MINUTES
FLOOD CONTROL DISTRICT ADVISORY COMMITTEE/PUBLIC REVIEW

CIP SUBCOMMITTE
November 2, 2016

Committee Members Present: James MacAdam, Ken Perry, Kumar Raut, Ian Sharp, Kieran Sikdar, Mike Todnem, John Wallace

Flood Control District Staff Present: Suzanne Shields, Director; Bill Zimmerman, Deputy Director; Eric Shepp, Deputy Director; Greg Saxe, Environmental Planning Manager; Tamara Jorde, Special Staff Assistant

Others Present: Keith Brann, Town of Marana; Janice Spencer, Town of Marana; Mo El-Ali, Town of Marana; Fred Felix, City of Tucson

The meeting was held at 201 N. Stone Avenue, Tucson, Arizona, 9th Floor Conference Room.

Suzanne Shields distributed the Text Descriptions of Evaluation Criteria (see attached) to the CIP Subcommittee prior to the jurisdictional presentations. Presentations were made by the Town of Oro Valley, Town of Marana and the City of Tucson (see attached). The Subcommittee reviewed the requests from the towns of Oro Valley and Marana and provided *draft* ratings. However, the Subcommittee did not feel they had enough information to begin rating the City's requests. The City will resubmit their requests with more information.

The next meeting is on November 16, 2016 following the Flood Control District Advisory Committee meeting.

The meeting adjourned at 12:02 a.m.

TEXT DESCRIPTIONS OF EVALUATION CRITERIA
CIP PROJECT PROPOSALS

1. Social Factors

- *Reduces Dangers to Human Life, Public Health and Safety, and Public and Private Property*

  This factor is used to measure how well the proposed project will succeed in reducing or eliminating life threatening, or potentially life threatening, flood and erosion hazards, as well as reducing the potential for flood and erosion damage to public and private property.

- *Jurisdictional Priority*

  This factor is a measure of the relative importance that area jurisdictions, residents, and/or elected officials place upon the construction or implementation of a particular project. Jurisdictions should prioritize (rank) the projects they submit for CIP funding.

- *Increases or Creates Multi-Purpose Use and Green-Belt Opportunities*

  This factor is a measure of the opportunities for promoting multiple objectives in conjunction with the proposed project. Examples of multipurpose uses include stormwater capture and recharge, passive and active recreation including development of river parks and hiking, biking and equestrian trails, open space "green belts," as well as enhancement of urban aesthetics, view sheds, and cultural values.

- *Improves Pedestrian and Vehicular Mobility*

  This factor is used to measure how well the proposed project will succeed in minimizing the disruption of community affairs by facilitating access to lands contiguous with or contained within flood prone areas.

2. Environmental Factors

- *Preserves and/or Enhances Natural Riparian Environment*

  This factor is a measure of how well the proposed project will succeed in preserving or enhancing the natural riparian environment along a watercourse.

- *Minimizes Impacts to Natural Riparian Environment and Restores Disturbed Areas*

  This factor is a measure of how the proposed project seeks to minimize the disturbance of the natural riparian habitat and ecosystem, and the degree to

which mitigation and restoration of disturbed areas are included.

- *Preserves and/or Enhances Wildlife Habitat and Movement Corridors*

  This factor is a measure of how well the proposed project will succeed in preserving or enhancing critical and sensitive wildlife habitat communities and important wildlife movement corridors.

- *Maintains or Enhances the Quality of Surface Water and Ground Water, and the Amount and Quantity of Ground Water Recharge*

  This factor is a measure of how well the proposed project will maintain or improve the quality of surface water and ground water, as well as the rates of stream bottom infiltration and the quantity of ground water recharge.

3. Economic Factors

- *Reasonableness of Total Costs, Relative to Benefits*

  This factor *is* a measure of the economic feasibility of the proposed project. It compares total costs with the economic, social, and political benefits of the project.

- *Long-Term Benefits*

  This factor is a measure of the project's long-term direct and indirect economic benefits to the community.

- *Estimated Total Construction Cost (Includes Mitigation Cost)*

  This factor is a measure of the estimated capital cost of the proposed project, including design, right-of-way acquisition, construction, project administration and mitigation.

- *Estimated Total Operation and Maintenance Cost*

  This factor is a measure of both the average annual and lifetime total operation and maintenance costs of the proposed project, relative to other alternatives.

- *Reduces Legal Liability*

  This factor is a measure of how well the proposed project will succeed in avoiding or minimizing public liability.

4. Technical Factors

- *Reduces the Frequency and Severity of Flooding, Erosion, and Sedimentation*

This factor is a measure of how well the proposed project will succeed in reducing the frequency and severity of flooding, as well as local erosion and sedimentation damages over the *short term* (e.g., single-event bank erosion or channel scour).

- *Promotes Long-Term Watershed and Channel Stability*

  This factor is a measure of the capability of the proposed project to maintain the existing hydrologic and hydraulic balance within the watershed. The project should minimize changes to the fluvial system of the watershed over the *long-term* (e.g., stream meandering and channel degradation).

- *Technical Feasibility of Implementation*

  This factor is a measure of the technical feasibility of the proposed project. Adequate technical resources should be available to design, construct, and implement the proposed project, and any physical constraints should be surmountable.

- *Regional Impacts*

  This factor is a measure of the compatibility of the proposed project with regional plans, prior commitments, and long-standing public expectations, including stewardship of natural resources.

- *Creates Links to Existing Flood-Control Facilities*

  This factor is a measure of the compatibility of the proposed project with existing flood-control facilities. That is, how well does the project link with, complement, and enhance existing flood-control facilities while improving flood or erosion protection?

5. Other

   This category rewards proposed projects that have additional benefits that do not fit into any of the categories described above.

Town of Oro Valley
Community Development and Public Works

September 2, 2016

Suzanne Shields, P.E., Director
Pima County Regional Flood Control District
201 N. Stone Avenue, 9th Floor
Tucson, Arizona 85701

Re: Proposal Request – Highlands Wash Basin Management Plan – Priority 4

Dear Ms. Shields:

This project is identified by the Town of Oro Valley as an area requiring completion of the Highlands Wash Basin mapping and subsequent Basin Management due to storm damage from July 4, 2012 and September 8, 2014 storm events. Historically this watershed has been on the County CIP funding request list as a project for consideration.

The Town of Oro Valley is requesting a Basin Management Plan for Highlands Wash and its tributaries, for fiscal year 2017/2018. This request includes (1) completion of the draft Technical Data Notebook for Highlands Wash, and (2) preparation of a comprehensive Basin Management Plan to be used as the basis for ongoing floodplain-management activities, as well as projecting the need for future maintenance and capital expenditures.

A complete project proposal is attached for your review and consideration. Enclosed are project forms, location and watershed maps.

Thank you for your consideration.

Sincerely,

Aimee Ramsey
Assistant Director

c: Paul Keesler, P.E., Director/Town Engineer – Floodplain Administrator
Michael Todnem, P.E, Stormwater Utility Division Manager
Justin Turner, P.E., Sr. Stormwater Engineer
John Lynch, P.E., Stormwater Project Manager

PROJECT PROPOSAL

Request for Funding

HIGHLAND WASH TECHNICAL DATA NOTEBOOK PROJECT

Town of Oro Valley
Stormwater Utility Division Priority 4

The Town of Oro Valley is requesting completion of the 2011 draft Technical Data Notebook for Highland Wash and its tributaries, for fiscal year 2017/2018.

Project Location: Highland Wash is located in the central Oro Valley (Figure 1). Most homes in the flood plain are manufactured and were ground set in the 1960s, prior to annexation. The remaining homes in the middle and upper reaches of this watershed are of recent construction and outside the regulatory floodplain. According to the 2010 census, there are 382 people living in or near the 100-year flood plain in this project area.

According to the 2007 draft Technical Data Notebook, the mainstem of Highland Wash has a 100-year flood peaks ranging from 1,040 cfs at Vistoso Highlands Boulevard to 2,160 cfs at Lambert Lane. These flood peaks are similar to those given in the Town Wide Drainage Study.

Project Description: This project has one general task. This is to have to have the RFCD complete the draft *Technical Data Notebook for Hydrologic and Hydraulic Mapping of Highland Wash and its Tributaries, Pima County, Arizona*, dated December 2011. We are asking that this earlier investigation be made ready for public distribution and possible submittal to FEMA. The purpose of this plan is to improve floodplain management by notifying affected property owners of their true flood risks.

Project Limits: The project is located within the Highland Wash watershed, and is generally bounded on the east by First Avenue, on the north by Stone Canyon, and the west by Monterra Vista Drive. All watercourses with 100-year peak discharges of 50 cfs or more are to be included.

Estimated Cost: The estimated cost is $80,000, and includes the work to be done by District staff.

Outlined below will be the social, economic, environmental, and technical factors driving the necessity of this study.

1. **SOCIAL FACTORS**

a. ***Reduces danger to human life, public health and safety, and public and private property:***

In lower Highlands Wash, there are 148 residences and 1 business located within the preliminary 100-year flood plain (Figure 2). Furthermore, in the last three years, the Town has responded to just one drainage complaint in this area pertaining to private

property damage (Figure 3). With completion of the revised Technical Data Notebook, it is believed that most affected property owners can be notified of their flood-hazard status and be able to take proactive steps to reduce their risk or exposure.

b. ***Jurisdictional Priority:***

The Highland Wash Technical Data Notebook Proposal is ranked number four out of four requests, the lowest priority for the Town of Oro Valley.

c. ***Increase or Create Multi-Purpose Use and Green-Belt Opportunities:***

Ownership or control of watercourses in this area is mostly private, with only about 4% held in public ownership or easements (see Figure 5). Most of the private areas are already in open-space set aside, allowing maximum opportunity for multi-purpose use and to promote green-belt opportunities.

d. ***Improves pedestrian and vehicular mobility:***

An estimated 6% of paved roadways are located in the regulatory floodplain, with most consisting of elevated approaches and box culverts. Only one critical "Hotspot" has been identified in this area (Figure 3) where roadway maintenance must be done after each runoff event (averaging six or more times each year).

ENVIRONMENTAL FACTORS

a. ***Preserves or enhances natural riparian environments:***

Approximately 10% of upper Highlands Wash and its tributaries are within designated Riparian Areas (Figure 4). Furthermore, only the lower reach of this watercourse is under sized relative to its ability to convey the 100-year peak discharges. It is anticipated that future changes needed to increase floodwater conveyance or control erosion may be done at the expense of removing existing riparian vegetation.

b. ***Minimize impacts to natural riparian environments and restores disturbed areas:*** I

This project will confirm the identity of known natural riparian environment and this information will help guide the mitigation selection procedure to minimize impacts and help restore disturbed areas. Identification and preservation of desert wildlife habitat as well as the corridors utilized is a goal of this project.

c. ***Preserves and enhances wildlife habitat and movement corridors***

The preservation and enhancement of wildlife habitat and movement corridors will be an important factor in guiding the selection of management strategies.

d. ***Maintains and enhances the quality of surface water and ground water and amount and quality of ground-water recharge:***

With the exception of suspended sediment, there are no known water-quality problems in the area.

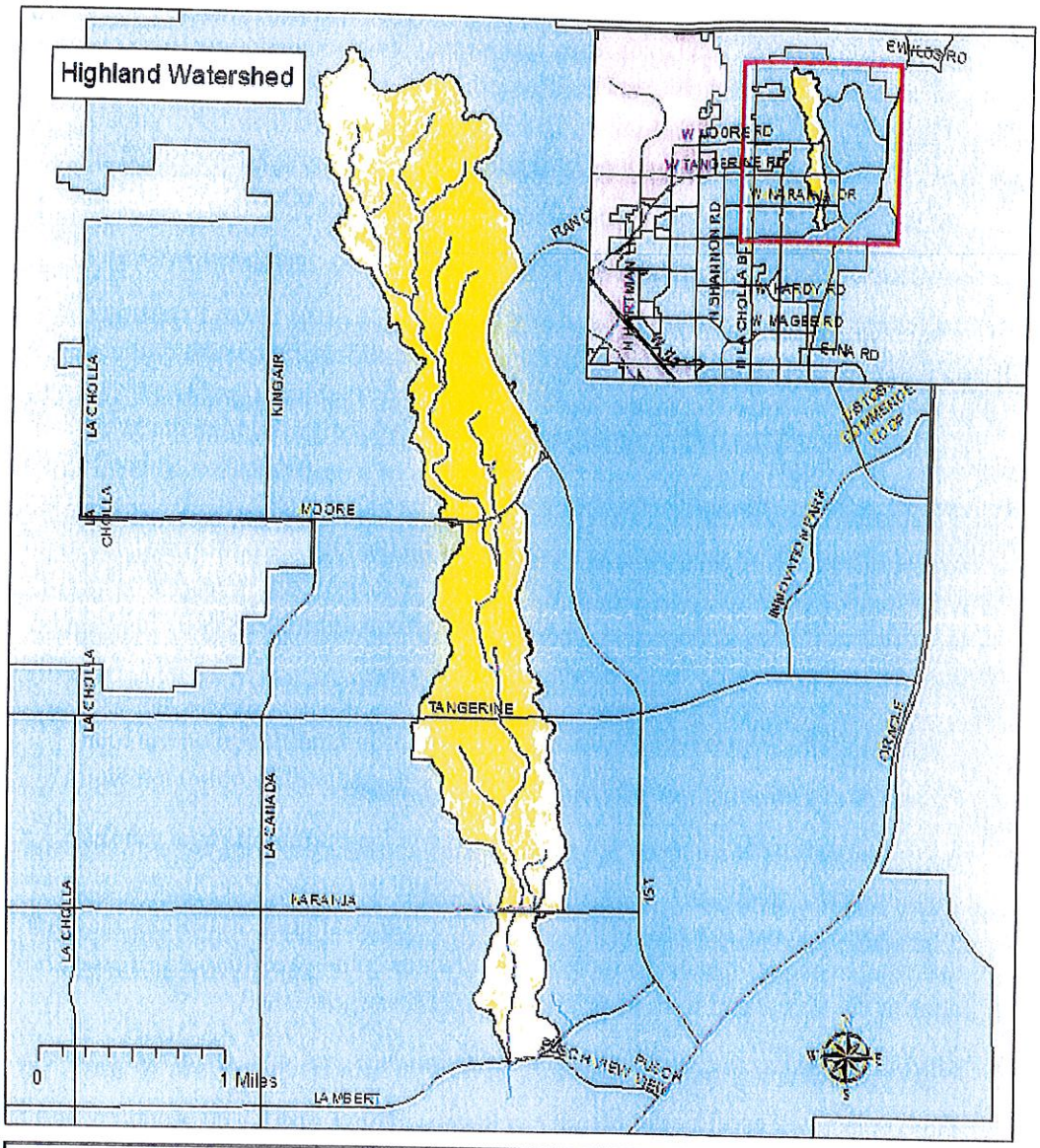
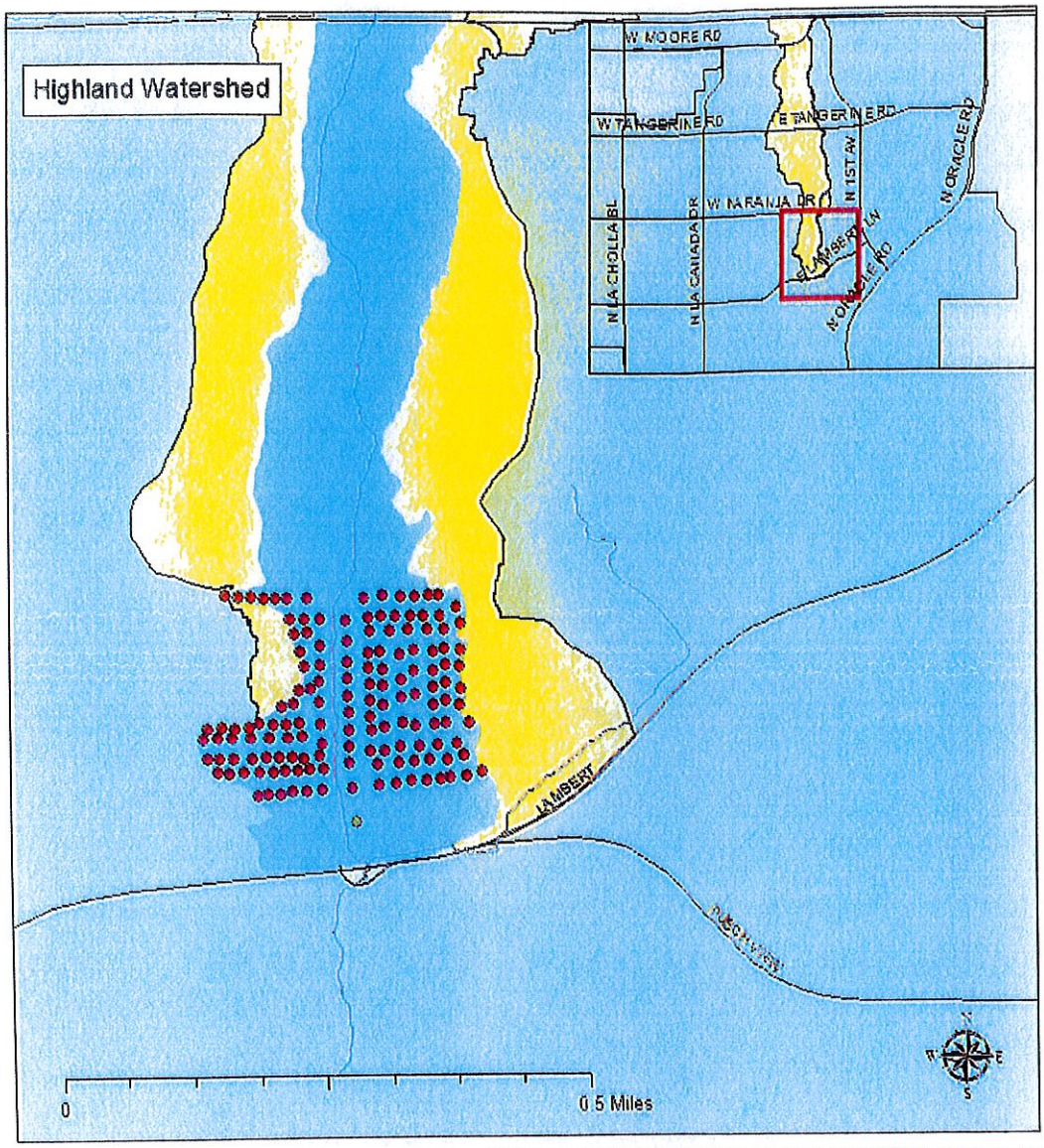


Figure 1. Location map of the Highland Watershed.



Explanation

- Highland Basin Flood Prone Residences
- Highland Basin flood Prone Businesses
- Cormack Wash and Tributaries
- Major Streets
- Highland Watershed
- Highland Watershed Flood Plain
- Oro Valley Town Limits
- Unincorporated Pima County

STORMWATER UTILITY

Figure 2. Highland Watershed flood prone commercial and residential properties.

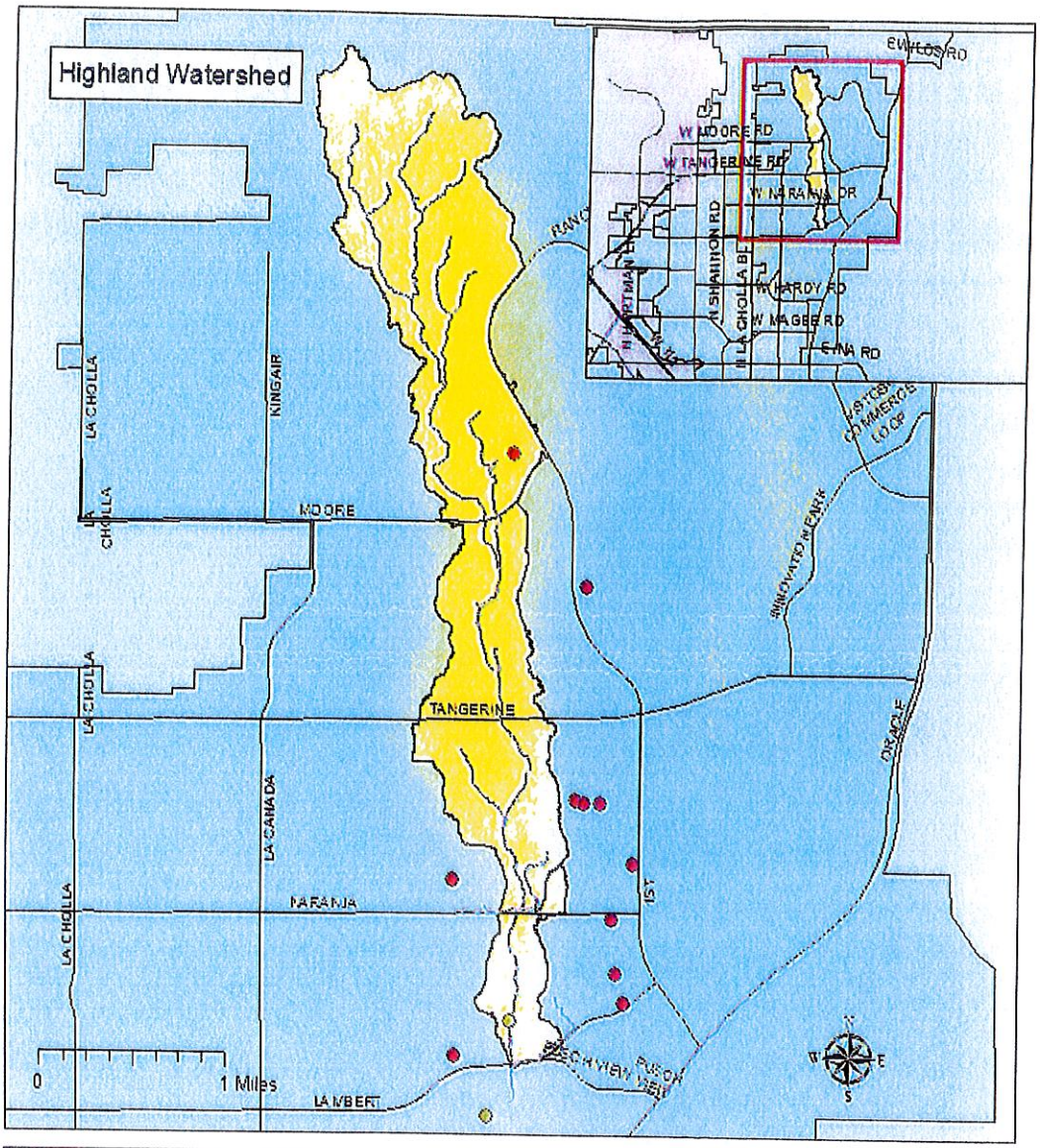


Figure 3. Highland Watershed hotspots and complaints

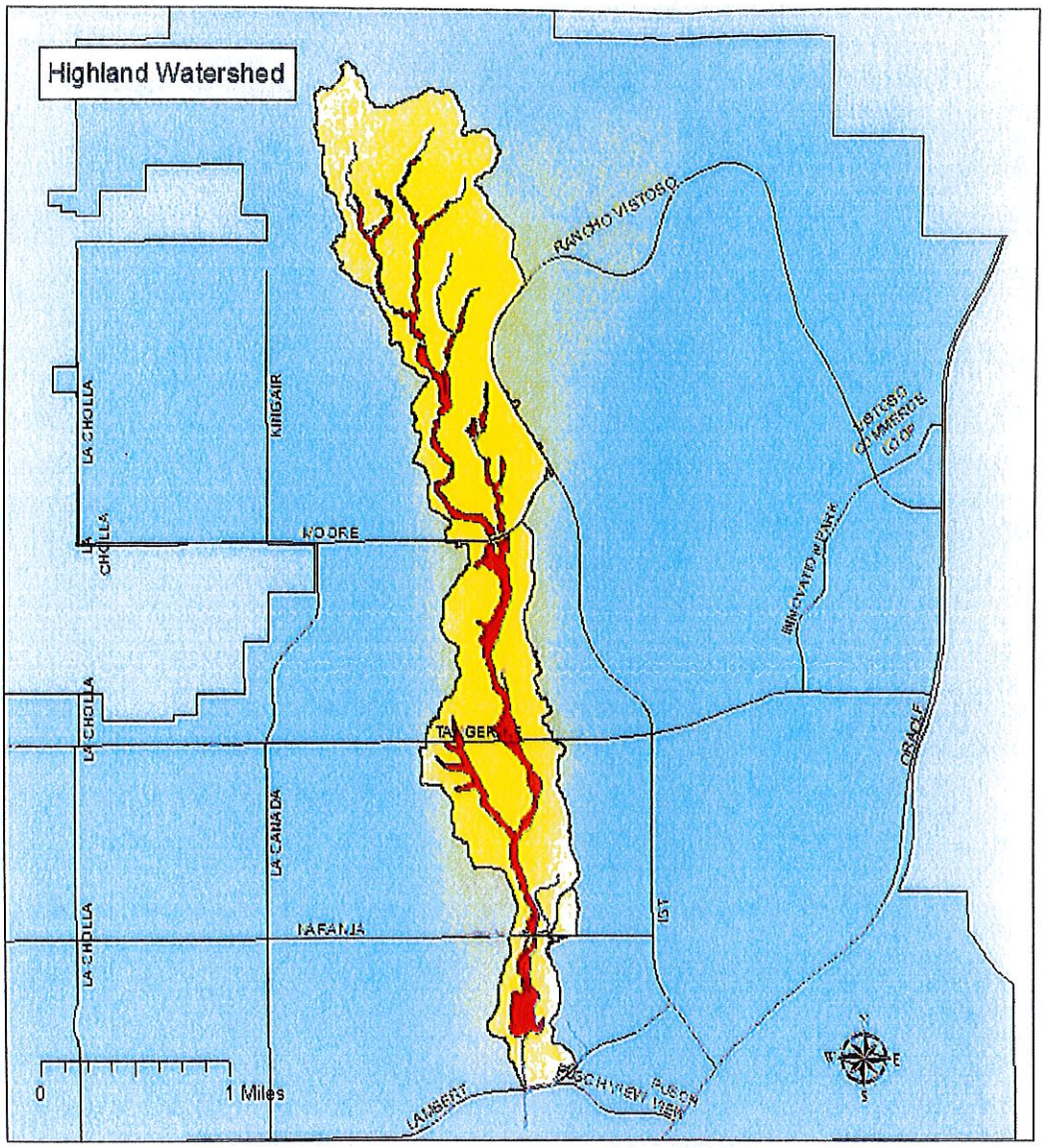


Figure 4. Highland Watershed designated riparian areas.

