Rainwater Harvesting Best Practices

Ken Nentwig BLA MLA CLM CLD
ARCSA-AP and Trainer

U of Guelph, Ridgetown Campus	1994 to 2010
Gaia College, 'Rainwater Harvesting and Management', online	2012 (ongoing)
CANARM/ARCSA	2012 (ongoing)
Pacific Design Academy	2016 (ongoing)

Rainwater Harvesting Best Practices

The case for Rainwater Harvesting – 2 premises

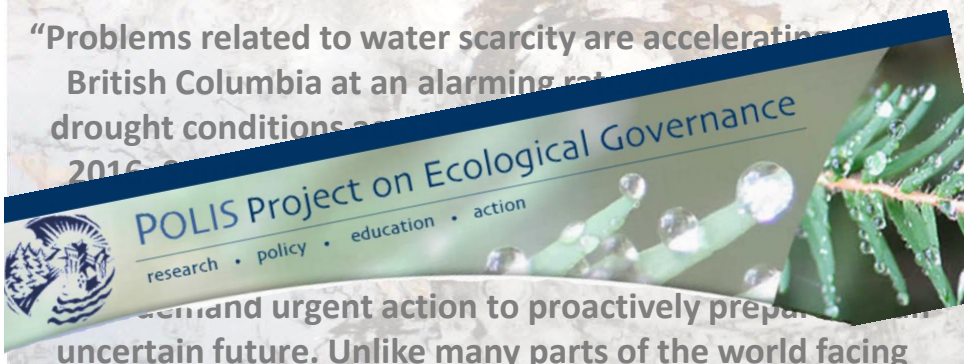
Premise 1: "RAINWATER HARVESTING IS GOOD"

Premise 2: "RAINWATER HARVESTING IS A SPECIFIC AREA OF EXPERTISE"

Best practices in Rainwater Harvesting Systems

Rainwater Harvesting Best Practices - UVIC, Nov 1, 2016

"Problems related to water scarcity are accelerating in British Columbia at an alarming rate. 2015 saw severe drought conditions across [illegible] of the province; in June 2016, Southern Vancouver Island experienced Stage 4 drought restrictions – the earliest ever such designation has ever been applied in BC – for the second year in a row. These escalating issues demand urgent action to proactively prepare for an uncertain future. Unlike many parts of the world facing state or even country-level water shortages and crises, British Columbia still has time to do things better before crippling widespread crisis hits."



Simms, R. & Brandes, O.M. (2016, September). **Top 5 Water Challenges that will Define British Columbia's Future**. Victoria, Canada: POLIS Project on Ecological Governance, Centre for Global Studies, University of Victoria, 2016, pg 8

OBVIOUS and NOTICEABLE

Problems accelerating

FLOODING

STORM INTENSITY

AQUIFER DEPLETION

WATER QUALITY DEGRADATION

Simms, R. & Brandes, O.M. (2016, September). **Top 5 Water Challenges that will Define British Columbia's Future**. Victoria, Canada: POLIS Project on Ecological Governance, Centre for Global Studies, University of Victoria, 2016, pg 8

Rainwater Harvesting Best Practices - UVIC, Nov 1, 2016

CLIMATE CHANGE
vs
WEATHER CHANGES

One site at a time

'Small steps... journey'

issues demand urgent action

"What can I do?"
WHAT
CAN – SHOULD
I – WE - THEY
DO – CONSIDER - LEARN

- "be more than 'I'" (Robert Sandford, United Nations University)
- be informed
- understand implications
- be proactive vs reactive

Simms, R. & Brandes, O.M. (2016, September). Top 5 Water Challenges that will Define British Columbia's Future. Victoria, Canada: POLIS Project on Ecological Governance, Centre for Global Studies, University of Victoria, 2016, pg 8

Rainwater Harvesting Best Practices - UVIC, Nov 1, 2016

Living Waters Rally and WATERSHEDS 2016

LEGISLATION - CODES - GUIDELINES

DISCUSSION and AWARENESS

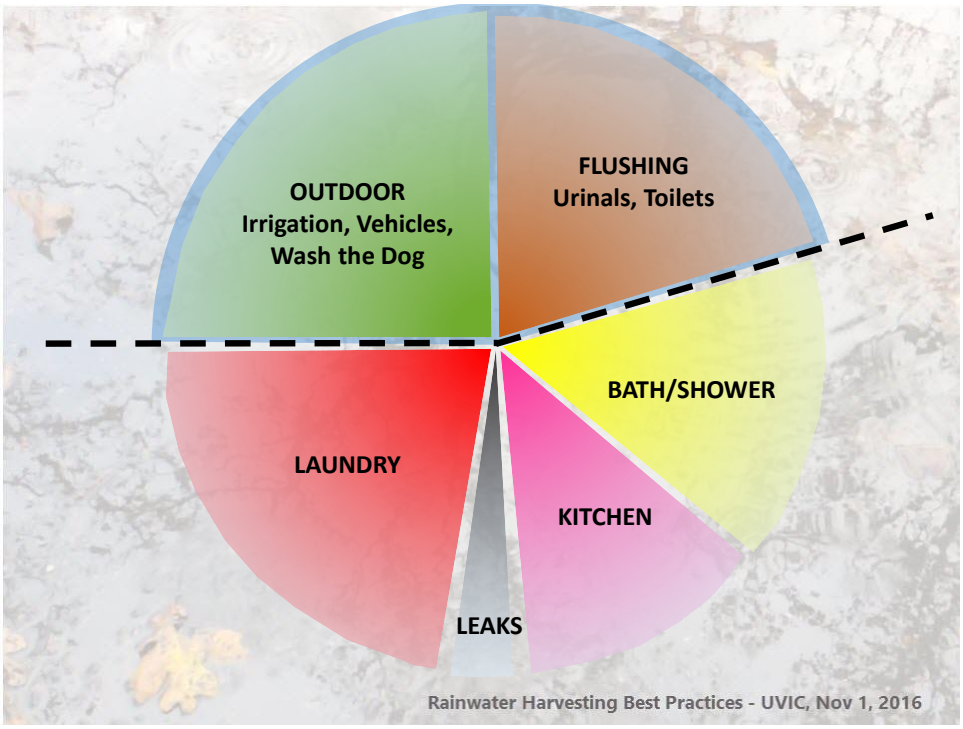
EDUCATION and TRAINING

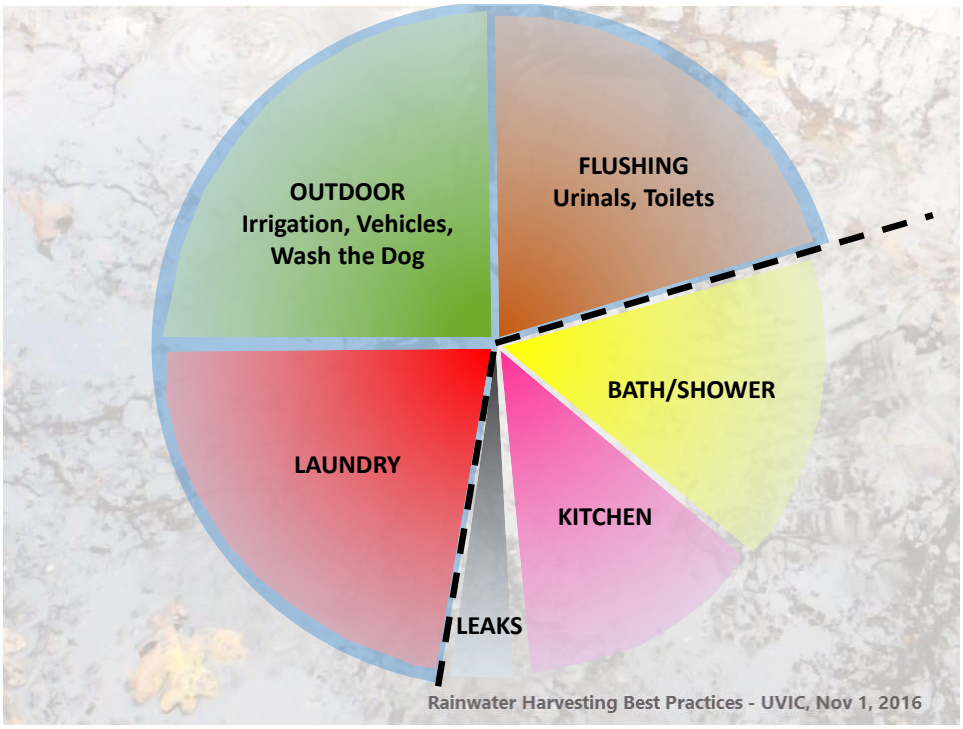
CERTIFICATION

proactively prepare
before crisis

Simms, R. & Brandes, O.M. (2016, September). Top 5 Water Challenges that will Define British Columbia's Future. Victoria, Canada: POLIS Project on Ecological Governance, Centre for Global Studies, University of Victoria, 2016, pg 8

