URBANGREEN Stormwater Solutions

Rainwater Harvesting

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UrbanGreen Rain Water Harvesting

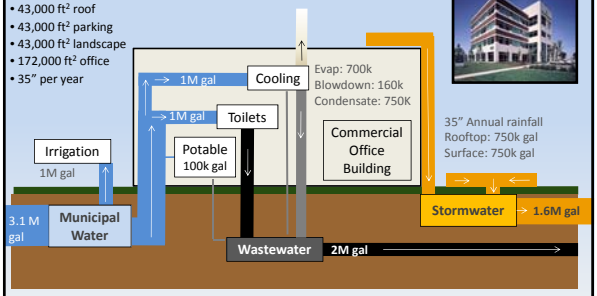
- RWH: A Runoff Reduction Tool
- Components
  - Pretreatment
  - Storage
  - Mechanicals Systems
- Design and Sizing
  - Runoff Reduction Calculator
- Case Studies

Total Site Solutions from CONTECH

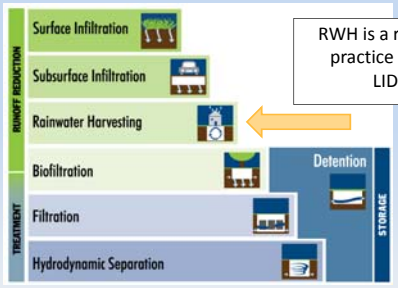
- **Stormwater**
- **Bridge**
- **Drainage / Sanitary / Irrigation**
- **Erosion Control**
- **Retaining Wall**
- **Soil Stabilization**

Water Management: Drinking, Waste, Storm

Commercial Development
- 43,000 ft² roof
- 43,000 ft² parking
- 43,000 ft² landscape
- 172,000 ft² office
- 35" per year



Stormwater Selection Staircase



RWH is a runoff reduction practice included in many LID regulations

RWH and LEED

Sustainable Sites
- 6.1 Stormwater Quantity
  - Pre-development peak and quantity – 1 Point
- 6.2 Stormwater Quality
  - Reduce annual TSS by 80% – 1 Point

Water Efficiency
- 1.0 Water Efficient Landscaping
  - Reduce by 50% - 2 Points
  - No Potable Use – 4 Points
- 2.0 Innovative Wastewater Technologies
  - Reduce potable water used for sewage – 2 points
  - OR
  - 50% onsite treatment – 2 points
- 3.0 Water Use Reduction
  - 30% reduction from Baseline – 2 points
  - 35% reduction from baseline – 3 points
  - 40% reduction from baseline – 4 points

LEED	12
• SS 6.1 (Quality)	1
• SS 6.2 (Quantity)	1
• WE 1 (Irrigation)	4
• WE2 (Wastewater)	2
• WE 3 (Indoor water)	4

DOE Volume 5 2012 Guidance

BMP T5.20: Rainwater Harvesting *Purpose and Definition*

Rainwater harvesting is the capture and storage of rainwater for beneficial use. Roof runoff may be routed to cisterns for storage and nonpotable uses such as irrigation, toilet flushing, and cold water laundry. Rainwater harvesting can help reduce peak stormwater flows, durations, and volumes. The amount of reduction achieved with cistern storage is a function of contributing area, storage volume, and rainwater use rate.

Design Criteria

- 100% reuse of the annual average runoff volume (use continuous runoff model to get annual average for drainage area).
- System designs involving interior uses must have a monthly water balance that demonstrates adequate capacity for each month and reuse of all stored water annually.

Runoff Model Representation

- Do not enter roof area draining to cistern into the runoff model.

Other Criteria

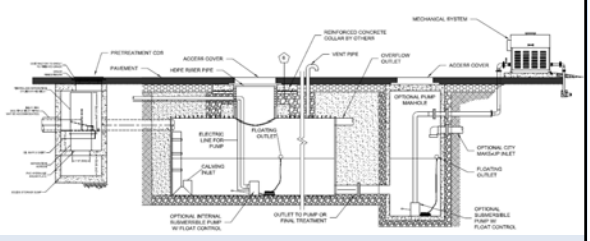
- Restrict use to 4 homes/acre housing and lower densities when the captured water is solely for outdoor use.

DOE LID Manual 2012 Guidance

- **Section 6.7.2 Design**
  - "In the Maritime Northwest rainwater collection should be sized to store as much rainfall as possible in April and May to provide water as far into the summer months as possible."
- **Section 7.7 of LID Design Manual**
  - "Do not enter roof drainage area into the runoff model. Note: This applies only to the roof drainage areas for which a monthly water balance indicates no overflow of the storage capacity."

