ASIC

2019 NATIONAL CONFERENCE
SANTA FE, NEW MEXICO

Discussing the Value of Sustainability in the Irrigation Industry

Bryce Carnehl – Corporate Social Responsibility Manager, Hunter Industries

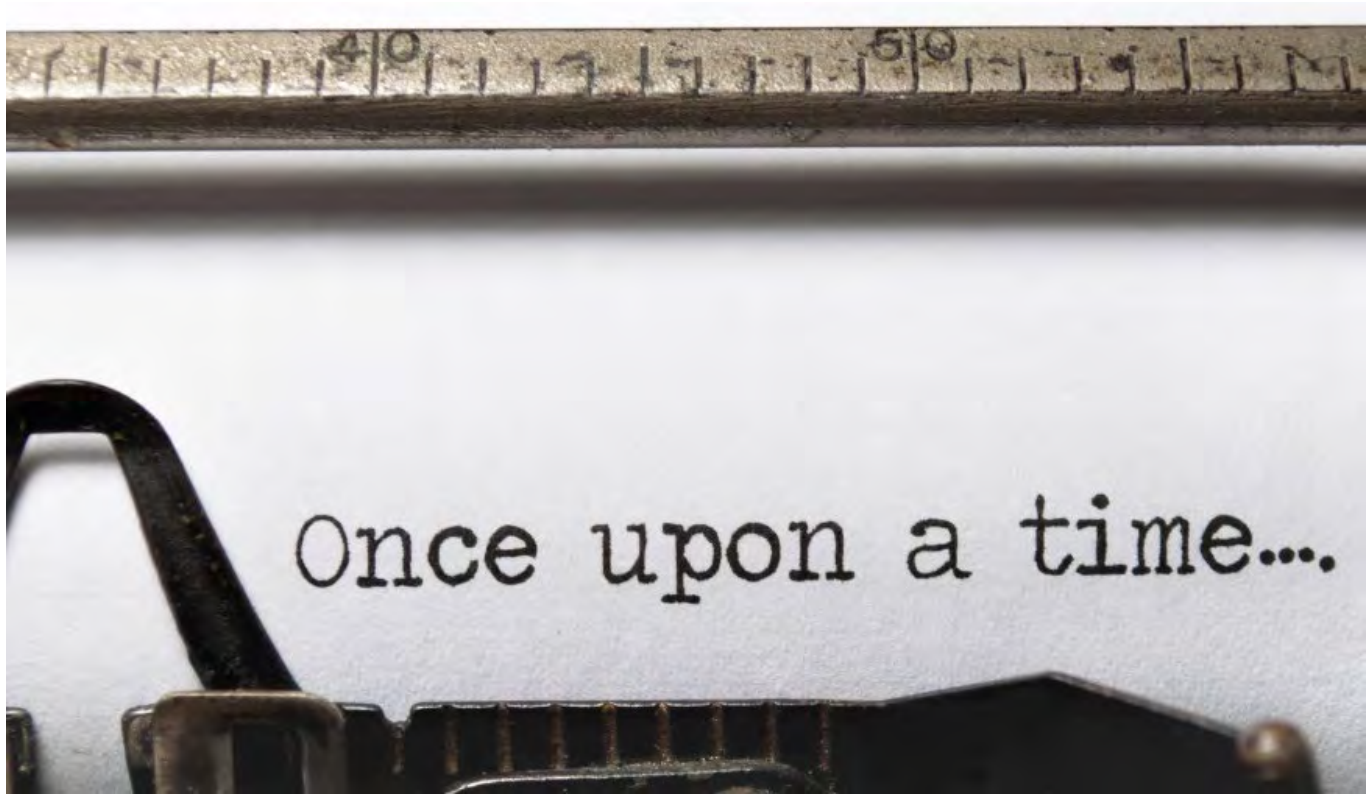
Warren Gorowitz – Vice President of Sustainability, Ewing Irrigation & Landscape Supply

Sustainability… Being Green

We’re part of the ”Original” Green Industry!

- Landscape Contractors
- Interiorscape Contractors
- Irrigation Consultants
- Landscape Architects
- Golf Course Superintendents
- Growers & Nurseries
- Sports Turf Managers
- Manufacturers & Distributors
- Urban Agriculture

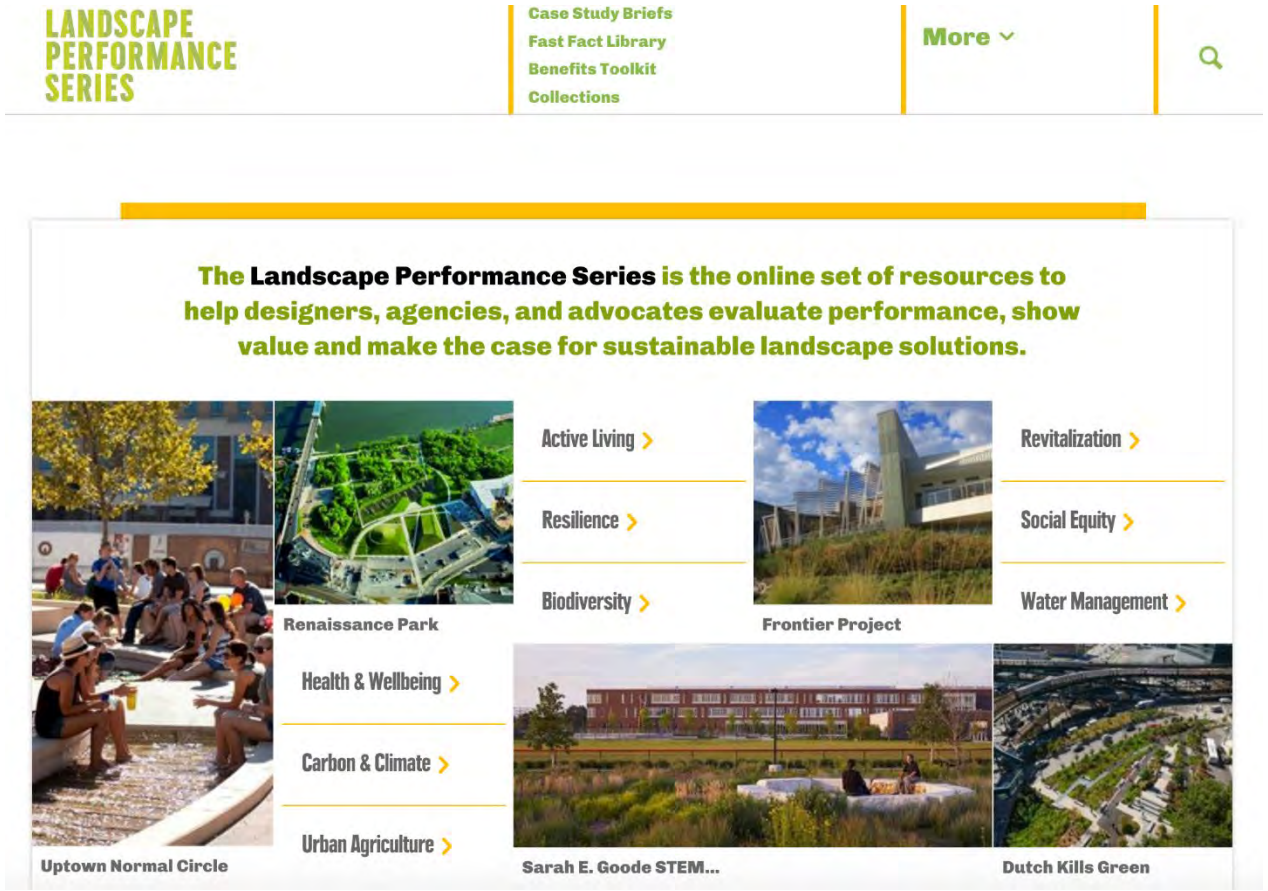
WE ARE THE ORIGINAL GREEN INDUSTRY

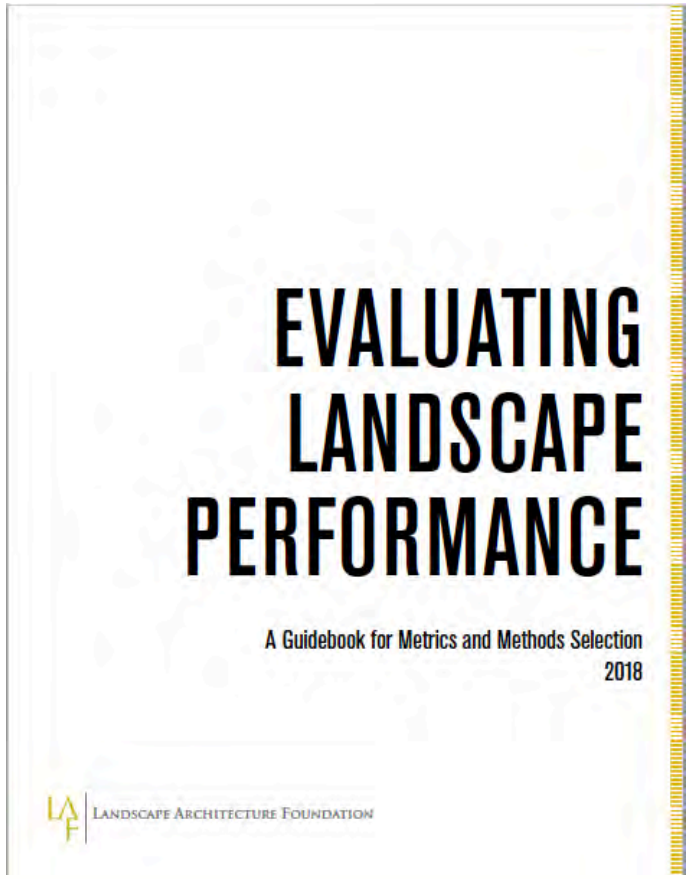


Irrigation is a necessity to sustain most green spaces in the urban environment

But, most of the time nobody actually gets to see our work…

Shift from Landscape Aesthetics to Performance





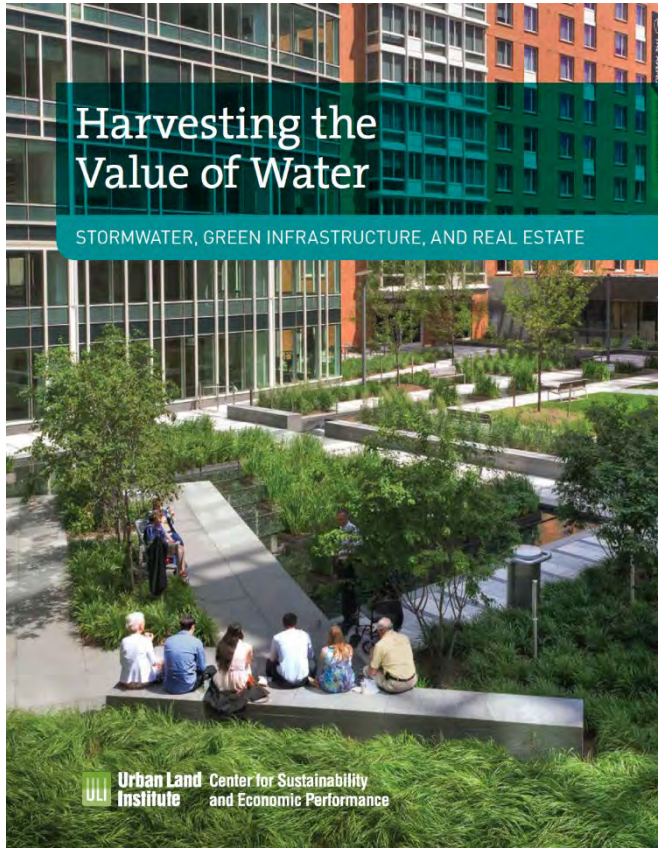
Eco-System Services provided by Green Infrastructure

05.02.17

These Cities Are Replacing The Worst Kind Of Infrastructure With The Best

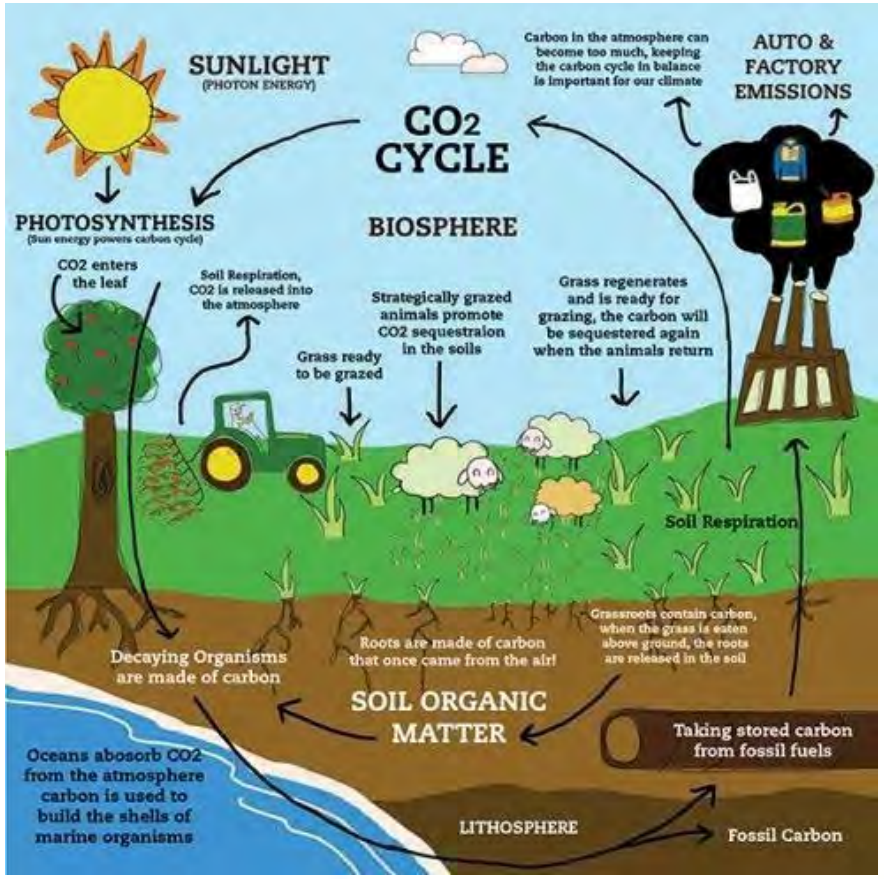
R.I.P. parking lots.