Rainwater Harvesting Best Practices - UVIC, Nov 1, 2016


OUTDOOR
Irrigation, Vehicles,
Wash the Dog
FLUSHING
Urinals, Toilets
BATH/SHOWER
KITCHEN
LEAKS
LAUNDRY
Rainwater Harvesting Best Practices - UVIC, Nov 1, 2016


OUTDOOR
Irrigation, Vehicles,
Wash the Dog
FLUSHING
Urinals, Toilets
BATH/SHOWER
KITCHEN
LEAKS
LAUNDRY
Rainwater Harvesting Best Practices - UVIC, Nov 1, 2016

Watershed stewardship organizations
Community interest groups
Provincial committees and departments
Federal ministries
First Nations
Building codes
Regulations
Guidelines
Standards
Environment
Developers
Gardeners
Landscape industry
Design professions
Property owners/managers

Educators
Manufacturers
Residents/Tenants
Commercial enterprises
Government buildings and properties
Roads and parking
Habitat: air, land and water
Retailers
Contractors
Researchers
Trade organizations
Climate change
Decision-makers

Drought and Flood Resistance

Water for Nature

Watershed Knowledge

Water Quality Protection

Energy and Water

Discussion
and
Action

Adapted from:
Simms, R. & Brandes, O.M. (2016, September). **Top 5 Water Challenges that will Define British Columbia's Future**. Victoria, Canada: POLIS Project on Ecological Governance, Centre for Global Studies, University of Victoria, 2016

Drought and Flood Resistance

Water for Nature

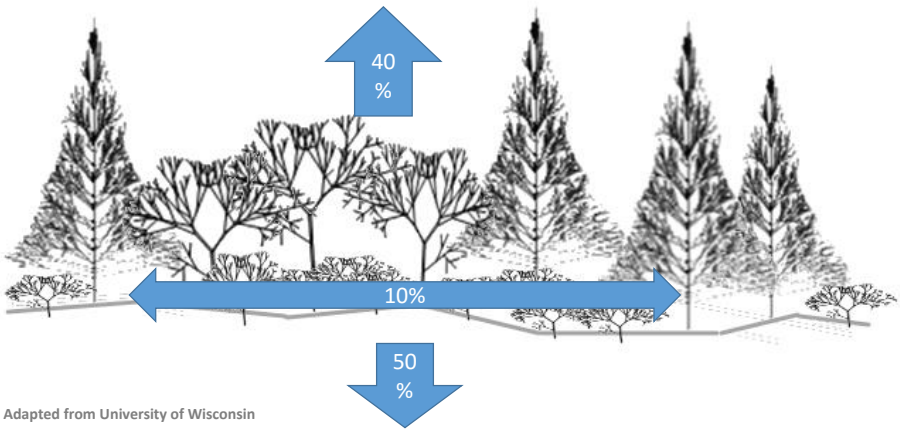
Watershed Knowledge

Water Quality Protection

Energy and Water

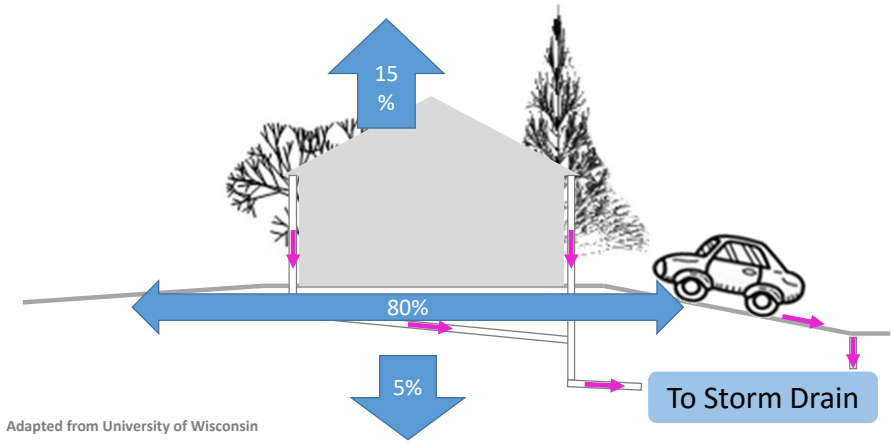
"He says it's rainwater harvesting…"

Previously…



Adapted from University of Wisconsin

Currently…

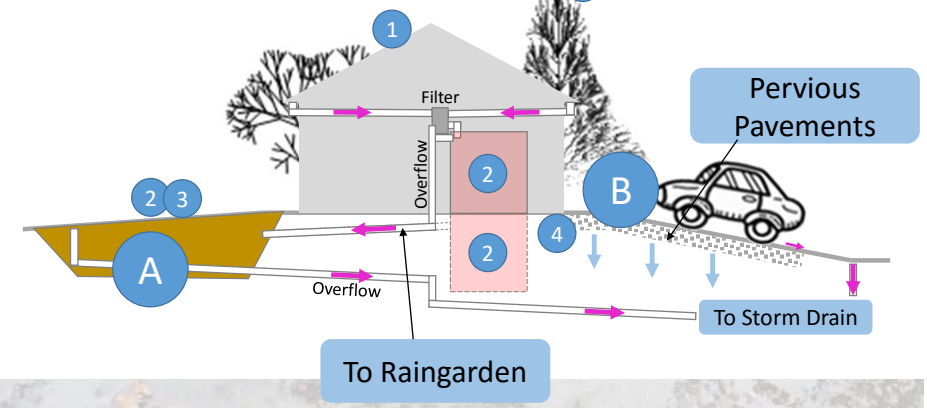


Adapted from University of Wisconsin

Drought and Flood Resistance RHS

- Use less water (conserve)
- Drought-tolerant plants
- Dormant or no lawns

1 - Alternative Source
2 - Detention
3 - Retention

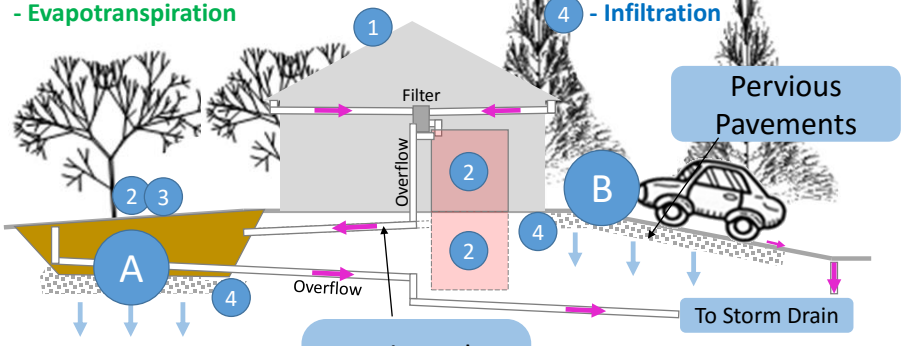


Water for Nature

RHS

- Plant Trees
- Mulch Planting Beds
- Sheet Flow / On-site Infiltration
- Evapotranspiration

1 - Alternative Source
2 - Detention
3 - Retention
4 - Infiltration



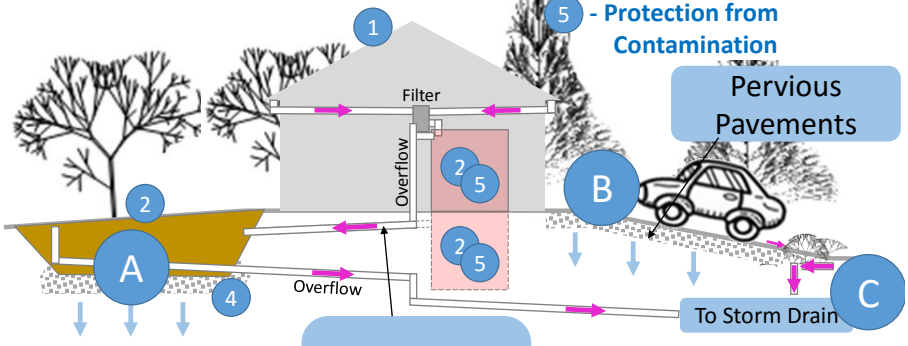
To Raingarden, Bio-Swale, Infiltration Pit

