MINUTES OF THE COUNCIL OF THE TOWN OF SILVER CITY
WORK SESSION

Grant County Administration Center, 1400 Hwy 180, Silver City, NM
August 17, 2010, 2:00 PM

Present: James R. Marshall, Mayor
Cynthia A. Bettison, District 1
Jamie K. Thomson, District 2
Simon Wheaton-Smith, District 3
Michael S. Morones, District 4

Also Present: Alex C. Brown, Town Manager-Finance Director
Ann L. Mackie, Town Clerk
Robert L. Scavron, Town Attorney
Peter Russell, Community Development Director

1. Call to Order, Pledge of Allegiance, and Reading of Mission Statement. Mayor Marshall called the meeting to order at 2:00 PM and Councilor Bettison read the Mission Statement.

2. Discussion to include, but not limited to the following: the draft of the revised Land Use Code. Mayor Marshall commented that 2 more work sessions for public input would be scheduled, and then the Council would begin debating the recommended changes and ideas from the Council members and the public input received. He stated that each individual that gave the Council advice and input was helping them to make decisions that were informed and educated. He read from the sign-up sheet for public input and announced Van Clothier's name to speak first. Mr. Clothier, Stream Dynamics, Inc., distributed documents to the Council (copies attached to these minutes) and he commented on his recommended changes that were related to water harvesting and floodplain management. There was further discussion with the Council, Manager Brown, and Peter Russell, Community Development Director. Denise Smith, an associate of Mr. Clothier, distributed documents to the Mayor (copies attached to these minutes) and she said that she agreed with Mr. Clothier about floodplain management and water harvesting.

Councilor Bettison moved for a short break at 2:53 PM, and Councilor Wheaton-Smith seconded. All were in favor, motion passed. Mayor Marshall called the meeting back to order at 3:08 PM. Tony Morones talked about manufactured housing and Residential B1 and the goals that could be accomplished through Residential B1 through conditional use permits. He asked that the Council consider Residential B2 for property owners with single-wides. Jim Goodkind followed-up on Mr. Clothier's comments and asked if Manager Brown could come up with the numbers on how much city employee time, and diesel, grader, and backhoe equipment time had been spent on the recent rain event, and how much time would be spent removing flood debris from city streets and property. He also asked for the amount of volume increases to the sewage plant after big rains, and he said that it may help them to understand how much it would save to redirect water to beneficial use rather than detrimental expense. Manager Brown said he would get the data. Mayor Marshall commented on the various recommendations that were brought forward, and he said the Council would go through all of the recommendations. There was no other public input.

3. Adjournment. Councilor Wheaton-Smith made a motion to adjourn at 3:21 PM. Councilor Bettison seconded the motion. All were in favor, motion passed.

_____/s/_____
James R. Marshall, Mayor

Attest:

_____/s/_____
Yolanda C. Holguin, Acting Town Clerk

Falling Free From the Sky

Water Resources and the Silver City Land Use Code

Submitted August 17, 2010

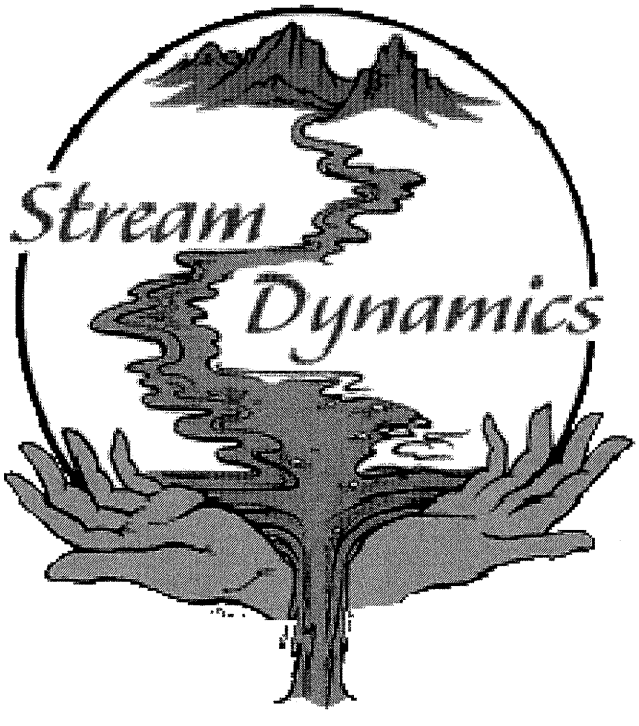
by

Van Clothier

and

Denise Smith

Stream Dynamics, Inc.



WHEREAS: Water is one of the most valuable resources in this dryland community. Developing, operating and maintaining well water and delivery systems is expensive. Town wells deplete the aquifer, and electricity must be used to pump this water uphill, where it originally came from. Meanwhile, storm water runoff from urban hardscape (roofs, roads, etc.) produces way more water than all the wells combined, and can deliver it for free directly to one thousand places. In this remote mountain community, rainwater from metal roofs can easily be filtered to meet the most stringent drinking water standards. Water from roads and parking lots is ideal for irrigating fruit and nut trees, shrubs and grass to benefit our whole community. Greywater recycling to irrigate the landscape is another water resource that can reduce the burden on our well water delivery infrastructure. At present, our codes, and ordinances, as well as the institutional culture of our town do not recognize the value of stormwater or greywater, and cause us to spend huge sums of money to dispose of this valuable resource in a very destructive way. Note that if the budgets for water delivery, street repair, stormwater disposal, and erosion control. were viewed as one, it would make economic sense to start making changes right away. In this era of stalled economic recovery, we must become more practical and more frugal. It should be relatively easy for tiny Silver City to follow the lead of Tucson (who has adopted a water harvesting ordinance), and even improve upon what they have started.

THEREFORE: The Silver City Land Use Code will treat rainwater, snow and stormwater runoff, and greywater as important water resources, and substantial changes to the draft Land Use Code will be made to cost effectively optimize the benefits our community will receive from all of this water. This will naturally improve public safety and security in many important ways. The basic design of new streets and stormwater facilities will be changed, old streets and drainage systems will be retrofitted over time to take fair advantage of this water before sending it out of town in the big ditch more slowly and in a cleaner condition. Since part of the problem and its solution is on private land, a new program will be started when funds become available to teach property owners how to safely harvest water from their roofs and landscapes for their own benefit, and to eliminate their contribution to runoff and erosion problems. Irrigation of landscaping with greywater will be required in new subdivisions and residential and commercial development. These changes will not be cleverly diluted in committees, so that the original intent will be made into a law that will accrue the most benefit to the people of our town in the long run. In addition, the council will direct staff to immediately start learning about water harvesting and greywater, and promoting it in their departments and in their interactions with the public. The floodplain manager will be directed to interpret the new Land Use Code very conservatively, keeping foremost the health of the watershed and the benefits of the waters to the people of our town.

General Comments: As concerned citizens and watershed experts, Van Clothier and Denise Smith are providing the following comments and recommendations on floodplain protection and use with regards to the draft Land Use Code Amendments to the Town of Silver City. Our comments are based on over 25 cumulative years of experience working within floodplains in the Southwest to enhance flood attenuation, reduce erosion, and protect natural resources (features that have ecological, economic, recreational, educational or aesthetic value).

Federal, state, municipal, and private funds as well as volunteer labor are being spent to protect and enhance the floodplains, including wetland and riparian areas, within and adjacent to the Town of Silver City, through sources such as the U.S. Environmental Protection Agency (EPA)

319 and wetland grants administered through the New Mexico Environment Department, and U.S. Fish and Wildlife's Partners for Fish and Wildlife Program. These efforts should be valued and recognized by the Town of Silver City and reflected in its Land Use Code.

We submit as a reference document, the EPA, "Statement of Procedures on Floodplain Management and Wetlands Protection", dated January 5, 1979. EPA recognized the importance of incorporating floodplain protection considerations into its planning, regulatory, and decision making processes over 30 years ago in order to restore and preserve the natural and beneficial values served by floodplains, and developed regulations to ensure that these important resources are not compromised. The suggested changes we are proposing are in concert with EPA's regulations, and have recently been adopted in communities nationwide, including large metropolises such as Tucson, Los Angeles and Seattle.

Section 4 of the document appears to lack specific guidance on maintaining the value of floodplains in relation to their natural and beneficial values, especially avoiding adversely impacting floodplains wherever possible and mitigating the adverse effects if impacts to floodplains are permitted. Without mitigation of individual floodplain impacts, the cumulative effect could result in the devastating loss of property and life that the Town wants to avoid. Fortunately, Water Harvesting is an elegant solution to the nuisance runoff problem that will save the Town money while creating a renewable resource for the community.

With all due respect to the Town of Silver City administration, we offer the following specific comments and recommendations.

