

# Rainwater Harvesting Systems

*Components  
Process (design)  
Research*

**Ken Nentwig**

BLA MLA CLM CLD  
ARCSA-AP and Trainer

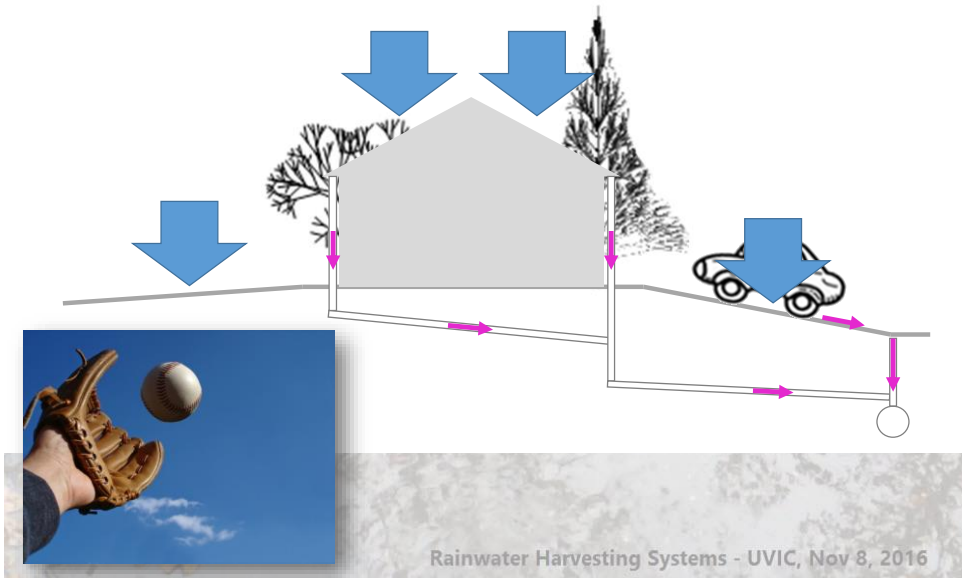
Rainwater Harvesting Systems - UVIC, Nov 8, 2016

## **RAINWATER HARVESTING SYSTEMS of good quality and suitability:**

- ARE NOT OFF-THE-SHELF PRE-PACKAGED
- ARE NOT THE SAME FOR NEAR-IDENTICAL SITES
- ARE NOT ROCKET SCIENCE, BUT REQUIRE CAREFUL CONSIDERATIONS and CALCULATIONS
- ARE NOT ALWAYS THE BEST SOLUTION to water-related problems
- MAY NOT RESEMBLE ANYTHING YOU WILL SEE IN THIS PRESENTATION
- **WEB-BASED INFO CAN BE GOOD or BAD, no guarantees**

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# WHAT CATCHMENT AREA



# WHAT CATCHMENT AREA



## WHAT CATCHMENT AREA



**PERMEABLE PAVEMENTS**

**RAINGARDENS**

**GRASSED SWALES**

**SURFACE RUNOFF – BERMS and SWALES**

**ROADS and PARKING**

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## WHAT CATCHMENT AREA

### QUALITY

Rainwater pH = normally 5.5 to 6.5, slightly acidic

Absorbs/carries chemicals and substances, needs treatment

Different surfaces have various components

- Asphalt = ~80% carbon, ~10% hydrogen  
~5% oxygen, + nitrogen + sulphur
- Shingles = granules containing copper (algicide – western)
- Cedar shakes = fire retardants
- Roads/Parking = heavy metals (vehicle emissions, oil and gas, etc)
- Metal = if coated with NSF protocol 151 potable-grade paint

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WHAT	CATCHMENT AREA
QUALITY	
<p><b>Leaves/needles and plant parts (twigs, bark, flowers, moss)</b></p> <ul style="list-style-type: none"> <li>- “compost (gutter) tea”</li> <li>- organic, affect colour, taste, odour</li> <li>- fruit/nuts, pollen</li> <li>- some parts can be poisonous</li> </ul>	
<p><b>Animal feces (birds, squirrels, racoons, rats, etc)</b></p>	
<p><b>Dust and particulate matter (construction, industry)</b></p>	
<p><b>Ambient chemicals (agriculture, landscape, cleaning)</b></p>	
<p style="text-align: right;">Rainwater Harvesting Systems - UVIC, Nov 8, 2016</p>	

WHAT	CATCHMENT AREA
<p><b>Asphalt (Bitumen)</b></p>	
<p>...elemental analyses indicate that most asphalts contain 79–88 weight per cent (wt%) <b>carbon</b>, 7–13 wt% <b>hydrogen</b>, traces to 8 wt% <b>sulfur</b>, 2– 8 wt% <b>oxygen</b>, and traces to 3 wt% <b>nitrogen</b>.</p>	
<p>Limited data are available on the concentration of asphalt in environmental media. Characterization of concentrations of asphalt fractions in air samples and plant samples collected at various distances from a highway indicated that these concentrations were <math>&lt;4 \times 10^{-3}</math> mg/m<sup>3</sup> and <math>&lt;4</math> mg/g dry plant material, respectively. An assessment of the effects of runoff from asphalt pavement on streams in California, USA, indicated that concentrations of all polycyclic aromatic hydrocarbon (PAH) analytes in all stream and road runoff samples were below the detection limit of 0.5 µg/litre. Although detectable levels of heavy metals were present in stream and runoff water, the authors concluded that no significant upstream versus downstream differences existed in the concentration of any heavy metal across all streams. <b>Metal concentrations were elevated in runoff water from road surfaces</b> relative to upstream samples. These elevated concentrations could be due to sources other than asphalt (e.g., <b>vehicle emissions, crankcase oil drippings</b>, etc.).</p>	
<p style="text-align: right;"><i>Concise International Chemical Assessment Document 59, World Health Organization, 2004</i> Rainwater Harvesting Systems - UVIC, Nov 8, 2016</p>	

