May 12, 2014

The Honorable Barry Bone, Mayor
City of Rollingwood
403 Nixon Drive
Rollingwood, Texas 78746

Subject: Drainage at Rollingwood Community Park

Dear Mayor Bone,

The Rollingwood City Council requested that LNV perform a site visit to the Rollingwood Community Park (Park) and prepare a visual assessment of drainage concerns associated with the Park and its operations. Findings from our Park site visit and our recommendations for future actions are provided in this letter report.

BACKGROUND

The Park is located in the City of Rollingwood and is bounded by Rollingwood Drive on the south side, Gentry and Nixon Drives on the west and northwest sides, and private property and the Western Hills Athletic Club on the north and east sides.

The approximate 8 Ac. Park is owned and operated by the City of Rollingwood and is used for multiple purposes including sports fields for baseball and softball, open space, day use activities including a playscape and Pavilion, walking trails, a community garden and a rainwater harvesting system. The park area includes paved parking lots and driveways. The Rollingwood City Hall sits on a tract on the western side of the Park and fronts on Nixon Drive.

Exhibit 1 attached to this letter presents the layout of the Park and illustrates the topographic separation of the Park by a bluff between the upper Park area and the lower Park area. Runoff from the Park generally sheet flows to the northwest before it gathers in small low areas and channelizes until it reaches a small drainageway that exits the Park in a northeast direction and flows under Pleasant Cove in culverts prior to reaching Town Lake (Colorado River) about o.6 miles downstream of the Park.

A significant rain event totaling about nine inches occurred on the days of October 30 and 31, 2013, resulting in runoff that gathered in several locations within the Park and caused some local flooding and erosion. Restoration of damaged areas and developing plans to prevent future damage by managing stormwater with context-sensitive mitigation features may be warranted.

SITE VISIT

A Park site visit was completed on March 26, 2014, with Parks Commission Member Robert Patterson in attendance. Commissioner Patterson pointed out areas of concern as we reviewed the upper park where the ball fields are located, the parking lot, the back of City Hall and the lower park where the pavilion and gardens are located.

A summary of our findings based on the site visit are:

UPPER PARK (BALL FIELDS)

This area has several issues affecting drainage and the overall use of the park. The first issue is that there is a significant amount of runoff from the baseball fields. Most people would assume that there would be little runoff from a ball field because of all the grass and dirt. In fact, the reality is that the runoff from an athletic field is almost equivalent to concrete or asphalt. The reason is because of the compaction of the soils beneath the turf and infield. Typically the surface bulk density for an athletic field ranges from 1.8 to 2.0 grams/cubic centimeter while the surface bulk density of concrete is 2.2 grams/cubic centimeter. The surface bulk density is directly related to infiltration such that as surface bulk density increases runoff increases. Additionally, athletic fields typically have a perimeter drain system (which this field does not). Since runoff is typically high in nitrogen and phosphorus, due to fertilizers to maintain a healthy and vibrant field. It is advantageous to catch this water as close to the source as possible to reduce or eliminate chemicals being carried over and possibly offsite. Runoff is also generated by two large concession stands with metal roofs that also contribute a significant amount of water to the runoff. Since the ball fields are built up at a higher elevation the surrounding area has been filled and compacted. This compaction reduces the overall infiltration and thus increases the stormwater runoff. This uncontrolled runoff then finds the easiest path to the bluff and thus down the bluff into the lower park and or behind city hall thus to the creek. This uncontrolled runoff leads to the second issue of the upper park and that is erosion of the crushed granite trail and limestone bluffs. The third issue with the upper park is the lack of tree wells. It appears that when this area was built up fill was brought all the way up to the trunks of the trees thus covering up the root zones. Placing fill, not to mention compacted fill, over the root zones of tree is very harmful to the trees and could suffocate the tree and eventually kill the tree. This may take 3-7 yrs depending on type and depth of fill. Exhibit 2 shows area of concerns in this location along with some suggested fixes.

Before you provide an engineering solution to a problem you have to know and understand the cause of the problem. This helps ensure that the corrective actions will indeed fix the issue. As with most drainage problems/issues the first step would be to exactly determine where the runoff is coming from and going to. This would require a detailed topographic and as built survey of the upper park. This information would then be analyzed with park divided into drainage areas. The stormwater runoff could then be quantified for each area along with volume, volumetric flow rate and velocity for each storm event analyzed. These values would then be utilized to properly design inlets, pipes, infiltration trenches, level spreaders, bio-swales, rainwater catchments and energy dissipaters to control and properly direct the stormwater water. The controls that are engineered and installed to control stormwater quantity and quality are typically referred to as BMP's (Best Management Practices

One remedy to control the runoff would to install a perimeter drain system typically found at athletic field which would drain to bio-retention system for additional treatment and allow for infiltration. A combined infiltration trench and level spreader could be installed in specific areas up-gradient of the bluff allowing for infiltration, reducing the amount of

stormwater flowing over the bluff thus reducing erosion and allowing the stormwater to be dispersed over a larger area (spreading the water out) thereby reducing velocities to minimize erosions and increase infiltration. The runoff from the metal roof concession stands could retained in a rainwater catchment or cistern which would be used to water the trees, landscape planters in this areas. The best way to mitigate the additional fill over the root zones of the trees is to remove the fill and build a tree well for each tree as required.. The other mitigation method would be to remove the tree completely which I think would be undesirable and is assumed not to be considered.

