Designing Irrigation Systems for Confined Areas

Improper design of confined areas is the single greatest reason for system failure.

In today's urban environments there are many types of confined areas. They include a wide range of medians, islands or narrow strips of land near buildings. In many cases mixed use of plant material types further complicates the problem. Careful planning and design can make these difficult areas manageable.

Irrigating confined areas cost most in terms of equipment and labor due to the restricted size. They usually require more controller stations, valves, and have a higher density of sprinkler heads per square foot. More equipment in the ground usually means greater maintenance and repair. In most landscapes, the most heavily used portions of the site are adjacent to confined areas. This provides more of an opportunity for equipment damage from vehicles, pedestrians, and vandalism. Confined areas are more difficult to repair. They also are harsh growing environments and will not provide the lush display expected.

The best advice for irrigating confined areas is to not irrigate them. The designer should look for an alternative to irrigating confined areas whenever possible. Some options include:

Use of precast pavers.

Expansion of paved areas to eliminate the confined area.

Rock or stone mulches.

Selections of drought tolerate plant material not requiring irrigation.

Landscape solutions that do not include plants (i.e., sand and rock gardens).

In areas where irrigation is critical to obtaining the desired landscape appearance following some basic concepts will offer the greatest opportunity for success.

Plan the irrigation system along with the landscape.

In many cases the designer plans landscape and site elements without regard to the requirements of irrigation systems. A landscape design that respects sound irrigation design principles will eliminate most problems. Some helpful rules include:

1. Minimize confined areas while organizing site elements. Try different walk or drive patterns that eliminate narrow strips of land.

2. Keep the landscape design simple. Avoid small non-contiguous landscape plantings or beds. In most cases the scale and size of most urban sites require bold landscape patterns of sufficient scale to make an impact on site. Use larger blocks of plants with similar water requirements.

3. Select a width for confined areas that match what is available in standard irrigation equipment. Modules of 8, 10, 12 and 15 feet seem to work well. This reduces the need for non-standard spacing.

4. Eliminate all confined spaces smaller than 5 feet in width. During construction, the contractor will not treat separately an area smaller than 5 feet. Plan on having the parking lot gravel under the planting area in most confined areas. Construction methods and contractors concern themselves with appearance of finished surfaces. The resulting concrete over-pours below ground will turn your 5 foot planting area to 4 foot or less.

Carefully select irrigation equipment for the application.

Read the manufacturers catalogue carefully. Everything most designers need to know is in the catalogue. This is critical information for designing a successful system.

1. Select sprinklers that match the width of the confined area. It is the best policy to select a product from the center of the manufacture's recommended operating range. This provides flexibility in nozzling up or down if conditions change slightly in the field. Do not exceed the manufacturer's recommendations for spacing. This only decreases application uniformity and forces over watering of the site. The manager

will try to water the dry areas created from improper head spacing and flood the site. Much of the water flowing down streets are ill fated efforts to water dry spots.

2. Select sprinklers to apply water at a rate that the soil can absorb. The sprinkler's precipitation rate should not exceed the soil infiltration rate. This is usually a conflict. Most typical small area spray heads have precipitation rates of 1 to 3 inches per hour. This greatly exceeds the infiltration rates of most soils. Be aware of the impact of slope on infiltration. Slopes will decrease the filtration rate. Examine low gallonage nozzles, micro-sprays, and drip emitters as methods to effectively apply water at a rate the soil can absorb.

3. Consider the available operating pressure when selecting equipment. High pressure can make sprinklers turn the water into a fine mist. Misting sprinklers increase wind drift, increase evaporation and decrease application efficiency. This results in water drifting on to windows and paved surfaces.
Select equipment that will regulate pressure if needed. The most effective method is separate pressure regulator on the mainline to reduce incoming pressure to an acceptable range for rotors (60 to 80 psi). Then use the new generation of pressure compensating nozzles to control pressure at the spray head.

4. Consider the slope of the area when selecting irrigation equipment. When a single irrigation zone exceeds 2 to 3 feet in elevation change, low head drainage becomes a factor. Low head drainage is when the zone completes a cycle and the

water remaining in the laterals flows out of the lowest head in the system. This usually ends up flowing across paved areas. Most sprinklers for confined areas have “stopamatic” features that have a small check valve in the sprinkler head. They will prevent low head drainage up to 10 feet of elevation change.

5. Select controllers that have the features and flexibility to properly manage water application to these difficult confined areas. An important feature is multiple schedule options. This provides the ability to design individual schedules specifically for difficult areas that are independent of other schedules. Many of today’s controllers offer up to 4 independent schedules. Controllers with multiple start times help manage the application of water to heavy soils. This feature is for precipitation rates that exceed infiltration of soil. Multiple start times can schedule short bursts of irrigation separated by soak time. This allows the soil to absorb the water at a slower rate. Drip applications require long station run times. Controllers that include drip need to have the ability to run for hours opposed to minutes. Commercial controllers may have a separate drip zone.

