

**RESOLUTION OF THE PIMA COUNTY FLOOD  
CONTROL DISTRICT BOARD OF DIRECTORS  
ADOPTING THE RUTHRAUFF BASIN MANAGEMENT  
STUDY**

**The Board of Directors of the Pima County Flood Control District finds:**

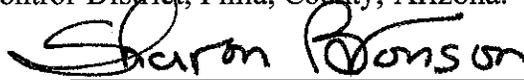
- A. The Arizona Legislature authorized the Pima County Flood Control District (District) to adopt floodplain management regulations designed to promote the public health, safety and general welfare pursuant to Arizona Revised Statutes (A.R.S.), Title 48, Section 48-3603 through 48-3627.
- B. The District is authorized to delineate floodplains for areas where development is ongoing or imminent pursuant to A.R.S. § 48-3609.
- C. The District is authorized to develop watercourse master plans and to adopt and enforce uniform rules for the river or drainage system pursuant to A.R.S. § 48-3609.01(A).
- D. The District in cooperation with the Pima County (County), and City of Tucson (Tucson) initiated the Ruthrauff Basin Management Study (Study) to identify potential flood hazards, provide a comprehensive flood control protection program and develop floodplain management protocol while enhancing public safety, fiscal responsibility and habitat conservation through a balance multi-objective approach.
- E. The District held stakeholder meetings, meetings that were open to the public, and a public website so that interested members of the public could review and comment on all studies and reports generated for the Study.
- F. The Study produced a common set of facts, flood hazard maps, and recommended alternatives, (Exhibit A – Ruthrauff Basin Management Plan - Summary Report of Volume I of II) which can now serve as a resource for the County and Tucson to guide and manage development activities in the Study Area.
- G. The Study is intended to provide guidance and regulatory authority to minimize development in flood prone areas, and alternatives to improve the drainage system.
- H. The Study includes a path to implement the recommended alternatives (Exhibit B –Ruthrauff Basin Management Plan - Implementation Plan of Volume II of II) which include phasing, maintenance plans, and infill incentives.
- I. The Study identifies specific drainage improvement measures to provide infill and redevelopment incentives along Highway Drive in area identified as an Infill Incentives District by the Pima County Board of Supervisors (Co7-08-01).

J. The Study identifies specific drainage improvement measures to provide infill and redevelopment incentives in the Flowing Wells Focused Development Area identified in the Pima County Comprehensive Plan.

**NOW THEREFORE, BE IT RESOLVED THAT THE PIMA COUNTY FLOOD CONTROL DISTRICT BOARD OF DIRECTORS:**

1. Adopts the Ruthrauff Basin Management Study (a complete copy of which is on file with the District) including the technical data, flood hazard maps, maintenance plan, incentives plan and implementation plan, which will:
  - Ensure that regional planning for land use, water resources and infrastructure are integrated.
  - Provide a regional uniform and coordinated approach by the County, and Tucson.
  - Guide redevelopment in the Study Area so that it is designed, constructed and located to promote public safety, protect the environment, and be economically and fiscally sustainable.
2. Directs District staff to continue to work with the County, and Tucson to implement the floodplain management recommendations and implementation plan in the Study.
3. Directs District staff to provide for the Board's consideration an amendment to the County's Comprehensive Land Use Plan providing Special Area Policies for the Ruthrauff Basin Management Study to integrate floodplain management and environmental protection policies into the County's land use planning for the Study Area.

Passed and Adopted this 3 day of October, 2017 by the Board of Directors of the Pima County Flood Control District, Pima County, Arizona.



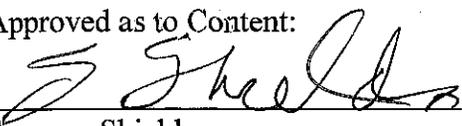
OCT 03 2017

Sharon Bronson  
Chair, Pima County Flood Control District  
Board of Directors

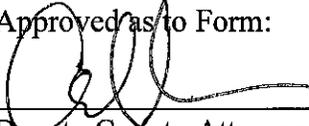
ATTEST:

  
Julie Castañeda, Clerk of the Board

Approved as to Content:

  
Suzanne Shields  
Director, Pima County Flood Control  
District

Approved as to Form:

  
Deputy County Attorney  
**ANDREW FLAGG**

**Ruthrauff  
Basin Management Plan**

**Volume I of II**

**Drainage Improvement Plan**



Prepared for:



**Pima County Regional Flood  
Control District**

Prepared by:  
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**February 14, 2017**



**Expires 12-31-19**

**RUTHRAUFF  
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**VOLUME I OF II**

**DRAINAGE IMPROVEMENT PLAN**

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- Exhibit B - Ruthrauff Area Drainage Master Plan – Problem Area 1 Draft Structural Alternatives
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## **Executive Summary**

This planning study was undertaken to address flooding and drainage problems in study basin. This basin is about 8 square miles in the area southeast of the confluence of the Santa Cruz and Rillito rivers. Prior to urbanization the area was used for irrigated agriculture, so predevelopment topography was extremely flat. Subsequent development, (most of which occurred prior to the adoption of the National Flood Insurance Program in 1968), neglected drainage so there was no comprehensive drainage plan and little drainage infrastructure. Many of the structures were not elevated, and many of the streets were constructed without curbs to accommodate storm flows. In general, the area suffers from sheet flooding and ponding due to the lack of topographic relief and sufficient drainage outlets under the Union Pacific Railroad and Interstate 10 to the Santa Cruz or Rillito Rivers.

The study was comprehensive in nature and included state of the art two-dimensional flood flow modeling with high quality topographic data which allowed us to see where flood flows were generated, how these flows moved, and where they ponded in this highly complex sheet flood environment. The study included significant community involvement to ensure that ponding and flooding problems were adequately identified and assessed. These state of the art technologies were then used to prepare new and more accurate local regulatory and FEMA floodplain maps.

The study also included an alternatives analysis and remediation recommendations. The alternatives analysis for the study area was used to identify a comprehensive list of both structural and non-structural flood hazard solutions based on the data gathered and evaluated in the project (e.g., drainage complaints, hydraulic analysis, existing and planned improvements...etc.). Objective scoring criteria and cost effectiveness were then considered to rank potential solutions.

The study presents a list of recommended alternatives that can be implemented over time and be used as the framework for reducing flooding and drainage problems in the basin. If approved and adopted by the Pima County Board of Supervisors and City of Tucson

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Mayor and Council, this Basin Management Plan can be used for development of future capital improvement and maintenance plans in the basin.

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**Abbreviations**

**Units**

cfs	cubic feet per second
F	degrees Fahrenheit
ft	Feet
in	Inch
lbs	Pounds
mi	Mile
sq.ft.	square feet

**Agencies, Firms, misc.**

ADOT	Arizona Department of Transportation
FIRM	Flood Insurance Rate Map
FLAP	Floodprone Land Acquisition Program
FEMA	Federal Emergency Management Agency
GI/LID	Green Infrastructure/Low Impact Development
COT	City of Tucson
CBC	Concrete Box Culvert
I-10	Interstate 10
JEF	JE Fuller Hydrology and Geomorphology Inc.
LOMR	Letter of Map Revision
PCRFC	Pima County Regional Flood Control District
RBMP	Ruthrauff Basin Management Plan
RD	Road
Stantec	Stantec Consulting Services Inc.
TSMS	Tucson Stormwater Management Study
UPRR	Union Pacific Railroad
WDG	Wheat Design Group

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## **1.0 Introduction and Project Scope**

### **1.1 Background and Purpose**

The Ruthrauff Basin Management Plan (RBMP) study area includes portions of both the City of Tucson (COT) and unincorporated Pima County east of and adjacent to Interstate 10 and the Union Pacific Railroad (UPRR). The area is subject to frequent and substantial sheet flow and, at numerous locations, the ponding of storm water because of the minimal topographic relief and inadequate drainage structures/systems. Historically, flood flows pond on the east side due to the embankment of the Union Pacific Railroad which is located immediately east of Interstate 10. The flooding in the western COT area was studied previously as part of a basin management plan (Cella Barr, 1981). A lack of adequate drainage from the east of the Union Pacific Railroad line to the Santa Cruz River was highlighted repeatedly as the ultimate source of the flooding problems on the western edge of the study area as highlighted in the reference map in Figure 1.

