

are manufactured in accordance with IS 458: 2003. Plastic footrests in the walls of manholes and sump wells are provided for cleaning and inspection. Under gravity outlet system, a small masonry structure at outlet with rodent guard is provided to safeguard the pipe edge from collapsing and rodent damaging. Recently, light weight manholes, sump and outlet pipes are introduced in place of RCC pipes. For pumped outlet system, a pump house (3x 3 x 2.4 m size) is constructed and a 6 HP diesel pump set for drainage is provided in accordance with IS 11538: 1986.

Costs of PVC pipes, synthetic filters, RCC pipes, pump house and pump set are based on 2016-17 price.



iii) Pipe installation

A fully mechanized method of installation of drain pipes on large scale is recommended. In this method, a self-propelled heavy duty chain trencher or trenchless machine with automatic laser control and other supporting drainage machineries are used for large scale mechanized installation of lateral and collector pipes at the



recommended grade and other structures. Installation costs of drain pipes and structures are based on 2016-17 price and are also compared with semi-mechanized rates under DSR of CPWD.

iv) Supervision of material and installation quality

A proper installed SSD system has an economic life of 30 years or longer. Therefore, total quality control of drainage materials and their installation is ensured in compliance with BIS drainage design specifications and installation standards. Supervision charges @ Rs. 4,000/- per ha are provided.

v) Operation and maintenance (O & M)

For pumped outlet system, pumping hours needed for first year dewatering and reclamation leaching, and second and third year leaching are worked out to be 350, 300 and 250 hours per year, respectively. The corresponding charges for pumping operation are Rs. 600/-, 500/- and 400/- per ha. Subsequently, O&M charges after three years will be met by farmers' drainage society (FDS).

vi) Contingencies

Cost estimate at feasibility stage may vary within 4-8% of actual cost. Therefore, contingencies @ 5% are provided to meet the unforeseen expenses as per the CPWD norms.

vii) Farmers' awareness training

Charges for farmers' awareness training including field visits @ Rs. 750/- per ha are allocated to enhance stakeholders' capacity on improved operation and maintenance of SSD systems.

viii) Monitoring and evaluation (M&E)

It is not necessary to monitor and evaluate all SSD projects. Nonetheless, a representative block in a few drainage projects should be monitored and evaluated by national institute/SAU/ NGO with experience in land drainage. M&E charges @ Rs. 2,000/- per ha are allocated.

COST OF SSD SYSTEMS

A model drainage block each in light, medium and heavy texture soils was considered for estimating drainage materials and their installation cost. Drain spacing is varied from 50 to 100 m in light and medium texture soils (with clay \leq 30%) and from 20 to 50 m in heavy texture soils (with clay > 30%). Both pumped and gravity outlet conditions were considered. All cost calculations have been done with and without M&E charges to work out the total and per ha costs which are rounded off to rupee five hundred values. The costs of SSD system with and without M&E charges for light and medium, and heavy texture soils for pumped and gravity outlet conditions for drain spacing from 20 to 100 m are presented in Table 4. The recommended drain spacing in medium texture soils with pumped outlet for north-western states is 60-67 m based on field orientation (killa line) whereas the spacing in heavy texture soils including Vertisols with gravity outlet for central and southern states is 30 m. Therefore, corresponding costs for medium texture soils are Rs. 74,000-79,000/- with M&E charges whereas the cost for heavy texture soils is Rs. 111,500/- with M&E charges. The component wise cost and its share in total cost for 67 m spacing and 30 m spacing are provided (Table 5).

SSD costs under light & medium texture soils are applicable to Haryana, Punjab and Delhi, & part of Rajasthan (IGNP), MP & UP whereas system costs under heavy soils (Vertisols)/ coastal soils are applicable to Maharashtra, & parts of Rajasthan, MP, Karnataka, Gujarat, AP, Telangana, T.N, Kerala and other coastal states.

Table 4. Cost of SSD systems in different soil textures, outlets and drain spacing

Soil texture & outlet type	Cost of SSD system (Rs. per ha) for different drain spacings (m)								
	20	30	40	50	60	67	80	90	100
• Light and Medium Texture Soils (Clay \leq 30%)									
<i>Without M&E charges</i>									
Pumped outlet	--	--	--	84,500	77,000	72,000	67,500	65,500	60,000
Gravity outlet	--	--	--	74,500	68,000	63,500	59,500	57,500	52,500
<i>With M&E charges</i>									
Pumped outlet	--	--	--	86,500	79,000	74,000	69,500	67,500	62,000
Gravity outlet	--	--	--	76,500	70,000	65,500	61,500	59,500	54,500
• Heavy Texture Soils including Vertisols (Clay > 30%)									
<i>Without M&E charges</i>									
Pumped outlet	172,500	129,000	105,000	91,000	--	--	--	--	--
Gravity outlet	148,500	109,500	88,000	76,000	--	--	--	--	--
<i>With M&E charges</i>									
Pumped outlet	174,500	131,000	107,000	93,000	--	--	--	--	--
Gravity outlet	150,500	111,500	90,000	78,000	--	--	--	--	--

Table 5. Cost of SSD components with gravity/pumped outlet in heavy and medium texture soils

Component of SSD	Cost (₹ ha ⁻¹) and share (%) in	
	Heavy soils (30 m)	Medium soils (67 m)
Preparation of DPR	2,500 (2.2)	2,500 (3.4)
Pipes & fittings	41,989 (37.6)	21,750 (29.2)
Filters	14,776 (13.2)	8,334 (11.2)
Structures and pumpset	3,785 (3.4)	7,142 (9.6)
Installation cost	36,766 (32.9)	22,953 (30.9)
Dewatering & O&M	0 (0.0)	1,500 (2.0)
Supervision charges	4,000 (3.6)	4,000 (5.4)
Contingencies	5,066 (4.5)	3,431 (4.6)
Farmer's training	750 (0.7)	750 (1.0)
M&E	2,000 (1.8)	2,000 (2.7)
Total:	111,500/- (100)	74,000/- (100)

Above SSD cost does not include tree removal, drain cleaning and deepening, approach road and land development, maintenance cost, farmers share and pumping cost for fourth year onwards. This cost includes collector length (25 m per ha) assuming surface drain in vicinity.

Additional charges for drain cleaning and deepening @ 7,500/-per ha, and extension of underground collector pipeline to open drain @ 15,000/- per ha may be provided separately on case to case basis.

WAY FORWARD

Costs of SSD systems vary considerably from north-western states to central and southern states depending on soil texture, drain depth and spacing, and outfall condition. These guidelines and costs may be used as cost norms for funding of large scale SSD projects under various national programmes to speed up reclamation of waterlogged saline soils through project agency or outsourcing in PPP mode in alluvial and heavy soils (Inland and coastal).

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