Layout the irrigation system using good design principals

The design of small confined areas is no different from other irrigation design problems. All the rules of good design should apply. There is an overwhelming tendency by designers to make exceptions for confined areas. This is because proper irrigation of confined areas appear to be overkill compared to open areas.

You have to accept the fact that confined areas are more costly and require more equipment. The principles that designers commonly overlook include:

1. Change nozzles and spacing as the area narrows. The most difficult areas are ones that vary in width across the entire zone. Avoid the temptation of using the same nozzle and spacing to solve problems of varying width. Select spacing and nozzles than work for the exact location in which they operate.

2. Do not place turf areas and landscape beds on the same zone. The water requirements are significantly different. They need individual control no matter how small they are. If this condition is absolutely unavoidable we suggest nozzles and precipitation rates need to reflect the differing water needs. While this method will make sense to you, the next person running the system will have no idea of what you were trying to do.

3. Separate areas of differing orientation, slope, soil conditions, and plant material types on different zones. Each special condition will require separate operational needs. Do not build in problems by placing west facing water loving plants and the same zone as north facing drought tolerant species.

4. Avoid obstructions that will interfere with the spray pattern. Confined shrub beds are one of the most difficult conditions to irrigate. We have developed a rule of thumb for this condition. We recommend subsurface drip in this situation if at all

possible. Where drip is not acceptable the mature height of the plant is important. When the mature height does not exceed 10 to 12 inches we will water the area using 12” high-pop spray heads with low gallonage or low angle nozzles. This will distribute the water above the mature plant material. In situations where the shrubs are taller than 12 inches we will irrigation then using 4” or 6” pop-up spray heads using flat stream spray nozzles. This approach allows the sprinkler to distribute water below the plant canopy. The design should compensate for some interference of the pattern. This may require closer head spacing. The stream spray nozzles seem to travel better under the plant canopy providing a more even distribution of water. This method hides the equipment and significantly reduces vandalism.

5. Avoid spraying water on building and glass surfaces. The quickest way to let management know the irrigation system is working is to wash down the windows after the make been cleaned. Unfortunately, management would prefer not to have proof the system is working. Whenever possible irrigation adjacent to low windows or building surfaces should be 6” to 12” away from walls. Ideally irrigate the area throwing water away from the building using flat or low angle nozzles and micro-sprays. In conditions where spraying toward the building is unavoidable design the system so they spray patterns will fall short of the last row of shrubs. Allow the water to migrate through the soil. In turf areas consider a simple 6 to 12 inch mow strip around the building. This serves a number of purposes including the need for trimming.

6. Provide flexibility in the design. As the old saying goes “the only thing that is constant is change.” Maintain the option to add a head or two in the future. Leave a little extra in the pipe flow capacity. This not only reduces the water velocity in the pipe, but it extends the system’s life. A common way to build in a small buffer is to use the pressure loss chart of the next higher scheduled pipe. For example if you plan to install PVC Class 200 IPS plastic pipe, design the system using the PVC Class 315 IPS plastic pipe chart. Flexibility in design includes running a couple of spare wires to the end of all the mainlines. This allows for an extra zone or two if needed in the future.

7. Assume something will have gone wrong by the time you need to install the system. Confined areas are by their nature difficult to get to once constructed. Sleeve all irrigation lines under pavement. Minimize the amount of pipe under pavement when possible. The contractor will install the irrigation sleeves for the system early in the construction process. At this point few references exist. Assume in the design that one or more sleeves will eventually be in the wrong location, to deep to use, or damaged during construction. Provide at least two way to get water and wires to a confined area. The cost of pipe early in the construction process is cheap compared to boring at the end of the process. In many cases we have found providing an electrician or plumber one of your extra sleeves makes you an instant hero. Be sure to size the irrigation sleeves at least 2 pipes larger than the pipe you want to place in it.

Adhering to a few simple rules will reduce the problems associated with irrigating confined areas. While difficulty of maintaining these areas will not disappear, it is likely they will not consume large amount of resources or time keeping them operating. Just remember keep it simple, do not get fancy, and follow good sound irrigation design principles.

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Slide 1: Poor material selection for a confined area. System not only does not work but it is a liability hazzard.

Slide 2: High pressure can distort even the best of designs.

Slide 3: An excellent example of irrigation for a confined area. Note the use of the site during an irrigation cycle with no overspray or disruption of walks.