Some of the recommendations of the 1981 study have been adopted including a storm drain along Ruthrauff Road. However, there are still areas mapped as FEMA (Federal Emergency Management Agency) or local administered floodplains along the UPRR. Flooding in the area between Prince Road and Ruthrauff Road comes from both the Flowing Wells Wash and the Ruthrauff Basin (AECOM, 2011). The Flowing Wells Wash from approximately 500 feet east of the railroad to the railroad does not have capacity for the 100-year event. A portion of the conveyed discharge overtops the channel that conveys Flowing Wells Wash (concrete lined channel) and the overtopped portion proceeds along the railroad to the northwest and combines with runoff from the Ruthrauff Basin.

As part of the ADOT widening of Interstate 10 between Prince Road and Ruthrauff Road (2011-2014), drainage under the freeway was improved but some of the drainage across the UPRR was not. This will eventually require additional outlets for the water during flood events to be conveyed under the railroad tracks and enter the improvements constructed during the Interstate 10 widening which will reduce the potential for ponding against the UPRR. There have been four drainage improvements at the UPRR proposed: at the Flowing Wells Wash, at the west end of Gardner Lane, and west of North Highway Drive between West Zinnia Avenue, due north of Ruthrauff Road, and West Verbena

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Avenue. As of the writing of this report only one, a culvert at Flowing Wells Wash, has been constructed.

In May of 2014, the Pima County Regional Flood Control District (PCRFCDD) contracted with Stantec Consulting Services Inc. (Stantec) to provide a professional consulting engineering team (i.e., Stantec, JE Fuller Hydrology and Geomorphology Inc. and Wheat Design Group) to develop a plan, that: identified flood hazard areas using improved topographic information and new hydraulic modeling techniques (i.e., two dimensional modeling), collected drainage compliant reports, reviewed drainage problems, and identified cost-effective solutions to alleviate or manage flooding in the study area. The plan incorporates all the existing stormdrains constructed along the railroad.

The purpose of the RBMP was to develop a comprehensive flood control protection program and to develop drainage alternatives which will improve public safety, provide fiscal responsibility, and provide a balanced multi-objective approach toward managing the watersheds, floodplains, and resources in the study area. The Ruthrauff basin is developed (e.g., commercial, industrial, residential...etc.) but the basin has been the target of a recent comprehensive plan amendment (Co7-08-01, Res. No. 2009-63), which will allow Pima County to initiate infill incentives along Highway Drive including development of a comprehensive flood control plan.

Once adopted by the Board of Supervisors and the City Council, this plan will provide guidance for development, redevelopment and retrofits in flood prone areas as well as drainage alternatives to further limit the potential for flooding. This study relied on interagency coordination to preserve the hydrologic integrity and storm water conveyance ability of the regional watersheds. The adoption of this study will ensure that the floodplain management regulations will balance competing residential community and private sector interests.

**1.2 Project Scope**

Stantec performed an existing conditions hydrologic and hydraulic analysis that incorporated recent drainage improvements within the study area, and identified areas of flooding and drainage conflicts. Currently available regulatory discharge values were identified at selected locations for future development and improvements, as applicable and/or for comparison to the hydraulic modeling completed for this basin management

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plan. The results of the analysis concluded that the existing floodplain mapping needed to be re-delineated (see Section 4.0) for a portion of the area.

The project included an alternatives analysis and remediation recommendations. The alternatives analysis for the study area was used to identify flood hazard solutions based on the data gathered (e.g., drainage complaints, hydraulic analysis, existing and planned improvements...etc.) and produced during the project. Remediation methods included both structural and non-structural approaches for mitigating the floodplain conflicts identified during the existing conditions analysis that include ranking by weighted performance criteria and cost effectiveness.

The RBMP included extensive public and stakeholder involvement and required dissemination of information, direct involvement (e.g., public meetings), and comprehensive stakeholder coordination for all elements of the Ruthrauff Basin Management Plan.

As part of the RBMP, Stantec prepared an Implementation and Maintenance Plan (see Volume II of II). This is the plan for moving forward with the funding, scheduling, and construction of the remediation recommendations contained within this report. Residing within the Implementation and Maintenance Plan is a plan for identifying, scheduling, and performing maintenance on existing and proposed drainage infrastructure.

**1.3 Study Area**

The RBMP study area is a 5440-acre (i.e., 8.5 square miles) urban area in east central Pima County. Approximately 3155 acres, or 58%, of this area falls within Ward 3 of the City of Tucson with the remaining portion of the study area located within unincorporated Pima County. It is bounded on the southern edge by: West Fort Lowell Road between Interstate 10 and North Flowing Wells Road, the Kleindale Road alignment between North Flowing Wells Road and North Estrella Avenue, East Greenlee Road from North Estrella Avenue to North Campbell Avenue. Interstate 10 marks the western edge and North Campbell Avenue comprises the eastern study limit. The northern limit consists of the southern bank of the Rillito River excluding the Tucson Mall property within the northern half of Section 23, Township 13, Range 13 East (see Figure 1).

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The project area is generally located within portions of Sections 8, 15, 16, 17, 21, 23, 24, 25, 26, 27, and 28 of Township 13, Range 13 East and Sections 19 and 30 of Township 13, Range 14 East.

**1.4 Approximate Cost**

The scope of this project included only preliminary design (15%) plans and therefore engineering costs are highly estimated. However, estimates of the cost of construction for the recommended alternatives (i.e., structural methods) were developed during the prioritization phase for the purposes of priority ranking (see Section 5.2). These estimates include an estimate of cost for construction only and do not include costs related to: design, construction administration, contingency, property acquisition, agency permitting/coordination nor environmental related expenses. It is recommended that a more comprehensive analysis of all costs related to the execution of construction for the individual alternatives be evaluated during a future project(s) as described in the Implementation Plan (see Volume II of II).

**1.5 Construction Schedule and Duration**

Given their conceptual nature and the need to allocate funding there is no set construction start date set for the recommendations resulting from this project. Additionally, until funding is established for any or all the recommended alternatives and all final plans, specifications, and opinions of the costs of construction are completed the duration of any of the proposed improvements cannot be accurately estimated.

**1.6 Project Disclaimer**

The author of this document has taken all necessary steps and included various assumptions that could be reasonably used without detailed discussions and/or review periods that would normally be undertaken with all necessary State and/or Federal agencies for a federally programmed project or one that requires direct coordination with all necessary State, Federal or other local agencies and/or utility owners. This document was prepared using current approaches, methodology, computations and standards of care and practice; however, the author cannot guarantee that such may be the same at a future date when funding has been established or when the final design phase

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commences. Therefore, at a future date this document may need to be reviewed and revised as necessary to comply with all applicable criteria at that time.

All recommendations provided within this report will require complete engineering design and other related services/efforts and approval by all appropriate agencies prior to any construction activities. This document does not serve as project approval.

Information provided to Stantec by the PCRFCFCD is considered appropriate for use within the nature of this study (i.e., conceptual) but will need to be reviewed and revised as necessary prior to use within any subsequent design phases.

