



Lecture : Introduction to building services I - Plumbing & Drainage Services

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Thei

Cheung's Old web site: <http://www.ad.arch.hku.hk/~kpcheung/index.html>

Web site jointly developed with *Dr Hui : <http://www.ad.arch.hku.hk/research/BEER/>

Plumbing & Drainage Services

Priority :

Safety [structural, fire, accident prevention] ,

Health : Good hygiene of water supply, soil and waste drainage, rain water drainage [good indoor air quality- good IAQ, little Electromagnetic effect, reasonable daylight, greening,],

Comfort [Reasonable comfort : temperature, humidity, noise versus quietness] ,

Sustainable building & Sustainable world [Energy saving, Energy efficient, Low carbon building]

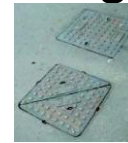
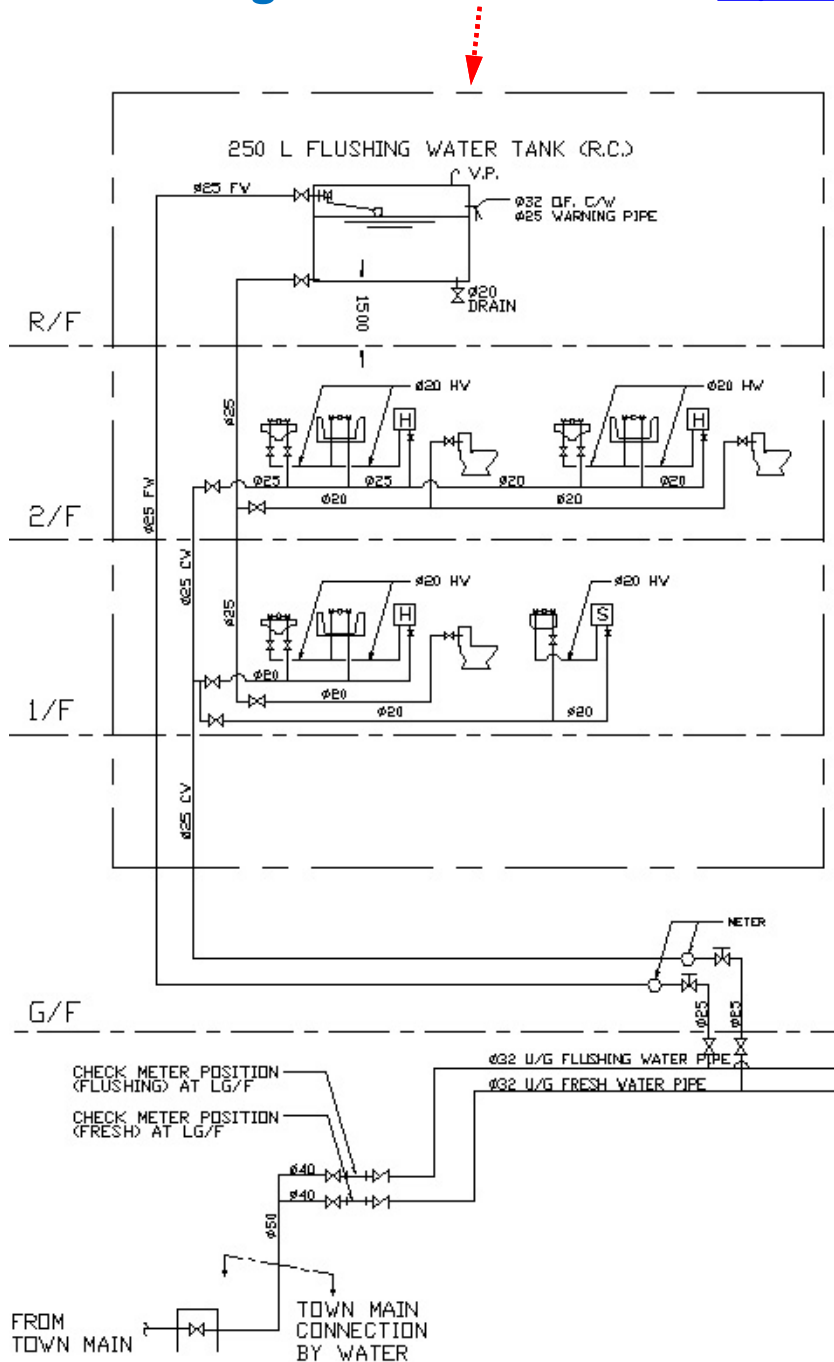
Types of Plumbing Systems SEE http://arch.hku.hk/teaching/envctrl/KPC_pub/PlumbDr1/index.htm

Plumbing Services of a house <http://arch.hku.hk/teaching/project/f-pl.htm> [5 diagrams of symbols, layout]