Specific Recommendations by page number:

p11 Article II. Definitions, Section 2.2 Definitions:

> **Floodplain.** The flat area adjoining a stream channel constructed by the stream in the present climate and overflowed at times of discharge that has a return interval of 1-2 years. Floodplains modulate flood duration and intensity and are important energy dissipaters.
>
> **Historic Floodplain**. A floodplain that is no longer overflowed by the 1-2 year return interval runoff event, because the grade of the channel has dropped.
>
> **Impervious Surface**. Infrastructure including but not limited to roads, parking lots, sidewalks, gutters, driveways and roofs that do not allow water to soak into the ground and contribute to storm runoff.
>
> **Natural Resource**. Features that have ecological, economic, recreational, educational or aesthetic value, such as flowing water and floodplains.
>
> **Watershed Restoration**. To re-establish a setting or environment in which the natural processes of the watershed, including bank protection with riparian vegetation, and energy dissipation through floodplains can again operate.

Water Harvesting. Directing runoff from an impervious surface into a system of attractive earth basins and vegetated swales that convert nuisance stormwater runoff to a beneficial resource. A cistern could also be used in the case of a metal roof to provide irrigation or drinking water.

Water Harvesting Curb Cut. Cutting a curb to allow street and gutter runoff to flow into a water harvesting basin, where trees and other beautiful landscaping will take advantage of this resource.

Water Harvesting Road Drainage. Draining a road, whether it is paved or not, to regulate the accumulation of storm water runoff on the road surface or gutters or roadside ditches. The runoff is redirected at frequent intervals to attractive water harvesting basins that grow trees, and where possible to drainage ways or watercourses that the road had previously cut off during its construction or subsequent maintenance, restoring the health and function of these important landforms.

ARTICLE IV. OVERLAY DISTRICT REGULATIONS

4.1 Floodplain Overlay District

B) Findings of Fact

p91 3) Flood frequency and flood height are increased by construction of impervious surfaces (roads, parking lots, sidewalks, driveways and roofs), and decreased by water harvesting cisterns, curb cuts, earth basins, and proper water harvesting road drainage. Present climate change appears to be increasing flood height. Downstream flood frequency and flood height are also decreased by appropriate tree and vegetation cover, proper grazing management, removal of impervious surfaces, and watershed restoration of uplands, stream banks, floodplains and wetlands.

p91 C) Statement of Purpose

2) Minimize expenditure of public money for costly flood control projects and associated maintenance for irrigation of public landscaping by promoting water harvesting that will convert nuisance stormwater runoff to a beneficial resource for the community, and reduce the cost of developing additional water resources for landscape irrigation;

p92 D) Methods of Reducing Flood Losses

2) Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the initial time of construction by simply requiring said facilities to be located outside of flood hazard areas;

3) ~~Control the alteration~~ Eliminate the degradation of natural floodplains, stream channels, and natural protective barriers, which are involved in the accommodation of flood waters, and seek to restore natural floodplain and hydrological function through watershed restoration where it has been adversely impacted;

4) ~~Control~~ Eliminate filling, grading, dredging and other development that may increase flood damage;

6) Require water harvesting from all residential and commercial development and all new road construction plans, submitted after January 1, 2012. This activity will be governed by the Town of Silver City Water Harvesting Ordinance (to be written)

p95 Y) Flood Protection System. Such a system typically includes ~~hurricane tidal barriers~~, dams, reservoirs, levees or dikes and require costly capital outlay and long-term maintenance. These specialized flood modifying works are constructed in conformance with sound engineering standards but decrease the ability of natural systems to function properly.

p95 BB) Functionally Dependent Use means a use which cannot perform its intended purpose unless it is located or carried out in close proximity to water. The term includes fishing, water harvesting, stream restoration and planting native riparian vegetation. ~~only docking facilities, port facilities that are necessary for the loading and unloading of cargo or passengers, and ship building and ship repair facilities, but does not include long-term storage or related manufacturing facilities~~

p99 F) Interpretation. In the interpretation and application of this section, all provisions shall be

2) Liberally construed ~~constructed~~ in favor of the governing body and the health of the watershed that supports our community; and

4.1.4 Administration

B) Duties and Responsibilities of Floodplain Administrator

p100 7) Assure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained.

p100 9) When a regulatory floodplain has not been designated, the floodplain administrator must require that no new construction, substantial improvements, or other development (including fill) shall be permitted within Zones A1-30 and AE on the community's FIRM. ~~unless it is demonstrated that the cumulative effect of the proposed development will not increase the water surface elevation of the base flood more than one foot at any point within the community~~.

10)Under the provisions of 44 CFR Chapter 1, Section 65.12, of the National Flood Insurance Program regulations, a community may approve certain development in Zones A1-30, AE, AH, on the community's FIRM which increases the water surface elevation of the base flood by more than one foot, provided that the community **first** applies for a conditional FIRM revision through FEMA. However, since stormwater runoff is a measure of a community's wastefulness, the floodplain administrator will not allow runoff to increase in any sub-watershed within the Town, and will actively promote watershed restoration, water harvesting and proper road drainage so as to decrease stormwater runoff over time.

<new section>11) Review all applications for water harvesting and watershed restoration to insure that the plans are in accordance with the Water Harvesting Ordinance.

<new section>12) Review all existing town impervious surfaces as time allows, and recommend the appropriate water harvesting retrofits to reduce stormwater runoff.

<new section> 13) Require experience and training in Natural Channel Stream restoration (Rosgen Level II training or equivalent) for all designers and builders of any alteration or relocation of a watercourse that drains an area greater than 80 acres. Not require an engineer stamp on designs of water harvesting earthworks or stream restoration projects.

<new section> 14) Allow the base level to be raised where a drainage easement has been created that will safely accomodate the higher water level, while providing channel storage that will reduce the velocity and stage of the flood for downstream reaches.

C) Permit Procedures

2) Approval or denial of floodplain development permit by the floodplain administrator shall be based on all of the provisions of this Section and the following relevant factors:

a) The danger to life and/or property due to flooding or erosion damage;

p101 <insert this after section a, and re-label subsequent provisions>

b) The effect of the proposed facility on the health of the watershed.

p102 D) Variance Procedures

8) Variances shall not be issued within any designated floodway. ~~if any increase in flood levels during the base flood discharge would result~~.

p103 4.1.5 Provisions for Flood Hazard Reduction

The flood protection in Silver City will eventually consist primarily of many small easy-to-maintain water harvesting earthworks distributed throughout the urban sub-watersheds wherever water starts to concentrate during a downpour. These water harvesting works will be designed and constructed in conformance with modern water harvesting principles that will convert stormwater to a beneficial resource on site.

A) General Standards. In all areas of special flood hazards the following provisions are required for all new construction and substantial improvements:

<insert these two new sections before section 1 and re-label subsequent sections>

1) No new construction or substantial improvements will be allowed below the base flood elevation. No variances will be made on this provision by any individual or committee.

2) Require water harvesting and greywater irrigation of landscaping for all new residential and commercial development. Require water harvesting for all new road construction. This will apply to all plans, submitted after January 1, 2012. This activity will be governed by the Town of Silver City Water Harvesting Ordinance (to be written)

p104 B) Specific Standards

3) Enclosures. New construction and substantial improvements, with fully enclosed areas below the lowest floor that are usable solely for parking of vehicles, building access or storage in an area other than a basement shall all be built below base level without exception. ~~which are subject to flooding shall be designed to automatically equalize hydrostatic forces on exterior walls by allowing for the entry and exit of flood water. Designs for meeting this requirement must either be certified by a registered professional engineer or architect, or meet or exceed the following criteria.~~

~~a) A minimum of two openings having a total net area of not less than one square inch for every foot of enclosed area subject to flooding shall be provided.~~

~~b) The bottom of all openings shall be no higher than one foot above grade.~~

~~c) Openings may be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwater~~

6) Water harvesting, watershed restoration, including designating drainage easements, increasing infiltration, and improving water quality, will be the primary methods to address flood hazards.

p106 C) Standards for Subdivision Proposals.

<insert this before section 1 and re-label subsequent provisions>

1) Require water harvesting from all new road construction plans, and require both water harvesting and greywater irrigation of landscaping for all subdivisions. This will apply to all plans submitted after January 1, 2012. This activity will be governed by the Town of Silver City Water Harvesting Ordinance (to be written), and the Town of Silver City Greywater Ordinance (to be written)

p107 E) Floodways

1) Encroachments are prohibited, including fill, new construction, substantial improvements and other development, within the adopted regulatory floodway. ~~unless it has been demonstrated through hydrologic and hydraulic analysis performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base flood discharge~~. Exceptions from this provision may be made for water harvesting and stream channel restoration work that reduces downstream flooding through infiltration and channel storage, including work that hydraulically reconnects the stream to its historic floodplain, and restores or maintains natural function. The channel may be raised to access the historic floodplain where not precluded by development, and where a drainage easement is designated.

