Lee Moore Wash Basin Management Study

Volume 3

Implementation Plan

Adopted by Pima County Regional Flood Control District Board of Directors June 1st, 2010

Adopted by City of Tucson Mayor and Council October 19th, 2010

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Stantec Project No.: 185120071

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Expires 12/31/2013

EXECUTIVE SUMMARY

The Stakeholder Involvement program for this project was designed by C.L. Williams Consulting, Inc. (CLW), and completed with the goal of maximizing implementation opportunities for the Recommended Alternative(s) of the Lee Moore Wash Basin Management Study (LMWBMS). The results of the Stakeholder Involvement and Implementation Strategy are summarized in this Implementation Plan which is Volume 3 of 3 of the LMWBMS. The Implementation Plan details the Recommended Alternative(s) by location, capital improvement costs, potential cost sharing partner, participation interest, potential mechanism for participation and preliminary timeline whenever possible. The Implementation Plan has been developed iteratively and in cooperation with the affected stakeholders. It 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 implementation efforts since the LMWBMS has been adopted by the Board of Directors, the City of Tucson and the Town of Sahuarita (see Appendices A, B, C for copies of the signed Resolutions). The Arizona State Land Department (ASLD) which owns approximately 48% of the land in the Basin was involved throughout the LMWBMS and has provided a Letter of Concurrence for the Study (see Appendix D). Several of the Recommended Alternatives are connected with other agency programs. The result is that often their schedule or funding will drive the implementation timeline. 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. If the coordination is not continued after LMWBMS completion, it is possible that other agencies will move ahead with their projects and not include Recommended Alternatives drainage improvements.

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.
2) Funded solely or in **partnership** among private and/or public agencies **including** the District.
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 within Volume 2 of 3 of the LMWBMS report is documentation of the public and stakeholder activities and responses.

STAKEHOLDER INVOLVEMENT PROGRAM APPROACH

The Stakeholder Involvement program for this project was designed and completed with the goal of maximizing implementation opportunities for the Recommended Alternatives of the Lee Moore Wash Basin Management Plan (LMWBMS). To achieve this end, the "3-I's" method (Inform, Involve and Include) to interact with stakeholders was utilized. Simply put, the 3-I's method of Stakeholder Involvement is to utilize a 3-Phase approach as identified in the accompanying Stakeholder Flowchart (see Appendix F) & Implementation Plan Summary below:

Phase 1

Inform the stakeholders of the project at the early stages to obtain any useful knowledge they may have from a data collection standpoint, as well as to receive any initial input they may have regarding scope of work or process. This was accomplished through facilitated workgroups of stakeholders with similar mandates, jurisdictions, and interests (i.e. private and public sector). Several individual meetings were also held for those stakeholders with a unique interest (i.e. Diamond Ventures, etc.). Stakeholders and their preliminary concerns/interests were identified and compiled into a spreadsheet which was used as the baseline database for the rest of the stakeholder involvement program. The Stakeholder database (see Appendix G) is included herein for completeness.

Phase 2

Involve the stakeholders throughout the course of the LMWBMS so that they stay informed and interested in the project. This also allowed for them to see how and the reasons why, or why not, their input would be included in the development of alternatives. This was accomplished through the use of

facilitated workgroups as well as individual meetings. An added benefit of maintaining contact throughoout the course of the project is that new staff members from the agencies were educated prior to being shown the end product. Their involvement was instrumental in developing the matrices used for all of the alternatives evaluated at each site as documented in Volume 1 of the LMWBMS .

Phase 3

Include the stakeholders in the process of selection of the Recommended Alternative(s). This effort included information exchange and discussion of:

a) costs of capital improvements
b) costs of maintenance
c) conceptual cost sharing agreements for capital improvements
d) conceptual agreements on maintenance responsibilities
e) conceptual construction timelines coordinated with other agencies' projects and budgets.

This was accomplished using a combination of workgroups and individual meetings because of the iterative nature of these negotiations. Stakeholders' input was considered in the conceptual design plans and cost estimates contained in Volume 1 of the LMWBMS .

IMPLEMENTATION SUMMARY

The results of the Stakeholder Involvement and Implementation Strategy are summarized in the following Implementation Summary. The Summary details the Recommended Alternatives by location, capital improvement costs, potential cost sharing partner, participation interest, mechanism for participation and preliminary timeline. The Implementation Summary was

developed iteratively and in cooperation with the affected stakeholders. It does not represent a binding legal agreement on any partners, but does provide a solid summary of implementation strategies to date and a roadmap for the Pima County Regional Flood Control District (District) implementation efforts since it was adopted by the Board of Directors on June 1st, 2010. Many of the Recommended Alternative(s) are connected with other agency programs. The result is that often their schedule or funding will drive the construction timeline. 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. If the coordination is not continued after LMWBMS completion, it is possible that other agencies will move ahead with their projects and not include Recommended Alternatives drainage and flood mitigation improvements.

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.
2) Funded solely or in **partnership** among private and/or public agencies **including** the District.
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 within Volume 2 of 3 of the LMWBMS Report is documentation of the public and stakeholder activities and responses. The stakeholder effort was designed and carried out so as to maximize development of Recommended Alternative(s) that could be implemented as efficiently and cost-effectively as

possible. The purpose of this Plan is to summarize the key opportunities and constraints for implementation of the Recommended Alternatives.

RECOMMENDED ALTERNATIVE OPPORTUNITIES AND CONSTRAINTS (Existing Conditions)

The Recommended Alternatives for the existing conditions are organized into the four (4) Planning Areas of the project with specific sites in each planning area. The Planning Areas (in capital letters) and identified problems within each planning area (designated numerically) are as follows:

LMWBMS Area-Wide Problem Area

1. **25 drainage complaints within unplatted areas north of Sahuarita Road; 60% related to access and flooding issues**
2. **20 drainage complaints along Wilmot corridor unplatted areas; 35% related to access and flooding issues.**
3. **35 drainage complaints within unplatted areas east of Wilmot Road; 40% related to access issues**
4. **Existing Stock Pond/Diversion Structures**
5. **Enhance Public Education and Outreach**
6. **Flooding within unplatted residential areas**

Franco/Flato/Summit Area Problem Area

1. **Old Vail Road; Franco Wash 100-year flow depth 7-8 feet**
2. **Summit Street; Franco Wash 100-year flow depth 3-4 feet**
3. **Flooding along Franco Wash; potential flooding of 45-50 structures within Summit Area**

4. **Flooding along Summit Wash; potential flooding of 30-35 structures from County Club to Nogales Highway**
5. **Additional flooding along Franco Tributary south of Old Vail Road**
6. **Flooding along Flato at Old Nogales Highway**
7. **Maintenance of Lee Moore Channel Bank Protection/Bank Erosion**
8. **Franco Wash at Houghton Road: +/-1000 feet, depth >1 foot**
9. **Flato Wash at Houghton Road--depth>1 foot**
10. **Stock ponds upstream of Wentworth/I-10 interchange--potential flooding at interchange with failure**
11. **Stock Ponds/diversions along Flato main corridor--potential diversion of flow north into Franco watershed**
12. **New Tucson all-weather access issues at several crossings; undersized culverts at several crossings**
13. **Impacts of stock ponds/diversion structures south of Sahuarita Road and New Tucson area**

Cuprite/Fagan/Petty Ranch Area Problem Area

1. **FICO Channel lacks capacity to convey flow north, breakout/flooding to west**
2. **Sahuarita Road-all-weather access limited from east near Wentworth Road to Houghton**
3. **Approximately 2 miles of Sahuarita Road - Houghton Road to Rita Road alignment**
4. **Houghton Road-all-weather access limited from north**
5. **Houghton, Sahuarita Area--flooding/erosion issues**

Sycamore Canyon & Gunnery Range Area Problem Area

1. **Sahuarita Road-Rita Road alignment to Nogales Highway**

2. **Undersized/clogged culverts in Sycamore Canyon Estates south of Sahuarita Road**
3. **Complaints about integrity of berm along Columbus Boulevard, north of Dawson, east of Irving**
4. **Sahuarita, Delgado, Dawson: FICO channel--lack of capacity/sedimentation causes residential flooding**

A brief description of the problem and overview of the Recommended Alternatives for each of the sites follows.

LMWBMS Area-Wide Recommended Alternative(s)

1. **25 drainage complaints within unplatted areas north of Sahuarita Road; 60% related to access and flooding issues.**

   - Structural Alternatives:
     - ***Floodproofing*** – Approximately 6 structures in this area could be protected from flooding by floodproofing.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

2. **20 drainage complaints along Wilmot corridor unplatted areas; 35% related to access and flooding issues.**

   - Structural Alternatives:
     - ***Floodproofing*** – Approximately 17 structures in this area could be protected from flooding by floodproofing.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

3. **35 drainage complaints within unplatted areas east of Wilmot Road; 40% related to access issues**

   - Structural Alternatives:
     - ***Floodproofing*** **–** Approximately 7 structures in this area could be protected from flooding by floodproofing.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

4. **Existing Stock Pond/Diversion Structures**

   - Non-Structural Alternatives:
     - ***Ensure maintenance, operation, study and analysis of stock ponds with future development*** **–** There are at least 105 stock ponds in this area to which this alternative could apply.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

5. **Enhance Public Education and Outreach**

   - Non-Structural Alternatives:
     - ***Public Education and Outreach*** **–** At least annually the District should disseminate information regarding flood and drainage hazards

and LMWBMS implementation status.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

6. **Flooding within unplatted residential areas in the Sahuarita, Santa Rita and Dawson areas**

   - ***Improvement District(s)* -** The Improvement District(s) allow property owners to pay to bring their infrastructure up to Standard so that a public agency can accept maintenance for the infrastructure.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

Franco/Flato/Summit Area Recommended Alternative(s)

1. **Old Vail Road -- Franco Wash 100-year flow depth 7-8 feet**

   - <u>Non-Structural Alternatives:</u>
     - ***Automatic barricade control* –** This alternative would require the installation of two (2) automatic barricades to prevent vehicles from entering flooded roadway. This could be a temporary alternative that would be removed once the culvert system was installed.

   - <u>Structural Alternatives:</u>
     - ***Install culverts* –** A total of 11- 10’ x 4’ RCB’s were sized within this area.

There was no negative feedback from the public regarding this component of the Recommended Alternatives. The County will be the lead agencies for implementation of this alternative and will be responsible for pursuing an Intergovernmental Agreement (IGA) with the County and City Department of Transportation's as well as the District.

2. Summit Street -- Franco Wash 100-year flow depth 3-4 feet

- Non-Structural Alternatives:
  - ***Automatic barricade control*** **–** This alternative would require the installation of two (2) automatic barricades to prevent vehicles from entering flooded roadway.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

3. Flooding along Franco Wash--potential flooding of 45-50 structures within Summit Area

- Non-Structural Alternatives:
  - ***Public Education and Outreach*** **–** While this can't be quantified, the effects of the dissemination of information should be measured in reference to reaching the goals being evaluated.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

4. **Flooding along Summit Wash--potential flooding of 30-35 structures from County Club to Nogales Highway**

   - Non-Structural Alternatives:
     - ***Public Education and Outreach*** **–** While this can't be quantified, the effects of the dissemination of information should be measured in reference to reaching the goals being evaluated.

