Mission Garden and

A-Mountain Watershed Workshop

October 23, 2012

Tucson, Arizona

BRIEF SUMMARY OF PRESENTATIONS

The immediate area of Mission Garden

Divided into 5 subwatershed-rainfall areas for purposes of this workshop, west, north, east, south, inside the wall. Estimated annual rainfall amounts over these areas are shown on Figure 1.

The number of plants that could be supported just on this rainfall are shown on Figure 1 and based on Appendix 4 of Rainwater Harvesting for Drylands, By Brad Lancaster

Assumes 20-ft tall/wide low-water-use canopied native food-bearing tree (velvet mesquite, desert ironwood, blue and foothills palo verdes), needs 3,000 gal/yr water

Assumes 16-ft tall/wide citrus needs 8,000 gal/yr water

Additional large volume of stormwater comes from A-Mountains (See Figure 2)

Brad Lancaster presented a range of useful, low-tech methods to manage flows of water and sediment.

He emphasized that plant water demand drives water budgets, and that the abundant stormwater flow and rainwater harvesting potential would allow significantly more trees.

Guide design with the 5 capitols: Social, Environmental, Economic, Infrastructure and Human Capacity

Briefing by Roger Pfeuffer, Friends of Tucson's Birthplace. This NGO has entered an agreement with City of Tucson and Pima County to manage the Mission Garden. They have proceeded with additional planning and planting and are raising money for Garden management on an on-going basis.

Field trip followed with participants walking the perimeter of Mission Garden to assess conditions there.

NOTE: SKETCHES AND DETAILED NOTED PREPARED BY PARTICIPANTS DURING FIELD TRIP HAVE BEEN RETAINED FOR USE IN FUTURE DISCUSSION AND DESIGN EFFORTS

OVERALL GOALS, ISSUES, CONSTRAINTS, POTENTIAL, QUESTION AND NEXT STEPS FOR THE MISSION GARDEN AND SURROUNDING WATERSHED AREAS

GOALS

Minimize use of potable water to support vegetation inside the Mission Garden and around its perimeter

Make optimum use of stormwater to serve multiple functions

Use reclaimed when available in the future as secondary water source after rainwater/stormwater

Improve habitat, shade, and aesthetics around the Garden

Support native food-bearing plants around the perimeter of the Garden, supported by stormwater

Plant vegetation to protect outer Garden walls from graffiti

Illustrate how and inspire neighbors to use similar strategies on a small scale on their own sites to utilize stormwater

Include the stormwater management areas around the perimeter of the Garden in public tours to illustrate creative, sustainable water management to support native vegetation and manage large stormwater flows

Reduce heat island effects

OVERALL ISSUES AND CONSTRAINTS

Archaeology constraints:

Significant archaeology to the west and north of Garden and inside its walls. Archaeology was mapped using trenches, so there is not a complete picture of it

The foundation of the historic wall in just south of Mission Lane north of the garden, and would affect the kind and location of plantings allowed north of the north channel

Inside dirt level at bottom of basins in the historic level of the garden

South of new Garden wall and East of new Garden walled are cleared archaeologically, so can move dirt here

Gasline constraints:

crosses from corner SW of Garden, through the Garden and out the south side. Can plant small plants over the buffer area.

Landfill issues

Jeff Drumm, COT Environmental Services provided map of density of materials in A-Mountain landfill pits

Landfill increases in depth substantially toward the river. Relatively shallow on the south side of the Garden wall. None inside Garden

There is a monitor well inside SE corner of Garden. Taps shallow perched groundwater. Does not always have sufficient water to sample. Avoid pumping when little water because it draws contaminants toward the well. Sampled every 6 months. Strata is recharged by river, in east to west direction.

Fill dirt was brought In South of Garden on top of landfill

Stormwater quality issues

Effects of fireworks on A-Mountain on stormwater quality should be checked through water sampling

Stormwater quality factors are affected by sediment load. Good to capture stormwater before it gets full of sediment – so before it crosses the road

On the south side of the Garden, stormwater that flows across Grande Rd surface is lower in quality due to picking up sediment and other materials from the road and landfill surfaces

The closer stormwater is used to where rain falls, the better its quality will be

Stormwater flow issues

Mission Garden walls are surrounded on 4 sides by drainage channels ("Mission Garden channels") that divert stormwater flows around the Garden (see Figure 3) and direct them east to the Santa Cruz River

To stop sheet-flow flooding of neighborhood north of Mission Garden, a culvert was constructed northwest of the garden wall, under Grande to concentrated former sheet flow into a channel that flows west to east along the north side of the garden.