SEE Drainage Services of a house

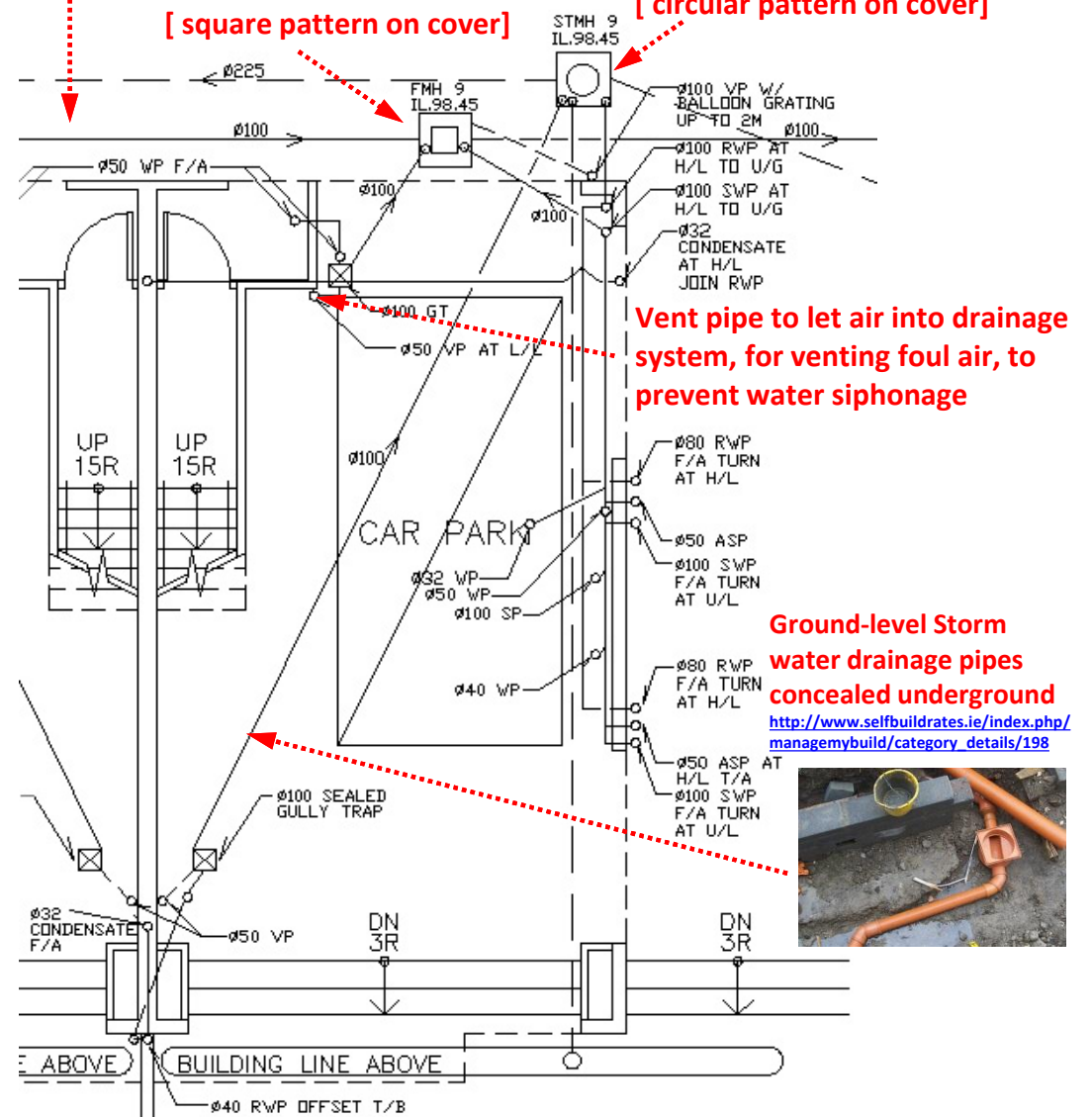
[35 diagrams of symbols, layout]

<http://arch.hku.hk/teaching/project/f-pl.htm>



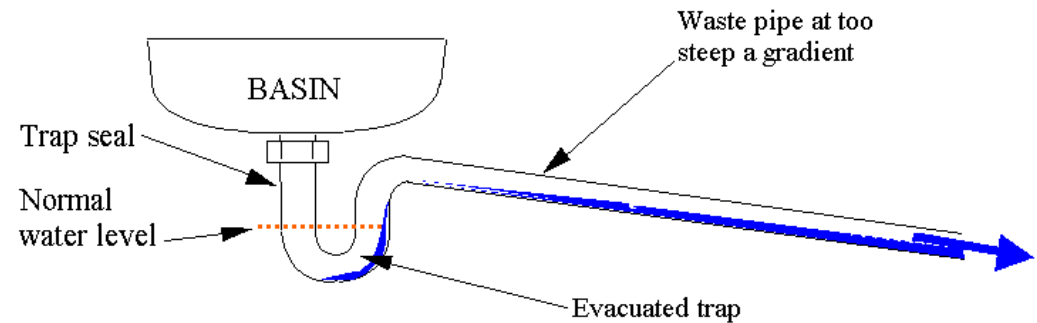
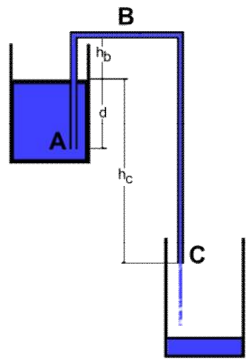
Soil & waste water manhole
 [square pattern on cover]

Storm water (rain water) manhole
 [circular pattern on cover]



Water Siphonage shall not occur in drainage systems, to allow water seal traps to be maintained always. Water seal traps will stop foul air of drainage to go into rooms.

Vent pipes connected to various parts of drainage systems will allow internal space inside drainage systems to be connected to atmospheric pressure, to prevent water siphonage to occur.



Example of Basin waste where self-syphonage may occur

Image : courtesy of http://www.arca53.dsl.pipex.com/index_files/drain4.htm

The Siphon – <http://en.wikipedia.org/wiki/Siphon>

Video <http://www.youtube.com/watch?v=CZmP0vsRBZ8>

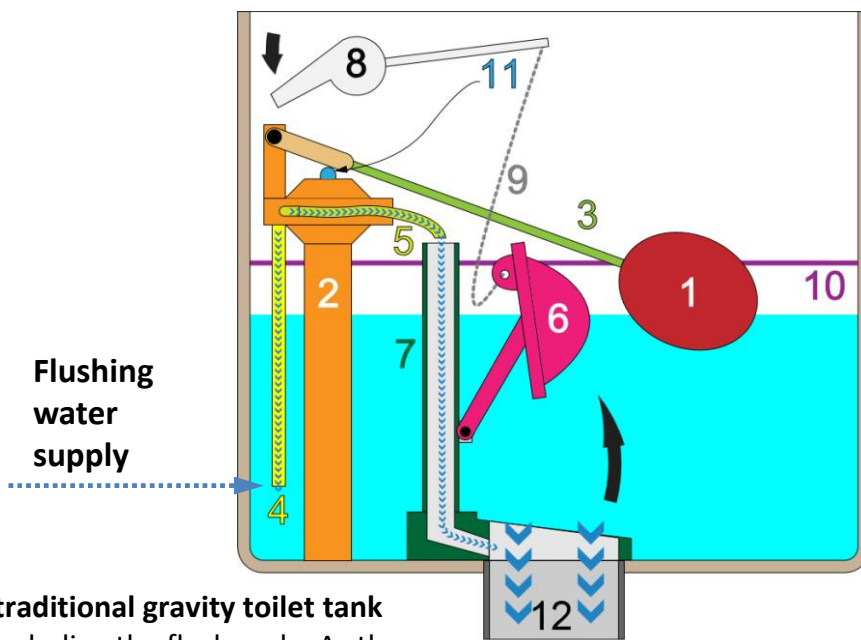
Induced Siphonage in a drainage system

Video : <http://www.youtube.com/watch?v=alp3dEXOwJI>

What is back-siphonage and how is it caused?

Video <http://www.youtube.com/watch?v=RPzhxc80qQ4>

Soil and Waste Drainage



A traditional gravity toilet tank concluding the flush cycle. As the water level in the tank drops, the flush valve flapper falls back to the bottom, stopping the main flow to the flush tube. Because the tank water level has yet to reach the fill line, water continues to flow from the tank and bowl fill tubes. When the water again reaches the fill line, the float will release the fill valve shaft and water flow will stop.