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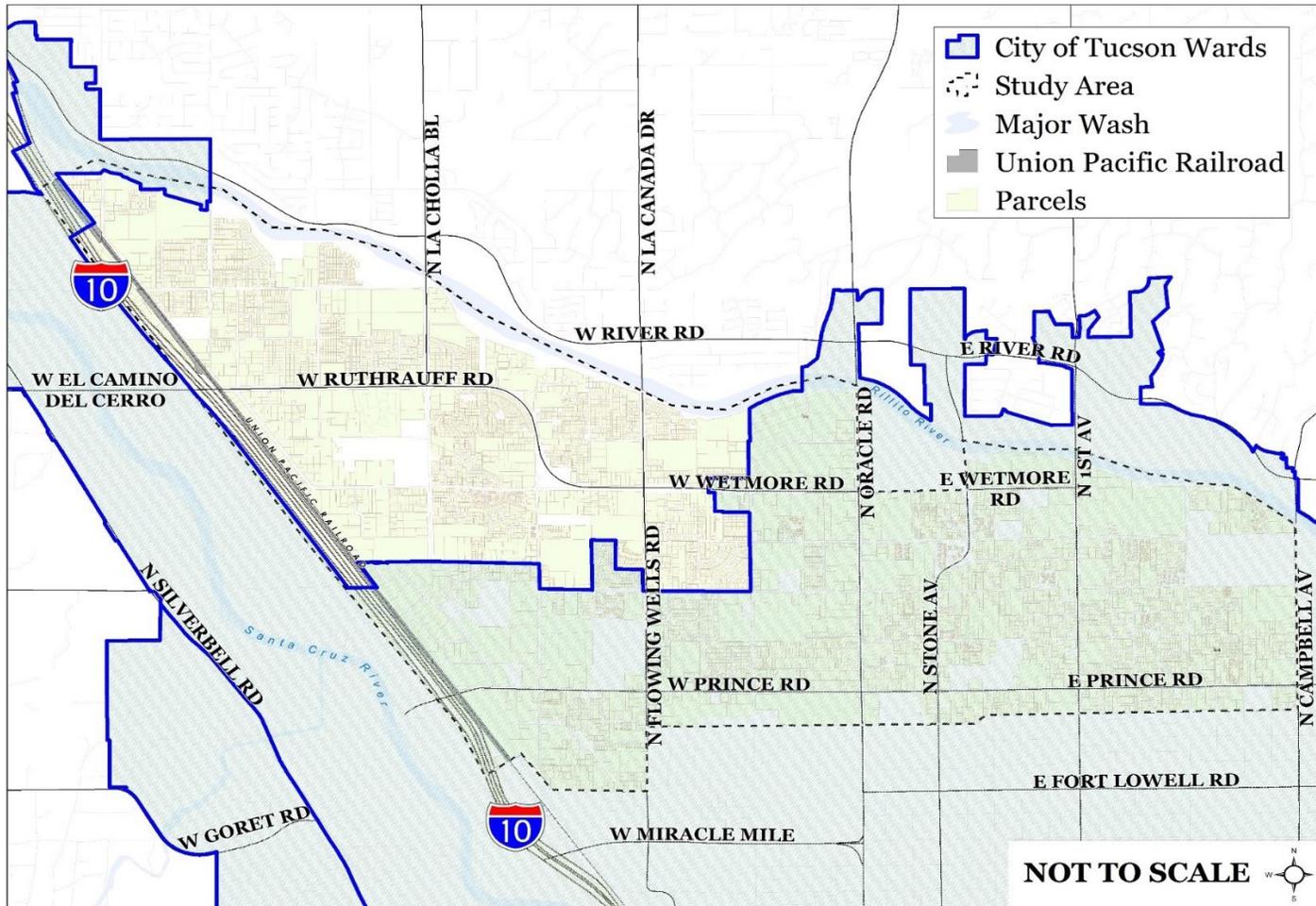
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**Figure 1 – Project Map with Jurisdictions**

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## **2.0 Existing Conditions**

The data for the analysis of the existing conditions within the Ruthrauff Basin was collected from: the PCRFCO, the COT, the Arizona Department of Transportation (ADOT), the UPRR, and other sources. The pertinent data was used to complete the hydrologic and hydraulic modeling and facilitate the analysis of structural alternatives. This information was gleaned from, but not limited to: as-built plans, existing reports/data, land use plans, city and county reports, geotechnical data, and spatial data (see Appendix B).

Additionally, there was a site visit conducted by the project team on July 10, 2014 with representatives from: Stantec, JE Fuller Hydrology and Geomorphology Inc. (JEF), PCRFCO, COT, and Wheat Design Group (WDG). JEF and WDG served as sub-consultants to Stantec during project as did the Gordley Group (stakeholder involvement task only). This field work allowed the team to understand the drainage problems more fully, identify additional data needs, and initiate discussions relative to potential alternative mitigation methods for future consideration. Photographs and observations were used to document the 14 problem sites that were visited (see Appendix B.1.9).

### **2.1 Flooding and Drainage Problems within the Study Area**

The 14 problem sites (i.e., isolated or individual locations) that were visited by the project team were identified from a list of 13 problem areas (i.e., regional or sub-regional locations) where existing chronic flooding and/or ponding problems were identified (see Appendix B.2). These problem areas were recognized by reviewing drainage complaints provided to Stantec by the County and the City (see Appendix B.1.10) as well as interviews conducted with PCRFCO and COT maintenance and floodplain management personnel. The drainage complaints, approximately 5,000 of them, were compiled from records obtained from the PCRFCO, the COT, and ADOT over the span of last 20 years. The complaints that had been resolved by improvements or were not located within the designated RBMP study area were removed from further consideration. The remaining complaints were plotted on a map (see Figure B.2) and used to identify areas of chronic flooding (i.e., frequent flooding and/or potential for high depth of the flow) and/or

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drainage issues. On October 23, 2014 a stakeholders meeting was held where businesses and neighborhood organizations helped to confirm the existence of those drainage problems and further define the areas of interest (see Section 6.0). In addition, an open house was held on December 14, 2014 to inform the public (i.e., homeowners, home owner associations...etc.) of the purpose of the project and receive feedback concerning ongoing drainage issues in the RBMP study area (see Section 6.0). During these outreach efforts the public was encouraged to fill out comment forms which were used to confirm the ongoing drainage issues (see Appendix F.1), identify any new concerns, isolate the most significant problem areas, and begin a discussion of possible alternatives.

Additionally, following a request for the drainage complaints recorded in the study area, ADOT staff indicated that the existing concrete barricades at the West Ruthrauff Road underpass do not allow runoff to exit the roadway. The existence and locations of these drainage problems were further verified by members of the public during two separate outreach meetings; a stakeholders meeting on October 23, 2014 (see Section 6.2) and an open house meeting held on December 14, 2014 (see Section 6.1).

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### **3.0 Hydraulic Analyses and Floodplain Delineation**

A hydrology and hydraulic analysis was completed by JE Fuller Hydrology and Geomorphology Inc. (JEF) to establish a current baseline model for the existing conditions and to compare local floodplain limits within the RBMP study area with effective information. Both analyses (i.e., hydrologic and hydraulic) were performed using the computer program FLO-2D PRO using input parameters based on PCRFCO Technical Policy 033, with some site specific considerations. The model was developed on a 15-ft grid which allowed flow from impervious surfaces like rooftops and roadways to be shown in detail. These models required the use of such parameters as rainfall, topography, soil, vegetation, land use characteristics and runoff coefficients to determine excess runoff volume totals and flood depths. The models were validated by comparing with a HEC-1 model (see Appendix C) because gauge data was not available for the study area.

The analysis included the 10-, 25-, and 100-year recurrence events, with a 3-hour rainfall duration. Resulting flood depths as well as the 100-year discharges and velocities for existing conditions within RBMP study area are included within the *Ruthrauff Basin Management Plan Technical Data Notebook for Hydrologic Analysis & Floodplain Mapping* (see Appendix C). The computer models prepared and the resulting maps (e.g., flood depths and limits) produced within the referenced report were used by the project team to consider the new floodplain limits, assess potential problem areas, and initiate discussions for remediation. In the alternatives phase these models were modified to analyze the effectiveness of the structural alternatives' ability to reduce flooding and resolve noted drainage issues.

