**MASTER PLAN**

**FOR**

**DRAINAGE OF STORM WATER DRAINAGE OF THE MCD & DDA AREA**

**IN**

**UNION TERRITORY OF DELHI**

****

**MASTER PLAN ORGANISATION**

**FLOOD CONTROL WING**

**DELHI ADMINISTRATION**

**1976**

**Master Plan for the drainage system in the**

**Muncipal corporation areas in Delhi.**

 The drainage systems under the Municipal Corporation areas in Delhi can be generally divided in to four parts:

1. Drainage System falling into Najafgarh Drain.
2. Drainage systems falling into Kushak Nalla Barapulla Nalla System.
3. Drains directly discharging into river Yamuna.
4. Drains falling into Shahdara drain.

The M.C.D. drains which fall into Najafgarh drain are again sub-divided into three zones viz. Karol Bagh Zone, West Zone and Civil Line Zone. The problem of drainage in these different zones are described in detail under their respective headings.

The drains of South Delhi which falls into the Barapulla basin are described in detail under the South zone heading.

The drains directly falling into the river Yamuna are described mostly under city zone and a few under Civil Line Zone.

As regards the Shahdara drainage system since the Shahdara basin in a composite one, consisting of both rural and urban drains, all the drainage systems in this basin are fully dealt with in a separate volume called Master Plan for Shahdara basin.

While designing the drains in the MCD areas, surveys were carried out jointly by MCD & FCD of practically all the drains. The problems were then examined during the 1975 monsoon which was a heavy rainfall year. It has been noticed that, there are no serious water stagnation in those M.C.D. drains, which are either constructed or remodeled according to the Reddy Committee recommendation of half inch per acre runoff, during the monsoon 1975, although the rainfall in 1975 monsoon, in certain automatic rain gauge stations were recorded as high as that of 10 years frequency. To give an example, the rainfall recorded at Gurmandi and Badli on 19th June, 1975 were 90.5 and 80 millimeters respectively. Subsequent to Reddy Committee also two committees were formed i.e. J.P.Jain Committee and Moti Ram Committee. There was no recommendation to increase the unit design discharge in urban area in these two reports as well .

During 1975 monsoon, however, the stagnation and erosion problems in the different reaches of MCD drains were noticed in the following cases. The reasons of stagnation were also analyzed and they were found mainly due to (a) Inadequate capacity (less than half cusecs per acre) (b) Poor maintenance of banks and bed (c) Failure of pumps (d) Chocking of nallas due to dumping of malba etc. The major problems faced in 1975 are listed below:

|  |  |  |
| --- | --- | --- |
| S.No. | Name of drain | Causes stagnation |
|  | Malviya Nagar drain | Very narrow and inadequate outfall drain. |
|  | Chirag Delhi Drain | Very narrow and inadequate section. Total silting up in upper reaches. |
|  | Greater Kailash drain | Poor maintenance of drain and inadequate section. |
|  | Wazirpur drain (Behind Model Town) | Inadequate out falling arrangement. |
|  | Radhey Puri drain (Shahdara) | Bad maintenance of embankments and inadequate of section.  |
|  | Kaithwara drain (Shahdara) | Inadequate out falling arrangements. |
|  | Navin Shahdara area | Temporary failure of pumping. |
|  | Lalita Park & Shakarpur area (Shahdara) | Total absence of drainage arrangements. |
|  | Madanpur Khadar | Inadequate outfall and poor maintenance of channels. |

It may be noticed that in spite of heavy rains in the urban area of Delhi in 1975, none of the drains constructed and maintained properly according to Reddy Committee recommendations, both in the NDMC and MCD areas suffered any water stagnation.

However to be on the safe side, designs of the MCD drains for the purpose of the Master Plan are done in two categories.

|  |  |  |
| --- | --- | --- |
|  | Light to moderately paved | 0.5 to 0.6 cusecs per acre. |
|  | Moderate to densely paved | 0.7 cusecs per acre. |

The areas in Karol Bagh and surrounding regions were considered moderate to densely paved, whereas the other areas were taken as light to moderately paved according to actual condition. As regards Red Fort area the catchments are assumed as moderate to densely paved, since they are mixed type catchments consisting of partly densely populated and partly open areas around Red Fort etc.

 In case of the major arterial drain like Najafgarh drain, Chirag Delhi drain Barapulla drain etc. the discharge in the different reaches were computed not by direct run off factors but by rational method, taking into consideration proper time of concentration, run off factors and areal distribution factors.

 The problems of the different drain in the different zones are described hereafter in details, one by one. The longitudinal sections of all the major drains are also enclosed, indicating therein all the necessary modifications.

 As regards the priority of scheme, the following are considered as of relatively urgent nature.

|  |  |  |
| --- | --- | --- |
| S.No. | Name of drain | Zone |
|  | Chirag Delhi drain | South |
|  | Malviya Nagar Drain | South |
|  | Wazirpur drainage scheme | West/Civil Line |
|  | Najafgarh (Upper urban reach) | Karol Bagh/ West |
|  | Redhey Puri drain | Shahdara |
|  | Shahdara arterial drain | Shahdara |
|  | Shakurbasti drain | Karol Bagh |
|  | Drain No.12-A | City Zone |
|  | Drain No.14 | City Zone |
|  | Greater Kailash drain | South |
|  | Daryai Nalla (tributaries) | Karol Bagh |
|  | Disused Channel | Shahdara |
|  | Gita Colony | Shahdara |
|  | Navin Shahdara drain | Shahdara |

**NAJAFGARH DRAIN:**

 The Najafgarh drain is the most important arterial drain that collects the urban drainage from the M.C.D. drains on the Northern and Eastern sides of the Union Territory of Delhi. The Najafgarh drain is actually the tailend of a river called Sahibi Nadi, coming from Rajasthan. It collects considerable storm water from Haryana Territory, crosses Dhansa Bund at the border, flows through rural Delhi for a length of 38.10 Kms and enters the city area near Nangloi outfall point.

 It traverses across the Karol Bagh zone, West Zone and Civil Line Zone of the Municipal Corporation area of Delhi. In a separate volume of the Master Plan, i.e. the Master plan for Najafgarh basin, the problems of the Najafgarh drain and its remodeling proposals have been described in detail. It has been mentioned, that the present capacity of the najafgarh drain is only three thousand cusecs at the outfall, which is totally inadequate and is being remodeled in its tail reach to a maximum capacity of 10,400 cusecs by providing lining. The Hydrological studies for ultimate remodeling of the Najafgarh drain were carried out in the Central Water Power Commission under the guidance of Shri J.Tripathi, Member (Floods), who had recommended that the ultimate possible augmentation of the capacity of the Najafgarh drain can be upto a figure of 10,000 cusecs. In his study the design discharges for the different reaches in the urban part of the Najafgarh drain were also given. His figures are enclosed as statement-I.

In this study, the C.W.C. had accepted a 5 years frequency rainfall of 2.17 inches for the design of this drain. The run off co-efficient were adopted as 0.45 in the moderately paved and 0.60 in densely paved areas. An areal distribution factor of 70% was adopted in the design.

In this study, it was presumed that the flow from Dhansa will not synchronie when the actual catchment of Delhi is discharging to its full. In exceptional case when both the storms coincide, there may be slight congestion in the city for a very short duration. Shri Tripathi also reiterated the proposal of a supplementary drain, which will ultimately cope with the discharge from the upper catchments and Delhi may be independently drained by the Najafgarh drain.

Since the question of constructing supplementary drain cannot be immediately thought of , on account of financial and other limitations, the proposals of improving the Najafgarh drain to its ultimate capacity in accordance with the recommended discharges calculated in Shri J.Tripathi’s report are taken up as final and the designs of the Najafgarh drain has been finalized in the urban reach. The proposed L-Sections are shown in drawing Nos. NGF XXII & XXIII. It may be mentioned that remodeling in the portion between Bharat Nagar bridge to the outfall point has already been started according to these proposals,

**Karol Bagh Zone:**

The Karol Bagh Zone comprises the urban area of Delhi bounded by Upper ridge road and Faiz Road on the East, Outer Ring Road on the West, Pusa Institute & New Rajinder Nagar on the South and Ashok Vihar & goods avoiding railway line on the North. There are a number of important storm water drain in this area, of which 10 drains, which require partial remodeling, were surveyed and examined in detail. A list of these drains, their salient features proposed depths etc. are given in the statement below. The other major drains in this area are functioning satisfactorily.

Out of the 10 drains examined, three drains e.g. Daryai Nalla (upper part), industrial nallah and Patel Road barrel are underground. Baljit Nagar drain is also a covered one. The Shakur Basti drain is also now proposed to be an underground barrel. A new drain for draining the Jakhira area is also proposed to be of RCC underground pipe.

Existing drains:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S.No.  | Name of drains | C.A. in Acs | Max. Q in Cus | Length Mts. | Lined Unlined/ Barrel | Max. Depth Mts. | Max. bed width Mts. | Remodeling require | Remark |
|  | Shakur basti Drain | 3850 | 1790 | 2440 | RCC Box | 4.00 | 6.00 | Yes |  |
|  | Daryai Nallah | 3385 | 2370 | 5718 | Lined | 2.00 | 12.00 | Yes |  |
|  | D.T.U. Nallah | 2000(U+R) | 670 | 1830 | Brick Lined | 1.60 | 10.00 | Yes |  |
|  | Patel Road Barrel | 850 | 510 | 2000 | RCC Barrel | 2000 mm.Q. | 4 Nos. | Yes |  |
|  | J.J.Colony Drain | 502 | 251 | 3220 | Lined | 1.70 | 2.80 | Yes |  |
|  | Subhadra Drain | 475 | 238 | 625 | Lined | 1.20 | 3.00 | Yes |  |
|  | Kanhaiya Nagar Drain | 333 | 233 | 2100 | Lined | 1.22 | 3.66 | No. |  |
|  | Industrial area nalla | 240 | 120 | 1003 | RCC Barrel | 1200mmQ  | 2 nos. | Yes. |  |
|  | Ranjit Nagar Drain | 182 | 91 | 1100 | Brick lined | 0.80 | 2.50 | No. |  |
|  | Baljit nagar Drain | 70 | 49 | 900 | Brick lined with cover | 0.60 | 1.25 | No. |  |

**Proposed Drain.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Baljit nagar Drain | 110 | 77 | 800 | RCC Pipe | 1200 mm Q. | 1 No. | New Drain |  |

A zonal Plan (Drawing No.MPO/KBZ/1) showing the alignments of all the above drains is enclosed.