PARKING LOT

This is a fairly recent addition to the park and is constructed entirely of asphalt with a concrete ribbon curb around the perimeter. The asphalt is considered 100% impervious cover (IC) along with the ribbon curb. Any rainfall that falls onto the parking does not infiltrate but rather runs down hill into the natural/bluff area. Additionally any stormwater that is up gradient of the parking runs onto the asphalt does not infiltrate and just continues downhill into the natural/bluff area. This area is a concern because it has started to erode the natural area and ruts and small gullies are starting to form. These are the first signs that significant erosion is starting to happen and methods need to be developed to control the runoff velocity.

As with the previous area the first step would obtain detailed topographic and as built information to determine how the water is actually flowing and with that develop drainage basins. The next step would be quantifying the stormwater runoff for each basin for the design storms that will be analyzed for the project. Once quantity is known these values are then applied to the design of the best manage practices (BMP's) for the control or containment of storm water.

There are numerous methods for controlling stormwater runoff from parking lots depending on what the ultimate goals are. The main purpose for the walkthrough and the letter memo was to look at the control and management of stormwater runoff as it relates to water quantity. Additional measures could be applied to the BMPs' designed for the parking lot to provide some treatment to improve water quality. Possible methods are provided in Exhibit 3. Once the actual volume of stormwater is calculated a better determination of the methods to be utilized can be recommended. With the limited data and information known a rain garden or bio-swale could possibly be constructed along the perimeter of the downstream edge of the parking lot with any overflow to be directed to the existing on-site pond assuming there is enough slope between the two locations.

CITY HALL

The main issue with City Hall is the rear corner of the building which backups to the bluff. It appears that the corner between City Hall and the police station is a low point which collects water and could cause water to backup into the building unless handled properly. For this reason at some point in time a drain was installed in this corner to handle the up gradient stormwater and prevent the building from flooding. It appears that the catch basin drains to a pipe which runs under the building. There are no drawings for this pipe

so the exact route and discharge location is unknown. However there is a 4" diameter pipe in the northwest corner of City Hall property which appears to be the discharge location. The water exits the pipe and discharges to the police station driveway thence into Nixon Street. Even though it is common to have some pipes installed under the foundation of a building, it is uncommon to have a stormwater pipe installed under a building. One reason is because the stormwater pipe is larger, thus carries a larger flow and in turn will develop a higher velocity. Also the stormwater pipe will be subjected to these conditions for a significant longer time than your typical drain pipe. If the storm drain pipe under the building were to develop a leak due to the higher flows, velocities and durations the damage would be significantly greater. A picture of the back corner of City Hall is provided in Exhibit 4.

To mitigate this runoff issue the solution would be very similar to the one mentioned in the upper park discussion. The first step would be to exactly determine where the runoff is coming from. If a drainage area map was developed (as indicated previously) this could be utilized to determine the areas contributing to the flow. The next step would be to quantify the amount of stormwater contributing to the inlet. The volume, volumetric flow rate and velocity for each storm event analyzed could be determined. With a detailed survey of the area along with the calculated flows, a mitigation plan could be developed.

One mitigation method would be to review the elevations around the building and add some fill in the back corner to force the water around to the sides away from the back corner. If we can't carry the water all the way around an inlet basin at the furthest location we could carry the water would be installed. A pipe would then be utilized to carry the water from the inlet basin to the street for the final discharge spot.

LOWER PARK

The lower park is an area that is frequently used by the residents of Rollingwood. This is where the pavilion is located, the playscape, community garden and rainwater harvesting system. The two main issues within this area are drainage/routing of the stormwater through the park and the bluff that is eroding away at an increasing rate due to the stormwater flow. See Exhibit 5 for pictures of the bluff and erosion issues.

As with the previous areas, the first step would be to obtain detailed topographic and as built information to determine how the water is actually flowing and with that develop drainage basins. The next step would be quantifying the stormwater runoff for each basin for the design storms that will be analyzed for the project. Once quantity is known these values are then applied to the design to minimize the erosion of the exposed bluff and properly route the drainage thru this area.

Once improvements are completed upgradient of this area there may be a minimal amount of work to be done in this area. This area should be the last one to be studied, with the exception of the exposed bluff, because improvements upstream will have an effect on the stormwater in this area. A wrought iron fence has been installed along the bluff to prevent kids from playing in this area and keeps some of the rocks from rolling onto the trail or from hitting someone. The exposed bluff could be considered a safety

issue and at minimum this should be examined to determine the likely hood that larger chunks may break loose and actually hurt someone.

One mitigation method for this area could be that a living wall be constructed in front of this area to allow for vegetation to take hold and help protect the face from further damage. The living wall would be considered a "green" solution such that it would beautify the area and add some color depending on the type plants utilized. Another benefit would be that the plants would stabilize the face of the bluff to limit future erosion. An alternative method could be limestone block stack wall that could be terraced or arranged such that some plants could be installed but the main purpose would be to protect the public from rocks falling onto the trail or actually hurting someone. A third method would be to shotcrete the exposed face and then build a concrete wall in front of this area to construct a large tank. This tank would then become part of a rain water collection system in which the water could used at the park or residents could come and take it and utilize it for their own house.