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## **4.0 FEMA Floodplain Map Revision**

In November of 2016, JEF, acting as a sub-consultant to Stantec as a part of the RBMP, submitted a Letter of Map Revision (LOMR) to the Federal Emergency Management Agency (FEMA) for the Flowing Wells Wash and Runway Drive Area (Case No. 17-09-0333P). The purpose of the LOMR is to revise the 1988 Flood Insurance Rate Maps (FIRM) for Panel Numbers 04019C2277L, 04019C2279L, and 04019C2283L based on structural drainage improvements and better hydraulic modeling method(s). The study was performed in accordance with FEMA Guidelines; HEC-RAS version 4.1 was used to model the hydraulics of the Flowing Wells Wash and FLO2D which has been approved for modeling in Pima County, was used to perform the hydraulic and hydrologic analysis for the Runway Drive area. The full results of the LOMR submittal document including the annotated FEMA panels can be viewed in the *Technical Data Notebook: Letter of Map Revision for Flowing Wells Wash & Runway Drive Area* (see Appendix D). At the time of this report the LOMR is still under review by FEMA.

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## **5.0 Alternatives Analysis and Remediation Recommendations**

The data collected within the RBMP study area included previous studies, previous and new computer hydraulic and hydrologic modeling, and input from the public outreach efforts, that were used to determine areas of flooding as well as nuisance ponding and other drainage issues (e.g., connectivity, diversions, capacity...etc.). This information was used to identify the top nine individual problem areas (see Table 1) of chronic drainage issues and evaluate remediation alternatives, both structural and non-structural, for each of them. In addition, basin-wide alternatives that would be effective in reducing the drainage problems within the Ruthrauff Basin were also developed. All the alternatives were then subjected to a prioritization scoring process. Out of this process a total of 18 recommended remediation alternatives, both structural and non-structural, resulted from the nine identified problem areas as well as seven basin-wide recommendations. The Recommended Alternatives Report (see Appendix E) details this development.

### **5.1 Alternatives Development Process**

The development of the alternatives began with evaluation of a review of reported drainage complaints (see Section 2.0) in conjunction with analysis of the existing drainage conditions within the RBMP study area (see Section 3.0).

The result of these efforts was the identification of nine problem areas, within the overall study area, of recurring or chronic issues where structural and non-structural alternatives were of the greatest need. These areas were mapped based on the relative density (i.e., number in a given area) of complaints, both ponding and uncategorized. Table 1 lists these nine problem areas along with the general problem statement of each area, and a description of area's boundary.

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**Table 1 – Alternative Development Problem Areas**

<b>Problem Area No.</b>	<b>Existing Problem Statement</b>	<b>Problem Area Boundary*</b>
1	Ponding and flooding issues in low lying areas.	West Curtis Road [S] North Highway Drive and North Camino de la Tierra [W] North Shannon Road [E] Rillito River [N]
2	Poor drainage and ponding issues.	West Gardner Lane [S] UPRR [W] Varies: North la Cholla Boulevard, North Plum Avenue and North Kain Avenue [E] Ruthrauff Road [N]
3	Drainage and ponding issues with houses at grade and unimproved streets.	West Gardner Lane [S] North la Cholla Boulevard [W] Romero Road [E] West Wetmore Road [N]
4	Street flooding and property erosion along Pomona Avenue.	West Wetmore Road [S] Ruthrauff Road [W] North Flowing Wells Road [E] Rillito River [N]
5	Ponding issues in the neighborhood east and north of Pelaar Street.	West Prince Road [S] North Flowing Wells Road [W] North Fairview Avenue [E] West Roger Road [N]
6	Flooding issues because of existing culvert frequently blocked with debris.	General area surrounding the intersection of: West Fort Lowell Road and North Flowing Wells Road
7	Ponding and lot drainage problems.	West Roger Road [S] North Stone Avenue [W] North 4 <sup>th</sup> Avenue [E] West Wetmore Road [N]

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<b>Problem Area No.</b>	<b>Existing Problem Statement</b>	<b>Problem Area Boundary*</b>
8	Ponding issues caused by blocked existing drainage structures.	General area surrounding the intersection of: West Roger Road at North Tyndall Avenue
9	Erosion problems and nuisance ponding in Richland Heights neighborhood (un-paved roads).	East Kleindale Road [S] North Mountain Avenue [W] North Martin Ave [E] East Prince Road [N]

\*the definition of “boundary” for this project may include area(s) adjacent to the limits shown for each problem area.

With the selection of the most urgent problem areas completed, the development of the alternatives best suited for these areas began. The alternatives selection process relied heavily on stakeholder outreach. On February 8, 2016 a workgroup meeting was convened that involved project team members and stakeholders from the county, city, and neighborhood organizations (see Section 6.4.2). The members of this workgroup were broken up into two teams with a facilitator and a “seedlist” for brainstorming viable ideas for alternatives in each problem area as well as for the RBMP study area termed as “basin-wide alternatives”. This process resulted in two comprehensive lists of alternatives to be considered which the project team, in consultation with PCRFC, combined into a single list, by area, of 31 possible alternatives (see Appendix E).

The ideas that came out of the February workgroup meeting were first classified as structural or non-structural alternatives and developed accordingly. The structural alternatives included channels, detention/retention basins, storm drains, and roadway improvements and were all designed using calculations based on the information developed for the existing conditions within the basin (see Section 2.0). In general, these alternatives are:

- 1) Providing drainage through the railroad embankment.
- 2) Slowing water and reducing flood peaks at multi-use basins.
- 3) Conveying water in drainage channels.

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- 4) Conveying water in stormdrains.
- 5) Improving roadways to better convey water.
- 6) Applying practices across the basin that reduce potential for flooding.

Of the original 31 possible alternatives, six are non-structural methods and were classified as area-specific or area-wide and researched on that basis. The result of the alternatives development process, both structural and non-structural, were documented in a memorandum that became the basis for the alternatives analysis phase of the project.

**5.2 Alternatives Analysis**

The alternatives analysis phase began with a workgroup of 25 stakeholders meeting on June 9, 2015 to establish “Performance Criteria” to rank the various remediation recommendations to come out of the alternatives development process (see Section 6.4.1). The criteria were chosen in coordination with the PCRFCDD as well as the area stakeholders and were weighted to reflect their degree of relevance and resulted in five Performance Criteria which are defined in Table 2.

**Table 2 – Performance Criteria Definitions and Weighting**

<b>Performance Criteria</b>	<b>Definition</b>	<b>Weighting*</b>
Public Safety	Minimizes risk to the public and improves public access and usage with minimal maintenance	30%
Implementation	Minimize complexity of required agreements, optimize stakeholders' support, ensure compatibility with other agency programs, minimize complexity of regulatory compliance, and optimize timing & phasing	23%

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Economic Vitality	Consistency with goals of PAG Vitality Advisory Committee and the City of Tucson Office of Economic Initiatives.	17%
<b>Performance Criteria</b>	<b>Definition</b>	<b>Weighting*</b>
Community	Compatibility with known community or neighborhood historic values, goals, social interactions, health and well-being, and the beneficial and multi-functional use of land	10%
Environmental Sustainability	Preserve, protect, and enhance the land and water while promoting conservation, multi-mode transportation, and minimizing the heat island effect.	20%

\* Out of a total score of 100%

The five weighted Performance Criteria were chosen to rank the recommended alternatives. Individually these Performance Criteria were to be evaluated according to between five and eleven weighted “Specific Criteria” and scored using detailed scoring descriptions (see Appendix E). The scoring of the criteria, both performance and specific, were based upon the evaluation of a scoring matrix (see Appendix E). The initial ranking (i.e., order of priority) of both the recommended structural (see Section 5.2.1) and non-structural (see Section 5.2.2) alternatives would rely upon these criteria. After the initial ranking an opinion of the cost of construction was developed for each the alternatives, not including the area-wide alternatives, and the resulting costs were used to develop a final ranking.