Components

System Components



Pretreatment

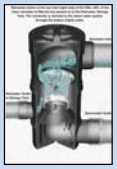


Photo source: http://www.wiley.de/eng/eng/wf1xx.htm

- Wall mounted or Underground
- Often called filtration but in reality it is usually screening
- Remove organic matter
- Recommended even for roof collection
- Look for:
  - Easy maintenance
  - Non-clogging

Photo source: http://www.rainharvest.com/graf-optimax-filter-pedestrian.asp

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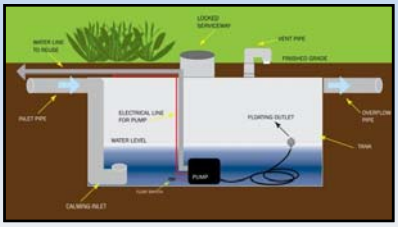
How to Store

- **Location:** Above or below ground
- **Loading :**HS-20 or higher
- **Longevity :** 20-100 years
- What Differentiates a Cistern from Detention:



Cistern Options

- Fiberglass
- Plastic Crates
- Concrete
- Metal
- Steel Reinforced Polyethylene

Photo source: http://wahaso.com

Steel Reinforced Polyethylene Cistern

Material

- HDPE
  - –High Performance Resin
  - –Recycled not allowed by standards
  - –1/3 of weight
- Steel
  - –55% post consumer recycled
  - –2/3 of weight
- Total Recycled Content: 37%

Design Life (depends of pressure)

- Cisterns: 75 years
  - –Max pressure is storage head
  - –Intermittent pressure up to 4.3 psi (120")
- Pressure Applications: 50 years
  - –15 psi continuous pressure
- Drainage: 100 years
  - –Gravity Flow

Mechanical System Components

Treatment Guidelines: Check Local Code

Water Source		Non-Potable Application
Rainwater/Stormwater →	Pretreatment 100um Filtration	**Irrigation** • Subsurface: nothing more • Drip: nothing more (usually) • Spray: Ultraviolet **Wash water:** finer filtration, Ultraviolet **Indoor:** finer filtration, Chlorination **HVAC Makeup:** finer filtration
HVAC Condensate →	Check metals	
HVAC Blow down Municipal Reclaimed Water →	Check Total Dissolved Solids	**Irrigation:** Dilute if TDS too high **Other Uses**: Ensure TDS level won't affect fixtures
Greywater →	Max Hold Time	**Irrigation:** Subsurface or Drip **Other uses:** more treatment

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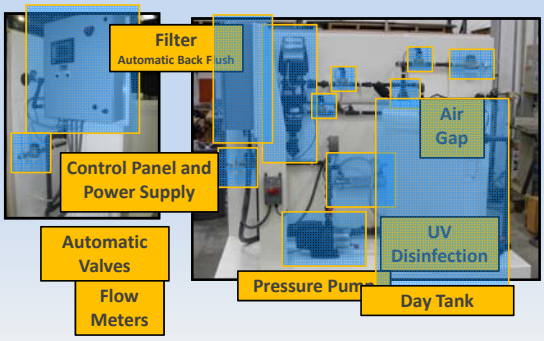
Example: Mechanical System



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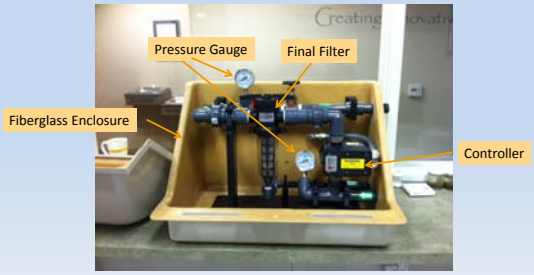
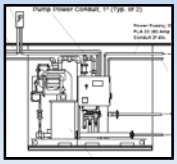
Example: Drip Irrigation Mechanical Skid



Mechanical System – Install Location

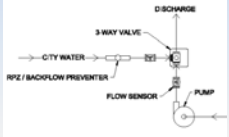
Indoor Skid Mounted	Outdoor Enclosure	Underground Vault
		

Pump Location

Submersible in Wetwell	Submersible in Cistern	Suction Above Ground

Make-up Water

- **Air Gap**
  - Required in Some States (Oregon)
  - Requires Re-Pressurization of Make-Up Water
- **3-Way Valve with Backflow Preventer**
  - Most Economical Design
  - Pressurizes Line when Cistern Level is Low
  - Not Allowed in All Areas



