

## **#1296 Evaluation of new retrofit technology for conversion of sprayheads to drip irrigation in municipal facilities**

As in many other cities, a large portion of runoff in the City of Santa Monica originates from excessive or misdirected sprinkler irrigation. In 2004 the City's Environmental Programs Division (SMEPD) began a search for City-owned properties that could serve as demonstration sites for various water conservation and runoff reduction technologies for the City's property owners.

A good candidate was found in Santa Monica Fire Station #2 (Figure 1) which had been completely rebuilt in 2003 as a result of damage sustained in the 1994 Northridge earthquake. The rebuild included new landscaping consisting of three turf zones and five shrub zones totaling a little over 2000 square feet; and an irrigation system composed of an Irritrol MC+ controller, Rain Bird EFB-CP valves and Rain Bird 1800 sprayheads with Rain Bird MPR nozzles. Most of the zones in this landscape are adjacent to hardscape and prone to overspray and runoff from the sprinklers (Figure 2).

A plan was created in-house to convert the five shrub zones to line-source drip irrigation and to retrofit the sprayheads in the turf zones with rotor-type nozzles. (Figure 3)

### **Equipment Choices –**

Since a goal of the project was easy replication by City residents on their own property, it was decided to use, as much as possible, simple, prefabricated assemblies. Devices chosen included the Rain Bird 1800-RETRO ("RETRO") (Figure 4) which provides a pressure regulator, filter and drip tubing connection point in a single assembly that can replace any existing sprayhead. Rain Bird Xericaps (Figure 5) were used to close off the remaining unconverted sprayheads in each zone. After a soil analysis, Agrifim 18mm Dura-Flo PC Dripperline with 0.5 gallon-per-hour (gph) emitters at 12" spacing was chosen as the line-source drip product (Figure 6). Agrifim 1/2" Swivel Tees and marlex street elbows were used to connect the tubing to the RETRO (Figure 7). Initially, It was planned to replace the existing valves with Weathermatic 21024E units; See VALVES below.

## **The Plan –**

One sprayhead, located away from foot or vehicle traffic, was flagged in each zone for conversion with the RETRO (Figure 8). Remaining sprayheads were to be capped except for one or two chosen to be Tattletale / Flush units (described below). The tubing laterals were planned for layout in parallel rows bracketing the original planting rows that appeared to be approximately 30" on center (Figure 9). In long narrow plantings, such as the 32" wide parkway in zone 5, a single line of tubing was used snaking around alternate sides of the plants (Figure 10).

The existing Zone 7 (Figure 11) included both turf and shrubs in the same zone. To correct this it was planned to extend the drip tubing from Zone 1 to include the zone 7 shrubs and all the sprayheads in that area would be capped leaving the unconverted portion of Zone 7 as turf only.

## **Installation –**

**SPRAYHEADS** – Because the original equipment was Rain Bird, the flagged sprayheads in each zone were converted with the RETRO device by simply removing the cap, nozzle, stem and spring from the existing unit and replacing it with the cap and internal portion of the RETRO. If other brands of sprinklers are being converted, the entire sprayhead body must be replaced with the complete RETRO unit (Figure 12). Rain Bird Xericaps (Figure 13) were used to close off the remaining unconverted sprayheads in each zone except for one or two chosen to be Tattletale / Flush units (described below).

**TUBING** -- First, the tubing was pulled into place below the canopy of the plants. When all lines were roughly in place, their location was adjusted at each plant and then fastened in place with galvanized steel, hairpin-shaped stakes at approximately three-foot intervals (Figure 14). When the laterals were in place, A feeder line of plain tubing without emitters was installed to connect the laterals to the RETRO (Figure 15) Rain Bird *Easy-Fit* connectors were used to make all tubing-to-tubing connections (Figure 16).

**TATTLETALE / FLUSH ASSEMBLIES (TFA)** – Maintenance personnel working with drip irrigation for the first time frequently are uneasy about shifting from observing water spray to observing plants in order to tell if the irrigation system is working properly. To assist in this transition we created the TFA (Figure 17) which is a 12" pop-up

sprayhead with a Rain Bird PA-80 adapter and PVC cap in place of the nozzle. In drip systems designed from scratch, we specify a TFA to be placed at the extreme ends of the pipe manifold in each drip zone. In normal operation, these white-capped *tattletales* pop up to full height for a visual indication that the system is pressurized and that there are no serious breaks in the unseen drip tubing. These end-of-the-line caps are easily removed for flushing the manifold when needed.