Water Quality Protection

RHS

- Eliminate Chemicals
- Reduce runoff volumes
- Natural filters and processes

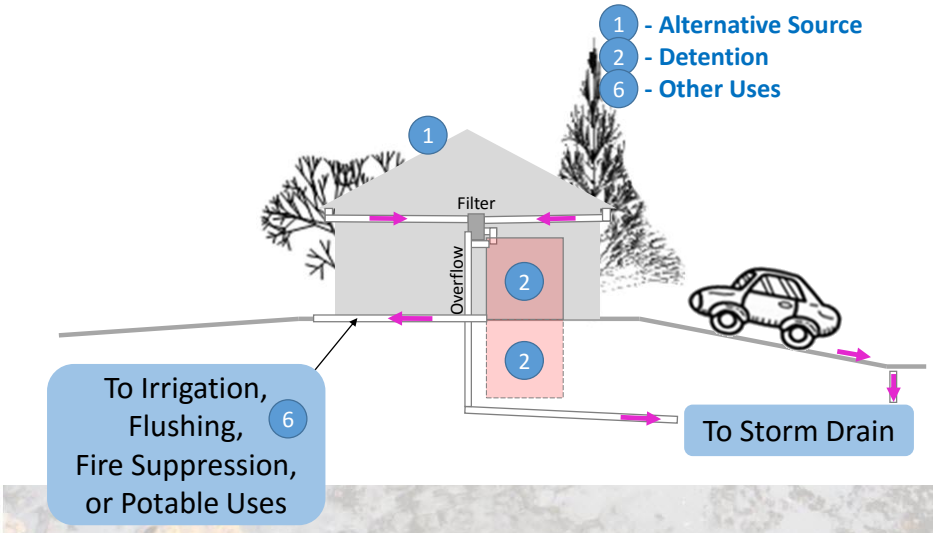
1 - Alternative Source
2 - Detention
4 - Infiltration
5 - Protection from Contamination



To Raingarden, Bio-Swale, Infiltration Pit

Other Rainwater Uses

RHS



Premise 1:

"RAINWATER HARVESTING IS GOOD"

Harvesting the rain through wise management of catchment, conveyance, storage and distribution benefits the environment:

- **Reduces runoff and associated pollution, erosion, and wastage**
- **Reduces demand on potable water sources**
- **Increases water volumes returned to the soil**

Premise 1:

"RAINWATER HARVESTING IS GOOD"

Harvesting the rain through wise management of catchment, conveyance, storage and distribution benefits the environment:

- Reduces runoff and associated pollution, erosion, and wastage
- Reduces demand on potable water sources
- Increases water volumes returned to the soil

Premise 2:

"RAINWATER HARVESTING IS A SPECIFIC AREA OF EXPERTISE"

As old as human habitation, harvesting rainfall has been pushed aside in favour of centralized and controlled procurement and distribution systems:

- **Standards, regulations, and codes do not always recognize rainwater**
- **Crosses over multiple trades and professions:** construction, landscape, plumbing, roofing, engineering, architecture, landscape architecture, stormwater management, planning, waste water, municipal…
- **'Best Practices' need to be applied**

RAINDROP HARVESTING, BC

INTERNET

CENTRAL SAANICH FIRE HALL, BARR PLASTICS

Rainwater Harvesting Best Practices - UVIC, Nov 1, 2016

RAINWATER HARVESTING SYSTEMS
of good quality and suitablity:

- 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 HAVE SEEN SO FAR IN THIS PRESENTATION

A Process of Design

Purpose, and General Opportunities and Constraints

System Overview: aspects of the RHS to be considered
feasibility / initial calculations

WHY?

Site Analysis: natural and man-made structures
climate, soils, slopes
neighbouring sites

Design Principles: what will work, what will not
types of systems

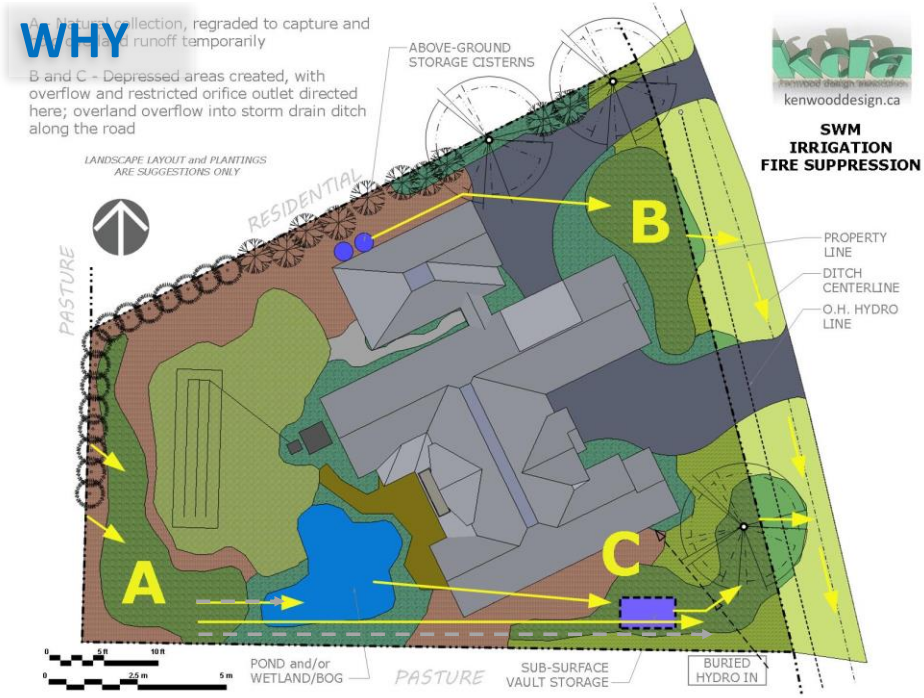
WHAT?

Design Approach: system components
relationships between components
detailed calculations

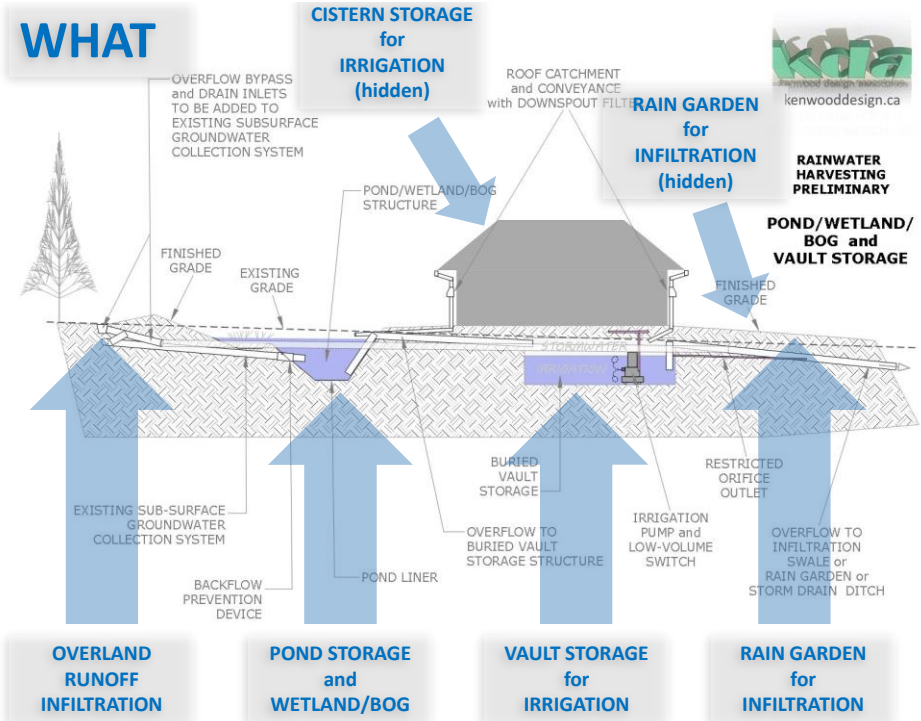
HOW?