**WHAT**

**QUALITY**

ACTUAL WATER TEST AFTER TREATMENT – metal roof

**COPPER**  
**34 / 1,000,000,000**

**1 / 1,000,000 = OK**

**3M Granules =**  
**0.5 / 1,000,000**

Sample: Rain 13Mar14 11:00a

ELEMENTS	SAMPLE	UNITS	Maximum Limits Permissible In Drinking Water*	
1) Aluminium	Al	<0.065	mg/L	no limit listed
2) Antimony	Sb	<0.500	ug/L	6.00 ug/L
3) Arsenic	As	<0.500	ug/L	10.0 ug/L
4) Barium	Ba	0.011	mg/L	1.00 mg/L
5) Beryllium	Be	<0.003	mg/L	no limit listed
6) Boron	B	<0.050	mg/L	5.00 mg/L
7) Cadmium	Cd	<0.100	ug/L	5.00 ug/L
8) Calcium	Ca	0.211	mg/L	200 mg/L
9) Chromium	Cr	<0.010	mg/L	0.050 mg/L
10) Cobalt	Co	<0.020	mg/L	no limit listed
11) Copper	Cu	0.034	mg/L	1.00 mg/L
12) Gold	Au	<0.040	mg/L	no limit listed
13) Iron	Fe	0.011	mg/L	0.300 mg/L
14) Lanthanum	La	<0.020	mg/L	no limit listed
15) Lead	Pb	2.18	ug/L	10.0 ug/L
16) Magnesium	Mg	0.172	mg/L	50.0 mg/L
17) Manganese	Mn	0.006	mg/L	0.050 mg/L
18) Molybdenum	Mo	<0.020	mg/L	no limit listed
19) Nickel	Ni	<0.050	mg/L	no limit listed
20) Phosphorus	P	0.049	mg/L	no limit listed
21) Potassium	K	0.060	mg/L	no limit listed
22) Scandium	Sc	<0.050	mg/L	no limit listed
23) Silicon	Si	<0.030	mg/L	no limit listed
24) Silver	Ag	<0.010	mg/L	0.050 mg/L
25) Sodium	Na	1.26	mg/L	200 mg/L
26) Strontium	Sr	<0.002	mg/L	no limit listed
27) Titanium	Ti	<0.010	mg/L	no limit listed
28) Tungsten	W	<0.050	mg/L	no limit listed
29) Vanadium	V	<0.010	mg/L	no limit listed
30) Zinc	Zn	<0.001	mg/L	5.00 mg/L
Hardness (mg/L CaCO3)		1.24	mg/L	0-75 mg/L = soft
pH		6.58	units	6.5 to 8.5

\* As per Canadian or B.C. Health Act Safe Drinking Water Regulation BC Reg 230/92, & 390 Sch 120, 2001. Task Force of Canadian Council of Resource & Envir. Ministers Guidelines for Canadian Drinking Water Quality, 1996. Ammend. Health Canada (2006).

Comments:  
 All constituents tested meet Canadian and B.C. drinking water standards.

**WHAT** **CATCHMENT AREA**

**QUANTITY**

**VOLUME = AREA x DEPTH\***

**1 mm on 1 sq m = 1 litre**  
**1 in on 1 sq ft = 0.623 US gal**  
**= 0.52 Imp gal**

\*conversion factor may be required

**Roof area = 100 sq m (1,100 sq ft)**  
**Annual rainfall = 850 mm (33.5 in)**

**V = A x D**  
**100 sq m X 850 mm = 85,000 litres (85 cu m)**

**V = A x D**  
**1,100 sq ft X 33.5 in X 0.623 = 22,950 US gal**  
**1,100 sq ft X 33.5 in X 0.52 = 19,160 Imp gal**

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## WHAT CATCHMENT AREA

### QUANTITY

#### Runoff Coefficient Table

Area Description	Runoff Coefficient C	Character of surface	Runoff Coefficient C
Business		Pavement	
Downtown	0.70-0.95	Asphaltic and concrete	0.70-0.95
Neighborhood	0.50-0.70	Brick	0.70-0.85
Residential		Roofs	0.75-0.95
Single-Family	0.30-0.50	Lawns, sandy soil	
Multiunits, detached	0.40-0.60	Flat, 2 percent	0.05-0.10
Multiunits, attached	0.60-0.75	Average, 2-7 percent	0.10-0.15
Residential (suburban)	0.25-0.40	Steep, 7 percent	0.15-0.20
Apartment	0.50-0.70	Lawns, heavy soil	
Industrial		Flat, 2 percent	0.13-0.17
Light	0.50-0.80	Average, 2-7 percent	0.18-0.22
Heavy	0.60-0.90	Steep, 7 percent	0.25-0.35
Parks, cemeteries	0.10-0.25		
Playgrounds	0.20-0.35		
Railroad yard	0.20-0.35		
Unimproved	0.10-0.30		