Final Treatment

- **Manual Filtration**
  - Bag filter/Screen
  - Maintenance: Manually clean/replace
  - Typically 50-200 microns
- **Automatic Filtration**
  - Bag Filter/Screen with drain
  - Maintenance: Automatic Drain Opening to Flush Filter
  - Typically 20-200 microns
- **Suction Scanning Filtration**
  - Auto-backflush based on pressure, time, and volume
  - Maintenance: Automatic Scrubbing of Screen with Waste to Drain
  - Typically 5-200 microns

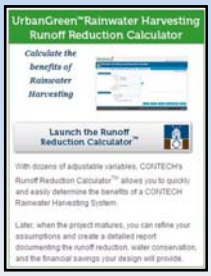
Maintenance

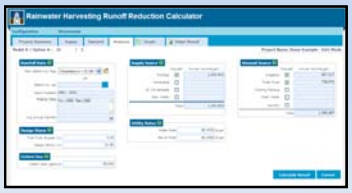
- **Cistern**
  - Ensure calming inlet is free from debris
  - Measure sediment depth > 4" indicates maintenance is needed
  - Check for floating debris and remove
- **Mechanical System**
  - Check Manual Filter – Clean or Replace
  - Replace UV Bulb Annually
  - Inspect Pumps for Wear

Runoff Reduction Model

RWH Sizing Online

www.conteches.com/Design-Toolbox/DYO-Project.aspx





Seattle Multi-Family: Site Overview

Mixed Use – Residential Portion

Rooftop Area: 20,000 ft²

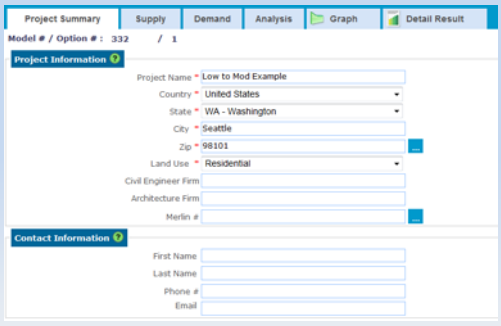
Building Area: 120,000 ft²

- 85% of area res. Units
- 1,200 ft² per unit
- 85 units

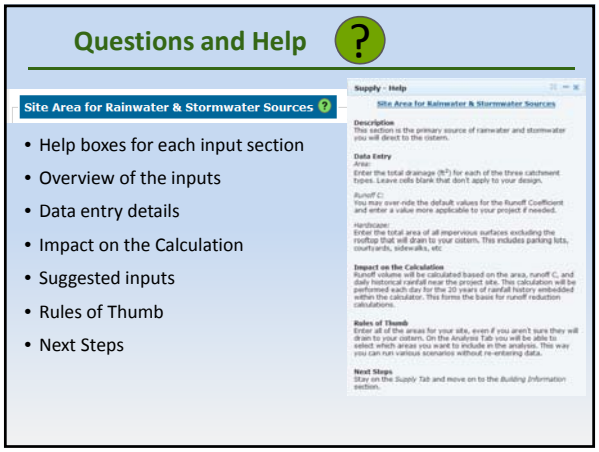
Hardscape Area: 7,500 ft²

Landscape Area: 7,500 ft²

Seattle – Multi-Family: Project Page

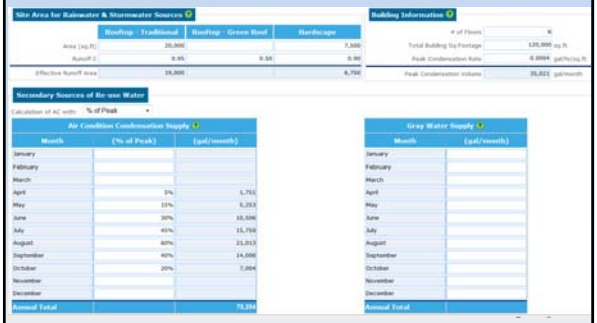


Questions and Help

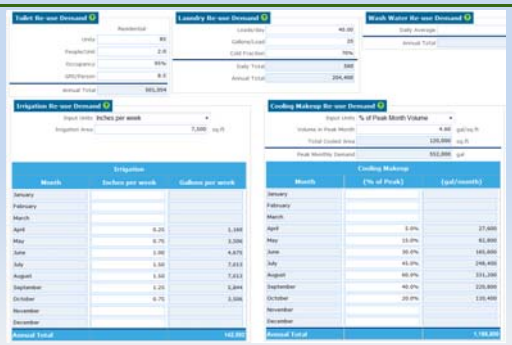


- Help boxes for each input section
- Overview of the inputs
- Data entry details
- Impact on the Calculation
- Suggested inputs
- Rules of Thumb
- Next Steps