In conversion of existing sprayhead systems, such as this project, there are built-in opportunities to create TFAs simply by capping the stem of the sprinkler rather than the body (Figure 18).

**VALVES** – Small-scale drip systems usually require a valve with a very low minimum flow rate (“MinFR”), frequently less than one gallon per minute (GPM). When converting sprayheads to drip, the existing valve frequently does not meet those specs, with a MinFR of 3-5 GPM more commonly found. This was the case at Fire Station #2 where the Rain Bird EFB-CPs have a MinFR of 5 GPM while some of the converted zones have flows of less than one GPM. Initially we purchased replacement valves for the five drip zones (Weathermatic 21024E) but decided, since the fire station is occupied at all times, to experiment with throttling down the flow controls on the existing valves before proceeding with replacement.

**TURF ZONES** – The standard nozzles in all turf zones were replaced with MP Rotator MP1000 nozzles.

**CONTROLLER** – A new program based on historical ET and actual zone precipitation rates was calculated and the controller was completely reprogrammed with the new data.

The installation was completed in February 2005.

**MULCH** – The system was observed in operation for two months to confirm correct placement of the tubing and check for leaks and then a 2-3 inch layer of shredded fir bark mulch was placed over all the shrub beds in April 2005.

## **Cost –**

Total material cost including the mulch and the as-yet-unused valves was \$1195 (77¢ per square foot) for the shrub zone conversions and \$136 (30¢ per square foot) for the turf areas. The installation was done by one irrigation tech and two untrained volunteers and required 42 person-hours.

## **Results –**

**PLANTS** – Plant growth was initially observed to be extraordinary. But the installation was completed as the wettest winter in Southern California history was ending, so it would be difficult to attribute the lush growth to the new drip system. However, as the garden moved through spring and a summer that was unusually hot, plant health continued to be very good. The one exception to this was a long line of shrubs against a south-facing wall in Zone 1 which became quite scorched. Ironically, the problem was found to be a malfunction in one of the sprayheads that had been converted to a TFA which created a leak that diverted water from the shrubs.

**RUNOFF AND OVERSPRAY** – Runoff has been completely eliminated from this site. Overspray still exists on hardscape adjacent to the turf zones. This is virtually unavoidable when turf is planted immediately adjacent to hardscape. However, the very low application rate of the rotor nozzles has reduced the problem to a level short of runoff.

**WATER CONSUMPTION** – Landscape water usage for Fire Station #2 increased 50% for the first six months after the conversion compared to the previous year. Since the new controller schedule was calculated based on ET using a  $K_c$  of 0.6 for the shrubs and 0.8 for the turf, it can be assumed that the previous operator of the system was deficit irrigating particularly since the previous system had significant runoff. The controller schedule has been recalculated using lower plant factors.

**MAINTENANCE** – There have been 5 incidents requiring maintenance in the first six months of project operation. Two of them involved failures of sprayheads left in place to act as TFAs. One involved tubing cut by

maintenance personnel, one involved the failure of a tubing connector and the fifth resulted from a valve not shutting off properly. Total repair time for all five incidents was one hour and fifteen minutes.

### **Additional Efforts –**

#### COLLATERAL MATERIAL

- ~ SMEPD has developed distinctive signage for use in landscape demonstration sites (Figure 19). A descriptive sign in this format is being created for the Fire Station #2 site.
- ~ A how-to booklet is being developed for residents and/or contractors to replicate this procedure on their own property.
- ~ Information about this project is being developed for posting on SMEPD's website at <http://www.smeprd.org>.

COMMUNITY RESPONSE -- Thus far one workshop for residents has been held at the site. Response was very favorable with attendees feeling that they could do a similar conversion in their own landscapes.

FUTURE PLANS FOR THIS SITE – After one year of operation in the current configuration, the existing controller will be replaced with a weather-based device.

FUTURE SITES – Santa Monica has three additional neighborhood fire stations and two branch libraries which would be good candidates for additional landscape demonstration projects.