[http://www.ems-i.com/wms/help/Hydrologic\\_Models/Models/Rational/Equation/Runoff\\_Coefficient\\_Table.htm](http://www.ems-i.com/wms/help/Hydrologic_Models/Models/Rational/Equation/Runoff_Coefficient_Table.htm)

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## WHAT CATCHMENT AREA

### QUANTITY

#### RUNOFF COEFFICIENTS ('Efficiency Factor')

Surface Type	Infiltration/Loss*	Runoff Coefficient**
Roofs	5% to 25%	75% to 95%

\* Infiltration is minimal in most roof surfaces, and for annual averages of collection could be fairly insignificant; Losses are due to spillage, leakage, evaporation, filtering, and wind.

\*\*Runoff Coefficient is taken from several sources, and is pretty much standard across all of them.

Pavement Material	Infiltration/Absorption*	Runoff Coefficient*
Asphalt, Concrete	5% to 25%	75% to 95%
Paving Stone	20% to 35%	65% to 80%
Permeable Paving Stones	40% to 80%	20% to 60%
Porous Asphalt, Concrete	75% to 100%	0% to 25%
Rain Gardens, Bioswales	90% to 100%	0% to 10%

\*Derived and compiled from various sources; estimates are based on averages from different studies. This is a representative overview, manufacturer's recommendations and statistics should be used.

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## WHAT

## CATCHMENT AREA

## QUANTITY

**VOLUME = AREA x DEPTH\*  
x COEFFICIENT**

\*conversion factor may be required

**1 mm on 1 sq m = 1 litre**  
**1 in on 1 sq ft = 0.623 US gal**  
**= 0.52 Imp gal**

*Roof area = 100 sq m (1,100 sq ft)*  
*Annual rainfall = 850 mm (33.5 in)*

**$V = A \times D$**

**$100 \text{ sq m} \times 850 \text{ mm} \times 0.8 = 68,000 \text{ litres (68 cu m)}$**

**$V = A \times D$**

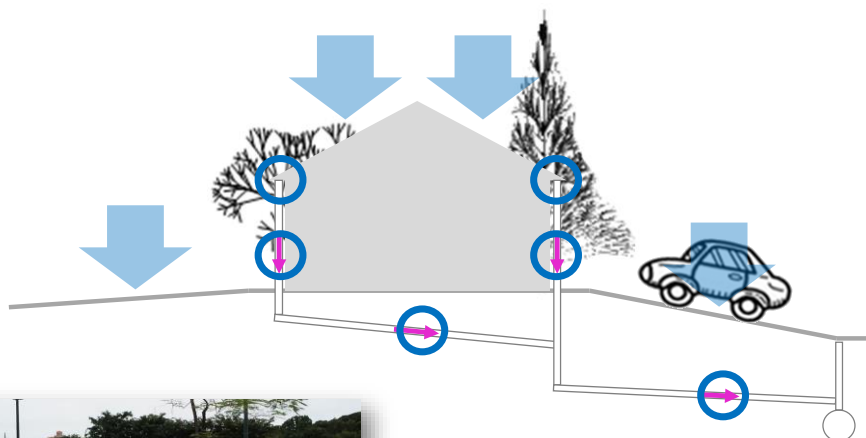
**$1,100 \text{ sq ft} \times 33.5 \text{ in} \times 0.623 \times 0.8 = 18,360 \text{ US gal}$**

**$1,100 \text{ sq ft} \times 33.5 \text{ in} \times 0.52 \times 0.8 = 15,330 \text{ Imp gal}$**

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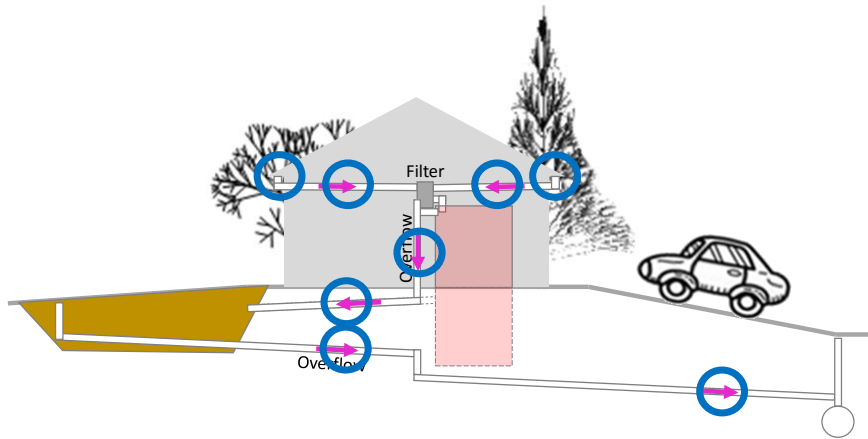
## WHAT