The description of the drains & their problems are given below:-

**1. SHAKURBASTI DRAIN:**

 The Shakurbasti Drain originates at Rampura near the Ring Road and flows southwards for a length of 625 metres. Thereafter it takes a turn towards east and runs along the Delhi-Rohtak Railway line and ultimately falls into Najafgarh drain. This drain has its catchment area to the North of Delhi-Rohtak railway line. The catchment area is partly industrial and a major portion is being developed by the DDA. The general slope of the country is towards Najafgarh drain. The total length of the drain 2440 metres and serves a catchments area of 3580 acres.

 The existing drain is underground, which is found to be inadequate to carry the discharge from its catchment area, which is being considerably developed and urbanized by DDA in their H4, H5 & H5 (part) zones. The section of the drain is therefore proposed to be replaced by RCC barrels. The area through which this drain passes being highly congested, no additional land can possibly be acquired. Therefore, the proposed barrels are also kept of the same width as that of the existing covered drain. The catchment of the drain is taken as fully developed, with moderate density of population. The design discharge has therefore been adopted as 0.5 cusecs per acre. The drain is to outfall into Najafgarh drain bed. Therefore, to prevent backing up of Najafgarh drain in case of high flood, as also to facilitate cleaning etc. of this barrel occasionally, provision of double grooves for providing karries at the outfall is proposed. The WSSDU had an alternative proposal of diverting part of the discharge from H5 area into Kanhaiya Nagar drain. This was examined in detail but found to be not a suitable proposition, since, the Kanhaiya Nagar drain runs along a relatively higher contour (parallel to the Delhi Tail Distributary) and hence against the natural direction of flow. L-section of this drain is shown in drawing No.MPO/KBZ/2.

**2. DARYAI NALLAH.**

 This drain at present carries the storm water and sullage discharge from the urbanized area of Karol Bagh, Rohtak Road etc. the existing drain is barrel type from the starting point at Shankar Road upto Rohtak Railway Bridge. The reach of the drain from railway line, as at present, is kacha open drain.

 The drains run through moderate to densely populated areas and a unit discharge of 0.7 cusecs per acres has been adopted for designing the drain. The drain originates near the Shankar Road and flows through Rajinder nagar for a length of 800 metres, where it crosses the Pusa Road. Thereafter, it flows through Karol Bagh and Sarai Rohilla area for a length of 3000 metres and crosses Shankar Road. It then flows towards Shastri Nagar and Bharat Nagar areas and falls into the Najafgarh drain. The total length of a existing drain is 5700 metres and serves a catchment area of 3386 acres.

 The capacity of the barrel portion has been found to be adequate under ¾ full condition with unit discharge 0.7 cusecs per acre all through its length. Capacity for a small portion between RD.2627 and RD.2816 is slightly less. However, the inadequacy is very nominal and can be permitted by slight encroachment of free board. In the open portion of the drain, below the railway bridge however, considerable silting has been noticed. The maintenance of the drain is very poor. Moreover, the capacity appears to be inadequate. Therefore, this reach is proposed to be remodeled and fully lined either with CC blocks or stone masonry. However, in case this lining is financially not possible the bed width of the drain should be suitably widened in this reach, accordingly to the design discharges mentioned in the L-section.

 It has been noticed in the Dev Nagar area that some of the barrels joining the Daryai Nallah are inadequate. Particularly one barrel is necessary, along the road, in between Lala Desh Bandhu Gupta Road and New Rohtak Road, for carrying the flood discharges from Anand Prabat which get stagnated in a round –about in this area. Similarly, the connecting drain from Bara Hindu Rao, Filmistan and Delhi Cloth Mill area should also be immediately improved, as these areas get water logged practically every monsoon. The outfall structure of the Daryai Nallah on the Najafgarh drain, has been examined and found to be adequate and requires no remodeling.

 L-section of this drain is shown in Drawing No. MPO/KBZ/12.

**3. D.T.U. NALLAH.**

 The drains starts at he confluence point of Ranjit Nagar and Baljit Nagar Nallah, near D.T.U. Colony. This is an open drain. Its length is 1830 metres and serves a drainage area of 2000 acres, of which 1000 acres in Pusa Institute and surroundings are considered as semi rural. The section of the drain is lined for the reach 0 to 1465 metres and thereafter the section is Kacha, which is proposed to be lined. The drain has its outfall into Ramesh Nagar Nallah.

 The area served by the drain is lightly built up and a design discharge of 0.5 cusecs/acre has been taken for the urban portion. For the semi rural portion 0.15 cusecs /acres has been adopted. The existing structures across the drain are adequate. It is proposed to provide pucca structures at the outfall points for proper energy dissipation. A small size cunnette is provided in the upper section of the drain, to carry the dry weather flow from the area.

 L-section of this drain is shown in Drawing No. MPO/KBZ/7.

**4. PATEL ROAD BARREL:**

 This is an existing underground drainage system. It starts near the crossing of Pusa road and Shankar Road, runs towards North-West along the Patel Road for a length of 2000 metres before out falling into the D.T.U. Nallah. The total area covered by this drain is 850 acres. The catchment area is developed two times moderately populated. The design discharge of 0.6 cusecs per acre has therefore been assumed for design purposes. The existing section of the drain is found grossly inadequate to cater for the storm water run from the area. Additional pipes are proposed to be added at different reaches.

 L-section of this drain is shown in Drawing No. MPO/KBZ/6.

**5. J.J. COLONY NALLAH**

 The drain starts from the Ashok Vihar Colony and runs by the site of the Link Road for a length of 500 metres where it turns towards South and Flows along the Delhi Tail distributor and ultimately the drain outfalls into the Najafgarh drain. The total length of the drain is 3220 metres and the catchment area is 502 acres. The bed level of the drain is to be lowered slightly all through. The bed of the drain at outfall point is quite above the bed level of the Najafgarh drain and as such a pucca structure is to be provided with necessary energy dissipation arrangements to avoid any damage to the Najafgarh drain. This structure is to be constructed after the proposed remodeling of the Najafgarh drain in this reach.

 L-section of this drain is shown in Drawing No. MPO/KBZ/11.

**6. SUBHADRA COLONY DRAIN:**

 The drain starts from the Subhadra Colony area and runs towards south-east along the Western Yamuna Canal and falls into Daryai Nallah. There is one Industrial Nallah which also joins the Subhadra Colony drain at RD.251. The total length of the drain is 625 metres and covers a catchment area of 475 acres. This is an open drain having lined section throughout its length. The area served by this drain is lightly populated and as such the design discharge of 0.5 cusecs per acre has been adopted for the design of drain. The portion from RD.251 upto outfall requires remodeling and lining. The water way for the existing structural safety has to be examined at the time of remodeling of the drain.

 L-section of this drain is shown in Drawing No. MPO/KBZ/10.

**7. Kanhaiya Nagar drain.**

 The drain originates near goods avoiding railway line and runs along Delhi tail distributory. It flows through Lawrence Road Colony, Tri Nagar and Ganeshpura and falls into the Najafgarh drain. The total length of the drain is 2100 metres and covers a catchment area of 333 acres. The existing drain is an open one with its bed and sides lined. The section of the drain is found to be adequate to cater for the discharge from the catchment area. The drainage area being moderate to densely populated, a design discharge of 0.7 cusecs per acre has been adopted. The water ways under the existing structures across the drain are also adequate. The bed of the stair at its outfall into the Najafgarh drain is at about 5 metres above. Therefore, suitable energy dissipation structure requires to be constructed at the outfall.

The existing drain passes through a closely built up area and it is suggested to cover the drain throughout its length to avoid falling of children in the drain as well as to avoid dumping of house-wastes in the drain, which may choke the water way and create insanitary conditions for the surrounding locality.

 L-section of this drain is shown in Drawing No. MPO/KBZ/3.

**8. Industrial area Nallah:**

 This drain starts from New Rohtak road and after passing through the railway protection force area, flows towards North and outfalls into Subhadra Colony Drain. The entire system is under ground, except for some portion falling within the R.P.F. area. The existing section of the drain is found/to be adequate except for a reach between RD.580 to 850 where an additional pipe of 600mm dia meter has been proposed to be laid. The total length of the drain is 1003 metres and it covers a catchment area of 240 acres. The drain passes through built-up areas and a design discharge of 0.5 cusec. per accre has been assumed for the design purposes.

 L-section of this drain is shown in Drawing No. MPO/KBZ/9.

**9. RANJIT NAGAR NALLAH:**

 The drain originates near the Ranjit Nagar Colony and passes through area of South Pater Nagar and Shadipur, etc. The drain after traversing a distance of 100m. outfalls into the D.T.U. Nallah near D.T.U. Colony. The total catchment area for the drain is 182 acres. The existing section of the drain is found adequate and remodeling of the drain is not necessary. At the outfall point it is proposed to provide suitable pitching to prevent retrogression.

 L-section of this drain is shown in Drawing No. MPO/KBZ/4.

**10. BALJIT NAGAR DRAIN.**

 The drain starts just behind the Shadipur Delhi Milk Scheme Depot and flows south west for a length of 900m. Where it meets the D.T.U. drain. The drain caters for a catchment area of 70 acres. The catchment is semi-hilly and moderate populated and a design discharge of 0.7 cusecs per acre has been assumed. The existing section of the drain is lined throughout its length and is quite adequate. There are a number of falls in the bed of drain and suitable pucca structures are required to be provided. The outfall point is also to be provided with suitable pitching.

 L-section of this drain is shown in Drawing No. MPO/KBZ/.

**11. JAKHIRA DRAIN**

 The area around Jakhira chowk is low lying and suffers drainage congestion during the monsoon season. It is proposed to provide a covered drain starting from upstream of Jakhira chowk. It is to run along the New Rohtak Road and will fall into Najafgarh drain. The total length of the proposed drain is 800m. and caters for a catchment area of 110 acres. The design discharge from the catchment is taken as 0.7 cusecs per acre as the area served by the drain is moderate to densely paved. As the difference of the bed levels at the outfall is 6.3 metres, adequate brick masonry wall outfall structure requires to be constructed.

 L-section of this drain is shown in Drawing No. MPO/KBZ/8.

**WEST ZONE DRAIN:**

 The topography of west zone is, in general, very flat and many pockets exist which are prone for storm water flooding. The catchment areas of all west zone drains are shown as drawing at appendix WZ1. The large drains built, generally, adequate to carry the anticipated discharge (except Ramesh Nagar & Ring drain) and all these drains outfall into Najafgarh drain. The levels at full supply depth of these drains are higher than the levels at full supply depth of Najafgarh drain, as such back water effect from Najafgarh is not anticipated.