Recent reshaping of channels around the garden, construction of a foot bridge northeast of the Garden wall, and grading and filling to put in parking lot southwest of the Garden wall may have changed stormwater flow patterns. New drainage volumes and patterns should to be analyzed and mapped

Make sure any plantings or other changes to channels do not reduce stormwater flow capacity

Sediment loads in stormwater

Large volumes of sediment originating largely from localized berms around the Mission Garden channels are carried around perimeter of garden. As berms continue to erode, these may change Mission Garden channel profiles and flow capacities. Some sediment is currently depositing east of the footbridge in the small channel that conveys stormwater to the Santa Cruz River

Land ownership and stewardship

majority of land inside Mission Garden is owned by Pima County

Much of perimeter land is owned by City of Tucson

Private landholdings are found north and northwest of the Garden

Three-way agreement between Pima County, City of Tucson, and Friends of Tucson's Birthplace, designates FOTB as having Mission Garden management responsibility

OVERALL POTENTIALS

Strong community participation in Mission Garden. Lots of volunteers have assisted here.

FOTB is managing the Garden and raising funds for this purpose

Conduct public workshops, have education signage, conduct tours of channels outside the Garden to educate about stormwater utilization

Strengthen the connection between the Mountain, Garden, River and history, Improve the connections between the Garden and other historic features that can help educate the public about stormwater management, native plants, historic water management strategies, etc

Historic Warner's Mill site west of Grande

The mountain is the "roof" the Garden is the "sponge"

The mountain and river used to directly connect farther south.

Remake this connection using an entry arch on Grande that is also a wildlife bridge

Redesigned entrance way driving north on Grande could be used as a flow splitter to reduce slow delivered in more northerly channel, if necessary

Make a "string of pearls" of historic and modern connections that educate the public about native plants, cultivated plants, stormwater management, water harvesting and other key subjects of interpretation

Imbed historic artifacts (shards, glass, etc) in future concrete works

Conduct arroyo farming outside the Garden wall in some appropriate location

Garden uses Kino trees and is getting a lot of attention and support for this effort

Carrillo House, to be rebuilt east of the Garden, north side of Mission Lane nearer the river

Permits and drawings are done

Find out its solar axis for passive solar design, has a flat roof

Could demonstrate home-based water management strategies

Put historic plants at Carrillo house

Demonstrate LID, cultural links, reduce neighborhood flooding in the neighborhood and Carrillo House

Mimic historic and prehistoric techniques wherever possible in modern stormwater management efforts

Very large volume of rainwater/stormwater is available to be put to beneficial use to grow vegetation inside and outside the Garden

Intercepting and utilizing rainwater/stormwater would decrease the volume being discharged in the Mission Garden channels, and help reduce the potential for neighborhood flooding

Inside the wall, there is limited rainwater runoff available due to generally flat slope, so divert water into the Garden from outside locations where possible. Make sure there is sufficient exit routes and capacities to get excess stormwater back out of the Garden as needed

Use higher quality external stormwater where possible to divert into the Garden

Plant native, low water use, multifunction trees, shrubs and other plants outside the Garden wall to utilize rainwater/stormwater without requiring tank storage.

Plants can help improve stormwater quality

Plants and trees help filter sediments from sheet flow and channel flow

Mitch Pava o-Zuckerman, UA student, found wood chipped mulched water harvesting areas 10 times more effective at bioremediation than non-organic mulched areas. No update of contaminants into woody plants. Not sure about herbaceous plants

Improve A-Mountain watershed by adding vegetation and reducing erosion

Have stormwater and associated vegetation serve multiple functions, including

support native food-bearing vegetation

reduce flooding at the base of the Garden wall and in neighborhood to the north.

Illustrate an assortment of Low Impact Development (LID) strategies

Create wildlife and bird habitat and viewing areas

Education

Photography

Make perimeter channel areas part of walking system around the Garden

Destination place to visit to see LID in practice

Ideally, plant on slopes above the breakline where the slope changes from relatively shallow to relatively steep, or below where slope changes from steep to more gradual as sediment deposits.