## CONVEYANCE



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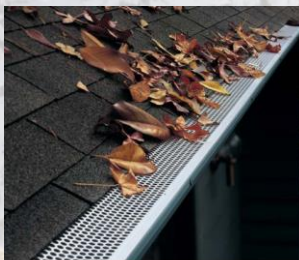
# WHAT CONVEYANCE



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# WHAT CONVEYANCE

GRANULAR MATERIAL BUILD-UP



Screen type



Sponge type



Pass-flow type

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## WHAT

## CONVEYANCE + FILTRATION

### QUALITY

#### GUTTERS

- keep clean, no debris build-up
- slope to drain, no standing water
- screen to keep debris out (optional)
- eliminate barriers to water movement



<https://www.google.ca/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#safe=off&q=downspout+screens>  
<https://www.google.ca/search?q=downspout+screens&safe=off&espv=2&biw=1236&bih=545&site=webhp&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKewjUgLLWkZQAhUNyGMKHQj-CicQ7AkIKQ&dpr=1.1>

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## WHAT

## CONVEYANCE

### QUANTITY

#### DOWNSPOUTS

- connect to gutter without inside 'seam'
- adequate diameter for roof area
- smooth corners, tight transitions

#### PIPING

SCHEDULE 40 PVC  
(Sched 40)



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# WHAT

# CONVEYANCE

DIVERSION / SHUT-OFF

DOWNSPOUT-to-PIPE with DEBRIS FILTER



DOWNSPOUT-to-PIPE, DEBRIS FILTER, and FIRST-FLUSH DIVERSION CHAMBER

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# WHAT

# CONVEYANCE + FILTRATION

QUALITY

DEBRIS FILTERS

- should be self-cleaning
- can transition to piping as well



<https://www.google.ca/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#safe=off&q=downspout+screens>

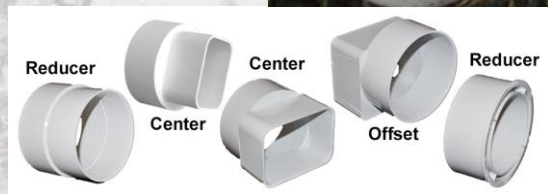
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# WHAT

# CONVEYANCE + FILTRATION

## QUALITY

**TRANSITIONS** - tight connections of piping are best  
 - offsets for better positioning



<https://www.google.ca/search?q=downspout+screens&safe=off&espv=2&biw=1236&bih=545&site=webhp&tbn=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwjUgLLWkzJQAhUNyGMKHQI-ClcQ7AkIKQ&dpr=1.1#imgsrc=07Xi4eIGChowSM%3A>

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# WHAT

# CONVEYANCE + FILTRATION

## QUALITY

**FIRST-FLUSH ('Roof Washers')** - calculations for sizing could be difficult



VERTICAL  
and  
ABOVE  
GROUND



HORIZONTAL  
and  
BURIED

Raindrop Connection, BC

<https://www.google.ca/search?q=downspout+screens&safe=off&espv=2&biw=1236&bih=545&site=webhp&tbn=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwjUgLLWkzJQAhUNyGMKHQI-ClcQ7AkIKQ&dpr=1.1#safe=off&tbn=isch&q=first+flush+diversion&imgsrc=ec905iiGzFTS-M%3A>

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## WHAT

## CONVEYANCE + FILTRATION

**QUALITY**

**FIRST-FLUSH ('Roof Washers')** - calculations for sizing could be difficult

**Figure B.5: Estimated Roof Contamination Potential**

High Contamination <sup>a</sup>	Medium Contamination	Low Contamination <sup>b</sup>
5.0 mm (0.20 in.)	2.0 mm (0.08 in.)	0.5 mm (0.02 in.)

<sup>a</sup>High contamination is considered to have high content of organic debris from animal waste, adjacent trees, and/or airborne contamination.

<sup>b</sup>Low contamination is considered to either have frequent rainfall to keep the collection surface clean and/or minimal nontoxic contamination.

Adapted from: ARCSA/ASPE/ANSI 63-2013

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## WHAT

## CONVEYANCE + FILTRATION

**QUALITY**

**FIRST-FLUSH ('Roof Washers')** - calculations for sizing could be difficult

**Roof area = 100 sq m**  
**First-Flush rainfall = 1.0 mm**

**100 sq m X 1.0 mm = 100 litres (0.1 cu m)**

	Area	Length	Volume	Req'd Length
dia (mm)	area m(2)	m	litres/m	m
<b>75</b>	0.004	1	4.4	<b>22.6</b>
<b>100</b>	0.008	1	7.9	<b>12.7</b>
<b>150</b>	0.018	1	17.7	<b>5.7</b>
<b>200</b>	0.031	1	31.4	<b>3.2</b>
<b>250</b>	0.049	1	49.1	<b>2.0</b>
<b>300</b>	0.071	1	70.7	<b>1.4</b>

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## WHAT CONVEYANCE + FILTRATION