RECOMMENDATION

Rollingwood like a majority of the Cities in this area want the best for its residents but at the same time they have a limited budget in which to work from. LNV understands that costs are an issue but the City needs to provide solutions within a budgetary frame work. To facilitate this recommendations are broken down into two major items Immediate and Long Term. The immediate recommendation is a concept in which LNV utilizes readily existing data/information to develop a working plan that the City can then take to a local landscape to get the modifications complete. If required LNV can be utilized to work directly with the landscape company chosen by the City to implement this work plan to answer questions and work out issue. The recommendations provided also include some long term solutions that once the item 1 was completed the City and Parks Commission could look at these items in more depth and consider a plan forward. LNV, Inc would recommend the following items to assist the City in resolving the drainage issues at the park:

IMMEDIATE

1. Develop a conceptual drainage plan with minor improvements to include:
    a. Utilize existing GIS information to develop rough drainage basins.
    b. Size appropriate BMP's for each drainage area. Not all BMP's would be looked at. Typical off the shelf BMP's which would not require engineering design solutions will be utilized.
    c. Develop conceptual drainage area map.
    d. Develop scope of and installation guidelines for local landscape firm.
    e. Work with landscape firm to monitor and install improvements.
    f. Cost estimate for (a-d) $7,500.
    g. Cost estimate for e, $2,500.

LONG TERM

1. Prepare a Stormwater Management Plan for the park to include:
    a. Topographic and as-built survey of the park, with final product having 1-ft contours and existing improvements. Budget Estimate $15,000.
    b. Delineate drainage basins with the park area to include area, time of concentrations, C values or drainage coefficients, impervious cover percentages an slopes. Budget Estimate $1,000.
    c. Calculate and quantify stormwater flow for each basin (flow, velocity and volumes) for the 2, 10, 50 and 100-yr storm events. Budget Estimate $2,500.
    d. Letter report identifying issues, resenting flows and identifying big picture ideas for the handling of the storm water. Budget Estimate $2,500.
    e. 2- Workshops with City Council, Parks Board and the Public to discuss and educate everyone on various types of Green Stormwater Management Techniques and BMP's applicable to park and its situation. Develop a consensus on BMPs' to utilize. Budget Estimate $2,500.
    f. Prepare letter report identifying the issues, providing recommendations with budgetary estimate and an implementation schedule and present to City Council and parks Board. Budget Estimate $2,500.
    g. Prepare Stormwater Management Plan for the park incorporating recommended and approved items include maintenance requirements for the new items and an integrated pest management plan for the ballfields and open space green areas in the lower park. Budget Estimate $5,000
    h. Approximate budget estimate for item 1. $30,000.
2. Based on improvements in the Stormwater management Plan for the park prepare plans, specifications, bid documents, open bids and provide recommendation for award. Budget Estimate $30,000.
3. Prepare a Park Master Plan for the City incorporating the Stormwater management plan ideas, review the hike and bike trails for the City and access to the nearby parks ideas or locations for new parks or trails, how to incorporate these ideas into a successful plan, public outreach, education, public input, taking recommendations from public and staff, prepare a 5 yr capital improvement plan and present to the Parks Commission and City Council. Budget Estimate $40,000.

The mitigation methods or procedures discussed in the report are based on limited knowledge of the existing issues and understanding of the current stormwater flows. Cost estimates are high level budgetary estimates and will change as the date gets closer. LNV appreciates this opportunity to work with the City on this review. If you have any questions please feel free to contact me at (512) 381-8333.

