replenishment of water on the suction side. Besides this, provision has been made for carrying the raw water from sump to suction header through 2 No. 2200mm dia MS pipes having wall thickness 14mm including provision of 2 No. sluice valves of 1800mm dia for control of raw water. The suction header and delivery header of 2200mm dia MS pipe have been made for 40 meters length each. The suction & delivery header channel for watch of leakage etc. has been provided in RCC.

1.5.3 RAW WATER PUMPING MACHINERY & PUMP CHAMBER WITH GANTRY: -

The pump chamber of size 55x18 mtrs. to house the machinery required for pumping the raw water from Kajauli Head Works to Water Works SAS Nagar for Phase-V & VI has been taken in the DPR. The 8 No. electric pump sets of 20 cusecs (2052 cum/hour) capacity each at a head of 328' (100 mtr) and 2 No. diesel engine pump sets of 20 cusecs capacity to act as standby arrangement has been taken in this DPR to pump the 40 MGD water to city including standby arrangement 50% for electric machinery as well as for diesel machinery has been made in the DPR. The construction of 66 KVA electric grid substation at head works Kajauli was taken up at the time of implementation of augmentation of water supply scheme Phase-III in the year 1993-94. The Grid Sub Station was upgraded to cater the additional requirement of electric load for scheme Phase-IV in the year 2005.

Now, 4800 KW additional load is required for augmentation of water supply scheme Phase- V & VI. The provision has been made for installation / replacement of 2 Nos. transformers of 10/12 MVA at 66 KV Grid Sub Station including HT panels of 66 KV & 11 KV including necessary cabling etc. as intimated by Senior Executive Engineer, Technical Operation Circle, PSEB, Ropar. (As per project report of UT)

1.5.4 STATION TRANSFORMERS: The provision has also been made for installation of 3 No. 5000 KVA station transformers to step down the voltage from 11 KV to 6.6 KV to facilitate the operation of 6.6 KV HT motor including HT panels of 11 KV. The one transformer will act as stand by transformer out of 3 proposed.

1.5.5 RAW WATER PUMPING MACHINERY: In order to pump 40 MGD water, the provision has been made for 6 No. centrifugal single stage pumps having 570 LPS capacity of

head 100 meter including 2 No. standby pump sets including electric motor of 1050 HP. The provision has been made to pump 50% raw water to the city in case of power breakdown by installing 2 No. diesel engine having capacity 1050 HP operated pump sets of same capacity. The electric backend equipment consists of 6.6 KV HT panels including bus couplers and soft starters etc have been incorporated in the DPR. Besides this, LT panel to cater the requirement of electrical appliances, vacuum pumps 50 DV Model, diesel generator 75 KVA for lighting and operation of vacuum pump etc in emergency and gantry including end guarders, crane of 10 Ton capacity have been provided in the DPR.

1.5.6 **SUCTION AND DELIVERY PIPES:** The 600mm dia MS suction pipes and delivery pipe have been proposed in the DPR. The provision has been made for fixing DI sluice valves of 600mm dia rating PN-1/ 1.6 on the suction and delivery side of each pump sets including 1 No. D.I. Non Return Valve of P.N.1.6 rating (16 Kg/cm^2).

The electromagnetic flow meters on the delivery side of the 8 No. pump sets have been proposed to be fixed to check the rated discharge of each pump to main the data base and efficiency of the pump.

1.5.7 **DIESEL STORAGE TANK:** Provision for construction of diesel storage tank has been taken in this DPR. The diesel storage tank has to be constructed for storage of 12000 Ltrs diesel to run the 2 No. diesel operated pump sets equipped with 1050 HP diesel engines to ensure the uninterrupted water pumping to the city Chandigarh. The consumption of one diesel engine of 1050 HP is 185 Ltr/ Hour. Accordingly, provision has been made for running the diesel pumping machinery, in case of emergency at least for 30 hours with the storage of 12000 Ltr diesel.

1.5.8 **SURGE CONTROL EQUIPMENT:** The M.S. surge vessel to relieve the pipe line from water hammer effect of required capacity for spring action including air receiver and compressor to ensure the downward thrust over the surge vessel has been proposed in the DPR.