(Note: the only way to encroach on a floodway without increasing the flood level is by causing the velocity to increase. This is not acceptable.)

p108 3) Under the provisions of 44 CFR Chapter 1, Section 65.1 of the National Flood Insurance Regulations, a community may permit encroachments within the adopted regulatory floodway that would result in an increase in base flood elevations, provided the community first completes all of the provisions required by Section 65.12; however this Land Use Code is written to more strictly protect public safety and the water resources of our community, and specifically prohibits encroachments within the adopted regulatory floodway.

p108 4) Permitted Uses

d) Water Harvesting and watershed restoration.

p109 6) Conditional Uses

a) Uses ~~or structures~~ accessory to uses permitted in the floodway district

7) Conditional Use Standards

a) Fills

i) Any fill permitted must have a beneficial purpose, and the size of the fill must be related to achieving said purpose. Since encroachments are prohibited in section 4.1.5-E-1 above, fill may only be used to replace material that has been eroded away during the last two years. Fill may only be composed of earth materials (rocks, sand, gravel, dirt, plant materials, including living plants, logs and posts) or concrete. Tire bales and other garbage are specifically prohibited from being used as fill.

F) Nonconforming Uses

p110 2) If a nonconforming use or structure is destroyed by any means, including floods, to an extent of fifty percent or more of its value before the damage occurred, it shall not be reconstructed. ~~except in conformity with the provisions of this section~~.

ARTICLE V DEVELOPMENT STANDARDS

5.1.5 Subdivision Design Standards and Layout

A) Blocks

1) The length or shape of blocks shall be determined with due regard to: provision of adequate building sites suitable to the special needs of the type of use contemplated; needs for convenient access, circulation, control and safety of street traffic; water harvesting basins, and limitations and opportunities of topography.

B) Lots

p116 4) Depth, width, area and shape of sites or lots for commercial or industrial purpose shall be adequate for off-street service, parking facilities, and water harvesting and landscaping required by the type of use and development contemplated and as specified in the Code.

p117 6) All new streets in all new subdivisions will be drained at frequent intervals with curb cuts or other means to water harvesting earth basins. If there is insufficient room to build the basins in the right of way, the basins will be incorporated into the yard landscaping of the new lots, and recorded in the deeds as drainage easements.

p117 Section 5.1.6 Land Dedication and Fees-in-Lieu

A) Parks, Playgrounds and Other Public Areas.

1) Land Dedication

a) For each single-family housing unit or unit in a multiple-family housing development, ~~0.01~~ 0.1 of an acre shall be set aside by the subdivider for public facilities, parks, open space floodplains, or recreation areas.

p118 2) Fee In-Lieu of Land

c) Monies accepted by the town in lieu of conveyance of land for public facilities, parks, or recreation areas shall be used toward the creation of or enhancement of a park or playground or for the purchase of flood prone lands which will be dedicated as open space in a nearby area.

p122 5.2 Streets – This entire section will be modified by the new Town of Silver City Water Harvesting Ordinance when it is written.

5.2.3

D) Curb/Gutter and Shoulders

p125 1) A 6" barrier curb with an 18" gutter is required on all urban street types. Roll curb may be used on rural streets or on urban streets with approval of the Public Works Director, if adequate separation between street and sidewalk is provided for pedestrian safety. All new streets in all new subdivisions will be drained at frequent intervals with curb cuts or other means to water harvesting earth basins.

2) Rural streets may be constructed without curb and gutter subject to the approval of the Public Works Director. Streets without curb and gutter shall have shoulders with stabilized surfacing planted with native grasses.

p128 5.2.6 Where a subdivision borders on or contains a railroad right-of-way, highway, or a natural physical barrier such as an arroyo the Town ~~may~~ will require a ~~street~~ 50 foot wide setback approximately parallel to and on each side of the right of way, ~~at a distance suitable for the appropriate use of the intervening land, as~~ for a park, open space or recreational purposes. ~~in residential zones or districts, or for commercial or industrial purposes in appropriate zones or districts. These distances also shall be determined with due regard for the requirements of approach grades and future separations~~.

p130 5.3 Alleys. This section will be modified by the new Town of Silver City Water Harvesting Ordinance when it is written.

p131 5.5 Natural Resource Protection

New construction shall comply with the following standards. ~~unless compliance with a particular standard would prevent the construction of any permanent structure for a primary use of the land, or require the construction to violate another requirement of this Land Use Code. Where more than one buildable site exists on a parcel and all buildable sites would violate at least one of the following standards, the construction shall be located so as to comply with as many standards as possible.~~ These standards do not create liability on the part, or cause action against, the Town or its officials.

5.5.1 Hazard Areas. Land subject to hazardous conditions such as wildfire, landslides, gamma radiation, mud flows, rock falls, possible mine subsidence, shallow water table, open quarries, floods, and polluted or non-potable water supply shall be identified in all applications, and development shall not be permitted in these areas unless the application provides for the avoidance of the particular hazards ~~If avoidance is impossible or would require the construction to violate other development standards, then such hazards shall be minimized or mitigated.~~ Land

subject to severe ~~wind and~~ water erosion shall be identified on all plans and shall not be subdivided. ~~unless the problems are mitigated by density limitation or some other practical method.~~

5.5.2 Slope Conditions

p132 C) Restoration of Disturbed Areas: add If re-vegetation is unsuccessful, planting will be repeated until more than 80% of the ground surface is covered in live vegetation.

5.6 Stormwater Drainage Control. This section will be extensively modified by the new Town of Silver City Water Harvesting Ordinance when it is written.

5.6.1 Purpose and Intent.

A) To treat stormwater as a valuable resource and to prohibit the concentration and/or disposal of stormwater directly into the natural drainage system.

Note: Change the letters in the remaining sections.

~~A)~~ B)

p133 ~~B~~ C) As to flood control, to prevent the loss or injury to human life, to minimize flood damages to public and private property, and to provide for timely and effective construction and maintenance of flood control facilities, and water harvesting works.

~~C)~~ D) As to storm drainage, to prevent the creation of public safety hazards and seek to eliminate existing problems, to prevent to the extent feasible the discharge of storm runoff from public facilities onto private property, if there is no drainage easement or if the landowner does not want this water, prevent the increased risk of flood damage to private property caused by storm runoff from other private property and to provide for timely and effective construction of water harvesting storm drainage facilities.

~~D)~~ E)

p134 5.6.3 General Provisions.

A) The Town is and shall remain an active participant in the National Flood Insurance Program. The Town endorses the program goal of flood damage reduction through the prohibition ~~regulation~~ of development within flood hazard areas, ~~and~~ the preservation and enhancement of floodways, and the construction of water harvesting features and watershed restoration that will diminish flood damage in a responsible and pro-active way. This Section is intended to complement and supplement the Floodplain Overlay District regulations and shall be administered in concert with them.

B) All land within the Town shall be developed with provisions for adequate drainage, flood control, water harvesting, and erosion control facilities . . . . .<keep remainder of section>

p135 H) Subdivisions shall be designed to optimize water harvesting within the urban landform. ~~minimize sheet flow from one lot to another~~

p135 5.6.4 ~~Surface of~~ Water Harvesting from Streets for Drainage and Flood Control Purposes

A) Water Harvesting shall be the primary means for managing street runoff. If this is not practical along certain blocks, the surface of streets may be used for drainage and flood control purposes, to the extent such use does not interfere with the safe transportation of people and vehicles. The primary use of streets shall be for conveyance of motorized and non-motorized travel.

C) The discharge of nuisance waters to public streets shall be prohibited ~~discouraged~~. Streets shall be protected from ~~flood~~ storm water runoff damages to the pavement and from safety hazards such as the deposition of sediment created by surface flow of nuisance waters across them.

p135 5.6.5 Water Crossings

D) Channel crossing structures which access new developments including temporary crossings, shall be constructed at developer expense. Crossings will be designed to protect the present grade of the channel from down cutting, will not adversely alter the channel alignment, and will have sufficient capacity so as not to increase the velocity of flow during a 10 year runoff event.

5.6.6 Channels

p136 A) The Town seeks to preserve pre-development drainage patterns, and to improve the ecological condition of these waterways to the extent possible. The use of natural channels as the overflow path for water harvesting earthworks for drainage is encouraged. ~~Concentrated~~ Natural drainage flows shall enter and depart from a developed area in the same manner and location as pre-development conditions. No development shall be constructed in such a way as to increase discharge to the natural waterways during the two year storm.

5.6.7 Financial Responsibility

B) All water harvesting drainage, and flood control facilities which directly result from proposed land use change are the responsibility of the developer. Developer financed facilities include all those within the boundaries of the development, those required for development adjacent to a major arroyo or within a flood hazard area, and all temporary and permanent off-site drainage facilities. If the construction of such facilities is a condition of plat approval or building permit issuance, the financial guarantees of such construction satisfactory to the town engineer shall also be provided as a prerequisite.

p137 5.7 Public Utilities

5.7.2 <keep original language and add> All subdivisions and all new residential and commercial construction shall have a greywater system dedicated to irrigation of landscaping, with a conveniently located "Y" valve installed to shunt this water to the sewer system when necessary.

5.9.5 Parking Layout and Design

A) Parking Area Dimensions

p149 6) Parking areas ~~should~~ shall be designed to provide adequate aisle widths between rows of parked cars, and provide adequate space for water harvesting tree basins, so that the parking stops prevent injury to the trees. Parking areas are required to have one water

harvesting tree basin for every four parking spaces. One tree shall be planted in each basin. If this tree dies or is injured so that it will not attain a height tall enough to provide adequate shade for the parked vehicles, it shall be replaced at the expense of the parking lot owner.

