1.6.7 Green Storm Water Quality Infrastructure

A. Retention/Irrigation Systems.

1. Introduction A retention/irrigation water quality treatment system consists of two primary components: (1) a basin which captures and isolates the required volume of stormwater runoff; and (2) a distribution and land application system which generally utilizes pumps, piping and spray irrigation components. The main characteristic of retention/irrigation systems is the ability to retain the entire water quality volume on site and is generally the water quality technology used to meet the SOS non-degradation requirement, 25-8-514(A). The design should consider factors such as basin impermeability and the irrigation area's ability to infiltrate the water quality volume. When properly designed, this system is effective in removal of pollutants through settling in the retention basin and contact with vegetation, air and soils in the irrigation process, as well as in mitigating stream-bank erosion as required by Section 1.6.8 of the Environmental Criteria Manual. The effectiveness of this BMP at meeting required pollutant removal efficiencies is based upon the following criteria being met.

~~1~~2. Minimum Design Criteria for the Retention Basin. Information on water quality volume, diversion structures, and lining requirements can be found in the Environmental Criteria Manual Section 1.6.2, General Design Guidelines. In addition, applicable requirements of Section 1.6.3, Maintenance and Construction Requirements must be incorporated in the design.

a. Retention Basin Volume. The basin must be of sufficient size to capture and hold the required capture volume. Retention basins are designed to capture and hold the water quality volume routed to them via diversion structures~~. The ability of the water quality basin to capture and hold the required water quality volume can be compromised if all storm sewer pipes, concrete structures, wet wells, or any drainage structure below the water quality elevation are not properly constructed and/or sealed. Guidance from Section 1.6.2 for pipes and structures should be utilized.~~ **All structural elements & piping below the WQE shall be watertight** For development in the Barton Springs Zone, refer to Section 1.6.9.3E of this manual for the required capture volume.

b. One-Hundred Year Storm. A bypass capable of conveying the 100-year storm around the basin must be provided.

c. Lining. A liner ~~may~~ will be required for a retention basin if the basin is located in the Edwards Aquifer recharge zone in accordance with Section 1 of the ECM. The liner must be designed in accordance with Environmental Criteria Manual Section 1.6.2C., Basin Liners. **All retention basins are subject to 1.6.3 maintenance and construction requirements.**~~ The ability of the basin to retain the water quality volume shall be evaluated by a qualified City of Austin pond inspector.~~

d. Erosion Prevention. The inlets to the retention basin must be designed to prevent erosion of the soil and liner. Rock rip-rap or other erosion prevention systems must be placed at the basin inlet to reduce velocities to less than three feet per second.

e. Access Ramp. A maintenance access ramp, as described in Environmental Criteria Manual Section 1.6.3, is required for all facilities.

~~2~~3. Minimum Design Criteria for Wet Well and Pumps.

a. Pumps.

(1) The retention basin must be emptied ~~by pumping~~ within 72-hours after a rain event ends. Emptying of the retention basin must not begin sooner than 12 hours after the end of the rainfall event. ~~The pump rate (gpm) shall be designed to evacuate the provided water quality volume (see appendix R-5) in 60 hours for two or more irrigation zones, or 30 hours for a single irrigation zone. For single zone systems the pump must rest for a total of 30 hours so the evacuation time is 60 hours (see 1.6.7(A)(4)(a). The system will be equipped with two identical pumps.~~ **The flow rate of the pumps (gpm) shall be designed with either a 30 or 60hour drawdown time (30 hrs for single zone and 60 for multi zone)**

(2) Pumps must be capable of delivering required volume of water at the necessary rate and pressure to the irrigation system in the designated time period. Pumps and wet well must be sized to minimize the number of on and off ~~-~~cycles of the pumps. The rate(Q_I) of inflow from the retention pond Intake Riser (see 1.6.7(A)(3)(c)) to the wet well must exceed the pump rate (Q_P). ~~If Q_I is less that Q_P, the pump will evacuate the wet well to the elevation of the off float prior to the pond actually being empty. The control panel restarts If Q_I is less that Q_P, the pump will evacuate the wet well to the elevation of the the delay functions each time the off float is activated. This condition known as "well starvation" will reset 12 hour delay preventing the basin from emptying in the required time. Additional mitigation for this condition can be achieved by designing a two zone system (1/2 the pump rate (Q_p) of a single zone). Alternative Intake Riser (or outlet structure to the wet well) may be proposed.~~

(3) A dual pump system must be provided, with each pump capable of delivering 100 percent of the design capacity.

(a) Plug valves must be located outside the wet well on the discharge side of each pump to isolate the pumps for maintenance and for throttling if necessary. Butterfly valves and gate valves must not be used.

(b) Check valve(s) must be provided to prevent backflow from the irrigation system back into the pump well.

(c) Pumps must be selected to operate within 20% of their best operating efficiency.