Sincerely,

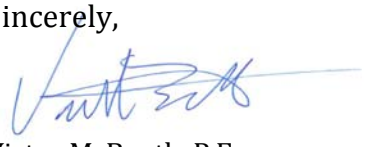

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EXHIBIT 1

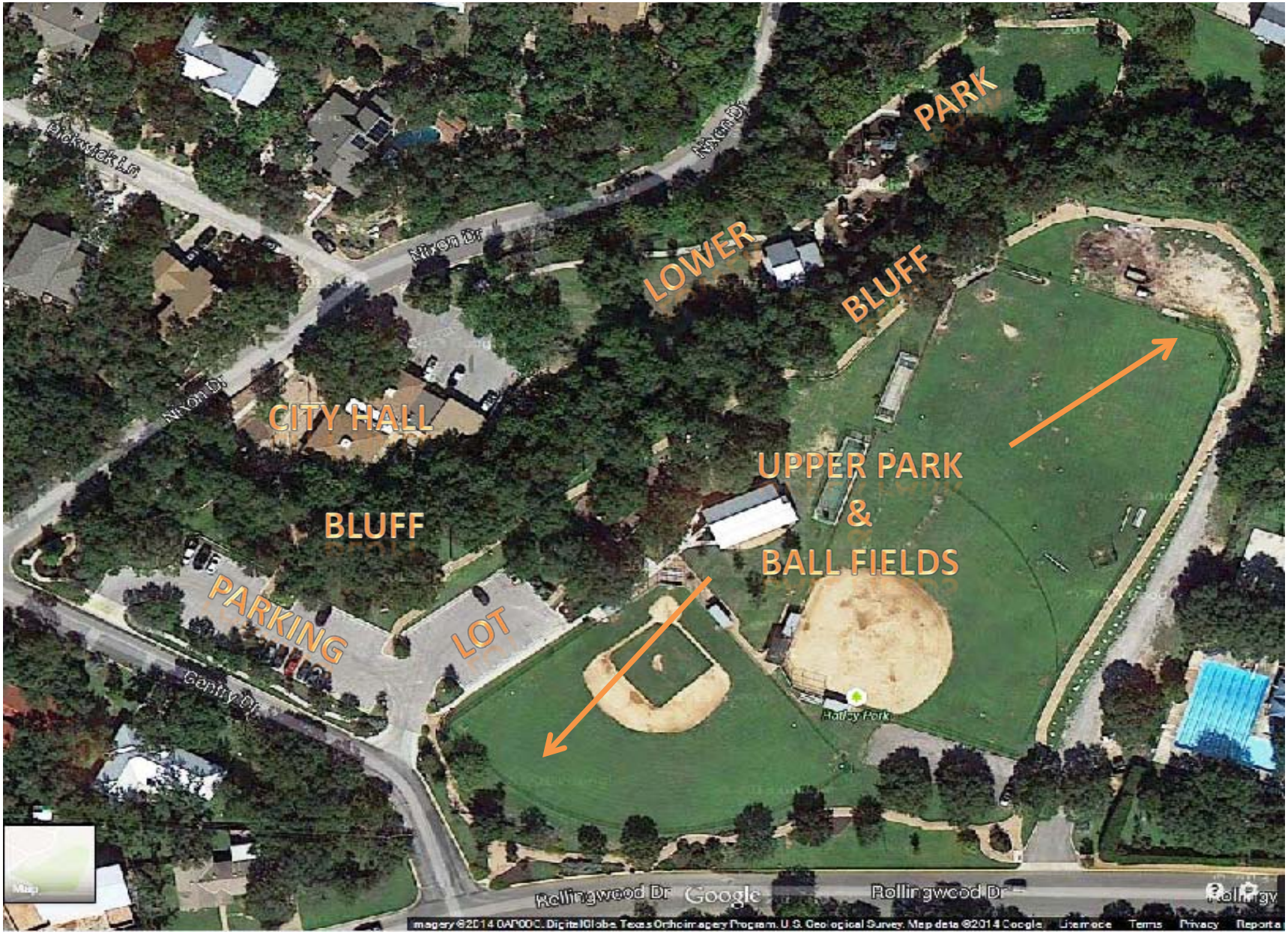
PARK
LOWER
BLUFF
CITY HALL
UPPER PARK
&
BALL FIELDS
BLUFF
PARKING
LOT
Nixon Dr
Blackjack Ln
Gentry Dr
