Rainwater Harvest System for Lena Street Lofts
For Irrigation and Toilet Flushing

The Lena Street Lofts is a five year construction project on a greenfield infill site in the City of Santa Fe. At completion it will cover an area of 3.36 acres (1.36 hectares). The total harvested roof area will be 31,466 square feet (2923 sq meters). (See the site plan)

The enclosed water supply budgets show the calculations. The majority of the collection is from metal roofs with gutters and downspouts so an efficiency of 90% was used. A demand budget was created using a low flow toilet of the times at 1.6 gallon (6 liter) per flush. The reserve graph was plotted that compared toilet demand to harvested rain water under average precipitation conditions and with three drought scenarios. This indicates that at the most severe drought condition and at full occupancy, the roof water will still have a continuous surplus. The entire grounds and parking areas are harvest passively to landscape. The surplus harvested rainwater will be used as a backup for the landscape irrigation. (See the water budgets)

The system consists of two parallel subsystems. This allows any part of the system to be isolated and bypassed for repair or replacement. This also allows the transfer of water between tanks so that one can be emptied for repair while the other collects and distributes water to all parts of the system. In order to create a system of this sophistication, 23 valves were required. There are valve sets that match functions, for example “close tank two for repair, transfer all water and run all functions from tank one”. The system will have different site managers that will need to be able to perform these types of operations on demand. Two solutions were created. The first is to physically label each valve as it corresponds to the flow schematic. This also indicates the default position of “Normally open”, or “Normally closed”. The second solution is in the owners manual. This document has sections for design, as built documentation. operation & maintenance, and warranties. The O&M section also has a group of function sets so that even an untrained operator can open and close a group of numbered valves to accomplish a desired function. (See the flow schematic)