- 1. float, 2. fill valve, 3. lift arm, 4. tank fill tube, 5. bowl fill tube, 6. flush valve flapper, 7. overflow tube, 8. flush handle, 9. chain, 10. fill line, 11. fill valve shaft, 12. flush tube

Water Seal Trap
[always to be present – to prevent foul air to come out into the toilet]

Figure 1

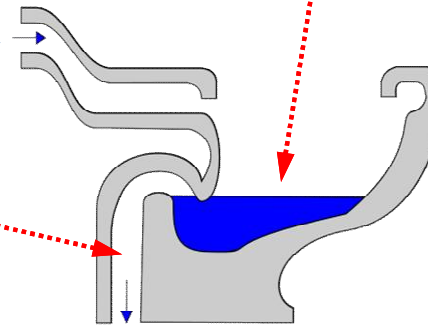
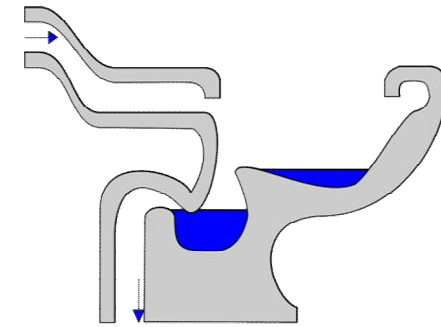
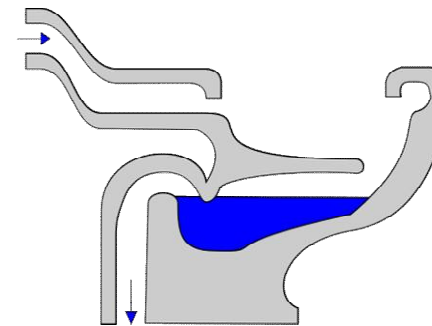


Figure 2



Connection to soil and waste drainage pipe

Figure 3



Soil and Waste Drainage : Three styles of toilet.

Figure 1. The Washdown style.

Figure 2. The Wash-out style.

Figure 3. The Reverse Bowl or Shelf Style.

Source : http://en.wikipedia.org/wiki/Flush_toilet

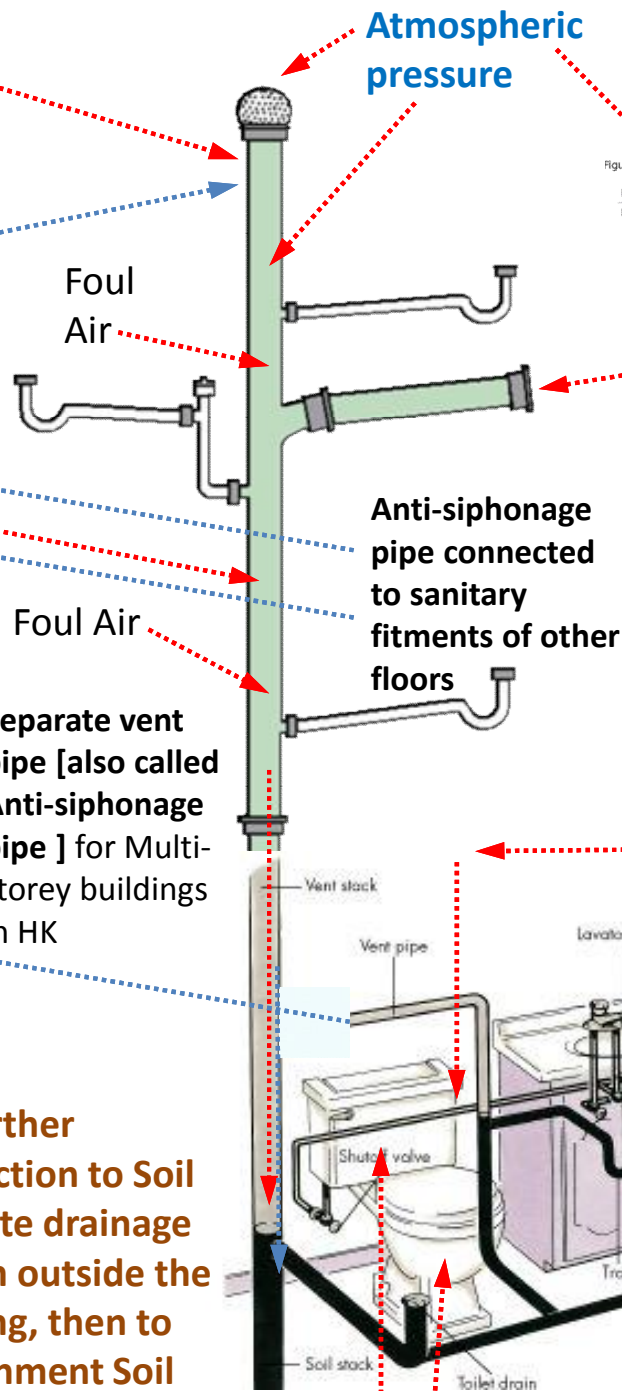
Detail of **soil stack**, which is connected to the sewer and vented at the top.

Vents release sewer gases outside. Vents provide a way to equalize the pressure on both sides of a trap, thereby allowing the trap to hold water, to prevent emptying the bold water due to water siphonage effect during flushing, needed to maintain effectiveness of the trap. Every fixture [i.e. toilet, basin, bath tub] is required to have an internal or external **trap**.

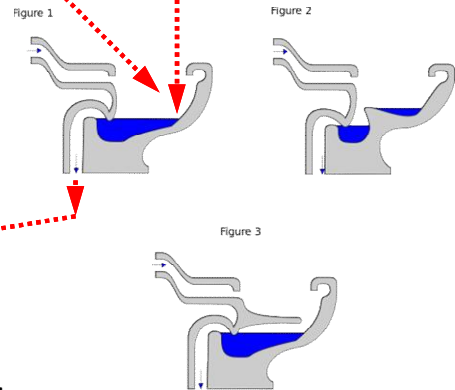
http://en.wikipedia.org/wiki/Drain-waste-vent_system

For further connection to Soil & Waste drainage system outside the building, then to Government Soil & Waste mains.

cistern [water closet]



Water Seal Trap
[always to be present – to prevent foul air to come out via the toilet into the room]



Soil and Waste Drainage

Flushing water supply system in HK shall be designed and installed to allow sea water to be used for flushing, though fresh water is used in some part of the city for flushing.