A comprehensive cost/benefit analysis was not performed as part of this study.

**5.2.1 Structural Alternatives Analysis**

The structural alternatives were analyzed in several steps. The first step involved conducting a fatal flaw analysis using hydraulic calculations. This eliminated several

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storm drains options (e.g., considering a new storm drain system when the existing downstream system has no additional capacity) and potential roadway improvements (e.g., curb and gutter at a location that would likely increase the potential for adjacent flooding). The remaining alternatives were then hydraulically modeled to determine their effectiveness on the extent and depth of flooding identified during the existing conditions analysis (see Section 2.0). For several of the alternatives, only the performance of the alternative, during the 10-year event, was considered as evaluation of a given alternative during the 100-year was deemed impracticable based on engineering judgement and regional experience. The resulting maps (i.e., depth grid comparison of pre-improvement versus post-improvement conditions) can be found in Appendix E.

**5.2.2 Non-Structural Alternatives Analysis**

The first step in the analysis of the non-structural alternatives was to apply them to the areas where they were needed the most. In doing this it was determined that all but one of them, the Floodprone Land Acquisition Program (FLAP), could be applied to the entirety of the RBMP study area. The FLAP program was particularly suited to the largely commercial zone as is noted in the Recommended Alternatives Report (see Appendix E). Additionally, a maintenance plan, though considered a basin wide alternative, was deemed so crucial that warranted its own section in the RBMP Implementation Plan (see Volume II). Documentation related to the other area-wide non-structural alternatives can be viewed in Appendix E.

**5.2.3 Alternatives Analysis Findings**

Stantec developed a detailed description of each alternative including: estimate of capacity, area requirements, resulting depth(s) of flow, connectivity, and land acquisition...etc. and the findings of these report are included within the Recommended Alternatives Report (see Appendix E).

**5.3 Recommended Remediation Alternatives**

Based on review of the findings for each alternative evaluated by Stantec in consultation with PCRFC and during several subsequent stakeholder meetings a list of the recommended alternatives was developed. This list represents the alternatives that were

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deemed most practicable for each noted problem area and included some combinations of several of the individual alternatives as explained in Section 5.2.1.

The recommended alternatives, including structural and non-structural, are summarized in the following table. A more comprehensive table, including: additional alternative details, performance and specific criteria scoring, rank based on scoring alone, and cost data in included within Appendix E. An overall rank each of problem area and the recommended alternative is shown within Table 3. Table 4 documents the ranking of the basin wide alternatives.

**Table 3 – Recommended Structural Alternatives**

<b>Problem Area No.</b>	<b>Alternative</b>	<b>Overall Rank (Priority)</b>
1	Shannon Road – drainage channel east side of road to the Rillito River.	13
1	Camino de la Tierra - drainage channel on east side of road to the Rillito River with a retention basin and diversion channel system located to the north and east of Highway Drive.	10
2	Construct retention/detention basin at the site of the old airport runway	16
2	Channel system/network immediately east of I-10 between Gardner Lane and Ruthrauff Road	5
2	FLAP/Consolidate parcels for future private owner - Improvement District/Infill Development Incentives	7
2	Retention basin and diversion channel system – along/near Paradise Lane	12
2	Retention basin just south of Wetmore Road	17
2	Retention basin just west of Highway Drive	9

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<b>Problem Area No.</b>	<b>Alternative</b>	<b>Overall Rank (Priority)</b>
2	Retention basin and diversion channel at the east end of Verbena Avenue	14
3	Retention basin/roadway -- west of Romero Road: improve Root Lane with inverted crown cross section and install curb/gutter for additional conveyance to proposed retention basin at west end of Root Lane along with channel/outlet system	1
4	Retention basin and channel -- South of Rillito Street in conjunction with drainage channel on the west side of Flowing Wells to the Rillito River	2
4	Roadway/channel -- Inverted crown roadways, curb/gutter along: Pomona, Rillito, Ruth and Camino Aire Fresca (streets)	14
5	Retention basin - South of Pelaar Street	8
6	Repair channel tiles along Flowing Wells Wash	11
7	Retention basin – western edge of Don Hummel Park	2
8	Reconstruction - Intersection of Roger Road & Tyndall Avenue	4
8	Dry wells – install near intersection of Roger Road and Tyndall Avenue	6
9	Road Improvements - Greenlee Road, Vine Avenue, Kleindale Road, Cherry Avenue, Martin Avenue...etc.	18

\*an exhibit was not prepared for this problem area as result of discussions with PCRFC

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**Table 4 – Recommended Non-Structural Alternatives**

<b>Area-Wide Alternative</b>	<b>Overall Rank (Priority)</b>
Declare entire project area a critical basin (i.e. new development to reduce flows below predevelopment levels)	2
Regular maintenance and solutions regarding agency and residents' cleaning vegetation from channels and enforcing vegetation removal in channels crossing private land	5
Infill incentives	3
Public information/education/outreach campaign -- possibly in utility bills (Tucson Clean and Beautiful)	1
GI/LID	4
Dry wells	6
Floodproofing	7

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## **6.0 Outreach**

Public engagement was a crucial element of this project. Engagement included:

- Individual stakeholder meetings held with key agencies.
- Meetings with community leaders.
- Public Open House meetings were held at critical project milestones of the project to both inform the public of the project's goals and progress as well as to obtain citizen feedback on the projects' objectives and obtain witnessed events of flooding and/or drainage issues and concerns.
- Workgroup sessions used to assemble and evaluate alternatives (both structural and non-structural) considered within this project.
- Periodic project updates.
- A project website.

The following sections contain additional information regarding the type of and information collected and disseminated at each outreach effort.

### **6.1 Public Open House Meetings**

Two public open house meetings were held for the RBMP project at key milestones. The first meeting was held during on December 14, 2014 during the initial phase of the project (i.e., data collection period) to explain to the public the project's goal and objective and to gather feedback on drainage issues in this region. The second meeting was held on November 16, 2016 to present to the public the preliminary findings of the project.

A detailed report of both public meetings was prepared for this task and is included within Appendix F.4 and includes all citizen comment feedback forms collected.

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**6.2 Stakeholder Involvement**

The primary intent of the stakeholders' meetings was for informational purposes. Stakeholder involvement for this project included two presentations: the first held on July 23, 2014 to all public sector stakeholders (e.g., PCRFD, Stantec, COT, ADOT, Pima County...etc.) and the second was held on October 23, 2014 and was open to all stakeholders (e.g., citizens, homeowner associations, school districts...etc.).

**6.2.1 Stakeholder Meeting 1: July 24, 2014**

This was the first stakeholder meeting for the RBMP. The purpose of this session was to familiarize the local government stakeholders with purpose, tasks, deliverables, and schedule of the project. The format for the meeting was an informational presentation followed by a discussion. The agenda and meeting summary for this stakeholder meeting are included within Appendix F.1.

**6.2.2 Stakeholder Meeting 2: October 23, 2014**

This was the second and final stakeholder meeting. The attendees of this meeting were stakeholders from school districts, utilities, and community organizations with the purpose of dispensing information about the RBMP and receiving input from them. The agenda, meeting summary, and relevant documents for this stakeholder meeting are included within Appendix F.2.

**6.3 Project Website**

A project website detailing the elements, description, and the location of the Ruthrauff BMP has been produced and maintained by PCRFD. Additional information available on the website includes periodic project updates as well as public involvement to date and completed project reports.

**6.4 Project Updates**

PCRFD has periodically released project updates to inform the public of the project progress to date. There have been 4 updates:

- October 2014

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- December 2014
- November 2015
- November 2016

These project updates and their contents are documented in Appendix F.4.