Fine-grained sediments hold the most water

The steep portion of the slope typically has lost its fine-grained sediments and is erosion prone.

However, around Mission Garden drainage channels, stabilizing steep slopes with plants is necessary to reduce sediment inputs to channels

Start with rock mulch above the breakline

Use water harvesting basins, swales and other techniques to harvest localized rainfall, especially on dry banks above water levels in channels

Mulch basins to assist in reducing evaporation, building soil, and removing sediment from runoff water

Need to allow for traditional maintenance in bottom of channels

Use strategies that don't preclude future needs for the area

Use workshops with public participation to implement small-scale techniques. Build social capitol

Could use water trucks to water plantings instead of investing in irrigation systems

Where water is temporarily ponding, toads may show up. This has already happened in some areas around the Garden

Add more bridges for pedestrians and bikes across drainages outside Garden wall. Would local design firms offer to design and build these?

Is there something to learn from 20 years of work in Sonoita Vineyards combining water harvesting and drip irrigation? (See Dollie Gadot, 1990 MS. Water Harvesting Supplement to Grapes)

Need to get deep infiltration of winter rains. Summer rains don't tend to infiltrate as deep. Consider infiltration trenches. Local bush and bulky collected piles may provide good mulch source

Talk to Bob Webb USGS about "Great Mesquite Forest", potential for huge mesquites here if they were supported by shallow groundwater

Need to decide: Natural approaches over engineered approaches

OVERALL QUESTIONS AND NEXT STEPS

Find out whether City engineers/hydrologist could perform a revised drainage analysis of the A-Mountain watershed and Mission Garden drainage channels, down to the Santa Cruz River.

If not, find out what it would cost for a private firm to do this

Figure out what is needed to proceed with this new analysis. This is key to all further steps

What areas on each channel must be left accessible to machinery to maintain the channels?

Need to recalculate precipitation and flow rates for watersheds

Develop plant pallet for outside the wall to serve the following functions:

Provide sense of place, shade, food, habitat, etc.

Stabilize eroding banks

MAP specific borders of areas that can be dug at interface between landfill and Garden area

Specific areas where no additional water can be allowed to infiltrate on/near landfill

Check soil types throughout Garden and surrounding areas, some may affect plant species selection

Check distance/depth throughout for landfill, archaeology, burials, utilities,

Find out radius needed for trails

Find 2006-2007 mapping of Rio Nuevo area for good contour information. Doesn't include all of A-Mountain

Will increased irrigation be detrimental to archeological features?

Which utilities are at the site, and may be impacted by stormwater utilization

Get specific setbacks and requirements for work around Gasline (contact Steve Tineo or Jose Ortiz)

Check out wall conditions: Garden wall cracked in one location. Is this due to subsidence? instability? Carefully consider effects of excessive water moving at or under foundations

Can Rio Nuevo large pipe system watershed be used to contribute any water to the Garden area?

Get Mission Road as-built drawings to see if they help determine where to capture water

Would adding more monitoring systems be helpful?

Continue to collect available pictures (e.g. recent flooding around the Garden) and knowledge from those who have been working with the Mission Garden area

Get plans for Carrillo house

Look for funding sources to undertake evaluation, design and implementation

TDOT grant for new culver design

Environmental Justice Grant applications due end of November

$226,000 (Marie Light PCDEQ - contact)

Get public involved at all steps: workshops, drivers' observations, school children, tours, etc.

DISCUSSIONS OF SPECIFIC SUBAREAS OF THE WATERSHED

SOUTH SIDE OF WALL (Figure 4)

CONDITIONS

There is rock below land surface south of Garden

Lots of sediment and other materials in stormwater here from landfill cap and due to stormwater crossing Grande

This south channel is currently also used as a road surface for access to the south side of the Garden

This side of the Garden is subject to the largest peak rate of runoff approaching from the south and the importance of proper storm-water management in this area is critically important

Landfill cap side slope should be stabilized to prevent further erosion and reduce sediment deposition in the channel.

Continued sediment deposition in the channel will result in the loss of channel conveyance capacity which could lead to overtopping and possibly flow into the Garden via the southern Gas Line Gate.