P150 5.10.4 Parking Lot Landscaping.

<add at end> Parking lots shall be designed to drain entirely to tree basins and other landscaping areas so that there is no runoff from the two year storm.

p151 5.10.6 Required Landscaping Materials and Practices

A) 1) At lease one low-water-use tree or other woody plant which is six feet or more in height. This vegetation must either be native to the Gila National Forest or food producing. Specifically prohibited are Tamarisk, Russian Olive, Tree of Heaven and Siberian Elm.

2) At least two shrubs, cacti, perennial flowers, or other herbaceous or woody plants of two to six feet in height when mature. This vegetation must either be native to the Gila National Forest or food producing.

C) Deprivation Standards.

p194 5) The extent to which the regulations protect users or neighbors from threats to health or safety shall be fully accounted. A use that seriously threatens the safety or health of future residents or neighbors, or that would constitute a nuisance at common law, is not a beneficial use. This would include attempting to build below base level.

p194 Granting Relief

1) b) The potential for damage to either residents or property or water quality on or nearby or downstream of the site in question shall be assessed in determining a beneficial use. Conditions shall be placed on sites where damage from building or hazardous circumstances is likely to occur. The conditions may include location restrictions, size limitation, construction practices and shall require a building to be built so it will not be damaged and so that it will not damage other property.

References:

Rainwater Harvesting for Drylands, by Brad Lancaster, Rainsource Press, 2006

Tucson Ordinance #10597 "Rainwater Harvesting"

U.S. E.P.A. Statement of Procedures on Floodplain Management and Wetlands Protection, Jan 5, 1979

U.S. Environmental Protection Agency

Statement of Procedures on Floodplain Management and Wetlands Protection

January 5, 1979

Section 1 - General

a. Executive Order 11988 entitled "Floodplain Management" dated May 24, 1977, requires Federal agencies to evaluate the potential effects of actions it may take in a floodplain to avoid adversely impacting floodplains wherever possible, to ensure that its planning programs and budget requests reflect consideration of flood hazards and floodplain management, including the restoration and preservation of such land areas as natural undeveloped floodplains, and to prescribe procedures to implement the policies and procedures of this Executive Order. Guidance for implementation of the Executive Order has been provided by the U.S. Water Resources Council in its Floodplain Management Guidelines dated February 10, 1978 (see 40 FR 6030).

b. Executive Order 11990 entitled "Protection of Wetlands", dated May 24, 1977, requires Federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction and to preserve the values of wetlands, and to prescribe procedures to implement the policies and procedures of this Executive Order.

c. It is the intent of these Executive Orders that, wherever possible, Federal agencies implement the floodplains/wetlands requirements through existing procedures, such as those internal procedures established to implement the National Environmental Policy Act (NEPA) and OMB A–95 review procedures. In those instances where the environmental impacts of a proposed action are not significant enough to require an environmental impact statement (EIS) pursuant to section 102(2)(C) of NEPA, or where programs are not subject to the requirements of NEPA, alternative but equivalent floodplain/wetlands evaluation and notice procedures must be established.

Section 2 - Purpose

a. The purpose of this Statement of Procedures is to set forth Agency policy and guidance for carrying out the provisions of Executive Orders 11988 and 11990.

b. EPA program offices shall amend existing regulations and procedures to incorporate the policies and procedures set forth in this Statement of Procedures.

c. To the extent possible, EPA shall accommodate the requirements of Executive Orders 11988 and 11990 through the Agency NEPA procedures contained in 40 CFR part 6.

Section 3 - Policy

a. The Agency shall avoid wherever possible the long and short term impacts associated with the destruction of wetlands and the occupancy and modification of floodplains and wetlands, and avoid direct and indirect support of floodplain and wetlands development wherever there is a practicable alternative.

b. The Agency shall incorporate floodplain management goals and wetlands protection considerations into its planning, regulatory, and decisionmaking processes. It shall also promote the preservation and restoration of floodplains so that their natural and beneficial values can be realized. To the extent possible EPA shall:

(1) Reduce the hazard and risk of flood loss and wherever it is possible to avoid direct or indirect adverse impact on floodplains;

(2) Where there is no practical alternative to locating in a floodplain, minimize the impact of floods on human safety, health, and welfare, as well as the natural environment;

(3) Restore and preserve natural and beneficial values served by floodplains;

(4) Require the construction of EPA structures and facilities to be in accordance with the standards and criteria, of the regulations promulgated pursuant to the National Flood Insurance Program;

(5) Identify floodplains which require restoration and preservation and recommend management programs necessary to protect these floodplains and to include such considerations as part of on-going planning programs; and

(6) Provide the public with early and continuing information concerning floodplain management and with opportunities for participating in decision making including the (evaluation of) tradeoffs among competing alternatives.

c. The Agency shall incorporate wetlands protection considerations into its planning, regulatory, and decisionmaking processes. It shall minimize the destruction, loss, or degradation of wetlands and preserve and enhance the natural and beneficial values of wetlands. Agency activities shall continue to be carried out consistent with the Administrator's Decision Statement No. 4 dated February 21, 1973 entitled "EPA Policy to Protect the Nation's Wetlands."

Section 4 - Definitions

a. *Base Flood* means that flood which has a one percent chance of occurrence in any given year (also known as a 100-year flood). This term is used in the National Flood Insurance Program (NFIP) to indicate the minimum level of flooding to be used by a community in its floodplain management regulations.

b. *Base Floodplain* means the land area covered by a 100-year flood (one percent chance floodplain). Also see definition of floodplain.

c. *Flood or Flooding* means a general and temporary condition of partial or complete inundation of normally dry land areas from the overflow of inland and/or tidal waters, and/or the unusual and rapid accumulation or runoff of surface waters from any source, or flooding from any other source.

d. *Floodplain* means the lowland and relatively flat areas adjoining inland and coastal waters and other floodprone areas such as offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year. The base floodplain shall be used to designate the 100-year floodplain (one percent chance floodplain). The critical action floodplain is defined as the 500-year floodplain (0.2 percent chance floodplain).

e. *Floodproofing* means modification of individual structures and facilities, their sites, and their contents to protect against structural failure, to keep water out or to reduce effects of water entry.

f. *Minimize* means to reduce to the smallest possible amount or degree.

g. *Practicable* means capable of being done within existing constraints. The test of what is practicable depends upon the situation and includes consideration of the pertinent factors such as environment, community welfare, cost, or technology.

h. *Preserve* means to prevent modification to the natural floodplain environment or to maintain it as closely as possible to its natural state.

i. *Restore* means to re-establish a setting or environment in which the natural functions of the floodplain can again operate.

j. *Wetlands* means those areas that are inundated by surface or ground water with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds.

Section 5 - Applicability

a. The Executive Orders apply to activities of Federal agencies pertaining to (1) acquiring, managing, and disposing of Federal lands and facilities, (2) providing Federally undertaken, financed, or assisted construction and improvements, and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

b. These procedures shall apply to EPA's programs as follows: (1) All Agency actions involving construction of facilities or management of lands or property. This will require amendment of the EPA Facilities Management Manual (October 1973 and revisions thereafter).

(2) All Agency actions where the NEPA process applies. This would include the programs under sections 306/402 of the Clean Water Act pertaining to new source permitting and section 201 of the Clean Water Act pertaining to wastewater treatment construction grants.

(3) All agency actions where there is sufficient independent statutory authority to carry out the floodplain/wetlands procedures.

(4) In program areas where there is no EIS requirement nor clear statutory authority for EPA to require procedural implementation, EPA shall continue to provide leadership and offer guidance so that the value of floodplain management and wetlands protection can be understood and carried out to the maximum extent practicable in these programs.

c. These procedures shall not apply to any permitting or source review programs of EPA once such authority has been transferred or delegated to a State. However, EPA shall, to the extent possible, require States to provide equivalent effort to assure support for the objectives of these procedures as part of the State assumption process.

Section 6 - Requirements

a. Floodplain/Wetlands review of proposed Agency actions.

(1) *Floodplain/Wetlands Determination*— Before undertaking an Agency action, each program office must determine whether or not the action will be located in or affect a floodplain or wetlands. The Agency shall utilize maps prepared by the Federal Insurance Administration of the Federal Emergency Management Agency (Flood Insurance Rate Maps or Flood Hazard Boundary Maps), Fish and Wildlife Service (National Wetlands Inventory Maps), and other appropriate agencies to determine whether a proposed action is located in or will likely affect a floodplain or wetlands. If there is no floodplain/wetlands impact identified, the action may proceed without further consideration of the remaining procedures set forth below.

(2) *Early Public Notice* —When it is apparent that a proposed or potential agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice procedures.

(3) *Floodplain/Wetlands Assessment* —If the Agency determines a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken. For those actions where an environmental assessment (EA) or environmental impact statement (EIS) is prepared pursuant to 40 CFR part 6, the floodplain/wetlands assessment shall be prepared concurrently with these analyses and shall be included in

the EA or EIS. In all other cases, a *floodplain/wetlands assessment* shall be prepared. Assessments shall consist of a description of the proposed action, a discussion of its effect on the floodplain/wetlands, and shall also describe the alternatives considered.