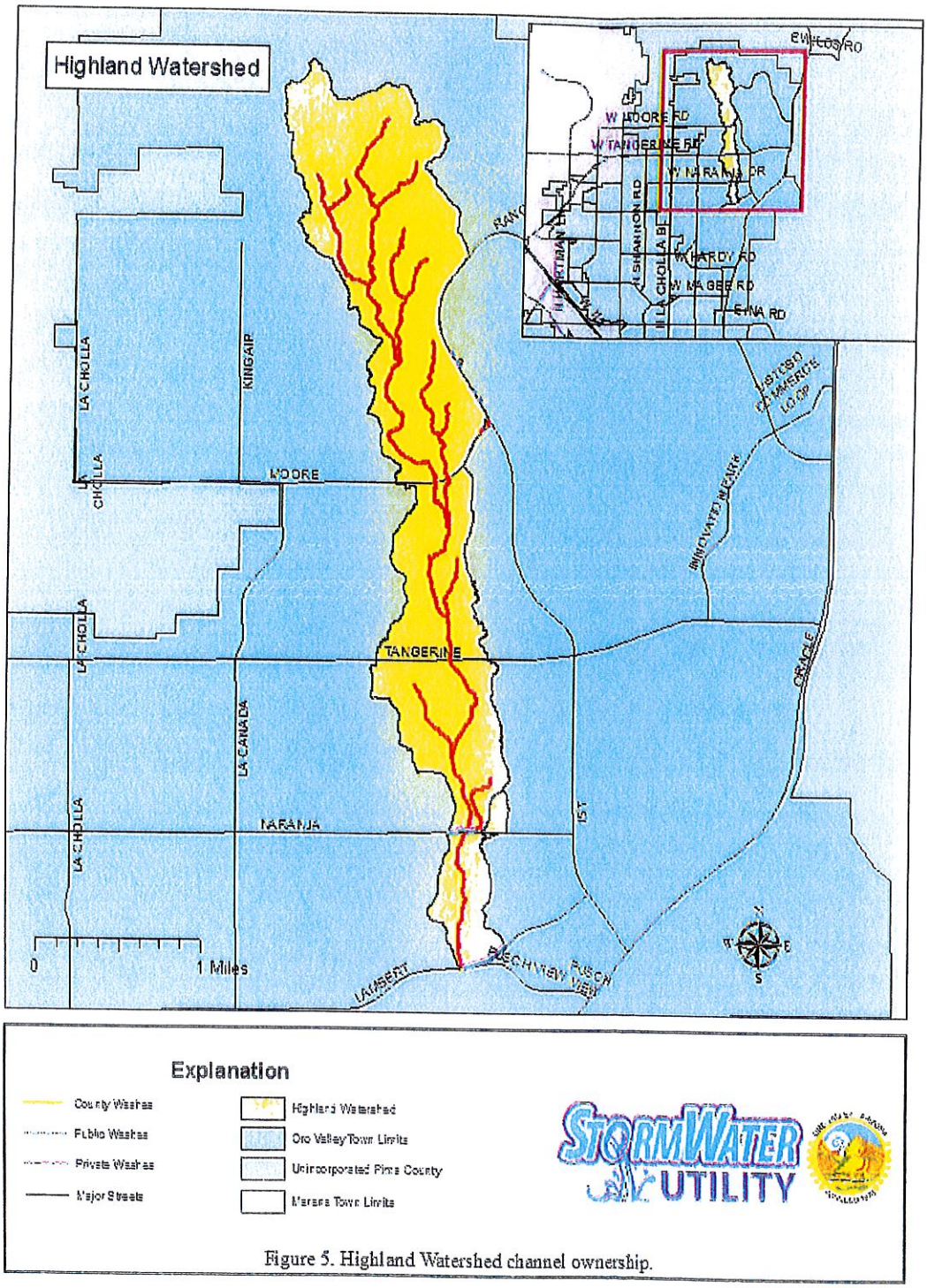


Figure 5. Highland Watershed channel ownership.

PIMA COUNTRY FLOOD CONTROL DISTRICT - CIP RATING FORM

Oro Valley - PROJECT NAME_____Highlands Wash_____DATE___9/2/16_____

CRITERIA	MIN/MAX SCORE	ACTUAL SCORE
1) SOCIAL FACTORS (category subtotal = 23)		
a. Reduces Danger to Human Life, Public Health and Safety and Public and Private Property	0-10	10
b. Jurisdictional Priority	0-6	3
c. Increases or Created multi-Purpose Use and Green-Belt Opportunities	0-4	4
d. Improves Pedestrian and Vehicular Mobility	0-3	3
Subtotal:	**0-23**	**20**
2) ENVIRONMENTAL FACTORS (category subtotal = 23)		
a. Preserves and/or Enhances Natural Riparian Environment	0-7	7
b. Minimizes Impacts to Natural Riparian Environment and Restores Disturbed Areas	0-6	6
c. Preserves and/or Enhances Wildlife Habitat and Movement Corridors	0-5	5
d. Maintains and/or Enhances the Quality of Surface Water and Ground Water and the Amount and Quality of Ground Water Recharge	0-5	5
Subtotal:	**0-23**	**23**
3) ECONOMIC FACTORS (category subtotal = 23)		
a. Reasonableness of Total Costs, Relative to Benefits	0-7	7
b. Long-Term Benefits	0-5	5
c. Estimated Total Construction Cost (Includes Mitigation Cost)	0-4	4
d. Estimated Total Operation and Maintenance Cost	0-4	4
e. Reduces Legal Liability	0-3	3
Subtotal:	**0-23**	**23**
4) TECHNICAL FACTORS (category subtotal = 23)		
a. Reduces the Frequency and Severity of Flooding, Erosion and Sedimentation	0-6	6
b. Promotes Long-Term Watershed and Channel Stability	0-5	5
c. Technical Feasibility of Implementation	0-5	5
d. Regional Impacts	0-4	4
e. Creates Links to Existing Flood-Control Facilities	0-3	3
Subtotal:	**0-23**	**23**
5) OTHER (category subtotal = 8)		
Highlands Wash floodplain mapping study - in progress		8
TOTAL :		**97**

PHOTO 1

PHOTO 2

PHOTO 3

Town of Oro Valley
Community Development and Public Works

September 2, 2016

Suzanne Shields, P.E., Director
Pima County Regional Flood Control District
201 N. Stone Avenue, 9th Floor
Tucson, Arizona 85701

Re: Request for Project Consideration – Peglar Wash Basin Management Plan – Priority 3

Dear Ms. Shields:

This project involves studying the Peglar Wash Basin (North of Magee Road between Northern Ave. & Oracle Road) within the Town of Oro Valley, which is composed of numerous tributaries that have a 100 year flow of over 1,500 cfs as they leave the town boundaries. To date, the Town of Oro Valley has been unable to address the growing concern in this area.

The Town of Oro Valley is requesting a Basin Management Plan for upper Pegler Wash and its tributaries, for fiscal year 2017/2018. This request includes (1) the expansion of the final Technical Data Notebook for Peglar Wash in Oro Valley and (2) preparation of a comprehensive Basin Management Plan to be used as the basis for ongoing floodplain-management activities, as well as projecting the need for future maintenance and capital expenditures.

A complete project proposal is attached for your review and consideration. Enclosed are project forms, location and watershed maps.

Thank you for your consideration.

Sincerely,

Aimee Ramsey
Assistant Director

c: Paul Keesler, P.E., Director/Town Engineer – Floodplain Administrator
Michael Todnem, P.E, Stormwater Utility Division Manager
Justin Turner, P.E., Sr. Stormwater Engineer
John Lynch, P.E., Stormwater Project Manager

PROJECT PROPOSAL

Request for Funding

UPPER PEGLER WASH BASIN MANAGEMENT PLAN

Town of Oro Valley
Stormwater Utility Division Priority 3

The Town of Oro Valley is requesting a Basin Management Plan for upper Pegler Wash and its tributaries, for fiscal year 2017/2018. This request includes (1) the expansion of the final Technical Data Notebook for Peglar Wash in Oro Valley, and (2) preparation of a comprehensive Basin Management Plan to be used as the basis for ongoing floodplain-management activities, as well as projecting the need for future maintenance and capital expenditures.

Project Location: The upper Pegler Wash is located in the southern portion of Oro Valley (Figure 1). Most homes in this area were constructed in the early 1960s, prior to annexation in 1974 and 1984. Neighborhoods in the area are locally known as Suffolk Hills, Catalina Citrus Estates, and Rancho Catalina. According to the 2010 census, there are 1922 people living in the 100-year flood plain in this project area.

Except for the upper-most reaches, drainage in this area generally follows roads, alleyways, utility easements and a few remaining washes, all of which generally cannot convey the 10-year flood without overtopping and causing significant damage to residential, commercial, and municipal property.

According to the 2007 Oro Valley Town Wide Drainage Study, the mainstem of upper Pegler Wash has 100-year flood peaks ranging from 314 cfs at Oracle Road and 1511 cfs at Ina Road. These flood peaks are similar to those given in the Technical Data Notebook.

Project Description: This project has two general tasks. The first is to have the RFCD expand into Oro Valley the floodplain mapping given in the *Catalina Foothills Watercourse Studies: Technical Data Notebook for Hydrology and Hydraulic Mapping of Pegler Wash, Pima County, Arizona*, dated June 30, 2013. This existing mapping stops at the Town boundary, and we are asking this earlier mapping effort is to be expanded into Oro Valley and made ready for public distribution and possible submittal to FEMA. The second task is to prepare a comprehensive Basin Management Plan of prioritized hazard mitigation and maintenance needs. The purpose of this plan is to improve floodplain management by notifying affected property owners of their true flood risks, and by developing a watercourse maintenance program, including possible capital improvements.

Project Limits: The project is located within the upper Pegler Wash watershed, and is generally bounded on three sides (east, south and west) by unincorporated Pima County. All watercourses with 100-year peak discharges of 50 cfs or more are to be included.

Estimated Cost: The estimated cost of Task 1 and Task 2 is $150,000, and includes the work to be done by District staff.

Outlined below will be the social, economic, environmental, and technical factors driving the necessity of this study.

1. **SOCIAL FACTORS**

a. ***Reduces danger to human life, public health and safety, and public and private property:***

In upper Pegler Wash, there are 25 residences and 5 businesses located within the estimated 100-year flood plain (Figure 2). Furthermore, in the last three years, the Town has responded to 9 drainage complaints in this area pertaining to private property damage and problems with public access (Figure 3). Although the 2007 Town Wide Drainage Study and the 2013 Technical Data Notebook identified flood peaks for upper Peglar Wash and most of its larger tributaries, there has been not floodplain mapping; the mapping stops at the Town limits. With completion of the revised Technical Data Notebook, it is believed that most affected property owners can be notified of their flood-hazard status and be able to take proactive steps to reduce their risk or exposure. Similarly, the Basin Management Plan will provide strategic floodplain management tools for implementation by the Town. When implemented, the Plan will reduce dangers to human life, public health and safety, as well as help protect public and private property.

Additionally, experience has shown that upper Pegler Wash has repetitive flood damages and the high potential for future flood damages.

b. ***Jurisdictional Priority:***

The Pegler Wash Basin Management Plan is ranked number four out of four request, the lowest priority for the Town of Oro Valley.

c. ***Increase or Create Multi-Purpose Use and Green-Belt Opportunities:***

Ownership or control of watercourses in this area are a mix of public and private stakeholders, with about 31% held in public ownership or easements (see Figure 5). This mix of ownership makes it difficult to create multi-purpose use areas or to promote green-belt opportunities.

d. ***Improves pedestrian and vehicular mobility:***

An estimated 12% of paved roadways are located in the regulatory floodplain, with many of these roadway segments regularly damaged by flood waters. Four (4) critical "Hotspots" have been identified in this area (Figure 3) where roadway maintenance must be done after each runoff event (averaging six or more times each year). Ordinary and emergency vehicular access along these damaged roadway segments is restricted until sand removal and related maintenance is done. Consequently, most north-south trending roads, with the exception of Oracle Road, do not have all-weather access at this time. When implemented, the Basin Management Plan will improve mobility.

2. ENVIRONMENTAL FACTORS

a. Preserves or enhances natural riparian environments:

Approximately 7% of upper Pegler Wash and its tributaries are within designated Riparian Areas (Figure 4). Furthermore, all watercourses are generally under sized relative to their ability to convey the 100-year peak discharges. It is anticipated that future changes needed to increase floodwater conveyance or control erosion may be done at the expense of removing existing riparian vegetation.

Vegetation removal and the loss of habitat are among the principal dilemmas facing the development of a comprehensive Basin Management Plan. Finding a balance between flood-damage reduction and habitat removal will be critical. But once implemented, the Plan will provide habitat management and maintenance guidelines to help the Town and its citizens preserve and restore these important habitat area.

b. ***Minimize impacts to natural riparian environments and restores disturbed areas:*** I

This project will confirm the identity of known natural riparian environment and this information will help guide the mitigation selection procedure to minimize impacts and help restore disturbed areas. Identification and preservation of desert wildlife habitat as well as the corridors utilized is a goal of this project.

c. ***Preserves and enhances wildlife habitat and movement corridors***

The preservation and enhancement of wildlife habitat and movement corridors will be an important factor in guiding the selection of management strategies.

d. ***Maintains and enhances the quality of surface water and ground water and amount and quality of ground-water recharge:***

With the exception of suspended sediment, there are no known water-quality problems in the area. One of the objectives of the Plan will be the establishment of good-housekeeping policies involving regular inspection and appropriate notification/ remediation of water quality issues, if any. Another objective is to identify of tenable retention-basin sites where stormwater can be stored and used for beneficial uses such as irrigation and or shallow ground-water recharge.

3. ECONOMIC FACTORS

a. Reasonableness of total costs relative to benefits derived:

With the ability to utilize information already developed by the District as part of the existing Technical Data Notebook, as well as the low cost of developing a Plan, it is believed this overall project will be a low-cost high-yield benefit to the Town and residents of Pima County.

b. Long term benefits:

A do nothing option will allow scour and/or down-cutting to continue, unabated, to the detriment of adjoining public and private properties. Scour and/or down-cutting will

eventually expose and undermine existing underground utilities, as well as roadway shoulders.

By comparison, adoption of new FEMA flood plains and a new comprehensive Basin Management Plan will have many long-term economic benefits, including the reduction future flood or erosion damage and repair, establishing stable property values commensurate with known risks, and the ability to prioritize future flood-related capital expenditures throughout the community based on reasonable and defensible priorities.

c. Estimated total construction costs:

The total cost of this project is estimated at $150,000. There will be not construction costs associated with this engineering study.

d. Estimated total operational and maintenance cost:

There are no operational or maintenance costs associated with administrative implementation of the Plan.

e. Reduces legal liability:

Recent severe storms on July 9, 2012, September 8, 2014, and August 16, 2016, among others, resulted in significant damage to road, homes and businesses. This included roadbed damage in areas located near at-grade wash crossings. Homes and businesses were also reportedly damaged.

Failure to take action and its implications regarding the public's health and safety or personal property has the potential for creating a litigious environment for compensation due to damages, either perceived or actual, incurred by the public, including injury or loss of life.

Exposure to liability will be reduced by establishing reasonable public expectations, requiring future flood insurance, and by establishing a defensible, prioritized list of capital improvements.

4. TECHNICAL FACTORS

a. Reduces the frequency and severity of flooding, erosion and sedimentation:

From a geomorphic standpoint, Pegler Wash and its main tributary channels are moderately incised and have undergone gradual channel-bed downcutting. This downcutting is particularly noticeable on the downstream side of roads at at-grade wash crossings. An example of this is Northern Avenue, among others. This is a north-south road that run perpendicular to the prevailing hill slope, and because of this, it tends to divert floodwaters and sediment along a flatter trajectory, causing sediment to be dropped along the roadside channels, and the remaining sediment-free water to continue downstream resulting in channel erosion and downcutting farther downstream. Consequently, many homes and businesses along these downcutting washes are in jeopardy from overbank flooding, as well as continued bank erosion.

Private levees, street curbs and instream diversion structure have been constructed in hopes of reducing damage, many of which were constructed prior to annexation. The goal of the Plan is to identify specific watercourse segments that can be improved to protect public and private properties, without transferring the problem farther downstream, or creating unintended consequences such as further channel down cutting. When fully implemented, the Basin Management Plan will have management approaches to reduce flooding and sediment deposition and erosion.

*b. **Promotes long term watershed and channel stability:***

Channel stability will be improved as needed.

*c. **Technical feasibility of implementation:***

The existing conditions hydrology has already been evaluated by the RFCD as part of the 2013 Technical Data Notebook. And the approach used to formulate and select preferred mitigation measures have been used in countless similar basin management plans in Pima County. Based on similar projects the technical feasibility of producing a final Technical Data Notebook and Basin Management Plan is unquestioned.

Long-term watershed and channel stability are the primary goals of the investigation.

*d. **Regional impacts:***

There are positive regional impacts to these studies including the ability to identify capital improvement needs and to place them in a defensible priority for implementation relative to other competing community needs.

*e. **Creates links to existing flood-control facilities:***

There are no links to existing flood-control facilities. However, the adoption of a Basin Management Plan will have widespread benefits because:

- Promotes long term watershed and channel stability
- This watercourse flows from one municipality into another,
- upstream tributaries affect downstream watercourses in another jurisdiction, and
- The possible locations of a flood control improvements provide benefits to more than one jurisdiction.

5. OTHER FACTORS

The Town of Oro Valley initially requested financial and technical assistance for this area was in ca 2005 and resulted in the completion of a Technical Data Notebook for areas south and west of the Town. The Town of Oro Valley continues to be concerned about this particular geographical area, and would like to see previous work efforts by the District optimized.

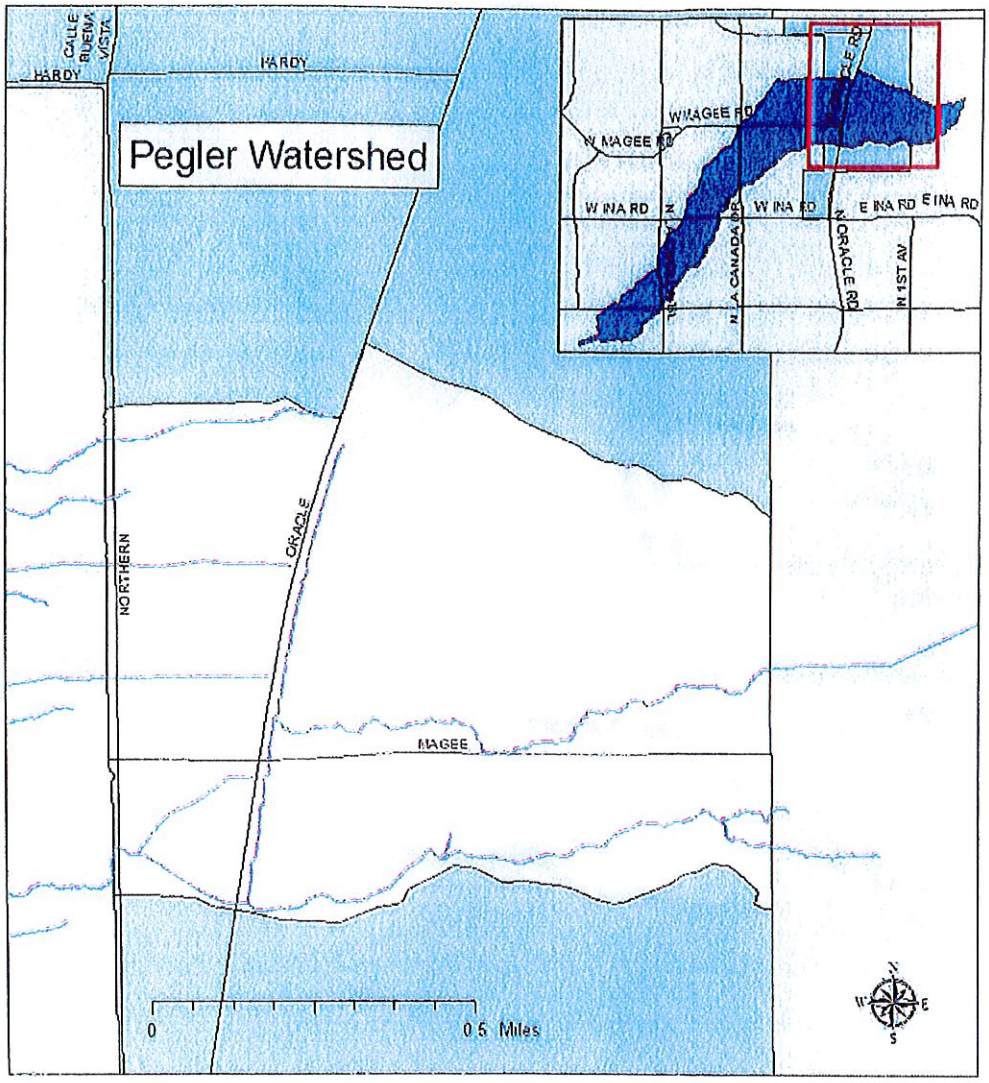


Figure 1 Location map of the Pegler Watershed

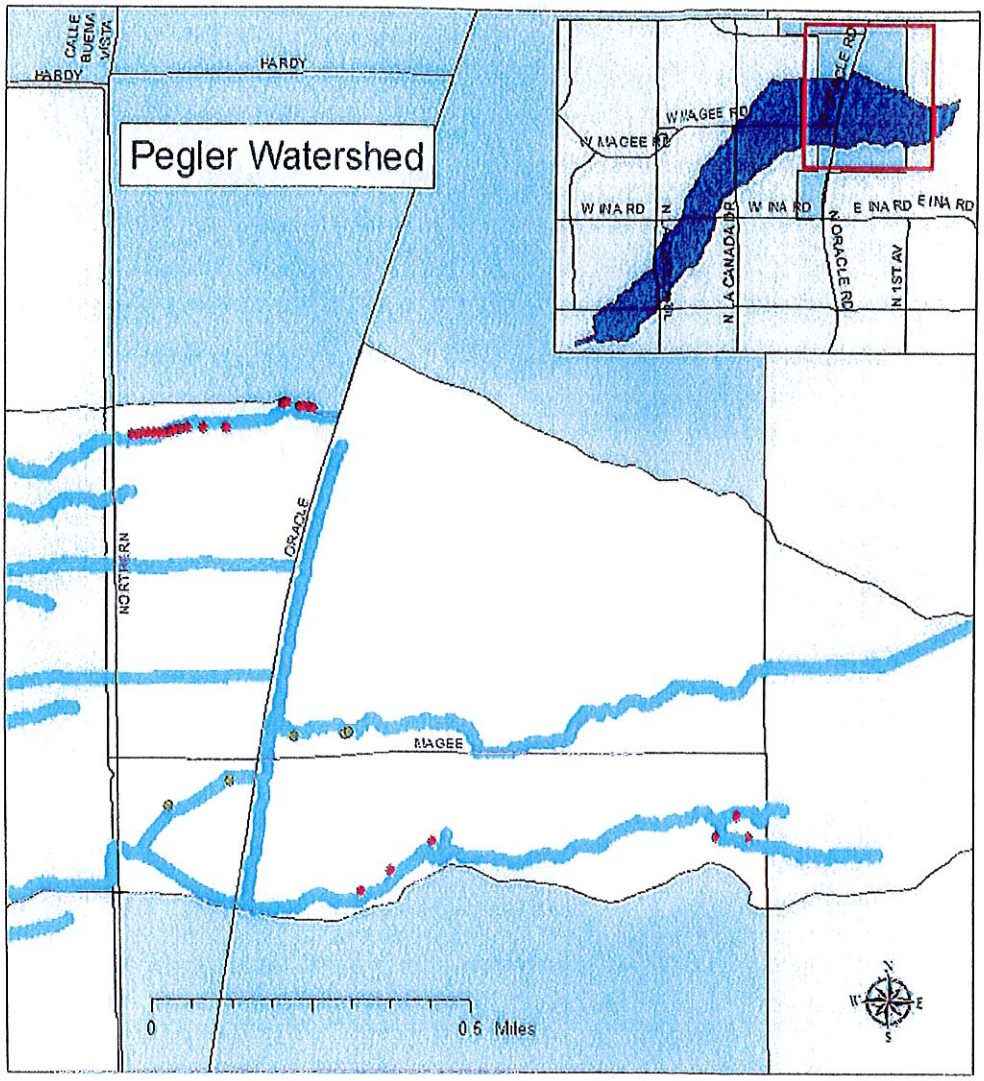


Figure 2. Pegler Watershed flood prone commercial and residential properties.