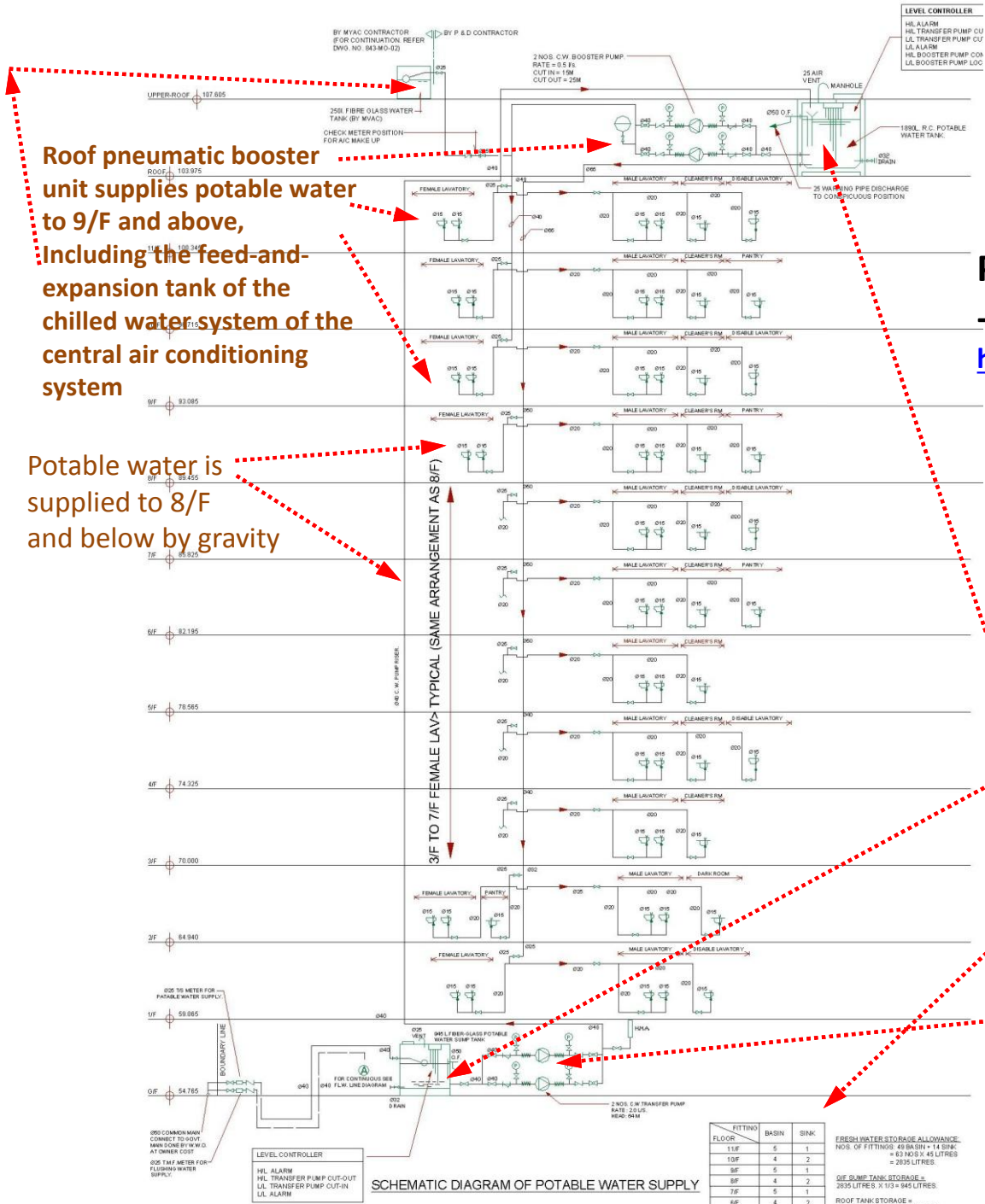
Soil and Waste Drainage : Three styles of toilet.
Figure 1. The Washdown style.
Figure 2. The Wash-out style.
Figure 3. The Reverse Bowl or Shelf Style.

Source : http://en.wikipedia.org/wiki/Flush_toilet

In HK, Flushing water supply system , and potable water supply system [i.e. for shower , cooking] are SEPARATE systems. Cold water supply and hot water supply are system types within the potable water system.

Bath tub [shower tub]
<http://en.wikipedia.org/wiki/Bathtub>
<http://en.wikipedia.org/wiki/Shower>

For details, see <http://home.howstuffworks.com/home-improvement/plumbing/plumbing-basics-ga.htm>



Roof pneumatic booster unit supplies potable water to 9/F and above, including the feed-and-expansion tank of the chilled water system of the central air conditioning system

Potable water is supplied to 8/F and below by gravity

Potable water supply system, i.e. for shower, drinking -Tsui Tsin Tong Building, HKU
<http://arch.hku.hk/teaching/intgtech/image/122a.jpg>

Total water tank volume =
 no. of fittings x 45 litre per fitting = 2835 litre :
 2/3 volume stored at roof tank; 1/3 volume stored at G/F sump tank;

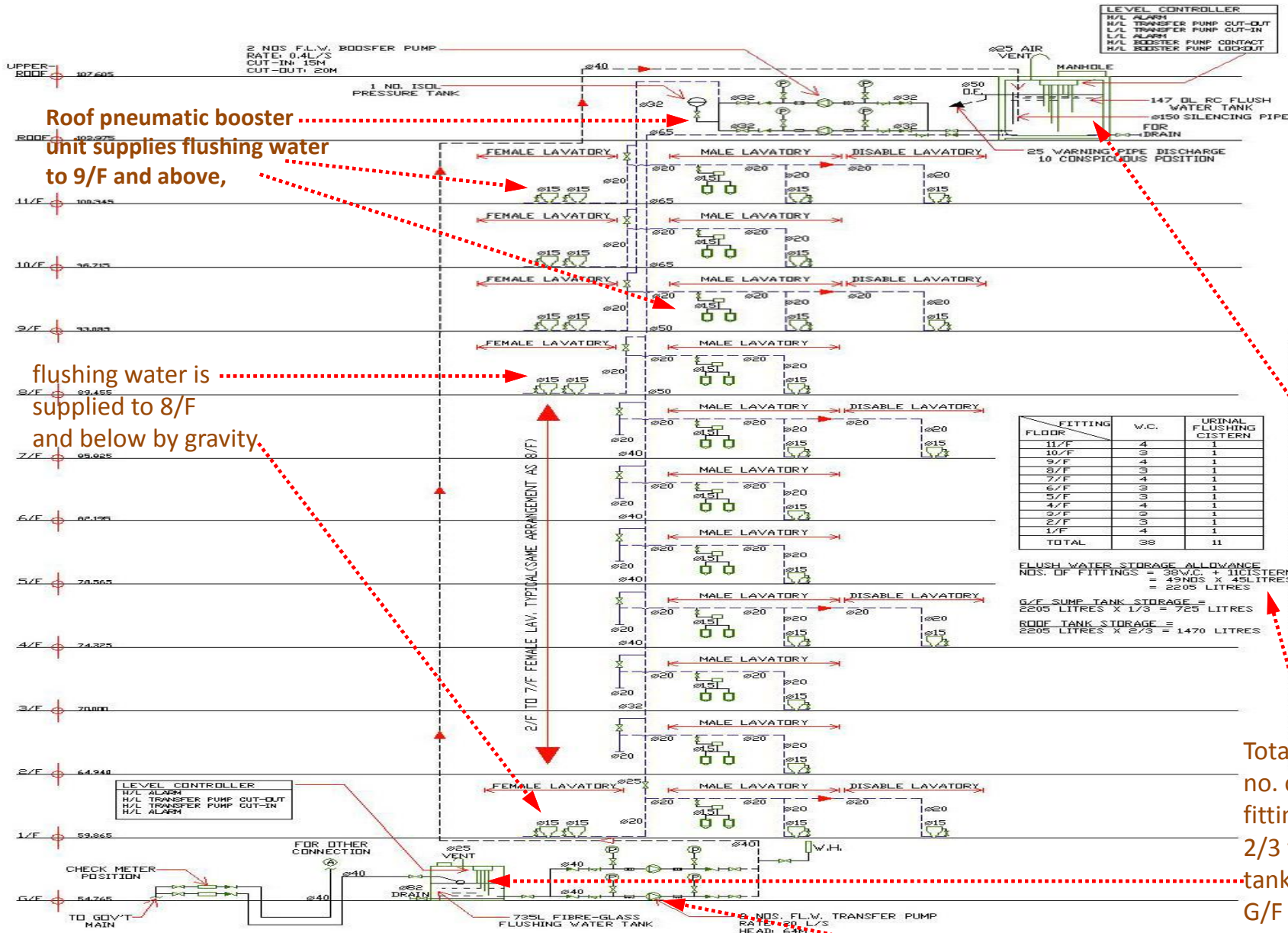
Potable water Transfer pumps to feed water to roof tank [one duty pump, one standby pump]