(4) *Public Review of Assessments* —For proposed actions impacting floodplain/wetlands where an EA or EIS is prepared, the opportunity for public review will be provided through the EIS provisions contained in 40 CFR parts 6, 25, or 35, where appropriate. In other cases, an equivalent public notice of the floodplain/wetlands assessment shall be made consistent with the public involvement requirements of the applicable program.

(5) *Minimize, Restore or Preserve* —If there is no practicable alternative to locating in or affecting the floodplain or wetlands, the Agency shall act to minimize potential harm to the floodplain or wetlands. The Agency shall also act to restore and preserve the natural and beneficial values of floodplains and wetlands as part of the analysis of all alternatives under consideration.

(6) *Agency Decision* —After consideration of alternative actions, as they have been modified in the preceding analysis, the Agency shall select the desired alternative. For all Agency actions proposed to be in or affecting a floodplain/wetlands, the Agency shall provide further public notice announcing this decision. This decision shall be accompanied by a Statement of Findings, not to exceed three pages. This Statement shall include: (i) The reasons why the proposed action must be located in or affect the floodplain or wetlands; (ii) a description of significant facts considered in making the decision to locate in or affect the floodplain or wetlands including alternative sites and actions; (iii) a statement indicating whether the proposed action conforms to applicable State or local floodplain protection standards; (iv) a description of the steps taken to design or modify the proposed action to minimize potential harm to or within the floodplain or wetlands; and (v) a statement indicating how the proposed action affects the natural or beneficial values of the floodplain or wetlands. If the provisions of 40 CFR part 6 apply, the Statement of Findings may be incorporated in the final EIS or in the environmental assessment. In other cases, notice should be placed in theFederal Registeror other local medium and copies sent to Federal, State, and local agencies and other entities which submitted comments or are otherwise concerned with the floodplain/wetlands assessment. For floodplain actions subject to Office of Management and Budget (OMB) Circular A–95, the Agency shall send the Statement of Findings to State and areawide A–95 clearinghouse in the geographic area affected. At least 15 working days shall be allowed for public and interagency review of the Statement of Findings.

(7) *Authorizations/Appropriations* —Any requests for new authorizations or appropriations transmitted to OMB shall include, a floodplain/wetlands assessment and, for floodplain impacting actions, a Statement of Findings, if a proposed action will be located in a floodplain or wetlands.

b. *Lead agency concept.* To the maximum extent possible, the Agency shall relay on the lead agency concept to carry out the provisions set forth in section 6.a of this appendix.

Therefore, when EPA and another Federal agency have related actions, EPA shall work with the other agency to identify which agency shall take the lead in satisfying these procedural requirements and thereby avoid duplication of efforts.

c. *Additional floodplain management provisions relating to Federal property and facilities.*

(1) *Construction Activities* —EPA controlled structures and facilities must be constructed in accordance with existing criteria and standards set forth under the NFIP and must include mitigation of adverse impacts wherever feasible. Deviation from these requirements may occur only to the extent NFIP standards are demonstrated as inappropriate for a given structure or facility.

(2) *Flood Protection Measures* —If newly constructed structures or facilities are to be located in a floodplain, accepted floodproofing and other flood protection measures shall be undertaken. To achieve flood protection, EPA shall, wherever practicable, elevate structures above the base flood level rather than filling land.

(3) *Restoration and Preservation* —As part of any EPA plan or action, the potential for restoring and preserving floodplains and wetlands so that their natural and beneficial values can be realized must be considered and incorporated into the plan or action wherever feasible.

(4) *Property Used by Public* —If property used by the public has suffered damage or is located in an identified flood hazard area, EPA shall provide on structures, and other places where appropriate, conspicuous indicators of past and probable flood height to enhance public knowledge of flood hazards.

(5) *Transfer of EPA Property* —When property in flood plains is proposed for lease, easement, right-of-way, or disposal to non-Federal public or private parties, EPA shall reference in the conveyance those uses that are restricted under Federal, State and local floodplain regulations and attach other restrictions to uses of the property as may be deemed appropriate. Notwithstanding, EPA shall consider withholding such properties from conveyance.

Section 7 - Implementation

a. Pursuant to section 2, the EPA program offices shall amend existing regulations, procedures, and guidance, as appropriate, to incorporate the policies and procedures set forth in this Statement of Procedures. Such amendments shall be made within six months of the date of these Procedures.

b. The Office of External Affairs (OEA) is responsible for the oversight of the implementation of this Statement of Procedures and shall be given advanced opportunity to review amendments to regulations, procedures, and guidance. OEA shall coordinate

efforts with the program offices to develop necessary manuals and more specialized supplementary guidance to carry out this Statement of Procedures.

Graywater and Rainwater Harvesting Stakeholder Group

Name	Organization
Lisa Hoffman (Alternates: Nate Allen, Kevin Koch)	Technicians for Sustainability
Alex Jacome	Southern Arizona Home Builders Association
Kevin Barber	American Institute of Architects
Dr. Paul Green (Alternate: Kendall Kroesen)	Tucson Audubon Society
Matt Hogel (Alternates: Jenny Neeley, Cory Jones)	Sierra Club – Rincon Group
Andy Karic	Triumph Builders
Brad Lancaster (Alternates: Val Little, Kevin Koch)	Rainwater Harvesting for Dry Lands
George Larsen (Alternate: Don Baker)	Larsen Baker Commercial Developers
Michael McDonald (Alternate: Terry Dee)	Habitat for Humanity
Colin Zimmerman	Tucson Association of Realtors
Jason Meininger (Alternate: Amy McCoy)	The Sonoran Institute
Nick Nieto	Plumbing, Heating & Cooling Contractors Association
Dave Pittman (Alternate: Brian Brown)	Arizona Builders Alliance
Jay Tripp (Alternates: Jay Casey, Mike Collins)	Plumbers and Pipefitters Union Local #469

ADOPTED BY THE
MAYOR AND COUNCIL

_____

ORDINANCE NO. 10597

RELATING TO BUILDINGS, ELECTRICITY, PLUMBING AND MECHANICAL CODE; AMENDING THE TUCSON CODE CHAPTER 6 BY ADDING A NEW ARTICLE VIII, RAINWATER COLLECTION AND DISTRIBUTION REQUIREMENTS, SECTIONS 6-181 THROUGH 6-188 REGULATING THE USE OF RAINWATER HARVESTING AND STORAGE SYSTEMS; REQUIRING A LANDSCAPE WATER BUDGET FOR ALL COMMERCIAL DEVELOPMENTS; PROVIDING THAT A MINIMUM 50% OF THE LANDSCAPE WATER BUDGET BE SUPPLIED BY HARVESTED RAINWATER; PROVIDING FOR EXCEPTIONS TO THE RAINWATER HARVESTING REQUIREMENT; REQUIRING AN ANNUAL RAINWATER HARVESTING REPORT; AMENDING TUCSON CODE CHAPTER 27, WATER, ARTICLE I, IN GENERAL, SECTION 27-15(A) TO INCLUDE A RAINWATER HARVESTING PROVISION AS AN ELEMENT OF WATER WASTAGE; SETTING AN EFFECTIVE DATE; AND DECLARING AN EMERGENCY.

WHEREAS the City of Tucson (the "City") has experienced substantial growth, continues to experience growth, and water resources sufficient to meet the growing needs of the community must be ensured and;

WHEREAS the City must secure additional water supplies over the long term; that such supplies will become more costly over time; and that the potential for drought in the Southwest is a real and continuing problem and;

WHEREAS the City and its citizens must acknowledge, and successfully manage and coexist with the resource limitations of the arid Sonoran Desert environment and;

WHEREAS water conservation constitutes a legitimate and critical public health, safety, welfare, economic, and sanitation concern and;

WHEREAS the City should maintain its leadership role among desert cities as an innovator in water resource management, water use efficiency, technology, policy, and regulation; and continue to create sound, sustainable policies for new developments that are cost-effective and responsible and;

WHEREAS, Tucson Water estimates that 45% of all water usage in its service area is dedicated to outdoor purposes;

BE IT ORDAINED BY THE MAYOR AND COUNCIL OF THE CITY OF TUCSON, ARIZONA, AS FOLLOWS:

SECTION 1. The Tucson Code Chapter 6 is hereby amended by adding a new Article VIII Sections 6 -181 through 6-188, to read as follows:

ARTICLE VIII. RAINWATER COLLECTION AND DISTRIBUTION REQUIREMENTS

Sec. 6-181. Definitions.

As used in this article, the following terms are defined as follows:

Commercial development means any new non-residential development that is intended to be used primarily for commercial activities, and is subject to the requirements of the International Building Code.

Rainwater means water that has fallen as rain and contains little dissolved mineral matter, or any other form of precipitation.

Sec. 6-182. Rainwater Harvesting Plan.

A. All commercial development and site plans submitted after June 1, 2010 shall include a rainwater harvesting plan. The rainwater harvesting plan shall include a landscape water budget and an implementation plan.