The link drains feeding the main drains require improvements and certain new link drains are proposed to ensure quick disposal of storm water from certain pockets prone to flooding.

The existing drainage scheme, taken up for detailed study is lined as under along with their general features. The drains are lined under two heads, existing drains and proposed drains.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| S.No. | Name | Length of drain in Km. | Catchment area in hectares | Maximum anticipated discharge in cumecs | Remarks  |
|  | West Zone drainage (Existing) |  |  |  |  |
|  | Subhash Nagar Drain | 4.72 | 823 | 28.5 | Existing sections adequate. |
|  | Ramesh Nagar Drain | 3.23 | 1380Urban+635(Rural) | 61.3 | Existing sections inadequate. to be remodeled. |
|  | Ring Road drain | 2.23 | 426 | 14.70 | Require extensive remodeling |
|  | Rajouri Garden | 0.82 | 646 | 2.27 | Existing section adequate. |
|  | Jail Road Drain | 1.94 | 106 | 3.72 | Existing single 48 inch dia barrel inadequate open drains proposed. |
|  | Tatarpur drain | 1.68 | 130 | 4.45 | Existing section adequate. |
|  | Moti Nagar drain | 1.07 | 316 | 11.20 | Existing section adequate. |
|  | West Zone drains (New proposed) |  |  |  |  |
|  | Jail Road drain | 1.14 | 64.6 | 2.27 | New Section |
|  | Prem Nagar drain | 0.50 | 61 | 2.12 | New Section |
|  | Hari Nagar drain | 1.34 | 204 | 7.15 | New Section |
|  | Wazirpur Complex (Existing) |  |  |  |  |
|  | Wazirpur Drain  | 3.99 | 822 | 28.8 | Inadequate section being reivised. |
|  | Wazirpur Complex (Now proposed)(only alternative 1 listed) |  |  |  |  |
|  | Shalimar Bagh drain Phase-I | 7.14 | 705 (Urban)+ 1140 (Rural) | 27.85 | New Section |
|  | Sabzimandi drain | 2.10 | 220 | 7.70 | -do- |
|  | Shalimar Bagh drain Phase-II | 2.70 | 248(urban) + 674 (rural) | 10.40 | -do- |
|  | Karnal Road drain | 1.68 | 127 | 4.45 | -do- |
|  | Model Town drain | 3.60 | 440 | 15.34 | -do- |
|  | Radio colony drain | 2.55 | 450 | 15.60 | -do- |

 The above drains are discussed in detail in the succeeding paragraphs.

**RAJOURI GARDEN DRAIN:**

 This is a drain of short length, running parallel to Najafgarh drain (flowing from West to East) and out falling into Ring Road drain. This drain is of considerable importance, as Rajouri Garden is a totally built up colony, virtually flat and it is reported that the colony get stagnated by knee-deep water.

 The drain is about 0.8 Km. long has a catchment area of 65 hectares and a maximum anticipated discharge of 2.29 cumecs. The existing drain has a lined section of size sufficient to carry the anticipated discharge. Thus no reasons could be attributed to the reports that the colony is vulnerable for flooding, except that the existing link drains may not be functioning properly.

The details of the drain are shown in the Drawing at appendix WZ-2.

**RING ROAD DRAIN:**

 This is one of the major drain in West Zone, which has a direct outfall into Najafgarh drain. The drain runs parallel to Ring Road, and Pusa North, draining Colonies likes Manas Sarovar,Sharda Puri, Rajouri Garden etc. The drain is having a shallow basin in its catchment area and these area are liable for flooding due to the inadequate functioning of cross/distributary drams/

 The drain is about 2.3 km long, and having a catchment area of 420 hectares and a maximum anticipated discharge of 14.7 cumecs at the outfall point. The existing section in the entire reach is lined section with brick-work. But the existing sections are found inadequate to carry anticipated discharge and revised sections are proposed for the entire length.

 Though the drain runs in a congested area, still there is sufficient land available for proposed widening of drain. At the outfall point, a masonry structure will be essential in view of the large difference in bed level of Ring Road drain and Najafgarh drain. But this outfall structure will have to be taken up only after the proposed widening of Najafgarh drain is completed. Also the existing culverts need remodeling.

 The details of the drain are shown in the Drawing at appendix WZ-3.

**MOTI NAGAR DRAIN:**

 Moti Nagar drain is one of the drains out falling into Najafgarh drain. The drain caters for storm water from Rampura, Moti Nagar etc. The drain is having an open section from Najafgarh road upto its outfall point. No defined open drain exists in its upper reaches and enquiries have revealed that the catchment area is not flooded during monsoon. Also, the catchment area in its upper reaches are industrial area and hence quick disposal of the storm drainage is looked after.

 The drain has length of about 1 Km., a catchment area of 316 hectares and a maximum anticipated discharge of 11.22 cumecs at its outfall point into Najafgarh drain. The section of the drain is well defined with stone pitching in bed and sides. Though the maintenance of the drain is poor, the existing section is adequate to carry the anticipated discharge, mainly due to the steep slope of the bed.

 No outfall structure is existing at the junction of Najafgarh drain. Due to the considerable difference in bed levels between Najagarh drain and Moti Nagar drain, it is recommended to construct a masonry outfall structure, preferably after the proper widening of Najafgarh drain.

The details of the drain are shown as the Drawing at appendix WZ-4.

**TATARPUR DRAIN:**

 This is another drain having a direct outfall into Najafgarh drain and by its catchment area it could be treated as a minor drain. The drain is having a length of 1.7 K.M., a catchment area of 130 hectares and a maximum anticipated discharge of 4.45 cumecs at the outfall point. The drain caters for storm water drainage of Tagore Garden and J.J. Colony behind it.

The section of drain, as existing, is built up with masonry side walls and bed to the full length. The section is in a good condition, except at places desilting may have to be done. No structure exists at the outfall point into Najafgarh drain. It is recommended that a proper masonry outfall structure be built, after the proposed widening of Najafgarh drain.

The details of the drain are show in the Drawing at appendix WZ-5.

**RAMESH NAGAR DRAIN:**

 This is one the most of the important drains of the West Zone area. This drain has a large catchment area of mixed categories. Considerable portion is highly urbanized area, certain portion is from the ridges of Central Delhi and another portion which can considered as rural. The drain is about 3.25km. long, has a total catchment area of 2015 hectares (1368 hectares urban and 635 hectares rural) and a discharge of 61.3 cumecs at the outfall point. The drain outfalls into Najafgarh drain. Except for the ridge area with rocky outcrops like Anand Parbat, Shankar Road and upper ridge road, the catchment area is generally flat.

 The link drains which are attributing to the storm flow are as under, which have been discussed in detail:

1. Patel Road drain
2. Ranjit Nagar drain
3. Baljit Nagar drain
4. D.T.U. drain
5. Inderpuri drain
6. Naraina drain

Patel Road drain, as existing consists of a barrel, laid underground and it is supplemented by another barrel towards its outfall. The catchment area is the portion east of Patel Road (i.e. East and West Patel nagar), upto the elevated ground of Anand Parbat. The area is densely populated. Because of the inadequacy of these barrels, a twin masonary rectangular drain is under construction. The drain outfalls into D.T.U. drain.

Baljit Nagar drain flows from East towards west, draining the thickly populated areas of Baljit Nagar and out falling into DTU Nallah. The existing drain is adequate to carry the maximum anticipated discharge.

 Rangit Nagar drain drains the area West of Patel road i.e. South Patel Nagar and Ranjit Nagar. The drain is an open drain with masonry bed and side wall and the existing section is adequate to carry the anticipated discharge.

 The DTU Nallah collects the storm water from the above mentioned drains, meanders through Pusa Agricultural Institute and joins Ramesh Nagar drain. The catchment area of the Pusa Agricultural Institute is treated as green area for purposes of contribution storm water from its catchment area to the drain. (A net discharge of 0.30 cusecs per acre is considered from the Green area, which is arrived at the using a runoff factor of 0.20).

 Inderpuri drain has its origin in the rocky ridges of central Delhi, flows near Inderpuri collecting the storm water and joins the drain from Naraina area.

 Naraina area between Ring Road and circular railway line disposes of the storm water into a pitched drain laid by DDA. This drain outfalls into Ramesh Nagar drain, after collecting the storm water from Naraina Industrial area and J.J.Colony.

 The existing Ramesh Nagar drain is a built up section to its entire length of drains i.e. upto its outfall point into Najafgarh drain. Though the drain has well defined section with masonry bed and side walls, still the section is inadequate to carry the anticipated discharge. Hence, a revised section is proposed, to cater for the discharge.

 At present, there is no proper structure at the outfall point into Najafgarh drain. In view of the large difference in bed level between proposed bed level of Ramesh Nagar drain and Najafgarh drain, a proper masonry structure is recommended to be built at the outfall point after widening of Najafgarh drain is completed.

The details of the drain are shown in the Drawing at appendix WZ-6.

**JAIL ROAD DRAIN.**

 As the name indicates, this drain has its origin near jail and run parallel to Jail road and outfalls into Subhash Nagar drain, after crossing Najafgarh Road.

 The existing arrangement is through pipe drain of 48 inches dia laid underground. The catchment area is predominantly flat and there are certain pockets in which drainage arrangements are inadequate and hence, the area is liable for water logging. Also, till recently the development activities were relatively non-existing as such the water logging of areas was not as seriously viewed as it is now, in view of residential accommodation springing up.

In view of proper drainage of the area, it is found that existing pipe drain is inadequate to carry the anticipated storm water and hence it is now proposed to run a open surface drain parallel to Jail Road upto the outfall point to Subhash Nagar. This drain has additional catchment area through a proposed link drain called Prem Nagar Link drain. The proposed link drain has to cross the Najafgarh road and from this covered drain in view of the developments which has already taken place.

 The drain, as proposed is about 1.1 K.M. long, has a catchment area of 64.6 hectares and a maximum anticipated discharge of 3.7 cumecs at the outfall point. The proposed drain is stone pitched section in its open reach and will have a suitable masonry outfall structure.

 The details of the drain are shown in the Drawing at appendix WZ-7.

**PREM NAGAR DRAIN.**

 This is a new drain, proposed to the west of Jail Road,. The drain is to collect the storm water in Prem Nagar area. The topography of the area is flat and at present, the area is prone for flooding. The proposed drain runs parallel to jail Road and function as a link drain to Jail road drain.

 The length of the proposed drain is 0.5 km, a catchment area of 61 hectares and an anticipated discharge of 2.1 cumecs at the outfall point.

