SAMPLE QUANTITIES REPORT

Plumbing quantities

Example house: G+1, 1,000 sq ft per floor

PREPARED FOR	LOCATION	REPORT ID	DATE
Example house (sample)	Lucknow, Uttar Pradesh	NS-PL-SAMPLE	29 October 2026

This is a sample report
It is a real report from the same calculations a paid report uses, made for an example house (G+1, 1,000 sq ft on each floor, Lucknow). It is not your project and nothing in it applies to your plot. Your own report uses your plot, floors and city, so its figures will differ.

Your water and drainage at a glance

HOMES
1
One house

PEOPLE COUNTED
6
6 in each home (bedrooms plus three)

WATER USED A DAY
810 L
135 litres per person (IS 1172)

WATER SUPPLY
Piped supply
Underground and overhead tanks

BATHROOMS AND WCS
3
1 kitchen in all

SOIL STACKS
1
No vent pipe needed

WASTE
To the sewer

RAIN WATER
4 down-pipes
75 mm each

What to order

The main totals. The line under each figure is the range the real number is likely to fall in.

WATER SUPPLY PIPE	DRAIN AND RAIN PIPE	TANKS	TRANSFER PUMP
177 m	114 m	1,500 litres	0.5 HP
133 to 239 m	91 to 148 m	1,350 to 1,800 L	

How to use this report
This is a code-based planning estimate worked out from the answers you gave, not a design for your drawings. Use it to plan, to check a contractor's quantities for gross errors and to order the first lots. Where a figure rests on an assumption, the report says so. Final quantities come from the drawings and the professional who signs them.

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Tanks and pump

Sized to the NBC storage split for your water source. Round-up sizes are the ones sold in India.

ITEM	SIZE	NUMBER	KIND	BASIS
Underground tank	1,000	1	ready-made tank	540 L needed
Overhead tank	500	1	ready-made tank	270 L needed
Transfer pump	0.5 HP	1	a standby is advised (a NirmanShastra assumption)	17 L/min against 14.0 m

Pump head is the climb to the terrace plus pipe friction (Hazen-Williams) plus 3 m of residual; power = flow × head ÷ (4,500 × 0.5), rounded up to a pump size sold. Delivery pipe: 25 mm.

Water supply pipe (CPVC, IS 15778)

Runs worked out floor by floor from your plan. The last column is what to buy, in whole 3 m lengths.

SIZE	RUN (M)	WITH 5% CUTTING WASTE (M)	3 M LENGTHS	TO BUY
15 mm	84.0	88.2	30	90 m
20 mm	22.8	23.9	8	24 m
25 mm	43.3	45.4	16	48 m
32 mm	11.5	12.1	5	15 m
All sizes	**161.6**	**169.6**	**59**	**177 m**

If your plumber prefers uPVC for cold water (6 m lengths) or PPR, the metres stay the same and the number of lengths changes.

Supply riser, floor by floor

Water comes down from the overhead tank, so each floor's riser is sized for the water used on that floor and every floor below it. The pipe narrows towards the ground.

FLOOR	BATHROOMS	KITCHENS	DEMAND CARRIED HERE (FIXTURE UNITS)	RISER SIZE
Ground floor	2	1	20.0	25 mm
First floor	1	0	30.0	32 mm

Fixture units follow NBC Part 9 Section 1 Table 2. The flow for those units is read from Table 3 and the smallest pipe that carries it at 2.4 m/s is chosen.

Supply fittings and valves

Counted per tap and per piece of equipment.

ITEM	NUMBER
Elbow 90°, 15 mm	23
Reducing tee, 20 × 15 mm	23
Female threaded adaptor or brass elbow, 15 mm	23
Ball valve, 20 mm (one at each bathroom)	3
Union, 15 mm (geyser connection)	3

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ITEM	NUMBER
Ball valve, 25 mm (home entry)	1
Union, 25 mm (home entry)	1
Tee, 25 mm (riser take-off)	1
Ball valve, 20 mm (home entry)	1
Union, 20 mm (home entry)	1
Reducing tee, 32 × 20 mm (riser take-off)	1
Reducer, 25 × 32 mm (riser)	1
Elbow 90°, 25 mm (pump and tank connections)	8
Float valve (one for each tank)	2
Ball valve, 25 mm (tank inlet and outlet)	4
Union, 25 mm (tank connections)	4
Foot valve, 25 mm	1
Non-return valve, 25 mm	1
Gate or ball valve, 25 mm (pump isolation)	2
Union, 25 mm (pump)	2
Pipe clamps on exposed pipe (about 1 per metre)	32

Pipes inside walls are chased in and need no clamps. Only risers, the terrace and the pump line are clamped.

Fixtures and taps counted

ITEM	NUMBER
Water closet with flush tank	3
Wash basin with tap	4
Shower with mixer	3
Health faucet	3
Kitchen sink with tap	1
Washing machine point	1
Balcony or utility tap	2
Terrace tap	1
Geyser point	3
Floor traps	7

Counted, not specified: the make, finish and model are yours to choose.

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Drain and rain pipe (uPVC SWR)

Soil, waste and vent stacks, branches, the building drain (110 mm) and down-pipes, in whole 3 m lengths.

SIZE	RUN (M)	WITH 5% CUTTING WASTE (M)	3 M LENGTHS	TO BUY
40 mm	4.8	5.0	2	6 m
50 mm	22.0	23.1	8	24 m
75 mm	42.0	44.1	15	45 m
110 mm	35.0	36.8	13	39 m
All sizes	**103.8**	**109.0**	**38**	**114 m**

Drainage fittings, traps and chambers

ITEM	NUMBER
Long-radius bend, 110 mm (WC branch)	3
Branch junction, 110 × 110 mm (WC to stack)	3
Branch junction, 110 × 75 mm (bathroom waste to stack)	3
Bend, 75 mm (floor-trap branch)	3
Floor trap, 50 mm seal, 75 mm outlet	7
P-trap or bottle trap, 40 mm (basin)	4
Sink trap, 40 mm	1
Branch junction, 75 × 50 mm (kitchen to waste stack)	2
Large-radius bend, 110 mm (stack foot)	1
Large-radius bend, 75 mm (waste stack foot)	1
Cowl, 110 mm	1
Cowl, 75 mm	1
Terrace outlet with grating, 75 mm	4
Bend, 75 mm (down-pipe)	8
Shoe, 75 mm (down-pipe foot)	4
Inspection chamber with cover (0.8 × 0.8 m, up to 1 m deep)	3
Pipe clamps on stacks and down-pipes (about 1 per 1.5 m)	29

Stack junctions: 8. Chambers are counted, not built: bricks, mortar and covers are in MasonryPro and the structure.

Sewer connection

ITEM	NUMBER	SIZE	BASIS
Connection from the last chamber to the public sewer	1	110 mm, about 6 m	The length depends on where the sewer is; your local body fixes the point of connection

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Rain-water down-pipes

ITEM	NUMBER	SIZE	BASIS
Down-pipes	4	75 mm uPVC, 6.5 m each	93 m² of roof, rain about 75 mm in an hour; a 75 mm pipe drains 27 m² (IS 1742 Table 5)

Checked against the Indian Standards

PASS IS 1172:1993 cl 4.1

Water use per person

135 litres per person per day is used (piped supply, full flushing). 6 people give 810 litres a day.

PASS NBC Part 9 Sec 1 cl 4.4.10

Storage

With an underground and an overhead tank, the underground holds two-thirds of a day's water and the overhead one-third.

PASS NBC Part 9 Sec 2 cl 4.2

Fixtures in every home

Each home has at least one WC, one kitchen sink and one bathing place.

PASS IS 5329:1983 cl 6.1.1

Soil stack

A single 100 mm stack without a vent pipe is allowed up to five storeys. The report counts one stack for every two WCs on a floor, a NirmanShastra assumption. You have 2 floors, so 1 stack carry the WCs.

PASS IS 1742:1983 Tables 3 and 4

Drain loads

The building drain carries 29 fixture units, so a 110 mm drain at 1 in 100 is enough (limit 180 for 110 mm). One stack takes up to 90 units in a floor and 500 in all; yours takes 14 and 21.

NOTE IS 1742:1983 cl 4.10.3.8

Rain water

For rain of about 75 mm in an hour, a 93 m² roof needs 4 down-pipes of 75 mm. IS 1742 gives no rainfall for each town, so the rain figure is the one you chose.

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How far off can this be

- Water supply pipe: from 25% below to 35% above the figure shown.
- Drain and rain pipe: from 20% below to 30% above the figure shown.
- Fittings and valves: from 30% below to 40% above the figure shown.
- Tanks and pump: from 10% below to 20% above the figure shown.