Particular attention is warranted at the SE corner where channel flow is made to turn a right angle. Per Environmental Services, buried landfill waste is near the channel bank and subject to exposure due to erosion

POTENTIAL/SOLUTIONS

Could put lined pond on top of landfill south of Garden, but do not induce increased infiltration of rainwater/stormwater here (do not put ponds in channel –always off channel)

Need to control evaporation losses from open pond. Is there a way to reduce this (at Page Ranch, they covered pond with floating ping-pong balls)?

Need large sediment trap south of Garden wall if there are plans to use stormwater runoff approaching Garden from this direction.

Sediment trap would be put outside south Garden wall

The finer the particles, the longer the settling time needed. Can undulate the flow path to allow more time to settle, but harder to clean out

A portion of the settling basin southwest of Garden could be vegetated with native flood plain grasses and disturbance-adapted shrubs

Could plant around the sediment trap/lined pond on top of landfill, but not trees whose roots go deep. Stick to shrubs and low plants

Or, could put settling pond outside Garden wall, and storage pond inside Garden wall

Could install underground tank here then pump water into the Garden (expensive, but “invisible” from historical perspective)

Make sure settling basin cleans water before going into Garden. Soil inside Garden is already very clayey

Along the south channel, there is clean localized runoff coming from wall side toward bottom of channel.

Could plant trees on wall side to take advantage of this localized runoff

They would also benefit from larger stormwater flows

An impermeable channel lining on the southeast corner of garden may be warranted especially if runoff is allowed to accumulate there

QUESTIONS

What role does A-Mountain drainage have in infiltrating into shallow perched aquifer? Can this recharge be enhanced? Take advantage of mountain front recharge to support deep-rooted trees

Can they stop driving outside along south was of Garden, may be deleterious to short term stability of channel. Create new road higher up on back-stopped terrace on toe of landfill

NEXT STEPS

See General next steps above, plus:

Get more specifics about landfill conditions in terms of how deep into south bank planting or excavation could occur

Find out what options are available for lined pond, underground tank, settling basins, and other structural works that might be considered here. What capacity should structures be built for

Need contours for this area, especially vis a vis changes in runoff patterns due to construction and gravel topping of new parking area

EAST SIDE OF WALL (Figure 5)

CONDITIONS

Runoff from the south flows northerly along the east side of the Garden where the main entrance is located

City Parks and Rec recently enlarge this channel due to water backing up against the east side of the Mission Garden wall

Need to maintain this profile or larger profile to ensure stormwater passes safely down to the river

Tall, steep bank borders the east side of the east channel, leading up to the capped landfill

Erosion runnels are present on the slope of the bank

Salt bush is growing in patches on the bank, providing localized stabilization

Rocks laid at the southeast corner outside the Garden wall are collecting sediment and reducing channel conveyance capacity. This is not a good place for this to happen, as it may result in the water backing up onto the foundation of the wall

Building along east wall line has supports to eventually have roof put on it. Not currently roofed

POTENTIAL/SOLUTIONS

Create an enhanced entrance for people walking to the Garden gate by planting trees along the east channel

A channel in this area could be properly designed and constructed to keep flow would not be adjacent to the Garden wall. May require excavation and disposal of landfill waste that may be encountered. An impermeable channel lining may be warranted to prevent infiltration into the landfill

Could road terrace be east of the channel on the east side of Garden wall?

Cut “alcoves” into the banks along the east channel to plant trees in.

Their roots would help stabilize the channel and make use of the stormwater

Adding check dams along east drainage might slow water enough to feed perched aquifer underlying that area if infiltration to aquifer is not a problem

Channel on east side needs to be widened, meandered and vegetated

Stabilize the banks

Put organic mulch on top of landfill to start the sponge, then work treatments downhill with rock berms interspersed with mulch and plantings

Lay rock bands on slopes with organic mulch in between bands to slow water and induce more infiltration on slope

Seed and/or plant appropriate low-water-use native plants. Wolfberrry (in the Goji berry family) and saltbush already doing well here. Expanses of these used to be common but are now rare

Roof the building along with east side wall.

Harvest runoff to support plants near entrance to Garden

Put in drinking fountain that drains directly to a plant (may need to treat this as greywater and route it underground to a plant)

QUESTIONS

What native plants are best for stabilizing the steep slope?

What are the implications of increased infiltration of water her to the perched aquifer below?

Is that a bad thing from landfill stability perspective?