1. The landscape water budget shall calculate the estimated volume of water required yearly for all site landscaping detailed in the development and/or landscape plan.

2. The implementation plan shall show how any combination of capture, conveyance, storage, and distribution will be utilized on-site to harvest rainwater. Implementation plans shall comply with applicable Development Standards for water harvesting applications.

3. The implementation plan shall also provide for water metering of all on-site landscape water through either:

(a) A separate water meter connected to the main water supply; or,

(b) An irrigation sub-meter.

B. The rainwater harvesting plan shall be submitted concurrently with the site plan and landscape plan.

C. The Director of the Development Services Department may authorize alternative compliance with Development Standards when conditions of topography, site soils or ratio of landscape area to total site area would make strict adherence to standard provisions unreasonable and the alternative compliance advances the spirit of this Article.

Sec. 6-183. Construction of rainwater harvesting system; Minimum landscape budget requirements; Request for Rainwater Harvesting Plan Revision.

A. All new commercial development built pursuant to a development plan submitted after June 1, 2010 shall include a rainwater harvesting system constructed according to an approved rainwater harvesting plan.

B. No later than three years from the date of issuance of a final certificate of occupancy, and for every year thereafter, 50% of the estimated yearly landscape water budget shall be provided by rainwater harvested on-site by a rainwater harvesting system constructed pursuant to an approved rainwater harvesting plan. The 50% landscape budget provision shall not apply in any calendar year in which the annual precipitation has fallen below the amount determined in the applicable development standards.

C. Within three years from the date of issuance of a final certificate of occupancy, the applicant, or a successor in interest, may request to revise the rainwater harvesting plan. The request shall be submitted to the Director of Development Services. The request shall be granted only if one of the following is true:

1. A mathematical or engineering error was made in the calculation of water required for on-site landscaping.
2. A variance related to landscape requirements, and which impacts the landscape water budget, is obtained subsequent to the approval of a submitted rainwater harvesting plan.

3. Additional data on site conditions or performance relevant to the subject site has been obtained, and results indicated a needed change in water budget calculations in the rainwater harvesting plan.

Sec. 6-184. Restrictions on installation of rainwater harvesting system invalid.

A. Any covenant, restriction or condition contained in any deed, contract, security agreement or other instrument affecting the transfer or sale of, or any interest in, real property which effectively prohibits the installation or use of a rainwater harvesting system is void and unenforceable.

B. A deed, contract, security agreement or other instrument affecting the transfer or sale of, or any interest in, real property entered into before June 1, 2010 shall not be subject to the provisions of this section.

Sec. 6-185. Exceptions.

A. That portion of a development which includes the following land uses shall be excepted from the 50% rainwater harvesting requirements:

1. Public parks and botanical gardens;
2. Outdoor recreation facilities, whether under public or private ownership, for public use, schools, and day care centers;
3. The playing areas of golf courses;
4. Cemeteries;
5. Natural open space;
6. Crop production.

Sec. 6-186. Annual Report.

A. A rainwater harvesting landscape water-use budget report shall be submitted annually by the owner or owner's agent to Tucson Water. The report shall include location and ownership information for the property, monthly rainfall totals collected from an on-site gauge or the SAHRA rain gauge closest to the site, monthly site water use data, and monthly relevant sub-meter or service meter data.

Sec. 6-187. Violation.

A. Failure to meet the 50% rainwater harvesting requirement for landscape irrigation shall constitute water wastage, and notwithstanding any other

provision of this section shall constitute a violation of Section 27-15 of this code.

B. The Director of Development Services or the Director of Tucson Water may require that any development not meeting the landscape budget requirements conduct and submit a landscape irrigation audit and report the results with the audit and reporting performed by a third party auditor and paid for by the property owner.

C. The imposition of civil liability shall not preclude the city from taking any other enforcement actions permitted under the code.

Sec. 6-188. Applicability.

The provisions of this Article shall apply to construction built pursuant to permits issued after June 1, 2010.

SECTION 2. The Tucson Code Chapter 27, Section 27-15 (a) is hereby amended by adding a new subsection (7) to read as follows:

> 7) Failure to meet the 50% rainwater harvesting requirement for landscape irrigation set forth in Chapter 6, Article VIII of the Tucson Code.

SECTION 3. The various City officers and employees are authorized and directed to perform all acts necessary or desirable to give effect to this ordinance, including, but not limited to, providing an instructional pamphlet setting forth in plain language the requirements of this ordinance.

SECTION 4. If any of the provisions of this ordinance or the application thereof to any person or circumstance is invalid, the invalidity shall not affect other provisions or applications of this ordinance which may give effect without

. . .

. . .

. . .

the invalid provision or circumstance, and to the end the provisions of this ordinance are severable.

SECTION 5. WHEREAS it is necessary for the preservation of the peace, health and safety of the City of Tucson that this ordinance become immediately effective, an emergency is hereby declared to exist and this ordinance shall be effective immediately upon its passage and adoption.

PASSED, ADOPTED AND APPROVED BY the Mayor and Council of Tucson, Arizona, _____.

_____
MAYOR

ATTEST:

_____
CITY CLERK

APPROVED TO FORM:

_____
CITY ATTORNEY

REVIEWED BY:

_____
CITY MANAGER

LK/kr
10/8/2008 11:53 AM

CITY OF TUCSON
DEVELOPMENT STANDARD NO. 10-03.0
COMMERCIAL RAINWATER HARVESTING

COMMERCIAL RAINWATER HARVESTING

10-03.0.0 COMMERCIAL RAINWATER HARVESTING.

10-03.1.0 GENERAL

1.1 INTRODUCTION. By minimizing amenity irrigation demands, rainwater harvesting reduces demand on the desert's most limited resource: water.

1.2 PURPOSE. This Development Standard has been prepared to facilitate effective use of available rainwater resources for landscape irrigation in commercial development as a means of reducing dependency on potable and reclaimed water sources. It shall clarify requirements for compliance with Ordinance No. xxxxx, the Commercial Rainwater Harvesting Ordinance. This standard provides:

A. Direction for design of rainwater harvesting systems;

B. Requirements and guidelines for the preparation and implementation of rainwater harvesting plans;

C. Requirements for maintenance and monitoring of completed installations;

D. Requirements for enforcement of the Standard, and;

E. Addresses special accommodations when warranted for site- and use-specific conditions.

1.3 This standard applies to all commercial development plans submitted after June 1, 2010.

10-03.2.0 DEFINITIONS. Other than as provided below, definitions used in this Standard are found in the Development Standards Glossary or Sec. 6.2.0 of the *LUC*.

2.1 *Commercial development.* Any new non-residential development that is intended to be used primarily for commercial activities, and is subject to the requirements of the International Building Code.

2.2 *Evapotranspiration (ET).* The loss of water from a vegetative surface through the combined processes of plant transpiration and soil evaporation. Simply put, the rate at which plants use water.

2.3 *Reference Evapotranspiration (ETo).* An estimate of the water used by a well-watered, full-cover grass surface, 8-15 cm in height used to establish a reference point for determining water use by other plant types through the application of a plant coefficient. ETo varies by month and is shown in inches (and feet) in the table below. (AZMET Station Data)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3.00 (.25)	3.72 (.31)	6.00 (.50)	8.04 (.67)	9.96 (.83)	10.56 (.88)	9.36 (.78)	7.92 (.66)	7.20 (.60)	5.76 (.48)	3.60 (.30)	2.64 (.22)

2.4 *Plant Coefficient* (PC). Landscape plant types are assigned a plant coefficient for the purpose of calculating the water budget as shown in the following table.

Plant Coefficient	Plant Type
0.13	Very low water use
0.26	Low water use
0.45	Medium water use
0.65	High water use

2.5 *Plant Coverage Area (PCA).* The area of ground covered by a plant or tree when viewed from above.

10-03.3.0 RAINWATER HARVESTING PLAN. A Rainwater Harvesting Plan is required to be submitted with all applications for land development where landscaping is required, except as noted in Section 10-03.4.0 of this standard. The Rainwater Harvesting Plan shall consist of a water budget and implementation plan addressing the information itemized below. Additional information may be requested or required by the Development Services Department (DSD) Director to evaluate rainwater harvesting proposals.

3.1 Water Budget.

A. Rainfall Supply: From 1993 to 2008, Tucson received as little 7.62 inches of rainfall (2004) to a high of 14.99 inches of rainfall (1999) with an average annual rainfall of 12.17 inches per year (Source: National Weather Service). To account for this variability, and ensure water harvesting systems function in the majority of years, water budgets prepared in compliance with this standard shall be based on nine (9) inches of rainfall per year. This equates to approximately 244,386 gallons per acre per year.

B. Landscape Irrigation Demand (LID). Landscape irrigation demand shall be stated in gallons and calculated on a montly basis using the following formula:

LID = PCA x ETo x PC x 7.48

PCA - Plant Cover Area

ETo - Reference evapotranspiration

PC - Plant Coefficient

7.48 - The number of gallons in a cubic foot of water.