Rollingwood Dr
Google
Rollingwood Dr
Halsey Park
imagery ©2014 DAR000, DigitalGlobe, Texas Orthoimagery Program, U.S. Geological Survey, Map data ©2014 Google
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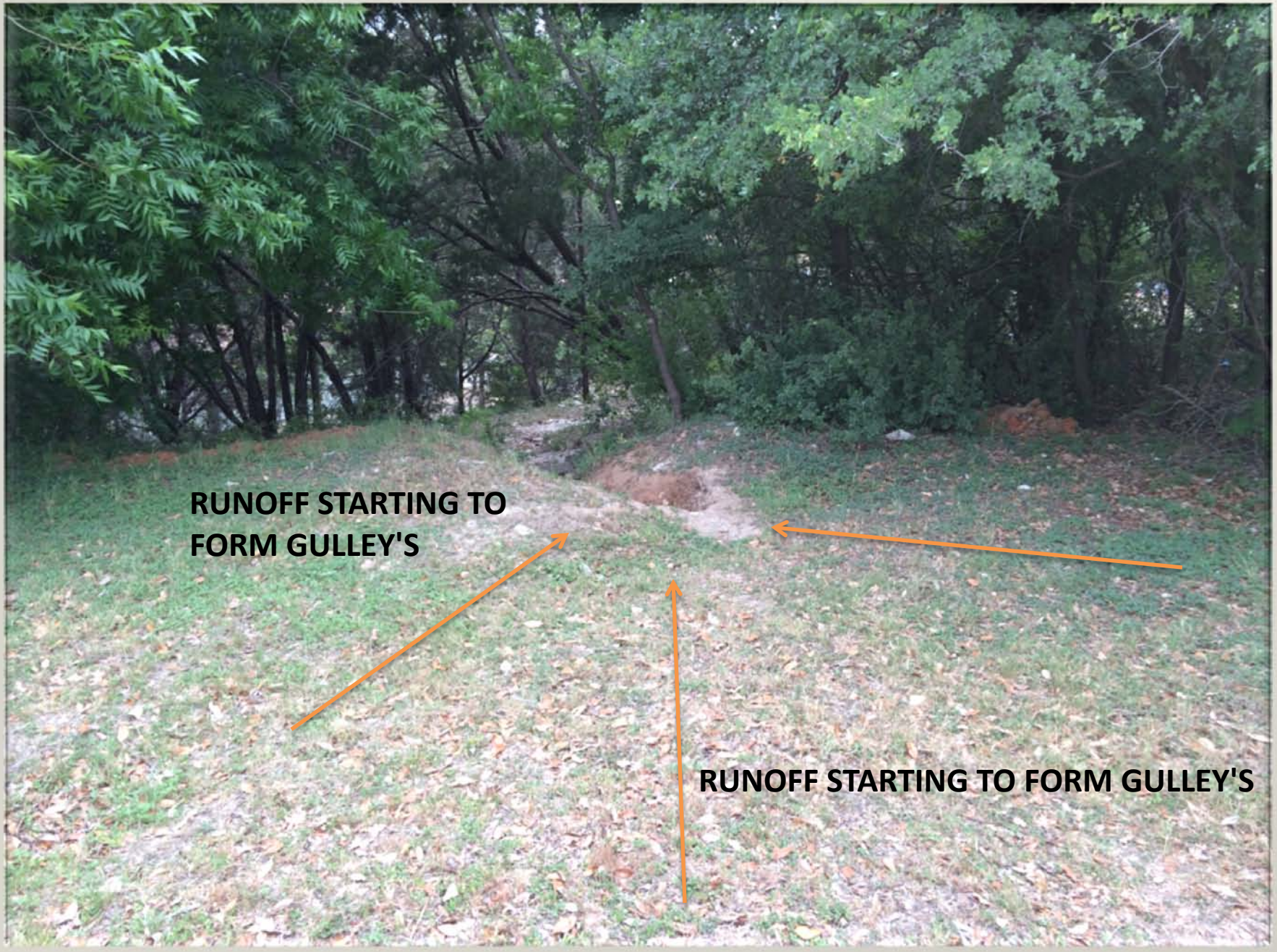
EXHIBIT 2