3/7 [Image: courtesy SWA]

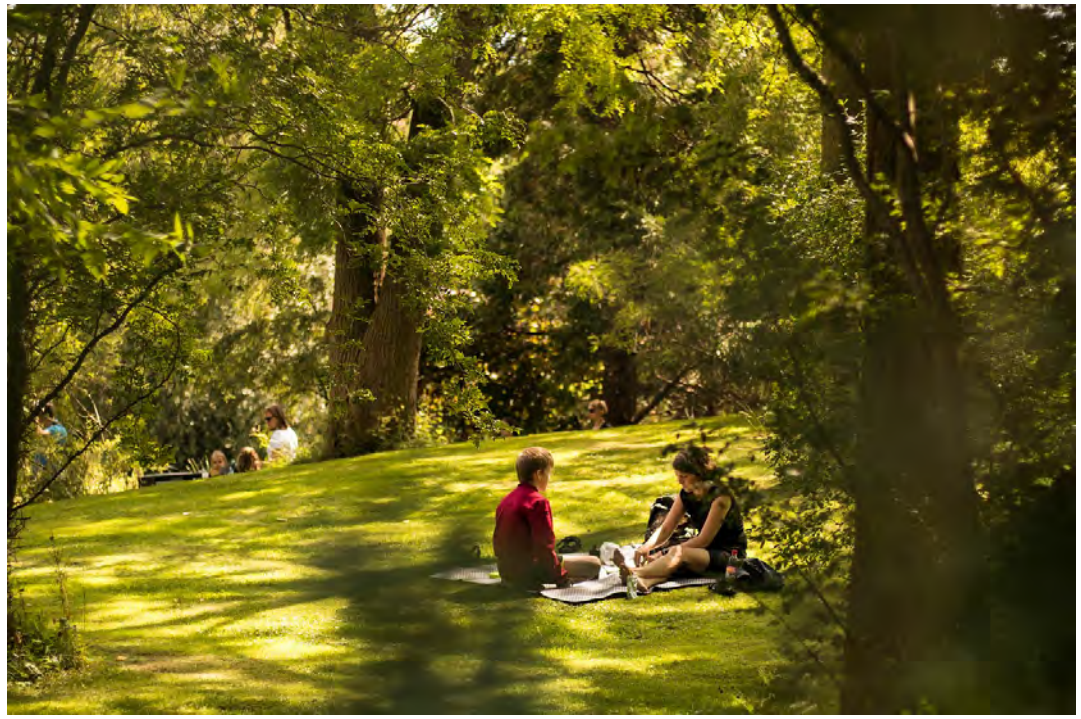


Economic Value and Benefits of Irrigated Green Spaces

Environmental Benefits of Irrigated Green Spaces



The Social Benefit of Green Spaces



Health and Well-Being Value of Irrigated Green Spaces

Polarized View of Green Spaces

Polarized View of Green Spaces

Irrigation often takes the blame…

Polarized View of Green Spaces

Irrigation often takes the blame…

Polarized View of Green Spaces

Context plays a role as well…

Polarized View of Green Spaces

As does landscape planning…

Polarized View of Green Spaces

The reactions we have in times of crisis…

Polarized View of Green Spaces

…May cause more harm than good

Save Our Water
and Our Trees!

saveourwater.com/trees

Polarized View of Green Spaces

…May cause more harm than good

Polarized View of Green Spaces

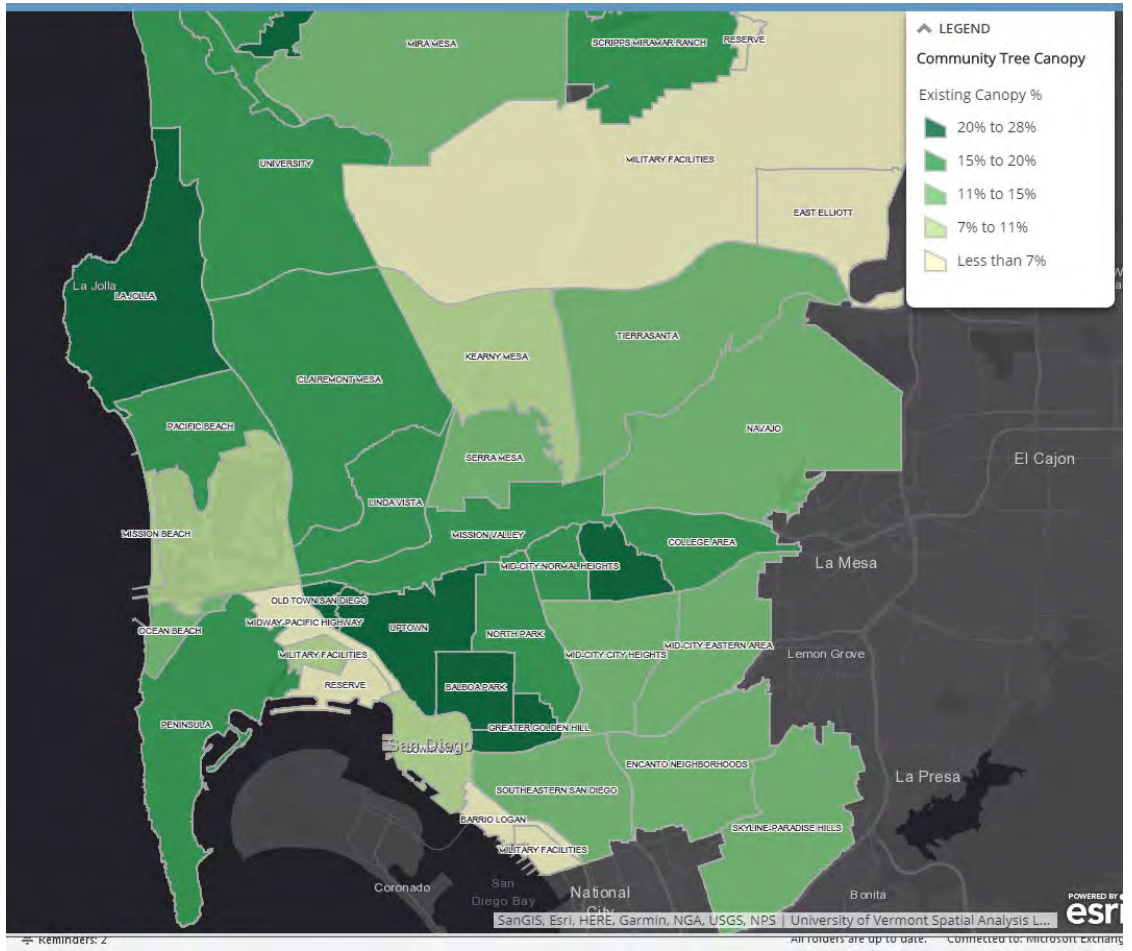
How does anyone make the right choice?

Polarized View of Green Spaces

More and more, the value of green spaces in being recognized

Trees

Trees are integral to meeting San Diego's commitment to climate change, carbon sequestration, storm water runoff reduction, and water conservation. As part of our urban forest, trees are found on both public and private property and help make our communities more sustainable and livable.



Polarized View of Green Spaces

More and more, the value of green spaces in being recognized

austintexas.gov
the official website of the City of Austin

Grow Zones

The City of Austin Parks and Recreation (PARD) and Watershed Protection (WPD) departments are working together to improve riparian zones in nineteen city parks.

What is a riparian zone?

The **riparian zone** is the transition area between the aquatic environment in the creek channel and the terrestrial environment outside the channel.

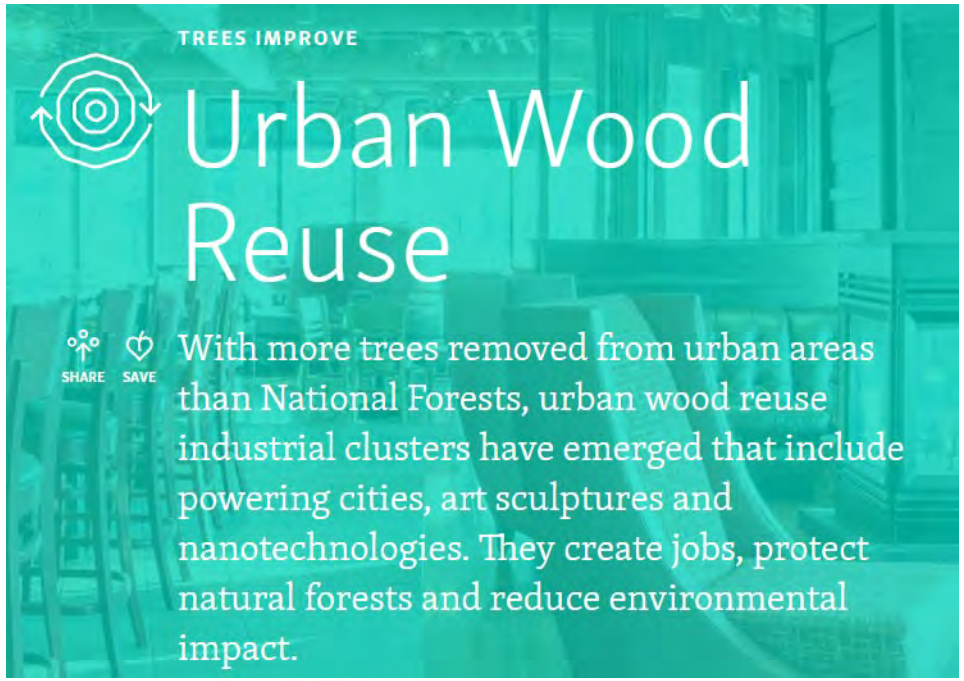
Benefits of riparian zones:

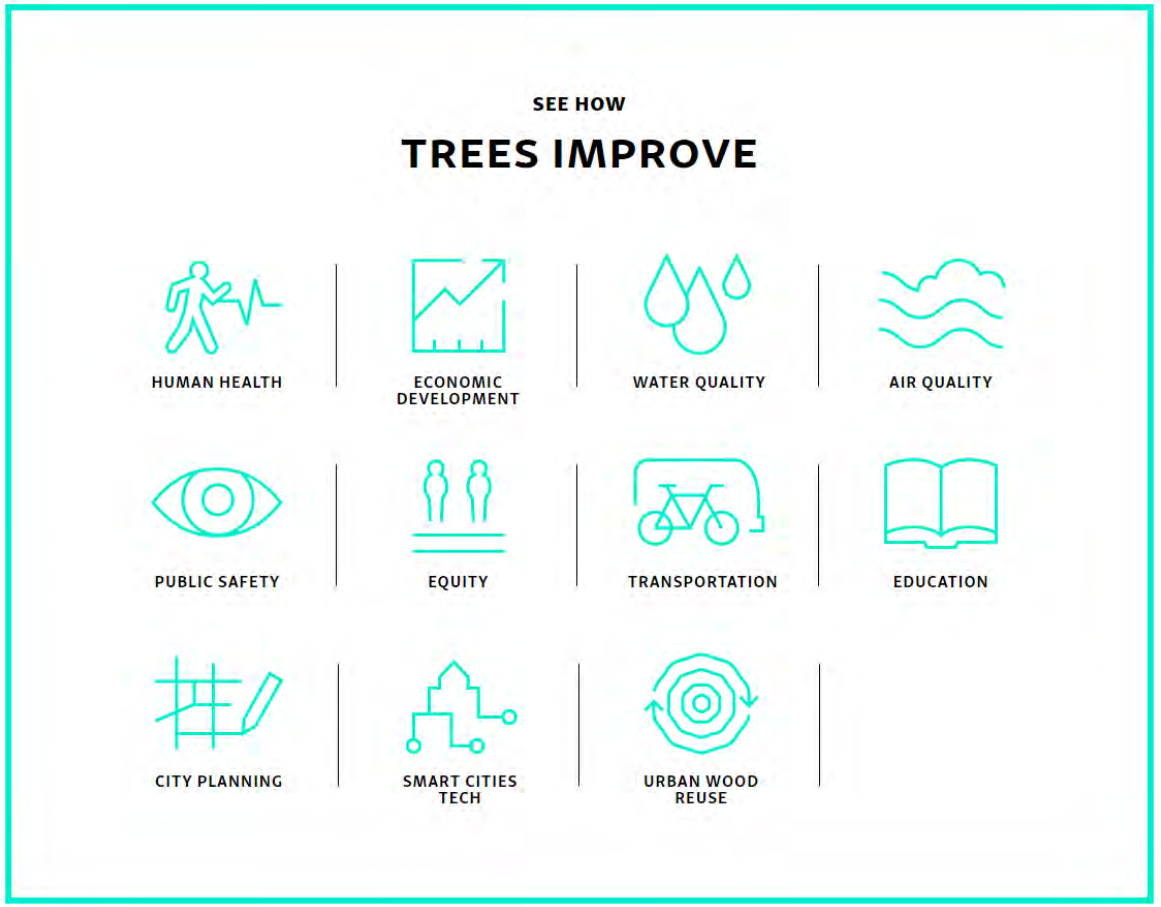
- Filter storm runoff, removing pollutants before they reach the creek
- Prevent stream bank erosion
- Slow flow, reducing downstream flooding
- Provide a "sponge" that will absorb water
- Provide shade that cools air and water temperatures
- Provide habitat and food for a diverse group of animals
- Reduce the City's carbon footprint via both sequestration and reduced emissions.
- Reduce mowing and maintenance by City staff.
- Creates a greenbelt forest and stream amenity with diverse tree and plant communities for outdoor enthusiasts.