SCHEMATIC DIAGRAM OF POTABLE WATER SUPPLY

FLOOR	BASIN	SINK
11F	5	1
10F	4	2
9F	5	1
8F	4	2
7F	5	1
6F	4	2
5F	4	1
4F	5	1
3F	4	1
2F	4	2
1F	5	0
TOTAL	49	14

FRESH WATER STORAGE ALLOWANCE:
 NOS. OF FITTINGS: 49 BASIN + 14 SINK = 63 NOS. X 45 LITRES = 2835 LITRES.
 G/F SUMP TANK STORAGE = 2835 LITRES. X 1/3 = 945 LITRES.
 ROOF TANK STORAGE = 2835 LITRES. X 2/3 = 1890 LITRES.

FLUSHING WATER SUPPLY SYSTEM SCHEMATIC DIAGRAM



Roof pneumatic booster unit supplies flushing water to 9/F and above,

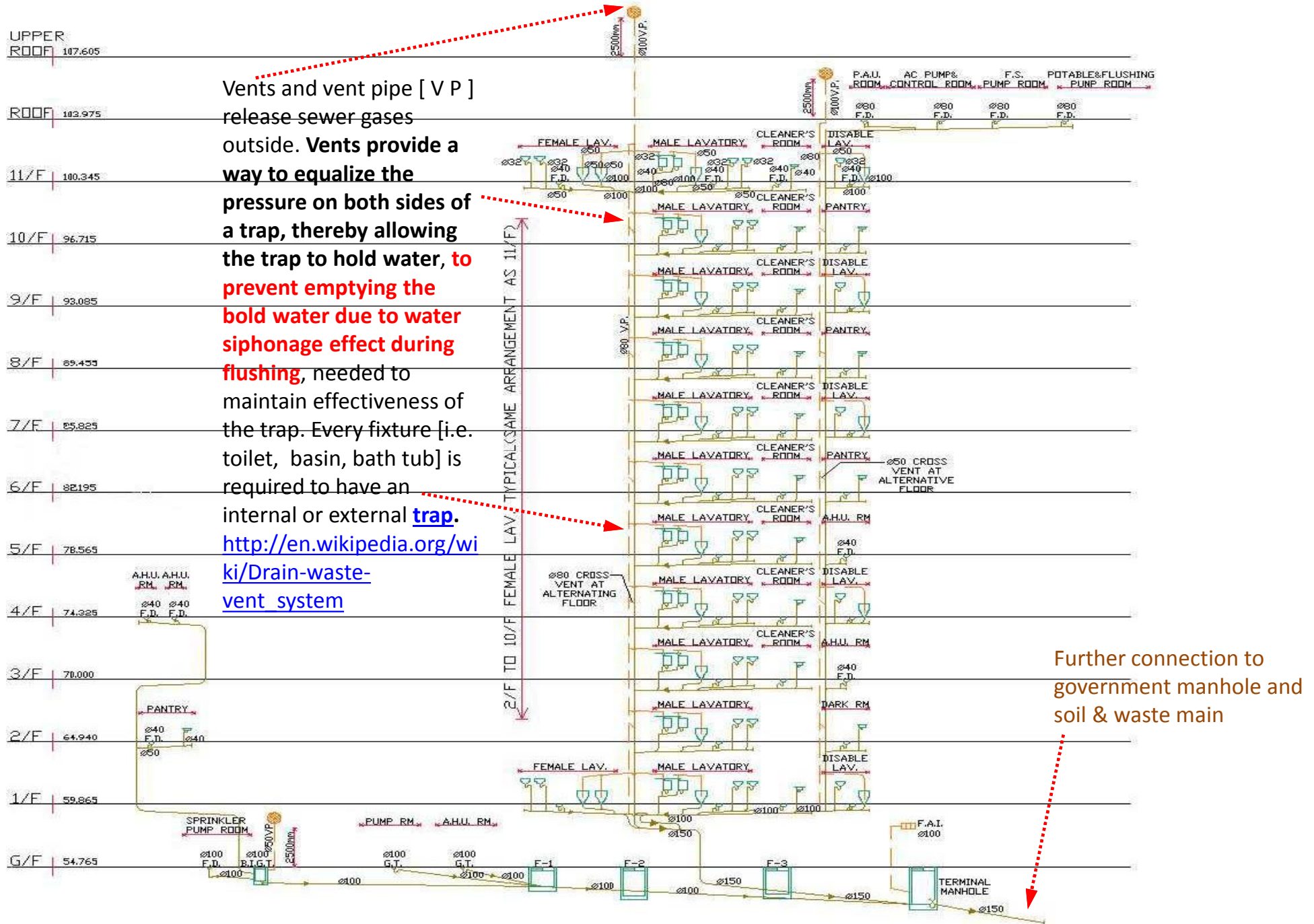
flushing water is supplied to 8/F and below by gravity.