   - Structural Alternatives:
     - ***Regional detention basin*** **–** The facility evaluated at this location would require about six (6) acres to meet design criteria.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

5. **Additional flooding along Franco Tributary south of Old Vail Road**

   - Non-Structural Alternatives:
     - ***Public Education and Outreach*** **–** While this can't be quantified, the effects of the dissemination of information should be measured in reference to reaching the goals being evaluated.

   - Structural Alternatives:
     - ***Regional detention basin*** **–** The facility evaluated at this location would require about 7 acres to meet design criteria.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

6. Flooding along Flato at Old Nogales Highway

- Non-Structural Alternatives:
  - ***Floodprone Land Acquisition Program (FLAP)*** **–** Approximately 13 structures can participate in the FLAP in this area.
  - ***Public Education and Outreach*** **–** While this can't be quantified, the effects of the dissemination of information should be measured in reference to reaching the goals being evaluated.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

7. Maintenance of Lee Moore Channel Bank Protection/Bank Erosion

- Structural Alternatives:
  - ***Bank stabilization*** **–** There is 7,2000 linear feet of bank applicable to this alternative.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

8. Franco Wash at Houghton Road: +/-1000 feet, depth >1 foot

- Non-Structural Alternatives:
  - ***Automatic barricade control*** **–** This alternative would require the installation of two (2) automatic barricades to prevent vehicles from

entering flooded roadway. This could be a temporary alternative that would be removed once the culvert system was installed.

- Structural Alternatives:
  - ***Install culverts*** **–** A total of 7- 10' x 4' RCB's were sized within this area.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

9. Flato Wash at Houghton Road--depth>1 foot

- Non-Structural Alternatives:
  - ***Automatic barricade control*** **–** This alternative would require the installation of two (2) automatic barricades to prevent vehicles from entering flooded roadway.

- Structural Alternatives:
  - ***Install culverts*** **–** A total of 20- 10' x 4' RCB's at 5 locations were sized within this area.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

10. Stock ponds upstream of Wentworth/I-10 interchange--potential flooding at interchange with failure

- Non-Structural Alternatives:

- ***Ensure maintenance, operation, study and analysis of stock ponds with future development*** **–** There are at least 8 stock ponds in this area to which this alternative could apply.

- Structural Alternatives:
  - ***Utilize stock ponds as regional detention basin(s)***

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

11. Stock Ponds/diversions along Flato main corridor; potential diversion of flow north into Franco watershed

- Non-Structural Alternatives:
  - ***Ensure maintenance, operation, study and analysis of stock ponds with future development*** **–** There are at least 3 stock ponds in this area to which this alternative could apply.

- Structural Alternatives:
  - ***Utilize stock ponds as regional detention basin(s)***

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

12. New Tucson all-weather access issues at several crossings; undersized culverts at several crossings (Wentworth Road, Andrada Road, Sahuarita Road and internal road crossings)

- Structural Alternatives:
  - ***Maintain culverts, upgrade culvert size*** **–** There are approximately 15 RCB's at 2 locations and 24 existing culverts in this area which should be maintained or upgraded.
  - ***Remove access points*** **–** There are approximately three (3) access points applicable to this alternative.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

13. Impacts of stock ponds/diversion structures south of Sahuarita Road and New Tucson area

- Non-Structural Alternatives:
  - ***Ensure maintenance, operation, study and analysis of stock ponds with future development*** **–** There are at least 10 stock ponds in this area to which this alternative could apply.
- Structural Alternatives:
  - ***Utilize stock ponds as regional detention basins*** **–** There are 10 stock ponds which could be utilized as regional detention basins.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

Cuprite/Fagan/Petty Ranch Area Recommended Alternative(s)

1. **FICO Channel lacks capacity to convey flow north, breakout/flooding to west**

   - No Action Alternative: The no action alternative was evaluated and determined to be the Recommended Alternative for this location

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

2. **Sahuarita Road-all-weather access limited from east near Wentworth Road to Houghton**

   - Structural Alternatives:
     - ***Collector/conveyance channels***
     - ***Install Culverts*** – A total of 8 - 10' x 4' RCB's and 7-48 inch culverts at 7 locations were sized within this area.
     - ***Maintain culverts, upgrade culvert size*** – There are approximately 4 existing RCB's and 4-48 inch culverts in this area at 3 locations which should be maintained or upgraded.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

3. **Approximately 2 miles of Sahuarita Road - Houghton Road to Rita Road alignment**
   - Structural Alternatives:
     - ***Install Culverts*** **–** A total of 27- 10' x 4' RCB's and 2-48 inch culverts at 8 locations were sized within this area.
     - ***Maintain culverts, upgrade culvert size*** **–** There are approximately 5 existing culverts in this area which should be maintained or upgraded.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

4. **Houghton Road-all-weather access limited from north**

   - Non-Structural Alternatives:
     - ***Automatic barricade control*** **–** This alternative would require the installation of 2 automatic barricades to prevent vehicles from entering flooded roadway.

   - Structural Alternatives:
     - ***Install Culverts*** **–** A total of 33- 10' x 4' RCB's and 21-48 inch culvertswere sized within this area.
     - ***Maintain culverts, upgrade culvert size*** **–** There are approximately eight (8) culverts in this area which should be maintained or upgraded.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

5. **Houghton, Sahuarita Area--flooding/erosion issues**

   - No Action Alternative: The no action alternative was evaluated and determined to be the Recommended Alternative for this location.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

Sycamore Canyon & Gunnery Range Area Recommended Alternative(s)

1. **Sahuarita Road-Rita Road alignment to Nogales Highway**

   - Structural Alternatives:
     - ***Install Culverts*** – A total of 56- 10' x 4' RCB's and 13-48 inch culverts at 16 locations were sized within this area.
     - ***Maintain culverts, upgrade culvert size*** – There are approximately 10 existing culverts and 6 RCB's at 2 locations in this area which should be maintained or upgraded.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

2. **Undersized/clogged culverts in Sycamore Canyon Estates south of Sahuarita Road**

   - Structural Alternatives:
     - ***Maintain culverts, upgrade culvert size*** – There are approximately 9

existing culverts in this area which should be maintained or upgraded.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

3. **Complaints about integrity of berm along Columbus Boulevard, north of Dawson, east of Irving**

   - No Action Alternative: The effects of taking no action should be evaluated for use as a baseline for any action alternative.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

4. **Sahuarita, Delgado, Dawson: FICO channel--lack of capacity/sedimentation causes residential flooding**

   - Non-Structural Alternatives:
     - ***Floodprone Land Acquisition Program (FLAP)* –** Approximately 141 structures can participate in the FLAP in this area.

   - Structural Alternatives:
     - ***Regional detention basin* –** The two facilities evaluated at this location would require about 154 acres to meet design criteria.
     - ***Maintain FICO channel* –** The subject channel is approximately 7000 feet in length.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

Summit Area Detailed Drainage Mitigation Study

One of the more intensely developed areas is located within the northwest portion of the Lee Moore Wash Basin Management Study project area along the Nogales Highway corridor, and is generally known as the Summit area. This area is situated within the downstream reach of the Franco Wash, and represents about a two-square mile residential area bounded by Old Vail Connection Road and the Singing Cactus Lane alignment along the north and south, respectively, and the Country Club Road alignment and Nogales Highway along the east and west. The Summit Wash impacts the southern portion of the area. There are a few small platted subdivisions within the area along with a limited number of County-maintained roads, however, the vast majority of the development within the area are unplatted subdivisions and lots. Many of the existing drainage problems reported within the LMWBMS project area are experienced within the above-referenced unrecorded subdivisions. Given the nature of flooding issues within the area, a more detailed study of the hydrology and hydraulics was authorized by the PCRFCD as part of the Lee Moore Wash Basin Management Study in order to evaluate the potential of developing site-specific drainage solutions. A summary of these efforts is presented in the following discussion.

The intent of the study was to identify local watersheds that generate peak flows in excess of 100 cfs, the threshold defined by Pima County ordinance for regulatory 100-year floodplains. Since the Summit area is generally bisected by the Franco Wash from southeast to northwest and the Summit Wash flows along the southern section, many of the subareas identified with these efforts were generally small tributary drainage areas flanking either side of these main washes. Additional areas that discharge east toward Nogales Highway, as well as a larger tributary to Franco Wash (north of the main Franco flow corridor) comprise the remainder of the watershed area impacting the Summit residential areas. A summary discussion of the Summit Area study is provided in the LMWBMS Summary report with detailed Hydrology and Hydraulic data included.

Upon identification of watershed areas that generate peak flows meeting the regulatory threshold, hydraulic models were developed to determine local regulatory 100-year floodplains within the Summit area. A map was generated displaying these floodplain areas, as well as the regional floodplains for Franco Wash and Summit Wash developed with the LMWBMS. Based on the data developed with this study, along with review of drainage complaints and information gathered from meetings with residents, potential drainage solutions to specific localized flooding areas were developed. The primary recommended alternatives involved grading and/or clearing specific drainage paths in order to provide positive drainage through the identified areas, as well as maintenance or upgrading of existing drainage culverts.

The proposed conveyance swales would typically be 10-20 feet wide with a depth of about one foot, and would convey flows associated with the smaller, frequent storms in a westerly, northwesterly direction through the developed areas. Maps of the proposed location and alignments of the conceptual improvements were generated, and are included in the Technical Appendices (Stantec, 2008c) associated with the LMWBMS Hydrologic and Hydraulic Report. The results of these efforts were presented to residents of the Summit area at public meetings. However, due to private ownership conflicts, it was determined that implementation of the proposed alternatives was not feasible at this time.

Specifically, the PCRFCD stipulated to the public at the beginning of the Summit Area Detailed Drainage Mitigation Study that the District would fund construction and maintenance of the local drainage improvements, but that residents must dedicate the necessary Right-of-Way or Easements without cost to the District. After numerous public and individual meetings an insufficient number residents were willing to dedicate the Right-of-Way or Easements, and therefore the local drainage improvements identified in the Summit Area Detailed Drainage Mitigation Study were not included as part of the Existing Condition Recommended Alternatives for the LMWBMS.

RECOMMENDED ALTERNATIVE(S) OPPORTUNITIES AND CONSTRAINTS (Future Conditions)

The Recommended Alternative(s) are organized into the four Planning Areas of the project with specific sites in each planning area. The Planning Areas (in capital letters) and problem sites within each planning area (designated numerically) are as follows:

LMWBMS Area-Wide Problem Area

1. **Develop Backbone Drainage Infrastructure**
2. **Identify and Disclose Flood Hazard Information**

Franco/Flato/Summit Area Problem Area

1. **50% of Wilmot Road & Kolb Road alignments are impacted by defined floodplain areas**
2. **Country Club Road alignment impacted by main flow corridors of Franco Wash and Flato Wash**
3. **Intersection at Dawn Road & I-10 located within floodprone area**

Cuprite/Fagan/Petty Ranch Area Problem Area

1. **Proposed Dawn Road alignment swings south into flood hazard area, +/- 1/3 mile flow depths >0.5 foot**
2. **60-65% of proposed Wilmot Road & Rita Road alignments impacted by defined floodplain areas**
3. **Swan Road Alignment--situated within sheet flow area north of Sahuarita Road**
4. **Pima Mine Road--from Houghton to Wilmot is within shallow sheet flow; divert flow to Cuprite watershed**

5. **Hook M Ranch property--40-50% of property impacted by shallow sheet flow**

Sycamore Canyon & Gunnery Range Area Problem Area

1. **Wilmot Road & Dawson Road proposed alignments situated in areas dominated by shallow sheet flow**
2. **Sycamore Canyon Blocks C-G--plan platted, currently undeveloped; flood hazard areas fairly contained**

A brief description of the problem and overview of the Recommended Alternatives for each of the sites follows.