Is this a good thing in terms of creating high moisture availability for tap rooted trees?

What are the trade off between these views?

NEXT STEPS

See General next steps above, plus:

Figure out preparations needed to remove and lower height of rock on southeast corner outside Garden wall

NORTH SIDE OF WALL (Figure 6)

CONDITIONS

Channel that flows west to east north of the Garden wall intercepts water from two locations:

Three 24-inch culverts recently added northwest of the Garden wall on the west side of Grande that drains the east and north side of A-Mountain. These are intended to reduce neighborhood flooding toward the northeast (see Fig 2)

A portion of the water that flows off the east-southeast flank of A-Mountain (see Fig 2) crosses Grande and flows east onto the landfill. A portion of this then flows west to east in the channel south of the Garden wall, and a portion flows south to north in the channel west of the Garden wall, where it turns the corner to flow west to east in the northern channel. Concentrated flow then flows east toward Santa Cruz River

Unclear whether the north channel is sufficient to contain the added flow from the south, and the concentrated culvert flow

This is the best quality stormwater available

The bottom of the north end of the concrete irrigation ditch (inside garden walls) is about 2 feet *higher* than the bottom of the earthen drainage channel outside the wall at a point due north of the concrete irrigation ditch.

The bottom of the east side of the culvert going under Mission is about 6 inches *lower* than the bottom of the concrete irrigation ditch within the Garden walls.

Bridge southeast of the Garden provides ADA access but is undersized

Bridge built before north channel was widened, and retains an earlier narrower flow capacity

Per observations, this summer's monsoon stormwater flooded out of the channel when it hit the bridge, and flowed to the northeast, a serious concern for the Barrio Sin Nombre neighborhood.

Can't raise the bridge into an arch shape because wheelchairs could not access it

Lots of sediment is moving down the channel due to erosion along the banks of the Mission Garden channels, and adjacent landfill areas

Channel extends east of the bridge to the Santa Cruz River

Channel gradient becomes more shallow here and channel appears to narrow

Presence of deposited sediment and large weeds indicate water is pooling

Sediment deposition may be propagating westward toward the footbridge and farther west. This would decrease conveyance capacity of the north channel.

POTENTIAL/SOLUTIONS

Could intercept flowing stormwater in the north channel at several points along with reach using pipes that perforate under the garden wall and discharge into Garden basins inside the wall.

This would reduce volume of stormwater flow downstream to the foot bridge

Could run pipe inside the wall to distribute to various basins inside, or check if the concrete channel inside the wall could be used

Manage channel configuration and sediment transport to continue flow without creating downstream flooding or problems

Reduce energy in channel by adding sinuosity to low flow channel. This would also help in reducing sedimentation under the bridge

Channel could be widened without threatening the buried historic Garden wall

Support vegetation growth and stabilize the banks of the north channel by cutting in a terrace on the south side of the channel, stabilize it with rock, and planting with native trees and shrubs

Roots of plantings will grow along banks and under the channel to create a “hammock” effect that helps stabilize channel soils

Can scallop out tree planting locations to allow more water to infiltrate and more area for planting

Line scallops with rock fro stability

Consider some planting on the north side of the north channel, being aware of constraints due to the buried wall foundations of the historic garden.

Could create shallow swales on south side of Mission Lane without damaging the wall.

Can plant shallow shrubs by the road, but not over the old wall foundation

This could also serve to indicate where the wall is for interpretation purposes

Make sure planting and water harvesting do not damage the pavement

Can put an-grade header to keep infiltration from damaging pavement (basically a deep curb)

Several suggestions to modify flow around the foot bridge so drainage capacity under it is at least as large as water volume draining toward it, including volume of culverts

Install culverts just north and just south of the footbridge to route large flows around it and back into the existing channel down to the Santa Cruz River

Remove wood bed of the footbridge. Dig out the chan nel as needed under the bridge so it matches the profile of the rest of the channel. Replace wood with a metal grate. Could put wood on top of this for aesthetic reasons

Build a new and large bridge.

QUESTIONS

What are elevations inside and outside the north Garden wall? Will these allow conveyance of stormwater from channel via passive pipe to inside the wall?

What pipe design would intercept channel water and get it safely into the garden?

What is the capacity of the channel and how is it changing over time?

How is channel affected by pinch point created by the foot bridge?