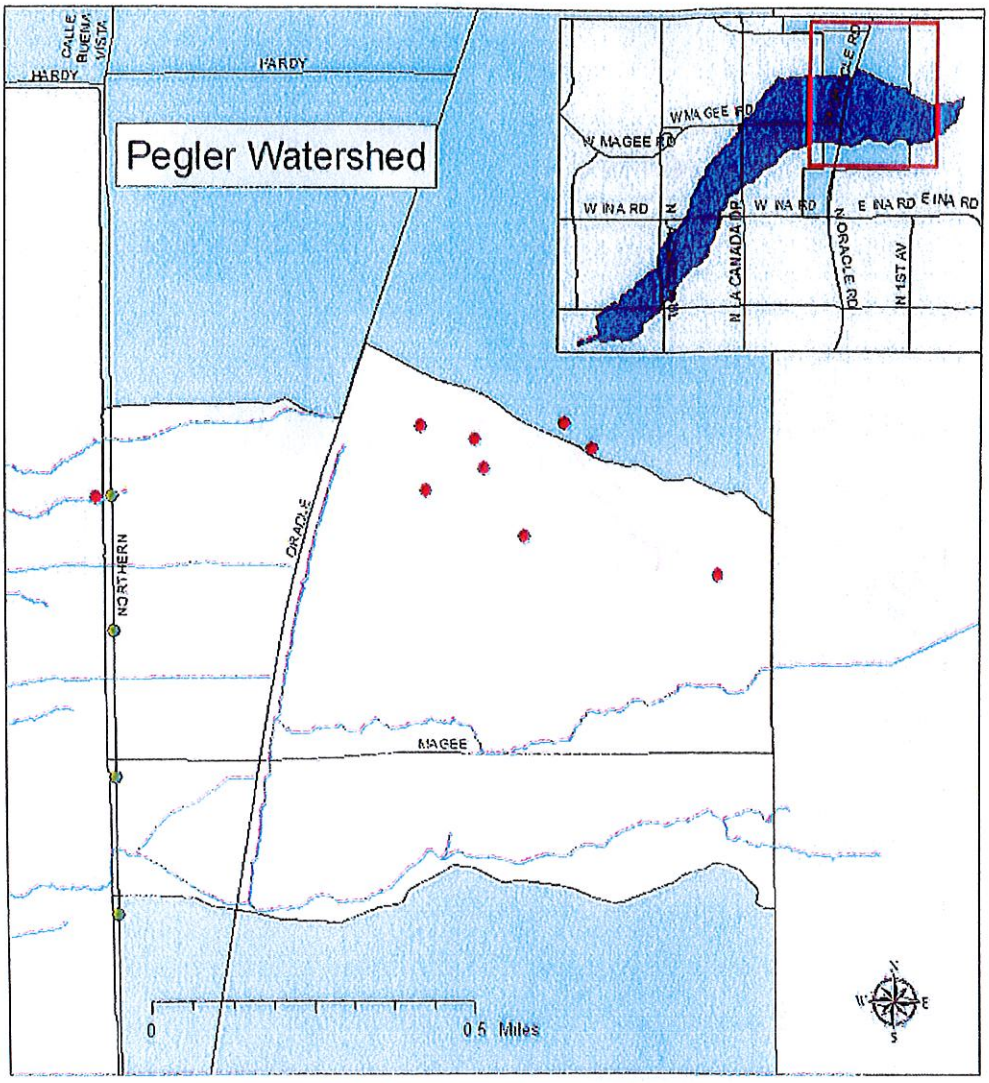


Figure 3. Pegler Watershed hotspots and complaints

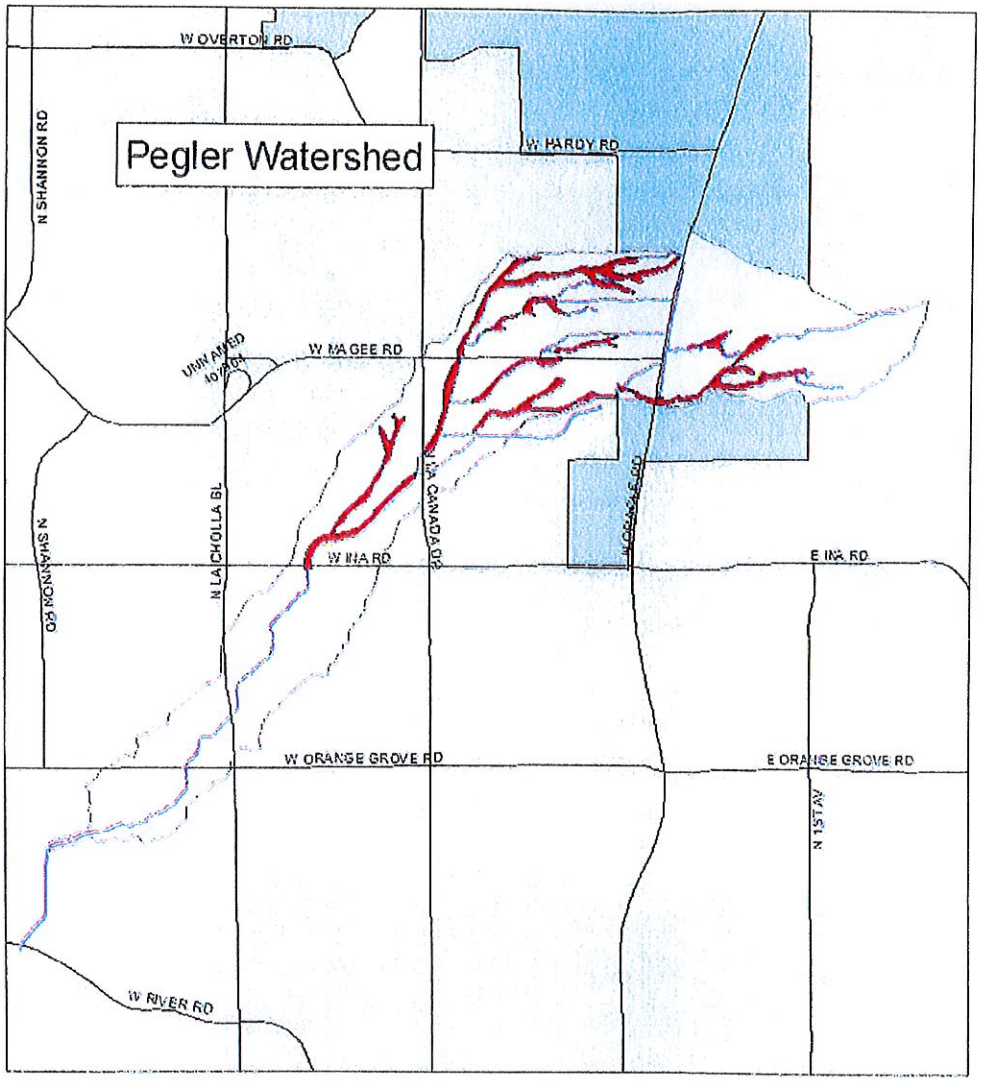
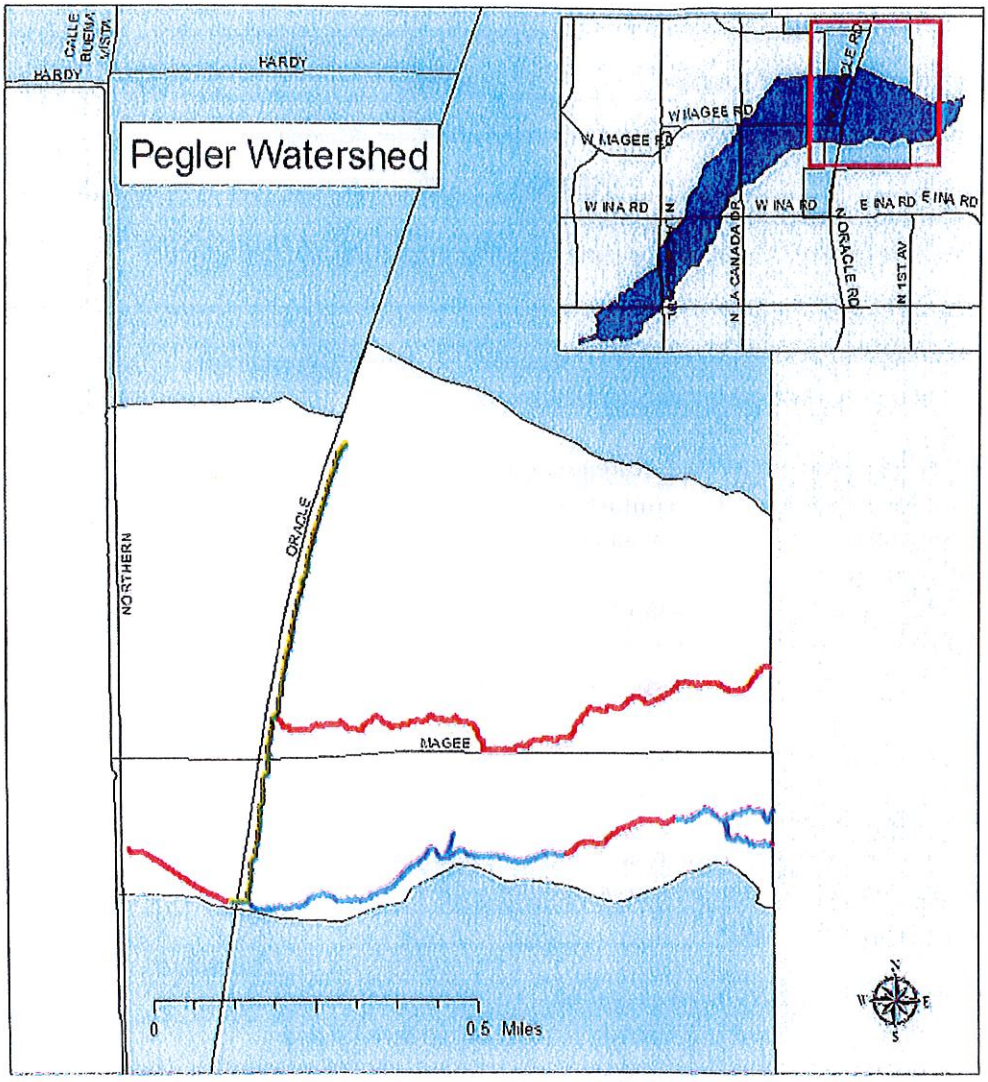


Figure 4. Pegler Watershed designated riparian areas.



Explanation

- State of Arizona Washes
- Public Washes
- Private Washes
- County Washes
- Major Streets
- Pegler Watershed Within Oro Valley Town Limits
- Oro Valley Town Limits
- Unincorporated Pima County
- Pegler Watershed

STORMWATER UTILITY

Figure 5. Pegler Watershed channel ownership within Oro Valley town limits.

PIMA COUNTRY FLOOD CONTROL DISTRICT - CIP RATING FORM

Oro Valley - PROJECT NAME_____Peglar_____DATE__9/2/16_____

CRITERIA	MIN/MAX SCORE	ACTUAL SCORE
1) SOCIAL FACTORS (category subtotal = 23)		
a. Reduces Danger to Human Life, Public Health and Safety and Public and Private Property	0-10	10
b. Jurisdictional Priority	0-6	4
c. Increases or Created multi-Purpose Use and Green-Belt Opportunities	0-4	4
d. Improves Pedestrian and Vehicular Mobility	0-3	3
Subtotal:	**0-23**	**21**
2) ENVIRONMENTAL FACTORS (category subtotal = 23)		
a. Preserves and/or Enhances Natural Riparian Environment	0-7	7
b. Minimizes Impacts to Natural Riparian Environment and Restores Disturbed Areas	0-6	6
c. Preserves and/or Enhances Wildlife Habitat and Movement Corridors	0-5	5
d. Maintains and/or Enhances the Quality of Surface Water and Ground Water and the Amount and Quality of Ground Water Recharge	0-5	5
Subtotal:	**0-23**	**23**
3) ECONOMIC FACTORS (category subtotal = 23)		
a. Reasonableness of Total Costs, Relative to Benefits	0-7	7
b. Long-Term Benefits	0-5	5
c. Estimated Total Construction Cost (Includes Mitigation Cost)	0-4	4
d. Estimated Total Operation and Maintenance Cost	0-4	4
e. Reduces Legal Liability	0-3	3
Subtotal:	**0-23**	**23**
4) TECHNICAL FACTORS (category subtotal = 23)		
a. Reduces the Frequency and Severity of Flooding, Erosion and Sedimentation	0-6	6
b. Promotes Long-Term Watershed and Channel Stability	0-5	5
c. Technical Feasibility of Implementation	0-5	5
d. Regional Impacts	0-4	4
e. Creates Links to Existing Flood-Control Facilities	0-3	3
Subtotal:	**0-23**	**23**
5) OTHER (category subtotal = 8)		
Peglar Wash floodplain mapping study - in progress		8
TOTAL :		**98**

Town of Oro Valley
Community Development and Public Works

September 2, 2016

Suzanne Shields, P.E., Director
Pima County Regional Flood Control District
201 N. Stone Avenue, 9th Floor
Tucson, Arizona 85701

Re: Request for Project Consideration – Carmack Wash Basin Management Plan – Priority 2

Dear Ms. Shields:

This project is identified by the Town of Oro Valley as an area requiring completion of Carmack Wash Basin mapping and subsequent Basin Management Plan due to storm damage from September 8, 2014. In the spring of 2015 the County assisted Oro Valley with funding to clean up debris and remove sediment from multiple locations within the Carmack Wash watershed. Historically this watershed has been on the County CIP funding request list since 2005 as a project for consideration "Shadow Mountain Estates Subdivision Flood and Erosion Protection".

The Town of Oro Valley is requesting a Basin Management Plan for upper Carmack Wash and its tributaries, for fiscal year 2017/2018. This request includes (1) completion of the draft Technical Data Notebook for Carmack Wash, and (2) preparation of a comprehensive Basin Management Plan to be used as the basis for ongoing floodplain-management activities, as well as projecting the need for future maintenance and capital expenditures.

A complete project proposal is attached for your review and consideration. Enclosed are project forms, location and watershed maps.

Thank you for your consideration.

Sincerely,

Aimee Ramsey

Aimee Ramsey
Assistant Director

c: Paul Keesler, P.E., Director/Town Engineer – Floodplain Administrator
Michael Todnem, P.E, Stormwater Utility Division Manager
Justin Turner, P.E., Sr. Stormwater Engineer
John Lynch, P.E., Stormwater Project Manager

Estimated Cost: The estimated cost of Task 1 and Task 2 is $200,000, and includes the work to be done by District staff.

Outlined below will be the social, economic, environmental, and technical factors driving the necessity of this study.

1. **SOCIAL FACTORS**

*a. **Reduces danger to human life, public health and safety, and public and private property:***

In upper Carmack Wash, there are 361 residences and 11 businesses located within the estimated 100-year flood plain (Figure 2). Furthermore, in the last three years, the Town has responded to 55 drainage complaints in this area pertaining to private property damage and problems with public access (Figure 3). Although the 2007 Town Wide Drainage Study identified flood peaks for upper Carmack Wash and most of its larger tributaries, the only floodplain limits mapped at that time are along the mainstem, and not the tributaries. With completion of the draft Technical Data Notebook, it is believed that most affected property owners can be notified of their flood-hazard status and be able to take proactive steps to reduce their risk or exposure. Similarly, the Basin Management Plan will provide strategic floodplain management tools for implementation by the Town. When implemented, the Plan will reduce dangers to human life, public health and safety, as well as help protect public and private property.

Additionally, experience has shown that upper Carmack Wash has repetitive flood damages and the high potential for future flood damages.

*b. **Jurisdictional Priority:***

The Carmack Wash Basin Management Plan is ranked number two, the second highest priority for the Town of Oro Valley.

*c. **Increase or Create Multi-Purpose Use and Green-Belt Opportunities:***

Ownership or control of watercourses in this area are a mix of public and private stakeholders, with about 60% held in public ownership or easements. This mix of ownership makes it difficult to create multi-purpose use areas or to promote green-belt opportunities. However, native vegetation does line the existing watercourses.

*d. **Improves pedestrian and vehicular mobility:***

An estimated 31% of paved roadways are located in the regulatory floodplain, with many of these roadway segments regularly damaged by flood waters. Five critical "Hotspots" have been identified in this area (Figure 3) where roadway maintenance must be done after each runoff event (averaging six or more times each year). Ordinary and emergency vehicular access along these damaged roadway segments is restricted until sand removal and related maintenance is done. Consequently, most north-south trending roads, with the exception of Oracle Road, do not have all-weather access at this time. When implemented, the Basin Management Plan will improve mobility.

2. ENVIRONMENTAL FACTORS

*a. **Preserves or enhances natural riparian environments:***

Approximately 29% of upper Carmack Wash and its tributaries are within designated Riparian Areas (Figure 4). Furthermore, all watercourses are generally under sized relative to their ability to convey the 100-year peak discharges. It is anticipated that future changes needed to increase floodwater conveyance or control erosion may be done at the expense of removing existing riparian vegetation.

Vegetation removal and the loss of habitat are among the principal dilemmas facing the development of a comprehensive Basin Management Plan. Finding a balance between flood-damage reduction and habitat removal will be critical. But once implemented, the Plan will provide habitat management and maintenance guidelines to help the Town and its citizens preserve and restore these important habitat area.

b. ***Minimize impacts to natural riparian environments and restores disturbed areas:***

This project will confirm the identity of known natural riparian environment and this information will help guide the mitigation selection procedure to minimize impacts and help restore disturbed areas. Identification and preservation of desert wildlife habitat as well as the corridors utilized is a goal of this project.

c. ***Preserves and enhances wildlife habitat and movement corridors***

The preservation and enhancement of wildlife habitat and movement corridors will be an important factor in guiding the selection of management strategies.

d. ***Maintains and enhances the quality of surface water and ground water and amount and quality of ground-water recharge:***

With the exception of suspended sediment, there are no known water-quality problems in the area. One of the objectives of the Plan will be the establishment of good-housekeeping policies involving regular inspection and appropriate notification/ remediation of water quality issues, if any. Another objective is to identify of tenable retention-basin sites where stormwater can be stored and used for beneficial uses such as irrigation and or shallow ground-water recharge.

3. ECONOMIC FACTORS

*a. **Reasonableness of total costs relative to benefits derived:***

With the ability to utilize information already developed by the District as part of the draft Technical Data Notebook, as well as the low cost of developing a Plan, it is believed this overall project will be a low-cost high-yield benefit to the Town and residents of Pima County.

*b. **Long term benefits:***

A do nothing option will allow scour and/or down-cutting to continue, unabated, to the detriment of adjoining public and private properties. Scour and/or down-cutting will

eventually expose and undermine existing underground utilities, as well as roadway shoulders.

By comparison, adoption of new FEMA flood plains and a new comprehensive Basin Management Plan will have many long-term economic benefits, including the reduction future flood or erosion damage and repair, establishing stable property values commensurate with known risks, and the ability to prioritize future flood-related capital expenditures throughout the community based on reasonable and defensible priorities.

*c. **Estimated total construction costs:***

The total cost of this project is estimated at $200,000. There will be not construction costs associated with this engineering study.

*d. **Estimated total operational and maintenance cost:***

There are no operational or maintenance costs associated with administrative implementation of the Plan.

*e. **Reduces legal liability:***

Recent severe storms on July 9, 2012, September 8, 2014, and August 16, 2016, among others, resulted in significant damage to road, homes and businesses. This included roadbed damage in areas located near at-grade wash crossings. Homes and businesses were also reportedly damaged in this particular area resulting in at least one law suit brought against the Town because of the September 8, 2014 storm.

Failure to take action and its implications regarding the public's health and safety or personal property has the potential for creating a litigious environment for compensation due to damages, either perceived or actual, incurred by the public, including injury or loss of life.

Exposure to liability will be reduced by establishing reasonable public expectations, requiring future flood insurance, and by establishing a defensible, prioritized list of capital improvements.

4. TECHNICAL FACTORS

*a. **Reduces the frequency and severity of flooding, erosion and sedimentation:***

From a geomorphic standpoint, Carmack Wash and its main tributary channels are moderately incised and have undergone gradual channel-bed downcutting. This downcutting is particularly noticeable on the downstream side of roads at at-grade wash crossings. Some examples of this include Northern Avenue, Overlook and Shadow Mountain Drive, among others. These are north-south roads that run perpendicular to the prevailing hill slope, and because of this, they tend to divert floodwaters and sediment along a flatter trajectory, causing sediment to be dropped along the roadside channels, and the remaining sediment-free water to continue downstream resulting in channel erosion and downcutting farther downstream. Consequently, many homes and businesses

along these downcutting washes are in jeopardy from overbank flooding, as well as continued bank erosion.

Private levees, street curbs and instream diversion structure have been constructed in hopes of reducing damage, many of which were constructed prior to annexation. The goal of the Plan is to identify specific watercourse segments that can be improved to protect public and private properties, without transferring the problem farther downstream, or creating unintended consequences such as further channel down cutting. When fully implemented, the Basin Management Plan will have management approaches to reduce flooding and sediment deposition and erosion.

*b. **Promotes long term watershed and channel stability:***

Channel stability will be improved as needed.

*c. **Technical feasibility of implementation:***

The existing conditions hydrology and floodplain mapping in some areas have already been evaluated by the RFCD as part of earlier draft Technical Data Notebook. And the approach used to formulate and select preferred mitigation measures have been used in countless similar basin management plans in Pima County. Based on similar projects the technical feasibility of producing a final Technical Data Notebook and Basin Management Plan is unquestioned.

Long-term watershed and channel stability are the primary goals of the investigation.

*d. **Regional impacts:***

There are positive regional impacts to these studies including the ability to identify capital improvement needs and to place them in a defensible priority for implementation relative to other competing community needs.

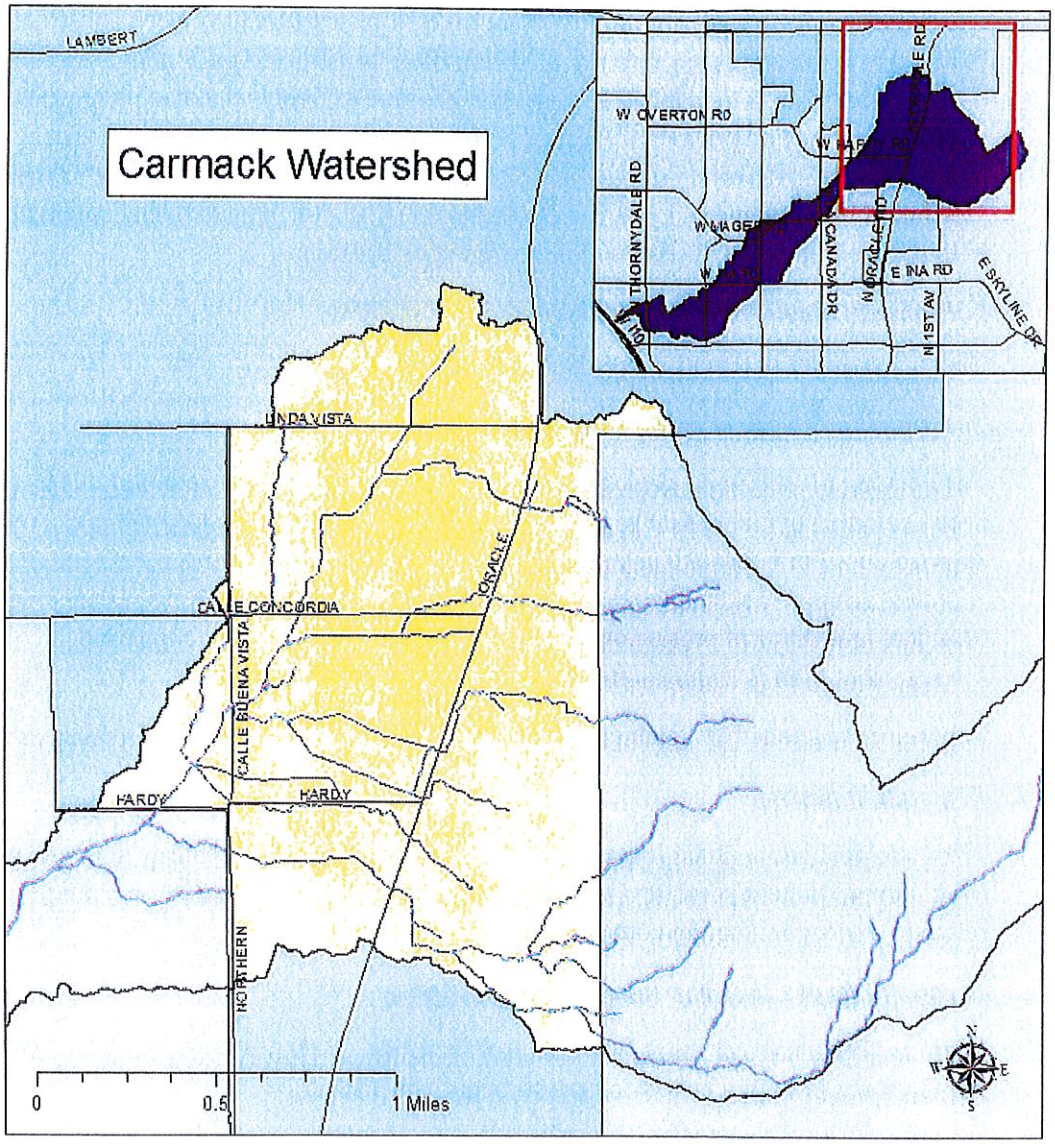
*e. **Creates links to existing flood-control facilities:***

There are no links to existing flood-control facilities. However, the adoption of a Basin Management Plan will have widespread benefits because:

- Promotes long term watershed and channel stability,
- This watercourse flows from one municipality into another,
- Upstream tributaries affect downstream watercourses in another jurisdiction, and
- The possible locations of a flood control improvements provide benefits to more than one jurisdiction.