LMWBMS Area-Wide Recommended Alternative

1. **Develop Backbone Drainage Infrastructure**

- Structural Alternatives:
  - ***Delineate and preserve flow corridors*** **–** There are 6,674 acres of Flow Corridor and 10,090 acres of potential reclaimed floodplain in this area.
  - ***Regional detention basins*** **–** There are 9 basins identified with a total of 925 acres needed.

- Non-Structural Alternatives:
  - ***Development Criteria*** **–** Uniform Development Criteria, a regulatory tool for all jurisdictions and are specific to the conditions within the LMWBMS are needed.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

2. **Identify and Disclose Flood Hazard Information.**

   - Non-Structural Alternatives:
     - ***Delineate additional FEMA floodplains*** **–** Approximately 333 stream miles could be delineated for adoption as FEMA floodplains.
     - ***Public Education and Outreach*** **–** While this can't be quantified, the effects of the dissemination of information should be measured in reference to reaching the goals being evaluated.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

Franco/Flato/Summit Area Recommended Alternative(s)

1. **50% of Wilmot Road & Kolb Road alignments are impacted by defined floodplain areas**

   - Structural Alternatives:
     - ***Realign Wilmot Road*** **–** Realignment will minimize the need for costly drainage structures while still providing traffic system continuity.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

2. **Country Club Road alignment impacted by main flow corridors of Franco Wash and Flato Wash**

   - Structural Alternatives:
     - ***Realign Country Club Road*** **–** Realignment will minimize the need for costly drainage structures while still providing traffic system continuity.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

3. **Intersection at Dawn Road & I-10 located within floodprone area**

   - Structural Alternatives:
     - ***Relocate intersection*** **–** Realocation will remove the intersection from the floodplain and thus eliminate the need for drainage structures while still providing traffic system continuity.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

Cuprite/Fagan/Petty Ranch Area Recommended Alternative

1. **Proposed Dawn Road alignment swings south into flood hazard area, +/- 1/3 mile flow depths >0.5 foot**

   - Structural Alternatives:
     - ***Realign roadway*** **–** Realignment will minimize the need for costly drainage structures while still providing traffic system continuity.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

2. **60-65% of proposed Wilmot Road & Rita Road alignments impacted by defined floodplain areas**

   - Structural Alternatives:
     - ***Realign Wilmot Road*** Realignment will minimize the need for costly drainage structures while still providing traffic system continuity.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

3. **Swan Road Alignment--situated within sheet flow area north of Sahuarita Road**

   - Structural Alternatives:
     - ***Remove roadway section*** **–** Removal will minimize the need for costly drainage structures while still providing traffic system continuity.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

4. **Pima Mine Road--from Houghton to Wilmot is within shallow sheet flow; divert flow to Cuprite watershed**

- No Action Alternative: The effects of taking no action was evaluated and determined to be the best alternative.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

5. **Hook M Ranch property--40-50% of property impacted by shallow sheet flow**

- Structural Alternatives:
  - ***Delineate and preserve flow corridors*** **–** Approximately 275 acres are needed for dedication as Flow Corridors and approximately 578 acres can be reclaimed from the floodplain.

- Non-Structural Alternatives:
  - ***Development Criteria*** **–** Uniform Development Criteria, a regulatory tool for all jurisdictions and are specific to the conditions within the LMWBMS are needed.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

Sycamore Canyon & Gunnery Range Area Recommended Alternative

1. **Wilmot Road & Dawson Road proposed alignments situated in areas dominated by shallow sheet flow**

- No Action Alternative: The effects of taking no action was evaluated and determined to be the best alternative.
-

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

2. Sycamore Canyon Blocks C-G--plan platted, currently undeveloped; flood hazard areas fairly contained

- Structural Alternatives:
  - ***Delineate and preserve flow corridors*** **–** Maintaining the platted drainage easements will provide for sufficient benefit for the backbone drainage system.

- Non-Structural Alternatives:
  - ***Development Criteria*** **–** Uniform Development Criteria, a regulatory tool for all jurisdictions and are specific to the conditions within the LMWBMS are needed.

There was no negative feedback from the public regarding this component of the Recommended Alternatives.

Table A Recommended Alternatives Summary – Existing Conditions

SITE(S)	TOTAL COST	PARTNER(S)	INTEREST/ BENEFIT	PARTICIPATION	MECHANISM	TIMELINE
AREA WIDE ALTERNATIVES						
1. 25 drainage complaints within unplatted areas north of Sahuarita Road; 60% related to access and flooding issues.						
a. Floodproofing	**$180,000**	**PCRFCD**	**Residential Flood Protection**	**In-House Engineering/Cost Share Funding**	**Operating Budget and /or Federal Grant**	**After FY10/11**
		Homeowners	**Residential Flood Protection**	**Cost Share Funding**	**Individual and /or Federal Grant**	**After FY10/11**
2. 20 drainage complaints along Wilmot corridor unplatted areas; 35% related to access and flooding issues.						
a. Floodproofing	**$510,000**	**PCRFCD**	**Residential Flood Protection**	**Cost Share Funding**	**CIP Budget and /or Federal Grant**	**After FY10/11**
		Homeowners	**Residential Flood Protection**	**Funding**	**Individual and /or Federal Grant**	**After FY10/11**
3. 35 drainage complaints within unplatted areas east of Wilmot Road; 40% related to access issues						
a. Floodproofing	**$240,000**	**PCRFCD**	**Residential Flood Protection**	**In-House Engineering/Cost Share Funding**	**Operating Budget and /or Federal Grant**	**After FY10/11**
		Homeowners	**Residential Flood Protection**	**Funding**	**Individual and /or Federal Grant**	**After FY10/11**
4. Existing Stock Pond/Diversion Structures						
a. Ensure maintenance & operation of stock ponds/diversion structures; study & analysis with future development	**$2,625,000**	**PCRFCD**	**BMS**	**Planning**	**PDD Budget**	**After FY10/11**

SITE(S)	TOTAL COST	PARTNER(S)	INTEREST/ BENEFIT	PARTICIPATION	MECHANISM	TIMELINE
		DEVELOPERS	Component of Backbone or other Drainage System	Funding	Development Budget	After FY10/11
		ASLD	Grazing Permitee Improvement	No Cost Permitting or Easements or Permitee Contribution	Operations Budget	After FY10/11
5. Enhance Public Education and Outreach						
a. Public Education and outreach	$30,000	PCRFCD	Flooding Education/CRS Credits	Funding	PDD Budget	Before June 2011
6. Flooding within unplatted residential areas						
a. Improvement District	- - -	PCRFCD	BMS	Planning	PDD Budget	After FY10/11
		RESIDENTS	Bring Infrastructure to Standard for Maintenance	Individual Funding	Individual Property Tax	After FY10/11
FRANCO/FLATO/SUMMIT AREA						
1. Old Vail Road -- Franco Wash 100-yr flow depth 7-8 feet						
a. Automatic Barricade Control	$300,000	PCRFCD	Public Safety	Cost Share Funding	CIP Budget and /or Federal Grant	After FY10/11
		PC/COT DOT	Traffic Safety	Cost Share Funding	CIP Budget and /or Federal Grant	After FY10/11
b. Culvert	$1,718,750	PCDOT	Traffic Safety	Funding	CIP Budget and /or Federal Grant	After FY10/11
		PCRFCD	Public Safety	Cost Share Funding	CIP Budget and /or Federal Grant	After FY10/11

SITE(S)	TOTAL COST	PARTNER(S)	INTEREST/ BENEFIT	PARTICIPATION	MECHANISM	TIMELINE
2. Summit Street -- Franco Wash 100-yr flow depth 3-4 ft						
a. Automatic Barricade Control	$300,000	PCRFCD	Public Safety	Funding	CIP Budget and /or Federal Grant	After FY10/11
		PCDOT	Traffic Safety	Cost Share Funding	CIP Budget and /or Federal Grant	After FY10/11
3. Flooding along Franco Wash--potential flooding of 45-50 structures within Summit Area						
a. Public Education and Outreach	$30,000	PCRFCD	Flooding Education/CRS Credits	Funding	PDD Budget	Before June 2011
4. Flooding along Summit Wash--potential flooding of 30-35 structures from County Club to Nogales Highway						
a. Public Education and Outreach	$30,000	PCRFCD	Flooding Education/CRS Credits	Funding	PDD Budget	Before June 2011
b. Regional detention basin	$513,110	PCRFCD	Component of Backbone Drainage System	Funding	CIP Budget, Bond and /or Federal Grant	After FY10/11
		DEVELOPERS	Component of Backbone or other Drainage System	Funding	Development Agreement	After FY10/11
		OTHER JURISDICTION	Component of Backbone Drainage System	Cost share Funding	IGA	After FY10/11
5. Additional flooding along Franco Tributary south of Old Vail Road						
a. Public Education and Outreach	$30,000	PCRFCD	Flooding Education/CRS Credits	Funding	PDD Budget	Before June 2011

SITE(S)	TOTAL COST	PARTNER(S)	INTEREST/ BENEFIT	PARTICIPATION	MECHANISM	TIMELINE
b. Regional detention basin	$578,920	PCRFCD	Component of Backbone Drainage System	Funding	CIP Budget, Bond and /or Federal Grant	After FY10/11
		DEVELOPERS	Component of Backbone or other Drainage System	Funding	Development Agreement	After FY10/11
		OTHER JURISDICTION	Component of Backbone Drainage System	Cost share Funding	IGA	After FY10/11
6. Flooding along Flato at Old Nogales Hwy						
a. Public Education and Outreach	$30,000	PCRFCD	Flooding Education/CRS Credits	Funding	PDD Budget	Before June 2011
b. FLAP	$1,482,000	PCRFCD	Remove Repetitive Loss Properties from Floodplain	Funding	PCRFCD Budget	After FY10/11
7. Maintenance of Lee Moore Channel Bank Protection/Bank Erosion						
a. Bank Stabilization	$3,445,200	PCRFCD	Protect Residents and Property from Channel Erosion	Funding	CIP Budget, Bond and /or Federal Grant	After FY10/11
8. Franco Wash at Houghton Road: +/-1000 ft, depth >1ft						
a. Automatic Barricade Control	$300,000	PCRFCD	Public Safety	Funding	CIP Budget and /or Federal Grant	After FY10/11
		PCDOT	Traffic Safety	Cost Share Funding	CIP Budget and /or Federal Grant	After FY10/11
b. Culvert	$1,093,750	PCDOT	Traffic Safety	Funding	CIP Budget and /or Federal Grant	After FY10/11
		PCRFCD	Public Safety	Cost Share Funding	CIP Budget and /or Federal Grant	After FY10/11