**QUALITY**

**FIRST-FLUSH ('Roof Washers')** - calculations for sizing could be difficult

*Roof area = 1,000 sq ft*  
*First-Flush rainfall = 0.1 in*

*1,000 sq ft X 0.1 in X 0.623 = 62.3 US gal*

*1,000 sq ft X 0.1 in X 0.52 = 52 Imp gal*

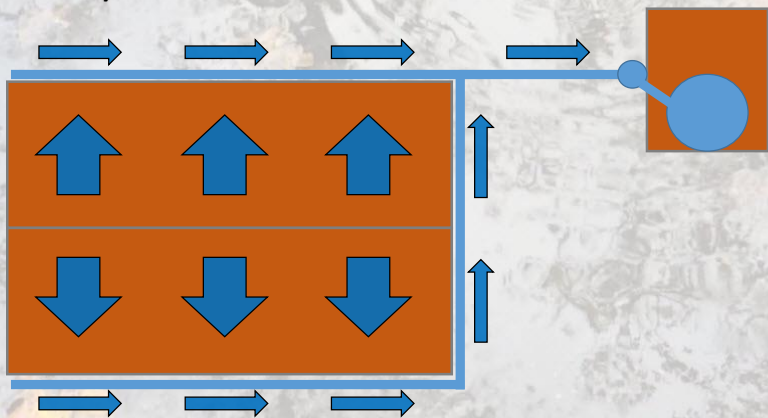
	Area	Length	Volume	Req'd Length
dia (in)	area ft(2)	ft	US gal/ft	ft
3	0.049	1	0.4	169.9
4	0.087	1	0.7	95.5
6	0.196	1	1.5	42.5
8	0.349	1	2.6	23.9
10	0.545	1	4.1	15.3
12	0.785	1	5.9	10.6

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## WHAT CONVEYANCE + FILTRATION

**QUALITY**

**FIRST-FLUSH ('Roof Washers')** - calculations for sizing could be difficult




The diagram illustrates a roof washer system. It shows a rectangular roof area with three horizontal arrows pointing right, indicating the direction of water flow. Below the roof is a collection tank with three vertical arrows pointing up, representing the water being collected. From the right side of the collection tank, a pipe leads to a filter unit (a blue circle with a smaller blue circle inside). Below the filter, another pipe leads to a storage tank (a blue circle with a smaller blue circle inside). The entire system is shown in a cross-sectional view.

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## WHAT CONVEYANCE + FILTRATION

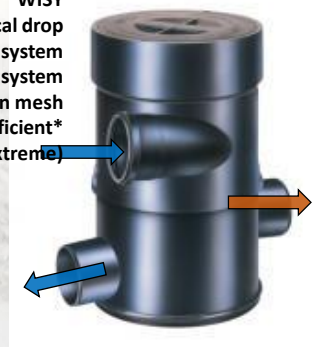
**QUALITY**




**INTEWA**  
Horizontal orientation  
'Jump' system  
~400 micron mesh  
95%+ efficient\*

<http://www.intewa.de/en/products/purain/>

**WISY**  
Vertical drop  
'Vortex' system  
'Wicking' system  
280 micron mesh  
75% to 90% efficient\*  
(50% @ extreme)



<http://www.wisy.de/node/402>



**3PTECHNIK**  
Horizontal orientation  
'Wicking' system  
~280 micron mesh  
50% to 90% efficient\*  
(depends on debris accumulation)

<http://www.3ptechnik.com/56-1-Patronen-Filter.html>

\*Research tests, 2002, Univ. of Seigen

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## WHAT CONVEYANCE + FILTRATION

**QUALITY**

**FILTRATION**

100 to 200 sq m roof area (intensity)

Debris filter upstream

Less effective in low intensity


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*Water follows inside of piping, swirls automatically (Vortex), passes onto sieve mesh*

*Mesh is dry, water passes over it, acts as first-flush system*

*Mesh gets wet, water capillaries through (Wicking), debris left in center*

*Waste water/debris to storm drain*



<https://store.vanislewater.com/rainwater-pre-filtration/wisy-4-plastic-downspout-filter-w-ss-280-micron-screen-wis-pdf>

## WHAT

## CONVEYANCE + FILTRATION

**QUALITY**

**'BASKET' FILTRATION** - acts as calming inlet (quiescent flow)

'Tuffy' filtration insert available  
([www.livingspringswater.ca](http://www.livingspringswater.ca))

Simple operation and maintenance



<https://www.google.ca/search?q=rainwater+tank+filters&safe=off&espv=2&biw=1236&bih=545&tbm=isch&tbo=U&source=univ&sa=X&ved=0ahUKEwiZmbrs5JnQAhUFzWMKHdhrRCiUQ7AkIVA#imgrc=BB3XCA1Vc6Gs4M%3A>

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## WHAT


## CONVEYANCE + FILTRATION

**QUALITY**

**FILTRATION**

All-in-one leaf (debris) filter, first flush, overflow, and clean water diversion