Total water tank volume = no. of fittings x 45 litre per fitting = 2835 litre :
2/3 volume stored at roof tank; 1/3 volume stored at G/F sump tank;

Flushing water supply system -Tsui Tsin Tong Building, HKU
<http://arch.hku.hk/teaching/intgtech/123.htm>

Flushing water Transfer pumps to feed water to roof tank [one duty pump, one standby pump]

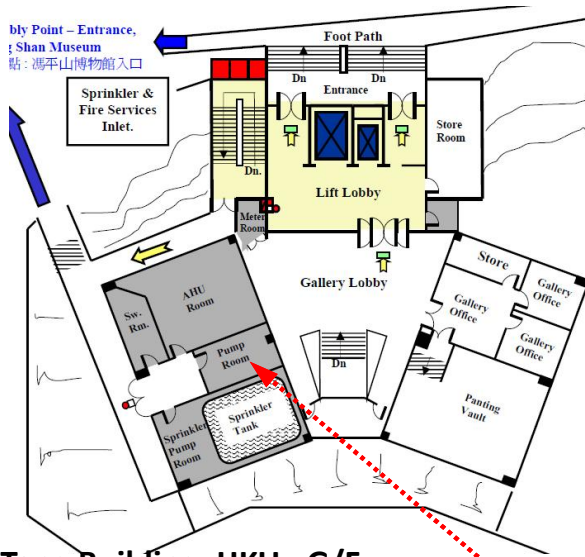
SOIL AND WASTE DRAINAGE SYSTEM SCHEMATIC DIAGRAM



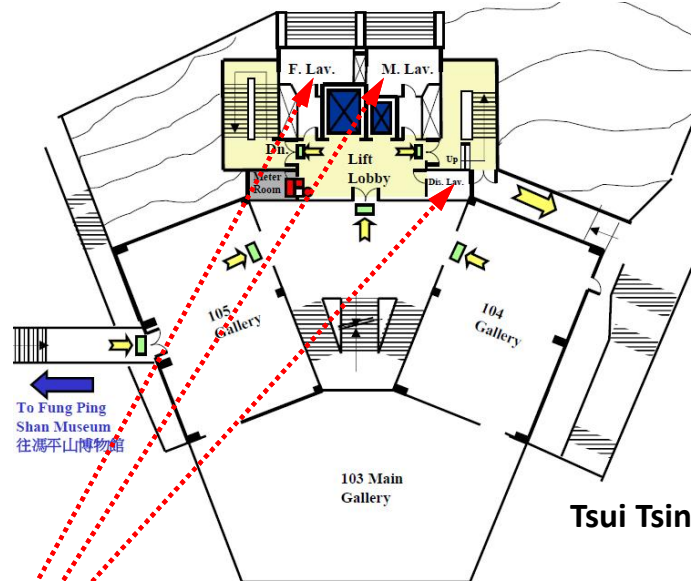
Vents and vent pipe [V P] release sewer gases outside. Vents provide a way to equalize the pressure on both sides of a trap, thereby allowing the trap to hold water, to prevent emptying the trap due to water siphonage effect during flushing, needed to maintain effectiveness of the trap. Every fixture [i.e. toilet, basin, bath tub] is required to have an internal or external trap. http://en.wikipedia.org/wiki/Drain-waste-vent_system

Further connection to government manhole and soil & waste main

Soil and Waste Drainage System -Tsui Tsin Tong Building, HKU <http://arch.hku.hk/teaching/intgtech/124.htm>