Plans, Specifications, Owner's Manual

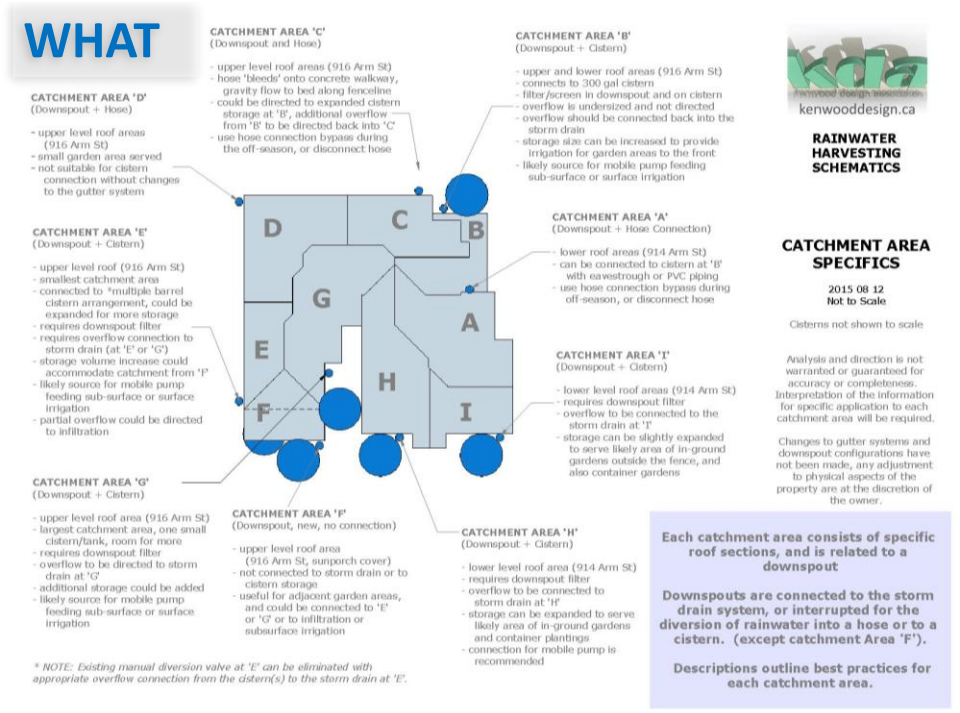
WHY


A - Pasture collection, regraded to capture and
detain runoff temporarily
B and C - Depressed areas created, with
overflow and restricted orifice outlet directed
here; overland overflow into storm drain ditch
along the road
ABOVE-GROUND
STORAGE CISTERNS
LANDSCAPE LAYOUT and PLANTINGS
ARE SUGGESTIONS ONLY
RESIDENTIAL
PASTURE
B
C
A
PROPERTY
LINE
DITCH
CENTERLINE
O.H. HYDRO
LINE
POND and/or
WETLAND/BOG
PASTURE
SUB-SURFACE
VAULT STORAGE
BURIED
HYDRO IN
kenwooddesign.ca
SWM
IRRIGATION
FIRE SUPPRESSION

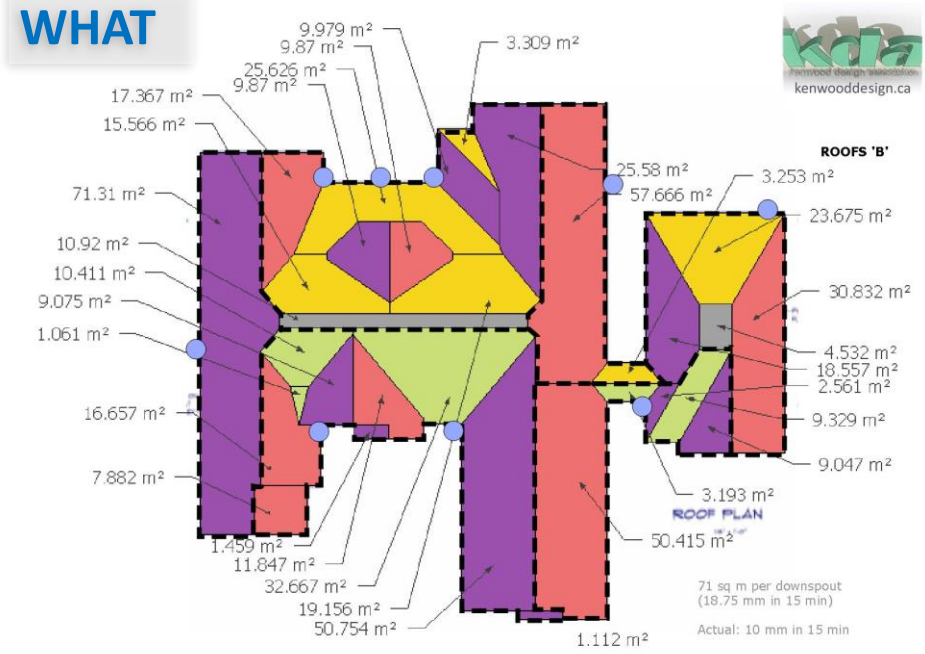
WHAT


CISTERN STORAGE
for
IRRIGATION
(hidden)
RAIN GARDEN
for
INFILTRATION
(hidden)
kenwooddesign.ca
RAINWATER
HARVESTING
PRELIMINARY
POND/WETLAND/
BOG and
VAULT STORAGE
OVERFLOW BYPASS
and DRAIN INLETS
TO BE ADDED TO
EXISTING SUBSURFACE
GROUNDWATER
COLLECTION SYSTEM
ROOF CATCHMENT
and CONVEYANCE
with DOWNSPOUT FILTER
POND/WETLAND/BOG
STRUCTURE
FINISHED
GRADE
EXISTING
GRADE
FINISHED
GRADE
STORMWATER
IRRIGATION
BURIED
VAULT
STORAGE
RESTRICTED
ORIFICE
OUTLET
EXISTING SUB-SURFACE
GROUNDWATER
COLLECTION SYSTEM
OVERFLOW TO
BURIED VAULT
STORAGE STRUCTURE
IRRIGATION
PUMP and
LOW-VOLUME
SWITCH
OVERFLOW TO
INFILTRATION
SWALE or
RAIN GARDEN or
STORM DRAIN DITCH
BACKFLOW
PREVENTION
DEVICE
POND LINER
OVERLAND
RUNOFF
INFILTRATION
POND STORAGE
and
WETLAND/BOG
VAULT STORAGE
for
IRRIGATION
RAIN GARDEN
for
INFILTRATION


WHAT
METAL
GREEN, or
VEGETATED
FIBREGLASS or
PLASTIC
CEDAR
SHAKE
ASPHALT
SHINGLE
ainwater Harv


WHAT
CATCHMENT AREA 'C'
(Downspout and Hose)
- upper level roof areas (916 Arm St)
- hose 'bleeds' onto concrete walkway, gravity flow to bed along fenceline
- could be directed to expanded cistern storage at 'B', additional overflow from 'B' to be directed back into 'C'
- use hose connection bypass during the off-season, or disconnect hose
CATCHMENT AREA 'B'
(Downspout + Cistern)
- upper and lower roof areas (916 Arm St)
- connects to 300 gal cistern
- filter/screen in downspout and on cistern
- overflow is undersized and not directed
- overflow should be connected back into the storm drain
- storage size can be increased to provide irrigation for garden areas to the front
- likely source for mobile pump feeding sub-surface or surface irrigation
CATCHMENT AREA 'D'
(Downspout + Hose)
- upper level roof areas (916 Arm St)
- small garden area served
- not suitable for cistern connection without changes to the gutter system
CATCHMENT AREA 'A'
(Downspout + Hose Connection)
- lower roof areas (914 Arm St)
- can be connected to cistern at 'B' with eavestrough or PVC piping
- use hose connection bypass during off-season, or disconnect hose
CATCHMENT AREA 'E'
(Downspout + Cistern)
- upper level roof (916 Arm St)
- smallest catchment area
- connected to *multiple barrel cistern arrangement, could be expanded for more storage
- requires downspout filter
- requires overflow connection to storm drain (at 'E' or 'G')
- storage volume increase could accommodate catchment from 'F'
- likely source for mobile pump feeding sub-surface or surface irrigation
- partial overflow could be directed to infiltration
CATCHMENT AREA 'I'
(Downspout + Cistern)
- lower level roof areas (914 Arm St)
- requires downspout filter
- overflow to be connected to the storm drain at 'I'
- storage can be slightly expanded to serve likely area of in-ground gardens outside the fence, and also container gardens
CATCHMENT AREA 'G'
(Downspout + Cistern)
- upper level roof area (916 Arm St)
- largest catchment area, one small cistern/tank, room for more
- requires downspout filter
- overflow to be directed to storm drain at 'G'
- additional storage could be added
- likely source for mobile pump feeding sub-surface or surface irrigation
CATCHMENT AREA 'F'
(Downspout, new, no connection)
- upper level roof area (916 Arm St, sunporch cover)
- not connected to storm drain or to cistern storage
- useful for adjacent garden areas, and could be connected to 'E' or 'G' or to infiltration or subsurface irrigation
CATCHMENT AREA 'H'
(Downspout + Cistern)
- lower level roof area (914 Arm St)
- requires downspout filter
- overflow to be connected to storm drain at 'H'
- storage can be expanded to serve likely area of in-ground gardens and container plantings
- connection for mobile pump is recommended
* NOTE: Existing manual diversion valve at 'E' can be eliminated with appropriate overflow connection from the cistern(s) to the storm drain at 'E'.
kenwooddesign.ca
RAINWATER HARVESTING SCHEMATICS
CATCHMENT AREA SPECIFICS
2015 08 12
Not to Scale
Cisterns not shown to scale
Analysis and direction is not warranted or guaranteed for accuracy or completeness. Interpretation of the information for specific application to each catchment area will be required.
Changes to gutter systems and downspout configurations have not been made, any adjustment to physical aspects of the property are at the discretion of the owner.
Each catchment area consists of specific roof sections, and is related to a downspout
Downspouts are connected to the storm drain system, or interrupted for the diversion of rainwater into a hose or to a cistern. (except catchment Area 'F').
Descriptions outline best practices for each catchment area.