Limited first-flush volume



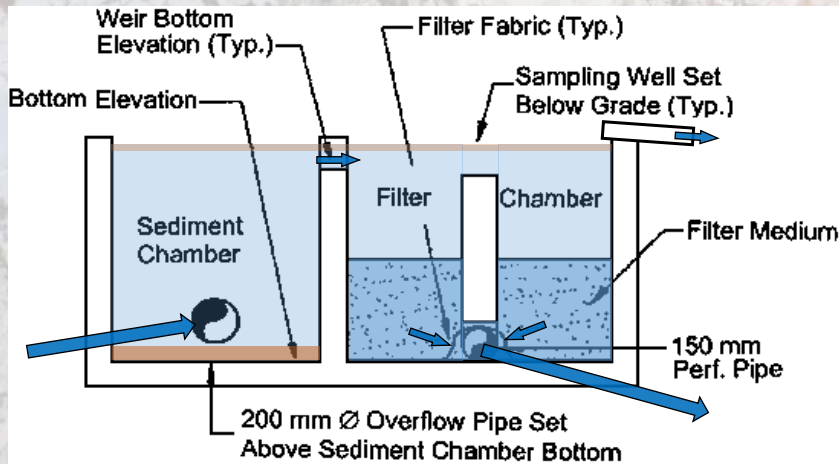
<http://livingspringswater.ca/media/5da14af1db9a1f82ffff939b7f000001.pdf>

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# WHAT CONVEYANCE + FILTRATION

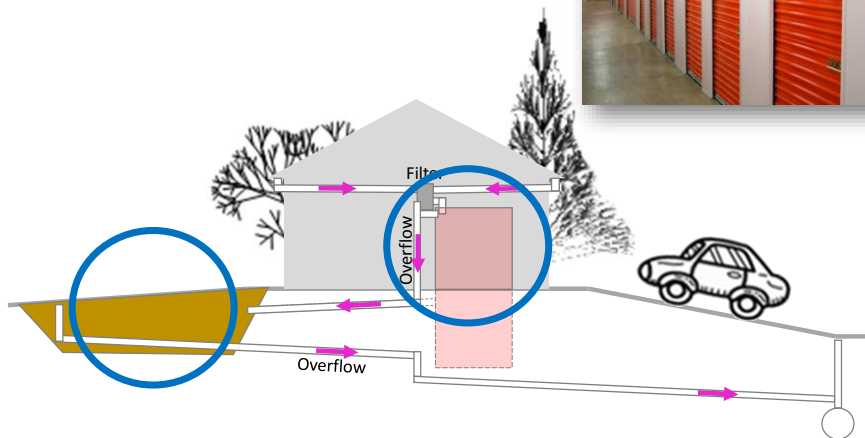
## QUALITY

### FILTRATION - Settling Tank (with sand filtration)



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# WHAT STORAGE



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**WHAT** **STORAGE**

**QUALITY**


**CALMING INLET ('Quiescent Flow')**

**ACCESS PORT**

**SUBMERSIBLE PUMP (shown)**

**FLOATING INTAKE (shown)**

**WATER LEVEL GAUGE**



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**WHAT** **STORAGE**

**QUANTITY**

**SIZE**

**STYLE**



[https://www.google.ca/search?q=rainwater+settling+tank&safe=off&espy=2&biw=1236&bih=545&tbm=isch&imgil=AA34ciYjuzhkZM%253A%253B9PH2hB7py3vW5M%253Bhttp%25253A%25252F%25252Fforum.homeone.com.au%25252Fviewtopic.php%25253FF%25253D35%252526%2525253D77970&source=iu&pf=m&fir=AA34ciYjuzhkZM%253A%252C9PH2hB7py3vW5M%252C\\_&usg=\\_BhRKWwfjJ-2aaZTp7-5eocCj0lk%3D&ved=0ahUKewiVh-e6\\_SnQAhVosFQKHR1rCoAQyJciVQ&ei=IzUIWNXpMejg0gKd1qmACA#imgsrc=dOYnqtMI702uLM%3A](https://www.google.ca/search?q=rainwater+settling+tank&safe=off&espy=2&biw=1236&bih=545&tbm=isch&imgil=AA34ciYjuzhkZM%253A%253B9PH2hB7py3vW5M%253Bhttp%25253A%25252F%25252Fforum.homeone.com.au%25252Fviewtopic.php%25253FF%25253D35%252526%2525253D77970&source=iu&pf=m&fir=AA34ciYjuzhkZM%253A%252C9PH2hB7py3vW5M%252C_&usg=_BhRKWwfjJ-2aaZTp7-5eocCj0lk%3D&ved=0ahUKewiVh-e6_SnQAhVosFQKHR1rCoAQyJciVQ&ei=IzUIWNXpMejg0gKd1qmACA#imgsrc=dOYnqtMI702uLM%3A)