Polarized View of Green Spaces

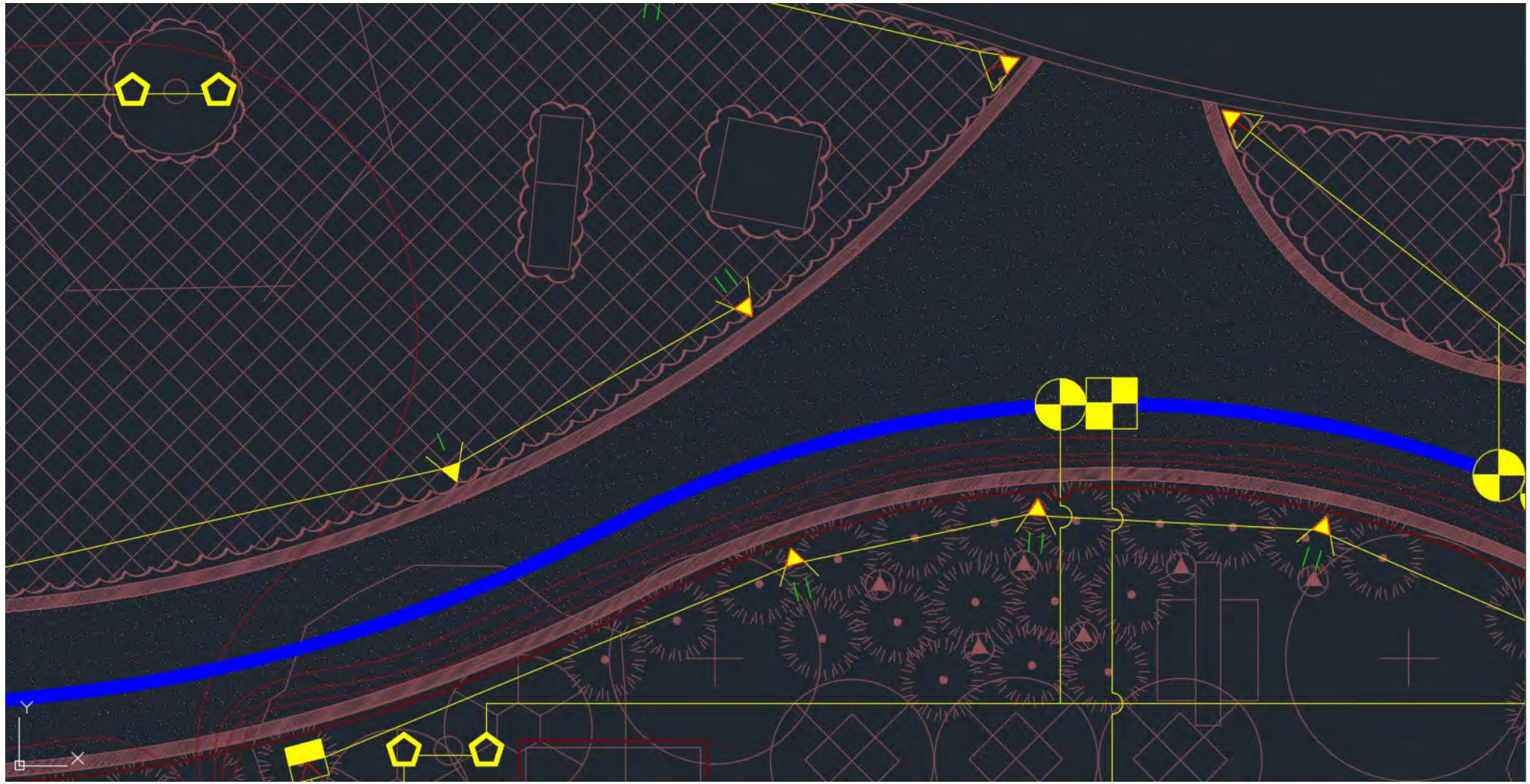
More and more, the value of green spaces in being recognized

VIBRANT CITIES LAB





Responsibilities of Irrigation Consultants

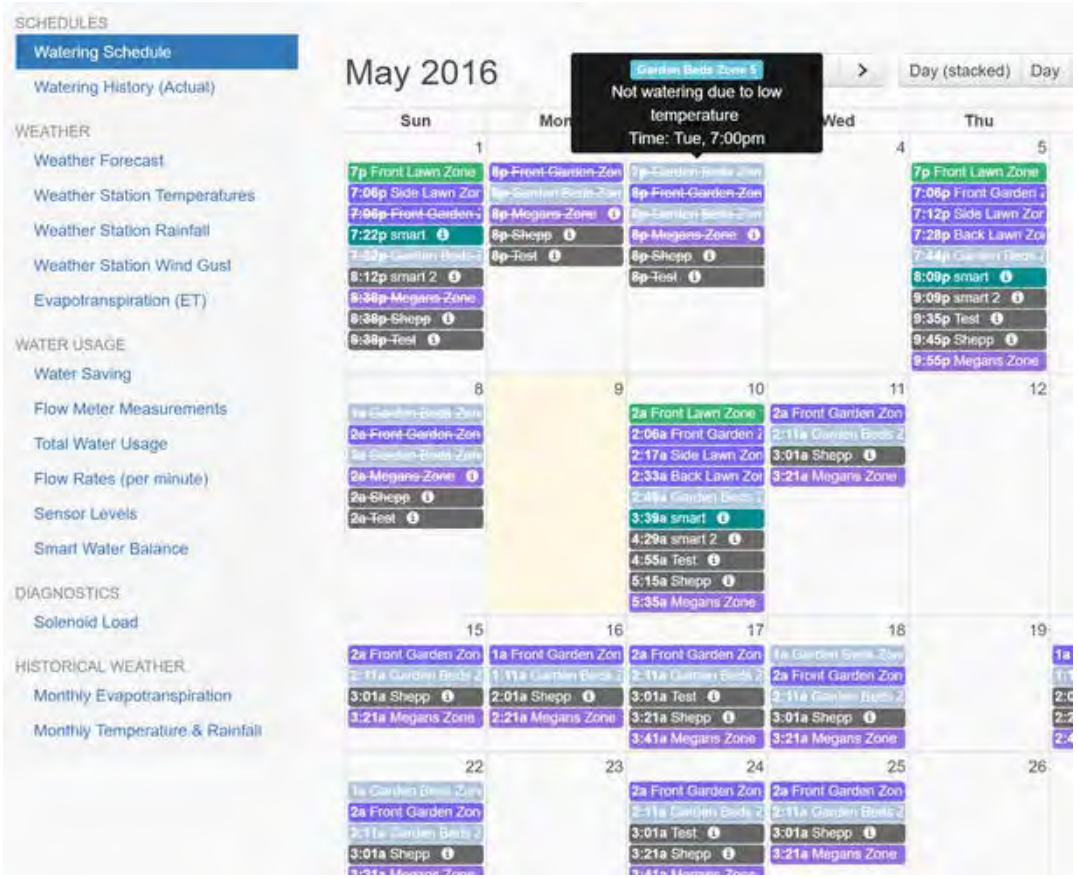


Responsibility of Irrigation Consultants

Best Practices for Design, Management and Maintenance

Responsibility of Irrigation Consultants

Best Practices for Design, Management and Maintenance



Responsibility of Irrigation Consultants

Best Practices for Design, Management and Maintenance

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Best Practices for Design, Management and Maintenance

Responsibility of Irrigation Consultants

Responsibility of Irrigation Consultants

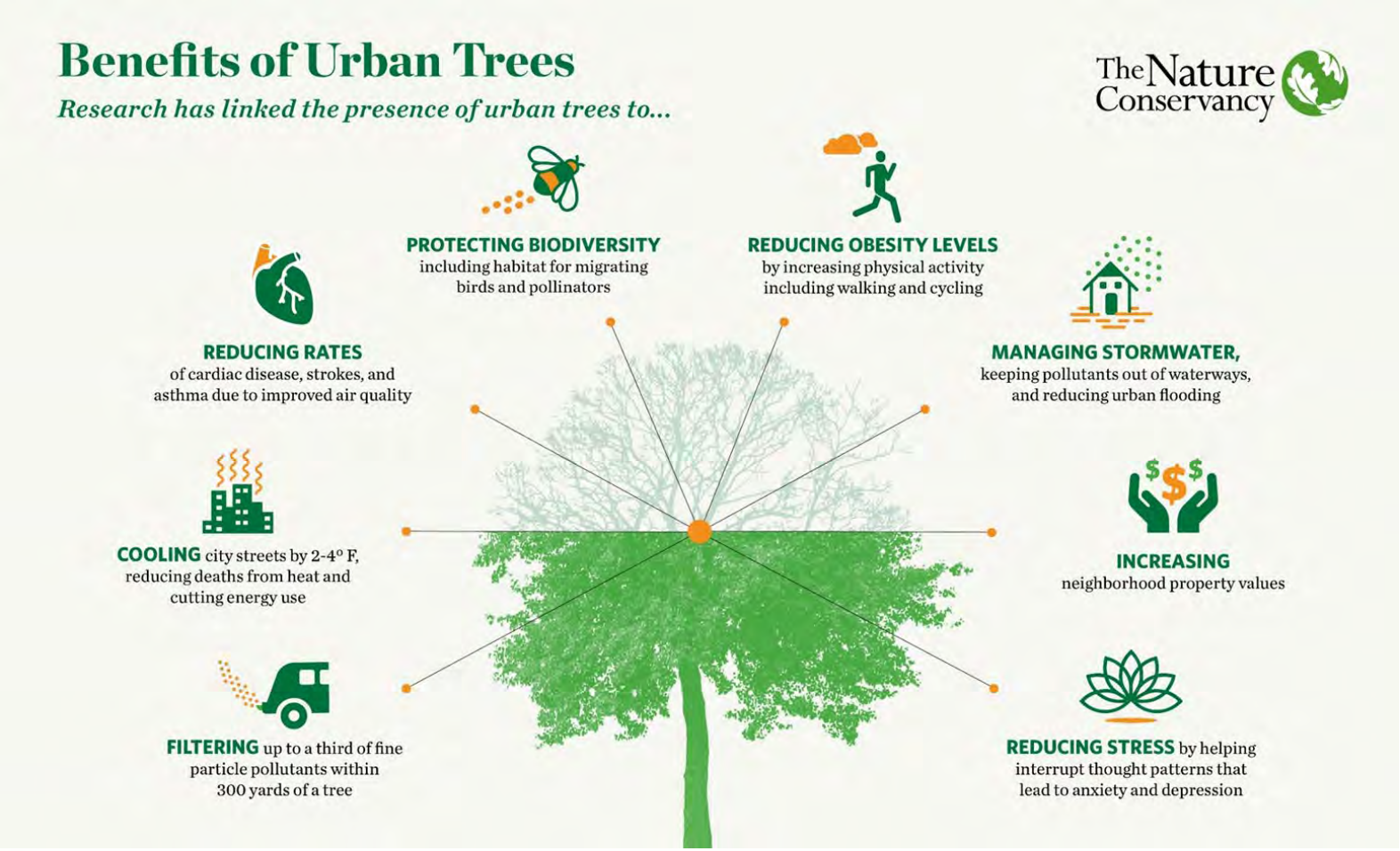
Innovate Water Supply Sourcing

Responsibility of Irrigation Consultants

Share your stories

Responsibility of Irrigation Consultants

Share your stories



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- https://www.hirerush.com/blog/how-to-start-a-vegetable-garden/

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SANTA FE, NEW MEXICO

Liquid Expectations – A Guide to Harvested Water Quality

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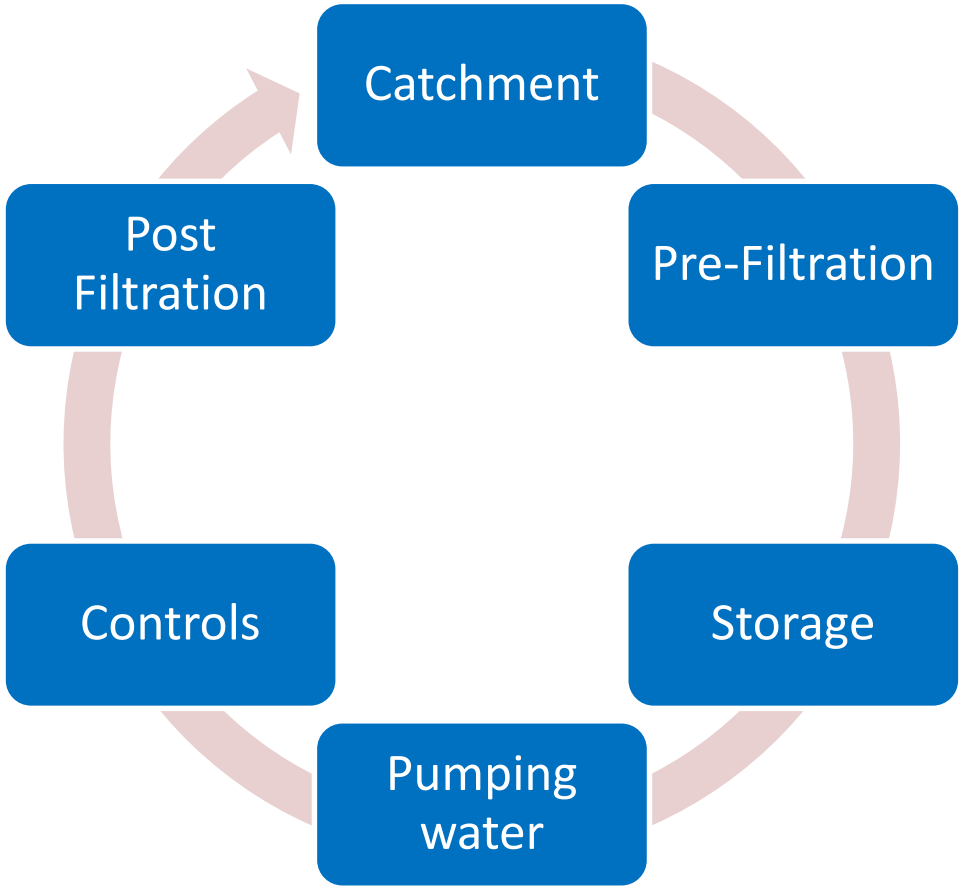
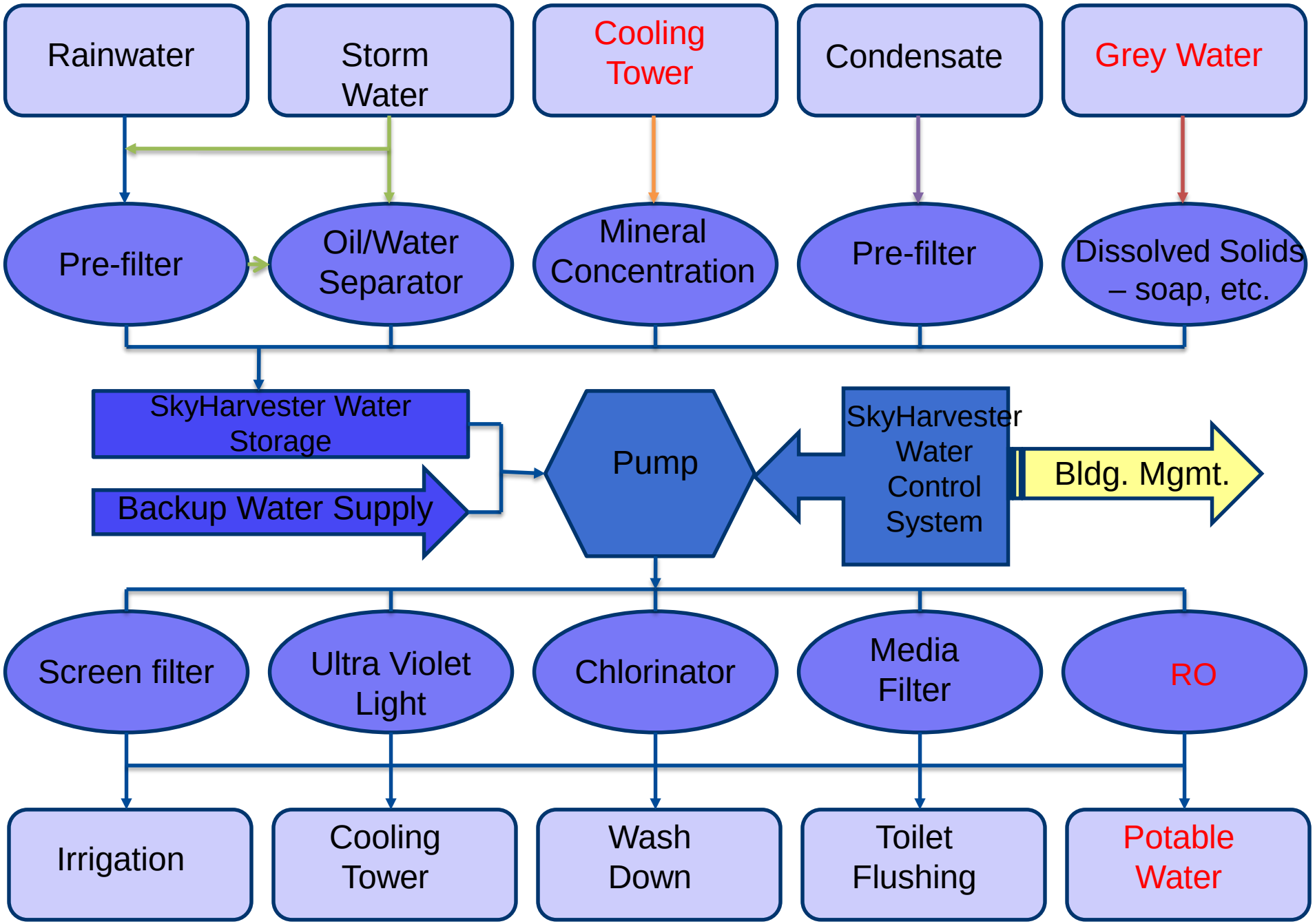
LEARNING OBJECTIVES