EARTHWRIGHTS DESIGNS

Technology and Nature

30 Camino Sudeste Santa Fe, New Mexico 87508 USA

Phone/Fax (1 505) 986-1719 email: ezentrix@aol.com

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Cistern install: July 2004

Backfill : August 2004

Installation of Bladder : August 2006

Pump Pit for Toilers : November 2006

Control Panel: March 2007

Valve Labeling : March 2007

Pit 1 : March 2007

Pit 2: March 2007

Lena St Business Park

ACTIVE WATER HARVEST CALCULATIONS Preliminary 16-Mar-07

Unit G Added **30% Increase**

Areas in Square Feet

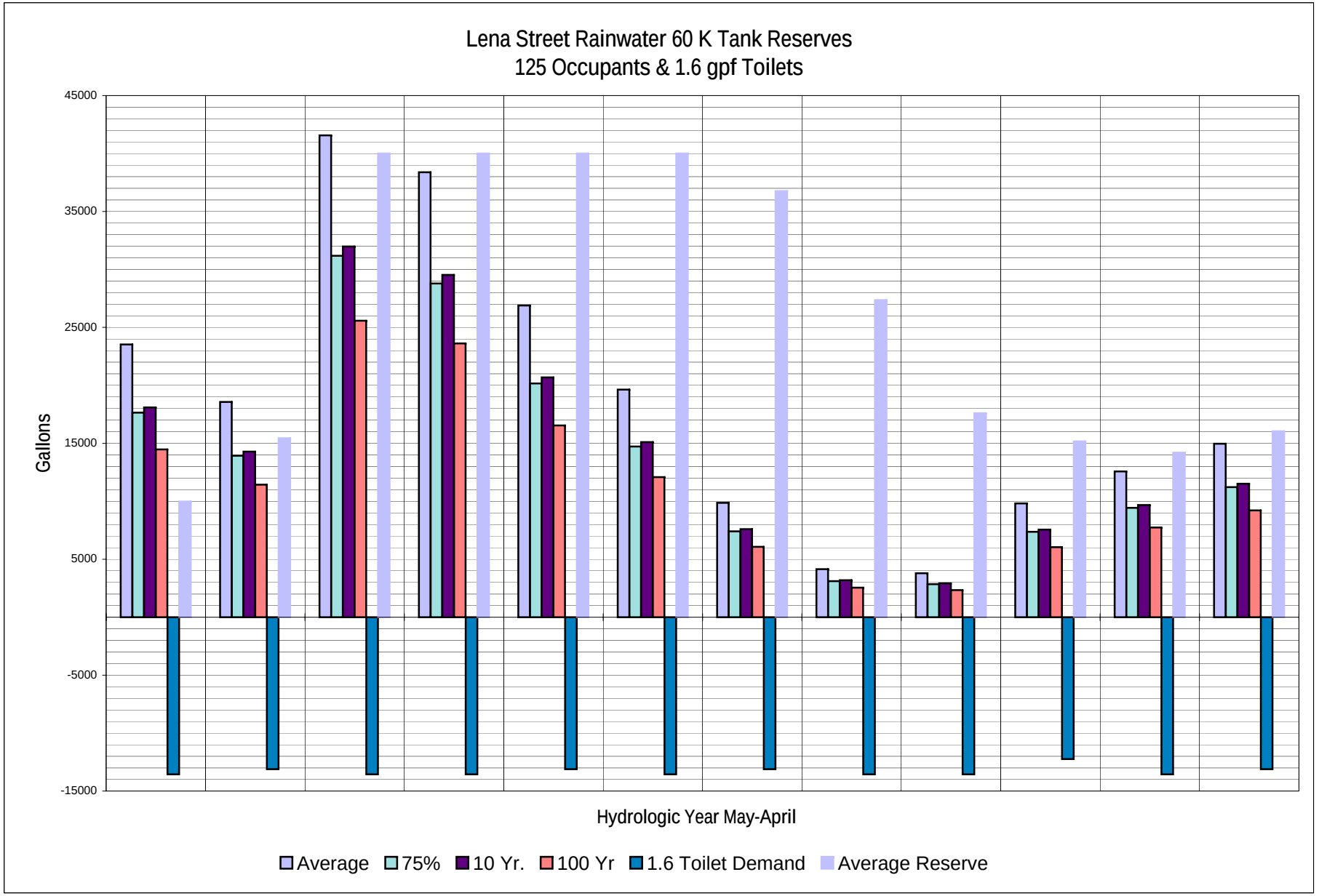
Unit A	Unit B	Unit C	Unit D	Unit E	Unit F	Unit G
6760	4246	5280	3520	2640	4000	5000

TOTAL HARVESTED AREA	31446	Sq Ft		
OTAL HARVEST IN AVERAGE YEAR	223737	Gallons	0.687	Acre Feet
ARVEST IN PROJECTED DROUGHT	167803	Gallons	0.515	Acre Feet
TOTAL HARVEST IN 10YEAR DROUGHT	127941	Gallons	0.393	Acre Feet
TOTAL HARVEST IN 100 YEAR DROUGHT	95956	Gallons	0.294	Acre Feet