Assumptions

- Code: 135 litres per person a day (IS 1172:1993 cl 4.1 and its Note; 135 L is the lower of the figures given, and a town of over a lakh people may need 150 L or more). Tanks follow the NBC Part 9 Section 1 split of two-thirds of a day underground and one-third overhead.
- Code: fixture units, simultaneous demand, 2.4 m/s velocity limit (NBC Part 9 Section 1 draft); drain loads, stack and drain limits (IS 1742); venting above five storeys (IS 5329); septic tank and soak pit tables (IS 2470); down-pipe areas (IS 1742 Table 5).
- Derived: people per home = bedrooms plus three. The NBC draft gives this relation in two readings that differ by one person; the larger is used, so tanks lean generous.
- Assumed: floor to floor height of 3.0 m; 3 m of pipe from the header to each tap; 0.6 × the side of the home for the header run from the riser; 4 m from the stack foot to its chamber and 8 m to the plot edge. No standard fixes these, so the report treats them as the least certain part and the range below is wide.
- Assumed: bathrooms are stacked one above another and share a wet wall, kitchens likewise.
- Assumed: one washing machine point per home, one balcony tap per home on every floor, one terrace tap, and one wash basin at the dining area for homes with two or more bedrooms.
- Assumed: a transfer pump fills the overhead tank in 30 minutes, at a pump efficiency of 0.5, over the climb plus 10 m of pipe and 30% extra length for fittings.
- Assumed: roof area equals your largest floor. Rain of about 75 mm in an hour, because the standard gives no figure for each town.
- Assumed: tank sizes are rounded up to 500, 1,000, 1,500, 2,000, 3,000 or 5,000 litres, which are the common ready-made sizes (no standard lists them). A larger need is shown as equal tanks, or a built sump underground.
- Assumed: 5% cutting waste on all pipe, and whole lengths of 3 m (CPVC, IS 15778 allows 3, 5 or 6 m; SWR pipe is sold in 3 m lengths).

Not counted in this report

- Building the underground tank, the septic tank, the soak pit and the inspection chambers (concrete, bricks, plaster, covers).
- The borewell, its submersible pump and the cable to it.
- Hot-water solar systems, water meters, water softeners and filters.
- Fire-fighting water and pipework (NBC Part 4).
- Make, model or finish of any fixture or tap.
- Excavation and refilling for drains and pipes in the ground, except the tank and pit digging shown.
- Kitchen hot water, which is cold-only in this count.

Standards and sources used

- IS 1172:1993 Basic requirements for water supply, drainage and sanitation
- IS 2065:1983 Water supply in buildings; IS 12183 (Part 1):1987 Water storage and pumping
- IS 1742:1983 Building drainage; IS 5329:1983 Sanitary pipework above ground
- IS 2470 (Part 1 and 2):1985 Septic tanks and soak pits; IS 4111 (Part 1):1986 Manholes
- IS 15778:2007 CPVC pipes; IS 4985:2000 uPVC pressure pipes; SP 35:1987 Water supply and drainage handbook
- NBC 2016 Part 9 Section 1 and Section 2, read from the BIS preliminary drafts of November 2024

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APPENDIX A

Calculation sheet

PlumbingPro: how every figure in this report was worked out

What this sheet is

This sheet shows how every figure in the PlumbingPro report was worked out: how many people the water is planned for, how big the tanks and the transfer pump are, how the pipes were sized and measured, how the septic tank and soak pit (or the sewer connection) and the rain-water down-pipes were found, and how the buy list was added up. It is written so that a plumbing engineer, a bank's engineer or a contractor can check the formulas and the arithmetic. It is a planning-level quantity estimate, not a plumbing design or a drawing.

How to read it

Each row is one step. STEP says what is being found. FORMULA gives it in symbols. WORKING puts the numbers in. RESULT is the answer with its unit. SOURCE names the clause or table the step rests on. The columns take turns being a lighter and a darker cream, so each figure sits under its own heading. Amber rows are inputs: a figure you gave, or a value read from a code table. Green rows are figures that appear in the report. Every sum was carried out at full precision and is shown rounded, so re-keying the rounded numbers by hand may differ in the last digit.

Method in brief

1. Your answers and the floor areas are read. The model works out the homes, the people (bedrooms plus three in each home unless you gave the number), the roof area and the fixtures on every floor.
2. Daily water is the people times the litres per person per day from IS 1172 (the model uses 135 L, the lower of the figures the sources give, or 150 L for a house on its own borewell).
3. The day's water is split between an underground and an overhead tank by the NBC Part 9 storage rule for the water source, and each part is rounded up to a tank size that is sold.
4. Each fixture is given water supply fixture units (NBC Part 9 draft). The units on a floor give the flow drawn at the same moment, and the smallest CPVC size that carries it at the velocity limit is chosen for each home header and for the riser at each floor.
5. The transfer pump is sized for the larger of the peak-hour demand and refilling the overhead tank in 30 minutes; the head is the climb plus pipe friction (Hazen-Williams) plus a residual head; the power is flow times head over 4,500 times the efficiency, rounded up to a pump size sold.
6. Supply pipe lengths are built from planning rules (the size of the home, bathrooms, kitchens and outlets), added by pipe size, and rounded up to whole lengths after cutting waste.
7. Soil and waste stacks, branches and the building drain are measured with planning rules; the load on a soil stack and on the building drain is checked against IS 1742, and the building drain size is chosen from the drainage fixture units.
8. With no sewer, the septic tank is worked out from the IS 2470 tank dimensions for the people served and the soak pit is sized from the rate for the ground you chose; with a sewer, a connection length is counted.
9. Rain-water down-pipes are found from the roof area, the rain you chose and the area one pipe drains (IS 1742 Table 5).
10. Fittings, valves, traps and clamps are counted per outlet and per piece of equipment with fixed rules.
11. The buy list collects the pipe, the tanks, the pump and the main fixture counts, and the uncertainty multipliers give the ranges printed under the totals.
12. Every total in the report is rebuilt from this working and compared with the report in the reconciliation at the end.

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Read this before relying on the sheet

- This is a planning-level quantity model, not a plumbing design. It does not draw the layout, route any pipe or size the branch pipes one by one. Pressure at the fixtures (the residual head) is not checked: header and riser sizes come from the velocity limit alone, so friction and fitting losses along them are not part of the sizing, and fittings enter only as 30% extra length on the delivery pipe when the pump head is worked out. Pipe lengths come from planning rules for the size of the home and the number of outlets, so the supply and drain pipe totals can be 25% to 35% off a real layout (section 13).
- Several of the code figures are read from the BIS preliminary drafts of NBC 2016 Part 9 (November 2024), not from the published code: people per home, the storage split, fixture units, the flow table and the 2.4 m/s velocity limit. A signing engineer should check them against the published edition. The 2 m/s used for the delivery pipe and the peak-hour factor of 1.5 (the draft mentions 2 to 3) are NirmanShastra assumptions.
- Water demand is 135 L a head (150 L for a borewell house). 135 L is the lower of the figures the sources give: IS 1172 cl 4.1 gives 150 to 200 L for towns of over a lakh people, and its Note allows 135 L for lower-income housing. A town above a lakh may need 150 L or more, which would raise the tanks, the pump flow and the waste water.
- Tank sizes are rounded to common ready-made sizes (a market practice, not a standard). Fire-fighting storage and a fire pump are not counted (NBC Part 4). Above six floors a booster or zoned supply may be needed; the sheet counts one riser and one overhead tank. Pipe is bought in whole 3 m lengths with 5% added for cutting. If uPVC or PPR is used for cold water, or the plumber cuts differently, the metres stay and the number of lengths changes. Make, model and finish of fixtures are not specified. Nothing here is a price or a rate, and what is not counted (the borewell, solar hot water, meters, filters, fire-fighting, the building of tanks and chambers) is listed in the report.
- The pump is sized by a simple formula (flow, head, an assumed efficiency of 0.5) and rounded up to a size sold. It does not read a maker's curve, check suction lift or the electrical supply, and the model shows no more than the largest size in its list even if the power needed is higher. Supply pipes stop at 100 mm in the same way: for a very large building the flow can be more than a 100 mm pipe carries at the velocity limit. The sheet marks both cases. Two pumps, one working and one standby, for two or more homes is a NirmanShastra assumption and not a code requirement (the NBC draft mentions standby pumps only for pressurised systems). A borewell pump is not sized.
- Drain loads are checked, not designed. Against the limits of IS 1742 the model checks the load on one soil stack (at a floor and in all) and the load on the building drain, which also sets the drain size; the waste stack, the branches and the vent stacks are not load-checked. The stack limit is one figure for every building height, which may be looser than the standard's table for a low building, and the 110 and 160 mm drains use the limits of 100 and 150 mm bores. The dining wash basin is left out of the drainage fixture units (a simplification in the engine), and the washing machine value of 3 units is not in Table 1 of IS 1742. Gradients, invert levels and the layout of the chambers are not designed.
- The septic tank dimensions for the people served come from IS 2470 Part 1 Appendix A, and the soak pit rates from IS 2470 Part 2 Table 2. The standard prints dimensions, not volumes: the volumes in the table are the model's own length × width × depth. The day's detention added for the other waste water, equal tanks above 100 people and any volume above the table's last row (300 users) are also the model's own working or extension. Waste water is taken as 108 L a head whatever the water source. The soak pit uses the rate for the class of ground you chose, not a percolation test; poor ground is flagged as unsuitable. Neither is designed structurally: walls, slabs, covers and linings are not counted.
- The rain you choose, not the rainfall of your town, sets the number of down-pipes, because IS 1742 gives no figure for each town. The roof is taken as the largest floor; gutters, terrace slopes and rain-water storage are not designed.
- Where the SOURCE column gives a clause number for a standard marked "not re-read against the published text" in the references, treat it as a pointer to check, not as a quotation.
- Each NirmanShastra tool lays out the rooms by its own rule, so a room's area or count in this report can differ from the same room in another NirmanShastra report.