WHAT

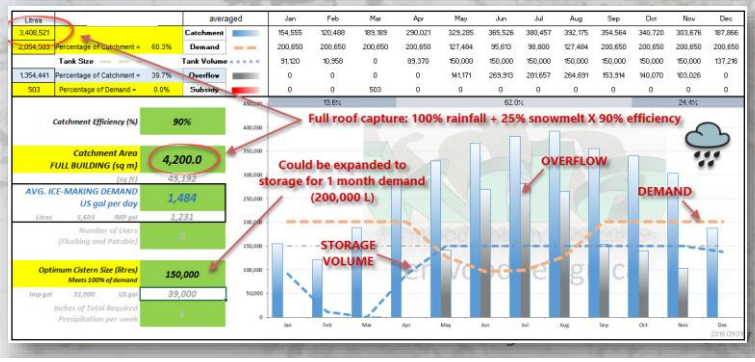

kenwooddesign.ca
ROOFS 'B'
ROOF PLAN
9.979 m²
9.87 m²
25.626 m²
9.87 m²
3.309 m²
17.367 m²
15.566 m²
71.31 m²
10.92 m²
10.411 m²
9.075 m²
1.061 m²
16.657 m²
7.882 m²
1.459 m²
11.847 m²
32.667 m²
19.156 m²
50.754 m²
1.112 m²
25.58 m²
57.666 m²
3.253 m²
23.675 m²
30.832 m²
4.532 m²
18.557 m²
2.561 m²
9.329 m²
9.047 m²
3.193 m²
50.415 m²
71 sq m per downspout
(18.75 mm in 15 min)
Actual: 10 mm in 15 min

WHAT


INTERNET

WHAT


1 month reserve
DEMAND
SUBSIDY
SUBSIDY
TANK LEVEL
Catchment Efficiency (%) 90%
Catchment Area QUARTER BUILDING (sq m) 1,060.0
AVG. ICE-MAKING DEMAND US gal per day 1,484
Recommended Cistern Size (litres) 1-month catchment as reserve 110,000


Full roof capture: 100% rainfall + 25% snowmelt X 90% efficiency
Could be expanded to storage for 1 month demand (200,000 L)
OVERFLOW
DEMAND
STORAGE VOLUME
Catchment Efficiency (%) 90%
Catchment Area FULL BUILDING (sq m) 4,200.0
AVG. ICE-MAKING DEMAND US gal per day 1,484
Optimum Cistern Size (litres) Meets 100% of demand 150,000

WHAT


CANARM


INTERNET


EXIT
got rainwater?

HOW

IRRIGATION

CATCHMENT AREA

105 sq m / 1,140 sq ft

POTENTIAL ANNUAL CATCHMENT VOLUME

80,500 litres (85% efficiency factor)

ANNUAL DEMAND VOLUME

19,500 litres (drip irrigation, 70 sq m, 19 weeks)

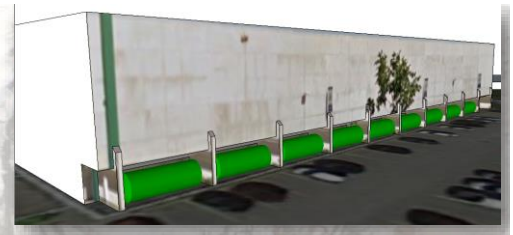
OPTIMUM CISTERN SIZE

5,000 litres (1,300 US gal)

(2nd cistern for future expansion)

HOW

ICE-MAKING



CATCHMENT AREA

4,200 sq m / 45,200 sq ft

POTENTIAL ANNUAL CATCHMENT VOLUME

3.30 million litres (90% efficiency factor + 25% snowmelt)

ANNUAL DEMAND VOLUME

2.05 million litres (540,000 US gal)

OPTIMUM CISTERN SIZE

250,000 litres (65,000 US gal)

HOW

IRRIGATION

ONE OF THREE TANKS

CATCHMENT AREA
90 sq m / 1,225 sq ft

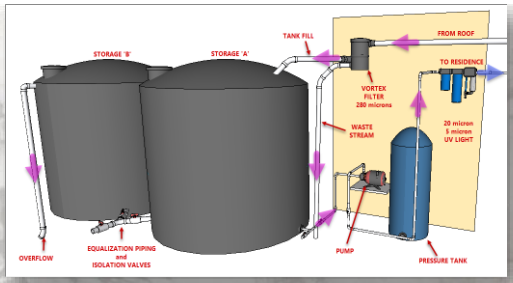
POTENTIAL ANNUAL CATCHMENT VOLUME
47,765 litres (90% efficiency factor)

ANNUAL DEMAND VOLUME (*requires supplemental water)
57,000 litres (15,000 US gal)

MAXIMUM* CISTERN SIZE (*no overflow left)
34,500 litres (6,890 US gal)

HOW

100% POTABLE



CATCHMENT AREA
114 sq m / 1,225 sq ft

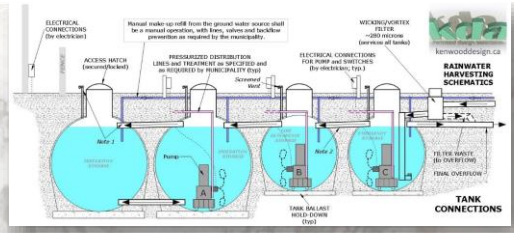
POTENTIAL ANNUAL CATCHMENT VOLUME
145,000 litres (90% efficiency factor)

ANNUAL DEMAND VOLUME
111,000 litres (29,290 US gal)

OPTIMUM CISTERN SIZE
26,500 litres (6,890 US gal)

HOW

IRRIGATION
EMERGENCY
FIRE SUPPRESSION



CATCHMENT AREA

185 sq m / 1,990 sq ft

POTENTIAL ANNUAL CATCHMENT VOLUME

166,900 litres (90% efficiency factor)

ANNUAL DEMAND VOLUME

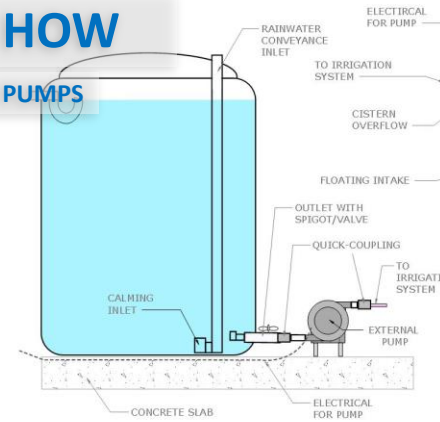
91,330 litres (24,100 US gal)

OPTIMUM CISTERN SIZE = 45,500 litres irrigation + 5,000 litres emergency + 20,000 litres fire = 70,000 litres (18,470 US gal)

Rainwater Harvesting Best Practices - UVIC, Nov 1, 2016

HOW

PUMPS



kenwooddesign.ca

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:	360-4000 rpm
Enclosure class (IEC 34-5):	IP55
Insulation class (IEC 85):	F
Type of cable plug:	NONE
Mains cable:	NO CABLE m
Net weight:	35.5 lb
Gross weight:	54.1 lb

GRUNDFOS

Leader 3/4 HP Divertron Pump

- Horsepower: 3/4
- Flow (GPM): 18 GPM @ 60' Head
- Flow (GPH): 1080 GPH @ 60' Head
- Shut Off: 118'
- Power Cord: 48'
- Voltage: 115v
- Phase: 1
- Hertz: 60
- Watts: 1000
- Discharge: 1"
- Weight: 24 lbs
- Height: 17.7"
- Width: 5.9"
- Length: 5.9"

GPM Flow @ Feet of Head								Shut-off Head
	30'	45'	60'	75'	90'	105'	120'	135'	
LEA/DT1000	22	20	18	13	8	6			118'
LEA/DT1200	23	22	21	19	18	14	11	8	157'
LEA/DT1200X	23	22	21	19	18	14	11	8	157'