5. Other Factors

The Town of Oro Valley initially requested financial and technical assistance in 2005 and resulted in the completion of a draft Technical Data Notebook. The Town of Oro Valley continues to be concerned about this particular geographical area and would like to see previous work efforts by the District optimized.

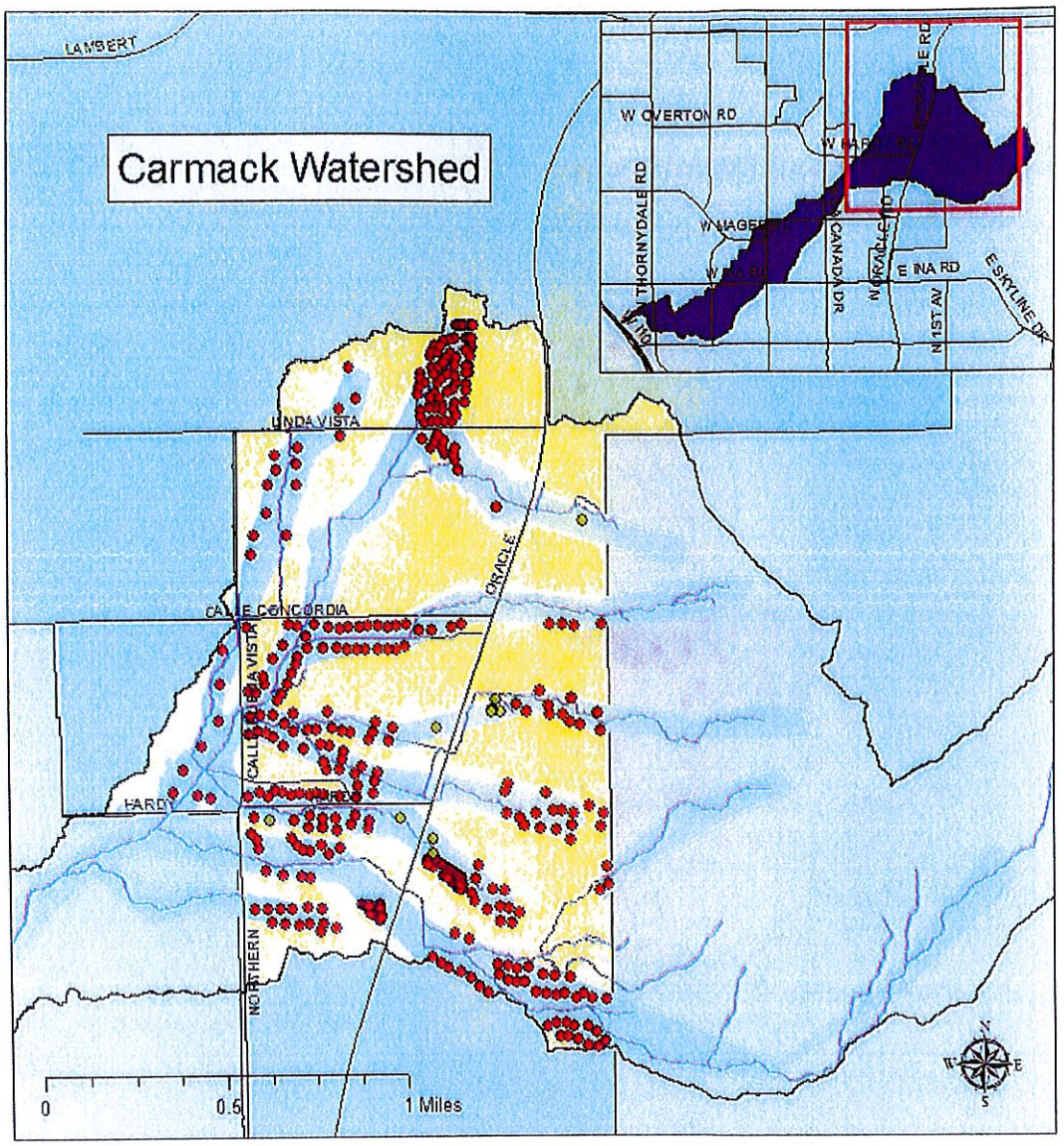


Explanation

- Carmack Watershed
- Carmack Wash and Tributaries
- Major Streets
- Carmack Watershed Within Oro Valley Town Limits
- Oro Valley Town Limits
- Unincorporated Pima County

STORMWATER UTILITY

Figure 1. Location map of the Carmack Watershed.

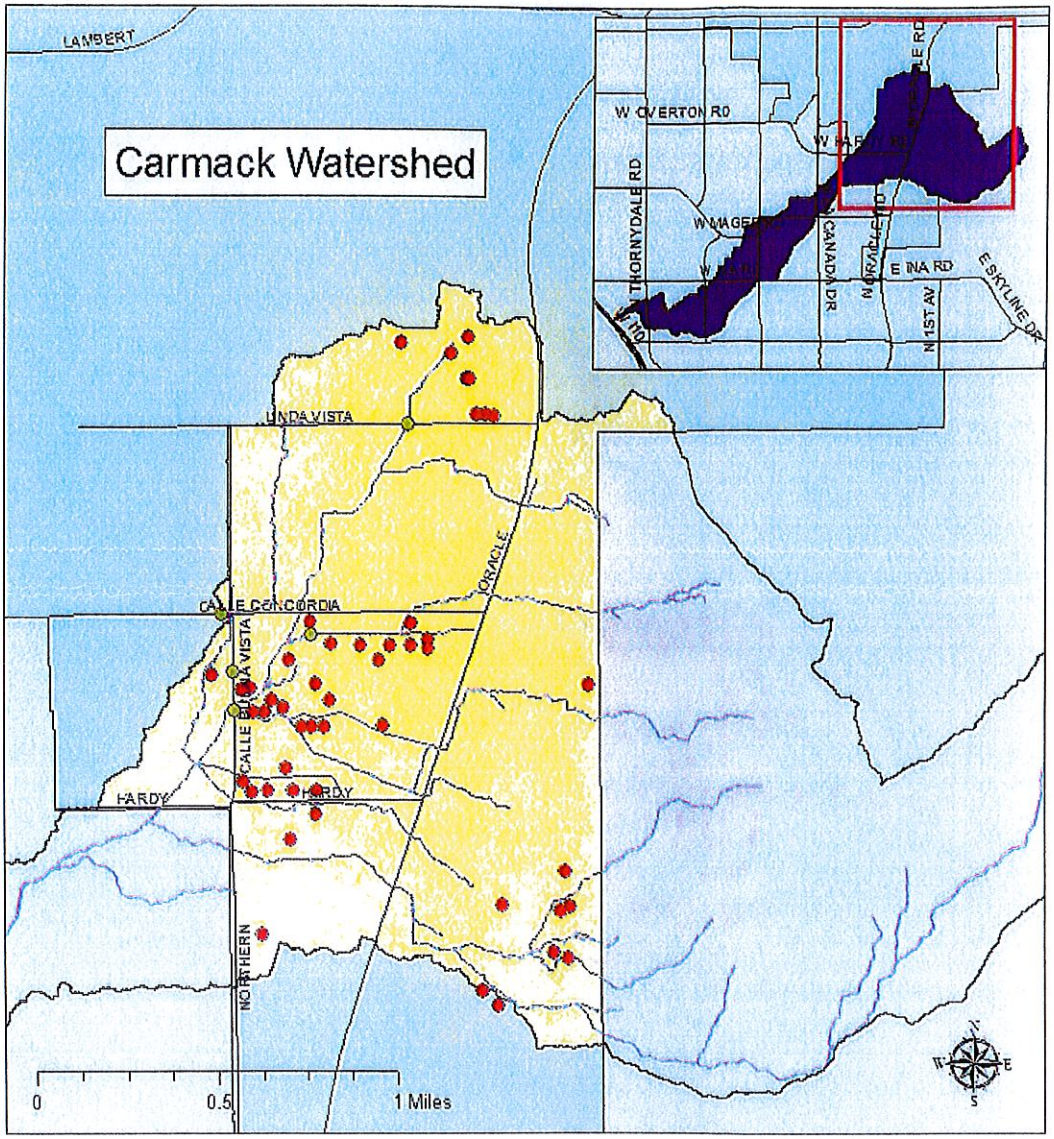


Explanation

- Carmack Basin Flood Prone Residences
- Carmack Basin flood Prone Businesses
- Carmack Wash and Tributaries
- Carmack Watershed Within Oro Valley Town Limits
- Major Streets
- Carmack Watershed
- Carmack Flood Plain
- Oro Valley Town Limits
- Unincorporated Pima County

STORMWATER UTILITY

Figure 2. Carmack Watershed flood prone commercial and residential properties.



Explanation

- Carmack Basin Complaints
- Carmack Basin Hotspot Areas
- Carmack Wash and Tributaries
- Carmack Watershed Within Oro Valley Town Limits
- Carmack Watershed
- Oro Valley Town Limits
- Unincorporated Pima County
- Major Streets

STORMWATER UTILITY

Figure 3. Carmack Watershed hotspots and complaints

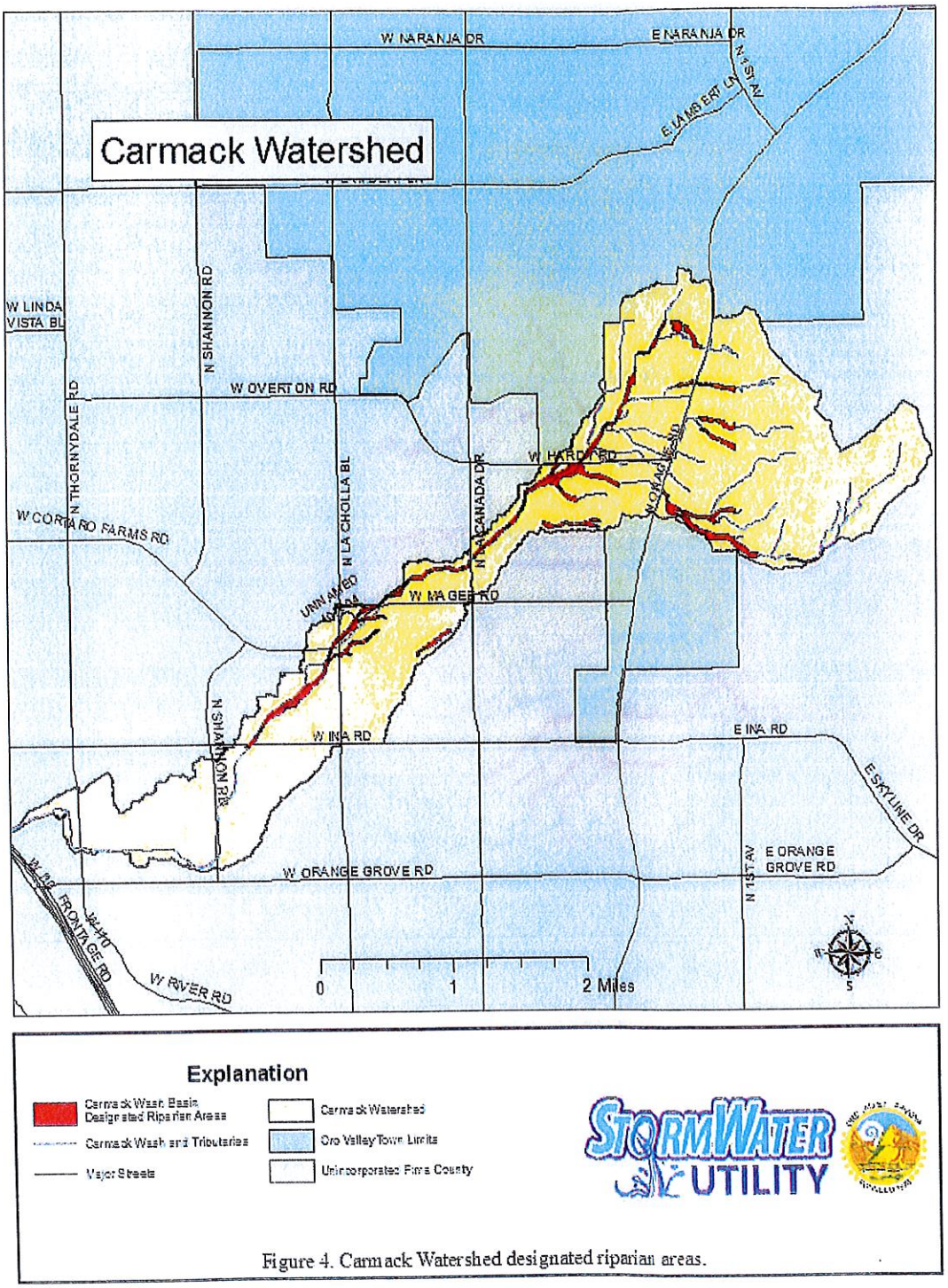
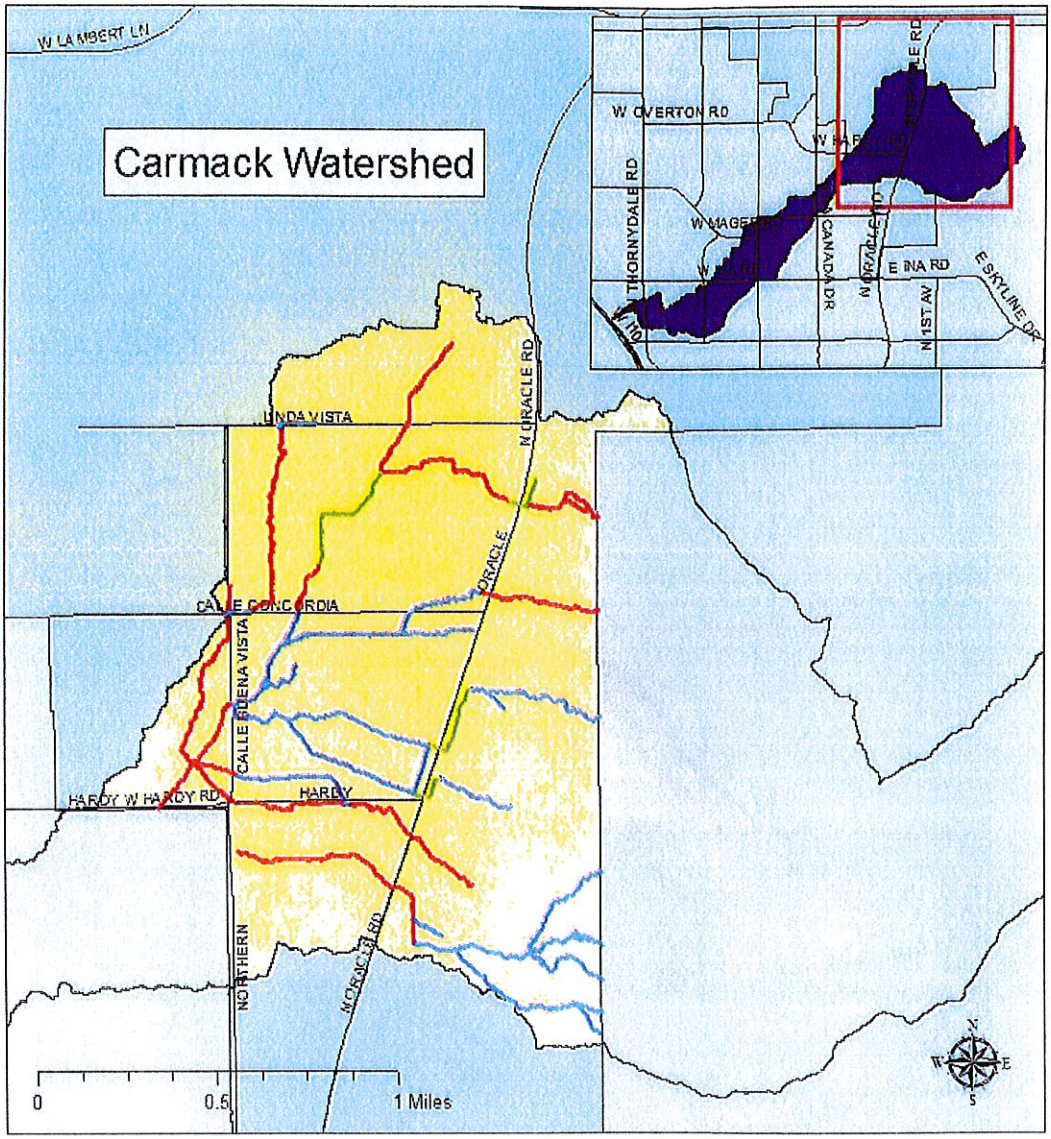


Figure 4. Carmack Watershed designated riparian areas.



Explanation

- State of Arizona Washes
- Public Washes
- Private Washes
- Major Streets
- Carmack Watershed Within Oro Valley Town Limits
- Oro Valley Town Limits
- Unincorporated Pima County
- Carmack Watershed

Figure 5. Carmack Watershed channel ownership within Oro Valley town limits.

PIMA COUNTRY FLOOD CONTROL DISTRICT - CIP RATING FORM

Oro Valley - PROJECT NAME_____Carmack Wash_____DATE___9/2/16_____

CRITERIA	MIN/MAX SCORE	ACTUAL SCORE
1) SOCIAL FACTORS (category subtotal = 23)		
a. Reduces Danger to Human Life, Public Health and Safety and Public and Private Property	0-10	10
b. Jurisdictional Priority	0-6	5
c. Increases or Created multi-Purpose Use and Green-Belt Opportunities	0-4	4
d. Improves Pedestrian and Vehicular Mobility	0-3	3
Subtotal:	**0-23**	**22**
2) ENVIRONMENTAL FACTORS (category subtotal = 23)		
a. Preserves and/or Enhances Natural Riparian Environment	0-7	7
b. Minimizes Impacts to Natural Riparian Environment and Restores Disturbed Areas	0-6	6
c. Preserves and/or Enhances Wildlife Habitat and Movement Corridors	0-5	5
d. Maintains and/or Enhances the Quality of Surface Water and Ground Water and the Amount and Quality of Ground Water Recharge	0-5	5
Subtotal:	**0-23**	**23**
3) ECONOMIC FACTORS (category subtotal = 23)		
a. Reasonableness of Total Costs, Relative to Benefits	0-7	7
b. Long-Term Benefits	0-5	5
c. Estimated Total Construction Cost (Includes Mitigation Cost)	0-4	4
d. Estimated Total Operation and Maintenance Cost	0-4	4
e. Reduces Legal Liability	0-3	3
Subtotal:	**0-23**	**23**
4) TECHNICAL FACTORS (category subtotal = 23)		
a. Reduces the Frequency and Severity of Flooding, Erosion and Sedimentation	0-6	6
b. Promotes Long-Term Watershed and Channel Stability	0-5	5
c. Technical Feasibility of Implementation	0-5	5
d. Regional Impacts	0-4	4
e. Creates Links to Existing Flood-Control Facilities	0-3	3
Subtotal:	**0-23**	**23**
5) OTHER (category subtotal = 8)		
TOTAL :		**91**

PHOTO 1


PHOTO 2

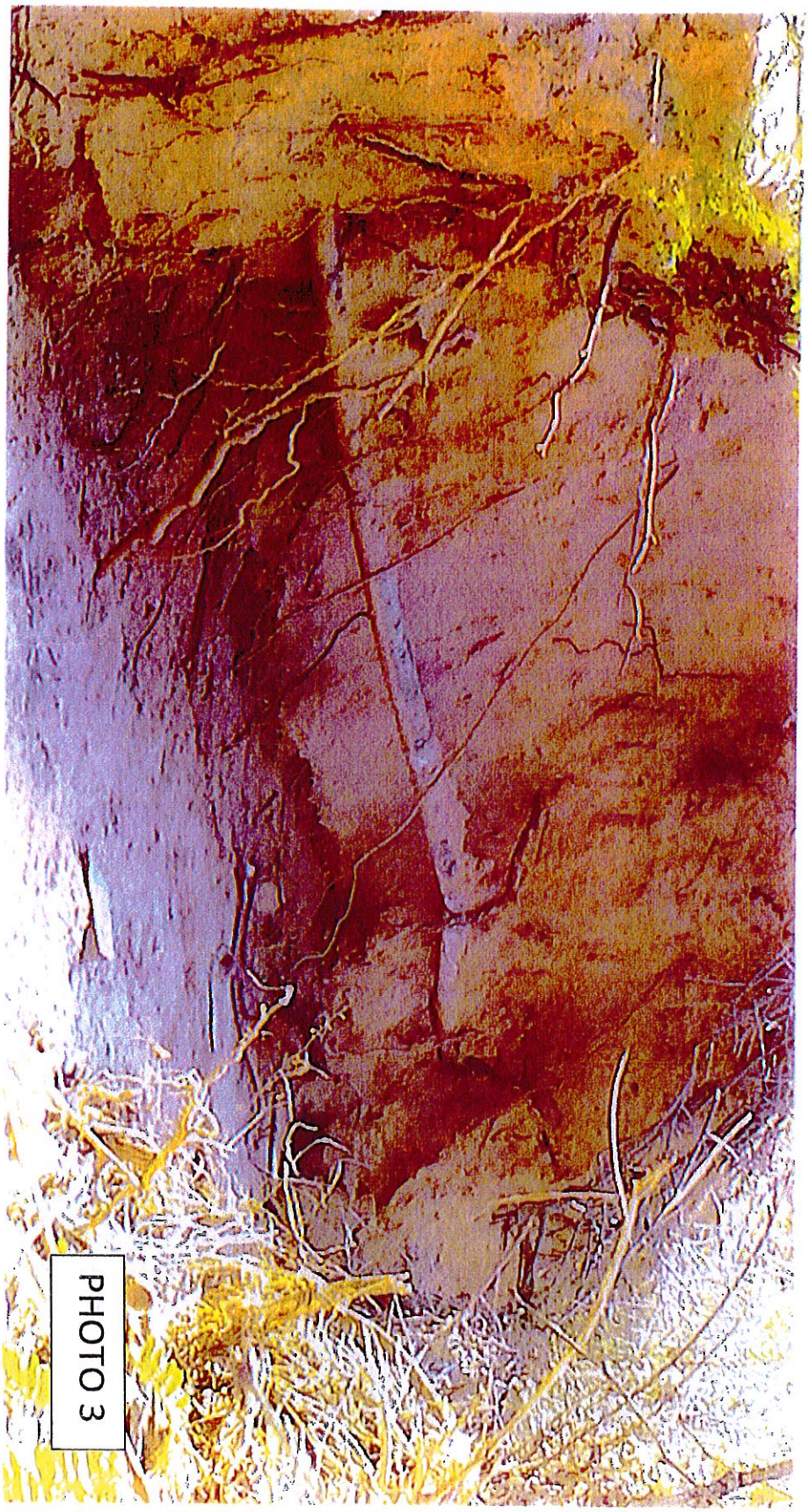


PHOTO 3

Town of Oro Valley
Community Development and Public Works

September 2, 2016

Suzanne Shields, P.E., Director
Pima County Regional Flood Control District
201 N. Stone Avenue, 9th Floor
Tucson, Arizona 85701

Re: Project Request – Catalina Ridge Drainage Channel Reconstruction Project – Priority 1

Dear Ms. Shields:

This project is identified by the Town of Oro Valley as an area requiring immediate repair due to storm damage on September 8, 2014. The existing 3,500' riprap channel bottom has begun to fail with portions of the grouted riprap channel banks and toedown/footings exposed to additional damage from future storms. To date the Town of Oro Valley is assisting the Catalina Ridge Home Owner's Association by soliciting bids to reconstruct a 100-foot-long segment of the severely damaged channel bottom and sideslope protection. Although the entire channel is owned by two adjacent HOA's, the $1.9M reconstruction and maintenance costs are beyond either of the two HOA's budgetary constraints. The Town is concerned that partial failure of this channel will jeopardize nearby homes and public roads. Consequently, the Town will be performing construction management and interim repairs using Stormwater Utility fees. These repairs are believed to be a stop-gap measure and the immediate remediation of the channel bottom is required.

Subsequent to these interim repairs, the Town is requesting funding from the RFCD to reconstruct 3,400 linear feet of channel bottom with reinforced concrete slab on grade. This repair will effectively stop the wash degradation and tie into the existing sideslope protection to ultimately protect adjacent public and private property, including public infrastructure, from damage.

Additionally, upon commitment of funding from the RFCD, the Town will proceed with transfer of ownership of the existing private channel to a Town of Oro Valley asset.

Thank you for your consideration.

Sincerely,

Aimee Ramsey

Aimee Ramsey
Assistant Director

c: Paul Keesler, P.E., Director/Town Engineer – Floodplain Administrator
Michael Todmen, P.E, Stormwater Utility Division Manager
Justin Turner, P.E., Sr. Stormwater Engineer
John Lynch, P.E., Stormwater Project Manager

PROJECT PROPOSAL

Request for Funding

CATALINA RIDGE DRAINAGE CHANNEL RECONSTRUCTION PROJECT

Town of Oro Valley
Stormwater Utility Division Priority 1

The Town of Oro Valley is requesting funding for reconstruction of the channel bottom of a constructed channel of an unnamed watercourse within and owned by the Canada Del Oro Estates and Rivers Edge Homeowners Associations. Funding is sought for fiscal year 2017/2018.

The project channel is located in Section 12, Township 12 South, Range 13 East, Gila and Salt River Meridian. More specifically, the segment of the channelized watercourse proposed for improvement extends from Naranja Drive on the north to Lambert Lane on the south. The channel is generally parallel and west of N. Avenida Vallejo. Refer to Exhibit No. 1.