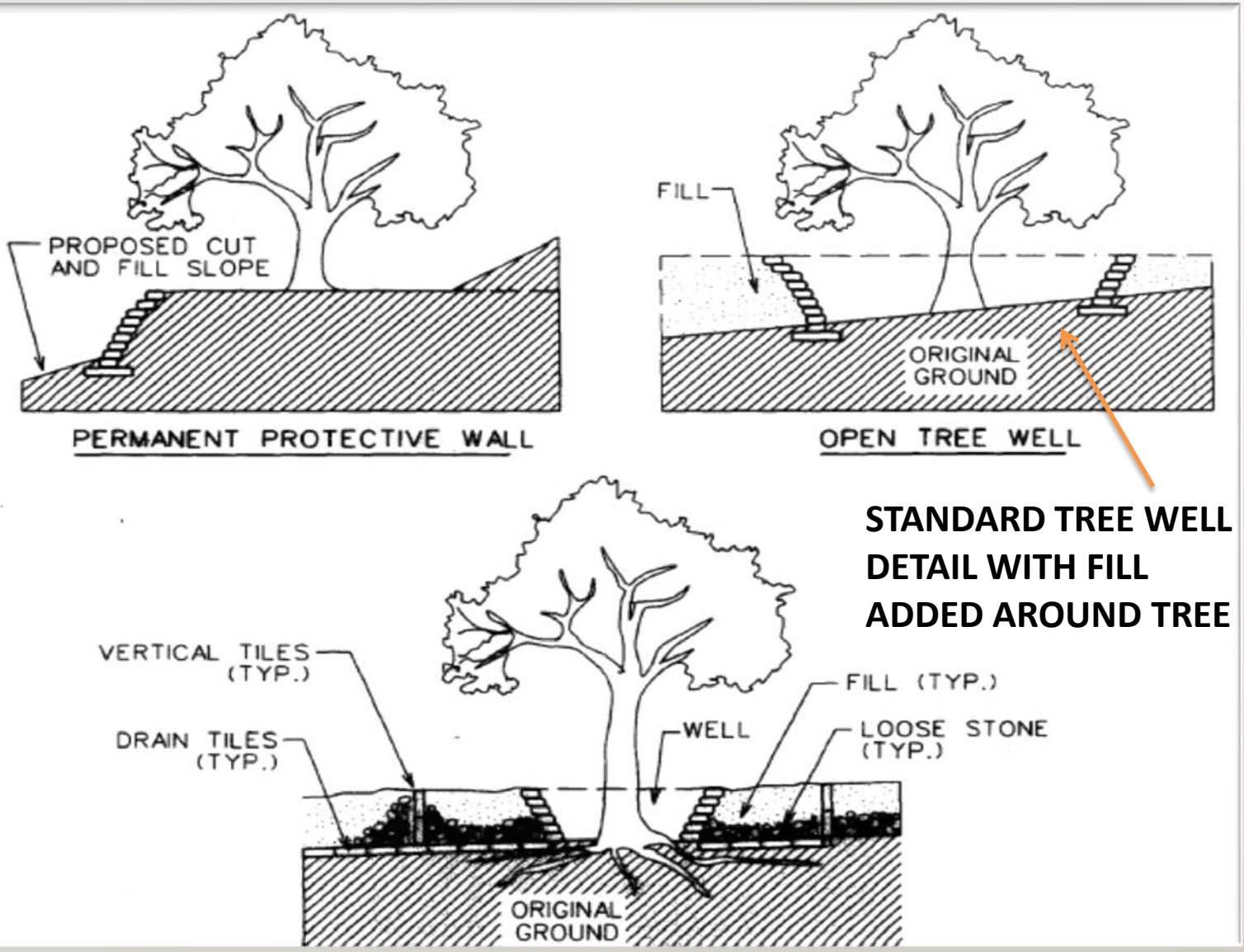

UNCONTROLLED RUNOFF FROM FIELDS
UNCONTROLLED RUNOFF FROM FIELDS
SEVERE EROSION & RUTTING


RUNOFF STARTING TO
FORM GULLEY'S
RUNOFF STARTING TO FORM GULLEY'S

THESE TREES NEED TREE WELL

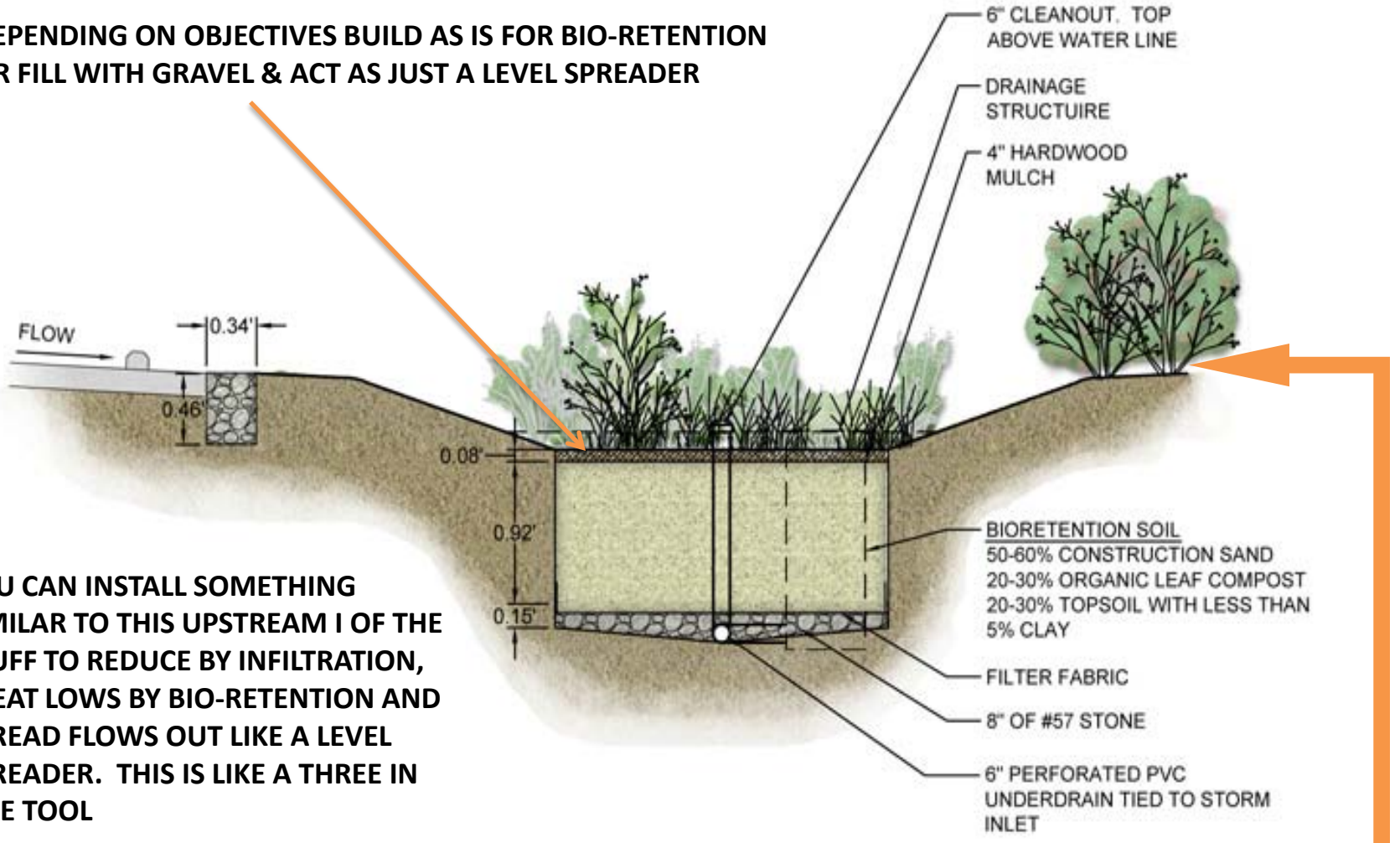
NATURAL GRADE AT TRAIL YOU CAN SEE HOW MUCH DIRT ADDED

NON STANDARD TREE WELL MADE AFTER THE FACT SHOULD USE STANDARD DETAIL



STANDARD TREE WELL DETAIL WITH FILL ADDED AROUND TREE

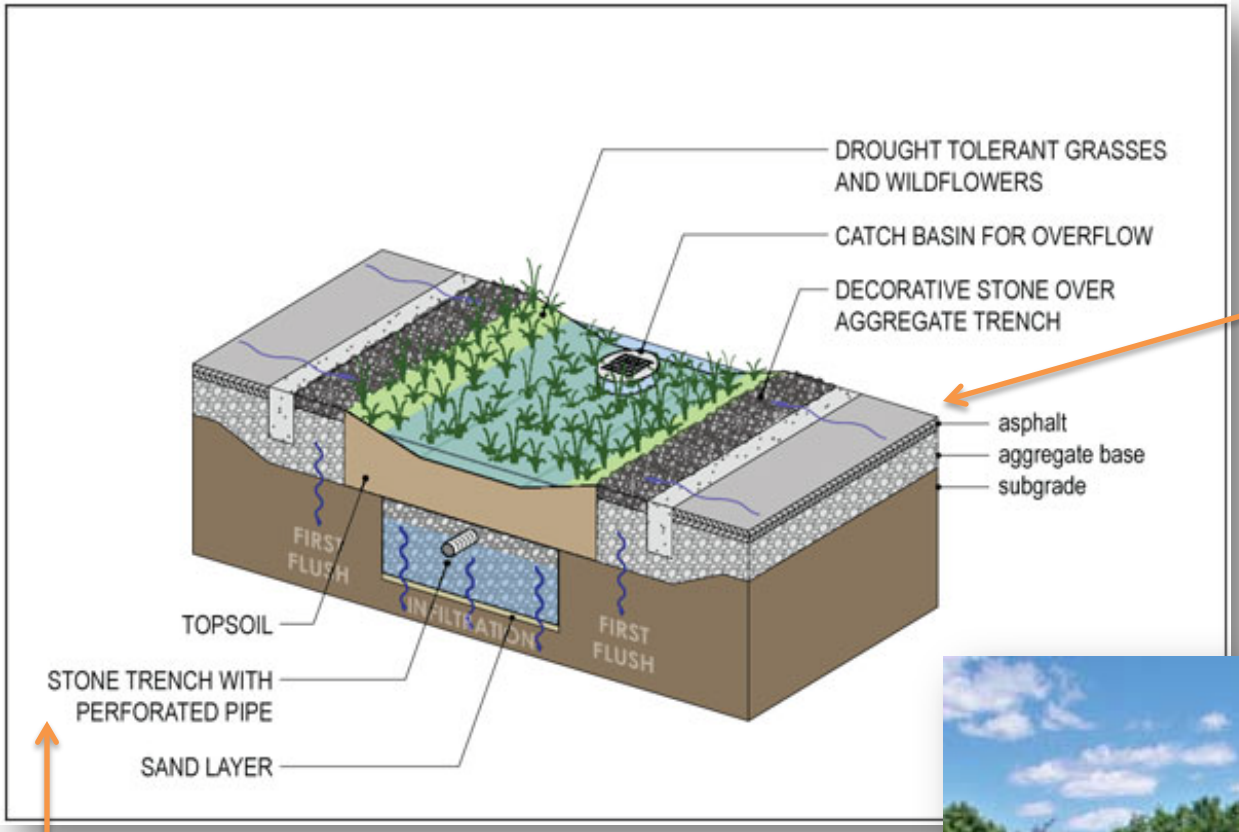
DEPENDING ON OBJECTIVES BUILD AS IS FOR BIO-RETENTION OR FILL WITH GRAVEL & ACT AS JUST A LEVEL SPREADER



YOU CAN INSTALL SOMETHING SIMILAR TO THIS UPSTREAM I OF THE BLUFF TO REDUCE BY INFILTRATION, TREAT LOWS BY BIO-RETENTION AND SPREAD FLOWS OUT LIKE A LEVEL SPREADER. THIS IS LIKE A THREE IN ONE TOOL