VAN ISLE WATER

Ken Nentwig, ARCSA AP, BLA MLA CLP CLD - 250 999 2472

WEATHER vs CLIMATE
Infrastructure
Policy/Standards

Be 'WE', it's more than just 'I'

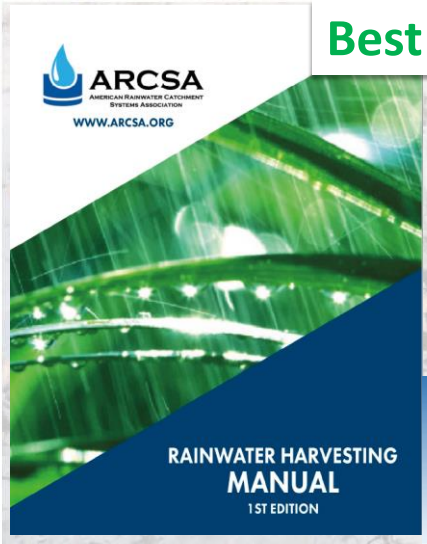
Awareness, Education, Training, Certification
BEST PRACTICES

ARCSA TRAINING PROGRAMS

ACCREDITED PROFESSIONAL (AP)*	- 2 day workshop (open to anyone)
for accreditation:	*+ membership + written exam*
DESIGN and CONSTRUCTION (DC)	- 2 or 3 day workshop (open to anyone)
INSPECTOR SPECIALIST (IS)	- 1 day workshop + exam
RAINWATER HARVESTING MASTER (RWHM)	- AP + DC + take-home problem + RWHM exam
CERTIFICATIONS (coming in 2017)	- Design, Installation, Inspection 3rd party, ASSE International

**Equivalency* *Gaia College, "Rainwater Harvesting and Management" (online)*
Royal Roads University and Seneca College (both online, through Gaia)

Best Practices



(November, 2015)

10 Trainers
Instructors Group
Education Committee
Executive Director
Board of Directors

Best Practices

ARCSA Accredited Professional Training Manual

AP Workshop Course of Study

Integrated RHS Design
Passive and Active RHS
Hydraulic Calculations
Supply and Demand
Components and Water Quality Issues
Pipe and Fittings
Rooftop Catchment and Conveyance
Debris Filtering and Removal
Above- and Under-ground, Large, and Small Tanks
Pumps and Controls
Treatment and Sanitation
Irrigating with Rainwater
Extreme Conditions
Safety and Quality Control
Stormwater Capture/Beneficial Use

Climate Change

Regulations, Codes, Standards, Guidelines

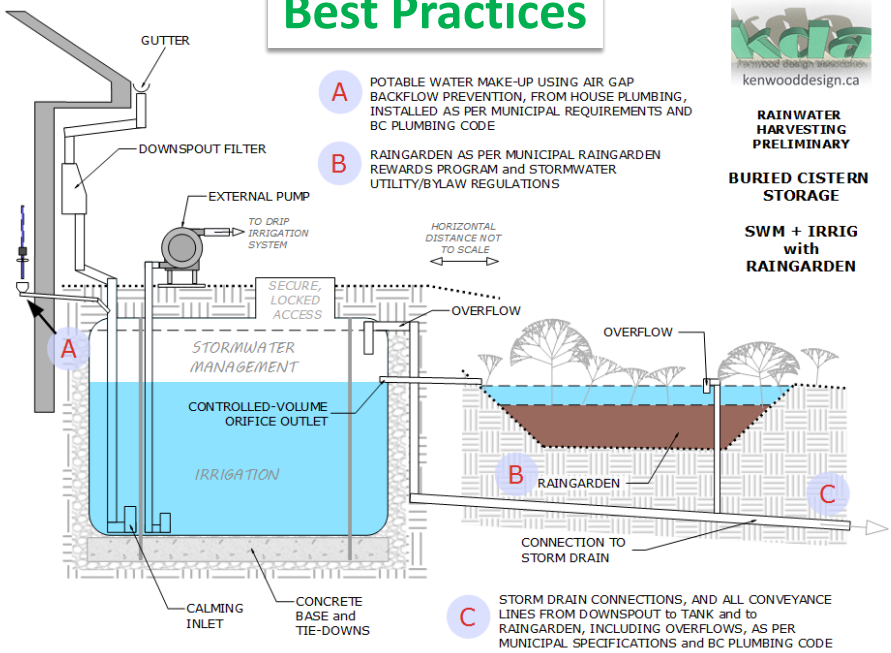
Best Practices

Data Sources

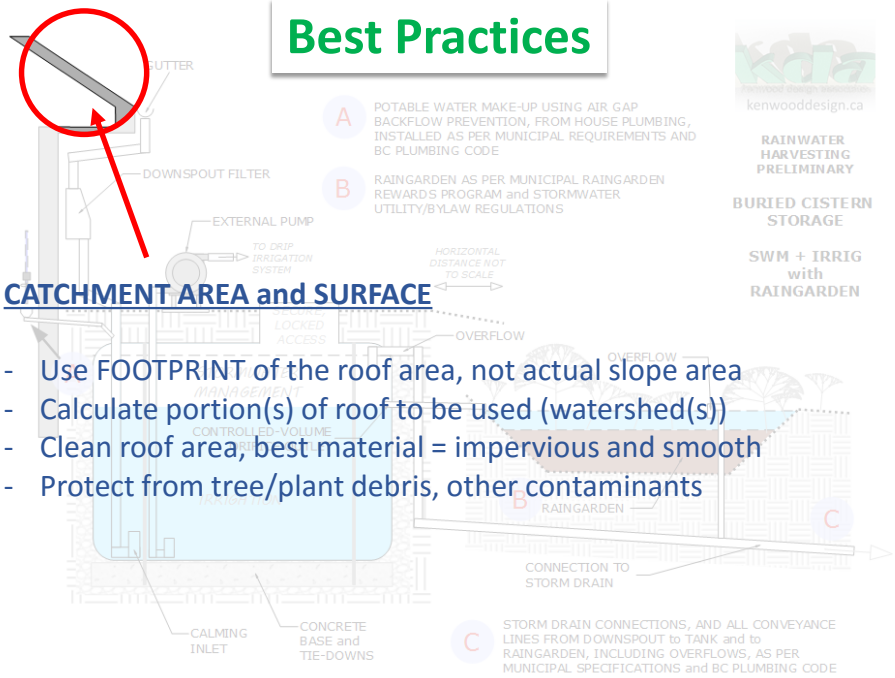
Networking

Accreditation and Certification

Best Practices



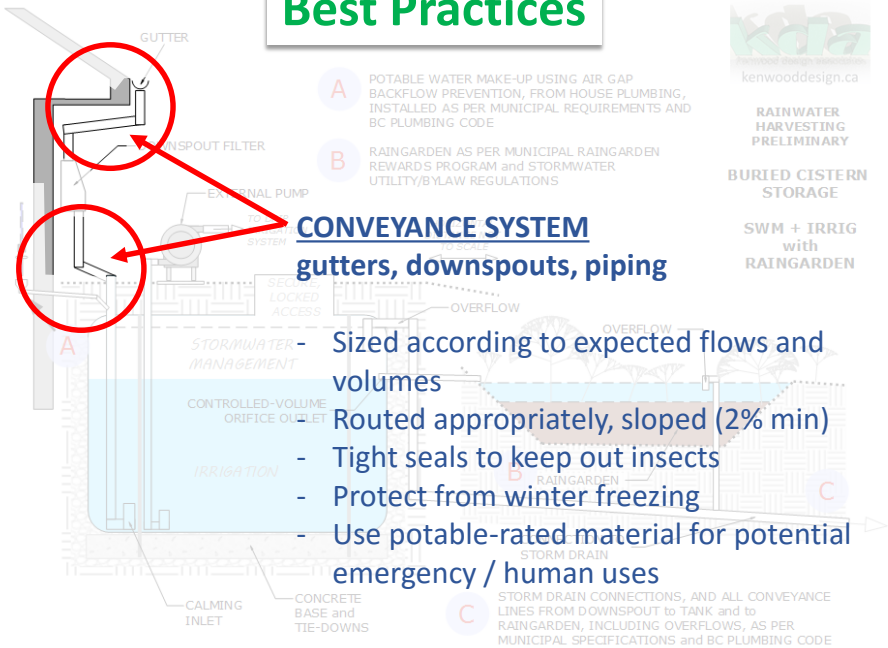
Best Practices



CATCHMENT AREA and SURFACE

- Use FOOTPRINT of the roof area, not actual slope area
- Calculate portion(s) of roof to be used (watershed(s))
- Clean roof area, best material = impervious and smooth
- Protect from tree/plant debris, other contaminants