### **6.5 Workgroups**

In contrast to the stakeholder meetings, the workgroups primary purpose was direct interaction and collaboration of stakeholders with the project team for improving aspects of the RBMP. Workgroup meetings were held frequently to develop potential alternatives to address flood and/or drainage problems within each critical area (see Section 5.1) and to develop performance and specific criteria (see Section 5.2) used to score each potential alternative.

#### **6.5.1 Workgroup 1: June 6, 2015**

This objective of this meeting, as described in Section 5.2, was to build a scoring system for ranking the recommended alternatives. The agenda, meeting summary, and related documents for this workgroup meeting are included within the Recommended Alternatives Report (see Appendix E).

#### **6.5.2 Workgroup 2: February 8, 2016**

The second of the workgroup meetings involved producing a comprehensive list of alternatives to consider for the RBMP (see Section 5.1). The agenda, meeting summary, and related documents for this workgroup meeting are included within the Recommended Alternatives Report (see Appendix E).

#### **6.5.3 Workgroup 3: August 31, 2016**

This was the last of the workgroup meetings after all the alternatives analysis and scoring had been performed. It was intended to inform the stakeholders from government and the neighborhoods of what the recommended remediation alternatives were and how they

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ranked per cost and criteria. The agenda and meeting summary for this workgroup meeting are included within the Recommended Alternative report (see Appendix E).

## **Appendix A – References**

*Report on the Existing 100-year Flooding Conditions within the Gardner Lane Area: City of Tucson Contract No. 0401-81, Cella Barr Associates; November 10, 1981*

*Hydrologic Investigation for Gardner Lane Area: City of Tucson Contract No. 0401-81, Cella Barr Associates; June 3, 1981*

*Alternative Design Schemes for the Gardner Lane Area: City of Tucson Contract No. 0401-81, Cella Barr Associates; June 16, 1981*

*I-10 mainline Reconstruction Casa Grande – Tucson Highway (I-10) Ruthrauff to Prince Road Final Drainage Report: ADOT Project No. 010 PM 252 H6241 01C, AECOM; April 2011*

Hydraulic analysis program (two dimensional modeling), FLO-2D, Pro Version (FLO-2D Software Inc., Post Office Box 66, Nutrioso, Arizona.

Hydraulic analysis program (one dimensional river analysis), HEC-RAS, version 4.1 (Hydrologic Engineering Center, 609 Second Street Davis, California, January 2010).

Hydrologic analysis program, HEC-1 (Hydrologic Engineering Center, USACOE, June 1998)

*Criteria for Two-Dimensional Modeling, Technical Policy, Tech-033, Pima County Regional Flood Control District; August 1, 2013*

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*Comprehensive Plan Update, Pima Prospers, Planning and Zoning Commission Public Hearing Draft, The Pima County Planning and Zoning Commission, File Number C07-13-10, Resolution No. 2009-63; March 25, 2015*

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Final Report  
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**Implementation Plan**



Prepared for:



**Pima County Regional Flood  
Control District**

Prepared by:  
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**September 11, 2017**



**Expires 12-31-19**

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**Executive Summary**

The Implementation Plan for this project was conceived and completed with the goal of maximizing implementation opportunities for the Recommended Alternative(s) of the Ruthrauff Basin Management Plan (RBMP). The results of the completed study, the Maintenance Plan, Infill Incentives and Implementation Recommendations are summarized in this Implementation Plan which is Volume II of II of the RBMP. This is the plan for moving forward with the funding, phasing, and construction of the recommended alternatives contained within the RBMP as described in Volume I of II, Drainage Improvement Plan.

The Implementation Plan has been developed iteratively and in cooperation with the Pima County Flood Control District, the City of Tucson, stakeholders, and other cooperating agencies. It lays out a path for implementation of non-structural and area-wide improvements that can begin at adoption and Capital Improvement Projects that begin at the downstream edge of the basin.

The Recommended Alternatives for this project are comprised of structural and non-structural solutions at various locations. These locations are distributed throughout the project area and include construction and non-construction activities that will ultimately be funded in one of three ways:

- 1) **Solely** funded by the District or the City of Tucson.
- 2) Funded solely or in **partnership** among private and/or public agencies **including** the District and/or the City of Tucson.
- 3) Funded **solely or in partnership** among private and/or public agencies **not** including the District.

The Recommended Alternatives were developed after extensive technical review of the drainage infrastructure and land use conditions in the project area. Significant effort was also put forth by the project team to involve the general public, as well as public and private sector stakeholders, in development of the Recommended Alternatives. Included

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within Volume I of II of the RBMP report is documentation of the public and stakeholder activities and responses.

The Implementation Plan does not represent a binding legal agreement on any partners, but does provide a solid summary of implementation efforts to date, as well as a roadmap for the Pima County Regional Flood Control District to implement future aspects of the RPMP. Often the schedule or funding for improvements will drive the implementation timeline and recognition of this fact by the District and planning for this in future follow through efforts will allow for cost effective and efficient construction completion.

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**Abbreviations**

**Units**

cfs	cubic feet per second
F	degrees Fahrenheit
ft	Feet
in	Inch
lbs	Pounds
mi	Mile
sq.ft.	square feet

**Agencies, Firms, misc.**

ADOT	Arizona Department of Transportation
FIRM	Flood Insurance Rate Map
FLAP	Floodprone Land Acquisition Program
FEMA	Federal Emergency Management Agency
GI/LID	Green Infrastructure/Low Impact Development
CIP	Capital Improvement Plan
COT	City of Tucson
CBC	Concrete Box Culvert
I-10	Interstate 10
JEF	JE Fuller Hydrology and Geomorphology Inc.
LOMR	Letter of Map Revision
NFIP	National Flood Insurance Program
PCDOT	Pima County Department of Transportation
PCRFCDD	Pima County Regional Flood Control District
RBMP	Ruthrauff Basin Management Plan
RTA	Regional Transportation Authority
Stantec	Stantec Consulting Services Inc.
TSMS	Tucson Stormwater Management Study
UPRR	Union Pacific Railroad
WDG	Wheat Design Group

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**1.0 Purpose**

The purpose of the implementation plan is to lay out a strategy for implementing the recommended alternatives, including both non-structural and structural, area-wide and problem area specific drainage solutions.

**2.0 Process**

The project team reviewed the existing conditions drainage constraints, recommended alternatives and the institutional desires described in FNWACC-prepared documents, and Pima Prospers to develop an implementation plan.

Historically, flood flows pond on the west side of the basin due to the embankment of the Union Pacific Railroad which is located immediately east of Interstate 10. A lack of adequate drainage from the east of the Union Pacific Railroad line to the Santa Cruz River was highlighted repeatedly as the ultimate source of the flooding problems on the western edge of the study area. This provided a basis for beginning drainage improvements, at the downstream end of the watershed and moving upstream

The Ruthrauff basin is developed (e.g., commercial, industrial, residential...etc.) and has been the target of a recent comprehensive plan amendment (Co7-08-01, Res. No. 2009-63), which will allow Pima County to initiate infill incentives districts including development of a comprehensive flood control plan that addresses the chronic ponding and flooding up against the railroad embankment on the western edge.

**2.1 Technical Summary**

Stantec Consulting Services Inc. (Stantec) provided professional consulting engineering services to develop a plan, that: identified flood hazard areas using improved topographic information and new hydraulic modeling technics (i.e., two-dimensional modeling), collected drainage compliant reports, reviewed drainage problems, and identified cost-effective solutions to alleviate or manage flooding in the study area.

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The available data and results of this comprehensive analysis and recommended alternatives are accessible in the RBMP Volume I of II. In real terms, Volume I of II lays out the drainage problems and solutions.