The existing channel is approximately 3,500 feet in length. The predominant channel width is 15 feet and the channel depth varies from 5 to 6.5 feet. Side slopes are 1H to 1V. The channel has paved slopes of 4-inch, unreinforced, rock-faced grout supported by 1 foot deep cutoff walls. The channel bottom is comprised of a 1+/- foot thickness of riprap having a rock size of 12 inches. The riprap is underlain with a geotextile separation fabric. The channel slope is typically 3+%.

Reconstruction of the channel bottom is due to extensive damage to the riprap. The damage to the riprap channel bottom is due to a combination of local scour and general down-cutting. These mechanisms have already caused an approximately 105 linear foot length of the east bank slope paving to fail. The failed area is approximately 1,000 feet north of Lambert Lane.

Given the extent of erosion and/or down-cutting in large segments of the 3,500 linear feet of channel and the minimal depth of protection afforded by the existing 1-foot deep cutoff walls, other areas of slope paving are in danger of having their base undermined leading to failure due to settlement and/or sliding.

The Town of Oro Valley is committed to providing in-kind project support as follows:

- All tasks necessary to transfer ownership of the existing private channel to the Town of Oro Valley;
- Prepare plans, specifications and opinion of probable construction cost;
- Coordinate with all utility organizations regarding facilities that may be impacted;
- Prepare contract documents, advertise for bid and award;
- Management, inspection and quality assurance during construction of the project;
- Project close out and record drawing preparation.
- Document archival which allows for ease of retrieval should an audit be requested.

The Opinion of Probable Construction Cost (OPCC) for reconstruction of the channel bottom with reinforced concrete is $1,876,205.22, inclusive of a 20% contingency. Refer to Exhibit No.2.

The funds requested by the Town are solely to cover the actual costs of reconstruction of the channel bottom.

1. SOCIAL FACTORS

a. Danger to Public Health and Safety and Public/Private Property:

The erosion and down-cutting damage to the channel bottom creates both a public health and safety concern as well as a danger to public and private property.

Factors exacerbating damage to the riprap bottom and ultimately to the channel slope paving include:

- high velocity flow (i.e., 10 to 16 fps for 100 year event);
- improperly sized riprap and improper thickness of riprap mat (i.e. a one foot thickness of 12" rock placed on a geotextile separation fabric);
- insufficient cutoff wall depth;
- channel down-cutting due to the steep channel gradient (avg 3+%);
- unreinforced and minimal thickness of slope paving particularly when placed on a 1H to 1V slope.

These factors have led to:

- failure of the dumped rip rap bottom protection in numerous areas of the channel; See attached photo(s)
- failure of a 105+/- LF section of the existing, 4 inch, un-reinforced, rock faced channel slope paving along the east bank approximately 1,000 feet north of Lambert Lane. See attached photo(s) [NOTE: The Town of Oro Valley has issued a bid solicitation to reconstruct the failed section of slope paving. Reconstruction is anticipated to commence in mid-October and be completed by mid-December.

While ownership of the existing improved channel is private (i.e., Homeowner Association), the Town has undertaken the expense of reconstructing the failed slope paving due to its concern regarding potential damage to the adjacent public right-of-way, utility infrastructure and public street (Avenida Vallejo).]

b. Jurisdictional priority

This is an extremely high priority issue for the Town as demonstrated by their response to the failure of a portion of the channel slope protection and undertaking the cost of its repair to protect public infrastructure assets.

Additionally, the Town is pursuing options to stabilize the entire 3,500 linear feet of channel from further damage. Given the limited monetary resources from the Stormwater Utility fees paid by Town residents, funding from the Regional Flood Control District is being sought.

Such funding would serve to mitigate the following issues:

- Correct damage currently existing in the riprap channel bottom protection;
- Halt the continuing channel erosion and down-cutting anticipated during future flow events;
- Protect proximate public rights-of-way and easements;
- Protect proximate public and private utilities and;
- Protect proximate private property;

- Ensure expeditious reconstruction by relieving the HOA's of the significant monetary burden required to adequately maintain and/or reconstruct the channel.

c. **Multi-Purpose & Green Belt Opportunities**

While the proposed reconstruction of the channel bottom will not create new multi-purpose and/or green belt opportunities, the project will negate damage to the adjacent public right-of-way (east) and access easement (west) that are used by vehicles, pedestrians and bicycles.

2. ENVIRONMENTAL FACTORS

a. **Preserves and/or Enhances Natural Riparian Environment**

As this is an already stabilized stormwater conveyance channel, its repair and reconstruction will not add to any enhancement or preservation of a natural riparian environment.

b. **Minimizes Impacts to Natural Riparian Environment and Restores Disturbed Areas**

Reconstruction of the project to negate the erosion and down-cutting that is taking place will have the effect of also protecting adjacent public and private property including public and private infrastructure from damage. It also will negate further disturbance to this stabilized stormwater conveyance channel.

c. **Preserves and/or Enhances Wildlife Habitat and Movement Corridors**

While the approximately 3,500 linear feet of channel may serve as a wildlife corridor of sorts, the constructed nature of the channel negates substantial vegetative growth which would serve as cover and enhance the potential for its serving as a habitat and/or corridor for wildlife.

d. **Maintains and/or Enhances Quality of Surface Water and Ground Water and Amount and Quality of Ground Water Recharge**

The channel slope and constructed nature of its bottom protection do not serve as an optimal environment for ground water recharge and/or quality enhancement. The proposed reconstruction of the channel bottom, further negate these options.

3. ECONOMIC FACTORS

a. **Reasonableness of Total Costs Relative to Benefits**

The opinion of probable construction cost for reconstruction of the channel bottom is $1.876M, inclusive of contingency. Refer to Exhibit No. 2.

Paving the channel bottom (refer to Exhibits No. 3A, B & C) with concrete will negate its further degradation due to scour and/or down-cutting.

A *do nothing* option will allow scour and/or down-cutting to continue, unabated, to the detriment of the remaining riprap bottom. Scour and/or down-cutting will eventually expose and undermine the minimal, 1-foot deep cutoff walls of the slope paving. Once undermined, support for the 1H to 1V, 4 inch, un-reinforced, rock faced grout slope protection will be compromised, resulting in significant probability of failure.

d. **Estimated Total Annual O&M Cost (with and without Project)**

Annual O&M Without the Project: As noted above, the existing channel, excepting the portion to be repaired by the Town this year, requires the following maintenance:

- removal of significant areas of vegetation from the channel bottom;
- grading and repair of a sizable area of scour and headcut damage;
- potentially, as much as 3,000 cubic yards of riprap (D_{50} = 21 inches);
- replacement of significant areas of damaged geotextile fabric.

The value of these immediate channel O & M costs is estimated at almost a quarter of a million dollars.

While the above repairs would stabilize the channel in the short run, the channel bottom would still be subject to continuing degradation due to erosion and down-cutting, although at a potentially reduced rate.

Ongoing annual O&M costs could easily average $10K to $50+K per year, depending on the frequency, volume and duration of flow in the channel.

The magnitude of the initial as well as the ongoing O & M cost would be a very significant financial undertaking for the Canada Del Oro Estates and Rivers Edge HOA's given the number of lots comprising each HOA.

Annual O&M With the Project: As noted previously, the proposed channel bottom paving would negate the need to expend significant monies on O & M once constructed.

Future maintenance costs would be limited to minor sediment removal, if any, as the 3% average channel slope would serve to make the channel mostly self-cleaning. It is estimated that annual O & M costs would average less than $1,500 per year for the 50 year design life of the channel.

e. **Reduces Legal Liability**

As addressed earlier, failure of the existing slope protection has the potential of placing significant public and private infrastructure assets at risk. Damage or destruction of public and/or private infrastructure could, potentially, create a liability for the HOAs as well as the Town.

Failure of the channel slope protection and its implications regarding the public's health and safety or personal property has the potential for creating a litigious environment for compensation due to damages, either perceived or actual, incurred by the public, including injury or loss of life.

4. TECHNICAL FACTORS

a. Reduces Frequency and severity of Flooding, Erosion and Sedimentation

As noted previously, the volume of flow conveyed in the existing channel, together with a channel slope of 3+% creates highly erosive flow velocities as well as significant down-cutting of the channel bed in trying to achieve its equilibrium slope.

The use of reinforced concrete to armor the channel bottom will negate the scour erosion and down-cutting that are undermining the stability of the existing slope protection.

As this channel is tributary to the Canada del Oro Wash (CDO), its sediment load is ultimately deposited directly into the CDO.

b. Promotes Long Term Watershed and Channel Stability

As discussed in previous areas of this narrative, the reconstruction of the existing channel bottom using reinforced concrete will stabilize the channel for the expected 50 year life of these improvements.

c. Technical Feasibility of Implementation

The improvements to reconstruct the existing riprap channel bottom with reinforced concrete is a very typical form of construction. Construction would not require special skill, equipment or materials. The project would be publicly advertised and bid. It is expected that the project would elicit 5 to 8 bids with bid prices being very competitive.

d. Regional Impacts

The channel conveying this unnamed wash is a direct tributary of the Canada del Oro Wash. Thus, any sediment load carried by the channel is directly deposited into the CDO. As the channel currently exists, riprap protection of appreciable areas of the channel bottom have been disturbed, damaged or destroyed. This leaves the native sandy/silty channel subgrade material, which is highly erosive, to be scoured, conveyed and deposited into the CDO. The improvements to replace the existing, damaged riprap bottom with reinforced concrete will negate the 3,500 linear feet of channel comprising the project from being a source of sediment deposition into the CDO.

e. Creates Links to Existing Flood Control Facilities

As noted above, the channel conveying this unnamed wash is a direct tributary of the Canada del Oro Wash. In fact, the termini of this project is approximately 1,500 feet north of its confluence with the CDO.

5. Other

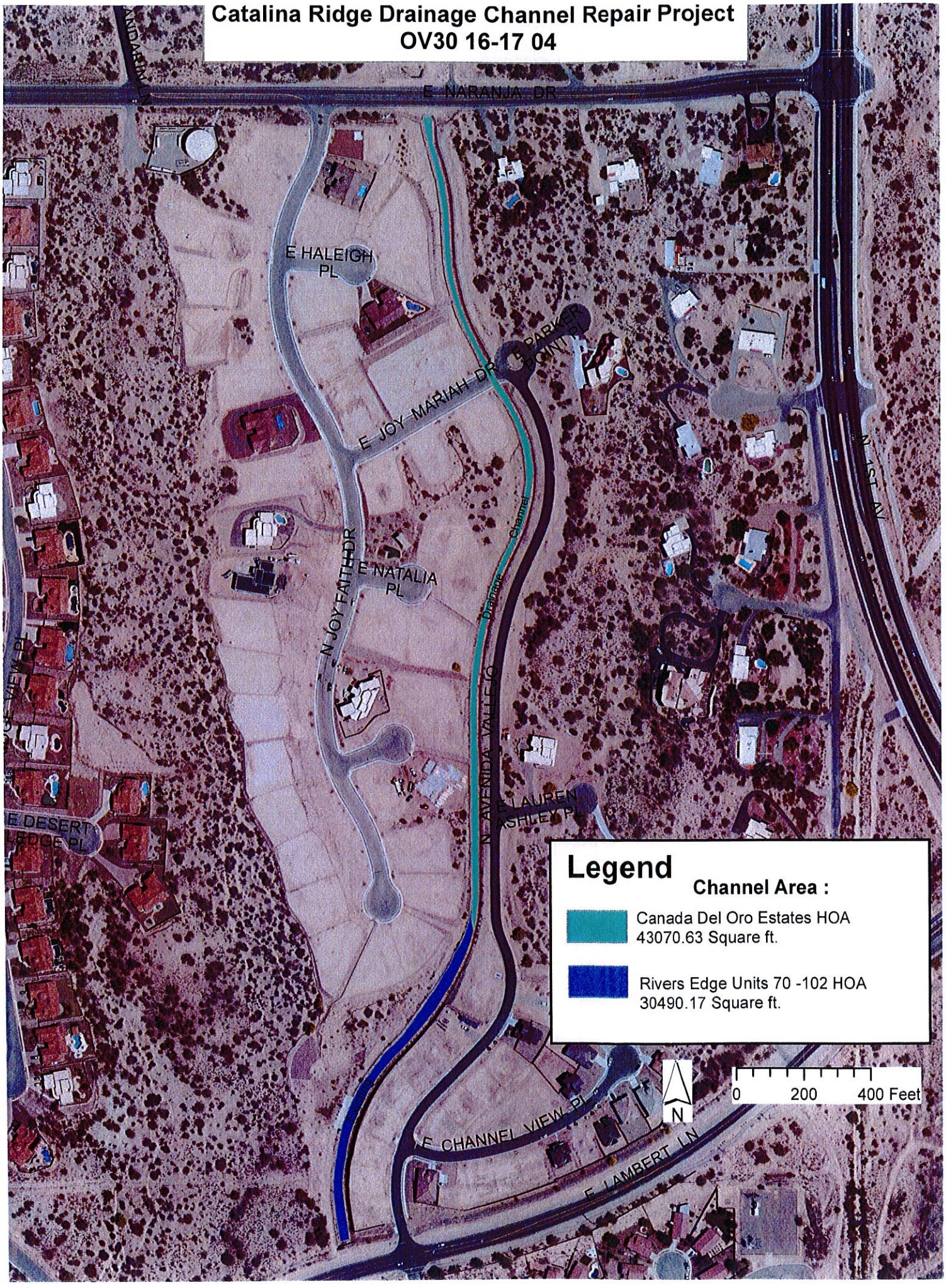
N/A

PIMA COUNTRY FLOOD CONTROL DISTRICT - CIP RATING FORM

Oro Valley - PROJECT NAME_____Catalina Ridge_____DATE___9/2/16_____

CRITERIA	MIN/MAX SCORE	ACTUAL SCORE
1) SOCIAL FACTORS (category subtotal = 23)		
a. Reduces Danger to Human Life, Public Health and Safety and Public and Private Property	0-10	10
b. Jurisdictional Priority	0-6	6
c. Increases or Created multi-Purpose Use and Green-Belt Opportunities	0-4	4
d. Improves Pedestrian and Vehicular Mobility	0-3	3
Subtotal:	**0-23**	**23**
2) ENVIRONMENTAL FACTORS (category subtotal = 23)		
a. Preserves and/or Enhances Natural Riparian Environment	0-7	7
b. Minimizes Impacts to Natural Riparian Environment and Restores Disturbed Areas	0-6	6
c. Preserves and/or Enhances Wildlife Habitat and Movement Corridors	0-5	5
d. Maintains and/or Enhances the Quality of Surface Water and Ground Water and the Amount and Quality of Ground Water Recharge	0-5	5
Subtotal:	**0-23**	**23**
3) ECONOMIC FACTORS (category subtotal = 23)		
a. Reasonableness of Total Costs, Relative to Benefits	0-7	7
b. Long-Term Benefits	0-5	5
c. Estimated Total Construction Cost (Includes Mitigation Cost)	0-4	4
d. Estimated Total Operation and Maintenance Cost	0-4	4
e. Reduces Legal Liability	0-3	3
Subtotal:	**0-23**	**23**
4) TECHNICAL FACTORS (category subtotal = 23)		
a. Reduces the Frequency and Severity of Flooding, Erosion and Sedimentation	0-6	6
b. Promotes Long-Term Watershed and Channel Stability	0-5	5
c. Technical Feasibility of Implementation	0-5	5
d. Regional Impacts	0-4	4
e. Creates Links to Existing Flood-Control Facilities	0-3	3
Subtotal:	**0-23**	**23**
5) OTHER (category subtotal = 8)		
Storm Damaged/on-going channel Degradation	0-8	8
TOTAL :		**100**

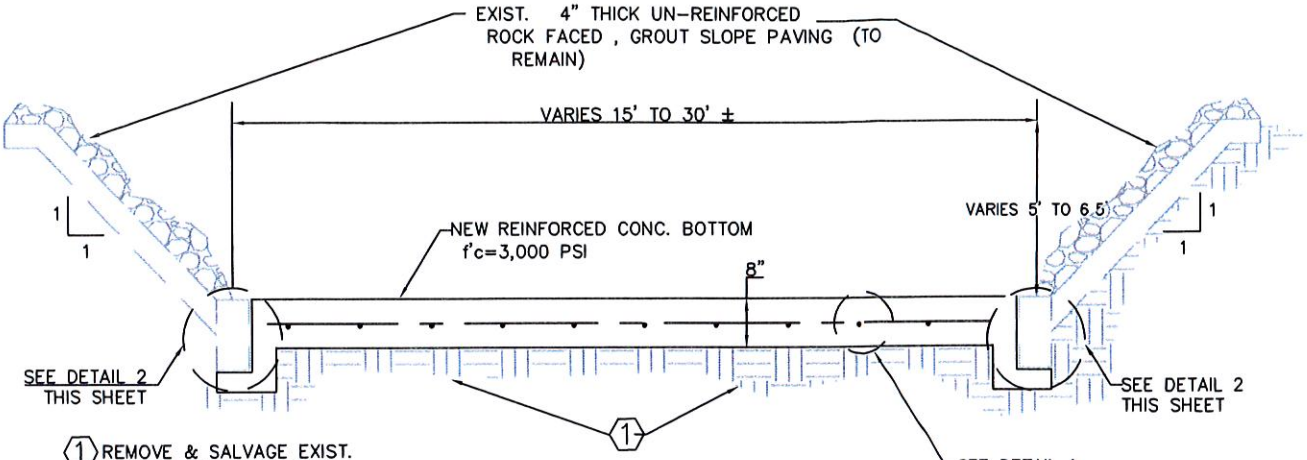
Catalina Ridge Drainage Channel Repair Project
OV30 16-17 04



CATALINA RIDGE

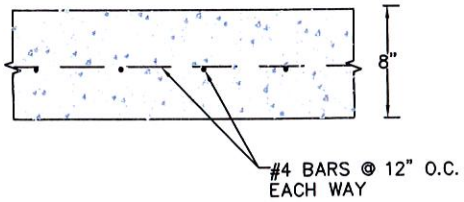
PROPOSED DRAINAGE CHANNEL REPAIR

STORMWATER UTILITY

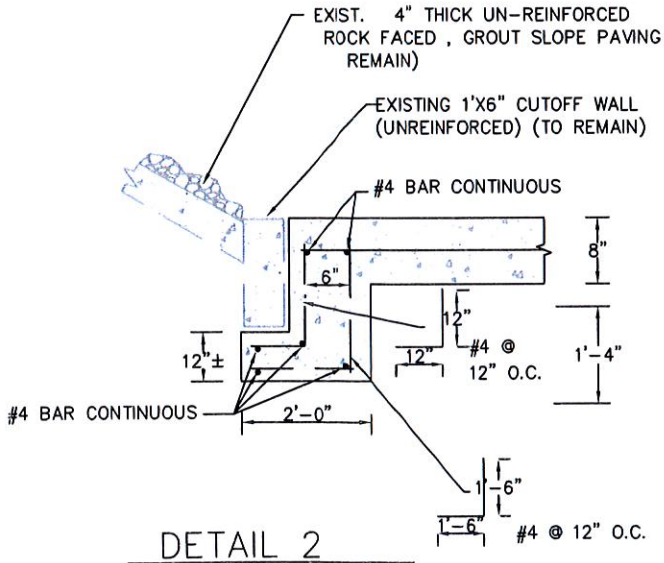


(1) REMOVE & SALVAGE EXIST. RIP-RAP FROM CHANNEL BOTTOM
REMOVE AND DISPOSE OF EXIST. GEOTEXTILE
REPLACE ERODED PORTIONS OF CHANNEL BOTTOM WITH STRUCTURE BACKFILL CONFORMING TO SUBSECTION 203-5.02(A) EXCAVATE, GRADE AND COMPACT TO 95% OF ASTM D698

CHANNEL BOTTOM PAVING (TYP)
NTS



DETAIL 1
NTS



DETAIL 2
NTS

0

SCALE: N.T.S.

SHEET 1 of 3

Designed By:	JBL	DWG Date:	08/31/16	Approved By:	JBL	
Drawn By:	BDR	Revision Date:		Revision Number:	0	
DWG Name:	CATRIDREP.DWG					

ARIZONA 811

ORO VALLEY ARIZONA FOUNDED 1974

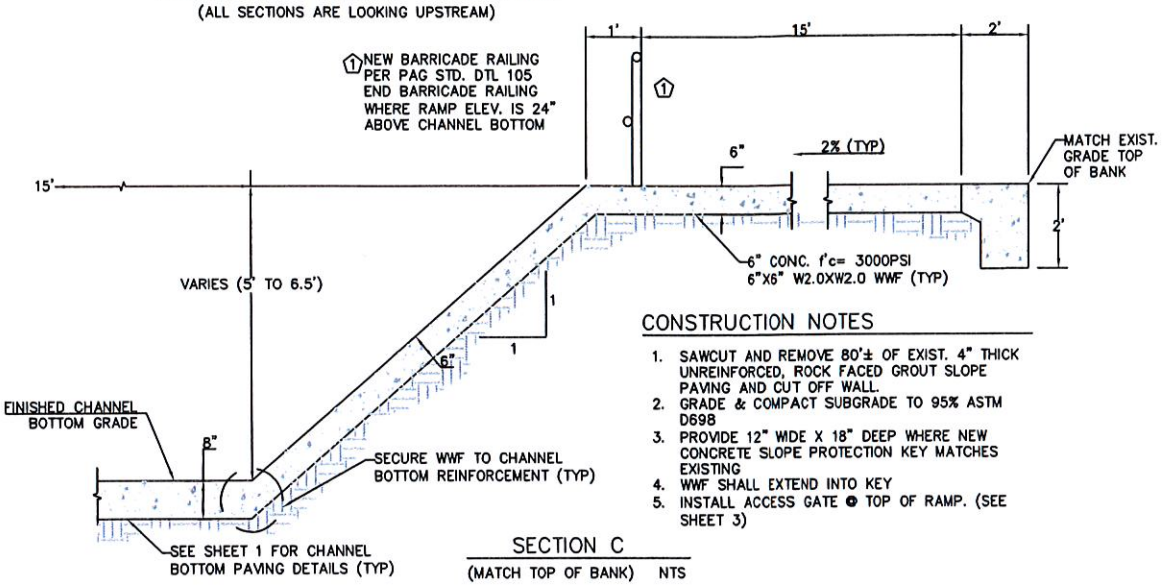
CATALINA RIDGE

PROPOSED DRAINAGE CHANNEL REPAIR

STORMWATER UTILITY

MAINTENANCE ACCESS RAMP (TYP)

(ALL SECTIONS ARE LOOKING UPSTREAM)

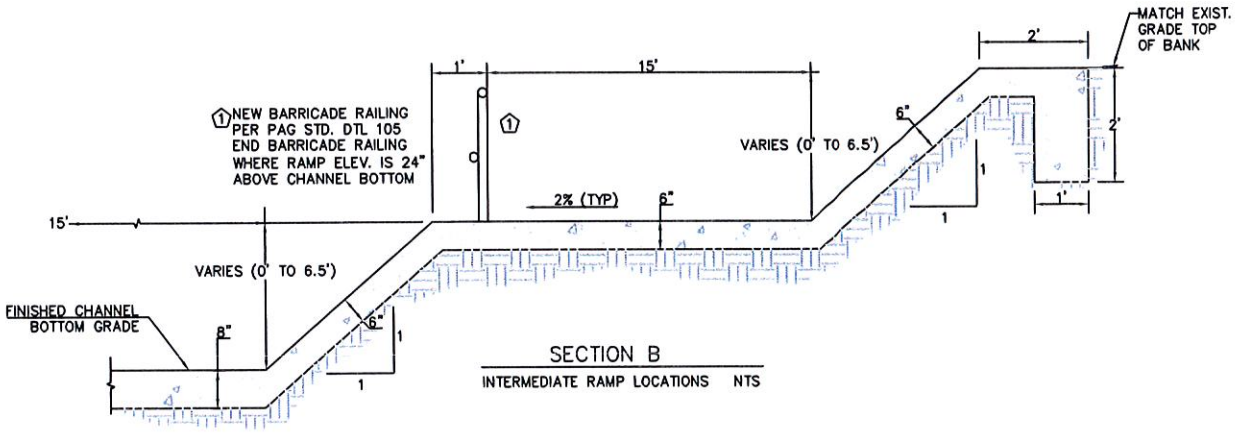


CONSTRUCTION NOTES

1. SAWCUT AND REMOVE 80'± OF EXIST. 4" THICK UNREINFORCED, ROCK FACED GROUT SLOPE PAVING AND CUT OFF WALL.
2. GRADE & COMPACT SUBGRADE TO 95% ASTM D698
3. PROVIDE 12" WIDE X 18" DEEP WHERE NEW CONCRETE SLOPE PROTECTION KEY MATCHES EXISTING
4. WWF SHALL EXTEND INTO KEY
5. INSTALL ACCESS GATE ⓔ TOP OF RAMP. (SEE SHEET 3)

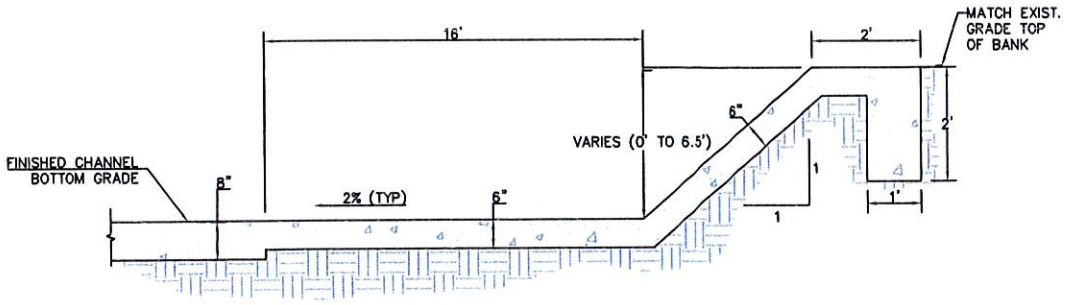
SECTION C

(MATCH TOP OF BANK) NTS



SECTION B

INTERMEDIATE RAMP LOCATIONS NTS



SECTION A

(MATCH CHANNEL BOTTOM) NTS

0

SCALE: N.T.S.