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## WHAT

**QUANTITY**  
**SIZE**  
**STYLE**

## STORAGE





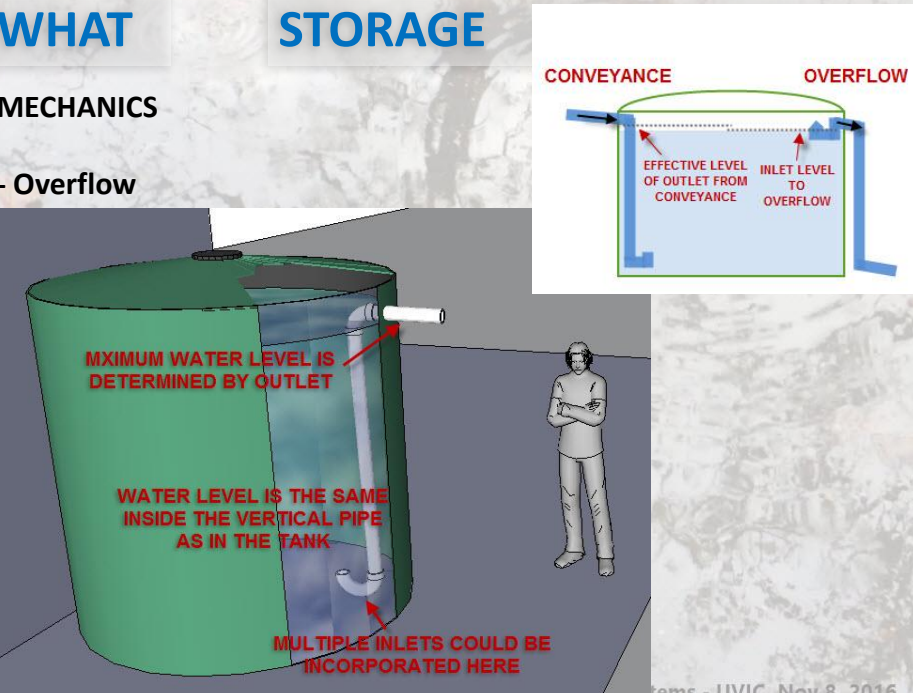
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## WHAT

**MECHANICS**

**- Overflow**

## STORAGE



MXIMUM WATER LEVEL IS DETERMINED BY OUTLET  
 WATER LEVEL IS THE SAME INSIDE THE VERTICAL PIPE AS IN THE TANK  
 MULTIPLE INLETS COULD BE INCORPORATED HERE

CONVEYANCE      OVERFLOW

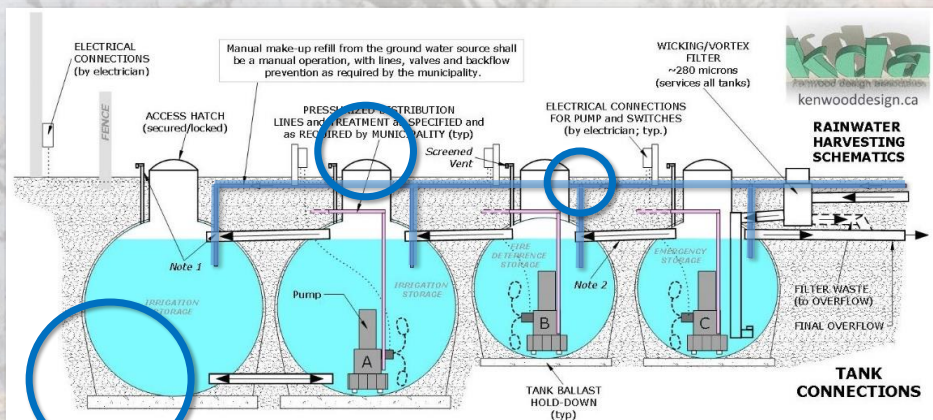
EFFECTIVE LEVEL OF OUTLET FROM CONVEYANCE      INLET LEVEL TO OVERFLOW

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# WHAT STORAGE

## MECHANICS

- **Ballast** (= weight of water displaced)
- **Tank Access** (= 4" to 8" above grade)
- **Make-Up System** (= optional, needs backflow prevention)