What is the change in flow/flooding potential created by the culvert and possibility of increased flows due to changes in grading southwest of the Garden that might shunt more stormwater around to the north channel?

How can the profile of the north channel be modified to support plantings on the south bank, while maintaining the needed conveyance capacity? How would the presence of vegetation here change flow characteristics?

What sizes culvert bypasses would be needed north and south of the bridge to make sure flow doesn't jump the banks? Is replacing wooden bridge bed with metal grate an option?

What is set back/easement requirement by City Transportation Dept for planting adjacent to Mission Lane?

What is the profile of the north channel relative to the Santa Cruz River? How does this affect sediment accumulation along the entire channel

What are the plans of Paseo de Iglesius Feasibility Study relative to this location? Is coordination needed with planning?

NEXT STEPS

See General next steps above, plus:

Start monitoring sediment erosion from the banks and sediment deposition in the channel

Look at channel characteristics and design terracing and vegetation planting in such a way that conveyance capacity is not reduced and potentially is increased

Determine best options for improving flow around the bridge that are historically appropriate and keep water from flowing outside the channel.

The design of channel and bridge crossing should be based on a detailed Hydrologic and Hydraulic Analysis.

Check geotechnical and ROW set backs

Find out what water rights might apply in this situation

Evaluate whether to consider filing for a surface water right, as was done for KERP project on Ajo by Pima County

A-MOUNTAIN AREA

CONDITIONS

Surface water flow crosses Grande in big rainfall events

In smaller rainfall events, water flows down the mountain, then collects on the west side of Grande and flows north from there

Two major watersheds on A-Mountain, one crosses Grande south of MG walls, the other is concentrated in culverts

Three 24-inch culverts pass stormwater from west to east under Grande NW of the NW corner of Mission Garden. From there, water flows E outside the N wall of Mission Garden

Culverts concentrate former sheet flow. Have helped reduce flooding in neighborhood N of Mission Garden

POTENTIAL/SOLUTIONS

Upgrade watershed on A-Mountain watershed conditions

Improve and upgrade rock terraces (trencheros), increase planting, etc

This could help reduce force of water coming off the mountain

Parks Department might want to do this, provides good historic connection

Create public pathway going up A-Mountain that harvests water to feed existing culverts and allows access to viewing area without having to drive a car up

Could harvest large volumes from A-Mountain runoff before it enters the culverts

This could be done just west of the culverts and/or south of the rock-lined channel to the south of the culverts. Could located the settling pond on City land

Design could be a settling pond with a vertical intake pipe in it at culvert location

Heavy materials would settle to bottom of settling pond below the intake line of the standpipe.

Floating vegetation and debris would be kept out of the standpipe with a beehive screen

Standpipe would do a 90 degree turn and convey water under Grande east toward the garden, attached to the inside top of a culvert.

Size of pipe would control rate of water flow into the garden. Could distribute through the concrete canal inside the Garden, leaving several gates open at all times to make sure stormwater can be quickly conveyed to appropriate receiving areas

Intake to standpipe could be an “infiltration box” constructed of redwood with pipe inlet. This is a Mormon tradition

Consider distribution pipe being piped along the inside the wall to distribute to various basins inside. Check if the concrete channel inside the wall could be used

What water is available for other subwatersheds on A-Mountains?

Could construct an additional culvert under Grande farther south to intercept water flowing north, just west of the road

Keep options open to capture water from another A-Mountain watershed

Keep options open to put an inlet at another point in the Garden, not just NW corner

QUESTIONS

What are the new drainage patterns and volumes for A-Mountain? Need a new hydrology/stormwater flow study.

Are there any water rights that would impede intercepting runoff from A-Mountain upstream of culvert conveying that water to the Garden in a pipeline?

Where is the line of City land ownership west of Grande

Would City approve putting a settling pond in intake pipe here

Have culverts been cleaned? There is limited sediment in them

NEXT STEPS

See General next steps above, and…

Get elevations of potential intake points west of Grande and potential garden delivery points

Determine whether it is advisable to investigate the feasibility and prepare design for this diversion approach

Get as-built diagrams for culverts

Evaluate whether there is a benefit to working on the A-Mountain slope, what type of work would be of value, and what is needed to do this work

WEST SIDE OF WALL (Figure 7) (this side was not walked by the group during the field trip, but some comments about it were received)

CONDITIONS

Runoff approaches from the south and west-overtopping Mission Road.