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1. Your answers and what follows from them

The report starts from a few plain answers and the floor areas. This section turns them into the homes, the people, the roof area and the fixtures that every later step uses.

1.1 Your answers

STEP	FORMULA	WORKING	RESULT	SOURCE
Building type			**A house**	Your answer
Bedrooms in the house			**3**	Your answer
Bathrooms with a WC in the house			**3**	Your answer
Kitchens in the house			**1**	Your answer
People in each home Bedrooms plus three is used (1.3).			**Not given**	Your answer
Water source			**Municipal supply**	Your answer
Public sewer at the plot			**Yes**	Your answer
Rain in the heaviest hour			**about 75 mm in an hour**	Your answer
Hot water (geysers) in the bathrooms			**Yes**	Your answer
Washing machine point in every home			**Yes**	Your answer
Tap in the garden or parking			**No**	Your answer
State and city Printed on the report; no figure on this sheet depends on it.			**Uttar Pradesh, Lucknow**	Your answer

1.2 Floors and roof area

STEP	FORMULA	WORKING	RESULT	SOURCE
Floors above ground			**2**	Your answer
Square feet to square metres			**0.09290304 m² per sq ft**	Conversion (1 ft = 0.3048 m)
Area of the largest floor (Ground floor)	A = a × k	1,000.0 × 0.09290304	**92.9 m²**	
Roof area The model takes the roof as equal to the largest floor. No terrace slope, parapet or setback is drawn.	roof = the largest floor area	largest of 92.9, 92.9	**92.9 m²**	NirmanShastra assumption

FLOOR	BUILT-UP AREA (SQ FT)	AREA (M²)
Ground floor	1,000	92.9
First floor	1,000	92.9
Roof (largest floor)	**1,000**	**92.9**

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1.3 Homes and people

STEP	FORMULA	WORKING	RESULT	SOURCE
Homes in the building	a house is one home	1	**1**	
People in each home The NBC draft gives this relation in two readings that differ by one person; the model takes the larger, so tanks lean generous.	persons = bedrooms + 3	3 + 3	**6**	NBC 2016 Part 9 Sec 1 (BIS draft, Nov 2024)
People counted	people = people per home × homes	6 × 1	**6**	

1.4 What each floor holds

STEP	FORMULA	WORKING	RESULT	SOURCE
How bathrooms and kitchens are placed	The bathrooms and kitchens of a house are spread over the floors as evenly as possible, ground floor first: each floor gets the whole-number share and the first few floors get one extra.			Engine rule
Washing machine and dining basin	A washing machine point is counted in every flat, and on the ground floor of a house. A dining wash basin is counted in every home with two or more bedrooms, in the same places.			NirmanShastra assumption

FLOOR	HOMES ON THE FLOOR	BATHROOMS IN EACH HOME	BATHROOMS ON THE FLOOR	KITCHENS IN EACH HOME	KITCHENS ON THE FLOOR	WASHING MACHINE POINT	DINING BASIN
Ground floor	1	2	2	1	1	1	1
First floor	1	1	1	0	0	0	0

1.5 Fixtures counted

STEP	FORMULA	WORKING	RESULT	SOURCE
Counting on Ground floor (worked example)	Each count is the number in one home times the homes on the floor. The same rule is applied to every floor in the table below.			Engine rule
WCs, showers and health faucets One WC with flush tank, one shower with mixer and one health faucet in each bathroom.	n = bathrooms × homes on the floor	2 × 1	**2 each**	Engine rule
Wash basins	n = (bathrooms + dining basin) × homes	(2 + 1) × 1	**3 nos**	Engine rule
Kitchen sinks	n = kitchens × homes	1 × 1	**1 nos**	Engine rule
Floor traps The washer standpipe has its own trap.	n = (bathrooms + kitchens + 1 balcony + washer) × homes	(2 + 1 + 1 + 1) × 1	**5 nos**	Engine rule
Water closets in all	WC = Σ over floors	2 + 1	**3 nos**	Engine rule
Showers with mixer in all	one per bathroom	2 + 1	**3 nos**	Engine rule
Health faucets in all	one per bathroom	2 + 1	**3 nos**	Engine rule
Wash basins in all	Σ over floors	3 + 1	**4 nos**	Engine rule
Kitchen sinks in all	Σ over floors	1 + 0	**1 nos**	Engine rule
Washing machine points in all	Σ over floors	1 + 0	**1 nos**	Engine rule
Balcony or utility taps in all	one per home on every floor	1 + 1	**2 nos**	Engine rule
Geyser points in all	one per bathroom	2 + 1	**3 nos**	Engine rule
Floor traps in all	Σ over floors	5 + 2	**7 nos**	Engine rule

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Terrace tap One tap on the terrace, always.				**1 no.**	NirmanShastra assumption
Garden tap				**0 no.**	Your answer

FLOOR	WC, SHOWER, HEALTH FAUCET	WASH BASINS	KITCHEN SINKS	WASHING MACHINE POINTS	BALCONY TAPS	GEYSERS	FLOOR TRAPS
Ground floor	2	3	1	1	1	2	5
First floor	1	1	0	0	1	1	2
All floors	**3**	**4**	**1**	**1**	**2**	**3**	**7**

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2. Daily water demand

Everything downstream (tanks, pump flow, waste water) rests on how much water the people use in a day.

2.1 Water used in a day

STEP	FORMULA	WORKING	RESULT	SOURCE
Litres per person per day IS 1172 cl 4.1 gives 150 to 200 L a head for towns of over a lakh people. The 135 L here is the figure its Note allows for lower-income housing. It is the lower of the figures the sources give, and the model uses it for every home on a piped or tanker supply, so a town of over a lakh people may need 150 L or more.			**135 L**	IS 1172:1993 cl 4.1 and its Note
Water used in a day	D = people × litres per person per day	6 × 135	**810 L**	IS 1172:1993 cl 4.1 and its Note

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3. Underground and overhead tanks

The day's water is split between an underground and an overhead tank according to the water source, then each part is rounded up to a tank that is sold. Fire-fighting reserve is not counted; it is a matter for NBC Part 4.

3.1 How the day's water is shared between the tanks

STEP	FORMULA	WORKING	RESULT	SOURCE
Underground tank: water to hold Two-thirds of a day underground when the supply is piped (note c).	UGT = ku × D	810 × 0.667	**540 L**	NBC 2016 Part 9 Sec 1 cl 4.4.10 (BIS draft)
Overhead tank: water to hold One-third of a day overhead.	OHT = ko × D	810 × 0.333	**270 L**	NBC 2016 Part 9 Sec 1 cl 4.4.10 (BIS draft)

3.2 Rounding up to tanks that are sold

STEP	FORMULA	WORKING	RESULT	SOURCE
Tank sizes sold (litres) The common ready-made sizes; no standard lists them. A larger need is shown as equal tanks, or as a built sump underground.			**500, 1000, 1500, 2000, 3000, 5000**	NirmanShastra assumption
Underground tank: size sold	smallest size sold that is at least the need	first size in the list that is at least 540 L	**1,000 L**	NirmanShastra assumption
Underground tank: capacity bought ready-made tank	size × number	1,000 × 1	**1,000 L**	
Overhead tank: size sold	smallest size sold that is at least the need	first size in the list that is at least 270 L	**500 L**	NirmanShastra assumption
Overhead tank: capacity bought ready-made tank	size × number	500 × 1	**500 L**	
Tanks: total capacity bought	UGT + OHT	1,000 + 500	**1,500 L**	
Tanks in all (for float valves, valves and overflow pipes)	number of UGT + number of OHT	1 + 1	**2**	

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4. Supply pipe sizing

The supply pipe is CPVC (IS 15778). The size of each home header and of the riser at each floor is the smallest size whose bore carries the simultaneous flow at the velocity limit.