SITE(S)	TOTAL COST	PARTNER(S)	INTEREST/ BENEFIT	PARTICIPATION	MECHANISM	TIMELINE
9. Flato Wash at Houghton Road--depth>1ft						
a. Automatic Barricade Control	$300,000	PCRFCD	Public Safety	Funding	CIP Budget and /or Federal Grant	After FY10/11
		PCDOT	Traffic Safety	Cost Share Funding	CIP Budget and /or Federal Grant	After FY10/11
b. Culvert	$3,125,000	PCDOT	Traffic Safety	Funding	CIP Budget and /or Federal Grant	After FY10/11
		PCRFCD	Public Safety	Cost Share Funding	CIP Budget and /or Federal Grant	After FY10/11
10. Stock ponds upstream of Wentworth/I-10 interchange--potential flooding at interchange with failure						
a. stock ponds/diversion structures; study & analysis with future development	$200,000	DEVELOPER	Component of Backbone or other Drainage System	Funding	Development Agreement	After FY10/11
b. Utilize as regional detention basins	$2,611,000	PCRFCD	Component of Backbone Drainage System	Funding	CIP Budget, Bond and /or Federal Grant	After FY10/11
		DEVELOPERS	Component of Backbone or other Drainage System	Funding	Development Agreement	After FY10/11
		OTHER JURISDICTION	Component of Backbone Drainage System	Cost share Funding	IGA	After FY10/11
11. Stock Ponds/diversions along Flato main corridor--potential diversion of flow north into Franco watershed						
a. stock ponds/diversion structures; study & analysis with future development	$75,000	DEVELOPER	Component of Backbone or other Drainage System	Funding	Development Agreement	After FY10/11

SITE(S)	TOTAL COST	PARTNER(S)	INTEREST/ BENEFIT	PARTICIPATION	MECHANISM	TIMELINE
b. Utilize as regional detention basins	$979,125	PCRFCD	Component of Backbone Drainage System	Funding	CIP Budget, Bond and /or Federal Grant	After FY10/11
		DEVELOPERS	Component of Backbone or other Drainage System	Funding	Development Agreement	After FY10/11
		OTHER JURISDICTION	Component of Backbone Drainage System	Cost share Funding	IGA	After FY10/11
12. New Tucson all-weather access issues at several crossings; undersized culverts at several crossings						
a. Maintain culverts, upgrade culvert size	$2,415,750	PCDOT	Traffic Safety	Funding	CIP Budget and /or Federal Grant	After FY10/11
b. Close access points	$545,600	PCDOT	Traffic Safety	Funding	CIP Budget and /or Federal Grant	After FY10/11
		PCRFCD	Public Safety	Cost share Funding	CIP Budget, Bond and /or Federal Grant	After FY10/11
13. Impacts of stock ponds/diversion structures south of Sahuarita Road and New Tucson area						
a. stock ponds/diversion structures; study & analysis with future development	$250,000	DEVELOPER	Component of Backbone or other Drainage System	Funding	Development Agreement	After FY10/11
b. Utilize as regional detention basins	$3,263,750	PCRFCD	Component of Backbone Drainage System	Funding	CIP Budget, Bond and /or Federal Grant	After FY10/11
		DEVELOPERS	Component of Backbone or other Drainage System	Funding	Development Agreement	After FY10/11

SITE(S)	TOTAL COST	PARTNER(S)	INTEREST/ BENEFIT	PARTICIPATION	MECHANISM	TIMELINE
		OTHER JURISDICTION	Component of Backbone Drainage System	Cost share Funding	IGA	After FY10/11
CUPRITE/FAGAN/PETTY RANCH AREA ALTERNATIVES						
1. FICO Channel lacks capacity to convey flow north, breakout/flooding to west						
a. No Action		N/A	- - -	- - -	- - -	- - -
2. Sahuarita Road-all-weather access limited from east near Wentworth Road to Houghton						
a. Culverts	$1,306,875	RTA	Traffic Safety as Part of Regional Transportation Corridor	Funding	CIP Funding	After FY10/11
		PCRFCD	Public Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11
		PCDOT	Traffic Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11
b. Maintain culverts, upgrade culvert size	$357,000	PCDOT	Traffic Safety	Funding	CIP & Maintenance Budget	After FY10/11
		PCRFCD	Public Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11
3. Approx. 2 miles of Sahuarita Road - Houghton Road to Rita Road alignment						
a. Culverts	$4,235,000	RTA	Traffic Safety as Part of Regional Transportation Corridor	Funding	CIP Funding	After FY10/11
		PCRFCD	Public Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11

SITE(S)	TOTAL COST	PARTNER(S)	INTEREST/ BENEFIT	PARTICIPATION	MECHANISM	TIMELINE
		PCDOT	Traffic Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11
b. Maintain culverts, upgrade culvert size	$15,000	RTA	Traffic Safety as Part of Regional Transportation Corridor	Funding	CIP Funding	After FY10/11
		PCRFCD	Public Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11
		PCDOT	Traffic Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11
4. Houghton Road-all-weather access limited from north						
a. Automatic Barricade Control	$300,000	PCRFCD	Public Safety	Funding	CIP Budget	After FY10/11
		PCDOT	Traffic Safety	Cost Share Funding	CIP Budget and /or Federal Grant	After FY10/11
b. Provide all weather access	$6,658,596	RTA	Traffic Safety as Part of Regional Transportation Corridor	Funding	CIP Funding	After FY10/11
		PCDOT	Public Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11
		PCRFCD	Traffic Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11
c. Culverts	$5,326,875	RTA	Traffic Safety as Part of Regional Transportation Corridor	Funding	CIP Funding	After FY10/11
		PCDOT	Public Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11
		PCRFCD	Traffic Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11

SITE(S)	TOTAL COST	PARTNER(S)	INTEREST/ BENEFIT	PARTICIPATION	MECHANISM	TIMELINE
5. Houghton, Sahuarita Area--flooding/erosion issues						
a. No Action		N/A				
SYCAMORE CANYON & GUNNERY RANGE AREAS ALTERNATIVES						
1. Sahuarita Road-Rita Road alignment to Nogales hwy						
a. Culverts	$8,855,625	RTA	Traffic Safety as Part of Regional Transportation Corridor	Funding	CIP Funding	After FY10/11
		PCRFCD	Public Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11
		PCDOT	Traffic Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11
b. Maintain culverts, upgrade culvert size	$967,500	RTA	Traffic Safety as Part of Regional Transportation Corridor	Funding	CIP Funding	After FY10/11
		PCRFCD	Public Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11
		PCDOT	Traffic Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11
2. Undersized/clogged culverts in Sycamore Canyon Estates south of Sahuarita Road						
a. Maintain culverts, upgrade culvert size	$27,000	PCDOT	Traffic Safety	CIP Funding	CIP Budget and /or Federal Grant	After FY10/11
		PCRFCD	Public Safety	Cost share Funding	CIP Budget and /or Federal Grant	After FY10/11
3. Complaints about integrity of berm along Columbus Blvd, north of Dawson, east of Irving						

SITE(S)	TOTAL COST	PARTNER(S)	INTEREST/ BENEFIT	PARTICIPATION	MECHANISM	TIMELINE
a. No Action		N/A				
4. Sahuarita, Delgado, Dawson: FICO channel--lack of capacity/sedimentation causes residential flooding						
a. FLAP	$23,062,806	PCRFCD	Remove Repetitive Loss Properties from Floodplain	Funding	PCRFCD Budget	After FY10/11
b. Regional detention basins	$14,881,300	PCRFCD	Component of Backbone Drainage System	Funding	CIP Budget, Bond and /or Federal Grant	After FY10/11
		DEVELOPERS	Component of Backbone or other Drainage System	Funding	Development Agreement	After FY10/11
		OTHER JURISDICTION	Component of Backbone Drainage System	Cost share Funding	IGA	After FY10/11
c. Construct 100-year channel	$2,541,000	PCRFCD	Component of Backbone Drainage System	Funding	CIP Budget, Bond and /or Federal Grant	After FY10/11
		DEVELOPERS	Component of Backbone or other Drainage System	Funding	Development Agreement	After FY10/11
		OTHER JURISDICTION	Component of Backbone Drainage System	Cost share Funding	IGA	After FY10/11

Table B Recommended Alternatives Summary – Future Conditions

SITE(S)	TOTAL COST	PARTNER(S)	INTEREST/ BENEFIT	PARTICIPATION	MECHANISM	TIMELINE
AREA WIDE ALTERNATIVES						
1. Develop Backbone Drainage Infrastructure						
a. Delineate and preserve flow corridors	$504,500,000	All Agencies and Developers	Component of Backbone Drainage System	Regulatory Preservation Requirement	Resolution and/or Special Area Plan	FY10/11
						After FY10/11
b. Regional detention basins	$127,692,675	PCRFCD	Component of Backbone Drainage System	Funding	CIP Budget, Bond and /or Federal Grant	After FY10/11
		DEVELOPERS	Component of Backbone or other Drainage System	Funding	Development Agreement	After FY10/11
		OTHER JURISDICTION	Component of Backbone Drainage System	Cost share Funding	IGA	After FY10/11
c. Development Criteria	No cost	All Agencies and Developers	Component of Backbone Drainage System	Regulatory Development Requirement	Resolution and/or Ordinance	FY10/11
2. Identify and Disclose Flood Hazard Information						
a. Delineate additional FEMA floodplains	$1,665,000	PCRFCD	Hazard Delineation	Regulatory Development Requirement	RFCD Operating Budget	After FY10/11
b. Public Education and Outreach	$30,000	PCRFCD	Flooding Education/CRS Credits	Funding	PDD Budget	FY10/11

SITE(S)	TOTAL COST	PARTNER(S)	INTEREST/ BENEFIT	PARTICIPATION	MECHANISM	TIMELINE
FRANCO/FLATO/SUMMIT AREA						
1. 50% of Wilmot Road & Kolb Road alignments are impacted by defined floodplain areas						
a. Realign Wilmot Road	($606,061)	PAG/RTA/PCDOT/COTDOT	Keeps Roadway out of Floodplain	Southeast Arterial study Revision	RTA Budget	After FY10/11
2. Country Club Road alignment impacted by main flow corridors of Franco Wash and Flato Wash						
a. Realign Country Club Road	($1,060,606)	PAG/RTA/PCDOT/COTDOT	Keeps Roadway out of Floodplain	Southeast Arterial study Revision	RTA Budget	Before June 2011
3. Intersection at Dawn Road & I-10 located within floodprone area						
a. Relocate intersection	$1,136,364	PCDOT	Keeps Roadway out of Floodplain	Funding	PCDOT Budget	After FY10/11
CUPRITE/FAGAN/PETTY RANCH AREA ALTERNATIVES						
1. Proposed Dawn Road alignment swings south into flood hazard area, +/- 1/3 mile flow depths >0.5ft						
a. Realign roadway	($757,576.00)	PAG/RTA/PCDOT/COTDOT	Keeps Roadway out of Floodplain	Southeast Arterial study Revision	RTA Budget	After FY10/11
2. 60-65% of proposed Wilmot Road & Rita Road alignments impacted by defined floodplain areas						
a. Realign Wilmot Road	($3,030,303)	PAG/RTA/PCDOT/COTDOT	Keeps Roadway out of Floodplain	Southeast Arterial study Revision	RTA Budget	After FY10/11
3. Swan Road Alignment--situated within sheet flow area north of Sahuarita Road						