 The details of the drain are shown in the Drawing at appendix WZ-8.

**HARI NAGAR DRAIN**

 This drain is also being proposed as a new drain. This drain is within the catchment area of Subhash Nagar drain and is meant to drain out the newly developed area between Subhash Nagar Colony, Jail Road and Mayapuri Road. The necessity of this drain might not have been felt earlier, as the area was not developed and hence stagnation of storm water did not draw attention. As a colony is under development in this area, and the topography of the area is virtually flat, this area is prone for flooding and requires immediate attention for drainage.

 The proposed drain is about 1.3 km. long, has an urban catchment area of 204 hectares and a maximum anticipated discharge of 7.15 cumecs at the outfall point. The drain is proposed to be stone pitched.

 The details of the drain are shown in the Drawing at appendix WZ-9.

**SUBASH NAGAR DRAIN:**

 This is another important drain of West Zone out falling into Najafgarh drain. This drain is about 4.7km long and having a catchment area of 823 hectares and an anticipated discharge of 28.5 cumecs at the outfall.

 The drain starts from Subhash Nagar drain and has link drain from Hari Nagar and Jail Road, crosses Najafgarh Road and outfalls into Najafgarh drain. The catchment area is almost flat.

 The drain is an open drain in its entire length, with a properly built section and pitched at its bed and sides. The existing section of the drain is adequate to carry the anticipated discharge; as such no modifications are required for the existing cross-drainage works. Though the existing section is adequate in carrying the anticipated discharge, yet desilting operations will have to be carried out in the entire stretch of the drain to achieve a uniform bed slope. At present, there is no proper structure at its outfall point in Najafgarh drain and it is essential that a masonry structure is built at this outfall point.

 The details of the drain are shown in the Drawing at appendix WZ-10.

**WAZIRPUR COMPLEX.**

 The drainage scheme in this complex is of considerable importance, as Wazirpur is being developed by DDA to an urban area (areas North of Ring Road) and the already developed areas in Model town and Azadpur do not have a proper drainage scheme. Area North-West of Model Town is already marshy land, causing health hazard to the population in this area. The marshy land is almost at the bed level of Najafgarh drain as such the storm water disposal of this area by gravity is ruled out. Due to the fact that this area is low lying, the area also gets water logged very easily. Hence drainage of this area is a primary problem, which had to be studied in great detail.

 The topography of the entire area has been studied before a suitable scheme is envisaged. Hence almost all primary main drains are proposed drains including their alignment. The area has been roughly categorized in three zones.

1. Zone to the West of Karnal road—G.T. Road.
2. Zone east of Karnal Road (Model Town area).
3. Existing marshy area.

The zone of category (a) is generally situated in relatively high ground, as such it is feasibility to drain the area by gravity flow, to Najafgarh drain. No suitable drain exists at present whose alignment/sections could be improved. The area being drained is taken through a drain which is contained in embankments and aligned in the area sandwiched between Model Town and marshy land.

 Wazirpur complex has been discussed in two alternative regarding disposal of storm water, alternative 1 & II.

Alternative-I.

 The names of proposed drains in this zone are Shalimar Bagh drains phase I & Phase II and Subzimandi drain.

 Under zone (b) entire existing Model Town Complex and Azadpur is being considered and the disposal of storm water is to be by a drain with gravity flow and out falling into Najafgarh drain. In view of the existing contours and levels the drain has a very flat bed slope and the general features including catchment are shown in the drawing at WAZ.1. In order to prevent back flow from Najafgarh drain into this drain, it is necessary to provide suitable arrangements like gated structure with wooden karries at the outfall point.

 The name of the proposed drain in this zone is Model Town drain.

 Under zone (c) the existing marshy land is being considered for drainage purposes. At present in this area, there exists a shallow drain (virtually confined by embankments) through which the sewage/ sullage/ storm water of Model Town area is being pumped from a pump house operated by MCD. The drain meanders through Radio Colony, crosses Shahalam Bund beyond Radio Colony and outfalls into Burari Creek. As Burari Creek it self is below the normal flood level of Yamuna (at 50,000 cusecs) the performance of this drain is very poor. Also, the discharge capability is totally dependent at the efficient pumping at Burari Creek Regulator.

 The proposed drain in this zone is Radio Colony drain.

 In addition to the above zones, it is possible to drain a considerable pitch of land West of Karnal road independently to Najafgarh drain by the provision of a new drain; called Karnal Road drain.

Shalimar Bagh Drain Phase-I.

 This is a new drain proposed to drain basically the newly developed (by DDA) Shalimar Bagh. The drain runs parallel to Northern Railway track (leading towards Karnal), crosses the railway track, and G.T.Road. At this point, two more link drains outfall into this drain. Since the area further is low-lying, it is proposed to run the drain in embankments in order to ensure a reasonably good velocity of flow in the drain.

 The length of the drain is 7.14k.m. a catchment area of rural (1140) Urban (705) hectares at its outfall point into Najafgarh drain and a new anticipated discharge of 26.6 cumecs. The proposed drain will have to have suitable cross-drainage works at its crossing of roads and railway track. The width of the drain is kept limited in order to ensure a minimum if land acquisition, as this may really pose a problem in the reaches of Radio Colony. In the proposed design, the full supply level of Shalimar Bagh drain and Najafgarh drain are same as such back water flow into Shalimar drain will occur. Hence, it is recommended that a suitable structure with provision of gate/wooden karries be made at the outfall point.

 The details of the proposed scheme are shown in drawing at appendix WAZ-2.

**SABZI MANDI DRAIN:**

The catchment area for this drain is the area between the Railway track (towards Karnal) and G.T. Road. At present, there is no suitable drain to dispose of rain water from Sabzi Mandi area, and the storm water has a tendency to flow north and inundate the rural area.

 The proposed drain has a length of 2.1 Km., a catchment area of 220 hectares and maximum anticipated discharge of 7.7 cumecs at its outfall point into the proposed Shalimar Bagh drain. The alignment of drain is parallel to G.T. Road and it is contended that this does not involve land acquisition problem for purposes of construction of drain. The proposed section is a lined section with stone pitching in sides and bed.

 The details of the proposed scheme are shown in drawing at appendix WAZ-3.

**SHALIMAR BAGH DRAIN: PHASE:II**

 The area north of Shalimar Bagh, upto the green belt zone bifurcating urban and rural area falls with the drain’s catchment. Thus, the catchment area is 248 hectares of urban and 674 hectares of rural area.

 The drain is about 2.7 km. long before it outfalls into Shalimar Bagh drain, and the alignment of the drain is U shaped. The drain runs parallel of Railway track, and traverses north, turns east at the railway culvert at milage 11/3 and runs South parallel to G.T. Road. As the area at the green belt (i.e. at railway culvert) is at low contours, the drain has influenced the bed level of Shalimar Bagh drain from Shahlam bund and further downstream. The area is general is still developing as such land acquisition may have no problems.

 The details of the proposed scheme are shown in drawing at appendix WAZ-5.

**MODEL TOWN DRAIN:**

 As already discussed, at present there is no proper storm water drain in Model Town area and the surface water flows into the marshy area. Hence, a new drain is being proposed to divert storms water out falling into Najafgarh drain. Since Model town area in general is in low contours, the proposed drain has very flat bed slopes, with very sluggish flow, giving room for a perpetual silting up problem. As this a better compromise when compared with pumping of water to avoid flooding, the maintenance authorities should ensure that desilting operation of drain is carried out before onset of monsoon every year.

 The drain is about 3.6km. long, has a catchment area of 440 hectares and a maximum anticipated discharge of 15.34 cumecs at the outfall point. It is proposed to align the drain parallel to Shalimar Bagh drain, as such the problem of land acquisition need not independently be looked into.

 Since the full supply level of the drain will be same as of Najafgarh drain, it is recommended that a suitable structure with provision of gates/wooden karries be provided to prevent back water flow.

 The details of the proposed scheme are shown in drawing at appendix WAZ-6.

**RADIO COLONY:**

 As discussed earlier, Radio colony is situated in levels well below the normal flood of Yamuna river, as such this area gets flooded due to in adequate drainage. The drainage is effective for storm water only when Yamuna has normal flow. Otherwise, storm water has to be pumped out.

 At present, the area North-West of Radio Colony is a marshy land where water gets stagnated all the year through. At present the outlet is only by pumping water into a shallow drain (existing above the natural surface level). Out falling into Burari Creek.

 It is now proposed to drain water from the marshy land to Burari Creek by a properly designed section to cater for the drainage of catchment area. In view of the development of Shalimar Bagh drain and Model Town drain, it is water to these low lying areas are largely reduced and it is practicable to drain the area.

 The proposed length of drain is about 2.55km. , a catchment area of 450 hectares and a maximum anticipated discharge of 15.6 cumecs at the outfall point (to Burari Creek). As the area is not developed, the problem of land acquisition for the proposed drain does not virtually arise.

 The details of the proposed scheme are shown in drawing at appendix WAZ-7.

**WAZIRPUR COMPLEX (ALTERNATIVE SCHEME).**

 The disposal of storm water from the present Model Town, Adrash Nagar, Azadpur, Shalimar Bagh area is through a drain called Wazirpur drain, which meanders through the region behind Model Town. There is no network of drain to locate the flow of storm water and the existing Wazirpur drain is totally inadequate to carry the storm water. Added to this, the Wazirpur drain outfalls into Burari Creek, which itself is ineffective during the moderate flooding of Yamuna river (even at 20,000 cusecs flood discharge, Burari Creek is ineffective, as its full supply level will be below Yamuna level).

 With the back ground, another scheme is also drawn up apart from the scheme already discussed, to drain out the storm water. The general layout/alignment of the drain and their catchment areas correspondingly are shown in drawing No.MPO/WAZ/8. It can be seen that primarily it has three drains, a drain running parallel to Karnal road & intercepting the catchment area of Shalimar Bagh area, Model Town drain with the catchment of Subzimandi, Adarsh Nagar etc. and the Radio Colony drain.

 The main feature of the scheme is that the main drain having maximum catchment area is being carried parallel to Karnal Road, out falling into Najafgarh drain. This drain has to be basically covered in its entire length (parallel to Karnal Road) as there is very limited space existing for an open drain. The RCC cover slab at top will function as the space for pedestrians etc. and this alignment is proposed to limit the cost of acquisition of land. The depth of cutting involved will be high, as the general ground level is sloping in the opposite direction to be proposed flow of drain. The scheme, with the proposed cross sections are shown in drg. No. MPO/WAZ/9.