THIS SIDE ELEVATION CAN BE ADJUSTED TO DRAIN AWAY SUCH THAT WHEN TRENCH FILLS UP WATER OVERTOPS AND DRAINS ACROSS THE ENTIRE LENGTH THUS SPREADING THE FLOW OUT SIMILAR TO LEVEL SPREADER

EXHIBIT 3



A SMALL SECTION OR STRIP COULD BE REMOVED ALONG THE DOWNSLOPE OF THE PARKING LOT AND REPLACED WITH A SECTION OF PERMEABLE PAVER SYSTEM WHICH HAS A GRAVEL BASE AND ACTS AS A DEVICE TO INFILTRATE WATER BACK INTO GROUNDWATER.

A RAIN GARDEN ARE WIDELY USED IN PARKING LOTS BECAUSE THEY CAN BE DESIGNED IN MANY SHAPES WITH DIFFERENT PLANTS AND MATERIALS. THE DRAIN PIPE COULD BE RAN SUCH THAT IT DRAINS TO THE EXISTING POND RECENTLY CONSTRUCTED ADJACENT TO THE PARKING LOT

EXHIBIT 4

BACK CORNER OF CITY HALL AT LOW SPOT WHERE WATER FROM THE BLUFF COLLECTS. SAND BAGS AT DOOR HELP REDUCE FLOODING. THIS WHOLE AREAS ELEVATION SHOULD BE BROUGHT UP AS HIGH AS POSSIBLE TO FORCE WATER AROUND THE BLDG