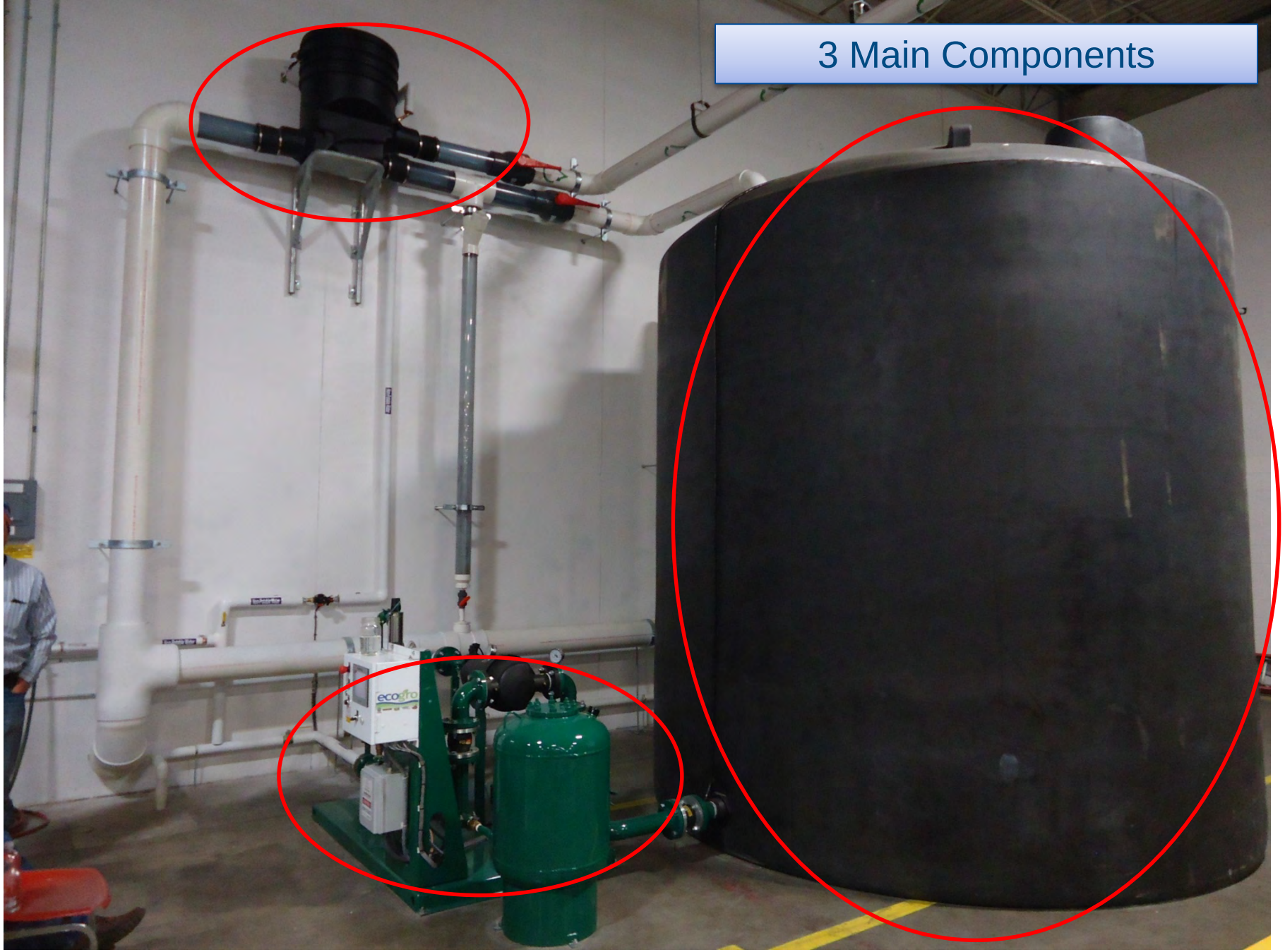
- Components of Rainwater Systems
- Tank Pre-filtration and sizing
- Common types of disinfection systems available
- Filtration integration into rainwater systems and for which water treatment purpose
- How to operate and size UV disinfection systems
- How a chlorine disinfection system works, and what to avoid in irrigation use
- What site circumstances will negatively affect water quality
- Common installation pitfalls

WATER HARVESTING
Major Components




Rainwater
Storm Water
Cooling Tower
Condensate
Grey Water
Pre-filter
Oil/Water Separator
Mineral Concentration
Pre-filter
Dissolved Solids – soap, etc.
SkyHarvester Water Storage
Backup Water Supply
Pump
SkyHarvester Water Control System
Bldg. Mgmt.
Screen filter
Ultra Violet Light
Chlorinator
Media Filter
RO
Irrigation
Cooling Tower
Wash Down
Toilet Flushing
Potable Water

3 Main Components



COMPONENTS – Pre-filter

- The best way to filter the water is at the source. The sooner we incorporate filtration, the better the rest of the system operates.
- Primarily particle filtration (TSS – total suspended solids)
- Oil/Water separation (Stormwater only – Hydro-Dynamic Separator)

Image courtesy of Graf

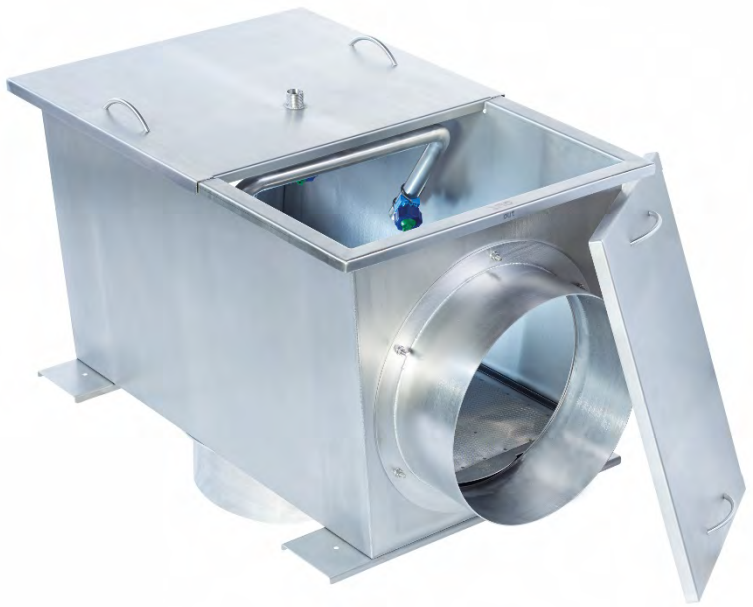


Image courtesy of Graf

Image courtesy of Contech

DESIGN OF COMPONENTS - Pre-filtration

- All Gravity type rainwater filters work on an efficiency principle
  - 200gpm @ 90% eff. = 180gpm to storage tank
- Sizes from 32 GPM to about 4,000gpm
- Some can be flushed with pressurized water
- Approx. 350 micron screens (.013”)
- Exception: Hydro-Dynamic separators 80% /100 micron

Image courtesy of Graf

DESIGN OF COMPONENTS - Pre-filtration

Image courtesy of Ridgewater Eng

Why Pre-Filtration?

Image courtesy of ITS Jim D.

Image courtesy of Contech.

Tank Pre-filtration

Commercial Installation Examples

Images courtesy of Watertronics

COMPONENTS - Storage

- Storage could be any vessel that can hold or retain water
- Tanks or Ponds
- Separate containment, or built into building foundation
- Below or Above ground

Image courtesy of Watertronics

Image courtesy of Watertronics

Image courtesy of Norwesco

Storage & Water Quality

Below ground tanks - limit sunlight, steady temperature

Above ground tanks – should be opaque (limit algae growth)

Water movement – recirculation systems

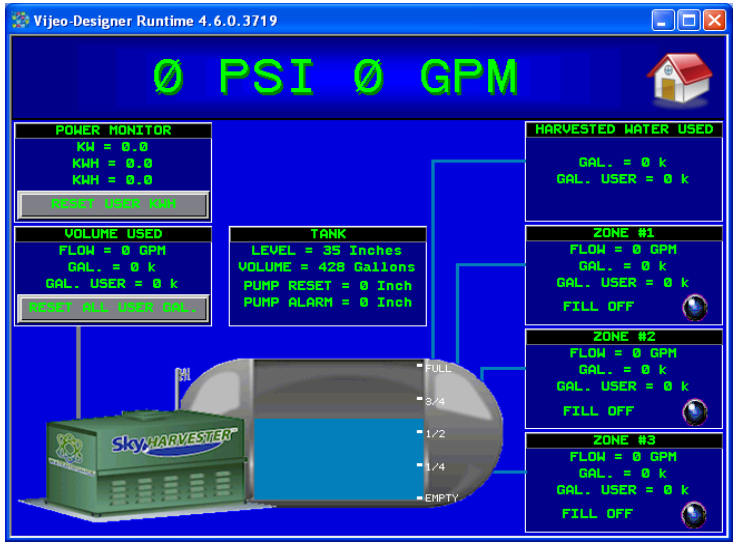
Keep organic items from decomposing in tanks (pre-filters)

Image courtesy of Watertronics

Image courtesy of Watertronics

COMPONENTS - Pumping/Controls

- The heart of the water harvesting system
- Submersible or above grade pumps
- Controls all peripheral components (level, flow, pressure, filters, treatment)
- Make a water manager out of the end user
- Quantify ROI and contain data about system



Images courtesy of Watertronics

TYPES OF PUMPS

Horizontal Centrifugal

Image courtesy of Goulds

Water well submersible turbine, installed Vertically or Horizontal

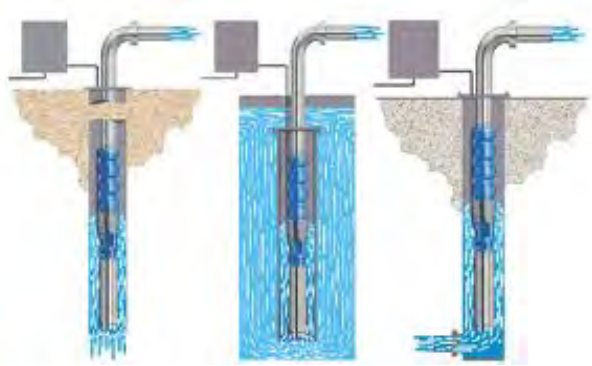


Image courtesy of Goulds

Submersible pump in Flow Inducer tube.

Images courtesy of Watertronics

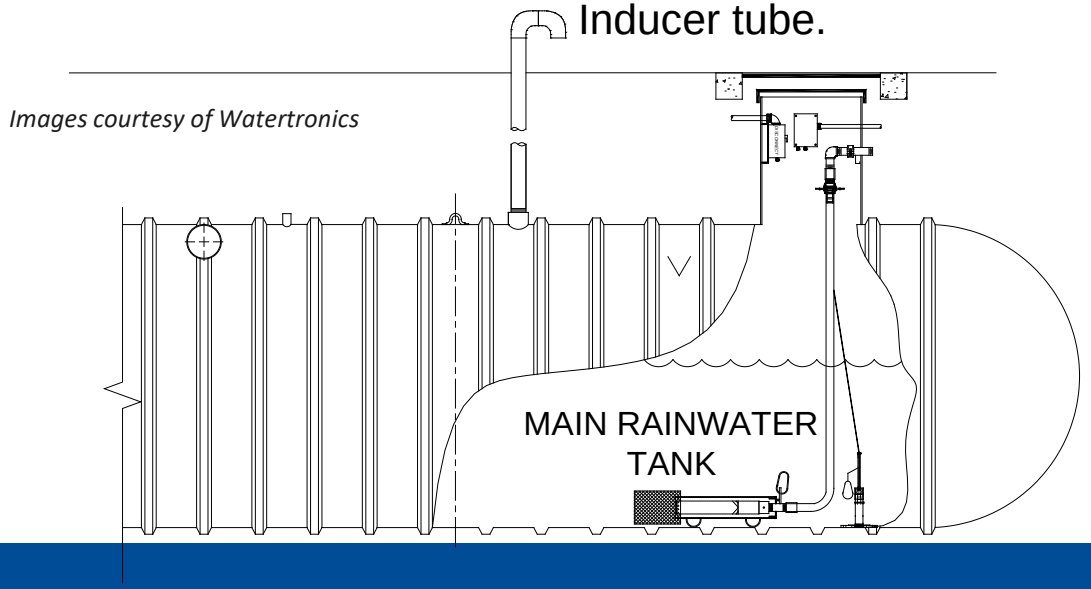


Image courtesy of Watertronics

COMPONENTS - Controls

Images courtesy of Watertronics

Automatic and Self protecting
Water Quality Specific Alarms (in addition to normal hydraulic pump station alarms)

DISCHARGE FILTRATION

Automatic Screen Filtration

-Reverses flow across the screen

-Internal self cleaning mechanism

-Note min. filter operating pressure and the extra demand it creates on the pump station

-Note screen area when sizing (water quality, UV, GPM/area)

UV Pre-Treatment = 5-25 micron
Drip Irrigation = 100 micron
Spray Irrigation = 200-500 micron