The Rio Nuevo drainage scheme would have directed approaching flows easterly to reduce drainage and erosion problems along the west side and north side of the Garden as well as to reduce flooding in the neighborhood to the north.

POTENTIAL/SOLUTIONS

Currently being planted and irrigation is being installed with funding from Friends of Tucson's Birthplace.

Using native low-water use trees and shrubs.

Will help shield wall from graffiti and shield view of Grande Rd from inside the Garden

Rock riprap in bottom of channel to remain

The roadside should be stabilized to reduce erosion and sediment deposition in the channel.

QUESTIONS

As a result of recent grading changes in this area, what is the new runoff flow distribution at the SW Garden corner with respect to the flow rate that drains northerly, and that which drains easterly?

How should channel conveyance along the western wall be clarified such that the runoff does not pond and threaten the gas apparatus or enter the Garden at the western Gas Line Gate?

NEXT STEPS

Include this area in reevaluation of drainage patterns around the Garden

To reduce water flow volumes that end up in the north channel, determine if flow from the south can be diverted east south of the garden, instead of flowing north though this area

INSIDE GARDEN

CONDITIONS

Does not have large water harvesting potential due to relatively flat grade of site

From south-to-north, based on elevations every 20 feet, the concrete irrigation ditch inside the wall is slightly undulated, and rises and falls with the difference not exceeding 1.5 inch. As a result, It appears water could be fed into either end of the ditch to supply the garden.

POTENTIAL/SOLUTIONS

Utilize potential stormwater sources flowing on the south and north side of the Garden wall inside the Garden where possible

Distribute organic mulch instead of gravel within walls to build soil, reduce soil temperature, reduce evaporation loss from soil, and illustrate the benefits of mulch to the public

Place a detention pond to retain stormwater flowing from the south either on the south side of the Garden wall or inside the Garden to increase the nonpotable water supply, and reduce peak flow problems in the outside channels

“Zone” the planting areas based on water harvesting potential, and select plant types accordingly

Design a “rainfall only” garden

Design a “rainfall + supplemental stormwater (“run-on”)” example

Use planting plans that coordinate with rainfall season: wheat likes to be flooded in the monsoon season

Educate public about differing water needs for plants

QUESTIONS

What elevations within the Garden would control stormwater inlets and overflow points?

Is the overflow pipe going east out of the orchard area sufficient to discharge excess stormwater there, if water were brought in from outside the Garden wall on the north?

Where would overflow be discharged if stormwater were brought in from the south side?

What options are there to vary the planting plan to create zones based on available stormwater?

How and where would stormwater be used within the Garden if it were brought in from the south and/or north?

Will monitoring well inside SE corner of Garden detect effects of irrigation of area above it when that area gets planted? What are the positive and negative implications if water levels rise here?

NEXT STEPS

Take elevations throughout the Garden

Further discuss the options and best strategy for using stormwater inside the Garden

LANDFILL

CONDITIONS

Has a soil cap

Has monitor wells for shallow groundwater and methane monitoring

There is interest by some to put an equestrian facility on the landfill. This would induce huge runoff from roof and parking lot

City is developing a walking path through the landfill

Important to retain overflow on the landfill itself. Some undulations there allow localized small volumes of infiltration, but not large volumes

POTENTIAL/SOLUTIONS

Landfill has serpentine shapes to reduce erosion and holding water on the surface of the landfill.

Site has been hydroseeded with seed mix developed by Pima County Parks and Rec.

This area is seen as Sonoran Desert Resource Park with the intent of creating a “sense of place”

High nitrate in monitor well could constitute nutrients for tap-rooted trees. Could an artificial perched aquifer be created here to support tap root trees? Would need to plant trees from seed to ensure they have proper tap root formation.

Path through the landfill could be joined with education efforts at Mission Garden and paths around channels outside Garden wall

QUESTIONS

What is the fate of the proposed equestrian facility? (could substantially impact Garden with increased water runoff from roof and parking area). When will this be decided?

When will path system be completed around the landfill? How could this be linked to path around outside of Mission Garden?

NEXT STEPS

Maintain close communication with City of Tucson Environmental Services and Tucson Parks and Recreation Department regarding their plans for the landfill, and to coordinate efforts related to Mission Garden