4.1 Pipe bore and what each size carries

STEP	FORMULA	WORKING	RESULT	SOURCE
Velocity limit in supply pipe The most the NBC draft allows for the velocity of the water in a supply pipe.			**2.4 m/s**	NBC 2016 Part 9 Sec 1 cl 4.8.6 (BIS draft)
Capacity of a 20 mm pipe (worked example) d is the inside diameter in mm; 60,000 turns m³/s into L/min.	$Q = (\pi \div 4) \times d^2 \times v \times 60{,}000$	$(\pi \div 4) \times (17.7 \div 1000)^2 \times 2.4 \times 60{,}000$	**35.43 L/min**	IS 15778:2007 Table 2 (65 to 100 mm derived)

NOMINAL SIZE (MM)	INSIDE DIAMETER (MM)	CARRIES AT 2.4 M/S (L/MIN)	CARRIES AT 2 M/S (L/MIN)
15	12.0	16.3	13.6
20	17.7	35.4	29.5
25	22.9	59.3	49.4
32	28.0	88.7	73.9
40	33.2	124.7	103.9
50	43.6	215.0	179.2
65	53.8	327.4	272.8
80	64.0	463.2	386.0
100	84.5	807.5	673.0

4.2 Water supply fixture units

Each fixture is given a number of fixture units. The flow that a set of units draws at the same moment is read from NBC Part 9 Table 3 (flush-tank column) and is much less than the sum of every tap running together.

STEP	FORMULA	WORKING	RESULT	SOURCE
Fixture units: bathroom (WC, basin, shower) Private use, flush tank.			**5.0 units**	NBC 2016 Part 9 Sec 1 Table 2 (BIS draft)
Fixture units: kitchen sink			**2.0 units**	NBC 2016 Part 9 Sec 1 Table 2 (BIS draft)
Fixture units: washing machine			**4.0 units**	NBC 2016 Part 9 Sec 1 Table 2 (BIS draft)
Fixture units: balcony or terrace tap (hose bib)			**2.5 units**	NBC 2016 Part 9 Sec 1 Table 2 (BIS draft)
Fixture units: dining wash basin			**1.5 units**	NBC 2016 Part 9 Sec 1 Table 2 (BIS draft)

FIXTURE UNITS	SIMULTANEOUS FLOW (L/MIN)
5	22.7
10	30.3
20	53.0

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50	109.8
100	166.5
200	246.0
300	321.7
500	473.1

4.3 Header and riser: worked examples

STEP	FORMULA	WORKING	RESULT	SOURCE
Worked example 1: the header of one home on Ground floor	This is the floor whose home draws the most. The header is the pipe from the riser into the home.			Engine rule
Fixture units of one home b bathrooms, k kitchens, w washing machine, one balcony tap (Uh), d dining basin.	u = b × Ub + k × Uk + w × Uw + Uh + d × Ud	2 × 5 + 1 × 2 + 1 × 4 + 2.5 + 1 × 1.5	**20 units**	NBC 2016 Part 9 Sec 1 Table 2 (BIS draft)
Flow drawn at the same time by one home	y = y0 + (x − x0) × (y1 − y0) ÷ (x1 − x0)	30.3 + (20 − 10) × (53 − 30.3) ÷ (20 − 10)	**53 L/min**	NBC 2016 Part 9 Sec 1 Table 3 (BIS draft)
Header size A 25 mm pipe carries 59.3 L/min at 2.4 m/s (table in 4.1).	smallest size, not under the minimum, whose capacity at the velocity limit is at least Q; the largest size if none is	from 20 mm up: capacity at 2.4 m/s must be at least 53.00 L/min	**25 mm**	NBC 2016 Part 9 Sec 1 cl 4.8.6 (BIS draft)
Worked example 2: the riser at the top (First floor)	Water comes down from the overhead tank, so the riser at a floor carries that floor and every floor below it. The top segment carries the whole building, the terrace tap and the garden tap.			Engine rule
Fixture units carried by the top of the riser	Σ (units of a home × homes) over the floors + garden tap + terrace tap	20.0 + 7.5 + 2.5	**30 units**	NBC 2016 Part 9 Sec 1 Table 2 (BIS draft)
Flow drawn at the same time by the whole building	y = y0 + (x − x0) × (y1 − y0) ÷ (x1 − x0)	53 + (30 − 20) × (109.8 − 53) ÷ (50 − 20)	**71.93 L/min**	NBC 2016 Part 9 Sec 1 Table 3 (BIS draft)
Top riser size A 32 mm pipe carries 88.7 L/min at 2.4 m/s (table in 4.1).	smallest size, not under the minimum, whose capacity at the velocity limit is at least Q; the largest size if none is	from 20 mm up: capacity at 2.4 m/s must be at least 71.93 L/min	**32 mm**	NBC 2016 Part 9 Sec 1 cl 4.8.6 (BIS draft)

4.4 Header and riser size, floor by floor

FLOOR	BATHROOMS	KITCHENS	WASHER	DINING BASIN	UNITS, ONE HOME	FLOW (L/MIN)	HEADER	UNITS CARRIED BY RISER	FLOW (L/MIN)	RISER
Ground floor	2	1	1	1	20.0	53.0	25 mm	20.0	53.0	25 mm
First floor	1	0	0	0	7.5	26.5	20 mm	30.0	71.9	32 mm

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5. Delivery pipe and transfer pump

The transfer pump lifts water from the underground tank to the overhead tank. Its flow, head and power are found as below and rounded up to a size sold.

5.1 Pump flow, head and power

STEP	FORMULA	WORKING	RESULT	SOURCE
Flow to meet the peak hour Peak hour taken as one and a half times the day's demand spread evenly over the hours of use. The factor 1.5 is a NirmanShastra choice; the NBC draft mentions a peak factor of 2 to 3.	Q1 = peak factor × D ÷ (hours × 60)	1.5 × 810 ÷ (12 × 60)	**1.688 L/min**	NirmanShastra assumption
Flow to refill the overhead tank The pump is assumed to refill the whole overhead tank in this many minutes.	Q2 = tank capacity bought ÷ fill time	500 ÷ 30	**16.67 L/min**	NirmanShastra assumption
Pump flow Refilling the tank is the larger flow here, so the peak-hour factor does not change the pump.	Q = the larger of Q1 and Q2	largest of 1.69, 16.67	**16.67 L/min**	NirmanShastra assumption
Climb from the water level to the top of the overhead tank	Hs = floors × floor height + tank stand + water depth + depth of the water below ground	2 × 3 + 1 + 1 + 2	**10 m**	NirmanShastra assumption
Velocity limit in delivery pipe A NirmanShastra assumption, lower than the 2.4 m/s maximum in the NBC draft (cl 4.8.6).			**2.0 m/s**	NirmanShastra assumption
Delivery pipe size A 25 mm pipe carries 49.4 L/min at 2 m/s (table in 4.1). 2 m/s is a NirmanShastra assumption, lower than the 2.4 m/s maximum in the NBC draft (cl 4.8.6).	smallest size, not under the minimum, whose capacity at the velocity limit is at least Q; the largest size if none is	from 25 mm up: capacity at 2 m/s must be at least 16.67 L/min	**25 mm**	NirmanShastra assumption
Delivery pipe length	L = Hs + extra run	10.0 + 10	**20 m**	NirmanShastra assumption
Friction loss in the delivery pipe Le is the pipe length times 1.3 for fittings, in m. Q is the pump flow in L/s (L/min ÷ 60) and d the inside diameter in mm; the formula divides each by 1000 to get m³/s and m. C = 120 is the model's value for plastic pipe.	hf = 10.67 × Le × (Q ÷ 1000)^1.852 ÷ (C^1.852 × (d ÷ 1000)^4.87)	10.67 × 26.00 × (0.2778 ÷ 1000)^1.852 ÷ (120^1.852 × (22.90 ÷ 1000)^4.87)	**0.986 m**	SP 35:1987 eq. 1 (Hazen-Williams)
Total head the pump works against	H = Hs + hf + residual head at the tank	10.0 + 0.99 + 3	**13.99 m**	NirmanShastra assumption

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Power needed Metric horsepower: 1 HP is 4,500 kgf·m a minute, and 1 L of water weighs 1 kgf. Pump efficiency is assumed.	P = Q × H ÷ (4,500 × efficiency)	16.7 × 14.0 ÷ (4,500 × 0.5)	**0.104 HP**	NirmanShastra assumption
Pump size sold Sizes listed: 0.5, 0.75, 1, 1.5, 2, 3, 5, 7.5, 10 HP.	next size up from the list	first size in the list that is at least 0.10 HP	**0.5 HP**	NirmanShastra assumption
Number of transfer pumps Two pumps, one working and one standby, for two or more homes is a NirmanShastra assumption. The NBC draft mentions standby pumps only for pressurised systems, so a standby pump is not claimed here as a code requirement.	two for two or more homes (one working, one standby), else one; none for a borewell	homes in the building: 1; two pumps from 2 homes	**1**	NirmanShastra assumption

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6. Supply pipe: lengths and what to buy

No drawing is used. Lengths follow from planning rules for the size of each home and the number of outlets; they are added by pipe size, 5% is added for cutting, and the total is rounded up to whole 3 m lengths.