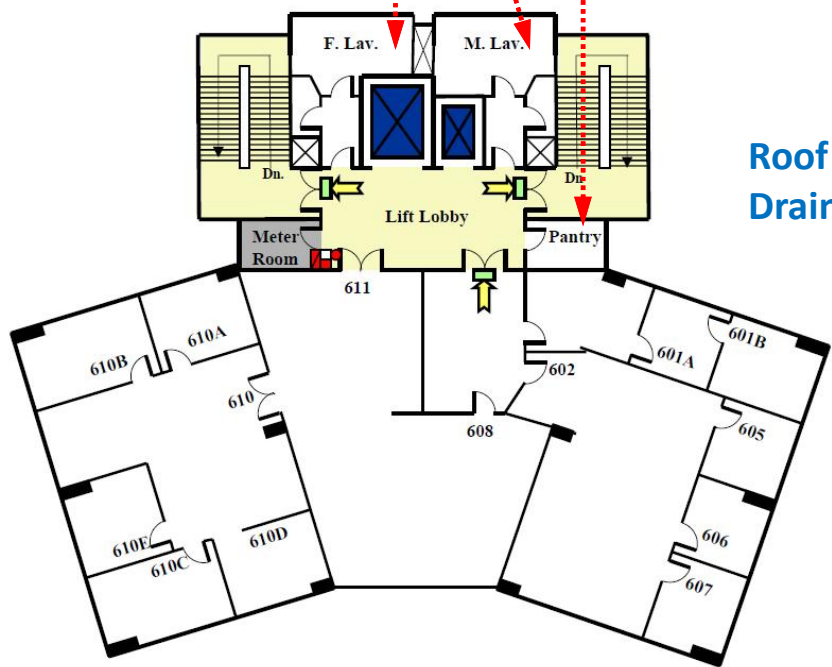
Tsui Tsin Tong Building, HKU : G/F



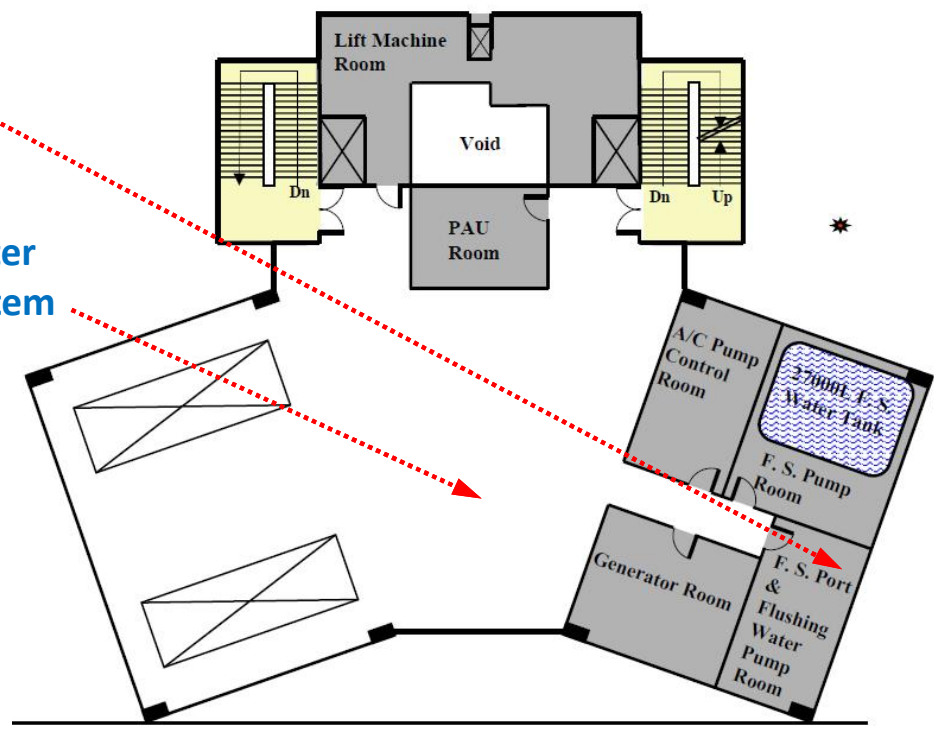
Tsui Tsin Tong Building, HKU : 1/F

Plumbing & Drainage Services

Roof Rainwater Drainage System



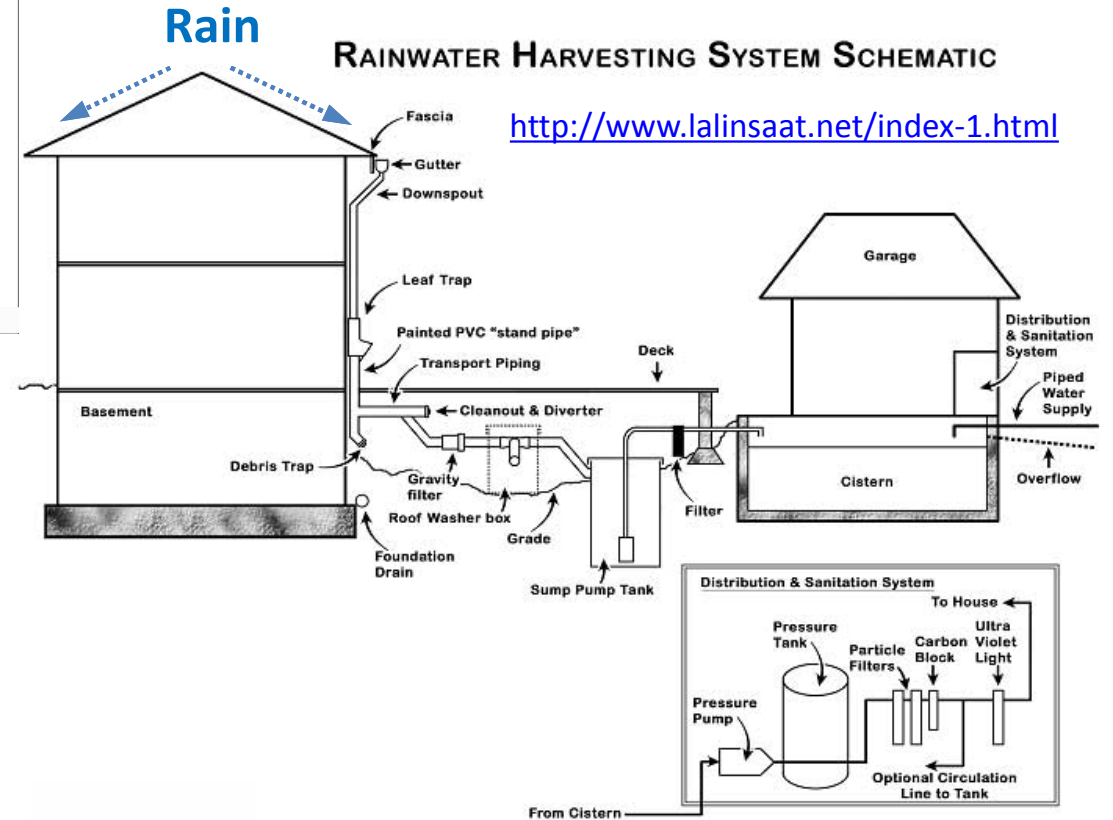
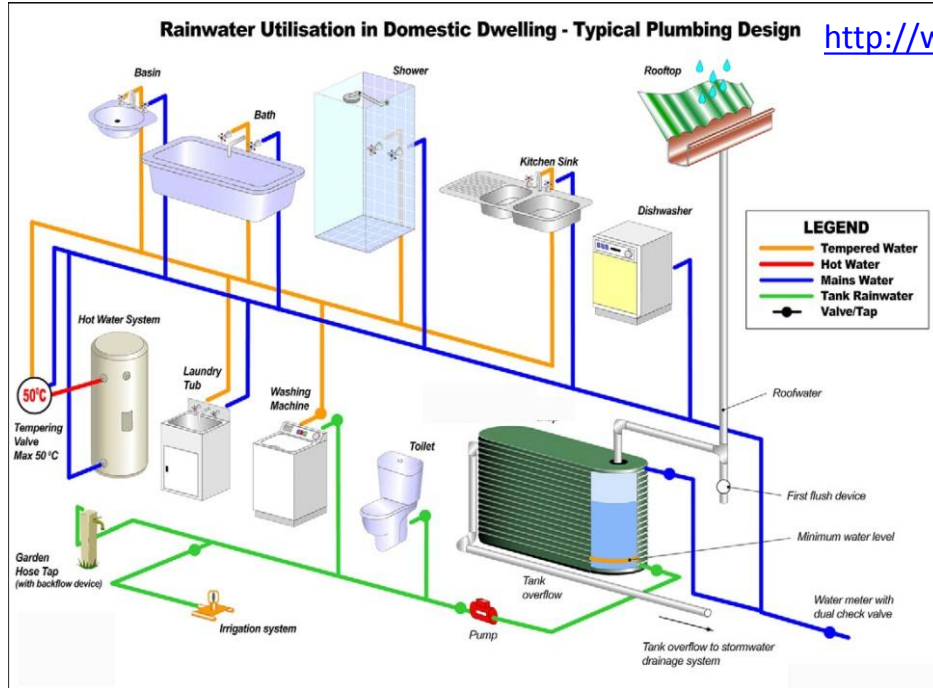
Tsui Tsin Tong Building, HKU : 6/F