SHEET 2 of 3

Designed By:	JBL	DWG Date:	08/31/16	Approved By:	JBL	
Drawn By:	BDR	Revision Date:	09/07/16	Revision Number:	1	
DWG Name:	PROPOSED_CATRIDREP.DWG					

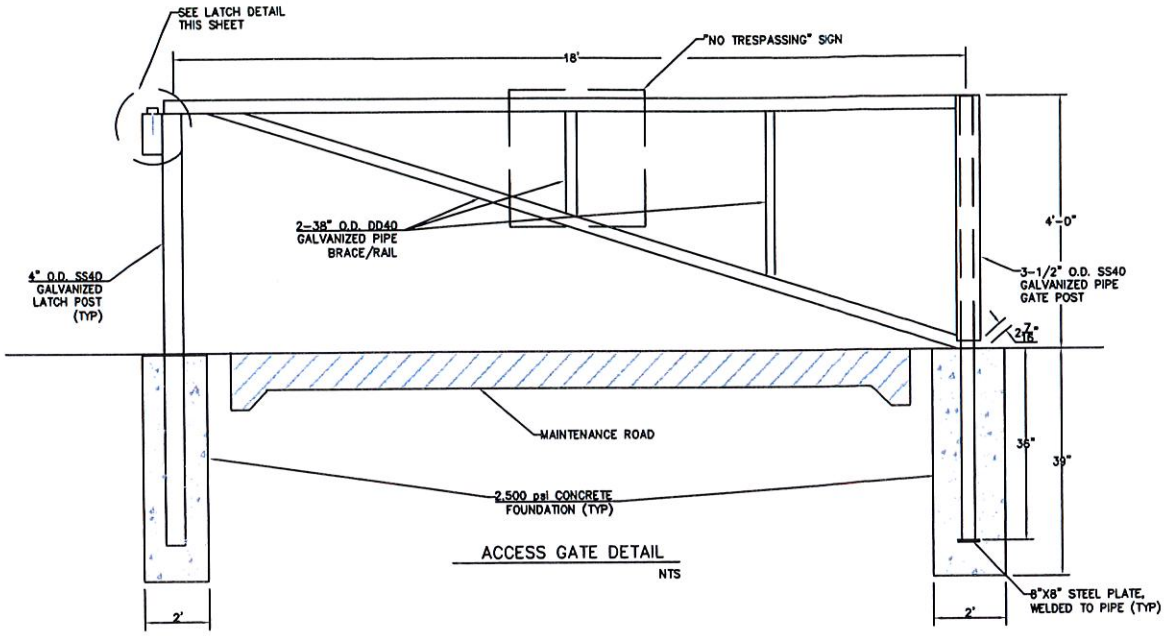
ARIZONA811 BLUE STAKE, INC.

ORO VALLEY ARIZONA FOUNDED 1974

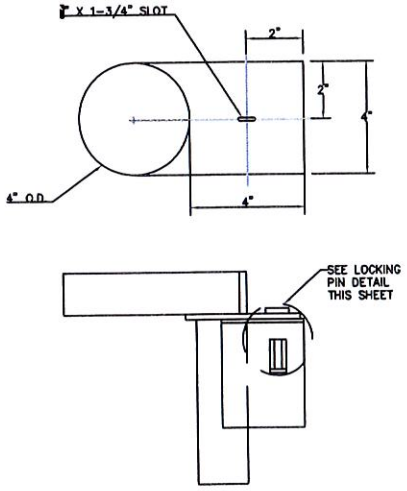
CATALINA RIDGE

PROPOSED DRAINAGE CHANNEL REPAIR

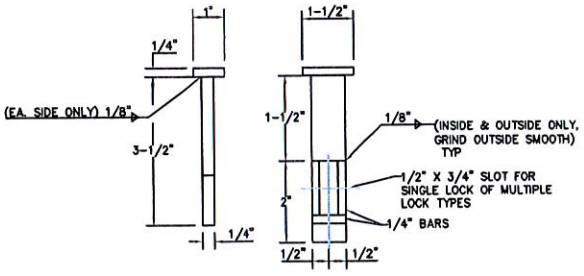
STORMWATER UTILITY



ACCESS GATE DETAIL
NTS



LATCH DETAILS
NTS



LOCKING PIN DETAIL
NTS

0

SCALE: N.T.S.

SHEET 3 of 3

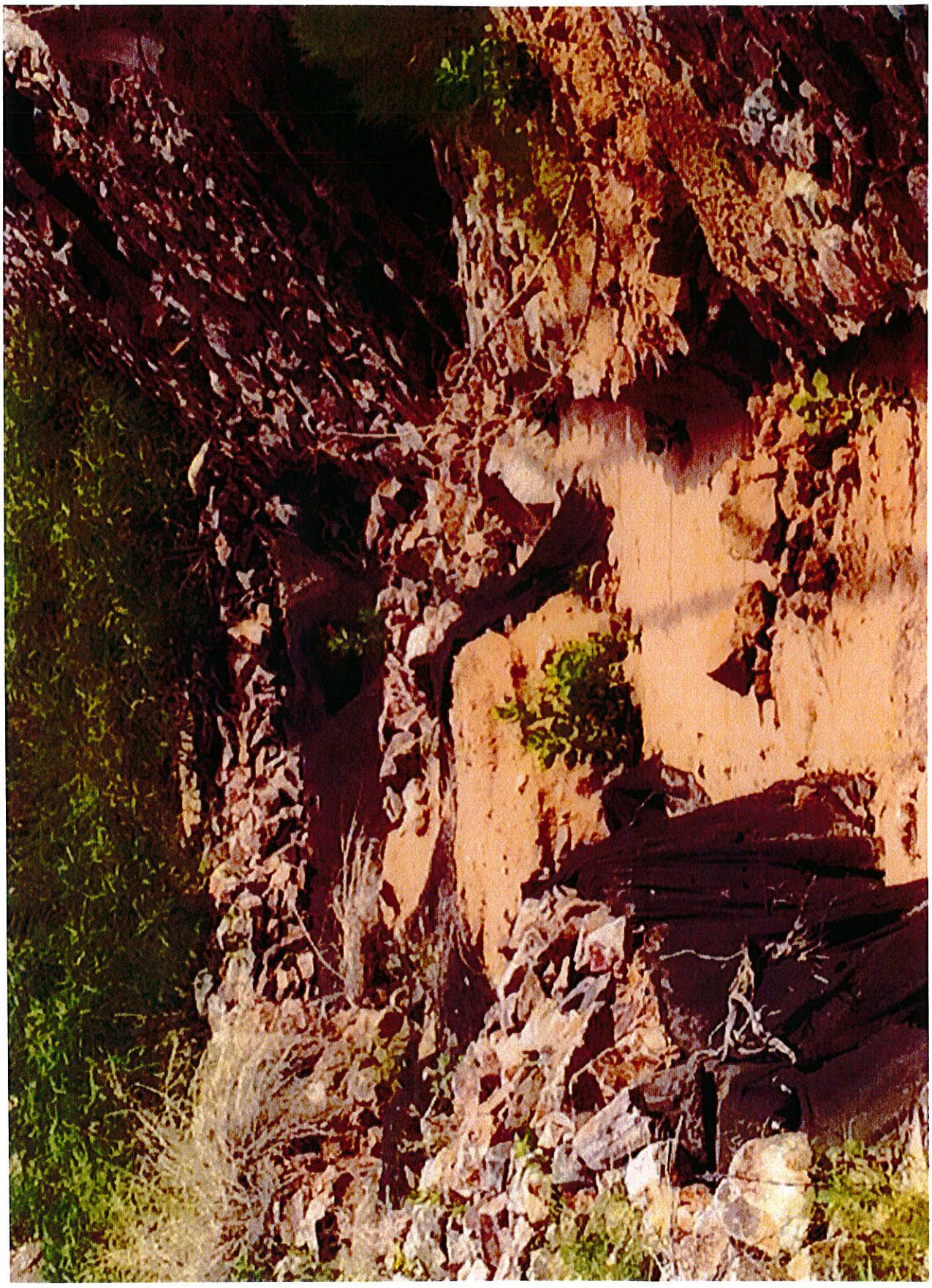
Designed By:	JBL	DWG Date:	08/31/16	Approved By:	JBL	
Drawn By:	BDR	Revision Date:		Revision Number:	0	
DWG Name:	CATRIDREP.DWG					

ARIZONA 811 BLUE STAKE, INC.

ORO VALLEY ARIZONA FOUNDED 1974

CATALINA RIDGE
PROPOSED CHANNEL REPAIR PROJECT
NARANJA ROAD TO LAMBERT LANE
ENGINEERS OPINION OF PROBABLE CONSTRUCTION COST (9/1/16)

				BASE BID	
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
202.1	SAWCUT, REMOVE & REPLACE EXTRUDED CONCRETE CURB	20	LF	$ 10.00	$ 200.00
202.2	REMOVE, SALVAGE & REPLACE BARRICADE RAILING (Std Dtl 105)	500	LF	$ 8.00	$ 4,000.00
202.3	REMOVE, SALVAGE & HAUL (TO NARANJA TOWN SITE) CHANNEL BOTTOM RIP RAP	73,561	SF	$ 3.00	$ 220,683.00
202.4	REMOVE 4' (Unreinforced, Rock-Faced Grout) SLOPE PROTECTION at RAMP LOCATIONS	1	LS	$ 32,000.00	$ 32,000.00
203.1	DRAINAGE EXCAVATION & GRADING FOR NEW CONCRETE CHANNEL BOTTOM (Incld Toe Support Key)	73,561	SF	$ 1.25	$ 91,951.25
203.2	GRADE & COMPACT SUBGRADE FOR NEW MAINTENANCE RAMP	8,000	SF	$ 1.95	$ 15,600.00
601.1	STRUCTURAL CONCRETE (8" Channel Bottom, Incld. Toe Support Key & Reinforcing Steel) COMPLETE IN PLACE	73,561	SF	$ 13.00	$ 956,293.00
601.2	STRUCTURAL CONCRETE (6" Slope Paving & Maint Ramp, incld Key & WWF Reinforcing) COMPLETE IN PLACE	8,000	SF	$ 11.00	$ 88,000.00
701	MAINTENANCE OF TRAFFIC	1	LS	$ 25,000.00	$ 25,000.00
810	EROSION CONTROL AND POLLUTION PREVENTION	1	LS	$ 7,500.00	$ 7,500.00
901	MOBILIZATION	1	LS	$ 15,000.00	$ 15,000.00
902	TEMPORARY FENCE	1,000	LF	$ 10.00	$ 10,000.00
912.3	STAIN CONCRETE PAVING (Natina Products or Approved Equal)	81,561	SF	$ 1.10	$ 89,717.10
933	BARRICADE RAILING (at Ramps)	320	LF	$ 13.00	$ 4,160.00
935	RAMP ACCESS GATE	4	EA	$ 850.00	$ 3,400.00
				SUBTOTAL	**$ 1,563,504.35**
				CONTINGENCY (20% OF SUBTOTAL)	**$ 312,700.87**
				TOTAL	**$ 1,876,205.22**



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RECREATION

Town of Marana

Proposal for Bank Protection at El Rio Riparian Preserve

Presented to Pima County Regional Flood Control District

November 2, 2016

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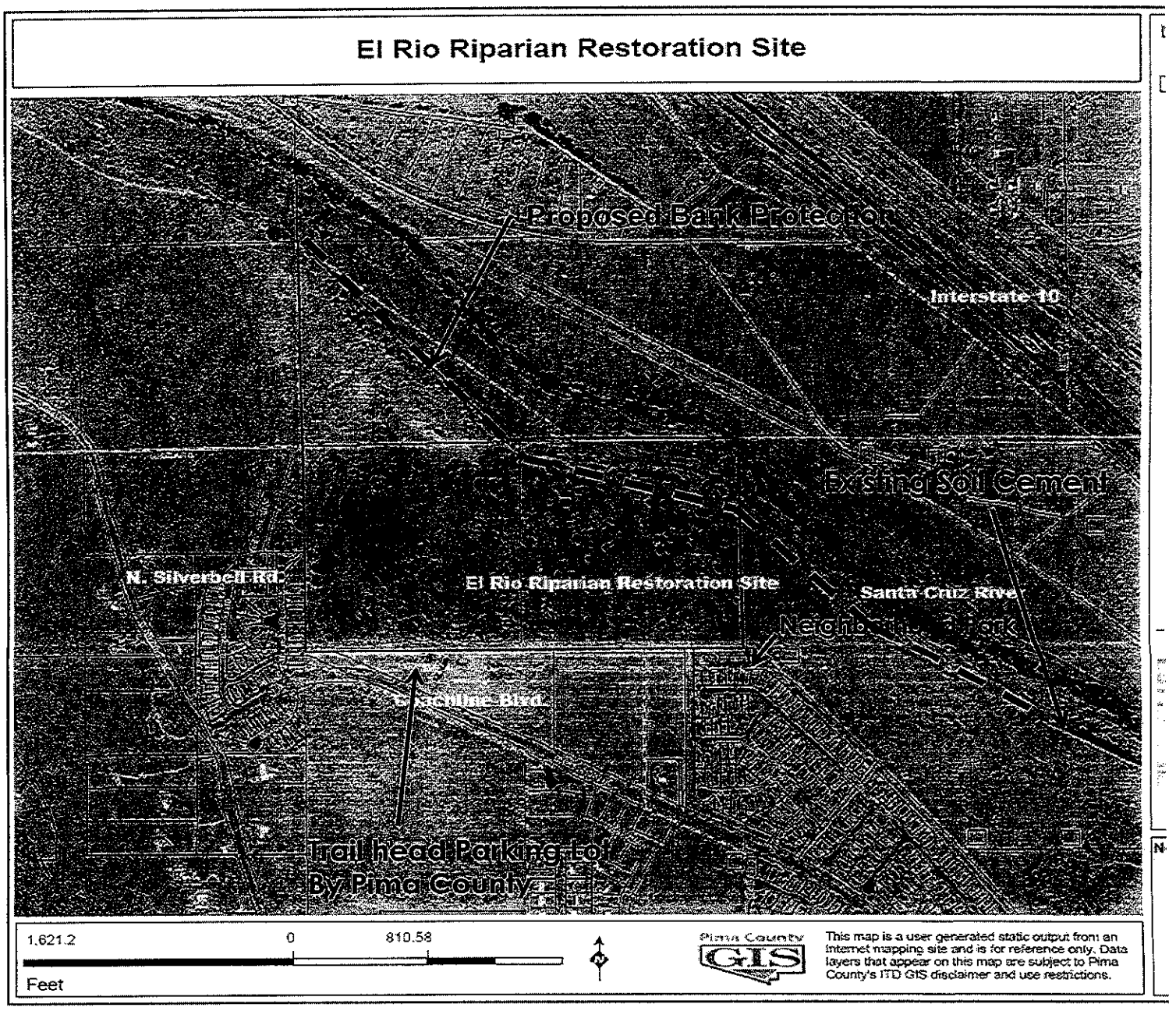

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Background

- Site is approximately 104 acres
- Originally an ADOT borrow pit used when building I-10
- Town bought the site in 2003
- Flood event in 2014 breached the non-engineered berm
- Town temporarily fixed breached part of the berm in 2014
- Reinforcing the berm with bank protection is a Town priority

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Problems/Concerns

- West bank continuously eroding adjacent to Sonoran Vista Subdivision
- Flooding dangerous next to kid's playground
- Standing water remains for months creating mosquito breeding site
- Increased turbidity, refuse and odor in outflow to Santa Cruz
- Trash and invasive plant seeds wash in
- Costly/difficult to clean up after floods
- Marana police are called periodically related to illegal hunting and off-road vehicles

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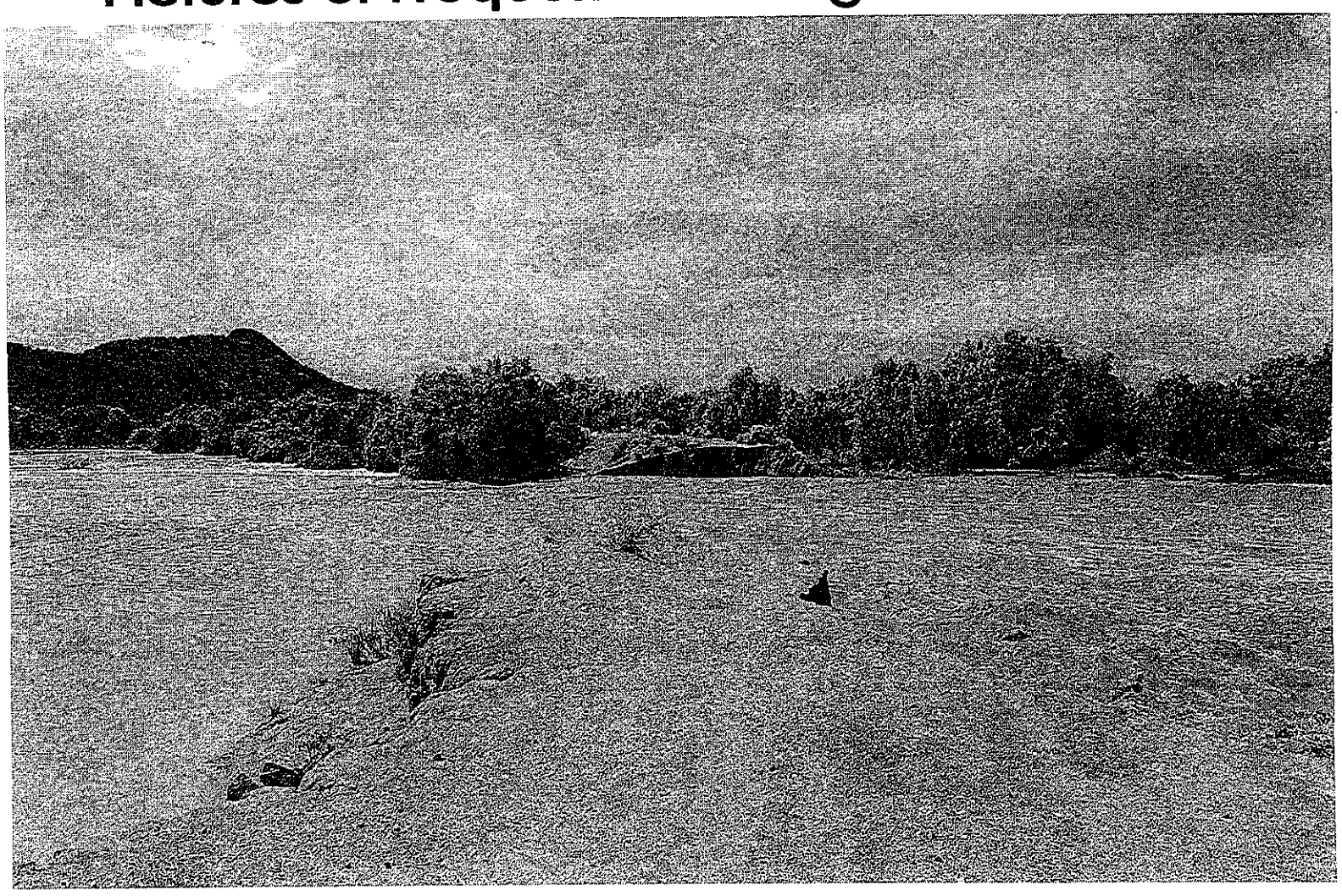
Pictures of Frequent Flooding of the Site



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August 9, 2016

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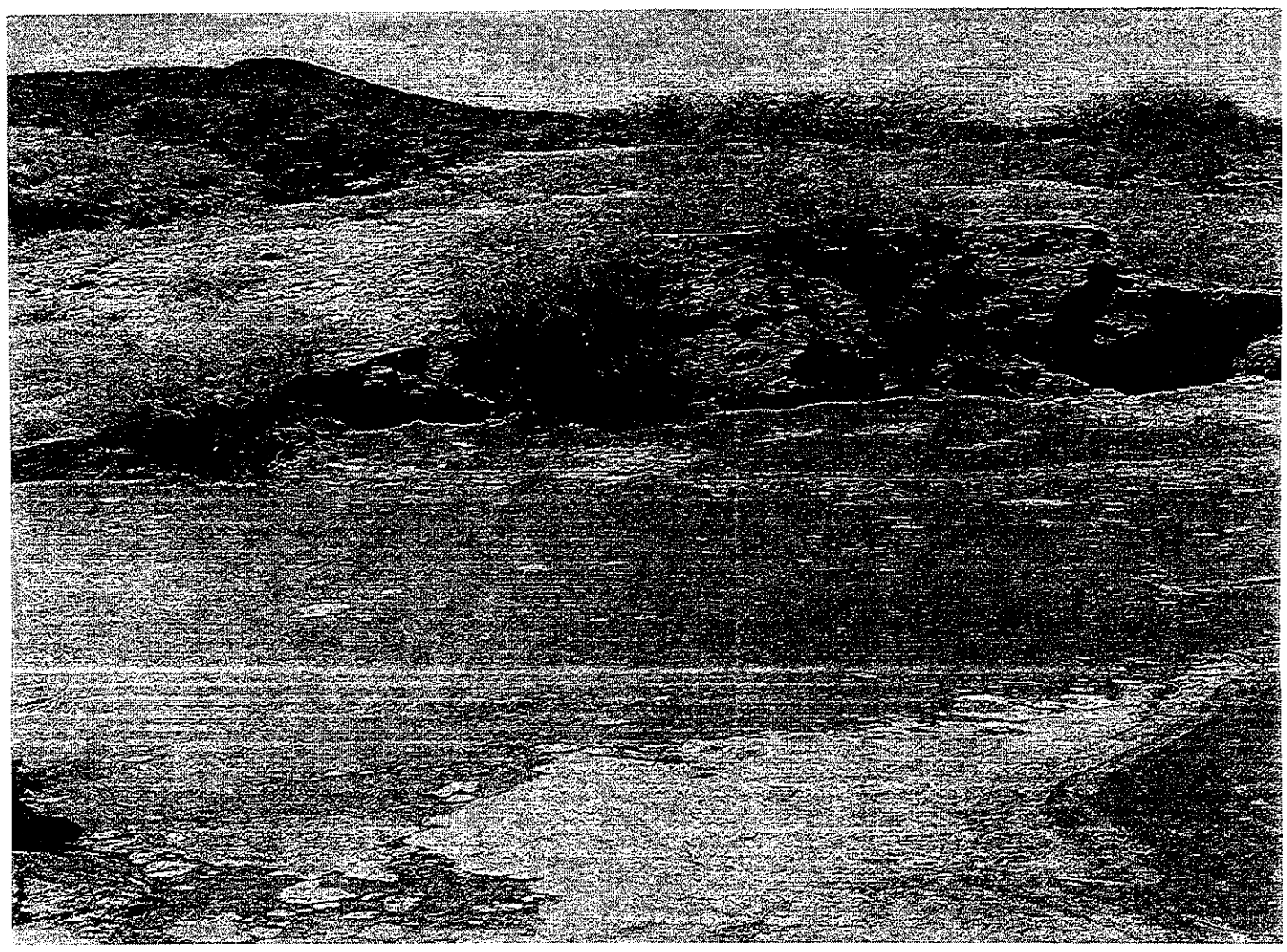

Post-flooding

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Post-flooding

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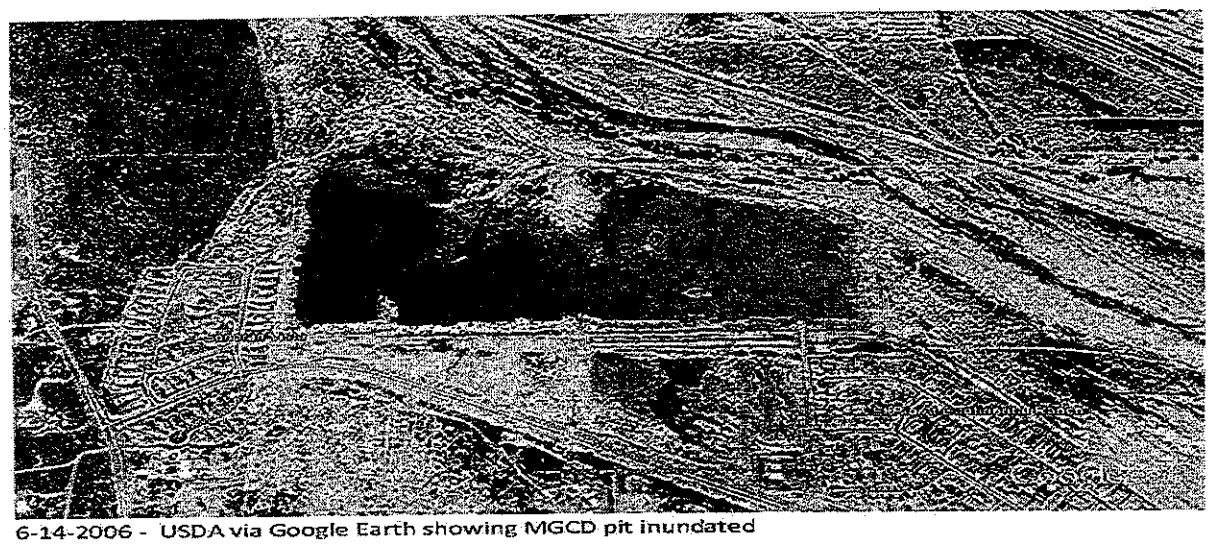
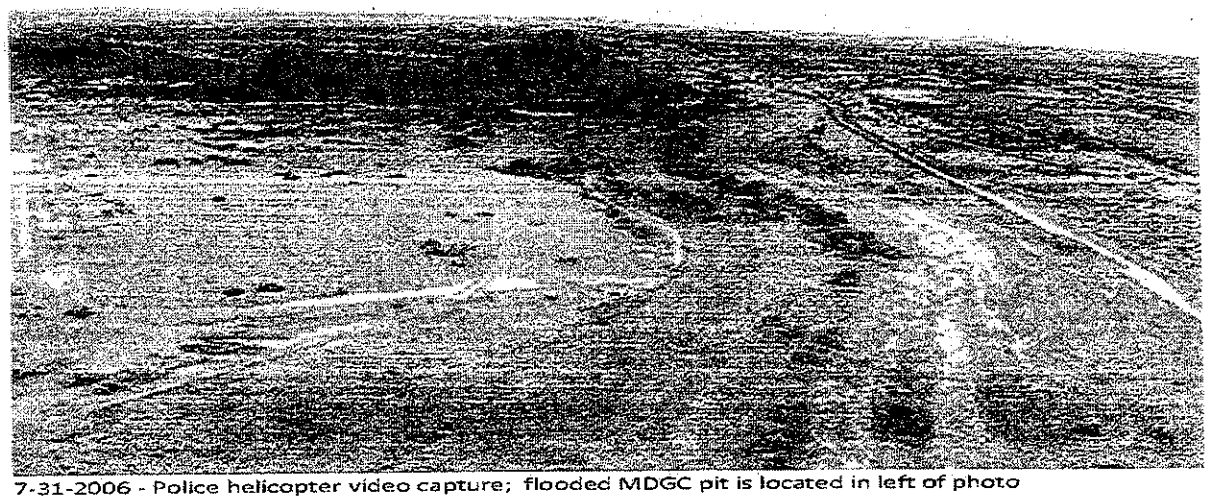


6-14-2006 - USDA via Google Earth showing MGCD pit inundated



7-31-2006 - Police helicopter video capture; flooded MDGC pit is located in left of photo

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.