**2.2 Products**

Volume II of II of the Ruthrauff Basin Management Plan focused on the steps needed to implement the solutions to the drainage problems. Accompanying this Implementation plan is a Maintenance Plan designed as a roadmap for building a maintenance program as well as estimated costs for specific Recommended Alternatives set forth in the RBMP Volume I. The implementation plan also includes an Infill Incentives Plan to describe how redevelopment, as identified by the Flowing Wells Neighborhood Association revitalization plan, can occur in the unincorporated Pima County portions of the study.

**2.2.1 Benefits of Floodplain Mapping**

Hydrologic and hydraulic analysis of the Ruthrauff Basin determined that the existing FEMA floodplain mapping needed to be re-delineated for the area south of Gardner Lane, east of I-10, west of Romero Road, and north of Flowing Wells Wash, especially considering the improved conveyance at the Flowing Wells Wash through the railroad embankment south of Prince Rd. In November of 2016, JEF, acting as a sub-consultant to Stantec as a part of the RBMP, submitted a Letter of Map Revision (LOMR) to the Federal Emergency Management Agency (FEMA) for the Flowing Wells Wash and Runway Drive Area (Case No. 17-09-0333P). The purpose of the LOMR is to revise the 1988 Flood Insurance Rate Maps (FIRM) for Panel Numbers 04019C1667L, and 04019C1669L based on structural drainage improvements, updated topography, and better hydraulic modeling method(s). At the time of this report the LOMR effective date is still pending.

The results of the LOMR indicated a dramatic reduction in floodplain limits which will result in more developable property in the remapped area. The advantages of the remapping are summarized in the benefits identified by the City of Tucson (see Appendix F).

The data provided to the PCRFD from the RBMP will be made available to the City of Tucson GIS staff to update local floodplain themes on Map Tucson for use by private and public development.

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**2.2.2 Maintenance Plan**

As part of the RBMP, Stantec prepared a Maintenance Plan (see Appendix B). Residing within the Implementation and Maintenance Plan is a guideline for identifying, scheduling, and performing maintenance on existing and proposed drainage infrastructure. It is intended as a guideline only for persons and entities seeking direction in developing maintenance plans and preliminary costs for drainage facilities within the Ruthrauff Basin.

The cost estimates are presented as annual and lifetime costs. The lifecycle for all the recommended alternatives was estimated to be 50 years. As this is just a preliminary estimate there was no adjustment for future inflation. Inspection and maintenance activities were broken down on a per unit basis. The costs of inspections were estimated by unit duration and the costs of maintenance activities were estimated to be 5% of the original cost of construction annually. The unit costs include labor, equipment, fuel, permits and supplies. Each of those separate tasks would have to be broken down individually for any comprehensive maintenance plan that would be developed for post-construction support of any specific alternative. The cost breakdowns and lifetime cost estimates can be viewed within the Maintenance Plan

**IMPLEMENTATION PLAN**

## **3.0 Implementation Recommendations**

### **3.1 Importance of Plan Adoption by Jurisdictions**

The first step in the implementation of the Ruthrauff Basin Management Plan should be the passing of resolutions adopting the plan by the jurisdictions which share the basin. The RBMP is an organizational plan wherein the framework for a basin-wide stormwater management program is established. Only a legislative body can commit funds to implement this framework and adoption is the first step in this process. Adoption is particularly useful in securing funding from certain state and federal programs as several these programs require adoption for the reasons outlined above. This includes use of the Plan in the eventuality of an emergency declaration and administration of the NFIP.

Adoption of the RBMP means that the technical data related to existing conditions, the identification of potential flood hazards and the recommendations for remediation that exist within the report has been accepted and can officially be used by the appropriate agencies within jurisdictions to develop floodplain management protocol while enhancing public safety, encouraging economic development, and ensuring fiscal responsibility. It enables integrated regional planning for land use, infrastructure, and water resources while encouraging a cooperative approach by the City and the County. Adoption is required if recommendations in the RBMP are to be used by the Pima County and the City of Tucson in a regulatory capacity as only a legislative body can approve regulations for the public. Additionally, adoption of the plan sends a message to the constituents of these jurisdictions, both residential and commercial, that their concerns about drainage issues in the area are being addressed. This is especially true of the FWNACC which has requested that Pima County and the City of Tucson work collaboratively in the RBMP to develop drainage solutions.

Once adopted by the Board of Supervisors and the City Council, anticipated in the Fall of 2017, this plan will provide guidance for development, redevelopment, and retrofits in flood prone areas as well as drainage alternatives to further limit the potential for flooding. This study relied on interagency coordination to preserve the hydrologic integrity and storm water conveyance ability of the Ruthrauff watersheds. The adoption of this basin management plan will ensure that the floodplain management regulations will balance competing residential community and private sector interests.

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The Resolution for Adoption; Pima County Board of Supervisor is included in Appendix C, and the Resolution for Adoption; City of Tucson Mayor and Council is included in Appendix D.

**3.2 Capital Improvement Plan Framework Established**

One option for the implementation of the RBMP is through establishment of Capital Improvement Plans (CIP). There are several projects being initiated on the western edge of the basin that establish a good framework for such a plan. One of the biggest issues plaguing the Ruthrauff Basin is the lack of drainage under the UPRR. While major improvements to drainage under I-10 to the Santa Cruz River were completed many years ago the lack of drainage infrastructure at the railroad right-of-way cause the tracks to act as a linear embankment trapping the water before it can reach these facilities. These projects seek to mitigate that problem by significantly improving conveyance to the Santa Cruz.

The PCRFCDD has contracted Kimley-Horn to design two culverts underneath the UPRR that will take advantage of existing I-10 infrastructure. Both culverts, located at Gardner Lane (see Appendix E, Exhibit 4, Volume II of II) and Zinnia Avenue (see Appendix E, Exhibit 2, Volume II of II) to complement a culvert to be constructed along Highway Drive, will bring improved drainage to Problem Area 2 identified in the Recommended Alternatives Report (see Appendix E, Volume I of II). Additionally, slated for construction in 2018, ADOT is in the planning the improvement of the I-10 interchange at El Camino Del Cerro/Ruthrauff Road which will invariably include drainage upgrades.

These infrastructure improvements bring increased opportunity to “drain the tub”. The improved ability to convey water out of the area creates an opportunity for CIP project development. This approach can open many avenues for implementation funding including private/public partnerships for economic development, Federal Community Development Block Grants (CDBG), and sponsorships from other governmental departments and agencies (ADOT, FHWA, etc.).

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**3.3 Phasing of Recommended Alternatives: Downstream to Upstream**

The construction of needed conveyance improvement projects on the perimeter of the Ruthrauff Basin (see Section 3.2) and connector channels to link those projects will enhance the ability for runoff to enter the major watercourses more easily. This would be the beginning of the phasing for the implementation of the recommended alternatives. Currently, as excess runoff flows toward the Santa Cruz on the western edge of the basin and the Rillito on the northern edge, a lack of adequate conveyances causes the water to pile up and flood streets and neighborhoods. Once this conveyance has been improved the phased implementation of the recommended alternatives will alleviate the issues in the problem areas. Exhibit A illustrates the improvements possible with implementation and are described below.

**3.3.1 Problem Areas 1 & 2: North of Curtis Road, Highway Drive, Camino de la Tierra, Emerald Avenue & South of Ruthrauff Road to Gardner Lane and South East along Runway Drive**

As these problem areas are on the extreme western edge of the basin, and immediately upstream of the Santa Cruz River, they would be included in the first phase of implementation. Their proximity of the to I-10 and shopping areas north of the Rillito make this a prime target for not only industrial but commercial and residential redevelopment. Funding opportunities that exist for these areas can include a CIP area that could encourage public/private partnerships.