6.1 Pipe inside a home

STEP	FORMULA	WORKING	RESULT	SOURCE
Worked example: pipe inside one home on Ground floor	Pipe lengths inside a home are not drawn: they follow from the size of the home and the number of bathrooms, kitchens and outlets. These are planning rules, not code values, and they are the least certain part of the report.			NirmanShastra assumption
Side of the home The home is taken as a square.	s = √(floor area ÷ homes on the floor)	√(92.903 ÷ 1)	**9.639 m**	NirmanShastra assumption
Header of one home: riser to the wet rooms (25 mm) a is the share of the side of the home; c is the extra run for each bathroom after the first.	Lh = a × s + c × max(0, b − 1)	0.6 × 9.639 + 2.5 × max(0, 2 − 1)	**8.283 m**	NirmanShastra assumption
Feed of one home into the bathrooms and the kitchen (20 mm)	Lf = b × Fb + Fk (if there is a kitchen)	2 × 3 + 3	**9 m**	NirmanShastra assumption
Pipe to the cold outlets of one home (15 mm) Per bathroom: WC cistern, basin, shower and health faucet (n outlets of p m each) and a geyser inlet (g m). Then the kitchen, the washer, the balcony tap and the dining basin.	Lc = b × n × p + b × g + k × pk + w × pw + pb + d × pd	2 × 4 × 3 + 2 × 2 + 1 × 6 + 1 × 5 + 5 + 1 × 3	**47 m**	NirmanShastra assumption
Pipe to the hot outlets of one home (15 mm) Two hot outlets in each bathroom that has a geyser. Kitchen hot water is cold-only in this count.	Lhot = b × nh × ph	2 × 2 × 3	**12 m**	NirmanShastra assumption

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6.2 Pipe inside one home, floor by floor

FLOOR	HOMES ON THE FLOOR	SIDE OF HOME (M)	HEADER SIZE	HEADER (M)	FEED 20 MM (M)	COLD OUTLETS 15 MM (M)	HOT OUTLETS 15 MM (M)
Ground floor	1	9.64	25 mm	8.28	9.00	47.00	12.00
First floor	1	9.64	20 mm	5.78	3.00	19.00	6.00

6.3 Riser, taps, delivery, suction and main

STEP	FORMULA	WORKING	RESULT	SOURCE
Other supply runs	The riser, the terrace and garden taps, the delivery and suction pipes and the main are measured next. Each is a planning length.			NirmanShastra assumption
Riser: one segment of floor height for each floor Each segment takes the size found for that floor in 4.4.	segment = floor height	3	**3 m**	NirmanShastra assumption

Riser top: stand-off at the overhead tank and run across the terrace (32 mm)	L = stand-off + terrace run	1.5 + 4	**5.5 m**	NirmanShastra assumption
Terrace tap feed (20 mm)	L = feed × number of terrace taps	5 × 1	**5 m**	NirmanShastra assumption
Delivery pipe (25 mm)	The delivery length of 20.0 m was found in section 5.			NirmanShastra assumption
Suction pipe size	one size larger than the delivery pipe	one size above 25 mm in the list of sizes	**32 mm**	NirmanShastra assumption
Suction pipe length (32 mm)	L = length per pump × pumps	3 × 1	**3 m**	NirmanShastra assumption
Water main to the underground tank (25 mm) The real length depends on where the main is; your local body fixes the point.	L = planning length	12	**12 m**	NirmanShastra assumption

6.4 Metres of supply pipe by size and by where it is used

STEP	FORMULA	WORKING	RESULT	SOURCE
15 mm supply pipe: run	Σ of the runs of this size	66.0 + 18.0	**84 m**	
20 mm supply pipe: run	Σ of the runs of this size	5.78 + 12.00 + 5.00	**22.78 m**	
25 mm supply pipe: run	Σ of the runs of this size	8.28 + 3.00 + 20.00 + 12.00	**43.28 m**	
32 mm supply pipe: run	Σ of the runs of this size	8.5 + 3.0	**11.5 m**	
All sizes: run	Σ over the sizes	84.0 + 22.8 + 43.3 + 11.5	**161.6 m**	

SIZE	HOME HEADER	FEED	COLD OUTLETS	HOT OUTLETS	RISER	TERRACE AND GARDEN TAPS	DELIVERY	SUCTION	MAIN OR FILLING	TOTAL (M)
15 mm			66.0	18.0						84.0
20 mm	5.8	12.0				5.0				22.8
25 mm	8.3				3.0		20.0		12.0	43.3
32 mm					8.5			3.0		11.5
All sizes	**14.1**	**12.0**	**66.0**	**18.0**	**11.5**	**5.0**	**20.0**	**3.0**	**12.0**	**161.6**

6.5 Supply pipe to buy, in whole 3 m lengths

STEP	FORMULA	WORKING	RESULT	SOURCE
15 mm: run with cutting waste (worked example) Cutting waste of 5% on all pipe.	Lw = L × (1 + waste)	84.00 × 1.05	**88.2 m**	NirmanShastra assumption
15 mm: whole 3 m lengths CPVC pipe is sold in 3, 5 or 6 m lengths (IS 15778); the model counts 3 m lengths.	n = ceil(Lw ÷ length)	ceil(88.20 ÷ 3)	**30**	NirmanShastra assumption
15 mm: to buy	n × length	30 × 3	**90 m**	
All sizes: with cutting waste	Σ (run × (1 + waste))	88.2 + 23.9 + 45.4 + 12.1	**169.6 m**	
All sizes: 3 m lengths	Σ n	30 + 8 + 16 + 5	**59**	
All sizes: supply pipe to buy	Σ n × length	59 × 3	**177 m**	

SIZE	RUN (M)	WITH CUTTING WASTE (M)	3 M LENGTHS	TO BUY
15 mm	84.0	88.2	30	90 m
20 mm	22.8	23.9	8	24 m

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25 mm	43.3	45.4	16	48 m
32 mm	11.5	12.1	5	15 m
All sizes	**161.6**	**169.6**	**59**	**177 m**

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7. Drainage

Soil and waste stacks, the branches to each fixture, the building drain and the inspection chambers. Two loads are checked against the fixture-unit limits of IS 1742: the load on one soil stack (at a floor and in all) and the load on the building drain, which also sets the drain size. The waste stack, the branches and the vent stacks are not load-checked.