SITE(S)	TOTAL COST	PARTNER(S)	INTEREST/ BENEFIT	PARTICIPATION	MECHANISM	TIMELINE
a. Remove roadway section	($10,984,848)	RTA	Keeps Roadway out of Floodplain	Southeast Arterial study Revision	RTA Budget	After FY10/11
4. Pima Mine Road--from Houghton to Wilmot is within shallow sheet flow; divert flow to Cuprite watershed						
a. No Action	NA					
5. Hook M Ranch property--40-50% of property impacted by shallow sheet flow						
a. Delineate and preserve flow corridors	$28,900,000	All Agencies and Developers	Component of Backbone Drainage System	Regulatory Preservation Requirement	Resolution and/or Ordinance	FY10/11
b. Development Criteria	No cost	All Agencies and Developers	Component of Backbone Drainage System	Regulatory Development Requirement	Resolution and/or Ordinance	FY10/11
SYCAMORE CANYON & GUNNERY RANGE AREAS ALTERNATIVES						
1. Wilmot Road & Dawson Road proposed alignments situated in areas dominated by shallow sheet flow						
a. No Action	NA					
2. Sycamore Canyon Blocks C-G--plan platted, currently undeveloped; flood hazard areas fairly contained						

SITE(S)	TOTAL COST	PARTNER(S)	INTEREST/ BENEFIT	PARTICIPATION	MECHANISM	TIMELINE
a. Delineate and preserve flow corridors	No cost	All Agencies and Developers	Component of Backbone Drainage System	Regulatory Preservation Requirement	Resolution and/or Ordinance	FY10/11
b. Development Criteria	No cost	All Agencies and Developers	Component of Backbone Drainage System	Regulatory Development Requirement	Resolution and/or Ordinance	FY10/11

Appendix A Pima County Flood Control District Board of Directors Resolution

RESOLUTION No. 2010 - FC 6

RESOLUTION OF THE PIMA COUNTY FLOOD CONTROL DISTRICT BOARD OF DIRECTORS ADOPTING THE LEE MOORE WASH BASIN MANAGEMENT STUDY

WHEREAS, 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, and

WHEREAS, the District is authorized to delineate floodplains for areas where development is ongoing or imminent pursuant to A.R.S. Title 48, Section 48-3609, and

WHEREAS, 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. Title 48, Section 48-3609.01A, and

WHEREAS, the District in cooperation with the Pima County (County), City of Tucson (Tucson) and Town of Sahuarita (Sahuarita) initiated the Lee Moore Wash Basin Management 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, and

WHEREAS, the District help open public meetings and stakeholder meetings to provide opportunity for the public to comment; and a public website so that interested members of the public could review and comment on all studies and reports generated for the Lee Moore Wash Basin Management Study, and

WHEREAS, the Lee Moore Wash Basin Management Study produced, for the County, Tucson, and Sahuarita, a common set of facts, flood hazard maps, implementation plan, and development criteria (Exhibit A) which can now serve as a resource to guide and manage development activities in the Study Area, and

WHEREAS, the Study is intended to provide guidance and regulatory authority to discourage development in flood prone areas by minimizing encroachments into regional floodplains, and establishing a watershed-wide "backbone" drainage system, primarily by employing a natural flow corridor concept (Exhibit B), and

WHEREAS, the Study provides for floodplain management guidance whereby lands within the regulatory floodplain including riparian habitat and erosion hazard areas will be

managed to preserve or enhance natural values and expressed environmental resource management goals.

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

1. Adopts the Lee Moore Wash Basin Management Study including the technical data, flood hazard maps, implementation plan and development criteria 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, Tucson and Sahuarita.
   - Guide new development in the Study Area so that it is designed 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, Tucson and Sahuarita 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 Lee Moore Basin to integrate floodplain management and environmental protection policies into the County's land use planning for the Study Area.

PASSED AND ADOPTED this 1st day of June, 2010 by the Board of Directors of the Pima County Flood Control District, Pima, County, Arizona.

ATTEST:

Lori Godoshian, Clerk of the Board

PIMA COUNTY FLOOD CONTROL DISTRICT BOARD OF DIRECTORS

Ramon Valadez, Chair

JUN 01 2010

Approved as to form:

Deputy County Attorney

Recommended to the Board:

Suzanne Shields, Director
Pima County Flood Control District

Appendix B City of Tucson Resolution

ADOPTED BY THE
MAYOR AND COUNCIL

October 19, 2010

RESOLUTION NO. 21641

RELATING TO PLANNING AND ZONING; AUTHORIZING THE ADOPTION OF THE LEE MOORE WASH BASIN MANAGEMENT STUDY; AND DECLARING AN EMERGENCY.

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

SECTION 1. The Lee Moore Wash Basin Management Study ("Study"), attached hereto as Exhibit A, which will be used to ensure that regional planning for land use, development, water resources, and infrastructure in the flood prone areas identified in the study are uniform is hereby adopted;

SECTION 2. The various City officers and employees are authorized and directed to perform all acts necessary or desirable to give effect to this resolution.

SECTION 3. WHEREAS, it is necessary for the preservation of the peace, health, and safety of the City of Tucson that this resolution immediately

become effective, an emergency is declared to exist and this resolution shall be effective immediately upon its passage and adoption.

PASSED, ADOPTED AND APPROVED BY THE Mayor and Council of the City of Tucson, Arizona, October 19, 2010.

MAYOR

ATTEST:

CITY CLERK

APPROVED AS TO FORM:

CITY ATTORNEY

REVIEWED BY:

CITY MANAGER

VRW:tl
10/6/10

Appendix C Town of Sahuarita Resolution

SAHUARITA RESOLUTION NO. 2010-237

A RESOLUTION OF THE TOWN OF SAHUARITA, ARIZONA, ADOPTING THE LEE MOORE WASH BASIN MANAGEMENT STUDY.

WHEREAS, 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; and

WHEREAS, the District is authorized to delineate floodplains for areas where development is ongoing or imminent pursuant to A.R.S. Title 48, Section 48-3609; and

WHEREAS, 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. Title 48, Section 48-3609.01A; and

WHEREAS, the District in cooperation with Pima County (County), City of Tucson (Tucson) and Town of Sahuarita (Sahuarita) initiated the Lee Moore Wash Basin Management 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 balanced multi-objective approach; and

WHEREAS, the District held open public meetings and stakeholder meetings to provide opportunities for the public to comment, and a public website so that interested members of the public could review and comment on all studies and reports generated for the Lee Moore Wash Basin Management Study; and

WHEREAS, the Lee Moore Wash Basin Management Study produced, for the County, Tucson and Sahuarita, a common set of facts, flood hazard maps, implementation plan, and development criteria which can now serve as a resource to guide and manage development activities in the Study Area; and

WHEREAS, the Study is intended to provide guidance and regulatory authority to discourage development in flood prone areas by minimizing encroachments into regional

floodplains, and establishing a watershed-wide "backbone" drainage system, primarily by employing a natural flow corridor concept; and

WHEREAS, the Study provides for floodplain management guidance whereby lands within the regulatory floodplain including riparian habitat and erosion hazard areas will be managed to preserve or enhance natural values and expressed environmental resource management goals.

NOW, THEREFORE, BE IT RESOLVED by the Mayor and Council of the Town of Sahuarita, Arizona, as follows:

Section 1. The Town hereby adopts the Lee Moore Wash Basin Management Study including the technical data, flood hazard maps, implementation plan and development criteria which will:

a. Ensure that regional planning for land use, water resources and infrastructure are integrated.

b. Provide a regional uniform and coordinated approach by the County, Tucson and Sahuarita.

c. Guide a new development in the Study Area so that it is designed and located to promote public safety, protect the environment, and be economically and fiscally sustainable.

Section 2. The Town directs Town staff to continue to work with the County, District, and Tucson to implement the floodplain management recommendations and implementation plan in the Study.

Section 3. The Town directs Town staff to provide for the Town's consideration of an amendment to the Town's General Plan providing Special Area Policies for the Lee Moore Basin to integrate floodplain management and environmental protection policies into the Town's land use planning for the Study Area.

Section 4. The various Town officers and employees are authorized and directed to perform all acts necessary or desirable to give effect to this Resolution and sections of the Town Code.

Section 5. All ordinances, resolutions, or motions and parts of ordinances, resolutions or motions of the Council in conflict with the provisions of this Resolution are hereby repealed, effective as of the effective date of this Resolution. All internal references within the Town Code to any affected provision are hereby updated.

Section 6. If any section, subsection, sentence, clause, phrase or portion of this Resolution is for any reason held to be invalid or unconstitutional by the decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions thereof.

PASSED AND ADOPTED by the Mayor and Council of the Town of Sahuarita, Arizona, this 13th day of December, 2010.

Mayor Lynne Skelton

ATTEST:

Vicky Miel, MMC
Town Clerk

APPROVED AS TO FORM:

Daniel J. Hochuli
Town Attorney

Appendix D Arizona State Land Department Letter of Concurrence

Janice K. Brewer
Governor

Maria Baier
State Land
Commissioner

ARIZONA STATE LAND DEPARTMENT

March 17, 2010

Suzanne Shields, PE
Chief Engineer
Pima County Regional Flood Control District
97 East Congress, 3rd Floor
Tucson, AZ 85701

RE: Concurrence Letter for the *Development Criteria for the Lee Moore Wash Basin Management Study*

Dear Ms. Shields:

The Arizona State Land Department (ASLD) has evaluated and been included in the process of the creation of the *Development Criteria for the Lee Moore Wash Basin Management Study (DCLMW)*, which is development criteria that will used by developers, land owners, utility companies, and governmental agencies to develop and construct in a way to mitigate flood impacts within the Lee Moore Wash Basin area.

ASLD will cooperate, to the extent permissible, with the Pima County Flood Control District (PCFCD) in the development and implementation of the DCLMW for planning State Trust Land (STL) within the Lee Moore Wash Basin study area.

Sincerely,

James L. Adams
Director
Real Estate Division
Arizona State Land Department

c: Lillian Moodey, Manager, Planning and Engineering Section, Real Estate Division, ASLD
Mike Farley, Planning and Engineering Section, Real Estate Division, ASLD
Tim Bolton, Planning and Engineering Section, Real Estate Division, ASLD

Appendix E Development Criteria

DEVELOPMENT CRITERIA

for the

LEE MOORE WASH BASIN

MANAGEMENT STUDY

Adopted by Pima County June 1, 2010

Adopted by the City of Tucson October 19, 2010

Adopted by the Town of Sahuarita December 13, 2010

Pima County
Regional Flood Control District

Stantec

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SECTION 1: INTRODUCTION

1.1 Background & Applicability

Historically, Arizona communities have developed floodplain-management measures such as floodplain ordinances, drainage ordinances, and development standards intended to mitigate the flood impacts of urbanization. If these measures are not adequate or are not adequately enforced, the consequences may include flooding of homes and businesses, displacement of existing natural flood flows, increased flood depths and flow velocities, and flooding of lands previously not in a floodplain. Adverse impacts of urbanization on drainage often include the following:

a. More Frequent Flooding. As the land area within a watershed is urbanized, less rainfall infiltrates into the ground and more rainfall becomes runoff. This results in more frequent runoff events and increased nuisance flooding.

b. Larger Flood Peaks. The change from natural, pervious land surfaces to urbanized, impervious surfaces also causes the size of floods to increase, as more runoff is generated within, and emanates from, the watershed. Urbanized watersheds generate not only larger flood peaks, but also larger flood volumes and floods of longer duration, both of which increase flood damages. As flood peaks increase with urbanization, existing drainage structures may become inadequate and have a greater risk of failure.

c. Loss of Natural and Beneficial Floodplain Functions. Natural floodplains provide important sociological, as well environmental and hydrologic benefits. These sociological benefits include continuous linear open space, visual and aesthetic beauty, multi-sensory relief from pervasive constructed hardscapes, and a sense of community character tied to the natural setting. These environmental and hydrologic benefits include sustaining system sediment balance and riparian areas, thus avoiding man-made erosion and loss-of-wildlife issues.

d. Scour and Erosion. Because more land area is covered by homes, streets and landscaping as a watershed urbanizes, the natural sediment supply to streams is decreased, which causes floods to be more erosive. This erosion leads to increasing the risk of property damage due to riverine bank erosion, scour damage to bridges, and adverse impacts to flood-control facilities and natural river habitat.

e. Flow Diversion. Lack of managing development can lead to blockage of natural flow paths, diverting runoff toward areas that were previously not flooded.

f. Flow Concentration. Development in riverine or distributary flow floodplains blocks natural overland flow paths, concentrating runoff through narrower conveyance corridors. Flow concentration leads to larger flood peaks, higher flow velocities, and accelerated scour and erosion.

g. Expanded Floodplains. Larger flood peaks and more flow diversions increase floodwater elevations and expand floodplain widths, inundating properties previously safe from flooding, thus increasing the number of homes and business at risk from future flood damage.

h. Reduced Surface Storage. Reducing surface storage area by grading and/or erecting structures within former ponding and flood-prone areas increases both the peak flow and the volume of runoff generated by a given storm, and may also result in a loss of vegetation that further increases runoff rates.

i. Decreased Groundwater Recharge. Increased areas of impervious surfaces in an urbanized watershed inhibit groundwater recharge and reduce soil moisture, with adverse consequences to long-term water supply, subsidence, and vegetation.

j. Loss of Riparian Habitat. Increased erosion due to increased flood peaks and reduced sediment supply leads to degraded habitat along river corridors, with adverse impacts to wildlife and public recreation.