(4) Pump Operation

(a) The pumps must alternate on start up~~. Alternating the pumps allows both pumps to be exercised. The pumps may alternate during an evacuation cycle, but~~ **T**he control logic must allow the system to operate normally with only one pump in service~~: i.e. all zones irrigate per prescribed plan of system.~~

(b) A manual control must be provided so both pumps can be turned on if necessary.

(c) A high/low-pressure pump shut off system (~~in case of~~ to detect line clogging or breaking) shall be installed in the pump discharge piping. As an alternative, an amp draw (overloads) or other equivalent monitoring device may be used.

(5) Float controls or submersible transducers must be provided to control operation of the pumps. Three control settings must be used: (1) one for starting the pump, (2) one for shutting off the pump at the normal low water level, and (3) one for back up shut off of the pump in case the first shut-off fails.

(6) An alarm system shall be provided consisting of a red light located at a height of at least five feet above the ground level at the wet well. The alarm shall activate when:

~~(a) The high water level has been maintained in excess of 72 hours.~~

(~~b~~a) The water level is below the primary shutoff float and the pump has not turned off.

(~~c~~b) The high/low-pressure pump shut off switch has been activated.

(c) Any other pump failures or system shut down indicated by control panel.

The alarm must be vandal proof and weather resistant. If the system is to be privately maintained, a sign must be placed at the wet well clearly displaying the name and phone number of a responsible party that may be contacted if the alarm is activated.

(7) A green "pump run light" shall be provided which is activated any time a pump is running. The green light should be located directly adjacent to the red alarm light. ~~Light-Emitting Diode (LED) lights are recommended.~~

b. Wet Well.

(1) A separate wet well outside of the basin must be provided for the pumps. The wet well must be constructed of precast or cast in place concrete. ~~Joints below the water quality elevation must be sealed to prevent leakage. The wet well's ability to retain water will be evaluated by a qualified City of Austin pond inspector.~~ Complete access to the pumps and other internal components of the wet well for maintenance must be provided through a lockable **hatch** cover. ~~Aluminum hatch-type covers are recommended.~~ An isolation plug valve to prevent flow from the retention basin to the wet well during maintenance activities must be provided.

(2) Calculations must be provided with the design showing that the wet well will not float under saturated--soil conditions. The top elevation of the well must be ~~at or~~ higher than the water quality elevation.~~walls or berms enclosing the retention pond.~~ The wet well, lateral inflow pipe, and pump must be designed to ~~be low enough to~~ completely evacuate the retention pond. ~~and a~~ A space of at least two feet must be available below the bottom of the pump intake. The two-foot minimum space below the bottom of the pump may be waived if the applicant demonstrates that adequate filtration of the water quality volume is provided.

(3) The pump installation in the wet well and access to the wet well must be designed to allow the pumps to be removed using truck-mounted hydraulic hoist equipment or a portable "A-frame." A system must be provided to allow pump removal without entering the wet well. If rails are used they must be stainless steel.

c. Intake Riser. Prior to entering the wet well, stormwater must pass through an appropriate intake riser with a screen to reduce the potential for clogging of distribution pipes and sprinklers by larger debris (e.g. cups, cans, sticks). The intake riser and screen should ~~shall~~ be designed similarly to Figure 1-54 in the Appendices of this manual. Alternative designs will be considered. ~~The rate of inflow to the wet well should be greater than the pump flow rate. Evacuating the wet well to the normal off elevation before the basin is empty will create an unacceptable duration to empty the basin (resets the 12 hour delay, see Section 1.6.7.5(A)(3)(a)(2)).~~

~~3~~4. Minimum Design Criteria for the Irrigation System.

a. Irrigation Timing.

(1) The retention basin must be emptied within 72-hours after a rain event ends.

(2) Irrigation must be initiated no sooner than 12 hours after the rain event ceases.

(3) The irrigation controller must be set to provide alternating, equivalent irrigation and rest periods until the basin is emptied. ~~The zones can be controlled by relays in pump control panel or a landscape irrigation controller.~~

(4) The time of irrigation on any area must not exceed the rest time. Continuous application on any area must not exceed two hours.

(5) An adjustable rain sensor must be provided which will normally be set to temporarily halt irrigation during rainfalls exceeding one half inch. The rain sensor must be able to interrupt irrigation (stop pumps) in the event of subsequent rain events prior to emptying basin. The 12 hour pump delay may initiate after the rain sensor senses the rain event has terminated.

(6) Division of the irrigation area into two or more sections such that irrigation occurs alternately in each section is an acceptable way to meet the requirement for a rest period.

b. Irrigation Rate. The infiltration rate at which the soil can accept the irrigated storm water must be established using the steps outlined in Section 1.6.7.4. ~~derived from the permeability listed in the U.S. Department of Agriculture National Resources Conservation Service Soil Survey for the county, location, and soil type verified to be present at the irrigation site. If a range is given, the minimum permeability rate is to be used, not to be less than 0.03 inches/hour.~~ Other methods of demonstrating site-specific permeability may be approved by the Director. ~~Importantly~~ **T**he application rate may not exceed the infiltration rate **on any portion of the irrigation area.** ~~and irrigation zone run times may not exceed 2 hours with an equivalent rest period after each cycle (section 1.6.7.5(A)(4)(a)(4)).~~

c. Irrigation Area. Calculations must be provided which demonstrate that adequate irrigation area will be provided based on the application rate, soil permeability, water quality volume, and the actual irrigation time. The irrigation area and system must be included within the water quality easement.

d. Irrigation Area Slope. Irrigation must not occur on land with slopes greater than 10%.

e. Piping and Valves.