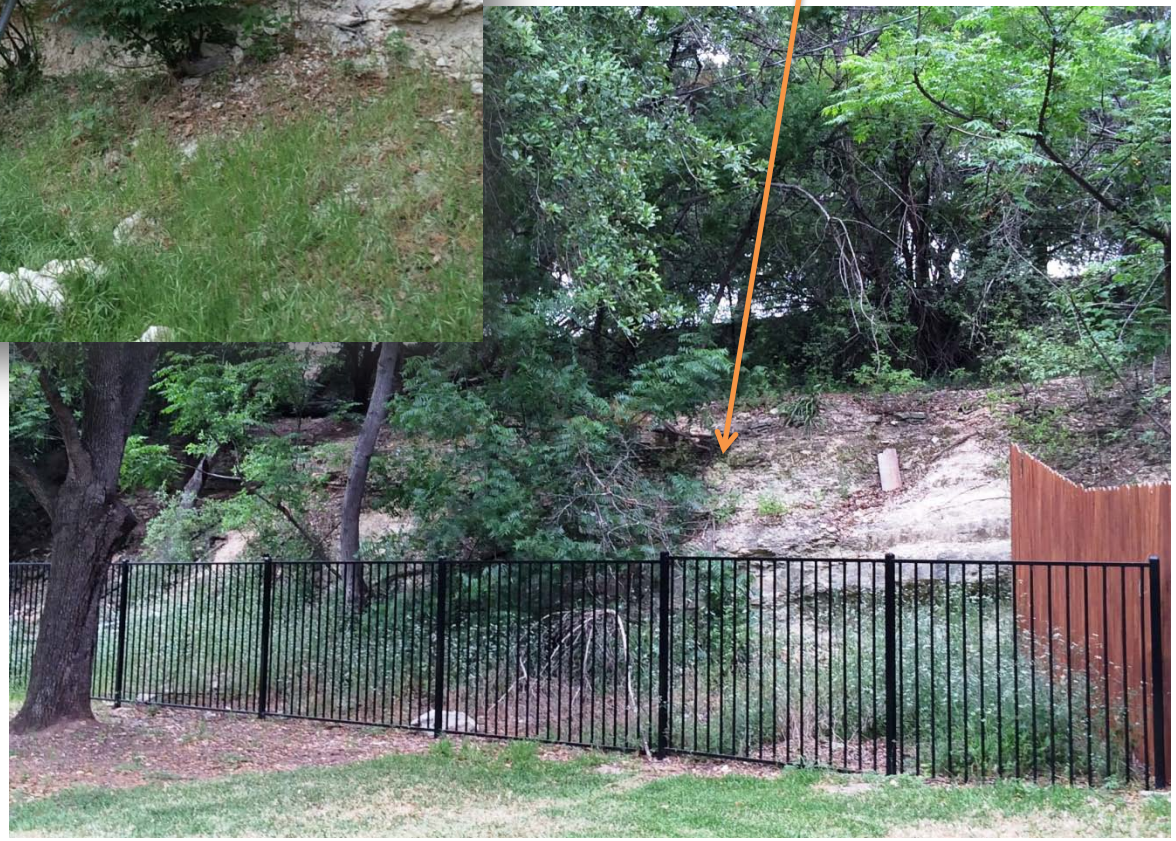
GULLEY/RIFF IS FORMING FROM THE AMOUNT OF WATER COMING FROM UPGRADIENT

THIS IS WHERE THE WATER IS COMING FROM

EXHIBIT 5

DIFFERENT COLOR ROCK BECAUSE WATER HAS BEEN FLOWING OVER ONE AREA BUT NOT THE OTHER

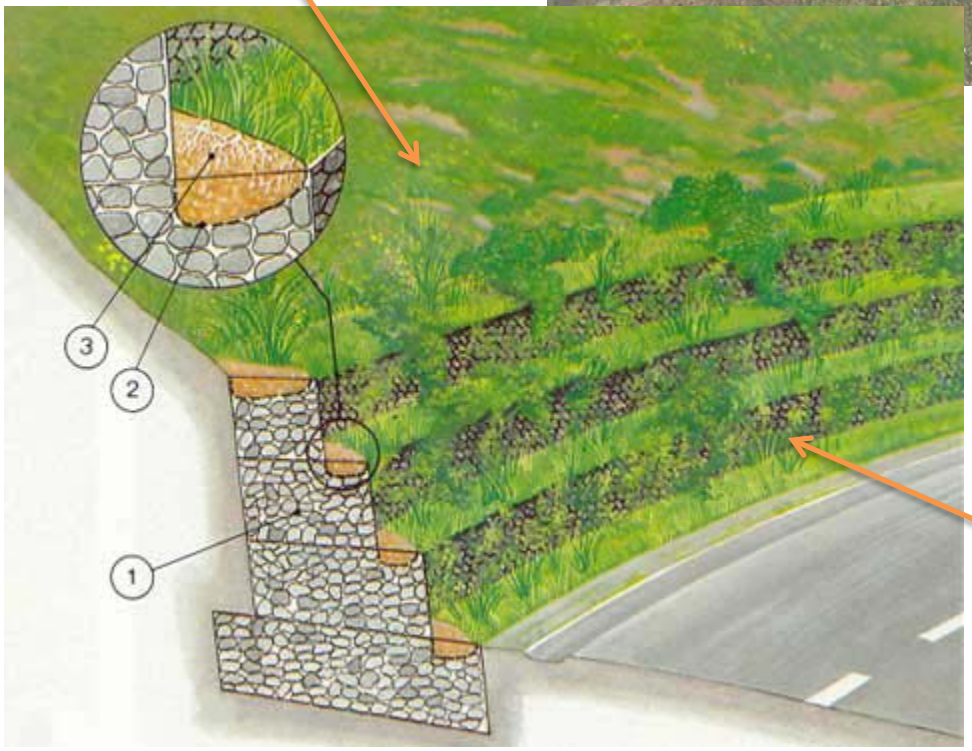
THIS AREA NOT AS STEEP AS 1:1 BUT YOU CAN IT IS ERODING AND BUSHES AND TREES ARE STARTING TO SLIDE DOWN BECAUSE THE WATER IS CARRYING AWAY ALL THE DIRT LEAVING NOTHING FOR THE ROOTS TO HOLD ONTO



PORTIONS OF THE FACE OF THE BLUFF ARE BREAKING AWAY. FENCE KEEPS PEOPLE OFF AND SOME PIECES OUT OF THE PARK BUT IT STILL MAY A SAFETY CONCERN

LIVING WALL DETAIL SOMETHING SIMILAR TO THIS UTILIZING LOCALLY ADAPTED PLANTS AND GRASSES FROM THE LADY BIRD WILDFLOWER CENTER THAT ARE DROUGHT TOLERANT AND SOME ARE SPECIFICALLY ENGINEERED FOR LIVING ROOFS OR WALLS

MISSION REACH RESTORATION UTILIZING NATIVE GRASSES WITH SPECIAL EROSION CONTROL MATS UNDERNEATH



THE PLANTS IN THESE GABIONS WOULD BE WILDFLOWERS AND NATIVE GRASSES SIMILAR TO MISSION REACH PROJECT ABOVE