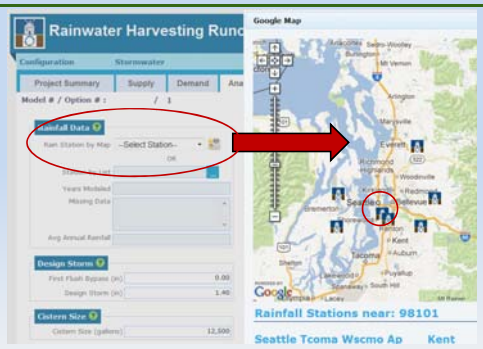
Seattle Multi-Family: Supply



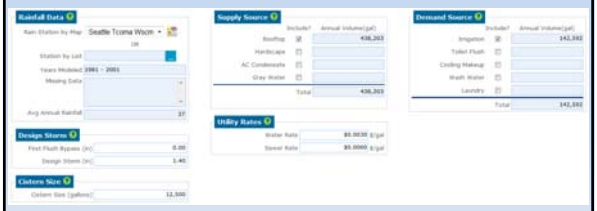
Seattle Multi-Family: Demand



Seattle Multi-Family: Analysis – Rain Gage



Seattle Multi-Family: Analysis Inputs



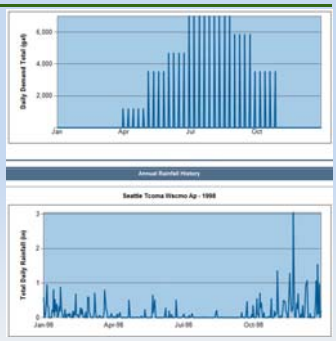
Annual Rainfall: 37in
First Flush Bypass: 0
Design Storm: 1.4in
Cistern Size: 12,500

Rooftop: 430k gal/yr

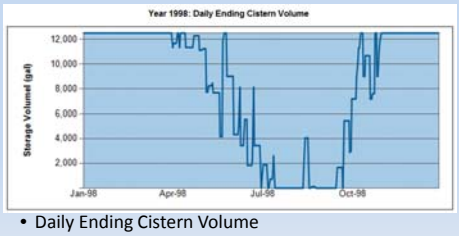
Irrigation: 142k gal/yr

Seattle Multi-Family: Graphs

- Annual Demand pattern
  - Weekly irrigation
  - Minimal in winter
  - Max in summer
- 1998 Rainfall Data
  - Dry Summers
  - Not aligned with Demand
- Need Winter demand



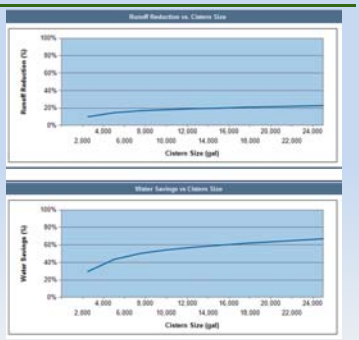
Seattle Multi-Family: Graphs



- Daily Ending Cistern Volume
  - Full in winter
  - Fills/empties in spring/fall
  - Mostly empty in summer

Seattle Multi-Family: Graphs

- **Cistern vs Runoff Red.**
  - 19% Runoff Reduction
  - Diminishing returns on cistern size
- **Cistern Size vs. Water Savings**
  - 55% water savings
  - For irrigation



Seattle Multi-Family – Summary Results

	Rainfall		Stormwater		Supply		Demand	Captured
	Total	Targeted	Targeted	Peak	Targeted/RW	Total		
Typical Rainfall Year	37	36	427,494	13,422	427,494	438,999	142,592	82,077
Max Rainfall Year	51	48	567,296	32,806	567,296	600,102	142,592	93,841
21 Year Total	779	759	8,976,538	241,803	8,976,538	9,218,141	2,994,432	1,723,628

	Runoff Retained (Targeted Rainfall)		Water Savings		Total Retained (Targeted, Peak, Secondary)		Savings
Typical Rainfall Year	82,078	20%	81,482	57%	82,077	19%	$733
Max Rainfall Year	93,841	17%	93,841	66%	93,841	16%	$845
21 Year Total	1,723,628	19%	1,711,125	57%	1,723,628	19%	$15,403