Qualitative Ponding and Flooding Assessment 2015

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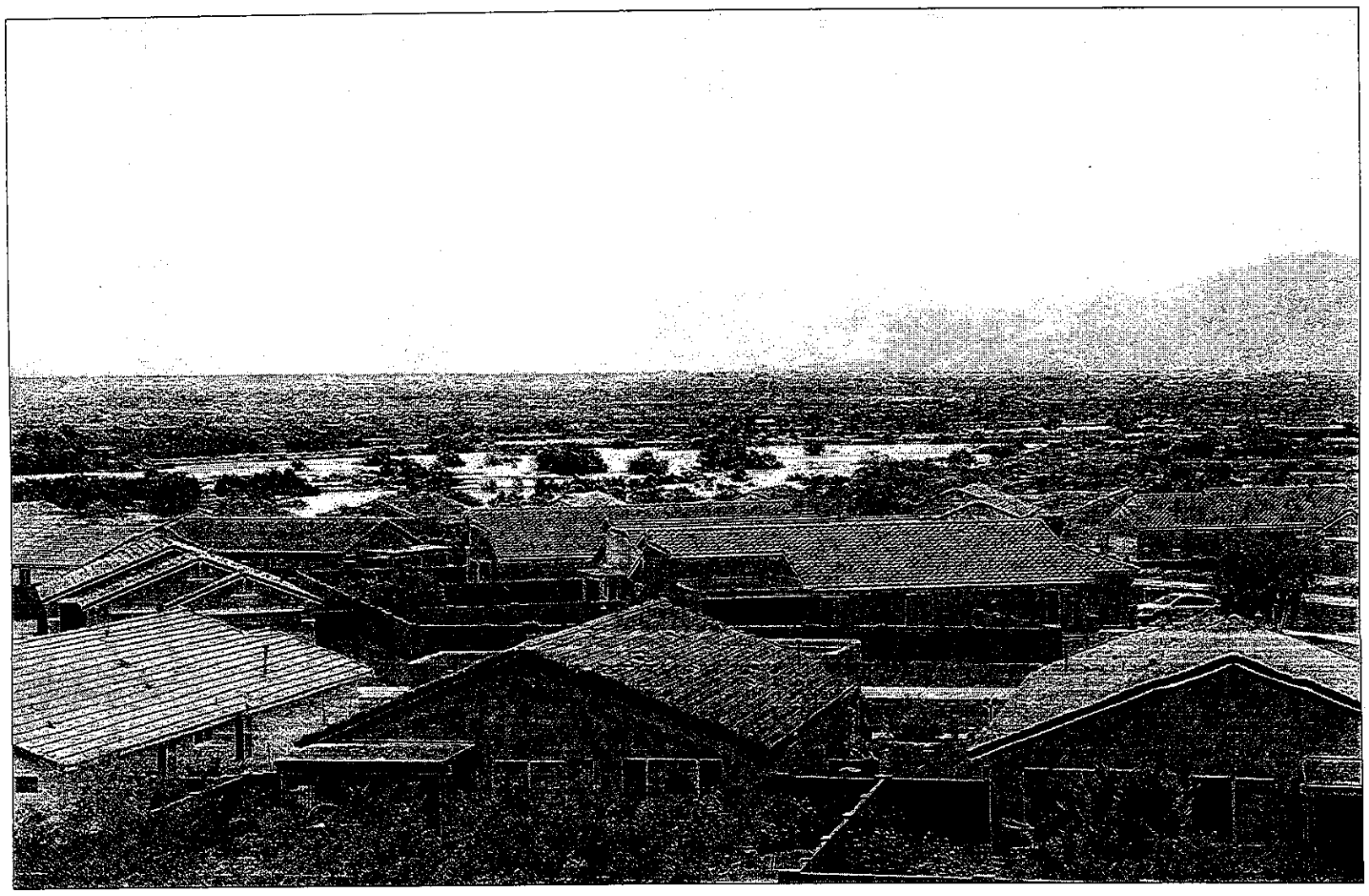

2006 Flood

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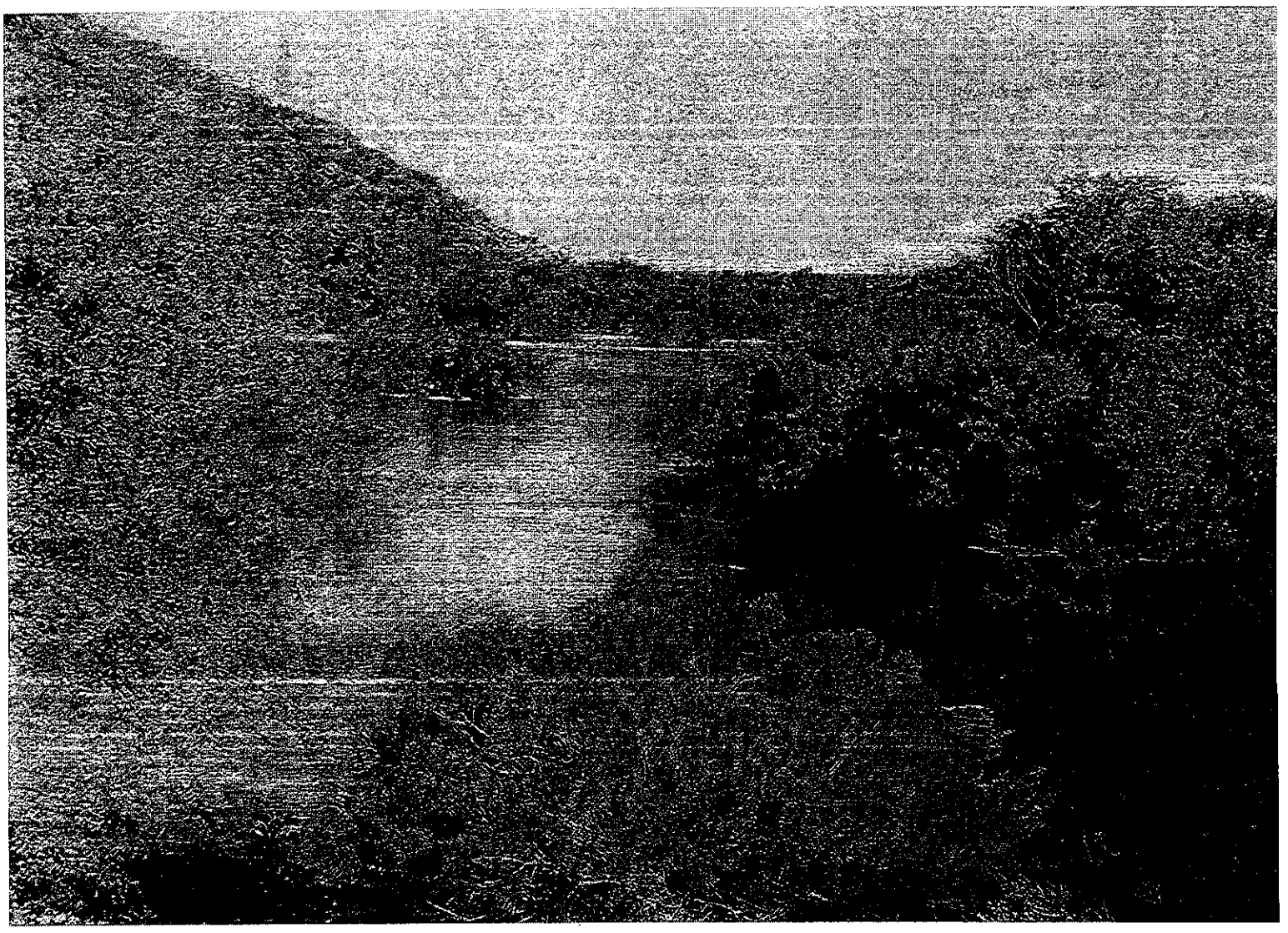

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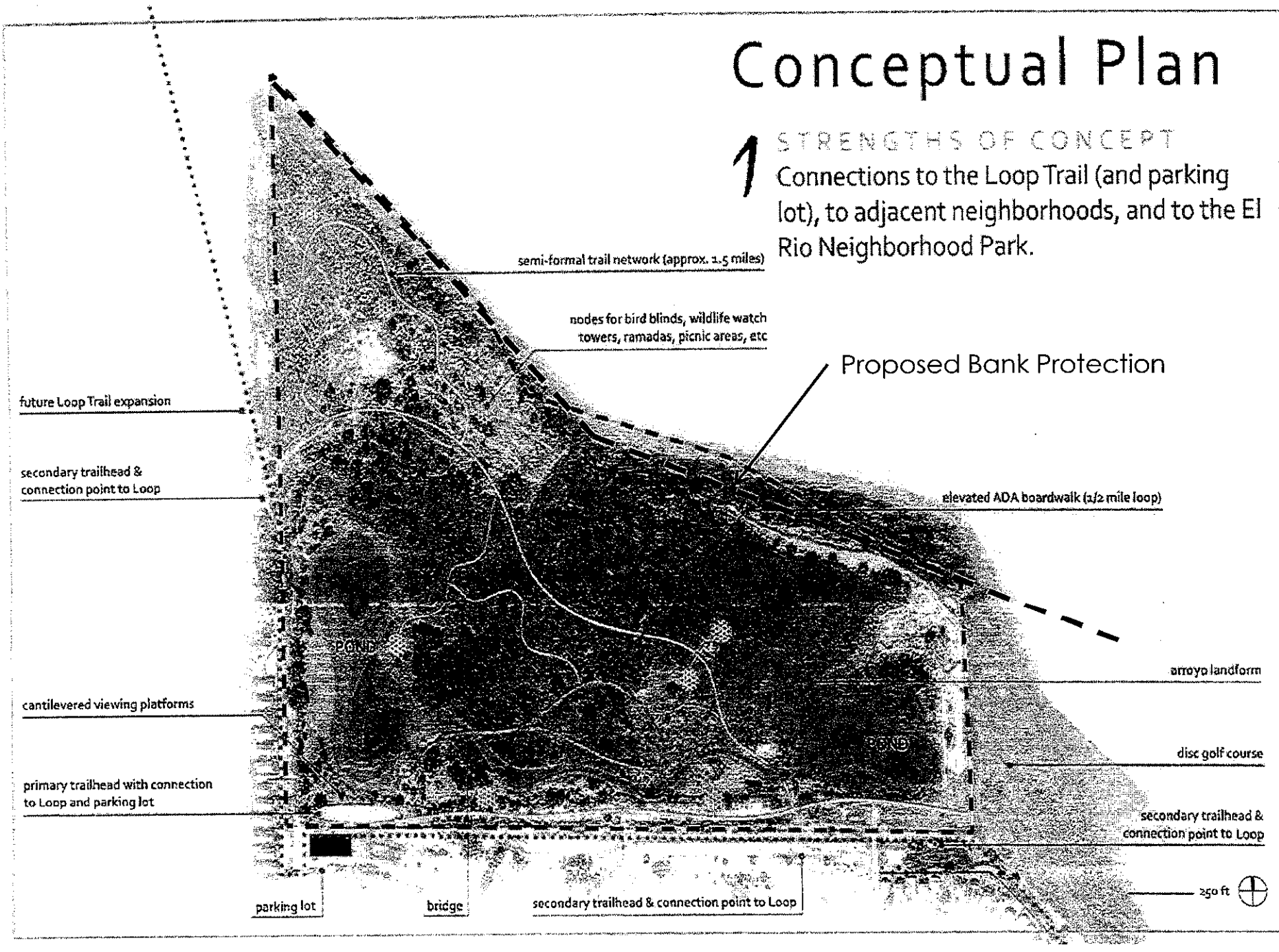
October 6, 2016

Conceptual Plan

1 STRENGTHS OF CONCEPT

Connections to the Loop Trail (and parking lot), to adjacent neighborhoods, and to the El Rio Neighborhood Park.



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Unique Characteristics of Site

- El Rio preserve is included in the book 'Finding Birds in Southeast Arizona, 8th edition, Ken Kauffman, ed. (2015) and 236 bird species have been recorded here
- The Loop Trail is being extended this fall around El Rio and Pima County built a Loop Trailhead parking lot at the SW corner
- El Rio is regionally recognized as part of an important wildlife linkage between the Tucson Mts., Santa Cruz, and Tortolita Mts.
- This project will add a link in the chain of preserved riparian habitat along the river.

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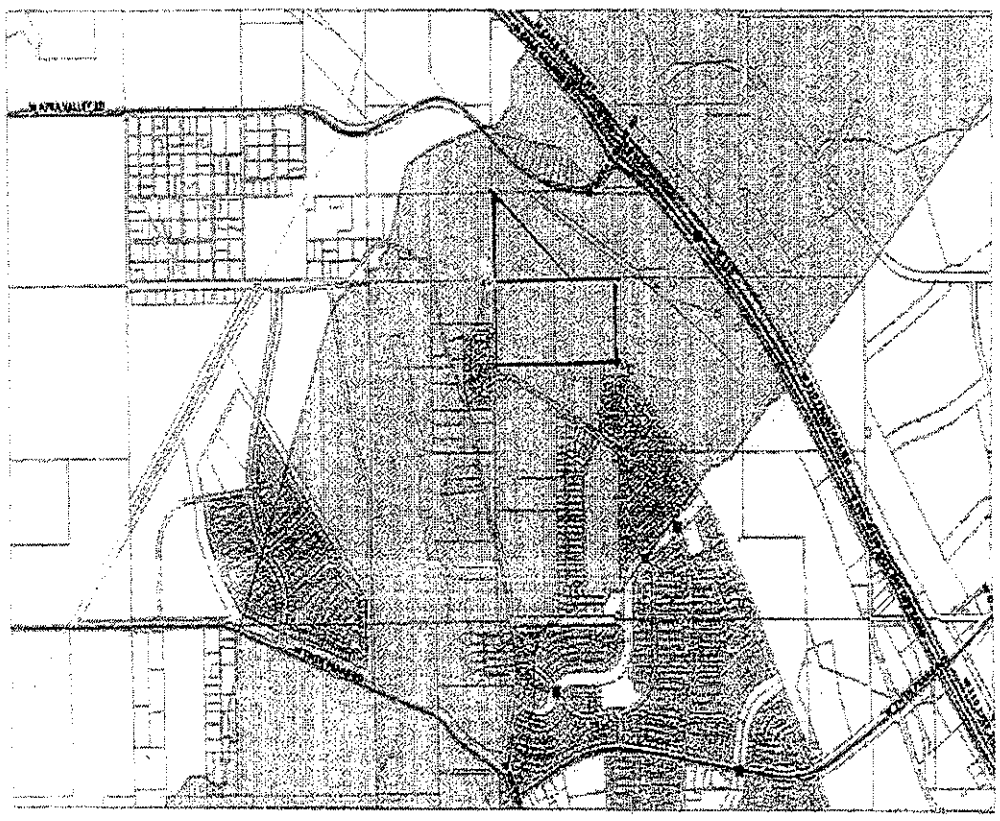
Wildlife Linkage AZGFD/NAU

Wildlife Movement Features
- CRITICAL LANDSCAPE CONNECTIONS
- CULVERT
- NATURAL OPEN SPACE (NOS)
- NOS REVEGETATION
- REVEGETATION
- UNDERPASS

Streets
- Streets - All
- Streets - Unknown
- Streets - Major - With Names

Parcels
- Parcels

Wildlife Linkages
- Wildlife Linkages - 2007-2008 AGFD/NAU



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What the Town has Done So Far:

- Council designated El Rio as a Preserve under Parks and Recreation Dept. 2015
- Hired a University of AZ Landscape Architecture grad. student to create a concept plan
- Held two Task Force meetings and a neighborhood meeting
- Cleaned up trash after 2014 flood
- Allocated over $400,000 for restoration
- Contracted for cultural survey and PJD
- Awarded a WIFA Grant for $35,000

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Why bank protection?

- To prevent the site from frequent flooding so the area can be developed as riparian habitat and to achieve other regional and community goals as envisioned by Town of Marana.
- Impossible to achieve any goals described in this presentation.

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Bank Protection and Riparian Restoration's Benefit:

- Prevent effluent and other frequent storm event flow from entering into El Rio Preserve and maintain the flow further downstream along the main channel of Santa Cruz.
- Proposed bank protection will tie into existing bank protection upstream of the site.
- Decrease flooding and related concerns next to subdivision and El Rio Children's playground
- Enhance wildlife linkage by planting natives, building pond, removing invasive plants
- Create an amenity for the neighborhood and for users of the extended Loop Trail
- Develop the site for environmental education

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El Rio Riparian Restoration Project With a Reinforced Berm Ties into Regional Goals:

- Enhance this portion of the regionally significant Tortolita-Tucson Mt. Wildlife linkage
- Create an amenity along the new section of the Loop Trail
- Maintain consistency with Pima County's SDCP and Floodplain Management Ordinance
- Initiate a project consistent with goals of Tres Rios del Norte Plan
- Support letter from TAS, SDCP, AZGFD

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Conclusion:

If Town of Marana receives support in designing and constructing a berm with bank protection, the town will be able to develop and maintain an important natural area where wild life connectivity and habitat will be maintained and people can enjoy nature.

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City of Tucson Drainage Projects Flood Control District Board Proposal November 2016

CITY OF TUCSON

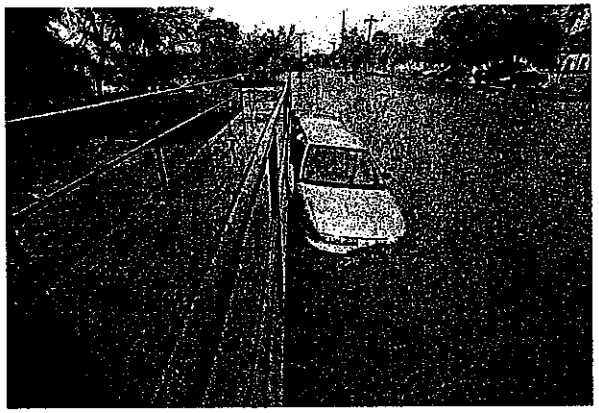
City of Tucson, Department of Transportation
Proposed Drainage/Flood Control Projects

City of Tucson Drainage

Drainage within urban areas is quite different and cannot be compared to rural floodplain management and conveyance planning. Washes or "drainage corridors" follow the historical flow direction, but properties have encroached into the flood conveyance area through the years.

Although new development would have to contain and direct stormwater through streets, storm drains, and natural channels per current development code requirements, eventually, the stormwater must be conveyed to older urban areas not having infrastructure. This creates a health and safety problems for Tucsonans in general, but especially for those in flood prone areas.

The City of Tucson is in a catch up situation. It is the desire of the Mayor and City Council to address the health and safety of the Tucson residents through capital improvements.



CITY OF TUCSON

City of Tucson, Department of Transportation
Proposed Drainage/Flood Control Projects

Proposed Capital Drainage Improvement Locations and Priorities

1. Christmas Wash
2. Wilson Wash
3. Navajo Wash
4. Alamo Wash
5. Rodeo Wash
6. Bronx Wash
7. El Vado Wash
8. Silvercroft Wash
9. Alvernon (Columbus) Wash
10. Tucson Arroyo (Naylor) Wash

Christmas W.A.S.H. Ordinance section of the watercourse

CITY OF TUCSON

City of Tucson, Department of Transportation
Proposed Drainage/Flood Control Projects

HISTORY

- Tucson Stormwater Master Study (TSMS) was adopted by the Tucson Mayor and City Council in 1996.
- Approximately 50 watersheds were identified and multiple projects proposes for each to improve the flood condition throughout the City limits. These were prioritized and alternate spending plans were provided for consideration ranging from $6M to $12 M per program.
- Only about 25% have been partially built or completed.

CITY OF TUCSON

City of Tucson, Department of Transportation
Proposed Drainage/Flood Control Projects

Christmas Wash

Project Limits:

Per the TSMS the project limits are between Fort Lowell Road and Tucson Boulevard.

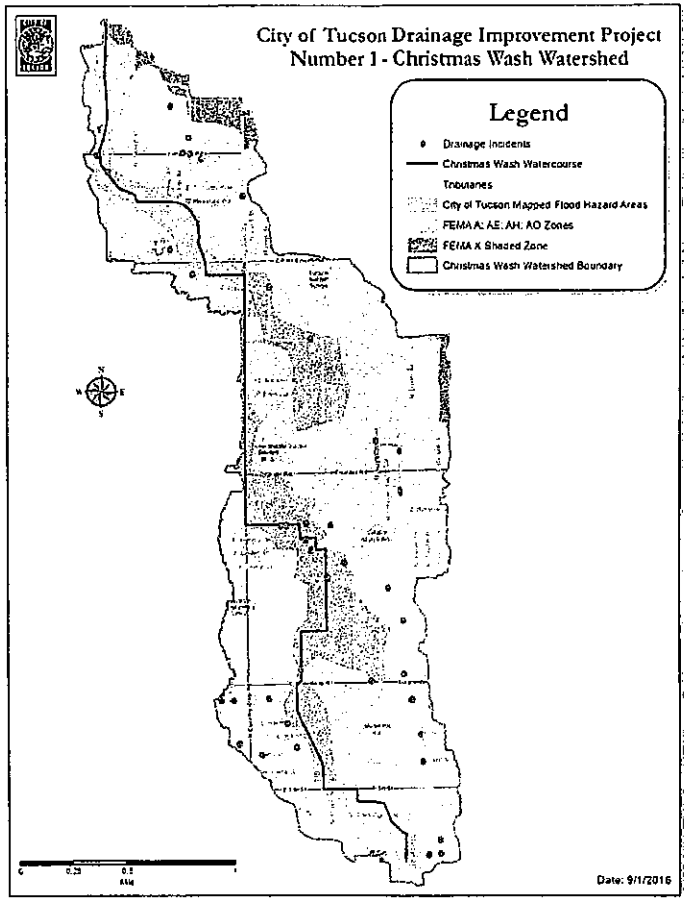
Project Details:

The project consists of three thousand linear feet of storm drain per TSMS.

Project Cost: $6,500,000 (2016 update)

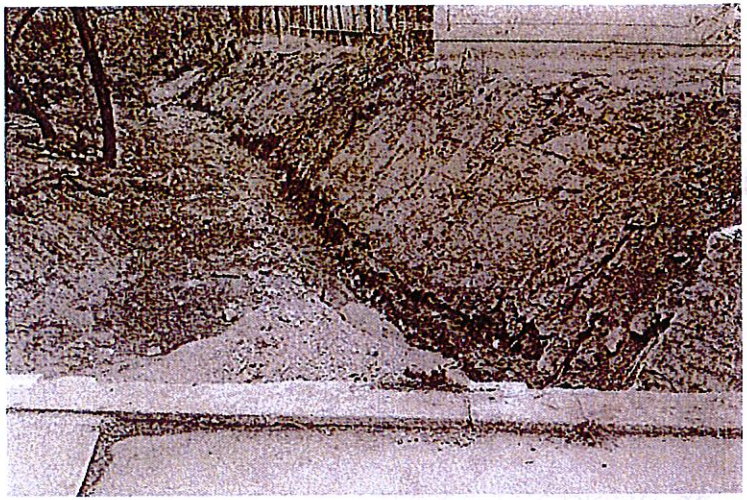
Project Benefits:

The project benefits include anticipated flood relief for about 222 homes and increased accessibility during any rain event.