 The alignment of Model Town drain has remained the same as in the earlier Scheme already discussed, except that in this proposal, it has an additional catchment area. The scheme along with section and details are shown on Drg. No. MPO./WAZ/10.

There is virtually no change in Radio Colony drain, small portion of the drain, in its upper reaches has retained the existing alignment of drain from the MCD pump house behind Model town upto Radio Colony. The details of the scheme have been shown on drg. No. MPO/WAZ/11.

**CIVIL LINES ZONES:**

**KHYBER PASS DRAIN:** (Refer Drg. No. MPO/CLG/2)

 The Khyber pass drain at present starts from Alipur Road near Civil Lines police Station, traverses a distance of about 545 metres and discharges into an open low-lying area, causing stagnation of water there.

 It is now proposed, that the drain which at present, finishes into a low-lying area, shall be excavated further upto Yamuna River for a length of 375 metres along a suitable alignment and as per the pitched section required for passing the requisite amount of discharge, as shown in the drawing of this drain. There is an existing culvert at the proposed crossing of this drain with Ring Road but a regulator is required to be constructed near Ring Road, so as to avoid the back water effects of Yamuna river during high floods.

 The total length of the drain when completed shall be about 920 metres. It shall cater to a total drainage area of about 128 acres (51.82Ha) upto its outfall point. The discharge at outfall works out to be 64 cusecs as per the Experts Committee’s recommendations of ½ cusecs/Acre for lightly paved area.

 The drain in general will dispose of the storm water of the localities of Khyber Pass market, Old Sectt. And Civil Lines area, etc.

 The existing initial reaches of this drain are pitched but their capacities are insufficient and hence, it is proposed to widen this drain by about 0.5m (from 0.8m. to 1.4m between RD.0 and RD.290, from 2m. to 2.5m in the balance reach). The bed of the drain also needs lowering nominally as per the proposal L-section of this drain.

**METCALFE HOUSE DRAIN:** (Refer Drg. No. MPO/CLG/3)

Metcalfe House drain starts from near the transport authorities (near Under-hill road) passes by the side of Malaria Institute, I.P. college, Metcalfe House, etc. and finally outfalls into Yamuna river through a regulator up stream of Ring Road culvert.

 The total catchment area of the drain is about 202 acres and the discharge at the outfall works out to be 101 cusecs (2.86 cumecs) as per a discharge factor of ½ cusecs/acre for lightly paved urban areas. The total length of the drain is about 1200 m. The existing sections of this drain from start to finish are found to be adequate to carry the design discharge and hence, no widening is proposed except that the drain should be properly reshaped to the designed bed levels. The drain is found to be considerably silted upto in the upper reaches and must be properly maintained and desilted every year. The existing regulator is adequate and no change is suggested. However, a proper outfall structure needs to be constructed as out falling water at present, is causing erosion on d/s of Ring Road and may endanger the Ring Road embankment.

**QUDSIA BAGH DRAIN** (Refer Drg. No. MPO/CLG/4)

The quidsia Bagh drain starts from the opposite side of St. Stephens College’s play ground & runs by the side of Qudsia Marg, till it outfalls into Yamuna River through an existing regulator. Two drains namely Bela Road drain and Morigate drain join Qudsia Bagh drain at Ring Road culvert, just before the Qudsia Bagh drain outfalls into Yamuna river. The total catchment area of the drain is about 954 acres (386 hectares) and the discharge at outfall works out to be 477 cusecs (13.5 cumecs) as per a discharge factor of ½ cusecs/acre for the lightly paved urban areas.

 This drain disposes of the storm water of the localities of the Moti Bagh, Rly Colony, Rajpur Road, part of Civil Lines, Ludlow Castle, etc., in addition to the localities which fall in the catchment of Morigate drain and Bela Road drain.

 The total length of the drain is about 1215m. The existing sections of the drain right from the beginning are inadequate to carry the design discharges.

Proposed sections as per requirements have been suggested, proposed, in addition to the lowering of the bed in the tail reaches. The drain, in general, requires sufficient remodeling in addition to the culvert at RD.0, RD.100, RD.250, which require remodeling. The drain regulator at outfall is at present manually operated with needles (Karies etc.) which may be equipped with a mechanically operated gate. The outfall structure downstream of regulator needs /or debris clearance and some minor repairs.

**MORI GATE DRAIN:** (Refer Drg. No. MPO/CLG/5)

 The existing mori Gate drain which is a covered drain starts from the crossing of Gokhale Market, Passes through Jhuggi Jhopdi Colony and then from Mori Gate Chowk it runs along the old city wall near ISBT and finally outfalls into a sump near Nigambodh ghat on the Ring Road.

 Besides carrying the storm water of its catchment, this drain, at present traps and carries and a certain amount of sewage also. This combined storm water sewage is than, lifted from the sump well of Nigam Bodh Ghat to the Delhi Gate Trunk Sewer.

 It is very necessary that the disposal of sewage be separated from the storm water by removing all the existing sewage connections. For the disposal lf the storm water, it is suggested that the existing drain be cut off from near the Inter State Bus Terminus and then taken to Qudsia Bagh drain, along Ring Road where an abandoned drain is already existing. This drain can thus dispose off its storm water into Yamuna river through Qudsia Bagh drain and there is no necessity of taking it to the Trunk Sewer & unnecessarily increasing the load on the sewage treatment plant. The catchment area of this drain is 435 acres (176 hectares) which caters to the storm water from Rly Colony, Gokhale Market, Morigate, ISBT etc. and the anticipated discharge is 217.5 cusecs (6.16 cumecs) as per the discharge factor of ½ cusecs/acres for lightly paved urban catchment.

 The existing section are sufficient to carry the design discharge upto I.S.B.T. crossing from where the drain is to be diverted along an old abandoned drain whose bed & banks may have to be remodeled slightly upto the required levels as shown in the drawing of this drain.

**TONGA STAND DRAIN:** (Refer Drg. No. MPO/CLG/6)

The Tonga Stand drain, which is a covered drain, starts from the Crossing of Netajee-Subhash Marg & Shyama Prasad Mukherjee Road, crosses the Railway Line at Calcutta Gate, then crosses Ring Road and finally outfalls into Yamuna river.

 A branch pipe of 36” starting from behind the G.P.O. outfalls into the main Tonga-stand drain near Calcutta Gate.

 The total catchment area of this drain is 200 acres (80 hec.) and it cater to the localities like Kashmiri Gate, Yamuna Bazar, Nigam Bodh Ghat, etc. The anticipated discharge at outfall works out to be 100 cusecs as per a discharge factor of ½ Cusecs/acre for lightly paved urban catchment. The existing rectangular section of the drain in the tail reaches i.e. from RD.330 to outfall are sufficient to carry the design discharge and as such no remodeling is suggested. While in the initial reaches, there are two 36” dia pipes along two different alignments which together are unable to carry the design discharge. It is therefore, suggested that either one of these pipes be replaced by 48” dia pipe or one more pipe of 36” dia along suitable alignment be laid in the reach of RD.0 to RD.330. Further the drain bed must be desilted properly every year.

 Moreover, the Sluice Valve regulator leaks during floods and needs proper repairs.

 Proper outfall structure should also be constructed at the outfall point of the drain as the out falling water at present, is causing erosion of the soil and may endanger the adjacent roadway.

**GUR MANDI DRAIN** (Refer Drg. No. MPO/CLG/7)

Gurmandi drain which is a covered drain starts from the D.T.C. Staff quarters and runs along the G.T. Road, thus crossing C.C .Colony, Rajpur Village, etc. till it finally outfalls into Najafgarh drain.

 The catchment area of the drain is 216 acres (87.5ha), which caters to the localities lime Gujaranwala colony, State Bank Colony, D.T.C. Colony, portion of Vijay Nagar and Gurmandi, etc. The design discharge works out to be 108 cusecs as per a discharge factor of ½ cusecs/acre for the lightly paved urban catchments. The total length of the drain is about 750m. It is a covered drain consisting of two R.c.c. pipes of 54” dia each, along the alignment shown in the drawing. The present section is sufficient to carry the design discharge and as such no remodeling is suggested. An outfall structure consists of steps in stone masonry is existing at site and no repair or change of any kind is needed.

**HANS RAJ DRAIN:** (Refer Drg. No. MPO/CLG/8)

 The Hansraj drain which is a covered drain starts by the side of Hans Raj College, passes through Maurice Nagar, runs along the imperial Avenue and outfalls into Najafgarh drain. The length of the drain is about 1530m. The catchment area of this drain is 182 acres and the design discharge works out to be 91 cusecs as per a discharge factor of ½ cusecs/acre for lightly paved urban areas. Hansraj drain, drains out the storm water from colonies like Malka Ganj & Maurice Nagar etc.

 The existing section for this drain are adequate to carry the design discharge and no major remodeling is suggested except that the drain bed shall be desilted & smoothened as per the L-section of the drain. The proper maintenance & desilting must be carried out every year since the available free board in this covered drain is only 0.2 metres. The existing outfall structure consists of steps in stone masonary which is adequate and as such no change and no repairs are needed.

**MALL ROAD DRAIN:** (Refer Drg. No. MPO/CLG/9)

 The Mall Road drain starts from near the crossing of Alipur road and mall road, then runs by the side of Mall Road, it then crosses Vishavidalaya Marg, Chhatra Marg, Vikramaditya Road, Sardar Patel Road, etc. and finally out falls into Najafgarh drain. The total length of the drain is about 1034M.

 The catchment area of the drain upto its outfall is about 89 acres and the design discharge works out to be 44.5 cusecs as per a discharge factor of ½ cusec/acre for lightly paved urban areas. It drains out the storm water from the surrounding of Mall Road and University area such as Khalsa College, Miranda House, etc.

 The existing section of the drain from RD.0 to RD.750 is sufficient to carry the design discharge from RD.750 to outfall, the existing section of the drain is insufficient. So, it is proposed that the section from RD.750 to outfall be widened from an existing bed width of 1.0m. to 2.0m., as shown in the drawing of this drain.

 A proper outfall structure consisting of steps in stone or brick masonary needs to be constructed along with widening in the tail reaches.

**TIMARPUR DRAIN:** (Refer Drg. No. MPO/CLG/10)

 The Timarpur drain starts from Timarpur near Govt. quarters and outfalls into Najafgarh Drain. The catchment area of the drain is 90 acres and the design discharge works out to be 45 cusecs as per a discharge factor of ½ cusec/acre for the lightly paved urban catchment. The drain caters to the storm water of localities like Timarpur, etc. The length of the drain is 420m. The existing section of the drain is sufficient to drain out the design discharge of 45 cusecs and hence, no remodeling is suggested but it is stressed that proper desilting must be carried out every year. This drain outfall into that reach of Najafgarh drain which at present is being widened and lined. Hence, a proper outfall structure of brick or stone steps must be constructed at the time of widening Najafgarh drain.