1.5.9 **RISING MAIN:** The M.S. pipe of dia 1150mm inside lined and outside coated with concrete was provided for Phase-I & Phase-II schemes. However, Prestressed concrete pipes of 1200mm dia have been used in Augmentation water supply scheme Phase-III & IV. By virtue of experience, it has been felt that the rising main having length 28.5 KM is surge prone due to frequent power tripping, the PSC pipes used to leak frequently. This has resulted higher maintenance cost as compared to MS pipes. Moreover, the defectiveness/ shut down cannot be prolonged for longer period due to the pressure from the public to ensure uninterrupted supply. The PSC rising main having flexible joints at every 5 meters require more surge control equipments as compared to MS pipe. In order to reduce the maintenance cost & to ensure uninterrupted supply, it has been proposed to provide 2200mm dia MS pipe of wall thickness 12 mm duly lined from inside & out coated in cement mortar through spinning to carry 80 MGD water from Kajauli to water works SAS Nagar and up to RD 25650. The 12 Nos. DI butterfly valves of 1800mm dia have been proposed for isolation at various segments. The DI butterfly Valves proposed are provided with mechanical seal in the gland box to ensure 100% leak proof to avoid wastage of water from the butterfly valve. The 50 Nos. air release valves including control sluice valves and stand pipes of dia 200mm i/d have been proposed for hydraulic health of the pipe line. The scour valves of 300mm dia including scouring pipe have been proposed at 14 points over the rising mains to drain out the water in case of any repair. The access manholes at 52 points having 600mm dia along with blank flange have been proposed on the rising main. The zero velocity valves have been incorporated as per the requirement of hydraulic design to

take care of water column of each section of the rising main to counter the surge pressure produced in the rising main.

1.5.10 **CROSS DRAINAGE WORKS:** The proposed rising main have to cross the natural rivers/river lets at Budki at RD 18000 mtrs. The provision has been made to carry the M.S. pipe over the under reamed RCC piles at above cited reduced distance.

1.5.11 **STAFF QUARTER:** The water supply is an essential service and is to be maintained around the clock, in spite of maintenance problems and break down. Therefore minimum staff has to be made available around the clock at Head works. It is therefore, necessary that certain no. of staff quarters are constructed with in the head works, so that they are available in case of emergency. Therefore 9 No. Staff quarters have been proposed to be constructed at head works Kajauli along with office cum rest house for senior officers. The design of the staff Quarters and Office-cum- Rest House has been taken in the estimate which were proposed for Sewage Treatment Plant, Sector 83, SAS Nagar

1.5.11 **MISC. PROVISIONS:** The rising main has to cross the railway track at 2 places near Morinda to cross Sirhind-Nangal and Morinda-Chandigarh railway track. The railway department will charge for way leave facility as well as for execution of the works. The rising main has to cross the various roads as per alignment of rising main. Accordingly the provision for the same has been made in the DPR.

Note: The major provisions taken in the DPR are based on the Project Report of Municipal Corporation, Chandigarh prepared for Augmentation of Water Supply Scheme of Chandigarh (Phase- V & VI) and approved by Govt. of India under JNNURM.

1.6 DISTRIBUTION ARRANGEMENT FOR S.A.S. NAGAR WATER SUPPLY

As the site for Water Works at SAS Nagar is yet to be finalized, therefore a separate DPR would be prepared as Part-B of the project for water treatment and distribution arrangement in SAS Nagar and this part of the project would be taken up separately under different tender.

1.7 **ACQUISITION OF LAND:** The land at water works Kajauli and 50 feet wide strip for laying 6 no. rising mains has already been acquired during the execution of phase I of Augmentation of water supply scheme of Chandigarh, for ultimate requirement. Hence no further land is required to be acquired for laying the pipeline for SAS Nagar. However, land is required to be acquired for Water Works SAS Nagar for which approximately 90 acres of land is required. This land is yet to be finalized and acquired.

1.8 **COST OF PROJECT (PART-A):** The total cost of Part A of the Project is worked out in the General Abstract of Cost and is Rs. 195.57 Crores, the detail of which is given in different sub heads. 3% provision for unforeseen items has been made in the estimate.

1.9 **SPECIFICATIONS OF WORK:** The work will be carried out in accordance with the Pb. P.W.D. specifications and relevant I.S. specifications / specifications mentioned in DPR & Tender Documents.

1.10 **TIME:** It will take 30 months to complete the work, after the allotment of the work subject to availability of funds.

1.11 **FUNDS:** Funds would be provided by GMADA.

Divisional Engineer (PH-2)
GMADA, SAS Nagar