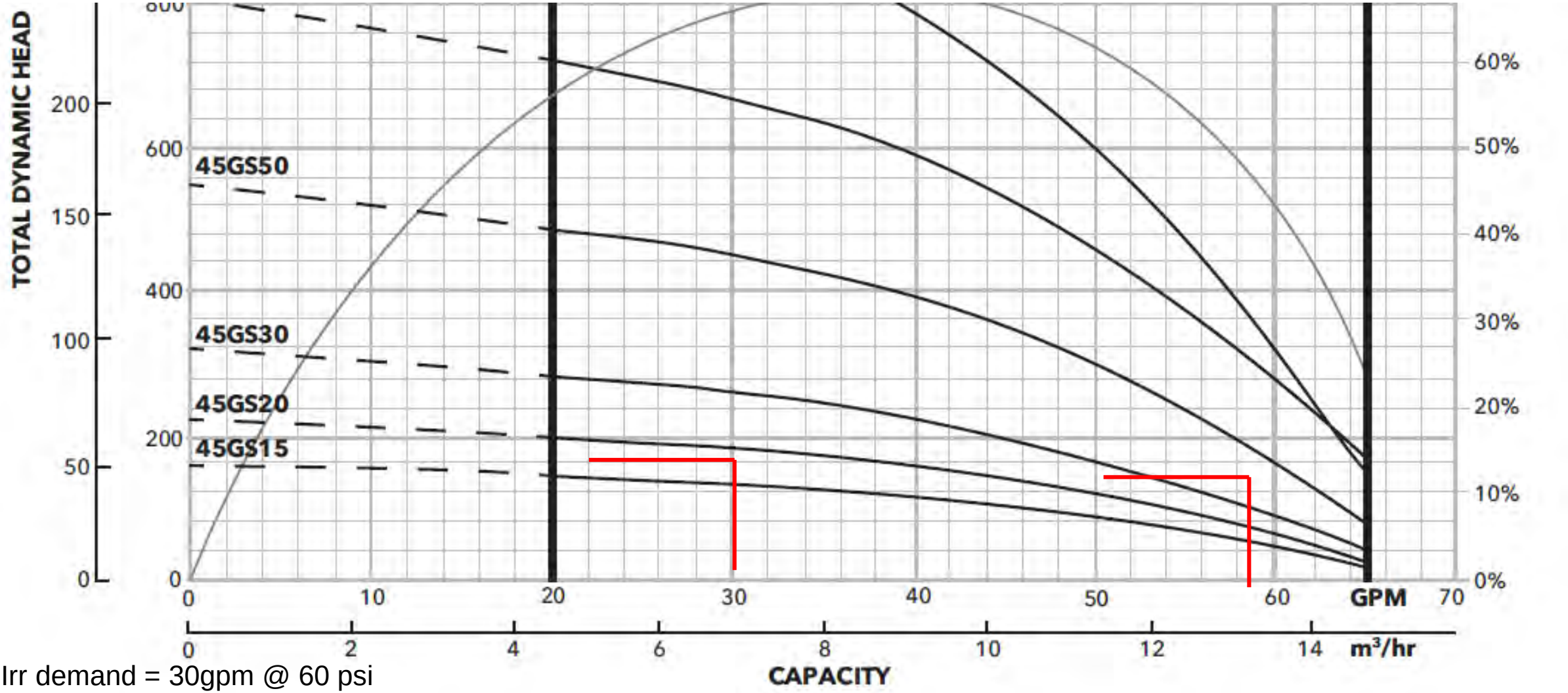
AUTOMATIC →

← MANUAL

Image courtesy of Rainharvest

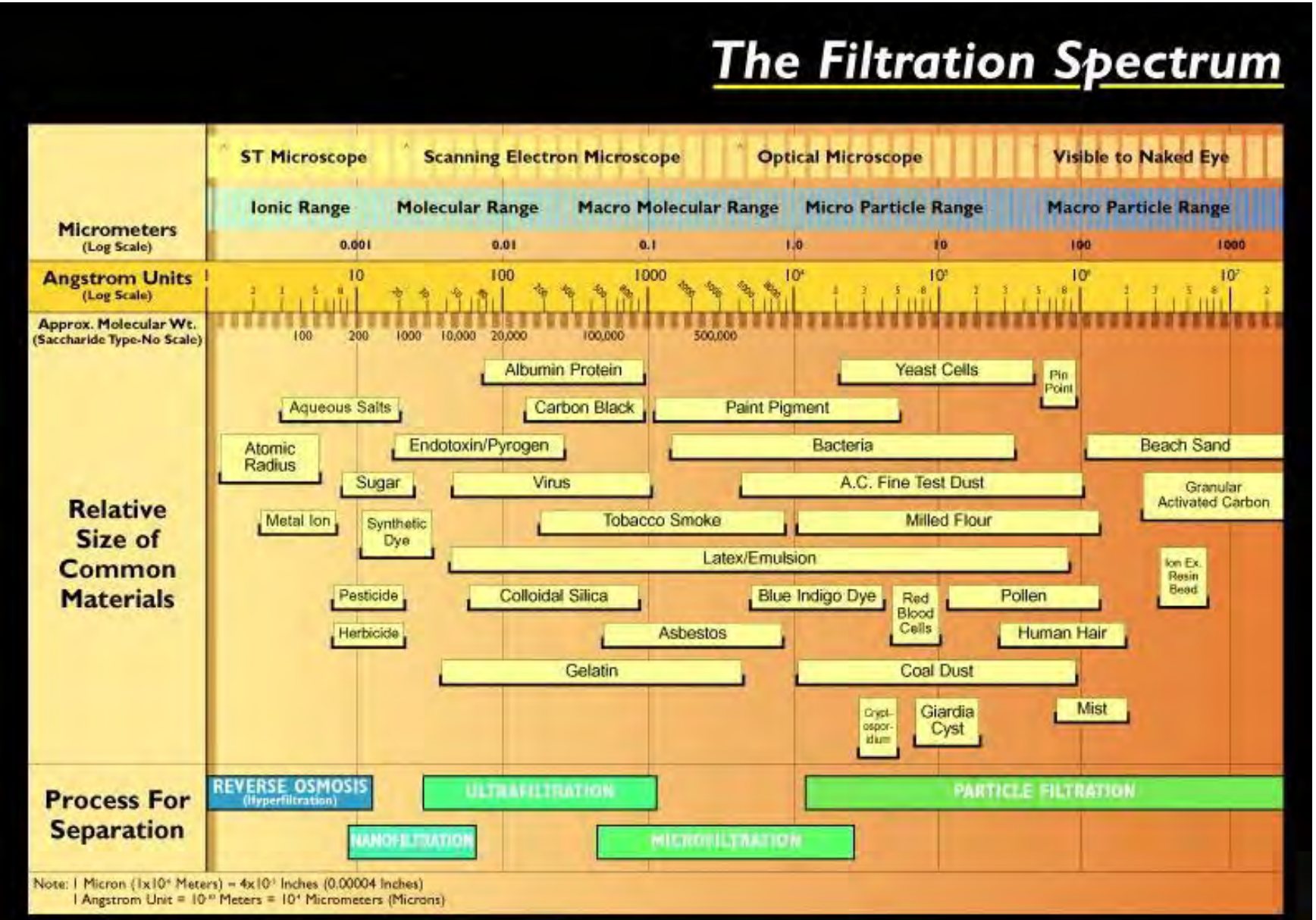
Image courtesy of VAF

DISCHARGE FILTRATION



Irr demand = 30gpm @ 60 psi
Irr + Filter flush = 55-60gpm @ min filter operating psi (50psi)
Actual filter pressure when irrigation is at max and filter is flushing is less than filter operating pressure required to clean the screen.

DISCHARGE FILTRATION



Ultra Violet Disinfection Basics

-254nm wave length UV light is used to render organisms inactive or unable to reproduce

-Water is in contact with light for a period of time. Energy is transmitted to the water (mj/cm2)

-Pick a dose (30mj/cm2) organisms require a certain amount of energy to be deactivated

-Pick a flow rate with a given UVT% (actual UVT of water not known without water sample.)

Image courtesy of Watertronics

Image courtesy of Aquafine UV

Water Quality Requirements for UV

Dose: Light Energy delivered into the water “mj/cm2” (see also destruction chart)

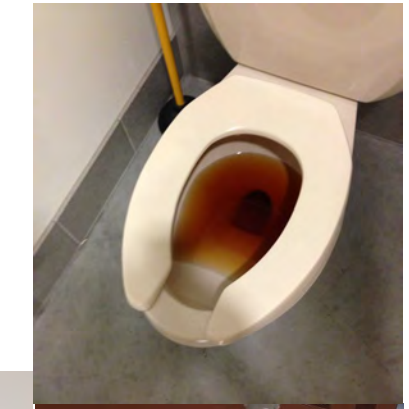
Ultra-Violet Transmittance %: Light’s Ability to Penetrate the Water

Flow Rate: Maximum GPM able to be disinfect at criteria above.

General Requirements

- 7grains or less of Hardness (rainwater is soft water)
- .3ppm of iron (limits quartz sleeve fouling)
- UVT% must be per the mfg. performance curve
- Must manage heat build up

If the UVT% of the water through the UV unit is different than what you sized the UV for, the dose is NOT DELIVERED!



Images courtesy of Watertronics

Water Quality Requirements for UV

What surface the water is collected from has a drastic affect on water quality

The surface of collection is the main driver in whether or not UV can be used on a given job site.

Avoid Green Roofs or other roofs with organic material

TDS vs. TSS !!
TDS can not be filtered out with screen filtration. Its dissolved.

Images courtesy of Watertronics

Ultra Violet Light Disinfection

#1 MKE canal

#2 Green Roof (AFTER 5 MICRON)

#3 Parking lot

#4 Metal Roof

#5 EPDM Roof Black

#6 EPDM Roof white

Image courtesy of Watertronics

Ultra Violet Light Disinfection

TEST RESULTS			
Bottle Label:	Watertronics Sample #1 UVT Testing	Bottle Label:	Watertronics Sample #4 UVT Testing
UVT (1cm, 254nm):	**78%**	UVT (1cm, 254nm):	**96%**
Bottle Label:	Watertronics Sample #2 UVT Testing	Bottle Label:	Watertronics Sample #5 UVT Testing
UVT (1cm, 254nm):	**8%**	UVT (1cm, 254nm):	**97%**
Bottle Label:	Watertronics Sample #3 UVT Testing	Bottle Label:	Watertronics Sample #6 UVT Testing
UVT (1cm, 254nm):	**89%**	UVT (1cm, 254nm):	**90%**

Image courtesy of Watertronics

#1 MKE canal #2 Green Roof #3 Parking lot

#4 Metal Roof #5 EPDM Roof Black #6 EPDM Roof white

Chlorine Injection Disinfection/Color

Chlorine Recirculation System on Day Tank (maintains 2-3ppm residual chlorine level)

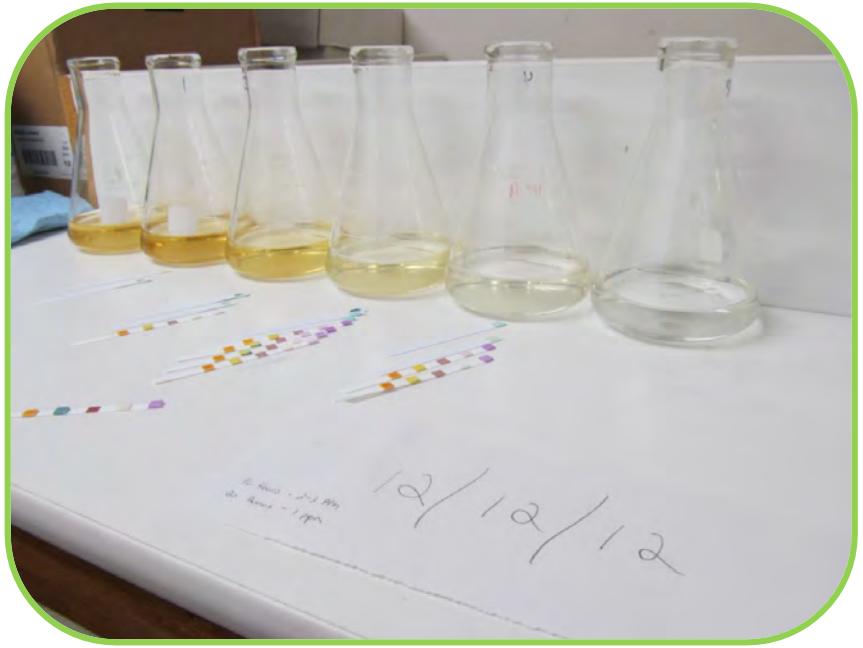
-Uses separate pump in Day Tank Start/Stop via timer

-Water sent through CHL Analyzer (PH & CHL sensor)

-Dosing pump injects to maintain set point of CHL in PPM

-30gal holding tank (uses household bleach/pool shock)

- *Chlorine will also effect color of water. It changes the way molecules reflect visible light to the naked eye.*
- *Like a stain removal on white T-Shirt.*



Images courtesy of Watertronics

Types of Systems and Applications

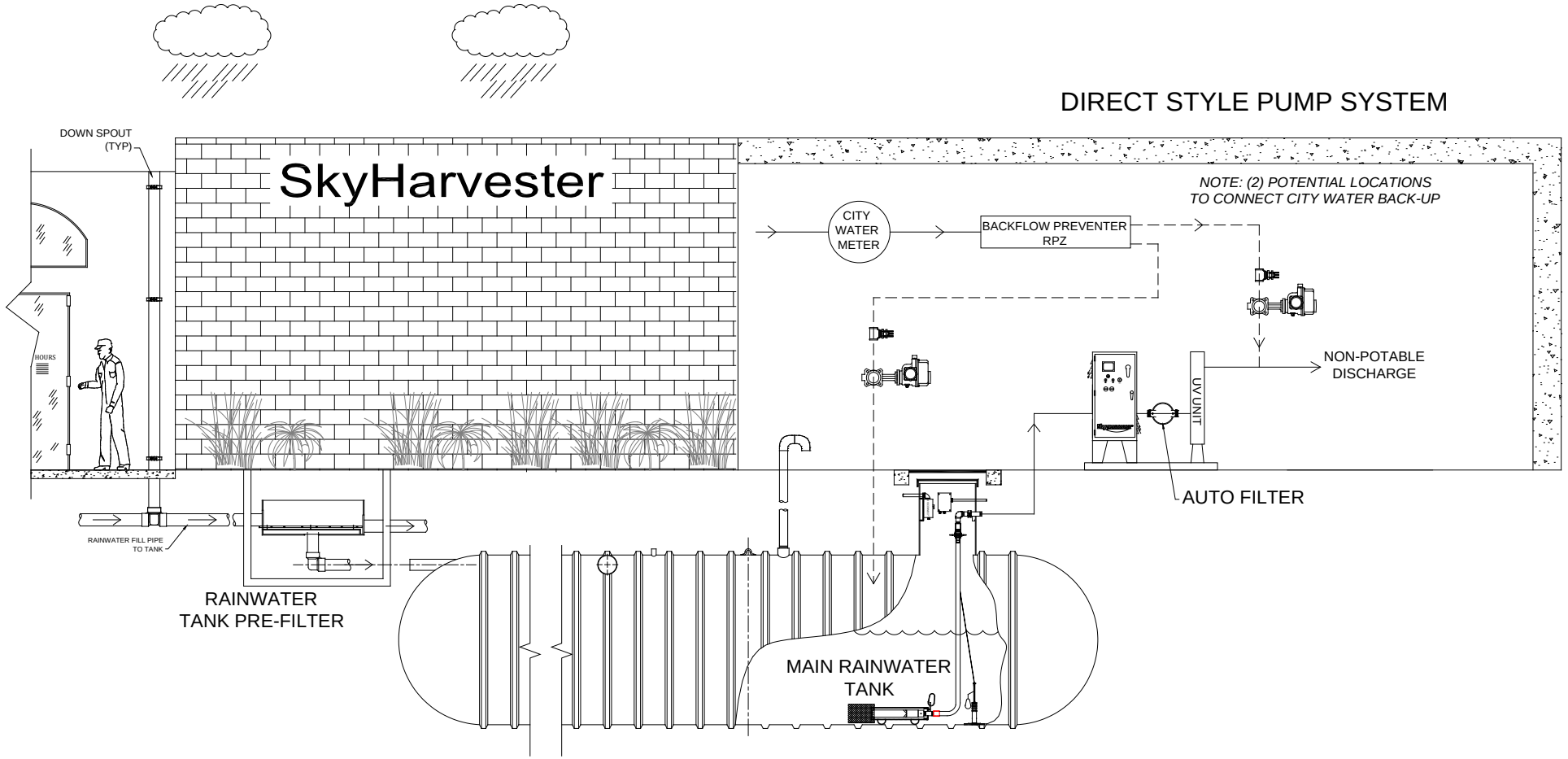
Direct Style System

The water in the main storage tank is pumped directly to the given application at the desired pressure. All components on the discharge side of the pump(s) are sized for max flow rate (capacity) and psi.