Previous Next Save Save and Download Cancel

- 19% Runoff Reduction
- 57% Water Savings
- $733 savings per year

Seattle Multi-Family: Toilet Flushing

- 71% Runoff Reduction, 60% water savings, $2,700/yr

Detailed Results and Report

- Detailed Results
  - Each year
- Report
  - Documentation
  - Input screens
  - Graphs
  - Summary Results
  - Detailed Results
  - Download – excel or PDF

Case Studies

South Seattle Transfer Station

ElectroFusion Coupler

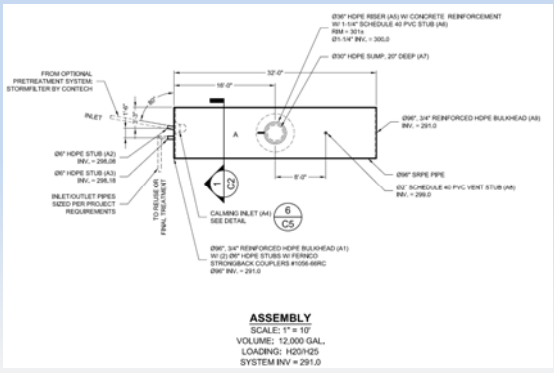
Power Core Heating Coils
- **Double Seal on each pipe**
- **Field testable after install**
- **No water or pressure test needed**

Fort Lewis Air Support Ops Squadron

- Rainwater Harvesting Cistern Collects rainwater from the roof of the weather squadron facility
- Rainwater is used for irrigation
- Overflow is routed to infiltration trench and rain garden
- Cistern size: 12,000 gallons
- Cistern Footprint: 96” Diameter, 32’ long
- Integrated sump for pump

JBLM
Joint Base Lewis-McChord

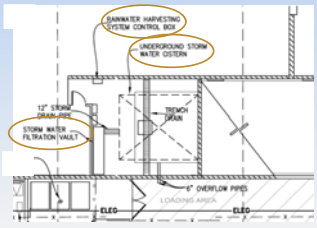
Fort Lewis Cistern Detail



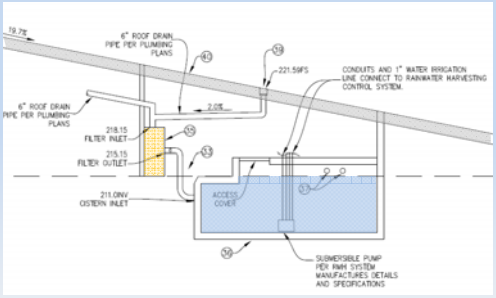
Fort Lewis Cistern

CVS Pharmacy

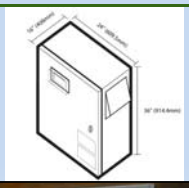
- Located in Los Angeles, CA
- Water used for irrigation and drip system to potted plants
- Installed Under Parking Garage Ramp



CVS Pharmacy Los Angeles



CVS Pharmacy Los Angeles



Summary

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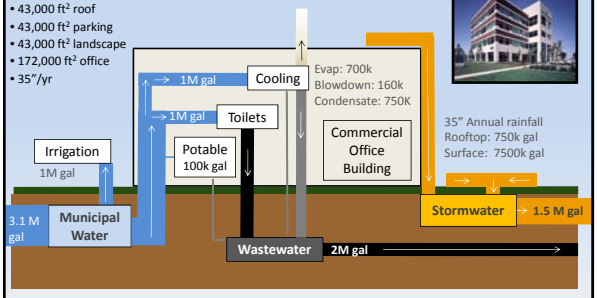
- 43,000 ft² landscape
- 172,000 ft² office
- 35"/yr



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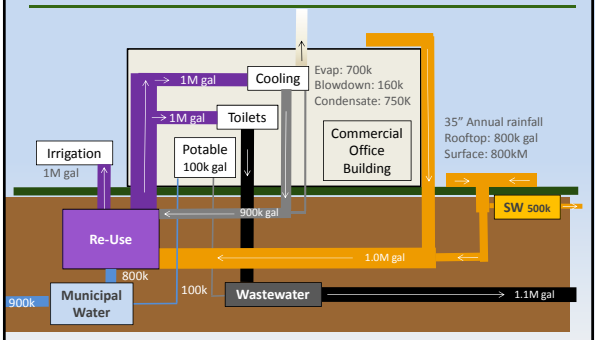

QUESTIONS?

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