In order to protect private and public property, as well as the health and general welfare of the public, naturally occurring flood hazards and potential flood hazards related to development need to be identified, and appropriate standards applied to safely manage new development.

Development Criteria are a work product of a Basin Management Study (BMS). This study includes a hydrologic assessment of the watershed, identifies potential flood-prone areas and drainage problems, and offers alternatives to mitigate flooding and related impacts of urbanization within a watershed. A key part of this BMS includes identification of new development criteria. Adherence to these development criteria will substantially lessen the adverse impacts of urbanization and will decrease the cost of mitigating flooding for the public and private sectors.

Development of this BMS included compiling information, identifying and analyzing alternatives, and selecting Recommended Alternatives (RA). The RA contain both structural solutions (such as basins, culverts, and channels) and non-structural solutions (such as development criteria, flood warning system, and property acquisition).

The Lee Moore Wash study area is located in the southeast portion of Pima County, and includes a portion of the City of Tucson and the Town of Sahuarita. The northern half of the study area lies predominantly within the incorporated limits of the City of Tucson. A small area in the southwestern portion of the study area lies within the bounds of the Town of Sahuarita. The majority of the central study area is located within unincorporated Pima County. Approximately the southern two-thirds of the Lee Moore Wash watershed are characterized by distributary flooding. Much of this area is undeveloped.

Counties and cities generally have what many consider adequate authority to regulate residential subdivisions, multi-family, industrial and commercial projects, and address potential flooding and related impacts on adjacent properties. Unlike cities, however, counties lack the regulatory authority to adequately manage lot splits (i.e., those exempt from subdivision and/or other improvement requirements due to the small number of lots involved). Although impacts from lot-split development may appear relatively insignificant on an individual lot-by-lot basis, the cumulative impacts over the long term may be significant.

Over the past few decades the County has been managing floodplain areas it has become apparent that there is a lack of tools to adequately manage individual lot development, especially lots located within distributary flow areas. As part of this BMS, it was determined that Development Criteria focused on single-family development on individual lots, standard subdivisions and/or large master-planned developments could reduce flood- and erosion-related damage within the Lee Moore Wash watershed.

Approximately 48 percent of the Study area is owned by the state of Arizona and managed by the Arizona State Land Department (ASLD). ASLD manages lands in compliance with the State Enabling Act, the Arizona Constitution, and with Arizona Revised Statutes Title 37, which all require that State Trust Lands be managed in the best interests of the designated State Trust beneficiaries. As such, certain elements of the Development Criteria presented herein may not have the same regulatory compliance authority with regard to State Trust Lands as they do to land owned by others. Nevertheless, the principles, policies, and practices contained within these Development Criteria provide a useful method for insuring a consistent and comprehensive approach to floodplain management within the Study area. Therefore, it is in the best interest of all land owners and jurisdictions to comply with these Development Criteria to the fullest extent possible.

1.2 Implementation

Implementation of these Development Criteria are addressed in Volume 3 of the Lee Moore Wash Basin Management Study.

1.3 Objectives

The Lee Moore Wash BMS identifies flooding and erosion hazards in the study area and recommends alternatives to mitigate those hazards. Both structural and non-structural measures are incorporated into the recommended alternatives to address drainage and flooding problems. The Development Criteria are one of the non-structural components of the recommended alternatives. General objectives of the Development Criteria are as follows.

1.3.1 General Objectives

a. Enhance public safety by guiding development in the watershed to protect current and future residents from flood and erosion related impacts.

b. Reduce adverse drainage and related impacts due to development in the watershed by guiding activities of residents so that future runoff into the Santa Cruz River is maintained at current conditions to preclude negative impacts to downstream and upstream neighbors.

c. Guide future development in a manner consistent with the recommended alternatives of the Lee Moore Wash BMS.

1.3.2 Specific Objectives

The following specific objectives were established to guide the development of the recommended Development Criteria, as presented herein, and their implementation.

a. Use existing aerial photography, topographic data, and GIS database resources to the maximum extent possible.

b. Use available resources and the work products of the BMS, including floodplain delineations, geomorphic evaluation, stakeholder involvement, public involvement and identification of drainage problems, to enhance the suitability and applicability of the Development Criteria.

c. Provide the citizenry with as much upfront information as possible about the process and permit requirements in order to minimize cost and time investments for all parties.

d. Allow for maximum flexibility in the review process so that Floodplain Use Permit applicants may proceed with single-lot and subdivision development, and may incorporate drainage features that do not explicitly meet the Development Criteria established herein—provided plans for such features are designed and sealed by a registered professional engineer and reviewed and approved by the local floodplain management

agency having jurisdiction.

e. Utilize Development Criteria consistent and compatible with existing statutes, ordinances, and regulations.

f. Limit the use of Development Criteria to those criteria necessary to address problems in the Lee Moore Wash watershed which are not adequately addressed by existing Floodplain or Drainage Regulations.

The proposed Development Criteria for the Lee Moore Wash BMS are consistent with the general and specific objectives set forth above.

1.4 Authority

The authority for counties, cities, and towns in Arizona to manage floodplains within their respective jurisdictions is authorized by the state of Arizona. Applicable state statutes providing for the use of Development Criteria by local governments are summarized below.

Arizona Revised Statutes (Excerpted)

a. ARS 11-251.36. Subject to the prohibitions, restrictions and limitations as set forth in section 11-830, adopt and enforce standards for excavation, landfill and grading to prevent unnecessary loss from erosion, flooding and landslides.

b. ARS 48-2664.D. The Board may adopt equitable by-laws, rules and regulations and perform all acts necessary to carry out the purposes of this chapter.

c. ARS 48-3609.B. Except as provided in section 48-3610, the board shall adopt and enforce regulations governing floodplains and floodplain management in its area of jurisdiction which shall include the following:
    i. Regulations for all development of land, construction of residential, commercial or industrial structures or uses of any kind which may divert, retard or obstruct floodwater and threaten public health or safety or the general welfare.

d. ARS 48-3609.01.A. If a district organized pursuant to this chapter has completed a watercourse master plan which includes one or more watercourses, and if the plan has been adopted by the board and subsequently adopted by the other local jurisdiction(s) in that river or drainage system, then the board and the governing body of each jurisdiction may adopt and shall enforce uniform rules for the river or drainage system within the jurisdiction using criteria that meet or exceed criteria adopted by the director of water resources pursuant to section 48-3605, subsection A.

1.5 Summary

An analysis of the BMS area-development trends and regulatory options was conducted to identify specific issues not addressed by existing drainage and floodplain regulations. Based on that analysis, it was determined that single-family development on individual lots, as well as master-planned subdivisions, would benefit from Development Criteria formulated specifically for the Lee Moore Wash watershed.

Implementation of Development Criteria intended to reduce drainage, flood, and erosion hazards will lessen public expenditures for structural flood-control measures, will decrease the amount of maintenance needed for flood-control facilities, will complement riparian-habitat regulations, and will lessen the need to acquire public right-of-way for flood-control purposes. In addition, application of Development Criteria will reduce flood-damage potential to private and public property, as well as the need for public funding for flood mitigation and repair of flood damage.

SECTION 2: FLOOD-HAZARD AREAS

2.1 Overview

The Study Area is subject to two major types of Flood Hazards: Riverine and Distributary Flow. Riverine areas are concentrated in the northern part of the Lee Moore Wash watershed; while Distributary Flow areas are found in the central and southern portions of the watershed. Due to the difference in flood hazards associated with the two flooding types, the following Development Criteria are proposed.

2.2 Riverine Areas

In addition to any other rules, policies, and standards that may apply, the following criteria shall apply in the Study Area.

2.2.1 Criteria

a. Floodplain delineations shall be conducted in conformance with Federal Emergency Management Agency (FEMA) Guidelines, Arizona Department of Water Resources (ADWR) State Standards, and local regulatory regulations. When development impacts non-FEMA-designated floodplains, floodplain delineations will be for local floodplain management purposes only, and need not be submitted to or approved by FEMA.

b. Development in FEMA-designated floodplains shall be governed by the most recent National Flood Insurance Program (NFIP) Regulations, ADWR State Standards, and any requirement by the local jurisdiction having authority. Anyone proposing development that alters a FEMA floodplain limit or base flood elevation is required by NFIP regulations to submit a Conditional Letter of Map Revision to FEMA for review and approval prior to construction, if appropriate. A Letter of Map Revision shall also be submitted to FEMA for review and approval prior to the Final Release of Assurances for subdivisions, and Certificate of Occupancy for Development Plans; but partial-assurance releases,

along with temporary Certificates of Occupancy, are allowable at the discretion of the local jurisdiction.

c. Development in, or modification of, the floodplain is generally discouraged. Development should be located outside the 100-year floodplain wherever possible. If site characteristics require development within the floodplain, the floodplain modifications should be minimized in order to lessen impacts on the natural stormwater and sediment-transport capacity of the floodplain.

d. The placement or development of critical facilities, as defined by FEMA, shall also be discouraged in the Riverine Floodplain of the Study Area.

e. Changes to natural drainage patterns in the interior of individual properties should be avoided whenever possible. The point(s) where regulatory drainage enters and exits a parcel shall not be altered without the express written consent of all affected property owners and unless an engineering study demonstrating no adverse impacts to affected land parcels is submitted to and approved by the flood-control agency having jurisdiction.

f. The lowest finished-floor elevation of all habitable structures (those structures which are constructed and permitted for human occupancy, whether on a full- or part-time basis) within a FEMA or other regulatory floodplain shall be at least one (1) foot above the highest natural adjacent grade. Highest natural adjacent grade is defined as the highest pre-construction/pre-grading ground elevation within the footprint of the proposed structure. For development within a floodplain, the minimum finished-floor elevation of all habitable structures shall be set to the regulatory flood elevation, which is one (1) foot above the base flood elevation.

g. All development in a Regulatory Floodway shall comply with applicable local, state, and federal standards. A "Regulatory Floodway" means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water-surface elevation by more than the

designated height as defined by the floodplain ordinance of the agency having jurisdiction.

h. Encroachment means the advance of obstructive uses, such as fill, excavation, buildings, temporary or permanent structures or other development, into a floodplain, in a manner which may impede or alter the flow capacity of a floodplain. Encroachment is allowed only where it can be demonstrated by an engineering analysis that no long-term or short-term off-site impacts are expected to occur, that neighboring properties are not adversely affected, and that the encroachment is adequately protected from erosion and flooding hazards. Also, a long-term inspection and maintenance program must be adopted by the property owner and approved by the floodplain management agency having jurisdiction.

i. The foundations of buildings constructed in the floodplain shall be protected against scour. Where floodplain or overbank flow is concentrated by development, the post-construction (full build-out) condition 100-year hydraulic data shall be used to establish the parameters for scour-protection design.

j. Building sites shall be graded to direct nuisance runoff away from the building pad and building interior.

k. Buildings constructed in riverine floodplains shall be aligned parallel to the primary flow direction in order to limit flow obstruction and allow for flow-path continuity.