Day Tank Style System

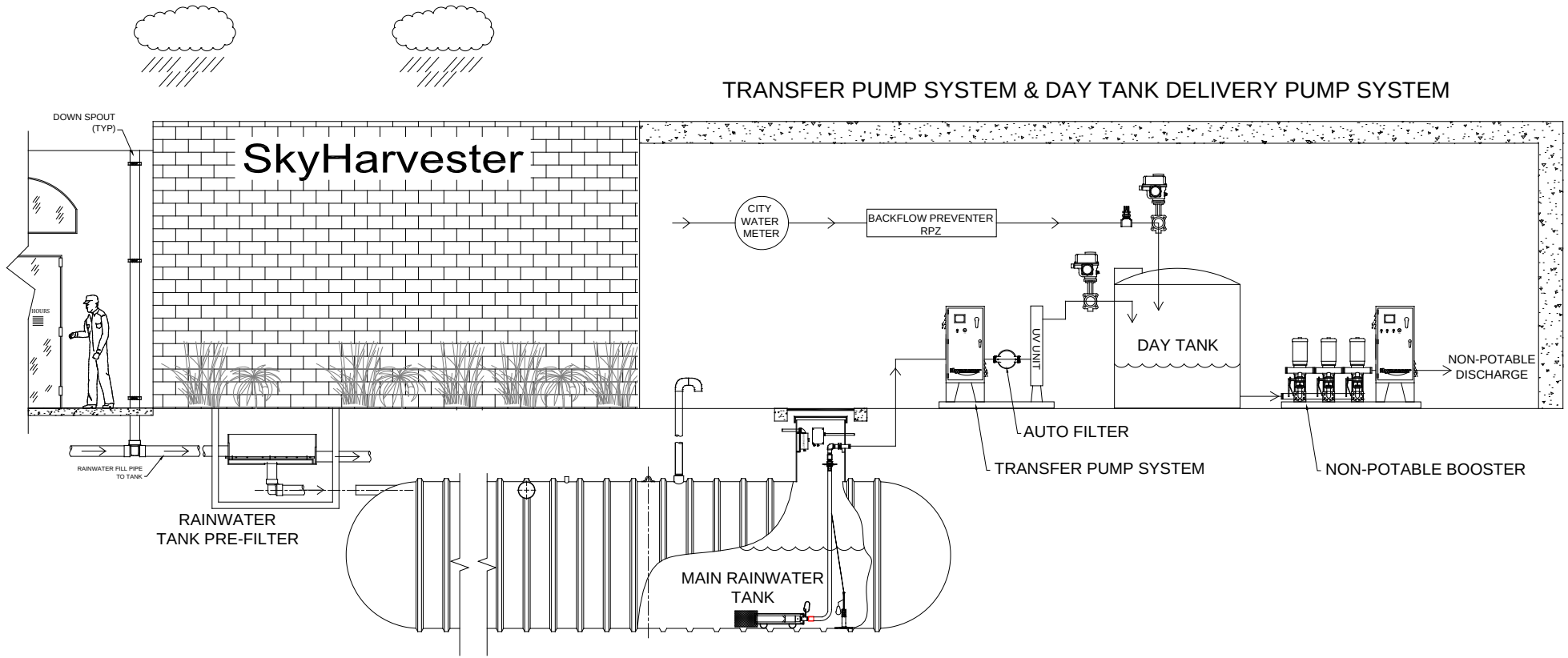
Complete rainwater system includes (2) storage tanks and (2) pump stations. Also known as “batch processing” where a smaller transfer pump is used to treat water from main rainwater storage tank at a lower flow rate to the “day tank”, while another pump station to deliver that water at required flow and psi for the application.

DIRECT STYLE SYSTEM



3 Main Components of Direct style system

TRANSFER & DAY TANK SYSTEM

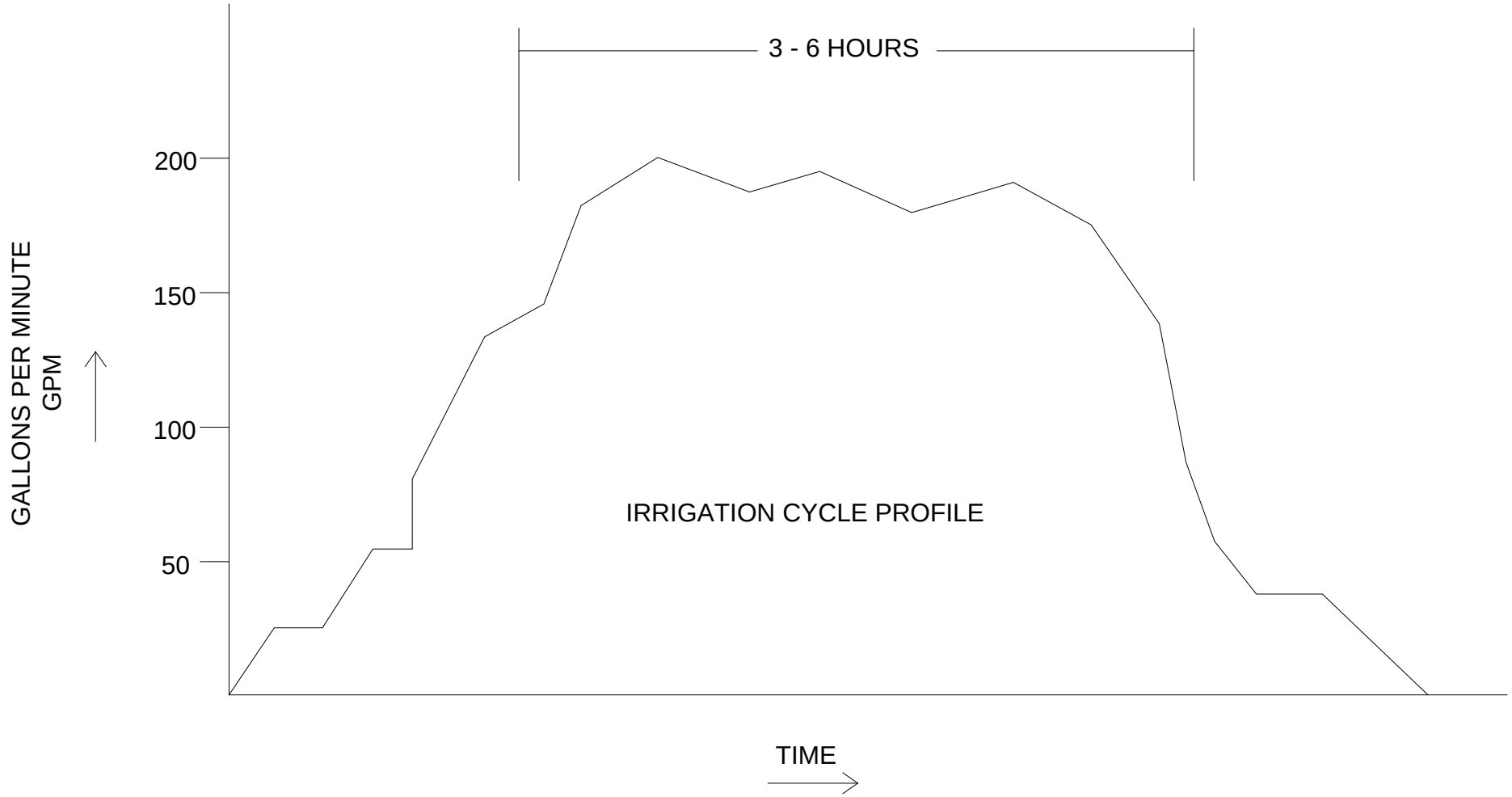


Types of Systems and Applications

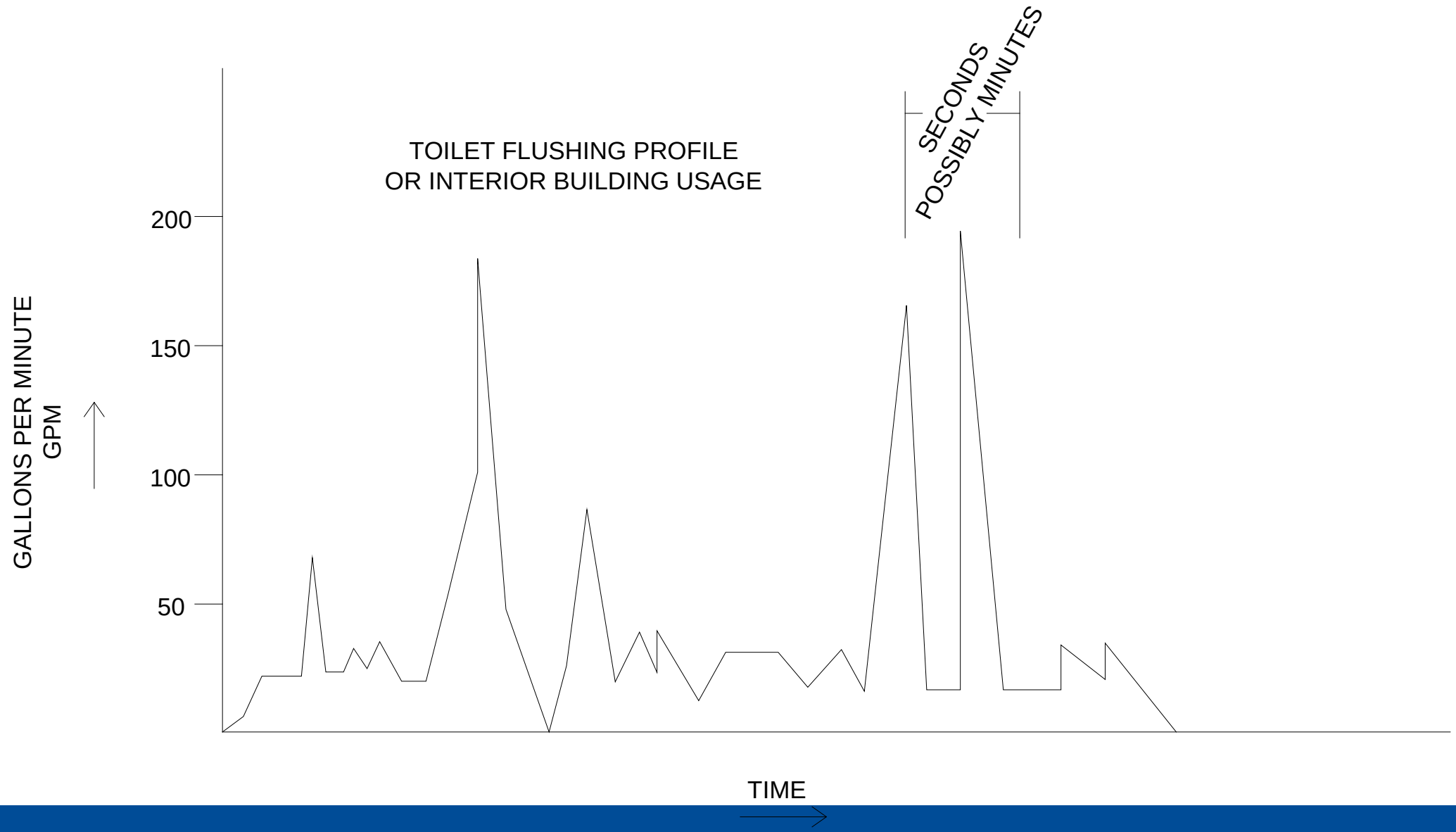
Deciding Factors to use Direct or Day Tank Style Systems

1. Pressure required for application (150 psi max rating / 125psi safety factor)
    1. *Filters and UV units have rating restrictions*
2. FLOW or GPM required to application: For Financial Savings $$
    1. *IF the application requires 80GPM, a day tank system that transfer water at 30gpm offers little or no cost savings*
3. Footprint or Available Space
    1. *A direct system may be chosen even though GPM (over 150gpm) is high due to space constraints*
4. Application or Usage Profile (ie..Irrigation vs. Toilet Flushing)

Types of Systems and Applications



Types of Systems and Applications



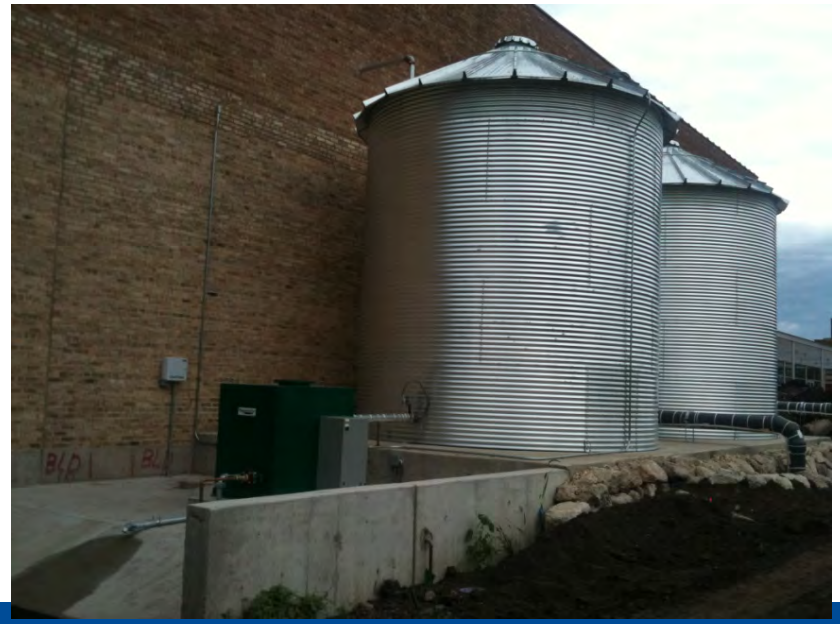
CITY OF OCEAN SPRINGS - Splash Pad

- 3k Below ground storage tank
- Submersible pump in tank
- Control skid with filtration (outdoors)
- Back up water will fill tank
- Fully flooded excavation installation
- Harvested splash pad water for irrigation

Images courtesy of Watertronics

RADIO FLYER
Irrigation

- 40k above ground storage tank
- Flooded suction pump w/ 100 micron filter
- Back up water will fill tank
- Cold weather environment



Images courtesy of Watertronics

Mitchell Park Domes Irrigation / Indoor

- 80k storage tanks
- Submersible pump 80gpm
- Filtration and UV
- City water back up direct
- Year round operation

Images courtesy of Watertronics

Thank you

Questions ?