Precip @ 75% of average

Average Efficiency of Collection **90%**

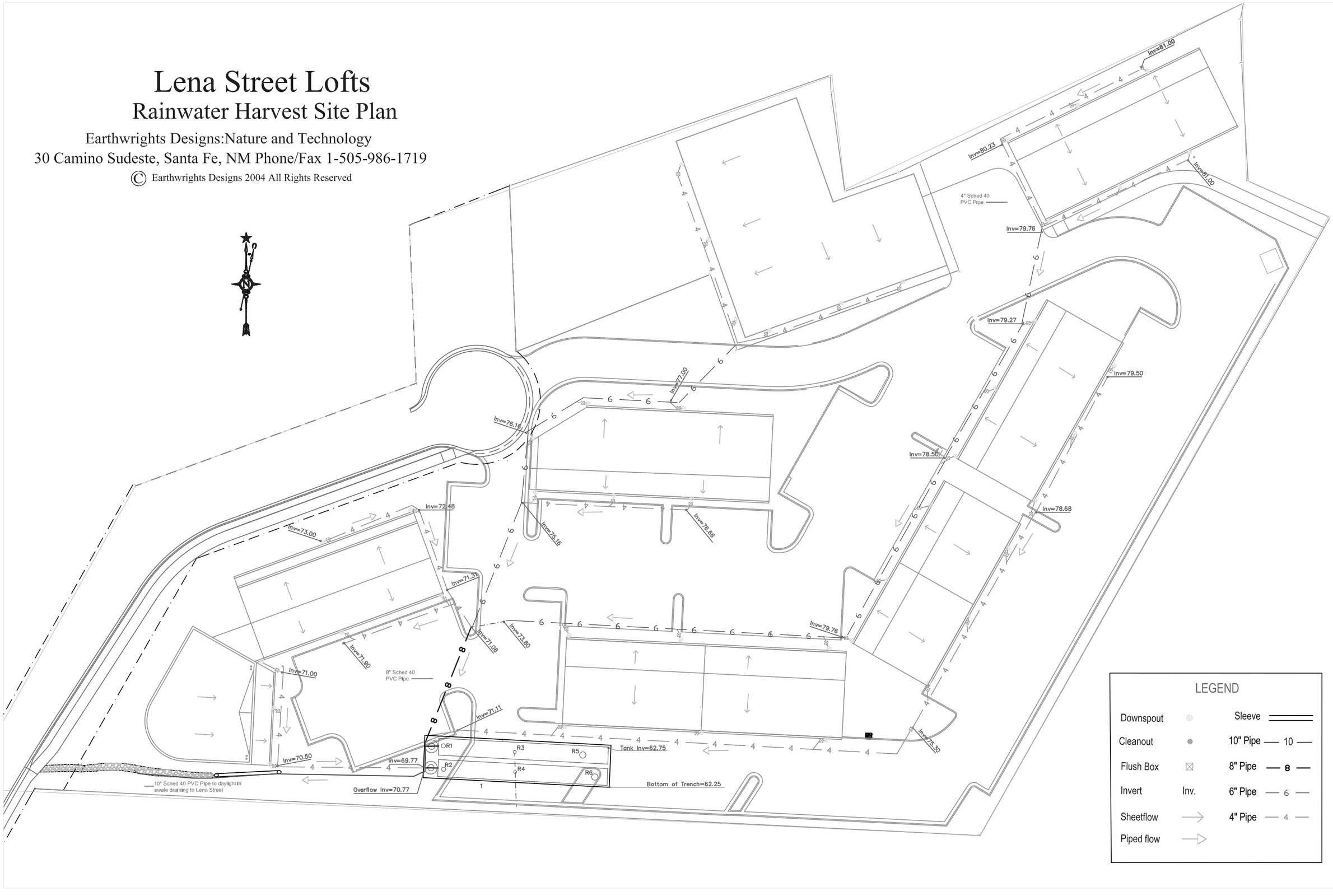
Average Precipitation	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Total	
In Inches	0.65	0.74	0.79	0.94	1.33	1.05	2.35	2.17	1.52	1.11	0.62	0.71	13.99	
Seasonal Factor	33%	75%	90%	90%	100%	100%	100%	100%	100%	100%	90%	33%		Percent
	Ave Collection in Gallons													of Total
Unit A	816	2110	2704	3217	5057	3993	8936	8251	5780	4221	2122	891	48097	21%
Unit B	512	1326	1698	2021	3177	2508	5613	5183	3630	2651	1333	560	30210	14%
Unit C	637	1648	2112	2513	3950	3119	6980	6445	4514	3297	1657	696	37567	17%
Unit D	425	1099	1408	1675	2633	2079	4653	4297	3010	2198	1105	464	25045	11%
Unit E	319	824	1056	1256	1975	1559	3490	3222	2257	1648	829	348	18783	8%
Unit F	483	1249	1600	1904	2993	2363	5288	4883	3420	2498	1256	527	28460	13%
Unit G	603	1561	2000	2379	3741	2953	6609	6103	4275	3122	1569	659	35575	16%
	3794	9817	12576	14964	23526	18573	41568	38384	26886	19634	9870	4144	223737	100%