Tsui Tsin Tong Building, HKU : Roof

A Rainwater Drainage System

Video <http://www.youtube.com/watch?v=Zgz33tfSu8M>

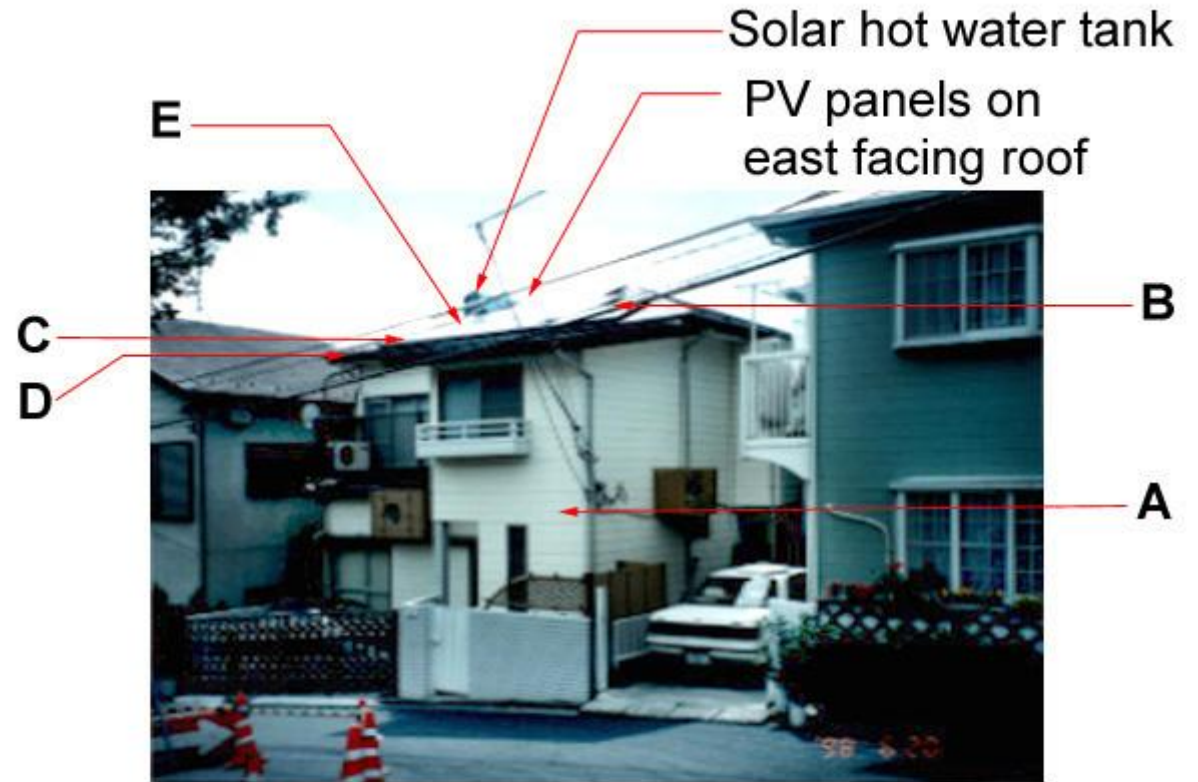


A Solar House near Yokohama in Japan

Mr. Tani installed **a solar hot water system** in 1993 on the south-facing roof of his house at 0.8M yen. The water tank holds 200 litres of hot water. The water tank looks like a small box on the roof. He also installed **a solar Photo Voltaic System**. <http://arch.hku.hk/teaching/envctrl/project122/p122.html>



Looking at the house from the South-West side



Looking at the house from the North-East side
(The solar photovoltaic panels are installed on the West and East facing parts of the roof. The solar hot water panels are connected to the 200 litre waer storage tank - the small box on the South-facing part of the roof.)

A Solar hot water system of a swimming pool complex in HK
<http://arch.hku.hk/teaching/cases/shingmun/shingmun.html>



Solar hot water panels



Solar hot water pumps and water filtration plant room [at basement] of the swimming pool



Integrated Sustainable Approach

- Water tanks and pump rooms for plumbing services, and drainage sumps and sometimes drainage pumps, [e.g. in basement] to be provided inside buildings
- Drainage seal traps to be maintained to contain water, to prevent foul air in drainage systems to go inside buildings
- Water efficient and energy efficient pumps and equipment are to be used
- Grey water [i.e. from wash-hand basins, bath and shower tubs to be collected separately, treated and reused for flushing, for watering plants, to increasing green for buildings and their environment
- Collection of rainwater for use in buildings, as far as possible
- Optimized overall planning with other building services, and FUNCTIONS of the buildings to be carried out to attain **Integrated Sustainability**

Case study on overall *Building Services Integration*

- **Tsui Tsin Tong Building, HKU:** Building No.13 in [HKU main campus map](#)
- Case Study <http://www.ad.arch.hku.hk/teaching/cases/ttsui/ttsui.htm>
- [Integrated technology study by BA\(AS\)-3 students 95/96 \[HKU\] :](#)
<http://www.ad.arch.hku.hk/teaching/intgtech/>
- Floor Layout and evacuation plans for **Tsui Tsin Tong Building, HKU :**
<http://www.safety.hku.hk/homepage/pdf/FPTTT.pdf> ;

Basic Reading :

1. PIPED SERVICES http://arch.hku.hk/teaching/envctrl/KPC_pub/piped.html
- 2.Plumbing services of a house <http://arch.hku.hk/teaching/project/f-pl.htm>
- 3.Drainage services of a house <http://arch.hku.hk/teaching/project/f-pl.htm>
4. HKSAR Law Chapter 123 Section I - BUILDING (STANDARDS OF SANITARY FITMENTS, PLUMBING, DRAINAGE WORKS AND LATRINES) REGULATIONS
http://www.legislation.gov.hk/blis_pdf.nsf/6799165D2FEE3FA94825755E0033E532/182338FA79710018482575EE003F2DBE?OpenDocument&bt=0
5. Tsui Tsin Tong Building, HKU- Case study <http://arch.hku.hk/teaching/intgtech/> ;
6. Tsui Tsin Tong Building, HKU - Evacuation plans with building services plant rooms
<http://www.safety.hku.hk/homepage/pdf/FPTTT.pdf> ;
7. Smith, David Lee, *“Environmental Issues for Architecture”*, Chapter 12 & 13. Hoboken, N.J. : Wiley, c2011. HKU Lib. Call # [720.47 S645](#)
8. Reid, Esmond, *“Understanding Buildings”*, London : Construction Press, 1984. HKU Lib. Call # [690 R35](#)

Further reference :

Drainage http://www.arca53.dsl.pipex.com/index_files/drain1.htm

Standard Drawings of DSD HK Government http://www.dsd.gov.hk/EN/Technical_Manuals/Standard_Drawings/

SEWAGE TREATMENT AND DISPOSAL <http://arch.hku.hk/~kpcheung/sewtreat.htm>

All buildings of HKU - Evacuation plans with building services plant rooms
http://www.safety.hku.hk/homepage/manual_Floorplan.html

***** Thank you very much *****