**T.B. HOSPITAL DRAIN:** (Refer Drg. No. MPO/CLG/11)

T.B.Hospital drain at present starts from near Babu Rajinder Prasad T.B. Hospital (Silver Jublee T.B. Hospital), run parallel to Ring road, passes near Bangali Co-operative Society Colony and Naini Lake reservoir and finally disposes off its storm water into the open low lying area being Model Town. It is now proposed that this drain will be intercepted halfway & Model Town drain. The T.B.Hospital drain will, therefore, functioning a link drain to the proposed Model Town drain.

 The total length of the drain shall be about 1600 metres and will be serving a catchment area of acres upto its outfall. The total discharge at the outfall works out to be about 45 cusecs as per a discharge factor of ½ cusec./acre for lightly paved urban catchments. Suitable widening and remodeling of the existing sections is required as suggested in the drawing of this drain.

**CITY ZONE:**

**VIJAY GHAT DRAIN:**

 Vijay Ghat drain starts from Ring Road near Red Fort wall facing electric crematorium and traverses a distance of about 335 metres by the side of Electric crematorium, before out falling into Yamuna river, through a regulator at Mughal Bund. The drain carries the discharge of areas from the back of Red Fort, surroundings of electric crematorium area of this drain is estimated to be about 180 acres (72.87 hec.) and the total discharge at outfall works out to be 90 cusecs (i.e. 2.54 cumecs) as per the experts Committee’s recommendations of ½ cusecs/acre for lightly paved areas.

 The existing sections of this pitched drain are adequate to carry the design discharge & hence, no remodeling is proposed.

**RED FORT DRAIN:** (Refer Drg. No. MPO/CZ/3)

 Red Fort drain is a link drain to Civil military drain. This drain carries water from the premises of Red Fort and runs by the side of Red Fort wall facing Ring Road. After traversing a distance of about 366 metres from its starting point (i.e. the point at which water from inside the Red Fort, falls outside into the drain), the drain finally outfalls into the Civil military drain. The total catchment area of this drain is 95 acres (38.45 hectares) and the total discharge at the outfall works out to be 1.35 cumecs (47.5 cusecs) as per the Experts Committee’s recommendation of ½ cusecs per acre for such lightly paved areas.

 No major remodeling is suggested on this earthen drain except that slight desilting and reshaping of bed may be required for giving a uniform bed slope.

 No culvert exists on this drain and hence, the question of their remodeling does not arise.

**CIVIL MILITARY DRAIN:** (Refer Drg. No. MPO/CZ/4)

 Civil Military Drain originates from the Chandni Chowk crossing taking the storm water of the adjoining areas and passes through Red Fort. It runs for a length of about 559 metres in the shape of a trunk sewer from Chandni Chowk crossing to slightly d/s of Khas Road Barracks; from RD.559 to RD.1180 the drain becomes in the shape of a covered arch section and crosses through a few roads such as Khas Road, Link Road etc. in its way. Beyond RD.1281 the Drain becomes an open drain & finally outfalls into amuna River, after crossing the Ring Road through a regulator at Mughal Bund. Slightly upstream of the Ring Road culvert, near a mandir, another drain called Red Fort drain joins this particular drain.

 The total length of Civil Military drain is about 1913 metres and the total catchment drained upto its outfall point consists of 325 acres highly paved+135 acres lightly paved urban areas. The total discharge at the outfall works out to be 360 cusecs (10.2 cumecs) by taking discharge factors of 0.9 cusecs acre and 0.5 cusecs acre for highly paved and lightly paved urban catchments, respectively.

 The existing arch section of the drain from RD.559 to RD.1180 is 1.8 mts wide and is capable of taking only 128 cusecs while the design discharge in this reach is 292.5 cusecs. This old arch barrel should therefore, be replaced by a rectangular section of 2.5m x 1.92m as shown in the drawing. The drain section from RD.1180 to outfall are adequate to carry the design discharge and no remodeling is proposed. However, the bed of the drain has to be desilted and reshaped as per the proposed L-section. The outfall structure and regulator at the outfall are sufficient to cater the design discharge and no remodeling is, therefore, suggested in them. Further, it appears that MCD is discharging certain sewage connections into this drain which should be stopped hence with as it is absolutely necessary to separate the sewage and storm water disposals.

**DELHI GATE DRAIN:** (Refer Drg. No. MPO/CZ/5)

 This drainage system No.16 of N.D.MC. starts from the junction of Jawahar Lal Nehru Marg (Circular Road) and Minto Road. It travels along Jawaharlal Nehru Marg and falls at the starting point of the Delhi Gate drain near the junction of Bahadur Shah Zafar Marg, Netaji Subhash Marg & Jawahar Lal Nehru Marg. The Delhi Gate drain then runs parallel to Jawahar Lal Nehru Marg near Football stadium & crosses Ring Road near Raj Ghat. After crossing the Ring Road, it runs parallel to Ring Road just touching the boundary of Gandhi Darshan and then takes a perpendicular turn just opposite Ashoka Pillar of the Firoz Shah Kotla. It then finally outfalls into Yamuna river through a gated regulator just near the boundary of Raj Ghat Power House.

 The total catchment area of this drain is 884 acres and the discharge at outfall works out to be 619 cusecs (17.53 cumecs) as per a weighted average discharge factor of 0.7 cusecs /acre for a combination of highly paved & lightly paved urban areas.

 This drain is a covered drain and the existing sections are adequate to carry the design discharges and hence no remodeling is proposed except that the bed shall be desilted and properly reshaped to the designed levels as given in its drawing.

 The gated outfall structure is also adequate and no change is proposed.

**SEN NURSING HOME NALLAH (I.E. NALLAH NO12)**

(Refer Drg. No. MPO/CZ/6)

 This drainage system used to be known as system No.15 of NDMC starts from Paharganj, runs along Rouse Avenue upto Harding Bridge and joins system No.13, which starts from North of Connaught Place near Chelmsford road, cross the railway line near the electric sub-station at Minto Road, and runs along Rouse Avenue till it meets Harding Bridge. At this point it becomes an open nallah usually called Sen Nursing Home Nallah and then runs by the side of railway line (going to Faridabad) being the I.P.Estate. After traversing a distance of about 1000 metres it cross Ring Road through a culvert. The drain runs beyond Ring Road culvert for a distance of about 220 metres when it cross the internal railway track system of C.Power House. Just D/S of this crossing there is an existing regulator through which the drain finally outfalls into Yamuna River.

 The drain in general, caters to a total catchment area of about 1730 acres (hectares) and the discharge at the outfall works out to be 865 cusecs (24.4 cumecs) as per the experts Committee’s recommendation of ½ cusecs /acre for lightly paved areas. The total length of this drain is about 1490 metres. The existing widths than designed (and may be left as it is & shall get silted up in due course); while in the upper reaches the existing width is just equal to the designed width. The bed of the drain has to be properly shaped and maintained at the designed bed levels as shown in its drawing.

 The bed of the nallah is generally silted and as such it is suggested that it must be desilted at least once a year before monsoon so that there is no stagnation of water. The existing regulator is adequate can be kept open even when the discharge in river Yamuna is 1.0 lacs.

**DRAIN NO.12 “A”** (REFER DRAWING NO.MPO/CZ/7)

 Nallah No.12 “A” starts from a Railway culvert beyond the Tilak Bridge Railway Colony and has to carry a combined discharge of three drains. These three drains which outfall together at the culvert point are (a) Drain NO.1 C.P.W.D. bringing a discharge of 59 cusecs from exhibition ground. (b) Drain No.2 from system No.14 of N.D.M.C. bringing a discharge of 220 cusecs (c) Drain No.3 of railway authorities bringing a discharge of 46 cusecs from local railway colony. The total discharge in drain No.12 “A” from start to finish is the summation of these three discharges and amounts to 325 cusecs (9.17 cumecs). The total catchment drained is 650 acres.

 This drain runs by the side of Sen’s Nursing Home Nallah (i.e. Nallah No.12) for a distance of about 290 metres, when it crosses Ring Road through a Ring Road culvert. It further travels a distance of about 340 metres before it outfalls into the River Yamuna through an existing regulator just after crossing the railway culvert.

 All the three existing culverts as well as the regulator of this drain needs remodeling as their existing sections are insufficient to carry the designed discharge. The drain itself needs sufficient widening from an existing bed width of 2.5 metres to 6.5 metres as shown in the drawing of this drain.

 On account of the very low ground levels of the Tilak Bridge Railway Colony, this drain has to run at considerably low elevation and the F.S.L. at its outfall has to be at about 50,000 cusecs flood level of Yamuna. The gates of the outfall regulator has, therefore, to be lowered, whenever there is a flood of more than about 50,000 cusecs in Yamuna. If this continues for more than 24 hours it is recommended that the storm discharge from drain No.12 “A” has to be pumped into Yamuna river during the period, when 12 ‘A’ is running full.

**DRAIN NO. 14** (REFER DRAWING NO.MPO\CZ\8).

 Drain No.14 starts from the junction of Purana Quila Road and Mathura Road, where the system No.12 of N.D.M.C. and one more M.C.D. nallah join it. The drain traverses a distance of about 900 metres through the exhibition ground (C.P.W.D. reach) . Thereafter, (in the M.C.D. reach) it crosses a couple of road culverts and a couple of railway culverts and finally outfalls into Yamuna river through the Ring Road culvert. A regulator just downstream of Ring Road is required to be constructed so as to avoid the back water effects of Yamuna river during high floods.

 The drain caters upto its outfall point, to an urban catchment of 500 acres (202.43 hectares) and the total discharge at outfall, therefore, works out to be 250 cusecs (i.e. 7.08 cumecs) as per the Experts Committee’s recommendation of ½ cusecs/acre for lightly paved areas.

 The bed of the drain from Rd.0 to RD.150 needs a slight lowering but from RD.150 to RD.630, the existing drain bed is lower than the proposed and hence, no lowering of bed is required in this reach. The existing lower levels can be left as they are and shall be silted up in due course. Beyond RD.630, the drain has been covered upto RD.780 and from where onwards it again becomes an open drain. The bed of the covered drain is almost at the designed levels and can be left as it is Beyond RD.900 to outfall, the existing drain bed is much higher than what is proposed and hence needs lowering of the order of 1 meter or so.