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SANTA FE, NEW MEXICO

Making Sense of Flow Meters

A Measured Discussion of Types and Technologies

Moderated by: Brent Mecham

Panelists: Norm Bartlett, Ronald Purdy, Jim Peterson

Agenda

- Discussion about SWAT testing protocol – Brent
- Historical perspective of flow management in irrigation – Norm
- Types of technology available for flow management – Ron
- Future of flow management – Jim
- Q & A – audience questions will be considered

- Note: This is not about product promotion, but rather understanding how to better use the technology.

SWAT Draft Testing Protocol

- Scope: standardized performance evaluation of flow sensors used in landscape irrigation up to 4-inch size.

- Accuracy of flow signal
- Repeatability of flow signal
- Range of flow
- Pressure loss through the sensor
- Pressure rating
- Durability
- Wet environment test

Terms:

- **4.1 Flow sensor**

A term commonly used in the irrigation industry referring to a device that detects flow and that generates a signal that is compatible with a controller or receiving device.

- **4.2 Flow meter**

Combination of a flow sensor and scaling device often integrated into a single device which displays and or transmits actual flow rates or volumes in standard units of measure.

Flow Rate Test

Sensor SN_____		Sensor size_____		
Test flow rate	Reference Meter Flow Rate gpm	Sensor Flow Rate gpm	Inlet Pressure psi	Delta Pressure change psi
Maximum flow rate				
80% of maximum				
60% of maximum				
40% of maximum				
20% of maximum				
Minimum flow rate				

Durability Tests

	PRESSURE psi	WATER TEMP °F	FLOW RATE unit per minute	OPERATING PERIOD
Continuous test	70	72	Q (80% of maximum)	10 hours
Cyclic test (on 30 sec. off 30 sec.)	70	72	Q (80% of maximum)	2,500 cycles

Why Testing?

- Flow sensing is being written into codes and regulations.
- Industry being proactive to validate the performance characteristics.
- Establish expectations of regulators.
- Should flow sensing be used to measure actual water usage?
- Improve consumer confidence.

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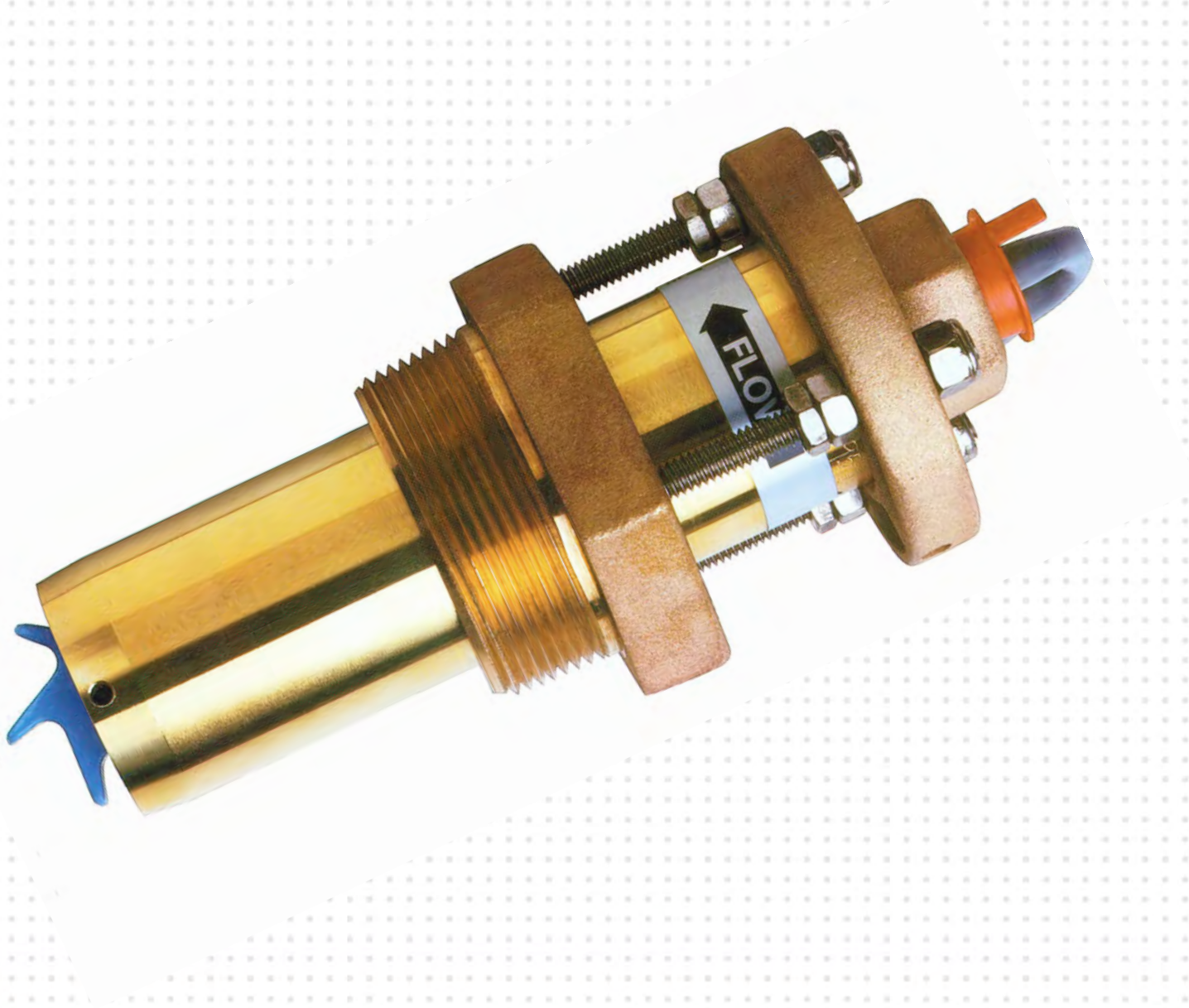
Norm Bartlett

Creative Sensor Technology

Beginnings…….

1986

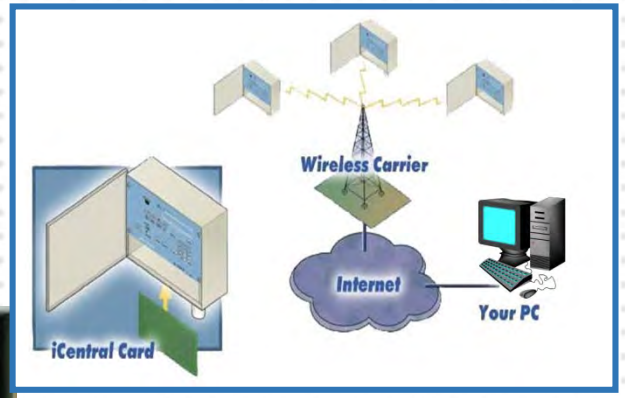


1986

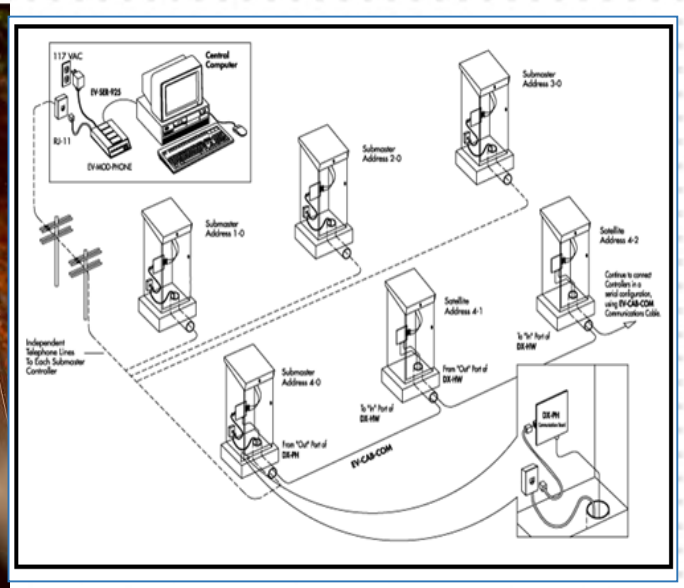
Change

- **Irrigation Controllers accept flow input directly from sensors**
- **Central Control Systems expand to incorporate flow**
- **2- Wire Decoder control systems incorporate flow**
- **Controller inputs expand**

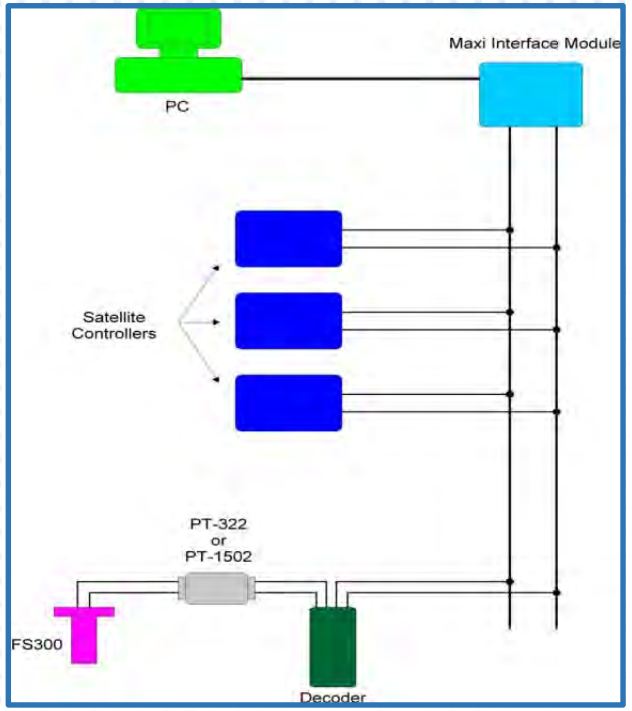
Y2K

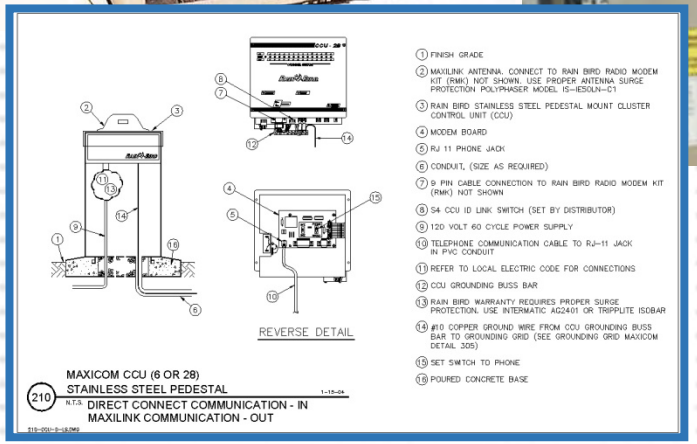

Wireless Carrier
Internet
Your PC
iCentral Card


RAIN BIRD


117 VAC
Central Computer
RJ-11
IV-MOD-PHONE
Submaster Address 3-0
Submaster Address 2-0
Submaster Address 1-0
Satellite Address 4-2
Satellite Address 4-1
Submaster Address 4-0
Independent Telephone Lines To Each Submaster Controller
IV-CAB-COM


RKS


Maxi Interface Module
PC
Satellite Controllers
PT-322
or
PT-1502
FS300
Decoder


REVERSE DETAIL
MAXICOM CCU (6 OR 28)
STAINLESS STEEL PEDESTAL
DIRECT CONNECT COMMUNICATION - IN
MAXILINK COMMUNICATION - OUT
1 FINISH GRADE
2 MAXILINK ANTENNA. CONNECT TO RAIN BIRD RADIO MODEM KIT (RMK) NOT SHOWN. USE PROPER ANTENNA SURGE PROTECTION POLYPHASER MODEL IS-IE50LN-C1
3 RAIN BIRD STAINLESS STEEL PEDESTAL MOUNT CLUSTER CONTROL UNIT (CCU)
4 MODEM BOARD
5 RJ 11 PHONE JACK
6 CONDUIT, (SIZE AS REQUIRED)
7 9 PIN CABLE CONNECTION TO RAIN BIRD RADIO MODEM KIT (RMK) NOT SHOWN
8 S4 CCU ID LINK SWITCH (SET BY DISTRIBUTOR)
9 120 VOLT 60 CYCLE POWER SUPPLY
10 TELEPHONE COMMUNICATION CABLE TO RJ-11 JACK IN PVC CONDUIT
11 REFER TO LOCAL ELECTRIC CODE FOR CONNECTIONS
12 CCU GROUNDING BUSS BAR
13 RAIN BIRD WARRANTY REQUIRES PROPER SURGE PROTECTION. USE INTERMATIC AG2401 OR TRIPPLITE ISOBAR
14 #10 COPPER GROUND WIRE FROM CCU GROUNDING BUSS BAR TO GROUNDING GRID (SEE GROUNDING GRID MAXICOM DETAIL 305)
15 SET SWITCH TO PHONE
16 POURED CONCRETE BASE

Y2K


Flow Measurement
For now
For the Future
presented to ASIC May 23, 2000
by Norman Bartlett
OTHER
CHNOLOGIES
NIC
SHEDDING
MAGNETIC

Is it a Flow sensor or a Flow meter?

- A sensor usually implies that it senses and tracks a physical property and produces a scalable output signal.
- A meter usually implies that it has a register or display
- Some devices can be both
- **In the irrigation industry the terms are used interchangeably**.

Pick the Right tool for the job

Balance your Requirements carefully

- Range of Measurement
- Friction Loss
- Pressure Rating
- Accuracy
- Repeatability
- Suitability for service

- Ease of installation
- Serviceability
- Reliability
- Support
- Cost
- Warranty

Is change a change for the better or just change?

- Materials of construction
- Electronics
- Detection principles

The Future?

Will ultimately be decided by :

Customer Demand

Water Availability

Regulatory Requirements

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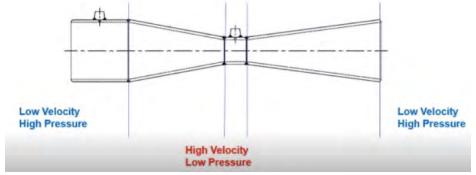
Ronald Purdy

Badger Meter

Common Technologies

- Impeller
- Electro-Magnetic
- Ultrasonic
- Disc
- Turbine
- Differential Pressure
- Vortex

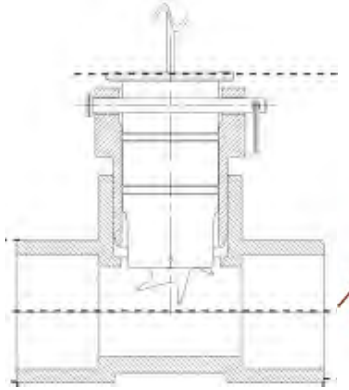


Impeller Meters

Operation:

Force of moving water turns a multi-bladed wheel whose axis of rotation is perpendicular to the flow. Rotation is proportional to flow, mid-range; but, does follow the non-linear “S” curve common to all Turbine Type meters; At the extreme low limits due to bearing friction, and at the upper limits due to cavitation. Rotation can be detected by Magnetic, RF, Proximity, Mechanical or optical means.