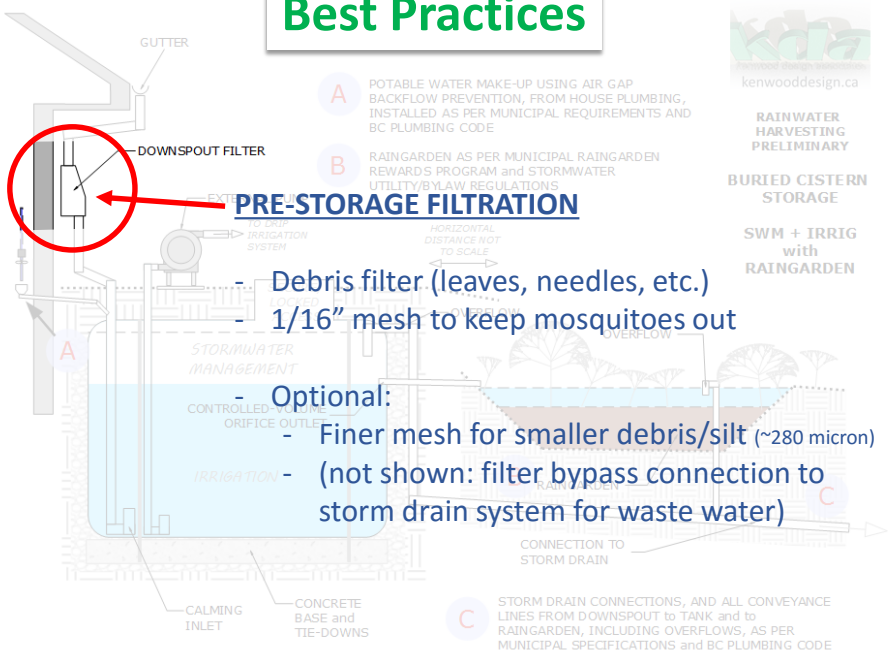
Best Practices



CONVEYANCE SYSTEM
gutters, downspouts, piping

- Sized according to expected flows and volumes
- Routed appropriately, sloped (2% min)
- Tight seals to keep out insects
- Protect from winter freezing
- Use potable-rated material for potential emergency / human uses

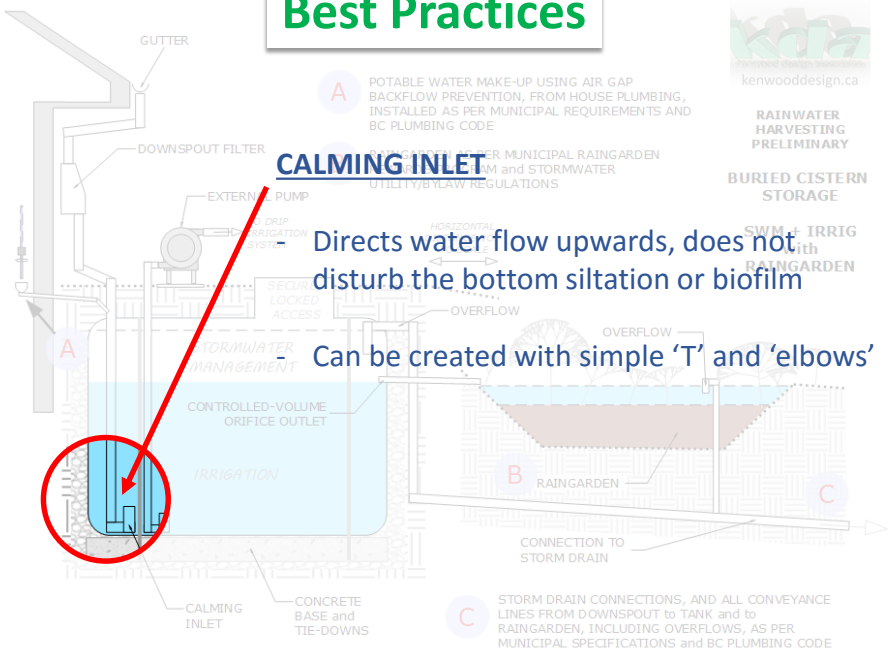
Best Practices



PRE-STORAGE FILTRATION

- Debris filter (leaves, needles, etc.)
- 1/16” mesh to keep mosquitoes out
- Optional:
  - Finer mesh for smaller debris/silt (~280 micron)
  - (not shown: filter bypass connection to storm drain system for waste water)

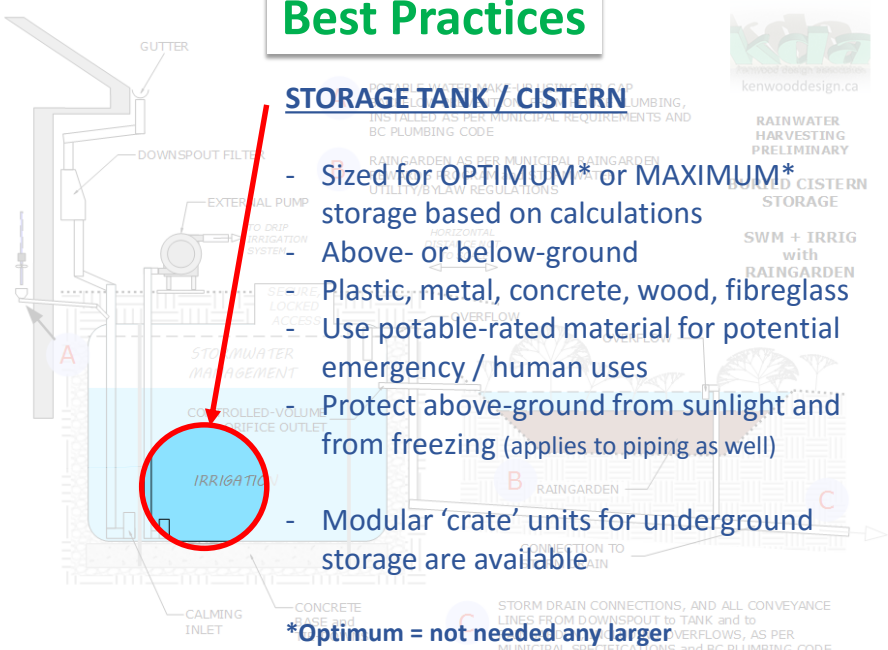
Best Practices



CALMING INLET

- Directs water flow upwards, does not disturb the bottom siltation or biofilm
- Can be created with simple 'T' and 'elbows'

Best Practices

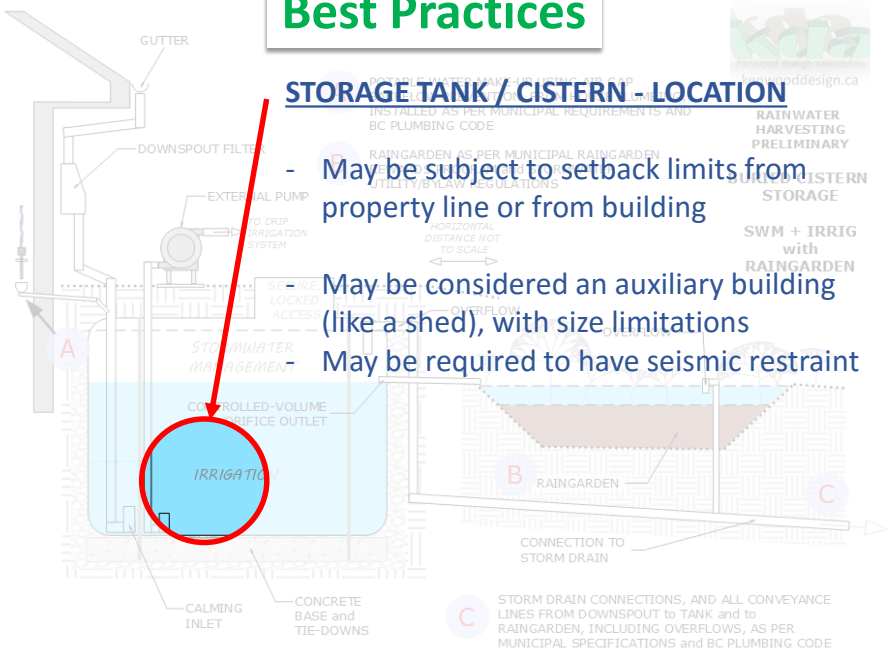


STORAGE TANK / CISTERN

- Sized for OPTIMUM* or MAXIMUM* storage based on calculations
- Above- or below-ground
- Plastic, metal, concrete, wood, fibreglass
- Use potable-rated material for potential emergency / human uses
- Protect above-ground from sunlight and from freezing (applies to piping as well)
- Modular 'crate' units for underground storage are available