**3.3.2 Transportation Projects which For Partnership in Perimeter Drainage Improvements**

Exhibit A also notes that there is potential for drainage improvements associated with planned transportation projects. ADOT is in the process of designing the Ruthrauff Transportation Interchange (TI), slated for construction in 2018, which will include drainage improvements. RFCDD has been coordinating with ADOT in this process, which should further improve drainage at the UPRR embankment on the Ruthrauff Rd. alignment in Area 2. West of I-10 work is being completed to connect the outfall of drainage from the Ruthrauff Basin into the Santa Cruz River which will enable full function of projects in the problem areas including the Gardner Lane drainage improvements.

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In addition, Pima County Department of Transportation has plans to extend Sunset Rd through drainage problem Area 1, and connect it to River Rd. This can be an opportunity to implement drainage improvements associated along this proposed alignment.

**3.3.3 Problem Area 4: North of Ruthrauff Road and West of Flowing Wells Road**

This area would also be included in the first phases of implementation. It is on the northside of the basin and is therefore on the downstream edge of conveyance to the Rillito River which would need to be improved concurrently with conveyance to the Santa Cruz River. Improved drainage facilities in this area open the door for residential revitalization by private developers attracted by the current relatively low property costs.

**3.4 Incentivize the Private Sector with Infill Incentives**

The development of Infill Incentives is another prospect for funding the implementation of the RBMP through encouraged private sector participation in economic development and community redevelopment to improve drainage to the perimeter public improvements. The PCRFCDD has initiated a tiered approach to Infill Incentives for parcels under two (2) acres based upon the flow depths shown in the FLO-2D models for the basin (see Appendix C, Volume I of II). The reasoning behind this is to remove roadblocks for the redevelopment of smaller parcels where drainage studies can present a prohibitive cost. Under this approach, a depth of flow of less than a foot in the 100-yr event would not need a drainage report, a depth of flow of 1-2 feet in the 100-yr event would need to consult with Flood Control and they would determine if a drainage engineering report is necessary, and any depth of flow greater than two feet would require an engineering drainage report. There are other requirements attached to each of these tiers that can be viewed in Appendix E of this Implementation Plan.

The areas along Highway Drive and Garner Lane, because of their proximity to I-10 and the relatively low value of the existing parcels, has been identified as a prime area for redevelopment. Pima County has already taken the first steps toward establishment of an Infill Incentive District by re-zoning the area for multi-use and green lighting its development (Co7-08-01, Res. No. 2009-63). The primary proposed incentives along

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Highway Drive involve providing private sector development with drainage corridors to be able to connect with the planned publicly constructed drainage infrastructure under the UPRR. The proposed channel improvements are available in Appendix E of this Implementation Plan. The ability to keep water off property is a great incentive for private development.

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**EXHIBIT A**

# First Phase: Current Projects & Proposed Alternatives for Basin Drainage to Major Watercourses

- Union Pacific Railroad
- Tucson City Limits
- Major Wash
- Study Area
- Roadway Right-of-Way
- Parcels

PCDOT- Sunset Rd  
Drainage Improvements

W Sunset Rd

**Problem Area 1:**  
Alternative 1 - Concrete Channel  
Alternative 2 - Earthen Channel Basin

Curtis St

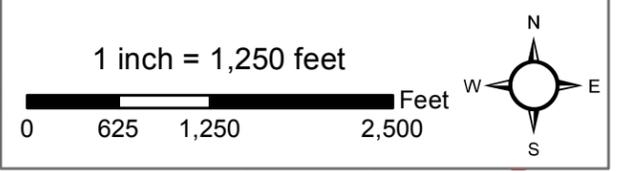
W EL CAMINO DEL CERRO

ADOT- Ruthrauff TI  
Drainage Improvements

Problem Site 01/07/2016  
Flo 2D 100 yr Flood Limits 11/02/2015

**Problem Area 2:**  
Alternative 2 - Channels  
Ruthrauff UPRR Culverts

**Problem Area 4:**  
Alternative 1 - Earthen Channel Basin  
Alternative 2 - Roadway Reconstruction



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**3.5 Improving Internal Drainage to Perimeter Drainage Improvements**

These areas would be included in the next phase of implementation. With conveyance improved downstream, the internal structural recommended alternatives in these areas would be connected to that perimeter drainage. Examples of these kinds of projects are shown in the following Exhibit B.

**3.5.1 Problem Areas 3 & 5 North of Ft Lowell to Ruthrauff and West to Flowing Wells**

There are opportunities in these areas for funding from other agencies (e.g. Pima County DOT) that a CIP would encourage because of improved infrastructure and property protection. Other improvements might be achieved as a condition of rezoning in redevelopment.

**3.5.2 Problem Areas 7, 8, & 9: North of Prince Road to the Rillito and East of Flowing Wells**

These areas would be included in later phasing of implementation. The internal structural solutions in these areas would convey water north to the Rillito increasing property values and public safety. These areas also would benefit from a CIP and perhaps public funding. These might be able to be implemented as part of rezoning and redevelopment of parcels in these areas.

**3.6 Area-Wide and Non-Structural Alternatives Implementation**

The implementation of the non-structural and area-wide alternatives can be phased concurrently with the areal structural alternatives. Implementation of these alternatives depend heavily on adoption of the RBMP by the jurisdictions of the basin.

In addition to infill incentives, and maintenance, described previously; recommended area-wide solutions include public education on flood risk and flood safety, and implementation of GI/LID features.

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These area-wide solutions will require stakeholder collaboration, and funding such as community development block grants (CDBGs) for implementation.

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**EXHIBIT B**

# Later Phases: Internal Structural Components

-  Tucson City Limits
-  Study Area
-  Major Wash
-  Parcels
-  Roadway Right-of-Way
-  Union Pacific Railroad

## Problem Area 3:

Alternative 1 - Inverted Crown Roadway  
Earthen Channel  
Basin

## Problem Area 7:

Alternative 1 - Basin

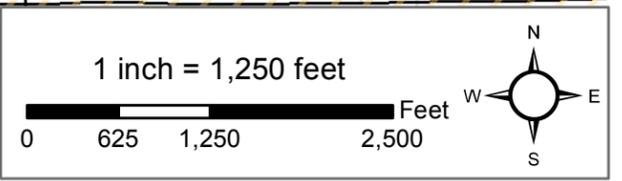
## Problem Area 5:

Alternative 1 - Basin

## Problem Area 8:

Alternative 1 - Roadway and  
Stormdrain Improvements

-  Problem Site 01/07/2016
-  Flo 2D 100 yr Flood Limits 11/02/2015



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## **4.0 Conclusion**

In conclusion, the adoption of the Ruthrauff Basin Management Plan by the City of Tucson and Pima County would greatly facilitate its implementation. As a framework for recommended improvements it leaves open opportunities for improved economic and community development without handcuffing public budgets. The proposed improvements for conveyance under the UPRR to the Santa Cruz River opens the door to a redevelopment. Implementation benefits the residents and property owners in the basin who are looking for the tools of revitalization and avenues for reduced flood hazards and related costs. The development of Capital Improvement Plans and Infill Incentives would encourage private sector development as well as incentivize private/public partnerships. Adoption of the RBMP would open opportunities for block grants and other sources of funding and additional resources from local, state and federal agencies.

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**Appendix A – References**

*Ruthrauff Basin Management Plan: Volume I of II*, Stantec Consulting; February 14, 2017

*Comprehensive Plan Update, Pima Prospers*, Planning and Zoning Commission Public Hearing Draft, The Pima County Planning and Zoning Commission, File Number C07-13-10, Resolution No. 2009-63; March 25, 2015

*Sunset Road – Silverbell Road to I-10*, Pima County Transportation/RTA, Website; <http://webcms.pima.gov/cms/One.aspx?pageId=66493>

*Comprehensive Plan Update, Pima Prospers*, Planning and Zoning Commission Public Hearing Draft, The Pima County Planning and Zoning Commission, File Number C07-13-10, Resolution No. 2009-63; March 25, 2015