Characteristics: Pipe Sizes ½-36+ Range 0.3 – 30 FPS Accuracy 1-3% (1 FPS+)



Advantages

- Rugged, Simple, Low Cost Design, with years of field experience
- Tolerates Particles in Flow Stream
- Low Head Loss
- Simple Two Wire Device, Compatible with most irrigation controllers

Disadvantages

- Limited Low Flow performance, sometimes requiring a meter run of smaller size pipe.

Best suited for

- Main and lateral lines connected to Irrigation Controllers
- Flow input to Flow Monitoring, Control and Metering Devices.

Electro-Magnetic Meter

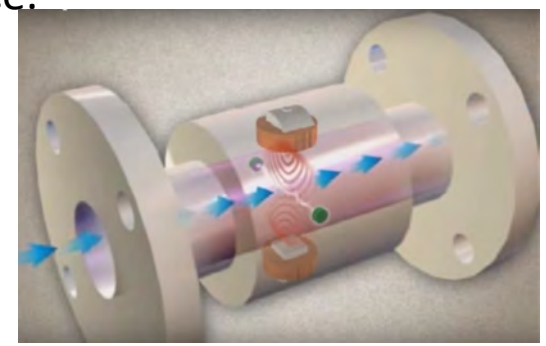
Operation

Electric current pulsed to a coil produces a strong Magnetic field. Movement of Water generates a voltage proportional to flow. Sophisticated, micro-processor circuitry converts the voltage impulse to flow rate and total. Inline types are most common; but, some manufactures offer insertion types.

Characteristics: Pipe Sizes ¼ -36+ Range 0.1 – 40 FPS Accuracy 0.25% - 0.5%

Advantages

- No Moving Parts and unaffected by sand and other debris
- Very Low Head Loss - Reduced Straight Pipe requirements
- High Accuracy with wide turn-down ratio, and good low flow performance.



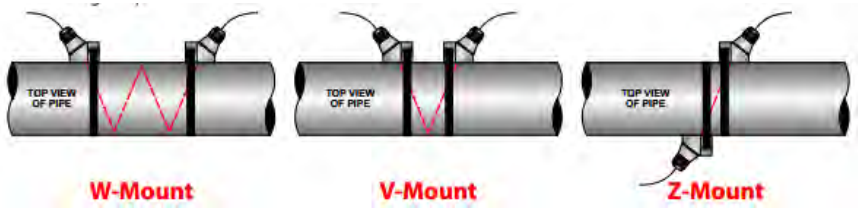
Disadvantages

- Sensitive to Grounding, EMI, and Vibration
- Cost – Weight – Power Consumption.
- Not generally recommended for below grade locations.

Best suited for

- Pump Stations.
- Lower cost alternative to Compound meters where a wide range of flows is expected

Ultra-Sonic Flow Meters



Operation:

Two basic types (Transit Time and Doppler Shift)

Doppler Shift measures the change in frequency of an acoustic pulse, as it reflects off particles moving in the flow stream. (Think sound of Train Whistle) Not usually used in the Irrigation Market.

Transit Time measures change in time it takes for acoustic pulse to travel from one transducer to the other. The path may traverse the flow in a "W", "V", "Z" pattern, or be in-line, parallel to the flow..

The time shift is extremely small and requires very precise timing, signal gain, and software algorithms to deal with all the subtle acoustical properties of the piping, fluid, and transducers.

Characteristics:

Pipe Sizes ½" - 36+" Range 0.1 – 40 FPS Accuracy 1 % - 3%

Advantages/Disadvantages:

With so many types available, it is hard to make a general statement.

As a general rule, inline types are best with small pipes below grade, while external mounts are best used in larger pipes in protected areas. They can susceptible to EMI, and acoustical vibration, such as found in pump stations; but, generally have good low flow performance in most environments.

Best Suited for

Locations with wide ranging, or low flow rates. Selection Application Specific.

Disc Series Meters

Operation:

- Positive Displacement Disc is driven around a tight tolerance chamber.

Characteristics: Pipe Sizes ½” - 2” Range 0.2 – 15 FPS Accuracy 1.5%

Advantages

- Low Cost
- Simple Design
- Positive Displacement Accuracy and Low Flow Performance

Disadvantages

- Small Pipe sizes only
- Clean Water Only
- Limited Signal Options
- Higher Head Loss

Best suited for

- Metering clean incoming City Water
- Small line sizes 2” and under, with low flows where accuracy in important

Turbine Meters

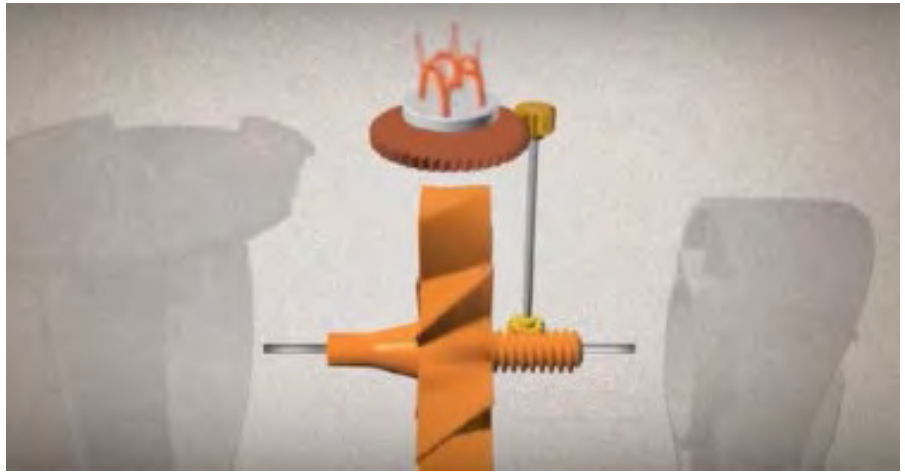
Operation:

Water turns a multi-bladed wheel whose axis of rotation is parallel with the flow. Rotation is proportional to flow, mid-range, but, does follow the non-linear “S” curve, common to all Turbine Type meters, at the extreme lower flow limits due to bearing friction, and at the upper flow limits due to cavitation. Rotation can be detected by Magnetic, RF, Proximity, Mechanical, or optical means.

Characteristics: Pipe Sizes 1.5” - 12” Range 0.25 – 30 FPS Accuracy 1.5% (above 0.4 FPS)

Advantages

- Wide Flow Range
- Good Accuracy
- Reduced Straight Pipe



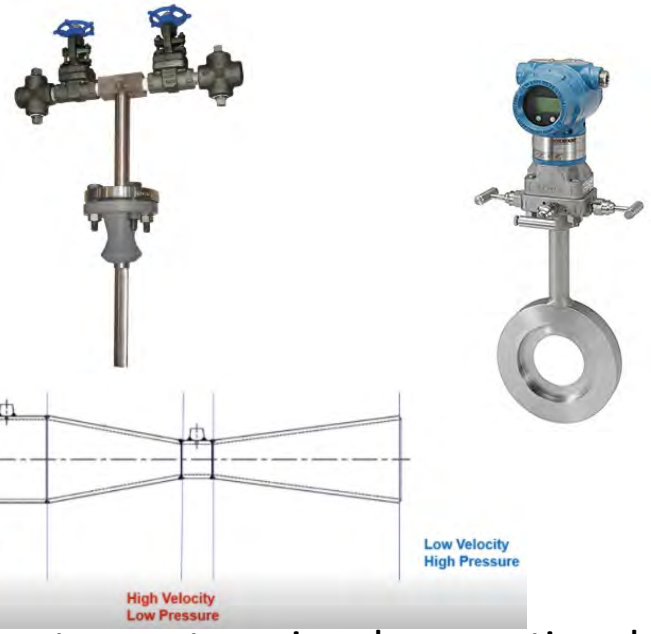
Disadvantages

- Clean Water Only – Requires inline filters
- Cost and Weight
- Limited Interface Options

Best Suited for

- Clean incoming city water where good accuracy is required with mid-range flows

Differential Pressure Flow Meters



Operation:

Three basic types (Pitot Tube; Orifice Plate, Venturi)

Pitot Tube: A small protrusion into the flow stream.

Orifice Plate: Precise symmetrical constriction of the flow.

Venturi: Precise narrowing of the flow tube

The basic principle the same for all.

Non-linear pressure drop is induced, requiring square-root extraction to create a signal proportional to Flow.

Characteristics: Pipe Sizes ¼" - 36+" Range 0.1 – 40 FPS Accuracy 0.5% - 1%

Advantages/Disadvantages:

Limited Turn-down ratio

Cost – Probes inexpensive; however, Signal Conditioners tend to be expensive

Best Suited for

Sometimes still used for flow verification, but portable Ultra-Sonic meters more common today.

Not often used in the Irrigation markets.

Vortex

Operation:

Although the shapes vary, a strut sometimes referred to as Bluff or Shredder Bar splits the flow stream causing vortexes to form. The frequency of these pressure waves are proportional to flow, detected as they pass transducers located close downstream. Although the principle is simple, these meters tend to be quite expensive due the sophisticated circuitry and micro-processor design required to separate signal from noise and deal with the differences' in flow mediums.

Characteristics: Pipe Sizes 1/4” – 24+” Range 1.3 – 30+ FPS Accuracy 0.5 - 1%

Advantages

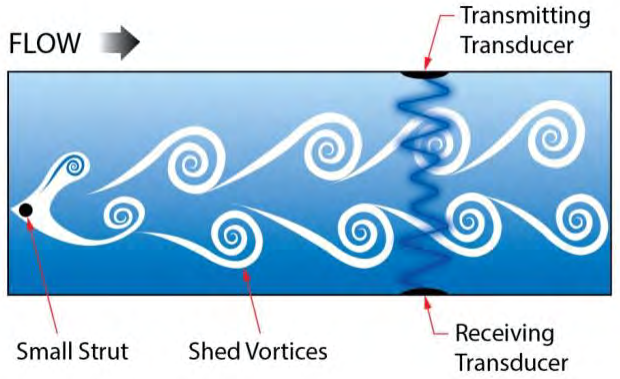
- Low Head Loss
- No Moving Parts

Disadvantages

- Poor low flow performance and for Clean Water Only
- Cost
- Limited Interface Options

Best Suited for

- Not usually used in the Irrigation Markets



Summary & Questions

Characteristics	Impeller	Electro-Magnetic	Ultrasonic	Disc	Turbine	Differential Pressure	Vortex
Pipe Size	1/2" - 36+"	1/4" - 36+"	1/2" - 36+"	½" - 2"	1.5" - 12"	¼" - 36+"	1/4" – 24+"
Range	0.3 - 30 FPS	0.1 - 40 FPS	0.1 - 40 FPS	0.2 – 15 FPS	0.25 – 30 FPS	0.1 – 40 FPS	1.3 – 30+ FPS
Accuracy	1 - 3% (Above 1 FPS)	0.25% - 0.50%	1 - 3% (Design Dependent)	1.50%	1.5% (above 0.4 FPS)	0.5% - 1%	0.5 - 1%
Technology	Simple	High Tech	High Tech	Simple	Simple	Mixed	High tech
Troubleshooting	Simple	Involved	Involved	Simple	Simple	Mixed	Mixed
NFS -Potable Approved	Mixed	Usually	Mixed	Usually built to AWWA Standards	Usually built to AWWA Standards	Mixed	Mixed
Suspended Solids	Tolerant	Toterant	Tolerant	Internal Screen	Requires Screen	Mixed	No
Wet -Below Grade	Yes	Usually Not Recommended	Inline OK Clamp-On Not Recommended	Yes	Yes	Yes	Mixed
Head Loss	Low	Very Low	Mixed	High	High	Medium	Low
EMI Tolerance	Good	Suceptable	Suceptable	Good	Good	Good	Susceptible
Cost	Low	High	Mixed	Low	High	Mixed	High
Power Requirement	From Controller	Line or Battery	Line or Battery	Mixed	Mixed	Mixed	Line
Weight	Light	Inline Heavy	Light	Medium	Heavy	Mixed	Mixed

Where used

City Water	Irrigation	Potable/Irrigation	Varies with Materials & Design	Potable/Irrigation	Potable/Irrigation	Varies with Materials & Design	Varies with Materials & Design
Pump Stations	Yes	Check for Grounding and EMI	Check for Acoustic & EMI	Small Pump Ok But Usually Not	Could be But Usually Not	Could be But Usually Not	Could be But Usually Not
Irrigation Controllers	Yes	Usually Not	Varies with Design	Yes	Usually Not	No	No
Flow Monitoring	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Flow Totalizing	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Jim Peterson

Great Plains Industries

How do we know what the future holds?

- No way to know exactly

- Ask your customers what they are looking for
  - OEMs
  - Distributors
  - Consultants
  - Irrigation Managers

What did they tell us?

- Easier Installation
- Eliminate the wire-path
- Lower the cost of the device
- More robust hardware
- Better Accuracy

Easier Installation

- Device that doesn’t require cutting into the pipe
- Reduced installation labor
- Clamp on Ultratrasonic
- retrofit applications

Eliminate the wire-path

- Continued advancement of wireless data transmission to the controller
- Affordably priced
- Reliable and Repeatable
- Retrofit applications

Lower the device cost

- This allows for more systems to add flow measurement
- Smaller commercial systems
- Residential system

Better Accuracy

- Flow sensor could also be a deduct meter
- Baseline to accurately measure the effects of water conservation measures
- Ability to tie into data analytics systems like IBM Watson
    - Allows for predicative anticipation of system problems

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Questions & Discussion

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The Future of Revit® in Irrigation

Moderated by: Lance Sweeney

BIM (Building Information Modeling)

- 3D model based design process
- Revit® - Autodesk BIM software
- Very Useful for Architects, MEP Engineers, etc.
- Data stored in “families” is very useful
- Not intended for landscape and irrigation design

Revit® Challenges

- Revit - $2,079 / year license (based on 3 year subscription)
- Difficult program to master compared to AutoCAD
- Irrigation is not designed in 3D (complicated and unnecessary)
- Irrigation piping and most equipment is diagrammatic
- Level of detail can be much higher than necessary or practical
- Installation of system likely will vary from plans
- Use of AutoCAD from Revit based files has challenges
- Development of equipment “families”

Revit Experiences

- Consultants who design in Revit
- Consultants who design in AutoCAD from Revit exported files
- Consultants who have used Revit consultants to convert 2D drawings into Revit
- Pressure from Landscape Architects to adopt Revit

Future of Revit in Irrigation

- Consultants looking to learn Revit?
- Should use of Revit be limited to within building shell?
- Should Revit use for irrigation be limited to piping or internal building installed equipment?
- What are irrigation manufacturers doing to assist?

ASIC Response to Revit

- Develop reasonable guidelines for use?
- Work with ASLA to define and mitigate Revit issues?
- Approach AutoDesk about future LIM (Landscape Information Modeling) development?
- Assist in sourcing irrigation specific training for members?

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Thank you!