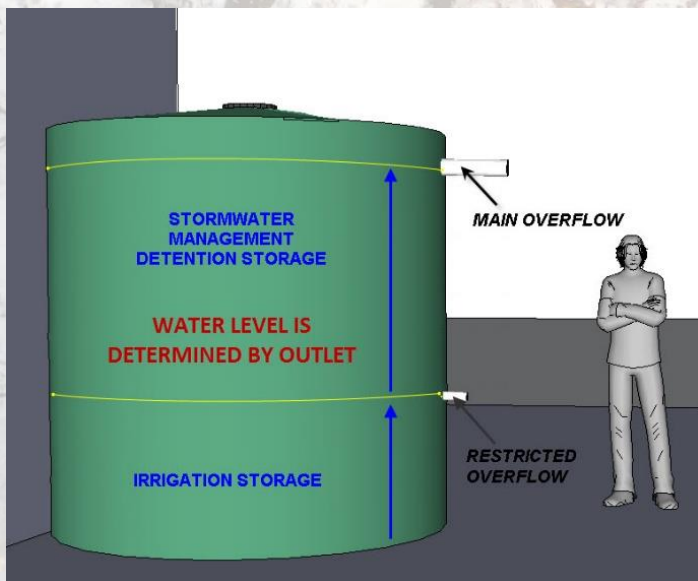


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# WHAT STORAGE

## MECHANICS

Stormwater Management Outlet



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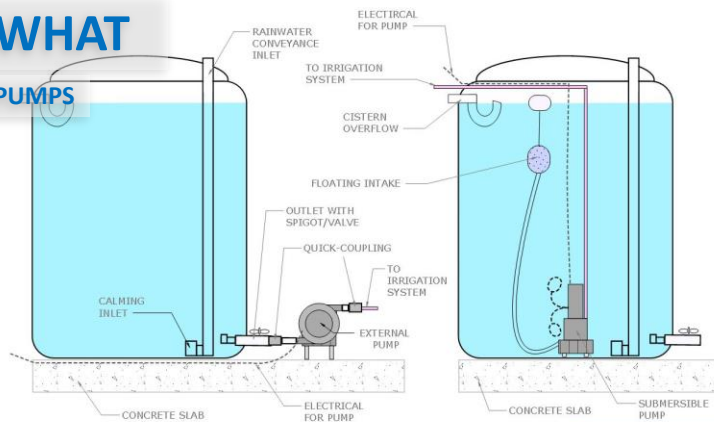
# WHAT STORAGE CALCULATIONS

**WHAT STORAGE**

# WHAT STORAGE – MONTHLY RAINFALL DATA, VICTORIA, BC

Rainfall (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Gonzales	85.2	68.1	45.3	28.5	25.8	20.7	14	19.7	27.4	51.1	95.5	101.9	583.1
Victoria - Phyllis St	99.4	72.7	50.9	36.1	34.2	25.5	16.1	23.8	25.9	66.7	129	105.8	686.1
Central Saanich Veyaness	121	94.7	72.1	47.8	35.9	30.7	19	26.4	27.9	67.1	141.3	134.3	818.1
Central Saanich Island View	118.4	91.1	67.2	44	36.5	31.8	20.8	27.1	31.6	78.6	142.6	132.9	822.5
Victoria Int'l Airport	121.8	98.8	75.8	44.5	36.5	32	19.5	23.9	30.4	75.6	144.4	138.3	841.4
Saanichton CDA	126.8	98.7	75.5	46.5	38.9	35	20.6	27.8	31.7	79.3	154.4	144.6	879.8
Saanichton Mt Newton	140.5	98.5	76.1	54.6	42.7	36	20.7	24.4	28.6	82.1	163.8	137.4	905.3
Metchosin	148.6	110.2	84.6	53.8	36.7	27.3	17.8	23.9	34.3	96.1	187.9	162.5	983.8
Colwood - Hatley Dr	158.9	111	75.7	59.7	38.9	29.5	19.2	22.1	30.5	106.5	201.1	145.7	998.9
Metchosin - Happy Valley	174.2	123.8	98.3	62.5	39	28.9	19.7	26.6	38.8	107.4	201.2	174	1094.4
Shawnigan Lake	172.2	139	114.7	64.9	48.7	40.2	24.7	29.3	37.6	104.2	207.2	189.5	1172.2
Victoria Marine	188.5	145.8	100.1	73.8	47	30.6	23.2	33.2	41.8	109.9	224.7	190.3	1208.8
Sooke Lake North	208.7	166.9	139	80.4	53.5	43.3	26.6	32.4	43	132.1	257.4	230.2	1413.3

# WHAT PUMPS



## RAINWATER HARVESTING SCHEMATICS

### Pump Options

\*Pump information from Grundfos.ca.grundfos.com and Van Isle Water store.vanislewater.com

Other pump options may be suitable



Rated power - P2: 0.75 HP  
 Main frequency: 60 Hz  
 Rated voltage: 1 x 200-240 V  
 Maximum current consumption: 3.45-2.90 A  
 Rated speed: 300-4000 rpm  
 Enclosure class (IEC 34-5): IP55  
 Insulation class (IEC 85): F  
 Type of cable plug: NONE  
 Flans cable: NO CABLE m  
 Net weight: 35.5 lb  
 Gross weight: 54.1 lb



- Horsepower: 3/4
- Flow (GPM): 18 GPM @ 60' Head
- Flow (GPM): 1050 GPH @ 60' Head
- Shut Off: 115'
- Power Cord: 45'
- Voltage: 115v
- Phase: 1
- Hertz: 60
- Watts: 1000
- Discharge: 1"
- Weight: 24 lbs
- Height: 17.7"
- Width: 5.0"
- Length: 5.5"

	GPM Flow @ Feet of Head						Shut-off Head
	30'	45'	60'	75'	90'	100'	
LEAD1800	22	20	18	13	8	6	116'
LEAD1200	23	22	21	19	18	14	11
LEAD1800X	23	22	21	19	18	14	11

Leader 3/4 HP Divertron Pump



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# WHAT

## POST-STORAGE TREATMENT

20 micron  
 5 micron  
 1 or 2 micron

Fibre, Spun,  
 Charcoal, Ceramic

5 micron or less  
 + UV light



<https://store.vanislewater.com>

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# WHAT

CROSS-CONTROL PROTECTION (Backflow Prevention)



<https://www.google.ca/search?q=backflow+prevention+devices+images&safe=off&espv=2&biw=1236&bih=589&tbn=jsch&tbo=u&source=univ&sa=X&ved=0ahUKEwjZ4q2WtrOAhUUS2MKHX6sDBgQ7AkiOw#imgrc=Fj5Y5HIWskmhM%3A>

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## Rainwater Harvesting Systems

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