Example: The formula for determining the landscape irrigation demand in gallons for a plant cover area of one acre (43,560 square feet) of all low water use plants (plant coefficient - 0.26) in January (ETo - three inches or .25 feet) would be as follows:

LID(month) = PCA x ETo(month) x PC x 7.48

LID(January) = 43,560 x .25 x 0.26 x 7.48

LID(January) = 21,179 gallons

C. Landscape Irrigation Supply (LIS). A minimum of 50 percent of the LID must be supplied by harvested rainfall. This requirement is represented by the following formulas.

LIS = HRW + PW + OS

and

HRW ≥0.5 x LID

HRW - Harvested Rainwater

PW - Potable Water

OS - Other sources of water

LID - Landscape Irrigation Demand

Potable Water Use. No more than 50 percent of the LID may be supplied by potable water sources.

PW ≤0.5 x LID

3.2 Rainwater Harvesting Implementation Plan (RHIP). The Rainwater Harvesting Implementation Plan shall consist of a separate sheet with a plan view layout of the site. The format of the RHIP shall be consistent with the base plan, be it a plat (DS 2-03), site plan (DS 2-04), development plan (DS 2-05), or their successor documents as applicable, together with details necessary and appropriate to convey the technical concept of the rainwater harvesting system design and facilitate proper installation and maintenance of the rainwater harvesting system in compliance with the Ordinance No.xxxxx, the Commercial Rainwater Harvesting Ordinance, and this standard. The RHIP shall be consistent with the landscape plan and the grading plan and shall be referenced on both.

A. In addition to the requirements of the applicable base plan, the RHIP shall include the following notes:

1. Square footage of plant cover area for 1) very low water, 2) low, 3) medium, and 4) high water use type plants.
2. Landscape Irrigation Demand (LID) in gallons per year.
3. Harvested rainfall and potable water use in gallons per year.
4. Percentage of LID satisfied by 1) harvested rainfall, 2) potable water, and 3) other sources.
5. Volume in gallons, and area in square feet, of each water harvesting area, and total volume of water harvesting areas.
6. Total rainwater diverted from detention/retention basins.

B. In addition to the requirements of the applicable base plan, the RHIP shall show the following

1. Water harvesting catchment areas shall be conceptually delineated with shading or a hatched pattern, with volume shown within the catchment area or by notes.
2. Very low, low, medium, and high water use plant cover areas shall be labeled and delineated with a heavy outline. Plant cover areas with both canopy and understory shall be delineated with a double outline.
3. Spot elevations shall be shown on the grading plans to indicate final grade, depth of mulch/ground cover, and finished grade.
4. Final grading elevation, depth of mulch/ground cover, and finished elevation.
5. All paving shall be labeled with arrows indicating slope.
6. The location of any french drains within water harvesting areas must be indicated on civil/grading plans.

C. Design requirements. The City of Tucson Water Harvesting Manual should be used as a reference.

1. Design shall accommodate overflow from catchment areas.

2. Water harvesting areas shall be sized according to the anticipated volume of water that will enter the basin, taking into consideration whether the basin will only collect water falling on the basin area or if it will be intercepting flows from adjacent watersheds. A 4:1 ratio of catchment area to plant coverage area, adjusted as necessary in response to site conditions, is recommended.

3. The edge of any ponding within water harvesting areas shall be at least 10 feet from building foundations. Closer placement may be possible with the approval of a soils professional and may include structural soil backfill with protective liner at the foundation.

4. Water harvesting areas shall be designed so that water infiltrates the soil within twelve (12) hours.

5. Water harvesting areas shall be designed to minimize ponding in areas which may create a nuisance for pedestrians.

6. Unpaved or planted areas shall be below the grade of adjacent hardscape to create micro-basins wherever possible. Pedestrian circulation should be designed to discourage cutting across basins so as to avoid compaction, erosion, and damage to plants.

7. Conveyance swales should incorporate check dams and/or nested micro-basins to slow and harvest water and trap sediment.

8. Water should be harvested and slowed near its source.

9. Plants selected for use in water harvesting shall have compatible water needs. Other considerations shall include sun exposure, maintenance requirements, shape, form and aesthetics. Certain plant forms may work better in informal vs. formal planting designs.

10. Soil beneath the bottoms of all water harvesting areas should be ripped to a depth of at least 12 inches prior to trenching and installation of irrigation lines.

11. Rip-rap shall be indicated where erosion protection at spillways is necessary.

12. A 12 inch wide shoulder with a maximum two (2) percent cross slope away from the pedestrian circulation paths shall be provided adjacent to water harvesting catchment areas.

13. Maximum reveal at edge of pedestrian circulation paving shall be 1" to minimize the risk of injury.

14. Ponding limits shall be a minimum of ten feet from all buildings.

15. Wherever possible hardscape surfaces shall be sloped toward water harvesting areas.

16. The ground surface treatment of areas conveying significant water flows shall be able to withstand scouring. Acceptable materials include hardscape paving, rock mulch, graded or sized rock, rip rap, fractured rock, and, in limited situations, turf. Bare soil, decomposed granite, or other loose forms of mulch are not acceptable. Filter fabric placed with 12" minimum toe downs at edges shall be used under all rock, mulch, and rip rap within conveyance areas.

17. Fine grades of decomposed granite shall not be used within or directly adjacent to water harvesting areas.

18. The bottoms of water harvesting basins should receive ½"-1" sized/graded crushed rock that has been washed to remove all fines or organic mulch.

19. Organic mulch is encouraged in locations where the vegetation, water collection, erosion, and slope characteristics make it appropriate.

D. Containment systems. Containments systems, typically above or below ground tank systems, are not required but may be necessary in some applications to supply the minimum required 50 percent of LID with harvested rainfall.

1. The following requirements apply to both above and below ground containment systems.

a) Rainwater outlet points on the roof.

i. Rainwater falling on the roof may be concentrated using in gutters, canales, or other concentration point devices

ii. Determination of the number, volume and location of concentration points will be determined by the applicant.

iii. Sizing for these structures is per the plumbing code (IPC).

iv. The size and configuration off the outlet points will need to be able to be joined to create the inlet line to the tank.

b) Inlet piping.

i. The tank inlet piping must be installed to connect the roof outflow to the tank inflow port.

ii. Inlet piping shall be of sufficient diameter as required by the IPC. An overflow mechanism, separate from that of the tank, shall be provided to ensure that water does not back up on the roof.

iii. Inlet piping may convey water overhead from the roof to the tank, or in a U-configuration that conveys water to a lower entry point on the

tank. The U configuration may be designed to hold standing water, and must be pressure rated and sealed to prevent leaks.

iv. Screening must be configured in such as way that an unmaintained screen can not cause detritus to block the inlet pipe preventing rainwater harvesting, and backing water up on the roof creating unsafe weight conditions on the roof.

v. Entry designs that involve water falling freely through the air before entering the tank will be allowed provided their design can minimize the entry of light and mosquitoes into the tank.

c) First flush device.

i. First flush devices deflect the first flush of rainfall off a roof before it goes into a tank. It is intended to deflect the associated dust, grit, leaves and other material that may accumulate on a roof from entering the tank.

ii. First flush devices are strongly recommended to be installed, but are not required.

iii. Both internal and external first flush devices are acceptable for use.

iv. Some first flush devices need post-rainfall maintenance to empty the device so its ready for the next rainfall.

d) Access.

i. Tank should have an entry port of sufficient size to conduct any necessary visual inspection, maintenance, entry for cleaning or repair and other tasks as described in the manufacturer's specifications or other guidance.

ii. Entry ports must be sealed to prevent entry of light and mosquitoes into the tank.

iii. If a manhole is provided with the intent of allowing human access into the tank, it must meet size and safety requirements for entry.

2. Irrigation Interconnect. A reverse pressure backflow preventer assembly is required when connecting irrigation from a rainwater collection tank to a potable water irrigation system in order to protect the public water system and/or building water system. (See Exhibit 3 Reduced Pressure Backflow Prevention Device.)The following requirements apply to above ground containment systems.

a) Size.

i. The dimensions of a tank will be determined by the applicant based on site-specific design needs.

ii. Design or review by a structural engineer may be required if there are no manufacturer specifications and/or details.

b) Construction materials.

i. Tanks and covers shall be constructed of materials appropriate for use for storing water in an above-ground configuration. These materials may include metal, plastic, reinforced concrete, fiberglass, or other DSD-approved material.

ii. Tank construction material must be able to endure UV exposure without loss of structural integrity, or must be UV protected with an appropriate coating.

iii. Tank construction material must be opaque to prevent sunlight from inducing algae growth.

c) Foundation.

i. Tanks shall have a base that meets manufacturer's specifications.

ii. If no specifications are provided by the manufacturer, the base shall be designed by a structural engineer.

d) Placement. Placement shall be as determined by the architect, landscape architect, and/or engineer, and shall meet all applicable codes.

e) Overflow.

i. There must be a structured overflow device installed with the tank to automatically allow excess infill water to exit the tank safely.

ii. The overflow line capacity shall meet the requirements of the International Plumbing Code.

iii. The outlet of the overflow pipe shall be positioned so as not to compromise the foundation of the building.