 The existing drain section between RD.0 and RD. ‘1000’ are wider than what are required and hence do not need any widening and can be left as they are. From RD. ‘1000’ to outfall the existing sections are somewhat smaller than proposed and hence needs widening as per the drawing of this drain o as to carry the design discharge.

 The culvert across Mathura Road, which connects the N.D.M.C. system No.12 and this M.C.D. drain No.14 is a very old one whose construction drawing and details are not known even to the M.C.D. (General Wing) under whose maintenance it is. This culvert is a heavily choked one, with a few pipes crossing at several points. As a result, every year, it blocks up the N.D.M.C. discharges at this point and allow overflow on the Mathura Road causing serious traffic jam. The required sections of this culvert from the proposed remodeled drain are also shown in the drawing of this drain.

 The bed levels of the culverts at Rly. and road bridges which at present are at higher levels need to be lowered or desilted from 0.6m. to 0.90m as shown in the drawing. The existing structure will most probably be safe if the lowered bed is protected with stone in mortar or concrete slab. However, the safety of the foundation must be confirmed before lowering their pucca beds if at all required.

**KUSHAK NALLAH—BARAPULLA NALLAH**

The Kushak Nallah- Barapulla Nallah system enters MCD area behind I.N.A. market After this, a very important tributary, called the Defense Colony Nallah joins. Thereafter sunehri Pul Nallah, bringing considerable discharge from New Delhi area also gets connected to it. Actually from this point the Kushak Nallah gets the name barapulla Nallah.

 Lajpat Nagar drain also joins on the right bank, slightly above the Suneharipul Nallah.

 The Barapulla Nallah problems have been described in detail under the N.D.M.C. system of drains. It has been mentioned there, that the Kushak Nallah – Barapulla Nallah system is otherwise quite adequate in its water way throughout its reaches. However, it requires regarding at certain points to cater for proper drainage of the surrounding catchments.

 The design discharge of the Kushak Nallah Barapulla system has been calculated on the basis of rational formula, with five years rainfall intensity of 2.17 inches per hour. The run off co-efficient are assumed as 0.60 from the plain and 0.70 from the hilly catchments. The calculations showing the design discharges of this system are enclosed as statement-II.

 The Barapulla Nallah at its tail reach, is having the serious problem of sullage and sewage water, entering from the authorized and unauthorized colonies by its sides, under maintenance of W.S.S.D.U. This nuisance is causing serious health hazard to the areas like Nizamudding, Bhogal, Jangpura, etc. It is essential that W.S.S.D.U. makes all arrangements to stop discharging sullage and sewage from their jhuggie jhompries and other unauthorized colonies. As regards the authorized colonies, W.S.S.D.. should be severely penalized, if they are found to be connecting their sewage pipe lines into Barapulla Nallah.

 It is also suggested that, an oxidation pond may be constructed in the open space between Lodhi Colony and Jangpura, for separating out the sullage and allowing only clear water into Barapulla Nallah thereafter.

 The Barapulla Nallah at its tail reach is affected by the pond level of Okhla weir. As a result, even during the dry weather, slight back water creates stagnation in its tail reach. There is a proposal of constructing a new Okhla Barrage about 1 ½ kilometers downstream of the present Okhla weir.

 The pond level of this proposed Okhla Barrage will be higher than the existing pond level. Naturally the effect of stagnation will be more pronounced than. In order to avoid this condition of stagnation at the tailend it is necessary to construct a temporary end sill at the tail end of Barapulla Nallah by means of intermediate pillars and karries. A small pump house is to be constructed at this point, to pump out throughout the dry season, the collected dry weather flow from Barapulla Nallah, across these karries, into the river Yamuna. During the flood season, these karries will be removed, to allow free flow of the Barapulla discharge. Otherwise serious afflux will occur at the railway bridge point, very near to the tailend of the Barapulla Nallah. The bridge girders are already within the allowable free board.

 The cost of this additional construction of karries and pump house will have to be borne by the U.P. Irrigation Department, who are proposing to raise the pond level of Okhla Barrage creating stagnation in the tail of Barapulla Nallah.

**SOUTH ZONE**

 The drainage system in south Zone is general good, due to the topography of the ground and also due to the reason that the existing sizes of drains are adequate. In general feature plan and contour plans showing alignment and catchment areas of drains are shown in drawings SZ-1 & SZ-2 respectively.

 In South Zone drainage system, the following are the important existing drains which have been taken up for the study. The general feature of the drains are shown against them:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name of drain | Length in Km. | Catchment area in hectares | Maximum anticipated discharge in cumecs. | Remarks |
| 1 | 2 | 3 | 4 | 5 |
| Chirag Delhi drain | 8.19 | 5300 | - | Existing section adequate. |
| Andrews Gunj Drain | 2.51 | 503 | 16.41 | -do- |
| Greater Kailash drain | 1.43 | 482.50 | 27.33 | Existing section in adequates to be remodeled. |
| Malviya Nagar Drain | 1.50 | 269 | 12.30 | -do- |
| Nauroji Nagar Drain | 5.40 | 1700 | 59.50 | Existing section adequate |
| A.I.I.M.S. drain | 2.65 | 2060 | 66.00 | -do- |
| Lajpat Nagar drain | 3.29 | 460 | 16.15 | -do- |
| Maharani Bagh drain | 3.71 | 554 | 19.48 | -do- |
| Kalkaji drain | 4.26 | 706 | 25.00 | Existing section adequate upto Mathura Road. Section downstream to be remodeled. |
| Sunehripul Nallah | 1.43 | 1918 | 67.00 | Existing section adequate. |

 As brought out, South Delhi area has good ground slopes and is the aristo ceratic zone of Delhi, as such there are no pockets of areas which have been referred as ‘Vulnerable for flooding’ zone. The area is highly urbanized and hence virtually no scope exists for widening of drains. The drains in general are also built up to the requisite size pitched/lined in their entire lengths and covered in many areas. Generally, all the drains are having their outfalls into another drainage system (except Maharani Bagh drain, which is joining river Yamuna).

 No, new drains have been considered essential since the existing net work of drains is functionally adequate. Generally, no large scale remodeling of drains are proposed, nor culverts and bridges.

 The existing drainage system is discussed in detail, in the following paragraphs.

**CHIRAG DELHI DRAIN.**

 Chirag Delhi drain is one of the most important tributaries of the Kushak Nallah Barapulla Nallah system. It originates from three hilly nallah above Devli Bund in Mehrauli. These three nallahs are all closed by the Deoli bund and one outlet and one spillway are provided across the bund for over flow of the discharges from upstream of the bund, into the tail of these nallahs downstream. The catchment behind Deoli bund that drain into these nallahs, is semi-hilly type, having extensive tracts of flat cultivated fields, which absorb practically the whole of the storm water of this large catchment of 2560 acres. Thus, the outflow from Deoli bund during the last six years was found to be negligible, in spite of quite heavy rainfall occurring in the Deoli bund catchment.

 The three nallahs after crossing Deoli bund, traverses through semi-hilly slopes of alluvium for a distance of 800 metres. Thereafter, they join together and run through a military farm and then through the juggi resettlement colony of Khanpur and enters the urbanisable limits of DDA Master Plan, across Mehrauli Badarpur Road. It is proposed to construct a regular channel for proper channelization of the upland discharges towards the culvert under the Mehrauli Badarpur Road. At present this culvert being silted up, the upland discharge completely spreads over the surrounding juggi development areas and MES farms. The channelization is proposed to be started, only from the point upto which the juggi resettlement works are at present in progress. This is about 600 metres above the culvert point. In the upper reach the nallahs are to be retained at present in their natural condition, so that there may be some moderation of the flood discharges in the rural area. In case the DDA development works extend further upstream, the channel may also have to be extended simultaneously.

 The arched culvert under the Mehrauli Badarpur Road having three spans of 7.80 metres each was constructed in the British period but is still in a good condition. However, the bed of this culvert has been considerably silted upto a depth of at least 1.5m. (5 feet). As a result, the storm runoff from the upper portion of the culvert, spreads out into these surrounding juggi resettlement areas and MES farms, overflows the Mehrauli Badarpur Road to a depth of 6 inches to 1 feet, traverses across the fields downstream and reaches back the Chirag Delhi drain with considerable silt carried from the fields. This reach of the drain from the Mehrauli-Badarpur road culvert upto Khirki bridge, has been heavily silted up, also for two other reasons. A number of pucca drains constructed across Dakishanpuri Colony Khanpur Janta Colony etc. on the right side of this drain, brings very heavy quantum of sullage and sewage, that drops into the Chirag Delhi drain. The cultivators on the left side of the drain in this reach also construct cross bunds at different places of the drain, for pumping out this sullage water, for irrigation in their fields.

 The vast tract of about 800 acres between Mehrauli Badarpur Road and Khirki Road, which is at present being cultivated, although acquired by DDA, will ultimately be fully developed into a colony by the DDA. The Chirag Delhi drain in this reach will therefore from the main arterial drain of this future developed area. It has been noticed that a number of serious rain cuts and gully formation have taken place on the sides of the drain in this reach, eroding valuable land that needs to be replaced afterwards at considerable cost. It is therefore very important that the DDA should immediately stop this wastage of land due to gullies and rain cuts, which can be done by constructing cross bunds across these gullies, until final development of the area is taking places.

 It may be pointed out that, this tract of flat land was formed due to the construction of the Khirki bund in the Mughal period, which was very well regulated by a stone built regulator with provisions for gate arrangements.

 Unfortunately today there is no regulation across the Khirki bund and the Chirag Delhi drain is having a free flow from under the Khirki bridge and causes severe land erosion.

 This reach of the Chirag Delhi drain is, therefore, proposed to be completely remodeled from the Mehrauli Badarpur Road bridge upto Khirki Bridge. The section of this proposed drain is given in drawing No.SZ (Sheet-I). As the land will be valuable after development the section is proposed to be pitched. The existing waterway of both the Mehrauli badarpur bridge and Khirki bridge appears to be adequate. Only the foundation of the Mehrauli Badarpur bridge has to be first checked by means of digging open trench as before the remodeling of the drain under this bridge. Downstream of Khirki bridge there is an existing drop of about 6 metres, in a distance of about 300 metres. Thereafter, the Chirag Delhi drain runs in a meandering course through fields and reaches the Chirag Delhi bridge, where actual urbanization starts today.