Lena Street Rainwater 60 K Tank Reserves
125 Occupants & 1.6 gpf Toilets
45000
35000
25000
15000
5000
-5000
-15000
Gallons
Hydrologic Year May-April
Average
75%
10 Yr.
100 Yr
1.6 Toilet Demand
Average Reserve

Lena Street Lofts

Rainwater Harvest Site Plan

Earthwrights Designs:Nature and Technology
30 Camino Sudeste, Santa Fe, NM Phone/Fax 1-505-986-1719



LEGEND

Downspout		Sleeve	
Cleanout		10" Pipe	10
Flush Box		8" Pipe	8
Invert	Inv.	6" Pipe	6
Sheetflow		4" Pipe	4
Piped flow			

COMPONENTS

1. 10 " pipe from roof harvest conveyance system
2. 8" Standpipe
3. 8" Top of Standpipe - Crossover
4. 2" Suction Line and Level Equalizer Pipe
5. 10" Overflow to swale
6. 1" line from potable system
7. Backflow Preventer 1" Wilkins 975 XL
8. Air relief vent
9. 2" Inter tank transfer pipe

VALVES

V1	1"	Ball	NO	Potable Water isolation
V2	1"	Solenoid	NC	Makeup water automatic feed - Weathermatic CR 2100
V3	1"	Ball	NC	Emergency manual feed for toilets
V4	6"	Butterfly	NO	Tank isolation valve for Tank 1
V5	1"	Gate	NC	Line Flush and Drain for Tank 1
V6	1.5"	Ball	NO	Filter isolation and service
V7	1.5"	Check		Pressurizes toilet line
V8	1"	Ball	NO	Pump isolation and service
V9	1"	Ball	NO	Pressure Tank Service
V10	1"	Ball	NC	Transfer Line Tank 1 to Tank 2
V11	2"	Ball	NO	Suction Line to Tank 1
V12	2"	Ball	NO	True Union to Suction Line to Tank 2 in pit 1
V13	2"	Ball	NC	True Union to Suction Line to Tank 2 in pit 1
V14	6"	Butterfly	NO	Tank isolation valve for Tank 2 in pit 2
V15	1.5"	Ball	NO	Filter Isolation and service
V16	1.5"	Check		Pressurizes toilet line
V17	1"	Ball	NO	Pump isolation and service
V18	1"	Ball	NC	Potable water direct to orrigation
V19	1"	Ball	NC	Transfer Line Tank 1 to Tank 2
V20	1"	Ball	NO	Pressure Tank Service
V21	1"	Solenoid	NC	Irrigation Master Valve - Weathermatic CR 21000
V22	1"	Gate	NC	Line Flush and Drain for Tank 1
V23	2"	Ball	NO	True Union to Suction Line to Tank 1 in pit 2

METERS

M1	1"	Records water withdrawn from municipal system
M2	1"	Records water delivered to toilets
M3	1"	Records water delivered to irrigation
		M2 +M3-M1= Harvested Rainwater