f) Direct outlet device. For use directly from the tank rather then through irrigation system.

i. Put only "keyed" hose bibs on tanks to prevent people from tapping the tank using a standard hose bib. This in intended to allow only authorized people to tap the tank water directly. Provided a yellow placard with black text at the hose bib stating the water in non-potable, as required by Uniforme Plumbing Code section 601.2.2.

ii. <<ADD MORE SPECS FOR SCREENING, SIZE, ETC, AS NEEDED BASED ON 9/30 MEETING WITH EXPERTS>>

3. The following requirements apply to below ground containment systems.

   a) Construction materials.

      i. Tanks shall be constructed of materials designed to be used for underground storage tanks holding water. These materials may include masonry, reinforced concrete, fiberglass, plastic, or other DSD-approved material.

      ii. Materials must be installed and sealed per manufacturer's specifications.

      iii. Any portion of a subsurface tank that is exposed to sunlight must be able to endure UV exposure without loss of structural integrity, or must be UV protected with an appropriate coating.

      iv. Any portion of the subsurface tanks that is exposed to sunlight must be opaque to prevent sunlight from inducing algae growth.

   b) Foundation. Tank should be installed in bedding per manufacturer's specifications and/or in consultation with a civil engineer to base the bedding on soil characteristics.

   c) Placement. Placement shall be as determined by the architect, landscape architect, and/or engineer, and shall meet all applicable codes.

   d) Overflow.

      i. There must be a structured overflow device installed with the tank to automatically allow excess infill water to exit the tank safely

      ii. The overflow line capacity shall meet the requirements of the International Plumbing Code.

      iii. The outlet of the overflow pipe must be at least 10 feet from the foundation of a building and shall be positioned so not to compromise the foundation of the building.

   e) Load bearing.

      i. Below ground tanks must be designed and installed under the guidance of a civil or structural engineer and/or tanks must be installed per manufacturer's specifications regarding bedding, setting the tank, and backfill.

      ii. Tanks must be utilized per the manufacturer's specifications regarding whether or not the finished installation is load bearing and the limits of that load.

f) Strapping. A strap must be installed around the tank per the manufacturer's recommendations.

4. The option shall be provided for the design team to design an alternative containment system (above ground fountain, pond, etc.) that does not fall under the strict category of a tank. Such containment systems shall follow the aforementioned guidelines for tanks to the extent possible while maintaining their design intent and will be evaluated on an individual basis.

E. Irrigation systems.

1. Irrigation systems shall be capable of monitoring and responding to plant water needs through the use of soil moisture gauges and/or weather station and/or evapotranspiration data.

2. Irrigation plans must include calculations for estimated water use.

3. Irrigation systems shall maintain a minimum 80% distribution uniformity.

F. Details

1. Typical basin cross section, see Exhibit I.

2. <<potential details-
- Water Storage Features
- Water Harvesting areas
- Regulatory Detention / Retention Basins
- Sumps
- Dry Wells
- French Drains and other Subsurface Structures
- Structural Soil
- Bubbler Boxes
- Sidewalk Scuppers
- Storm Sewers
- Area Drains
- Infiltration Chamber
- Permeable Paving
- Curb Openings

3.3 Maintenance Standards. After the system has been constructed, it must be properly operated and maintained to assure reliable and safe service. A key issue for operation and maintenance is keeping the system clean and leak-free. Proper system design to prevent impurities from entering the system will greatly simplify upkeep. The following maintenance requirements shall be addressed on the RHIP.

A. Pipes, pipe joints and connectors, pumps, vents, etc., shall be inspected monthly for any damage or disrepair. Problems noted shall be repaired and/or corrected.

B. Gutters, leaf screens, filters, first-flush devices, etc., shall be cleaned monthly.

C. System shall be inspected during heavy rains or shortly thereafter to check for leaks and/or overflow problems. Problems noted shall be repaired and/or corrected.

D. Containment structures shall be inspected annually. Residue and sludge that effects system performance or capacity shall be removed.

E. Containment system access hatches should be checked regularly to make sure they are securely closed.

F. Catchment areas shall be maintained to ensure they continue to function as designed.

G. Overflow structures of water harvest basins shall be maintained to prevent erosion of basin or surrounding areas.

H. All required water harvesting areas, containment systems, and site improvements necessary for the rainwater harvesting system to function as intended shall be maintained as shown on the approved plans

3.4 Monitoring

A. Monitoring of water use and related information at the site shall be the responsibility of the property owner.

1. A Tucson Water irrigation sub-meter is required except on smaller sites.

2. Private sub-meter may be permitted on smaller sites. Private sub-meters must meet the accuracy standards provided in Exhibit 2 Accuracy Standards for Private Sub-meters.

B. An Annual Report shall be submitted to the appropriate Department by January 30 of each year, on a form provided by the appropriate Department.

C. The Report shall contain information for the previous calendar year:

1. The amount of irrigation water delivered from the public water distribution system on a monthly basis.

2. The amount of irrigation water delivered from the public water distribution system authorized under the RHIP.

3. Changes to the landscape or irrigation system in the reporting calendar year.

4. Rainfall

a) On-site gauge

b) Interpolated rain estimate from local rain gauge network.

5. Water use data

a) Service meter

b) Sub-meter

6. Other information as deemed necessary.

10-03.4.0 DROUGHT. <<address per Tucson Water – move to definitions?>>.

10-03.5.0 ENFORCEMENT

5.1 All water harvesting area grading in planting areas must be inspected and accepted by DSD prior to plant installation and prior to application of mulch, or decorative rock, etc.

5.2 Landscape Irrigation Audit <<necessary?>>

EXHIBITS

Exhibit 1 Basin Cross Section

Exhibit 2 Accuracy Standards for Private Sub-meters

Exhibit 3 Reduced Pressure Backflow Prevention Devices

ATTACHMENT D

MEMORANDUM

DATE: October 9, 2008

TO: Honorable Mayor and Council

FROM: Commercial Rainwater Harvesting Development Standard Technical Advisory Group (see membership below)

SUBJECT: Development Standard 10-03 Commercial Rainwater Harvesting

On September 4, 2008, our Technical Advisory Group (TAG) was convened to facilitate creation of a development standard to implement the Commercial Rainwater Harvesting Ordinance. The 24 member TAG is made up of design professionals in engineering, hydrology, planning, architecture and landscape architecture, as well as landscape contractors, general contractors, and water harvesting specialists. In the last five weeks the TAG has met ten times to develop an understanding of the key elements of water harvesting in Tucson and formed subgroups to address rainfall variability, water budget methodologies, irrigation efficiency and design, earthworks, containments structures, monitoring, and maintenance. This has been an intensive and fruitful effort.

The structure of the standard has been established and the technical content is 90% complete, however further refinement is required before the standard can be used for review. The main section of the standard, per the rainwater harvesting ordinance, is the Rainwater Harvesting Plan, and this makes up the bulk of the development standard. The Rainwater Harvesting Plan is further broken down into 1) Water Budget, 2) Rainwater Harvesting Implementation Plan, 3) Maintenance, and 4) Monitoring.

As our work progressed, we identified issues that are outside the scope of our assignment that nevertheless need to be addressed prior to the effective date of the Rainwater Harvesting Ordinance and the Commercial Rainwater Harvesting Development Standard. For example, the existing restrictions in the LUC as they relate to cisterns create unworkable constraints on the design of active water harvesting systems. Administration of the Land Use Code needs to address the appropriate placement of cisterns and calculation of lot coverage so as to not inhibit creative design in above ground water harvesting systems. The Water Waste Ordinance will need to be amended to facilitate enforcement of the Rainwater Harvesting Ordinance. When finalized, the standard could be applied to a limited number of real, implementable pilot projects which will highlight other areas of conflict that no doubt exist within existing regulations. Together with an education and outreach program, this will allow the issues to be addressed and the development community informed before the effective date of the ordinance and will result in a better, more workable development standard.

There are many other environmental issues that are directly related to this ordinance and development standard that could be negatively impacted if not taken into consideration. Property owners should be encouraged to incorporate maximum water harvesting principals in their projects, above and beyond the ordinance where possible, through incentives such as but not limited to; reduced service fees, and parking requirements, expedited reviews, and tax incentives at the state level.

It is this group's goal to ensure that the Rainwater Harvesting Ordinance and the Commercial Rainwater Harvesting Development Standard do not push new development to meet only the minimum landscape requirements. Instead, it should encourage environmental stewardship and sustainability, promoting developments that strive to reduce the heat island effect or provide shading for buildings to reduce their energy loads (which in turn saves the water used to create energy). This will require additional study of related code issues such as screening, setbacks, and parking requirements, both in material and number, among others.

The TAG asks that Mayor and Council adopt the Commercial Rainwater Harvesting Ordinance together with the draft Commercial Rainwater Harvesting Development Standard. With Council direction, following adoption of the ordinance, the TAG will reconvene to finalize the standard, with completion expected by the end of the year.

TAG Membership:

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Eric Barrett, RLA, Arc Studios Inc.
Jeff Blau, PE, Parsons Brinkerhoff
Mike Censky, HSL Properties
Justin Cupp
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