7.1 Stacks

STEP	FORMULA	WORKING	RESULT	SOURCE
Soil stacks	The model counts one soil stack for every 2 WCs on a floor, so the stacks needed are the most WCs on any floor divided by 2, rounded up, and at least one. The figure of 2 WCs to a stack is a NirmanShastra assumption; it is not a fixture-unit rule of IS 5329.			NirmanShastra assumption
Soil stacks	n = largest of 1 and ceil(WCs on a floor ÷ WCs per stack) over the floors	largest of 1, 1, 1	**1**	NirmanShastra assumption
Waste stacks One waste stack for each kitchen on the floor with the most kitchens.	n = largest of 1 and the kitchens on a floor	largest of 1, 1, 0	**1**	NirmanShastra assumption
Height of a stack The stack goes above the roof to vent; the foot is taken below the slab. Both lengths are planning lengths.	H = floors × floor height + foot below the slab + top above the roof	2 × 3 + 1 + 1.5	**8.5 m**	IS 5329:1983 cl 6.8.4 (stack above the roof)
Vent stacks The research notes give IS 5329 as allowing a single stack without a vent up to five storeys, so the model adds a vent stack from 6 floors up.	one beside each soil stack from this many floors up	floors in the building: 2; a vent stack from 6 floors up	**0**	IS 5329:1983 cl 6.1.1 (single stack without a vent)

FLOOR	BATHROOMS ON THE FLOOR	STACKS NEEDED	KITCHENS ON THE FLOOR
Ground floor	2	1	1
First floor	1	1	0

7.2 Stacks and branches

STEP	FORMULA	WORKING	RESULT	SOURCE
Soil stacks (110 mm)	L = stacks × H	1 × 8.5	**8.5 m**	NirmanShastra assumption
Waste stacks (75 mm)	L = stacks × H	1 × 8.5	**8.5 m**	NirmanShastra assumption
WC branches (110 mm)	L = WCs × branch length	3 × 1.5	**4.5 m**	NirmanShastra assumption
Shower and floor-trap branches (75 mm)	L = bathrooms × branch length	3 × 2.5	**7.5 m**	NirmanShastra assumption
Basin waste (40 mm)	L = basins × waste length	4 × 1.2	**4.8 m**	NirmanShastra assumption
Kitchen, washer and balcony waste (50 mm)	L = kitchens × Lk + washers × Lw + balcony taps × Lb	1 × 3 + 1 × 2 + 2 × 2.5	**10 m**	NirmanShastra assumption
Overflow and scour pipes at the tanks (50 mm)	L = tanks × length	2 × 6	**12 m**	NirmanShastra assumption

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7.3 Load on the stacks, the building drain and the chambers

STEP	FORMULA	WORKING	RESULT	SOURCE
Drainage fixture units on the building drain Ub: bathroom group with a flush-tank WC; Ut: floor trap; Us: kitchen sink; Uw: washing machine. IS 1742 Table 1 lists no washing machine; the model uses the combination sink-and-tray value. The dining wash basin is not counted: the model gives it no drainage fixture units (a simplification in the engine).	FU = WCs × (Ub + Ut) + kitchens × (Us + Ut) + washers × Uw + balcony traps × Ut	3 × (6 + 1) + 1 × (2 + 1) + 1 × 3 + 2 × 1	**29 units**	IS 1742:1983 Table 1
Building drain size At a fall of 1 in 100 a 100 mm drain takes 180 units and a 150 mm drain 700 units. The model buys SWR in 110 and 160 mm and uses the 100 mm and 150 mm values for them.	smaller size up to its limit, else the next size	29 units against a limit of 180 units for 110 mm	**110 mm**	IS 1742:1983 Tables 3 and 4
Load on one soil stack at a floor Limit 90 units for one floor of a stack: within the limit.	FU = WCs per stack at a floor × (Ub + Ut)	2 × (6 + 1)	**14 units**	IS 1742:1983 Tables 3 and 4
Load on one soil stack in all Limit 500 units on a stack, the one figure the model uses for every building height: within the limit. The building drain is checked against 700 units, the most that the largest drain size in the list takes (160 mm, read as the 150 mm value); the size chosen above is the smallest that carries the load: within the limit.	FU = WCs × (Ub + Ut) ÷ soil stacks	3 × (6 + 1) ÷ 1	**21 units**	IS 1742:1983 Tables 3 and 4
Building drain length	L = stacks × run from stack foot to chamber + run to the plot edge	(1 + 1) × 4 + 8	**16 m**	NirmanShastra assumption
Inspection chambers IS 1742 requires a chamber where a drain changes direction, gradient or size; the 30 m spacing and the count at each stack foot are planning rules.	n = stacks + 1 at the outlet + floor(drain length ÷ spacing)	1 + 1 + 1 + floor(16.0 ÷ 30)	**3**	IS 1742:1983; IS 4111 (Part 1):1986 (chambers)

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8. Sewer connection

A public sewer runs past the plot, so the waste connects to it and no septic tank or soak pit is counted.

8.1 Sewer connection

STEP	FORMULA	WORKING	RESULT	SOURCE
Connection from the last chamber to the public sewer (110 mm) The real length depends on where the sewer is; your local body fixes the point of connection.	L = planning length	6	**6 m**	NirmanShastra assumption

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9. Rain-water down-pipes

The roof is taken as the largest floor. The number of down-pipes follows from the rain you chose and the area one pipe drains; gutters, terrace slopes and storage are not designed.

9.1 Down-pipes for the roof

STEP	FORMULA	WORKING	RESULT	SOURCE
Rain in the heaviest hour about 75 mm in an hour. IS 1742 gives no rainfall for each town, so this is the figure you chose.			**75 mm per hour**	Your answer
Roof drained by one 75 mm pipe			**27.0 m²**	IS 1742:1983 Table 5, cl 4.10.3.8
Roof drained by one 100 mm pipe			**57.0 m²**	IS 1742:1983 Table 5, cl 4.10.3.8
75 mm pipes needed	n = ceil(roof ÷ area drained by one pipe), at least the fewest allowed	larger of 2 and ceil(92.9 ÷ 27)	**4**	IS 1742:1983 Table 5, cl 4.10.3.8
Down-pipe size The model moves to 100 mm pipes when more than four 75 mm pipes would be needed.	use 100 mm when 75 mm pipes would be more than the limit	75 mm pipes needed: 4; most allowed before 100 mm is used: 4	**75 mm**	NirmanShastra assumption
Number of down-pipes	n = ceil(roof ÷ area drained by one pipe of the chosen size), at least the fewest allowed	larger of 2 and ceil(92.9 ÷ 27)	**4**	IS 1742:1983 Table 5, cl 4.10.3.8
Pipe size bought	uPVC SWR is sold in 75 and 110 mm; 110 mm drains at least what 100 mm does	a 75 mm design pipe is bought as 75 mm	**75 mm**	NirmanShastra assumption
Length of each down-pipe	L = floors × floor height + extra	2 × 3 + 0.5	**6.5 m**	NirmanShastra assumption
Down-pipe length in all	L = n × length of each	4 × 6.5	**26 m**	NirmanShastra assumption

9.2 Roof area one down-pipe drains

RAIN (MM PER HOUR)	75 MM PIPE (M²)	100 MM PIPE (M²)
75	27.0	57.0
100	20.4	42.7
150	13.6	28.5

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10. Drain and rain pipe: lengths and what to buy

The runs found in sections 7 to 9 are added by pipe size, 5% is added for cutting, and the total is rounded up to whole 3 m lengths.

10.1 Metres of drain and rain pipe by size and by where it is used

STEP	FORMULA	WORKING	RESULT	SOURCE
40 mm drain or rain pipe: run	Σ of the runs of this size	4.8	**4.8 m**	
50 mm drain or rain pipe: run	Σ of the runs of this size	10.0 + 12.0	**22 m**	
75 mm drain or rain pipe: run	Σ of the runs of this size	8.5 + 7.5 + 26.0	**42 m**	
110 mm drain or rain pipe: run	Σ of the runs of this size	8.5 + 4.5 + 16.0 + 6.0	**35 m**	
All sizes: run	Σ over the sizes	4.8 + 22.0 + 42.0 + 35.0	**103.8 m**	

SIZE	STACKS	BRANCHES	TANK OVERFLOW	BUILDING DRAIN	PIPE TO SEWER OR PIT	RAIN DOWN-PIPES	TOTAL (M)
40 mm		4.8					4.8
50 mm		10.0	12.0				22.0
75 mm	8.5	7.5				26.0	42.0
110 mm	8.5	4.5		16.0	6.0		35.0
All sizes	**17.0**	**26.8**	**12.0**	**16.0**	**6.0**	**26.0**	**103.8**

10.2 Drain and rain pipe to buy, in whole 3 m lengths

STEP	FORMULA	WORKING	RESULT	SOURCE
75 mm: run with cutting waste (worked example) SWR pipe is sold in 3 m lengths.	Lw = L × (1 + waste)	42.00 × 1.05	**44.1 m**	NirmanShastra assumption
75 mm: whole 3 m lengths	n = ceil(Lw ÷ length)	ceil(44.10 ÷ 3)	**15**	NirmanShastra assumption
75 mm: to buy	n × length	15 × 3	**45 m**	
All sizes: with cutting waste	Σ (run × (1 + waste))	5.0 + 23.1 + 44.1 + 36.8	**109 m**	
All sizes: 3 m lengths	Σ n	2 + 8 + 15 + 13	**38**	
All sizes: drain and rain pipe to buy	Σ n × length	38 × 3	**114 m**	

SIZE	RUN (M)	WITH CUTTING WASTE (M)	3 M LENGTHS	TO BUY
40 mm	4.8	5.0	2	6 m
50 mm	22.0	23.1	8	24 m
75 mm	42.0	44.1	15	45 m
110 mm	35.0	36.8	13	39 m
All sizes	**103.8**	**109.0**	**38**	**114 m**

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11. Fittings, valves, traps and fixtures

Fittings are counted per outlet and per piece of equipment with fixed planning rules. The fixtures themselves (WCs, basins, showers, sinks and taps) were counted in section 1.5; the report lists them with the floor traps and the geyser points.