2.2.2 Rationale

In the study area, riverine floodplains of watercourses with discharges greater than 100 cubic feet per second (cfs) are found along portions of the Franco, Flato, Summit, and Lee Moore washes. These watercourses include both the river channel and adjacent areas that are periodically inundated by floodwaters. For the purposes of these Development Criteria, a riverine floodplain only occurs along a defined stream channel.

Floodplain means any land area susceptible to being inundated by water from any source. A riverine floodplain exists along a river or linear watercourse.

Flood Hazard Zone means any land area located partially or wholly within a delineated floodplain that is susceptible to flood-related damage, as designated on the flood-management maps.

Regulatory Flood Elevation, which is an Arizona state standard, means an elevation one foot above the base flood elevation for a watercourse for which the base flood elevation has been determined. Base Flood Elevation means the water-surface elevation produced by a base flood, or one-hundred-year flood.

Certain riverine floodplains located within the area encompassing the Lee Moore Wash Basin Management Study area have been delineated on Flood Insurance Rate Maps or other flood-hazard maps published by the Federal Emergency Management Agency (FEMA), and are referred to as **FEMA Floodplains**.

Some riverine floodplains in the Lee Moore Wash Basin Management Study area have been delineated by agencies, developers, or other parties; but have not been submitted, reviewed, or approved by FEMA. Per NFIP regulations, these floodplains may be used in the Lee Moore Wash Basin Management Study area as the best available information for floodplain-management purposes, which are based on local standards.

2.3 Distributary Flow Areas

In addition to any other rules, policies, and standards that may apply, the following criteria shall apply in the Study Area.

2.3.1 Criteria

a. Development in, or modification of, the floodplain is generally discouraged. Development should be located outside the 100-year floodplain wherever possible. If site characteristics require that some development occur within the floodplain, the floodplain modifications should be the minimum possible to lessen impacts to the natural stormwater and sediment-transport capacity of the floodplain.

b. Development in regulatory distributary flow areas should not concentrate flows or eliminate flow paths that change the flow rate or flow distribution on adjacent parcels.

c. A drainage master plan is required for any subdivision plat or development plan located in distributary areas. The drainage master plan should demonstrate that the roadway network that serves the development has acceptable impacts relative to drainage patterns and runoff concentration. Drainage design in distributary flow areas shall limit the concentration of flows. Where flows are concentrated, appropriate scour protection shall be provided along the channel reach. Concentrated flows shall be returned to the natural distributary flow condition prior to exiting the property.

d. Finished-floor elevations of all habitable structures (those structures constructed and permitted for human occupancy, whether on a full- or part-time basis) within a FEMA or other regulatory floodplain shall be at least (1) foot above the highest natural adjacent grade. Highest natural adjacent grade is defined as the highest pre-construction/pre-grading ground elevation within the footprint of the proposed structure. For development within a floodplain, the minimum finished-floor elevation of all habitable structures shall be at least one (1) foot above the regulatory flood elevation, which is one (1) foot above the base flood elevation. In addition, the finished-floor elevation for new construction may be estimated using the procedures cited in State Standard 4-95.

e. For drainage design purposes, if a hydraulic rating is used to determine flow distribution at a flow-split, no less than 50% of the 100-year discharge upstream of the bifurcation should be used on any single channel downstream, unless a publicly maintained engineered structure controls the flow distribution. If no hydraulic modeling is provided, the full 100-year discharge upstream of the split should be used on all downstream channels.

f. Applicable engineering guidelines for estimating flow rates, designing flood-control facilities, setting finished-floor elevations, and for

performing other floodplain management tasks should be used in Distributary Flow areas.

g. The foundations of buildings constructed in the floodplain shall be protected against scour. Where floodplain or overbank flow is concentrated by development, the post-construction (full build-out) condition 100-year hydraulic data shall be used to establish the parmeters for scour-protection design.

h. Building sites shall be graded to direct nuisance runoff away from the building pad and building interior.

i. Buildings constructed in distributary floodplains shall be aligned parallel to the primary flow direction in order to limit flow obstruction and allow for flow-path continuity.

2.3.2 Rationale

Distributary flow areas occur within a significant portion of the Lee Moore Wash Basin Management Study area, and create difficulty for engineering design and floodplain management due to the uncertainty created by diverging flow paths. Development in distributary flow areas can cause changes to flow distributions and result in adverse impacts to downstream and adjacent properties.

Distributary flow is a specific drainage pattern in which defined channels divide, such that the number of channels increase in the downstream direction. Distributary flow areas have channels which split and rejoin in a complex pattern. The number of channel forks commonly exceeds the number of channel confluences, creating a distributary, rather than tributary, drainage pattern. The separate channels downstream of a channel fork may have terraces independent of other channels within the distributary flow system. A distributary channel is a stream branch flowing away from the main stream and not rejoining it. Identifying characteristics of distributary flow areas include, but are not limited to, the following:

a. Low, but distinguishable topographic relief perpendicular to the primary flow direction.

b. Topographic relief sufficient to create isolated islands during flood conditions within the overall floodplain.

c. Channels that divide in the downstream direction so that the number of flow paths conveying floodwaters increase in the downstream direction.

d. An increase in vegetative density along flow lines extending laterally over an expansive area, with more uniform upland vegetation types found between flow lines.

e. During larger floods, the distribution of flow between various existing distributary flow paths may not be predictable.

f. Flow lines are relatively stable, especially during smaller floods.

g. Larger floods may cause isolated or widespread bank erosion and/or sediment deposition within the channel, which changes channel capacity and/or overbank conveyance. Such conditions may lead to channel avulsion.

2.4 Ponding Areas

In addition to any other rules, policies, and standards that may apply, the following criteria shall apply in the Study Area.

2.4.1 Criteria

a. All areas upstream of embankments (such as roadway, canals, dams and earthen embankments) shall be evaluated to determine if ponding conditions exist.
   i. For Subdivisions and Commercial Development – Detailed engineering analyses shall be performed to determine ponding elevations and flow patterns. Such analyses may include generation of hydrographs using detailed rainfall/runoff models, hydrologic and hydraulic routing of hydrographs, development of stage-storage-discharge relationships for the ponding area, hydraulic rating of outflow control structures, and hydraulic

modeling of flow parallel to the impoundment structure. In some cases, two-dimensional modeling may be required to accurately account for both the hydrologic and hydraulic characteristics of the flooded area. The engineer should distinguish between static and flowing ponding areas when selecting the appropriate modeling tool(s).

ii. Single-Lot development - If no detailed ponding data are available, the ponding depth shall be assumed to be at least equal to the elevation of the embankment crest. The Floodplain Management agency having jurisdiction may require a detailed engineering analysis, as described above, if the ponding hazard appears severe or the flow patterns are complex.

b. The following criteria apply to development in ponding areas:

i. Discourage development in ponding areas behind (upstream of) embankments; and in areas downstream of embankments, where stormwater runoff overtops these structures during the 100-year or more frequent flood events.

ii. Onsite stormwater detention/retention shall be provided to decrease hydrostatic pressure on embankments.

iii. Avoid disrupting any existing drainage pathways located parallel to embankments, and maintain current flow and volume quantities along streets and roads.

c. Finished-floor elevations shall be at least one foot above the 100-year ponding elevation. Where detailed information is not available, the finished-floor elevations for single-lot residential development may be set at least one foot above the structure crest controlling the ponding elevation.

d. Removing ponding areas by site-grading or by breaching the controlling embankment are permitted only if an engineering analysis is performed that demonstrates no adverse impact to adjacent and upstream/downstream properties.

2.4.2 Rationale

Ponding is a type of floodplain in which flood levels are controlled by a structure that blocks or restricts flow, in which no well-defined channel exists, and where the floodwater has near-zero velocity. Ponding occurs in both natural and developed watersheds.

Natural ponding areas occur in topographic depressions. They are somewhat rare, geologically short-lived features that tend to be filled with sediment over time.

Man-made ponding areas are far more common than natural ponding areas, and are caused by constructed features, such as roadway embankments, levees, canals or railroad grades that block natural flow paths. Man-made ponding areas are often found in sheet and distributary flow areas where well-defined flow paths are lacking, like much of the Lee Moore Wash watershed. Ponding also typically occurs in agricultural areas where field leveling and irrigation structures block and obscure the natural drainage pattern.

SECTION 3: STRUCTURAL CATEGORIES

3.1 Road Crossings

In addition to any other rules, policies, and standards that may apply, the following criteria shall apply in the Study Area.

3.1.1 Criteria

a. Roadway alignments shall be designed so that runoff collected by the roadway is conveyed to its historic flow path to the maximum extent possible. Roadways shall be designed so as to not divert flows, unless it can be shown that the diversion will have minimal impact on the natural functioning of the subject watercourse.

b. Roadway crossings should be designed so the roadway alignment is perpendicular to the watercourse in order to minimize disruption to the floodplain. The crossing should generally be located at the narrowest part of the floodplain. New roads shall be aligned to minimize placement of pavement within designated Flow Corridors. Road intersections should not be located over watercourses.

c. Roadway crossings are discouraged at locations where the watercourse is braided. Where braided watercourses must be crossed, wide or multiple crossings that minimize flow contraction and disruption of sediment balance are recommended.

d. Roadway crossings should be designed to minimize downstream scour, minimize the risk of erosion of roadway approaches, and maintain sediment balance up to the bank-full discharge. Scour protection is required to assure structure stability.

e. All crossings, regardless of the type, should be designed to minimize the disruption of sediment-transport balance upstream and downstream of the crossing.

3.1.2 Rationale

Roadway crossings of drainageways and floodplains can create considerable problems if not properly designed, constructed, and maintained. These problems include sediment-transport disruption, increased velocities and (potential) scour downstream of the crossing, ponding and (potential) flow diversion upstream of the crossing, and unintended overtopping of the roadway due to debris clogging of culverts and erosion of channel banks adjoining the crossing.

Maintenance of roadway crossings is made more difficult by poorly located, designed or constructed crossings. Increased maintenance is required when culverts are undersized, which can cause ponding and sedimentation upstream, scour downstream, pavement damage from overtopping, and erosion of channel banks adjoining the crossing.