 There is a very flat low land on the left side of the drain just after the Khirki bridge. It is proposed to construct two pucca masonry falls below the Khirki bridge, with complete energy dissipation arrangements, to kill the energy of the 6 metres drop in this reach. The earth available from remodeling the drain in the reach from Mehrauli Badarpur Road to Khirki Road bridge can be utilized in the reach down stream of Khirki bridge for improving the land undulations. Alternatively, it may also be studied if across bund can be constructed somewhere down below, thereby forming a pond, in the vast shallow area mentioned above. This pond may have a moderation effect on the flood discharge that will traverse down below. But a danger in constructing this lake is that, it may get filled up with sewage and sullage which is at present coming from Dakhasin Puri area, through this drain. Therefore, the question of this lake formation should not be considered, until the WSSDU ensure omission of any sewage or sullage disposal, through this drain.

 A major tributary to the Chirag Delhi drain is existing in this reach that is the Malviya Nagar drain. Although the Malviya Nagar drain near its outfall point is having considerable width along natural depression, it is having a very narrow and shallow brick lined section at the reach, where it emerges out of the Malviya Nagar Colony. As a result, the complete drainage of Malviya Nagar gets choked and three to four feet of water stagnate in the colony. This actually happened in the year 1975 on 5th August. The Malviya Nagar drain requires complete remodeling and the proposed sections are given in the drawing No.SZ-4. The Chirag Delhi drain, at the crossing of the Chirrag Delhi bridge is very narrow. As a result, the Chirag Delhi bridge was by-passed in 1975. This bridge, therefore, needs considerable widening with spans metres earch. The road level also should be raised to RL. After the Chirag Delhi bridge, the nallah is having adequate sections for some distance which needs only proper trimming and pitching. These are indicated in drawing No.SZ-2 (sheet-II).

 The next serious problem in this drain starts from the point where Greater Kailash drain outfalls at RD.4710. The Greater Kailash drain collects considerable storm water from the undulating areas on the South side of Greater Kailash. The section of this drain being inadequate and badly maintained, the storm water spills over and stagnates to a depth of ½ to 1 metre in the highly developed area of Greater Kailash S-Block. A proposed remodeled section of the drain is therefore, indicated in drawing No.SZ-5.

The Chirag Delhi drain also downstream of this point, is extremely narrow. Thus, with a slightly high rainfall, the drain overflows and spills into the buildings and basements on its right side. In 1975 monsoon, heavy damages occurred on both the banks of this drain as well as on the bed in this reach. There is ample scope of widening the drain on the left side, which is part of the old Siri Fort area. The proposed section of the drain in this reach is indicated in drawing No.SZ-2 (sheet-II). The remodeling will be in the shape of widening, providing pucca cunnette, providing dry stone pitching on the banks, remodeling the bridge behind Archna Cinema and providing masonry falls as indicted in the drawing No.SZ-2. The bank pitching’s must be laid on proper filter material to prevent soil erosion. The slope of the banks should be 1v in 1.25H.

Some distance above the Ring Road, a pucca drain joins Chirag Delhi drain from Andrews Ganj side. The section of this drain has been examined & found to be adequate. It is indicated in the drawing No.SZ-3.

In the reach below Ring Road, upto its junction with the Kushak Nallah across the Railway line, the section of this drain appears to be more or less adequate except it needs some desilting of the bed and repairing of the cunnettee wherever necessary. The foundation of a few foot bridges appears to have scoured out and the bridges are standing in the dangerious condition. All such bridges should be immediately examined and repairs done.

Considering its length and vast catchment the design of Chirag Delhi drain has been made by the rational formula, assuming 45% runoff factor as it is lightly paved; a two year frequency hourly rainfall of 51 millimeters (as given by I.M.D.) and an arial distribution factor of 85%. The value of N in the unlined reach is adopted as 0.025 while that in the reach proposed to be lined on the sides as 0.0225. For the upper rural catchment of Deoli Bund and below, upto the starting point of the drain, as unit discharge of 1/10cusecs per acre has been adopted. This is based on a three day storm of 11.5 inches being drained in three days with 70% runoff factor. The 5 years frequency 3 day of 11.5 inches has actually been calculated for Mehrauli area, by analyzing the rainfall data from the rain gauges in this area.

**NAUROJI NAGAR DRAIN:**

 This is one of the major drain in South-Eastern part of Delhi. The drain is approximately 5.5 K.M. long with a catchment area of 1700 hectares at its outfall point. The drain originates in the hilly reaches of Mehrauli (close to Jawahar Lal Nehru University) drains important parts of Delhi like R.K.Puram, Vasant Vihar, Nauroji Nagar and outfalls to Kushak Nallah near Kidwai Nagar (West).

 The drain is generally well defined in its entire reach and section is stone pitched beyond Vasant Vihar area upto its outfall point. Though the drain is well defined, the maintenance of the drain is poor, as such the drain needs designing and improvement to the bed (by dry stone pitching) in certain reaches. Otherwise, the existing section of the drain is adequate to carry the anticipated discharge except in the top reaches i.e. RD.0 to RD.1200 where section of drain is to be remodeled. Similarly the cross –drainage works like culverts are also adequate to carry the discharge.

 A series of vertical drops already exist in the bed as well as a masonry outfall structure at the junction of this drain with Kushak Nallah. The drain has a maximum discharge of 59.5 cumecs at the outfall point.

 Though the drain meanders in a thickly dense urban area, the drain is generally free from built up areas on its banks.

 The details of the drain are shown in drawing No. SZ-7.

**KALKAJI DRAIN:**

 This an another important drain in South Delhi. The drain is about 4.5 km long with a catchment area of 700 hectares at its outfall point. The drain originates in Kalkaji area and flows east and outfalls into Agra Canal. The general ground level towards Agra Canal is sufficiently steep and hence no drainage congestions are found. The existing drain is well defined in the upper reaches viz. upto the crossing of Mathura Road and is pitched with stone bricks. The urban area drained is mainly Okhla Industrial estate, apart from Kalkaji area.

 Beyond Mathura Road and upto agra Canal the drain is at present meandering in the present day rural fields. The drain is well formed though not built-up in the area. The natural surface here is basically an agricultural land (mainly due to Okhla sewage disposal works) upto Agra Canal, except for a small stretch of land to the east of Mathura Road which is being developed by DDA and along the periphery on which runs the proposed drain. On enquiry with the people cultivating in the fields at the lower reaches, it is understood that there has never been flooding of the area, through the existing drain is not well defined.

 The existing sections of drains are generally adequate in the reach from Kalkaji upto Delhi – Agra Railway line. The culverts across Mathura Road and one line of Railway track needs remodeling.

 Since the area downstream is not urbanized, land acquisition may not pose a problem, and this stretch of drain has to be constructed as per the drawings. An outfall structure of masonry exists at the tail end of the drain near Agra Canal, which requires remodeling, after the scheme of drainage is finalized.

 The details of the drain are shown in drawing No. SZ-8.

**MAHARANI BAGH DRAIN:**

 This is one of the drains in South Zone which has a direct outfall into river Yamuna. This drain originates in the high grounds near Kalkaji Shiv Mandir and flows North-East, draining highly urbanized areas like East of Kailash Amrit Puri, Srinivas Puri, Friends Colony and Maharani Bagh. The drain is about 3.7 K.M. long, has a catchment area of 554 hectares and maximum discharge of 19.5 cumecs at the outfall point, and falls into river Yamuna at Bhogal village. Since the topography, in general, is steep almost upto its outfall the drain is well defined in its course and because of the drain flowing through urbanized area, the drain is built up almost in its entire reach (except in the last half km. length where its banks are not defined.

 The existing section of the drain in its upper reaches are pitched both on its bed and sides and the drain is totally covered on the downstream side beyond Mathura Road (From RD.2256 to 3093) and for a portion in Srinivas Puri (from RD.1174 to 1220). The existing section of the drain is found adequate to carry the anticipated discharge upto 3093 and also the existing culverts and bridge are adequate.

 The last stretch of drain (0.5 km. from the outfall point) requires remodeling on two scores viz. the existing banks are not defined and too shallow a drain exists and secondly during high floods in Yamuna, a large area on this stretch get inundated. Since there is no proposal to extend a marginal bund south of Ring Road, the inundation is inescapable. However, it is recommended to raise the banks of the drain in this reach upto river Yamuna and provide pitching on either sides of these embankments so that the course of the drain is maintained.

 The details of the drain are shown in drawing No. SZ-9.

**SUNHERI PULLA DRAIN.**

 This may be termed as one of the most important drains as the catchment area of this drain includes Rashtrapati Bhawan, North-South Blocks, Connaught Place other important areas South of India Gate upto Lodhi Colony. But the entire drainage system (storm water) of this area is led through underground covered drains and the main artery of this system outfalls to an open drain near Dayal Singh College. The stretch of this open drain upto its confluence with Kushak Nallah is called Sunheri Pulla drain, which in reality is only a link drain to Barapulla (Kushak Nallah) drain.

 The drain has well defined embankment upto its outfall point, with a cunnette sections in the middle. The length of the drain is about 1.4 km. and has a catchment area of 1918 hectares.

 This system of drain has one link drain, discharging the storm water from Lodhi colony area. There are no other link drains of importance.

 The existing section of this drain is found quite adequate to take the anticipated discharge. Hence no modifications need be taken for the culverts and bridges, except that a small portion of left embankment of the drain at the confluence point with Kushak Nallah needs proper embankment to prevent storm water back flow into the West –Nizamuddin Colony area, where natural surface levels are below full supply level of the drain.

 The details of the drain are shown in drawing No. SZ-10.

**LAJPAT NAGAR DRAIN:**

 This drain also originates on the same high grounds as of Maharani Bagh drain and this drain runs due North, collecting the storm water of densely urbanized areas of Amar Colony and Lajpat Nagar, before out falling into Barapulla drain. The drain is about 3.3 km. long drains a catchment area of 460 hectares giving a maximum anticipated discharge of 16.15 cumecs at the outfall point.

 The drain is an open drain throughout the length, with well defined banks. The catchment area so highly dense, has not been indicated as flood prone. The existing cross-section of drain, it is observed, is having brick-lined sides and because of considerable silting (which is unform) the bed through lined is not visible except in certain reaches. The existing section is found adequate to carry anticipated discharge, through lined is not visible except in certain reaches. The existing section is found adequate to carry anticipated discharge, through it is considered that by desilting of the drain.

 Except at the tailend of the drains, the side banks of the drain are free, with a dwarf masonry walls built at its periphery in considerable reaches.

 The existing…. Bridges and culverts across the drain are found adequate and no remodeling is considered necessary. The bed levels of Barapulla drain and Lajpat Nagar drain are same, at the confluence outfall structure is existing nor is it considered necessary.

The details of the drain are showing in drawing No.SZ-11