11.1 Supply fittings and valves

STEP	FORMULA	WORKING	RESULT	SOURCE
Cold outlets in all	Σ over floors of (outlets in a home × homes)	12 + 5	**17**	Engine rule
Hot outlets in all	Σ over floors of (hot outlets in a home × homes)	4 + 2	**6**	Engine rule
Outlets in a home	Cold outlets in one home: bathrooms × 4 (WC cistern, basin, shower, health faucet) + kitchens + washer + balcony tap + dining basin. Hot outlets: bathrooms × 2 when there are geysers.			Engine rule
Outlets, cold and hot	outlets = cold + hot	17 + 6	**23**	Engine rule
Elbow 90°, 15 mm	one at every outlet	23	**23 nos**	NirmanShastra assumption
Reducing tee, 20 × 15 mm	one at every outlet	23	**23 nos**	NirmanShastra assumption
Female threaded adaptor or brass elbow, 15 mm	one at every outlet	23	**23 nos**	NirmanShastra assumption
Ball valve, 20 mm (one at each bathroom)	one per bathroom	3	**3 nos**	NirmanShastra assumption
Union, 15 mm (geyser connection)	one per geyser	3	**3 nos**	NirmanShastra assumption
Ball valve, 25 mm (home entry)	one per home on the floors of this header size	1	**1 nos**	NirmanShastra assumption
Union, 25 mm (home entry)	one per home on the floors of this header size	1	**1 nos**	NirmanShastra assumption
Tee, 25 mm (riser take-off)	one per home on the floors of this header size	1	**1 nos**	NirmanShastra assumption
Ball valve, 20 mm (home entry)	one per home on the floors of this header size	1	**1 nos**	NirmanShastra assumption
Union, 20 mm (home entry)	one per home on the floors of this header size	1	**1 nos**	NirmanShastra assumption
Reducing tee, 32 × 20 mm (riser take-off)	one per home on the floors of this header size	1	**1 nos**	NirmanShastra assumption
Reducer, 25 × 32 mm (riser)	one where the riser changes size	riser changes from 25 mm to 32 mm	**1 nos**	NirmanShastra assumption
Elbow 90°, 25 mm (pump and tank connections)	a set number at the pump and tanks	8	**8 nos**	NirmanShastra assumption
Float valve (one for each tank)	one per tank	2	**2 nos**	NirmanShastra assumption
Ball valve, 25 mm (tank inlet and outlet)	tanks × valves per tank	2 × 2	**4 nos**	NirmanShastra assumption
Union, 25 mm (tank connections)	tanks × unions per tank	2 × 2	**4 nos**	NirmanShastra assumption
Foot valve, 25 mm	one per pump	1	**1 nos**	NirmanShastra assumption

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Non-return valve, 25 mm	one per pump	1	**1 nos**	NirmanShastra assumption
Gate or ball valve, 25 mm (pump isolation)	pumps × valves per pump	1 × 2	**2 nos**	NirmanShastra assumption
Union, 25 mm (pump)	pumps × unions per pump	1 × 2	**2 nos**	NirmanShastra assumption
Exposed supply pipe that needs clamps Pipes inside walls are chased in and need no clamps.	riser + stand-off and terrace run + delivery pipe	2 × 3 + (1.5 + 4) + 20.0	**31.5 m**	NirmanShastra assumption
Pipe clamps on exposed supply pipe	n = ceil(exposed length ÷ spacing)	ceil(31.5 ÷ 1)	**32 nos**	NirmanShastra assumption

Counts per outlet and per piece of equipment are planning rules; the fittings are the least certain part of the report.

11.2 Drainage fittings, traps and chambers

STEP	FORMULA	WORKING	RESULT	SOURCE
Long-radius bend, 110 mm (WC branch)	one per WC	3	**3 nos**	NirmanShastra assumption
Branch junction, 110 × 110 mm (WC to stack)	one per WC	3	**3 nos**	NirmanShastra assumption
Branch junction, 110 × 75 mm (bathroom waste to stack)	one per bathroom	3	**3 nos**	NirmanShastra assumption
Bend, 75 mm (floor-trap branch)	one per bathroom	3	**3 nos**	NirmanShastra assumption
Floor trap, 50 mm seal, 75 mm outlet	floor traps counted in 1.5	7	**7 nos**	IS 1742:1983 Table 1
P-trap or bottle trap, 40 mm (basin)	one per wash basin	4	**4 nos**	NirmanShastra assumption
Sink trap, 40 mm	one per kitchen sink	1	**1 nos**	NirmanShastra assumption
Branch junction, 75 × 50 mm (kitchen to waste stack)	kitchen sinks + washing machine points	1 + 1	**2 nos**	NirmanShastra assumption
Large-radius bend, 110 mm (stack foot)	one per soil stack	1	**1 nos**	NirmanShastra assumption
Large-radius bend, 75 mm (waste stack foot)	one per waste stack	1	**1 nos**	NirmanShastra assumption
Cowl, 110 mm	one per soil stack	1	**1 nos**	NirmanShastra assumption
Cowl, 75 mm	one per waste stack	1	**1 nos**	NirmanShastra assumption
Terrace outlet with grating, 75 mm	one per down-pipe	4	**4 nos**	NirmanShastra assumption
Bend, 75 mm (down-pipe)	two per down-pipe	4 × 2	**8 nos**	NirmanShastra assumption
Shoe, 75 mm (down-pipe foot)	one per down-pipe	4	**4 nos**	NirmanShastra assumption
Inspection chamber with cover (0.8 × 0.8 m, up to 1 m deep)	chambers counted in 7.3	3	**3 nos**	IS 1742:1983; IS 4111 (Part 1):1986 (chambers)
Pipe clamps on stacks and down-pipes	n = ceil(stacks × H ÷ spacing + down-pipe length ÷ spacing)	ceil((1 + 1 + 0) × 8.5 ÷ 1.5 + 26.0 ÷ 1.5)	**29 nos**	NirmanShastra assumption

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Stack junctions: the three branch-junction lines above, added These junctions are already part of the items counted in the table; the report repeats their sum in the note under the table, so they are not an extra item.	Σ of the three branch-junction lines	3 + 3 + 2	**8**	

Chambers are counted, not built: bricks, mortar and covers are in MasonryPro and the structure.

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12. The buy list

12.1 The buy list

Each line of the buy list is a figure already found above: pipe to buy from sections 6 and 10, tanks from section 3, the pump from section 5, and the counts from sections 1, 7 and 11. The Grand Total adds these lines across the trades by their key.

ITEM	QUANTITY	UNIT	FOUND IN
CPVC pipe 15 mm	90	m	Section 6.5
CPVC pipe 20 mm	24	m	Section 6.5
CPVC pipe 25 mm	48	m	Section 6.5
CPVC pipe 32 mm	15	m	Section 6.5
uPVC SWR pipe 40 mm	6	m	Section 10.2
uPVC SWR pipe 50 mm	24	m	Section 10.2
uPVC SWR pipe 75 mm	45	m	Section 10.2
uPVC SWR pipe 110 mm	39	m	Section 10.2
Underground tank	1,000	L	Section 3.2
Overhead tank	500	L	Section 3.2
Transfer pump 0.5 HP	1	nos	Section 5
Water closets	3	nos	Section 1.5
Wash basins	4	nos	Section 1.5
Inspection chambers	3	nos	Section 7.3

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13. Uncertainty bands

The ranges printed under the totals in the report are the figure times a low and a high multiplier. They are the model's own judgement, not a statistical result.