CITY OF TUCSON

City of Tucson, Department of Transportation
Proposed Drainage/Flood Control Projects



City of Tucson

City of Tucson, Department of Transportation
Proposed Drainage/Flood Control Projects

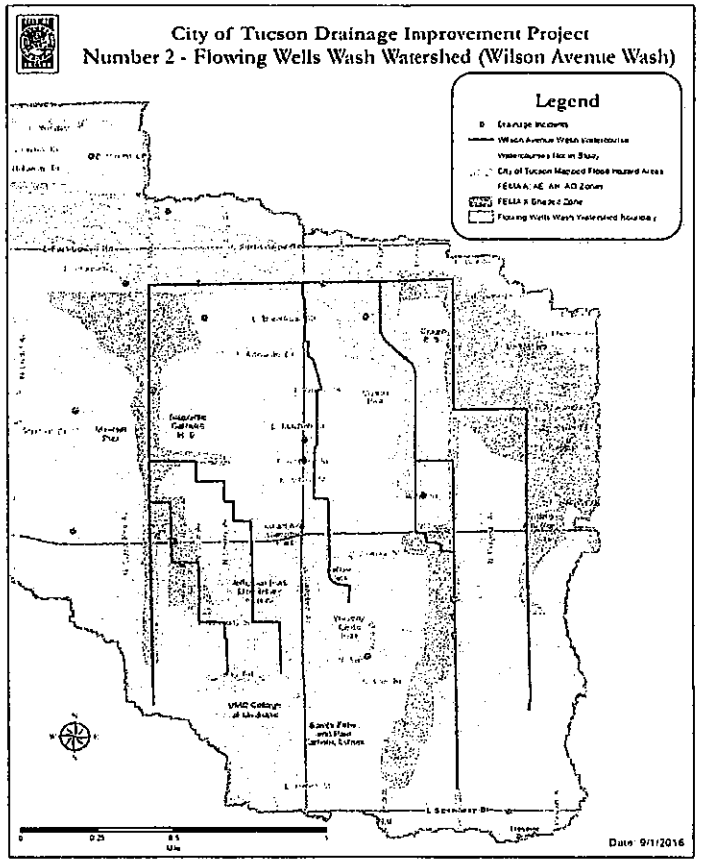
Wilson Wash

Project Limits:
Grant Road to Mountain Avenue

Project Details:
Two miles of storm drain

Project Cost: $6,100,000(2016 update)

Project Benefits
The project benefits include flood relief for approximately 258 homes and increased road accessibility during any rain event.



CITY OF TUCSON

City of Tucson, Department of Transportation
Proposed Drainage/Flood Control Projects

Navajo Wash

Project Limits:

Mountain Avenue and Oracle Road

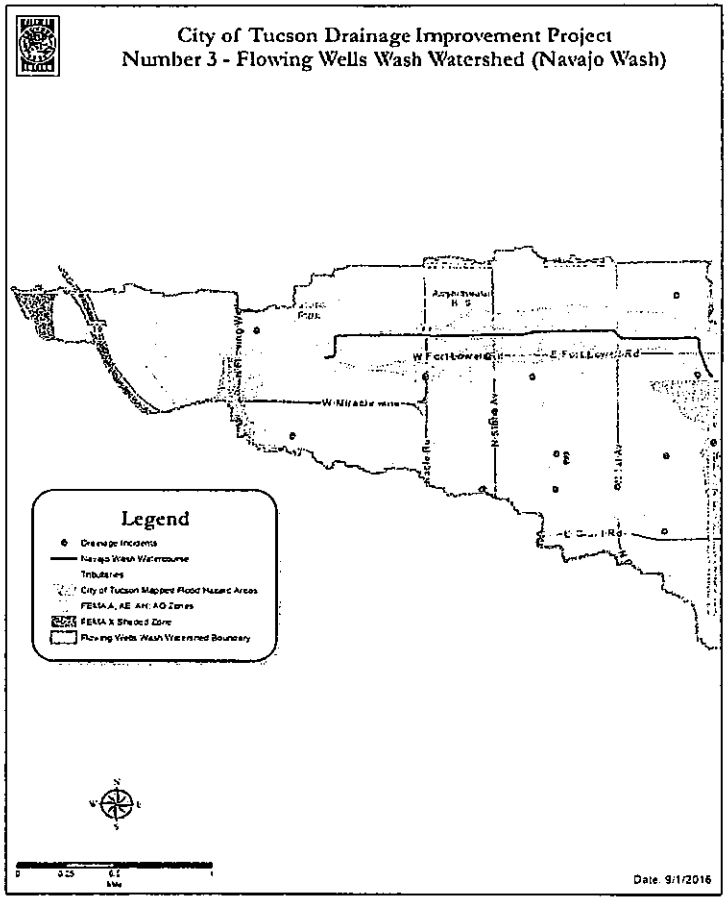
Project Details:

Additional conveyance capacity using storm drains, box culverts, and open channels

Project Cost: $7,054,510

Project Benefits:

The project benefits include making it safer for residents who experience flooding of varying degrees with any storm event. Improvements proposed by the TSMS would provide relief to 135 homes and 528,900 SF of high density land use.



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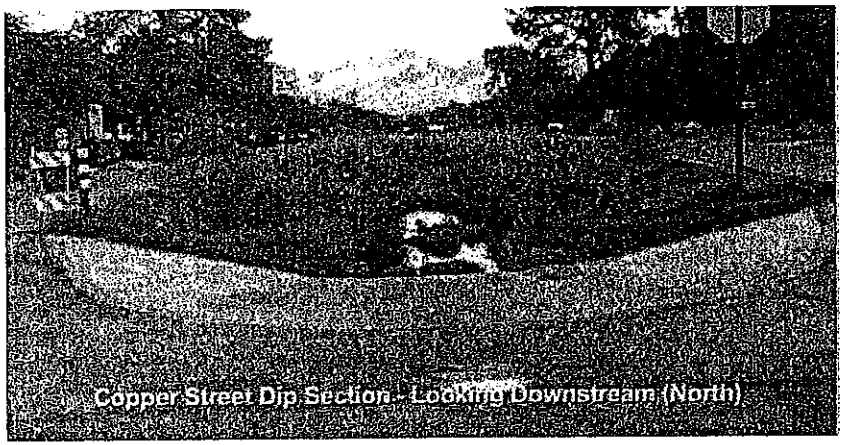


Copper Street Dip Section - Looking Downstream (North)

Glen Street Dip Crossing at Wilson Wash - Looking Upstream (South)

Wilson Wash at Glen - Looking Downstream (Wilson Drive at 30" CMP)

City of Tucson

City of Tucson, Department of Transportation
Proposed Drainage/Flood Control Projects

Alamo Wash

Project Limits:

Van Buren Avenue and Sahuara Avenue between Speedway Boulevard to Alamo Avenue

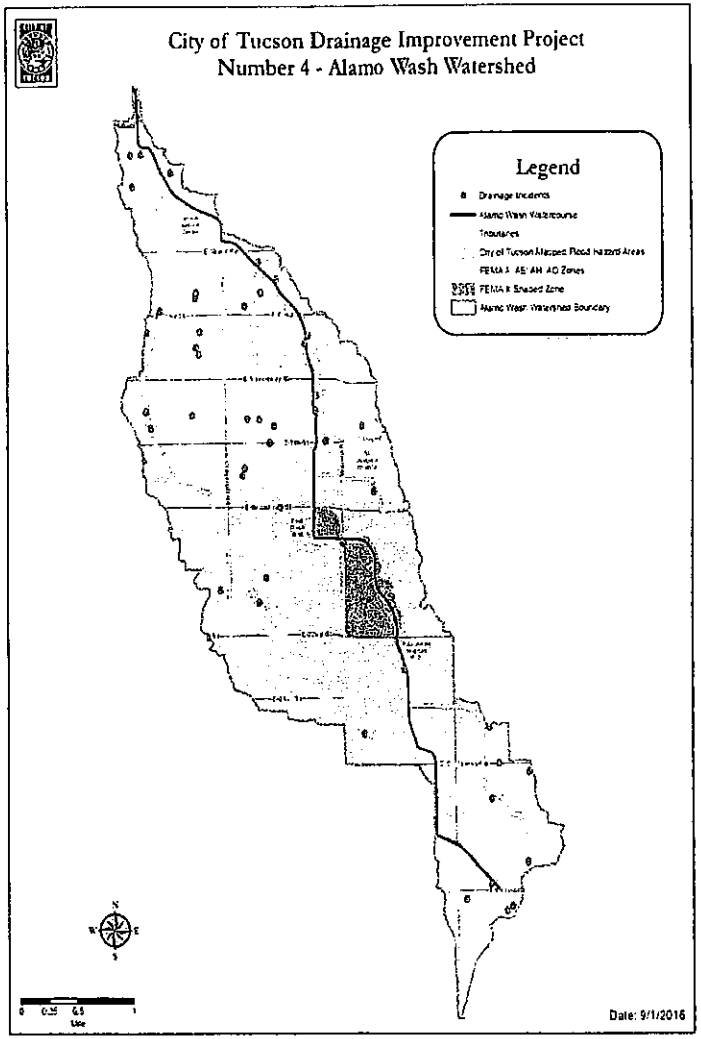
Project Details:

Construct 1.2 miles of storm drain

Project Cost: $6,100,000

Project Benefits:

The benefits would provide flood relief for about 184 homes and increase road accessibility during any flood event.



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City of Tucson, Department of Transportation
Proposed Drainage/Flood Control Projects

Rodeo Wash

Project Limits:

6th Avenue, 7th Avenue and Michigan Street, Pennsylvania Street and Lundy Avenue

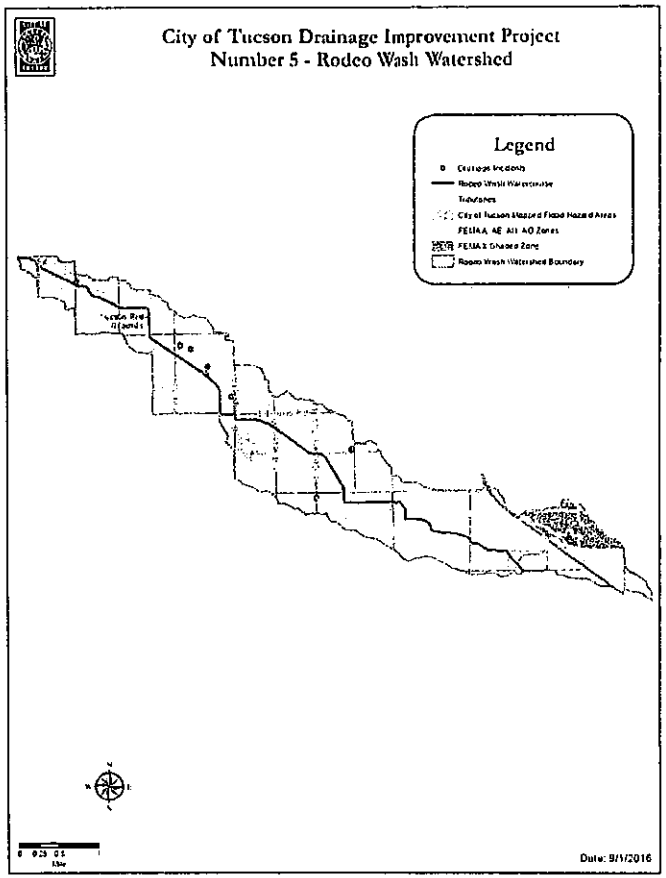
Project Details:

Install box culverts at dip crossings

Project Cost: $3,300,000

Project Benefits:

The improvements would provide flood relief and street accessibility for about 13 homes. Two fatalities have occurred in this area.



CITY OF TUCSON

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Proposed Drainage/Flood Control Projects

Bronx Wash

Project Limits:

Between 6th Avenue and I-10

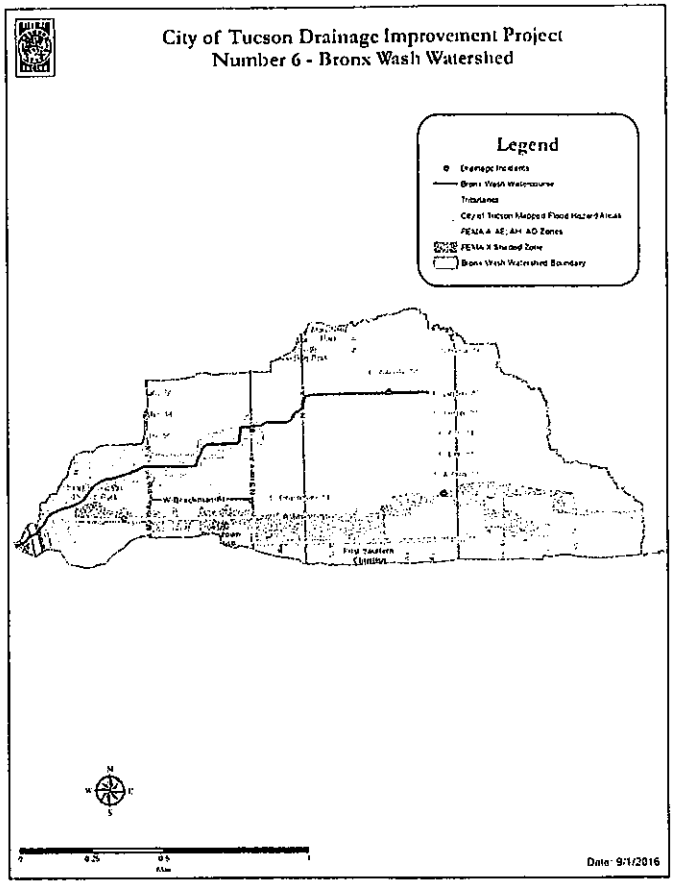
Project Details

Provide additional stormwater conveyance through the construction of additional storm drain, catch basins, and open channels.

Project Cost: $1,077,435

Project Benefits:

The proposed improvements would provide flood relief for about 17 homes and 112,775 square foot of high density land use where repetitive loss occurs.



CITY OF TUCSON

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Proposed Drainage/Flood Control Projects

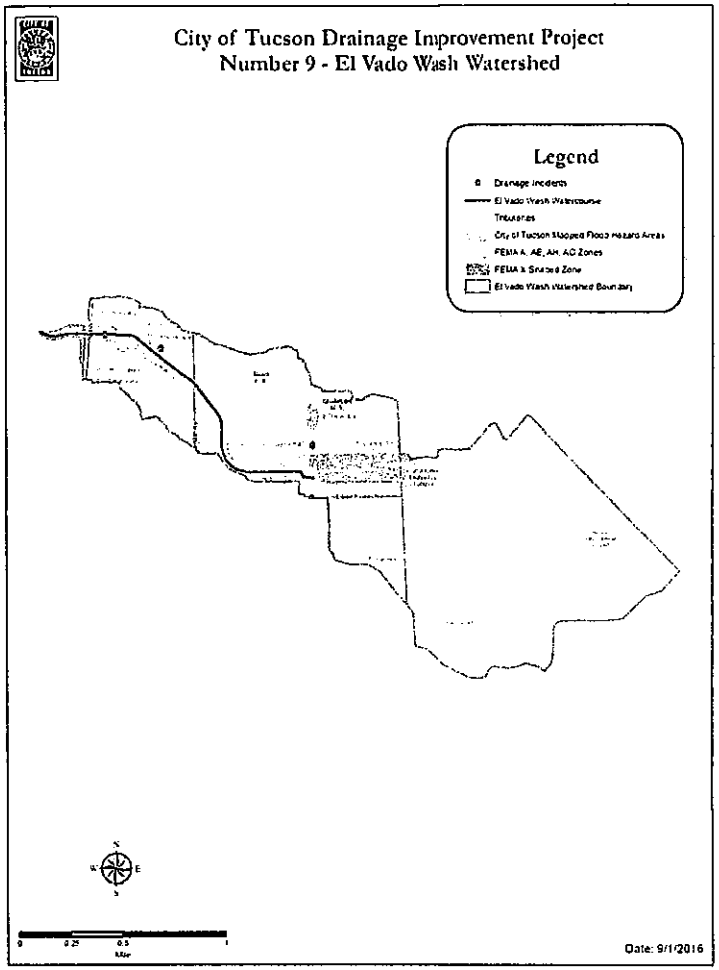
El Vado Wash

Project Limits:
Corona Road to 12th Avenue

Project Details:
Construct soil cement banks

Project Cost: $5,319,510

Project Benefits:
This will provide flood relief for about 106 homes within the channel reach.



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City of Tucson, Department of Transportation
Proposed Drainage/Flood Control Projects

Silvercroft Wash

Project Limits:

Various locations north of Grant Road and in the El Rio Wash

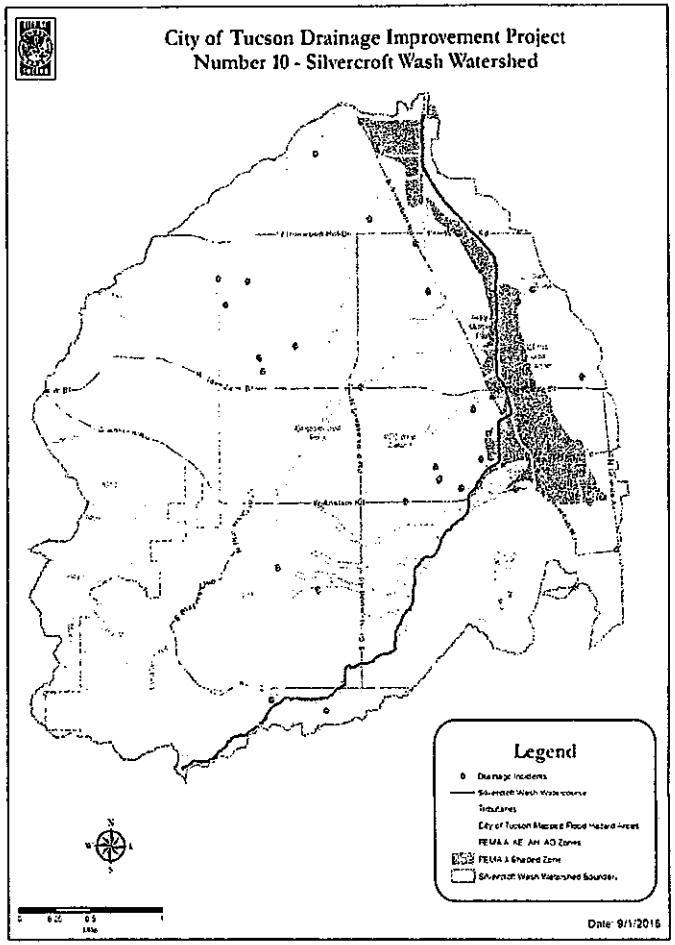
Project Details:

Provide storm drains, catch basins, and bank protection.

Project Cost: $4,100,000

Project Benefits:

Not in the TSMS. Protect existing land fills, improve street accessibility during most storm events for 1,7533 residents, and free up land for economic development.



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Proposed Drainage/Flood Control Projects

Tucson Arroyo

Project Limits:

22nd Street and 23rd Street, Beverly Avenue and 23rd Street, and Craycroft Road and Sahuaro Avenue.

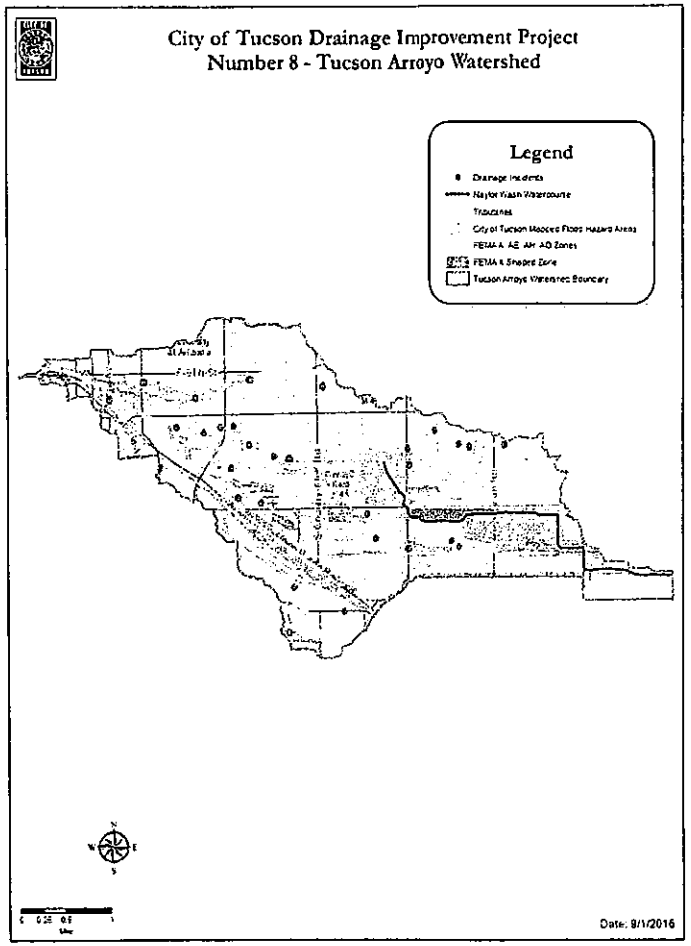
Project Details:

Construct bank protection

Project Cost: $3,619,210

Project Benefits:

Provide flood relief for approximately 122 homes in the flood hazard zone.



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Proposed Drainage/Flood Control Projects

Alvernon Wash

Project Limits:

Pima Street to Broadway Boulevard

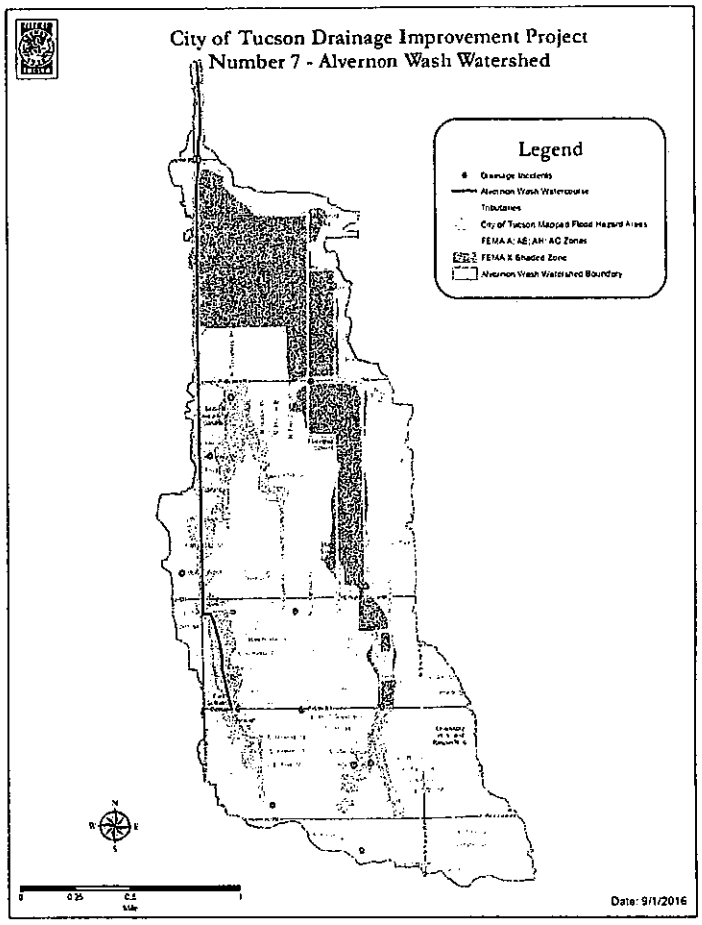
Project Details:

Provide storm drains and catch basins

Project Cost: $19,000,000

Project Benefits:

Not in the TSMS. Provide flood relief and street accessibility during any storm event for 1,842 residents.



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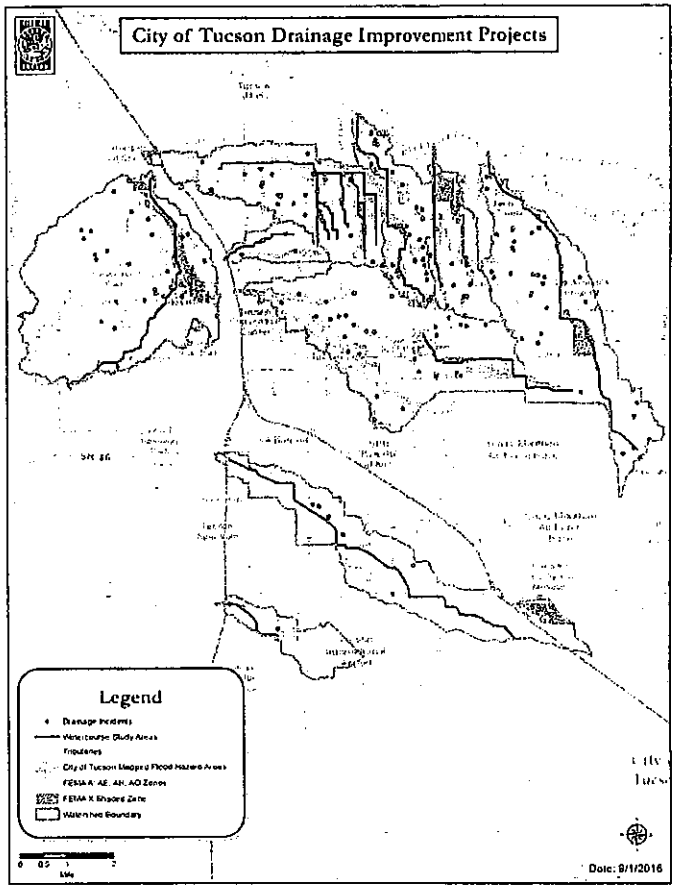
City of Tucson, Department of Transportation
Proposed Drainage/Flood Control Projects

Proposal Summary

- Nine projects
- $7M each year for 10 years
- Modified Scopes
- Additional study
- New projects to be identified



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