FILTERS

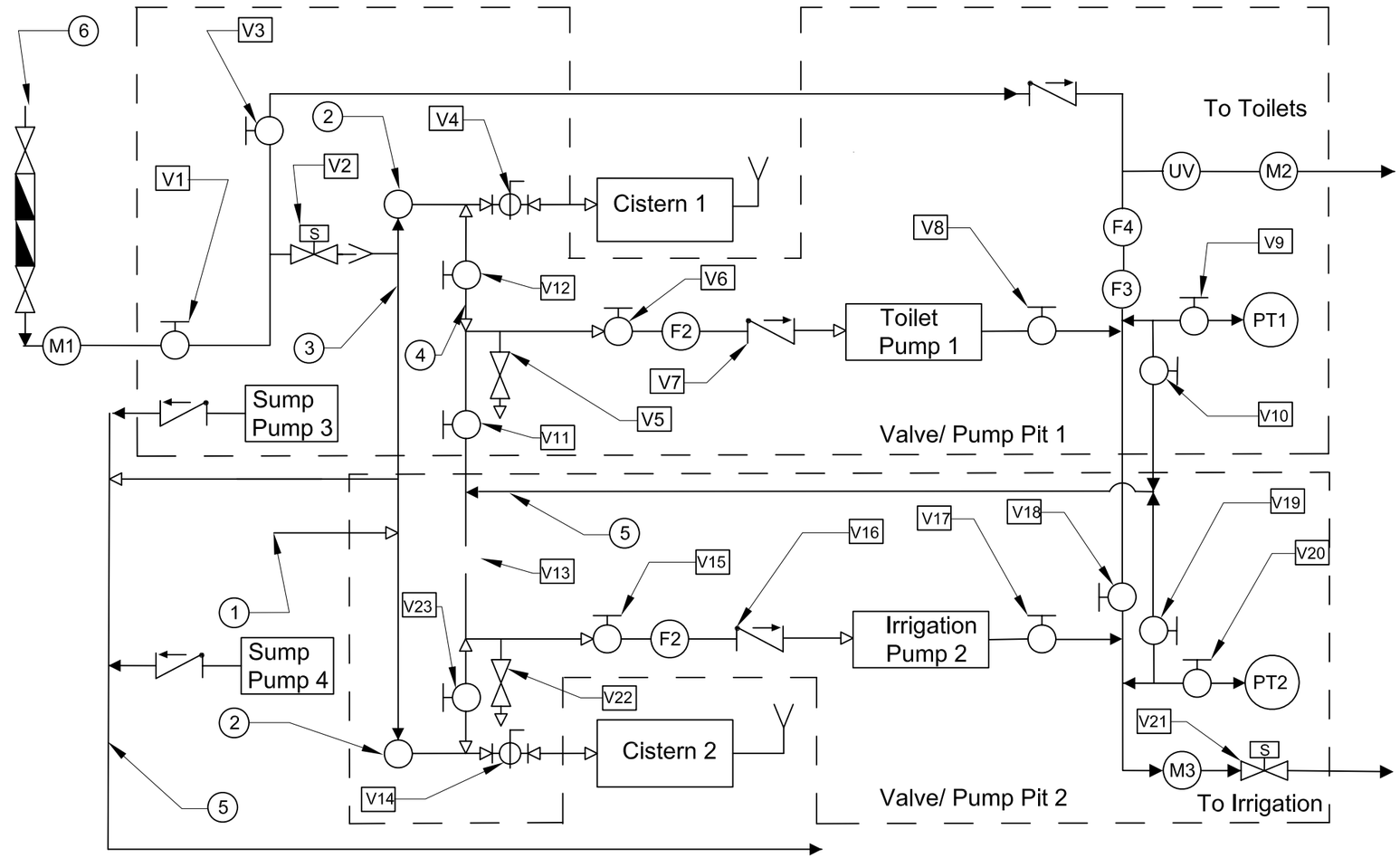
F1	1"	Pump inlet filter (30 micron)	Starite Pro 903 filter w/ Pro 30 cartridge
F2	1"	Pump inlet filter (30 micron)	Starite Pro 903 filter w/ Pro 30 cartridge
F3	1"	Cartridge filter (5 micron)	Starite 900 filter w/ Pro 22 cartridge
F4	1"	Cartridge filter (5 micron)	Starite 900 filter w/ Pro 22 cartridge