***Optimum = not needed any larger**
***Maximum = cannot collect any more water**

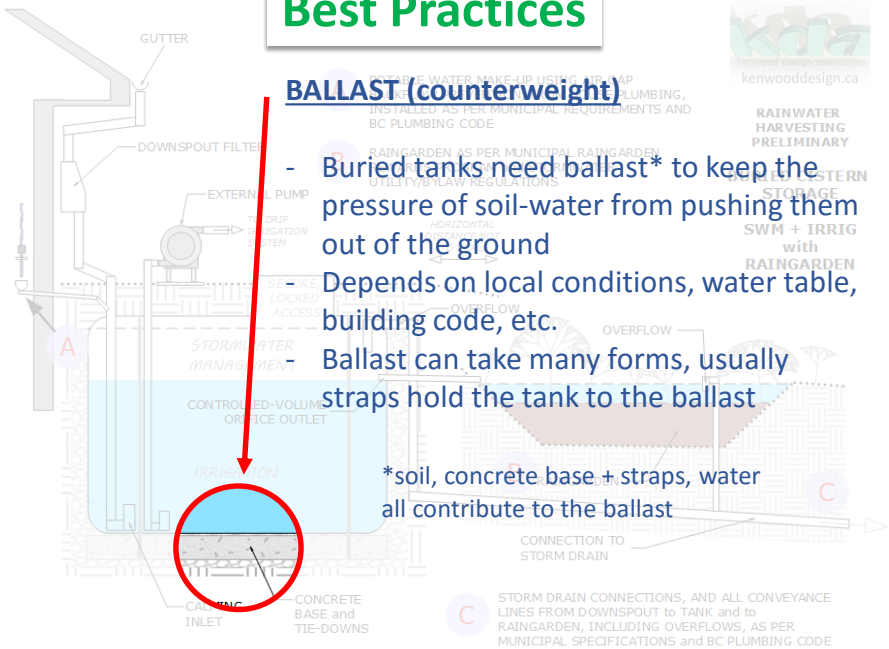
Best Practices



STORAGE TANK / CISTERN - LOCATION

- May be subject to setback limits from property line or from building
- May be considered an auxiliary building (like a shed), with size limitations
- May be required to have seismic restraint

Best Practices



BALLAST (counterweight)

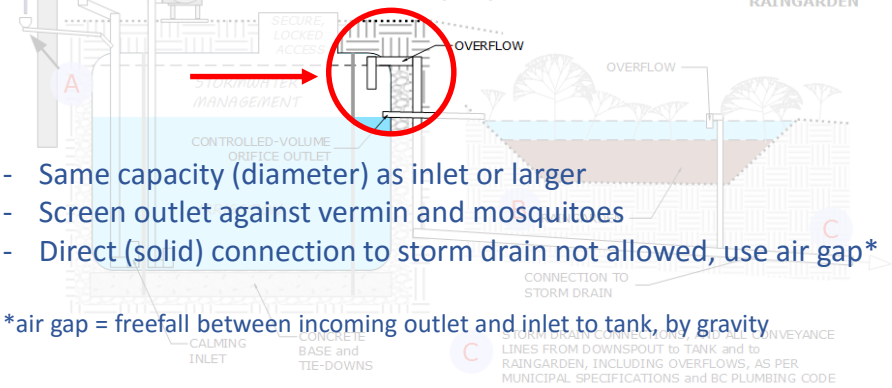
- Buried tanks need ballast* to keep the pressure of soil-water from pushing them out of the ground
- Depends on local conditions, water table, building code, etc.
- Ballast can take many forms, usually straps hold the tank to the ballast

*soil, concrete base + straps, water all contribute to the ballast

Best Practices

OVERFLOW

- Slightly lower than horizontal inlet
- Sets maximum tank level
- Slope away from tank and building(s)



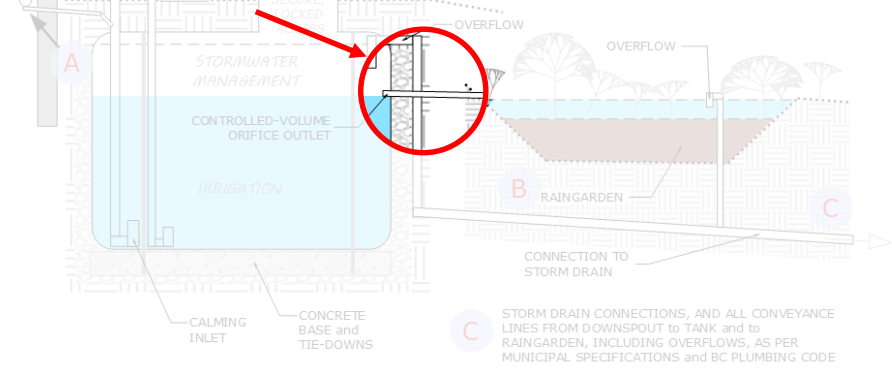
- Same capacity (diameter) as inlet or larger
- Screen outlet against vermin and mosquitoes
- Direct (solid) connection to storm drain not allowed, use air gap*

*air gap = freefall between incoming outlet and inlet to tank, by gravity

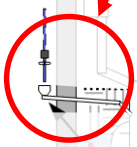
Best Practices

OPTIONAL: CONTROLLED RELEASE OUTLET to RAINGARDEN or to STORM DRAIN

- Smaller size than overflow (restrictive, controlled)
- Controls normal level of tank, reserve left in tank for other uses



Best Practices



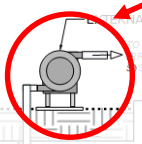
OPTIONAL: MAKE-UP SUPPLY (if permitted)

- Municipal water supply, automatic valve controlled by float switch in tank
  (too-low tank = make-up valve opens)
- Uses air gap* plus likely backflow prevention**

*air gap = freefall between incoming outlet and inlet to tank, by gravity

** backflow prevention = cross-connection control: device or assembly, licensed plumber or cross-connection control certified

Best Practices

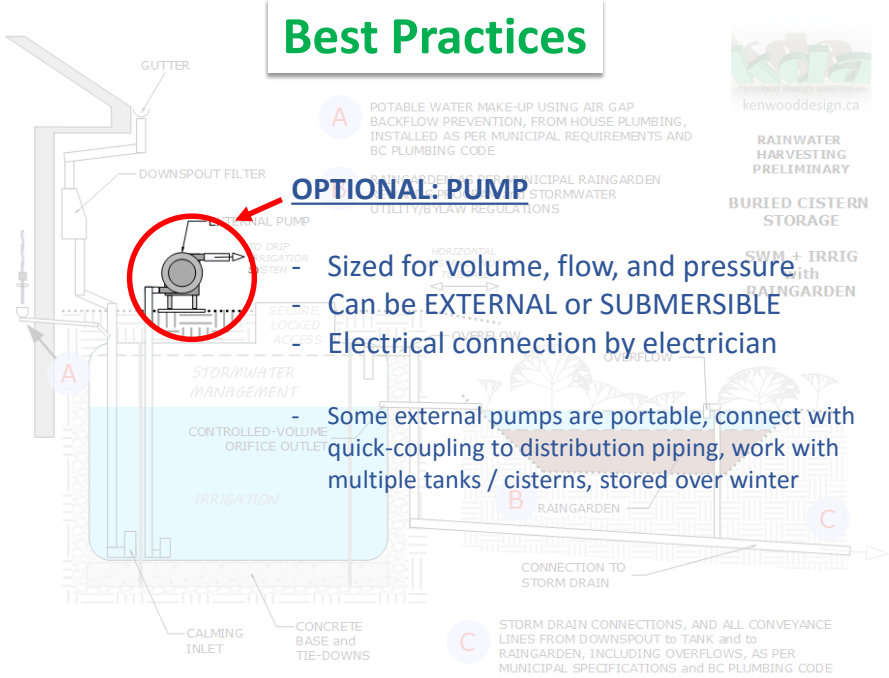


OPTIONAL: PUMP

- Sized for volume, flow, and pressure
- Can be EXTERNAL or SUBMERSIBLE
- Electrical connection by electrician

- Some external pumps are portable, connect with quick-coupling to distribution piping, work with multiple tanks / cisterns, stored over winter

Best Practices



OPTIONAL: PUMP

- Sized for volume, flow, and pressure
- Can be EXTERNAL or SUBMERSIBLE
- Electrical connection by electrician

- Some external pumps are portable, connect with quick-coupling to distribution piping, work with multiple tanks / cisterns, stored over winter

Rainwater Harvesting Best Practices

Ken Nentwig

ken@canarm.org
ken.nentwig@gmail.com
250 999 2472
604 757 1805