13.1 How far off the figures can be

STEP	FORMULA	WORKING	RESULT	SOURCE
Water supply pipe: low end of the range	low = figure × low multiplier	177 × 0.75	**132.8 m**	NirmanShastra assumption
Water supply pipe: high end of the range	high = figure × high multiplier	177 × 1.35	**239 m**	NirmanShastra assumption
Drain and rain pipe: low end of the range	low = figure × low multiplier	114 × 0.8	**91.2 m**	NirmanShastra assumption
Drain and rain pipe: high end of the range	high = figure × high multiplier	114 × 1.3	**148.2 m**	NirmanShastra assumption
Tanks: low end of the range	low = figure × low multiplier	1,500 × 0.9	**1,350 L**	NirmanShastra assumption
Tanks: high end of the range	high = figure × high multiplier	1,500 × 1.2	**1,800 L**	NirmanShastra assumption

FIGURE	LOW MULTIPLIER	HIGH MULTIPLIER	WHY IT IS WIDE
Water supply pipe	0.75	1.35	Lengths follow planning rules for the size of each home, not a drawing.
Drain and rain pipe	0.80	1.30	Stack and branch lengths and the run to the plot edge are planning lengths.
Fittings and valves	0.70	1.40	Counts per outlet are planning rules; a plumber's layout can differ.
Tanks and pump	0.90	1.20	Tank sizes are rounded to sizes sold; the pump depends on the actual layout and maker.

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Reconciliation: the report against this sheet

The totals printed in the report, rebuilt from the working above. Every row must read the same on both sides. This shows that the report and this sheet agree with each other, which is a check of the arithmetic; it does not show that either one is right against a standard or against your site.

ITEM	IN THE REPORT	FROM THIS SHEET	MATCH
Homes	1	1	Yes
People counted	6	6	Yes
Bathrooms and WCs	3	3	Yes
Water used a day	810 L	810 L	Yes
Underground tank: size	1,000 L	1,000 L	Yes
Underground tank: number	1	1	Yes
Underground tank: litres needed	540 L	540 L	Yes
Overhead tank: size	500 L	500 L	Yes
Overhead tank: number	1	1	Yes
Overhead tank: litres needed	270 L	270 L	Yes
Tanks, total capacity (headline figure)	1,500 L	1,500 L	Yes
Pump: size	0.50 HP	0.50 HP	Yes
Pump: number	1	1	Yes
Pump: flow	17 L/min	17 L/min	Yes
Pump: head	14.0 m	14.0 m	Yes
Transfer pump, size (headline figure)	0.50 HP	0.50 HP	Yes
Transfer pump, number (headline figure)	1	1	Yes
Supply pipe: run, all sizes	161.6 m	161.6 m	Yes
Supply pipe: with cutting waste	169.6 m	169.6 m	Yes
Supply pipe: 3 m lengths	59	59	Yes
Supply pipe: to buy	177 m	177 m	Yes
Water supply pipe to buy (headline figure)	177 m	177 m	Yes
Soil stacks	1	1	Yes
Drain load: fixture units on the building drain	29 units	29 units	Yes
Drain load: one soil stack, one floor	14 units	14 units	Yes
Drain load: one soil stack, in all	21 units	21 units	Yes
Sewer connection: pipe size	110 mm	110 mm	Yes
Sewer connection: length	6 m	6 m	Yes
Down-pipes: number	4	4	Yes
Down-pipes: size	75 mm	75 mm	Yes
Down-pipes: length of each	6.5 m	6.5 m	Yes
Down-pipes: roof area	93 m²	93 m²	Yes
Down-pipes: rain in the heaviest hour	75 mm	75 mm	Yes
Down-pipes: size of design pipe	75 mm	75 mm	Yes

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Down-pipes: area one pipe drains	27.0 m²	27.0 m²	Yes
Rain-water down-pipes (summary line)	4	4	Yes
Drain and rain pipe: run, all sizes	103.8 m	103.8 m	Yes
Drain and rain pipe: with cutting waste	109.0 m	109.0 m	Yes
Drain and rain pipe: 3 m lengths	38	38	Yes
Drain and rain pipe: to buy	114 m	114 m	Yes
Drain and rain pipe to buy (headline figure)	114 m	114 m	Yes
Supply pipe clamps	32	32	Yes
Supply fittings and valves: items in all	106	106	Yes
Drainage pipe clamps	29	29	Yes
Drainage fittings: items in all	49	49	Yes
Fixtures and taps: items in all	28	28	Yes
Buy list: CPVC pipe 15 mm	90 m	90 m	Yes
Buy list: CPVC pipe 20 mm	24 m	24 m	Yes
Buy list: CPVC pipe 25 mm	48 m	48 m	Yes
Buy list: CPVC pipe 32 mm	15 m	15 m	Yes
Buy list: uPVC SWR pipe 40 mm	6 m	6 m	Yes
Buy list: uPVC SWR pipe 50 mm	24 m	24 m	Yes
Buy list: uPVC SWR pipe 75 mm	45 m	45 m	Yes
Buy list: uPVC SWR pipe 110 mm	39 m	39 m	Yes
Buy list: Underground tank	1,000 L	1,000 L	Yes
Buy list: Overhead tank	500 L	500 L	Yes
Buy list: Transfer pump 0.5 HP	1 nos	1 nos	Yes
Buy list: Water closets	3 nos	3 nos	Yes
Buy list: Wash basins	4 nos	4 nos	Yes
Buy list: Inspection chambers	3 nos	3 nos	Yes
Water supply pipe: range in the report, low end	133 m	133 m	Yes
Water supply pipe: range in the report, high end	239 m	239 m	Yes
Drain and rain pipe: range in the report, low end	91 m	91 m	Yes
Drain and rain pipe: range in the report, high end	148 m	148 m	Yes
Tanks: range in the report, low end	1,350 L	1,350 L	Yes
Tanks: range in the report, high end	1,800 L	1,800 L	Yes

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Standards and references used in this sheet

DOCUMENT	TITLE	USED FOR
IS 1172:1993	Code of Basic Requirements for Water Supply, Drainage and Sanitation	Litres per person per day (cl 4.1 and its Note). Table 1 of the standard is for buildings other than residences and is not used. The 135 L used is the lower of the figures the sources give; see the limits.
NBC 2016 Part 9, Sections 1 and 2	Plumbing Services, read from the BIS preliminary drafts of November 2024	People per home, split of stored water (cl 4.4.10), fixture units (Table 2), simultaneous flow (Table 3) and the 2.4 m/s velocity limit (cl 4.8.6). Draft text, not the published code. The 2 m/s for the delivery pipe, the peak factor of 1.5 and the standby pump are not from the draft; they are NirmanShastra assumptions.

IS 12183 (Part 1):1987	Code of Practice for Plumbing in Multistoreyed Buildings: Water Supply	Named in the notes to the NBC draft storage clause. No figure on this sheet is taken from it directly. Clause numbers as given in the tool's research notes; not re-read against the published text.
IS 2065:1983	Code of Practice for Water Supply in Buildings	Named in the notes to the NBC draft storage clause. No figure on this sheet is taken from it directly. Clause numbers as given in the tool's research notes; not re-read against the published text.
SP 35:1987	Handbook on Water Supply and Drainage	The Hazen-Williams friction formula (eq. 1) for the delivery pipe, with C = 120 for plastic pipe. Clause numbers as given in the tool's research notes; not re-read against the published text.
IS 15778:2007	CPVC Pipes for Potable Hot and Cold Water Distribution: Specification	Bore of CPVC pipe by size, and the lengths pipe is sold in.
IS 1742:1983	Code of Practice for Building Drainage	Drainage fixture units (Table 1), limits on stacks and drains (Tables 3 and 4), rain-water pipes (Table 5, cl 4.10.3.8), inspection chambers. Clause numbers as given in the tool's research notes; not re-read against the published text.
IS 5329:1983	Code of Practice for Sanitary Pipe Work above Ground for Buildings	Named for a single soil stack without a vent up to five storeys (cl 6.1.1) and a stack that runs above the roof (cl 6.8.4). The count of one stack for every two WCs on a floor is not from this standard. Clause numbers as given in the tool's research notes; not re-read against the published text.
IS 2470 (Part 1):1985	Code of Practice for Installation of Septic Tanks: Design Criteria and Construction	Tank dimensions for the people served (Appendix A, Tables 5 and 6), least capacity and width (cl 3.4.5.1), length to width, free board (cl 3.4.8). The standard prints dimensions, not volumes: the volumes are the model's own length × width × depth.
IS 2470 (Part 2):1985	Code of Practice for Installation of Septic Tanks: Secondary Treatment and Disposal of Effluent	Rate of application of effluent to the ground for the soak pit (Table 2: 118, 52 and 33 L/m²/day for water falling 25 mm in 3, 15 and 45 minutes); ground that is too slow.
IS 4111 (Part 1):1986	Code of Practice for Ancillary Structures in Sewerage System: Manholes	Named for inspection chambers. Clause numbers as given in the tool's research notes; not re-read against the published text.

This sheet shows the method and the arithmetic behind a planning-level quantity estimate. It lets a qualified person check the formulas and the working. It is not a structural design, a drawing or a certificate, and it does not replace the drawings and calculations that a licensed professional signs for your building.

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