PUMPS

P1	1HP	Toilet Pump	Starite shallow well Jet Pump SNE
P2	1HP	Irrigation Pump	Starite shallow well Jet Pump SNE
P3	½ HP	Sump	Starite EC650
P4	½ HP	Sump	Starite EC650

PRESSURE TANKS

PT1	85 gallon - Starite Fiberwound SR85
PT2	85 gallon - Starite Fiberwound SR85



Design Narrative:

The Rainwater Harvesting System is designed to collect precipitation from an office park with a total roof area of 32,000 square feet. The rainwater is conveyed by a network of pipes to an underground storage system. First flush boxes are located at all inlets to the system so that the dirtiest water is segregated and sediment has a chance to be continuously dropped out before reaching storage. The flushes are designed to drain between events and will require removal of sediment on a routine basis.

The storage is a parallel system of two tanks each with a capacity of 30,000 gallons. All other operations are also parallel so that any part of the system may be repaired while the entire system continues operation. The rainwater will be used to supply 100% of the irrigation needs as well as flushing all toilets in the development. The water budget shows adequate water resources for these activities even in a 50 year drought. A potable water makeup line is available for additional water to flush toilets if required. There is also a mechanical switchover with adequate backflow prevention so that the toilets can be fed directly by city water. This is available for use in case of a prolonged power outage at the development that would prevent the use of the pumps that normally feed the toilets.

All functions are metered at strategic points. This will provide data on how much rain water is harvested. It will record how much goes to landscape and how much becomes a return flow to the city system via the toilets. Any water that is withdrawn from the city system will also be recorded.

Lena Street Lofts

Rainwater Harvest Flow Schematic NTS

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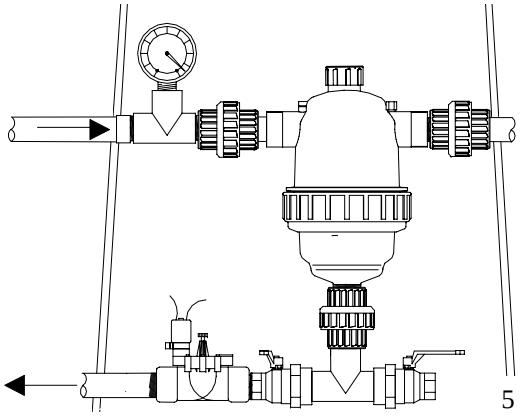
30 Camino Sudeste, Santa Fe, NM Phone/Fax 1-505-986-1719
email: ezentrix@aol.com

This is a rainwater harvesting system with irrigation at the entryway to a new development in Albuquerque, New Mexico (#1), which will eventually cover 13,000 acres (5265 hectares). The owners want to present themselves as interested in sustainable designs, so the first commercial building had a symbolic active rainwater harvesting system. A 54,750 square foot (5086 sq meter) roof is harvested via screened roof drains and a gravity conveyance line. Two tanks of 16,000 gallons (60,560 liters) each are installed downstream of a vertical self draining first flush column (#2). The landscape design called for both spray turf irrigation and drip irrigation. The owners insisted on



using the cistern system for both demands. A 3HP pump was installed to accommodate the high flows and pressures required for the operation of rotors. In order to provide a consistent load for the pump, the drip irrigation has a flush valve on the discharge of the filter (#5). The flush is operated by the master valve signal which is programmed with the drip zones. The outlet of the flush is recirculated to the tanks. The control panel (#4) switches all operations automatically based on demands and water levels. Makeup water is added only when a demand creates a deficit. There is no automatic fill to level which leaves the entire capacity of the tanks available to harvest water. A weather station is used to match irrigation run times to on site ET. Flows are metered at the panel so that the amount of water consumed can be allocated to harvested rainwater and municipal makeup water.

Water Harvesting From an Industrial Building

Advent Solar, Albuquerque, New Mexico

Construction: Klinger Constructors Landscape and Irrigation: Heads Up Landscapes

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