(1) All irrigation system distribution and lateral piping (i.e. from the pumps to the spray heads) must be Schedule 40 purple PVC. All pipes and electrical bundles passing beneath driveways or paved areas must be sleeved with PVC Class 200 pipe with solvent welded joints. Sleeve diameter must equal twice that of the pipe or electrical bundle. Buried piping must be marked with detectable marking tape labeled "CAUTION: BURIED NON-POTABLE WATER LINE BELOW".

(2) Valves. All valves must be designed specifically for sediment bearing water, and be of appropriate design for the intended purpose. All remote control, gate, and quick coupling valves must be located in ten-inch or larger plastic valve boxes with purple caps. All pipes and valves must be marked to indicate that they contain non-potable water. All piping must be buried to protect it from weather and vandalism. The depth and method of burial must be adequate to protect the pipe from vehicular traffic such as maintenance equipment. Velocities in all pipelines should

be sufficient to prevent settling of solids. The irrigation design and layout must be integrated with the tree protection plan and presented as part of the Site Plan or Subdivision Construction Plan.

(3) Systems must include a plug valve to allow flushing at the end of every line

f. Sprinklers. All sprinkler heads must have full or partial circle rotor pop-up heads and must be capable of delivering the required rate of irrigation over the designated area in a uniform manner. Sprinkler heads should have purple caps to indicate non-potable water. Irrigation must not occur beyond the limits of the designated irrigation area and sprinkler heads should be located at least twice the calculated spray radius from any residential lot. Partial circle sprinkler heads must be used as necessary to prevent irrigation beyond the designated limits. Sprinkler heads must be capable of passing solids that may pass through the intake. Sprinkler heads must be flush mounted and encased within a 2 feet x 2 feet concrete housing capable of protecting the head from mowing and service equipment (see Appendix V, Figure 1-59F for an example).

g. Vegetation. The irrigation area must have native vegetation or be restored or re-established with native vegetation, unless approved by the Director. These areas must not receive any fertilizers, pesticides, or herbicides. If landscaped areas are used for irrigation, fertilizers, pesticides, or herbicides must not be applied to those areas and this limitation must be outlined in the Integrated Pest Management (IPM) plan. For publicly maintained systems, fencing or signs must be installed to limit unauthorized use of the irrigation area. If signs are installed, they must include the phrase "Stormwater Irrigation Area – No Trespassing."

h. Soil. A minimum of 12 inches of soil, with the identified permeability rates, must be present in the irrigation area. Soil enhancement is allowed to achieve this requirement. A soils report must be provided and must include at a minimum a soils map verifying soil types in the irrigation area, permeability rates, soil depths, percent of coarse fragments gravel size (2.0 mm diameter) and larger, found on the soil surface and in the subsurface soils, depth of roots, locations of borings or trenches, photographs of exposed soils, location and type of soil enhancement performed, soils testing results, etc. A site visit may be conducted by the city to confirm soil conditions, including when representative trenches have been opened or borings are being conducted. City staff must be given at least 72 hours notice of when borings or trenches are to be backfilled.

i. Geological Features. The irrigation area must not contain any Critical Environmental Feature Buffer Zones.

j. Irrigation Area Buffer. A buffer area of un-irrigated vegetation must be provided downstream of the irrigation area to treat any runoff that may occur from the irrigation area during heavy rainfall or from excessive irrigation. This area must be a minimum of 50 feet in length (in the direction of flow) and be adjacent to all downstream edges of the irrigation area. As an option, a diversion system (e.g. a swale or berm) may be provided to route any runoff to the retention basin. This diversion system must be designed to carry the runoff from the two-

year storm. Alternatively, the irrigation area may be located upstream from the development such that any runoff will be routed to the retention pond.

4<u>5</u>. <u>Manuals and As-Built Plans.</u>

a. The applicant must provide two complete copies of an Operations Manual for the pumps and irrigation system, which must include:

(1) Pump curves, electrical schematics, pump and instrument technical information, components of the control panel, pump maintenance recommendations with required frequencies, irrigation controller operation instructions and a written warranty.

(2) As-built plans of the retention basin, wet well, pumps, piping and irrigation system. The plans must show the location, size, and type of all pipes, valves, wiring, wiring junctions, and sprinkler heads.

For retention-irrigation systems that are to be maintained by the City of Austin, both sets of plans and manuals shall be submitted to the Field Operations Division of the Watershed Protection and Development Review Department.

For systems that are to be maintained privately, one set of plans and one manual shall be included with the operating permit application and the second set of plans and one manual shall be retained on site at all times.