Crossings that utilize the natural main-channel depth, width, and slope at the crossing location will have the least impact. Crossings that widen, narrow, deepen, or flatten the main channel may require frequent maintenance and may be more at risk of failure than crossings that maintain the natural channel geometry.

Roadway crossings shall be consistent with all local, state, and federal ordinances and regulations regarding environmental issues and riparian habitat.

3.2 Stock Ponds

In addition to any other rules, policies, and standards that may apply, the following additional criteria shall apply in the Study Area.

3.2.1 Criteria

a. An engineering analysis of any upstream or onsite stock ponds is required in order to determine the potential flood hazard posed to new development.

b. Based on the results of the analysis, stock ponds may be addressed by one of the following measures:

i. Breaching and/or removing, if approved by the owner;
ii. Improving the stock pond as warranted, so that it remains intact during the 100-year flood. A maintenance plan with posted assurances will be needed, similar to what is required for other significant flood control structures. In this case, the stock pond may be used to reduce or off-set stormwater detention/retention requirements; or,
iii. Allowing the stock pond to remain in its existing condition, and addressing the flood hazard associated with pond failure, including the potential for a flood wave that exceeds the base flood floodplain, and the potential for redirection of flow outside of the historic floodplain.

c. If the stock pond needs to be mitigated or removed, all local, state, and federal ordinances and regulations pertaining to environmental and riparian issues shall be addressed.

3.2.2 Rationale

There are over 100 stock ponds within the Lee Moore Wash Basin Management Study area. Stock ponds typically consist of a non-engineered earthen dam of varying height placed across a watercourse to impound stormwater runoff. Vegetation typically lines the impoundment area on older facilities. Should downstream areas become developed, these non-engineered earthen dams may pose a hazard from potential flow diversions and/or overtopping.

The ADWR Dam Safety Section has legal jurisdiction over dams (embankments) that exceed certain height and storage limits. ADWR currently defines a jurisdictional dam as *"either 25 feet or more in height or stores more than 50 acre-feet. If it is less than six feet in height regardless of the storage capacity or does not store more than 15 acre-feet regardless of height, it is not jurisdictional."* Even though a structure may not be considered jurisdictional, dams (embankments) in an urban environment may pose a significant flood hazard.

As development occurs, the structural integrity, hydraulic influence, and the safety of existing stock ponds should be assessed relative to downstream impacts created by a dam break. A stock-pond analysis may indicate that the

structure reduces downstream flooding, and is therefore beneficial. The analysis might also indicate that removing or breaching the structure would minimize downstream flood-hazard potential. Regardless, any analysis should address maintenance needs, as sedimentation and reduction of embankment integrity can occur over time if the structure is not properly maintained.

3.3 Stormwater Detention Facilities

In addition to any other rules, policies, and standards that may apply, the following criteria shall apply in the Study Area.

3.3.1 Criteria

a. Within the Study Area, only regional inline stormwater detention basins are allowed in a Flow Corridor.

b. If a regional detention basin is proposed in a Flow Corridor, the basin must pass the 10-year existing pre-development flow in order to minimize disruption to sediment-transport rates.

c. All regional stormwater detention basins shall be analyzed and designed to accommodate multi-use functions in a manner determined by the floodplain management agency having jurisdiction.

d. Within the Study Area, all stormwater detention facilities shall be designed in accordance with the regulations, policies, and standards of the floodplain management agency having jurisdiction. This may include, but is not limited to:
   i. Stormwater Detention/Retention Manual and Update; Pima County Department of Transportation and Flood Control District, City of Tucson
   ii. Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona; City of Tucson Department of Transportation, Engineering Division
   iii. State Standard for Stormwater Detention/Retention; Arizona Department of Water Resources, Flood Mitigation Section

iv. Watercourse and Riparian Habitat Protection and Mitigation Requirements, Pima County Regional Flood Control District
v. Tucson Codes 23, 26, and 29, with related Policies and Standards, City of Tucson
vi. Guidelines for the Development of Regional Multi-Use Detention Basins in Pima County, Pima County Transportation and Flood Control District

3.3.2 Rationale

Stormwater detention is widely used to mitigate the effects of urbanization on flood-peak discharges. Generally speaking, stormwater detention involves storing stormwater runoff emanating from urbanized areas and releasing it at flow rates that reflect natural or non-urbanized conditions which existed prior to development. Within the Lee Moore Wash Basin Management Study Area (Study Area), detention is required by all the jurisdictions, for certain types of new development. Stormwater detention may also be utilized to mitigate existing flooding problems within the Study Area.

Within the Study Area, certain washes have been designated as “Flow Corridors”. Within these defined Flow Corridors, only regional inline stormwater detention facilities are allowed. Offline stormwater detention basins are not allowed, as Flow Corridors are intended to maintain natural flow and sediment-transport capacity, and remain free from development.

Because stormwater detention basins can impact habitat and wildlife within washes, basin design and analysis of impacts shall address federal, state, and local environmental requirements, as well as relevant policies and guidelines in adopted land use plans. Where feasible, detention basins shall be designed for multi-purpose uses, including riparian habitat and wildlife, as well as passive and active recreational uses. Stormwater detention basins shall also be analyzed and designed, to the fullest extent possible in accordance with other local land policies, standards, and ordinances.

Mitigation of the effects of urbanization increasing stormwater runoff volumes is further addressed in the Development Criteria for water harvesting.

3.4 Utility Crossings

3.4.1 Criteria

a. Underground utilities shall be buried below the total 100-year scour depth in the main channel, including any long-term scour component (i.e., streambed degradation), unless acceptable engineering mitigation is provided.

b. Where the potential for lateral migration of the main channel exists, underground utilities shall be buried at the same depth in the overbank areas or erosion-hazard zone as in the main channel, unless controls are in place to prevent utility damage and/or exposure after lateral movement of the main channel.

c. Utility poles shall be placed outside the floodplain and erosion-hazard zone when possible. Where it is necessary to place utility poles within the floodplain, they shall be designed to withstand scour, debris impacts, and hydraulic forces, including debris accumulation.

d. Utilities shall cross the regulatory floodplains, and especially designated Flow Corridors, at the same locations and in the same manner as Road Crossings (i.e., typically perpendicular to the wash), to the greatest extent possible.

e. Utilities shall be attached to the downstream side, rather than upstream side, of bridges unless placement at the latter location is justified.

f. Utilities located at culverts or at-grade crossings shall be located on the upstream side, rather than downstream side, of the culvert or at-grade crossing unless placement at the latter location is justified.

g. After construction, utility-crossings shall be revegetated in a manner consistent with all applicable local, state, and federal laws and regulations. U.S. Army Corps of Engineers 404 Permit requirements typically provide guidance for this activity.

h. Utility design standards exist for most utilities. Where the standards conflict with the criteria set forth in this document, a conflict resolution meeting will be requested by the floodplain management agency havin jurisdiction to determine the appropriate course of action.

3.4.2 Rationale

Direct impacts on channel stability can occur during utility construction due to disturbance of channel bank and floodplain soils and vegetation. Where vegetation is removed, the disturbed and underlying soils are more vulnerable to erosion and scour. If floods occur before the vegetation is re-established, erosion along the construction alignment may occur, which in turn may initiate erosion of adjacent channel reaches. Mitigation of construction impacts should be addressed in the grading plan.

Site-specific conditions must always be considered during the planning, design, and construction phases, whenever utilities are to be placed in or near drainageways or floodplains. Also, after major flow events utilities located within drainageways or floodplains should be regularly inspected, and subsequently maintained as needed.

3.5 Culverts & At-grade Crossings

In addition to any other rules, policies, and standards that may apply, the following criteria shall apply in the Study Area.

3.5.1 General Criteria

a. At-grade roadway crossings of watercourses are generally appropriate along watercourses characterized by shallow flow conditions, such as distributary flow areas, due to the difficulty in spanning the floodplain.
   i. Subdivision Roads and Public Roads - At-grade roadway crossings may be allowed in rural and low-density residential areas, when intended for secondary and not primary access, if such crossings are acceptable to the jurisdiction having floodplain-management authority.
   ii. Private driveways – At-grade crossings shall be required in

distributary flow areas, unless the design of a culverted crossing is prepared by an Arizona registered civil engineer and submitted to the jurisdiction having floodplain management authority for review and approval.

3.5.2 Culverted Crossing Criteria

a. When culverts are proposed to cross a major watercourse, drivable access to the culvert shall be provided in order to facilitate access by maintenance vehicles. Major watercourses are defined as those with a 100-year discharge greater than 2,000 cfs. If there are environmentally sensitive areas near the culvert crossing, alternative access locations may be proposed nearby, subject to approval of the Floodplain Management agency having jurisdiction.

b. Box culverts shall be used to span the main channel(s) of a watercourse. The total box culvert span shall be at least as wide as the main channel bankfull width, and the box culvert rise shall be at least as high as the bankfull elevation. An exception to this rule is where a deeply incised channel has a much greater capacity than the design event. Unless approved by the local Floodplain Management agency having jurisdiction, all box culverts shall have a minimum height of 4 feet.

c. All culverts shall be provided with engineered outlet protection in accordance with applicable local standards.

d. Culvert design shall address potential clogging from the accumulation of sediment and debris. For culverts less than four feet high, a debris control device shall be required, except in unusual situations where it can be demonstrated that the culvert size or watershed characteristics preclude clogging.

3.5.3 Improved At-grade Crossing Criteria

a. At-grade crossings, or dip crossings, typically have only minimal or localized impacts on watercourse stability. More commonly, streams impact at-grade crossings, rather than vice-versa. Flow over the at-

grade crossing can cause erosion of the pavement and subgrade, deposition of sediment in the road section, and disruption of traffic flow. Channel stability impacts commonly observed near at-grade crossings that need to be mitigated include the following:

i. Roadway Elevation - If the improved at-grade crossing is constructed at an elevation above the natural channel bed, deposition will occur upstream of the crossing. This may lead to expansion of the floodplain, increasing the risk of avulsions and accelerating the formation of a downstream scour hole. The minimum elevation of an improved at-grade crossing shall not be higher than the upstream existing channel invert.
ii. Carrying Capacity - The profile of the roadway at the improved at-grade crossing shall be sufficient to pass the design event so that the roadway does not capture and divert flows from the upstream wash.
iii. Scour Hole - A scour hole often forms on the downstream side of an at-grade crossing due to long-term system sediment discontinuities, acceleration of flow over the hydraulically smooth roadway surface, and increased turbulence as flow transitions back at the natural channel bed. Development of a scour hole can undermine the at-grade crossing, ultimately leading to its failure. To mitigate downstream scour impacts, the following criteria apply: For Subdivisions and Public Roads: For an improved at-grade crossing, upstream and downstream cutoff walls shall be designed to withstand scour during a 100-year peak discharge, as well as predicted long-term streambed degradation.
iv. For private driveways: Upstream and downstream cutoff walls for improved at-grade crossings shall extend at least three (3) feet below natural grade.

3.5.4 Rationale

The design of culvert structures includes consideration of public safety, long-term function and maintenance, and impacts to the channel form and function. Typically, the impacts of culvert crossings on a watercourse system are primarily a function of their size relative to design discharge, channel and floodplain

morphology, clogging potential, sediment-transport capacity, and scour potential. Undersized culverts and culverts that create significant headwater ponding can have adverse impacts on both upstream and downstream properties. Impacts of undersized culverts on channel stability may include the following:

a. Sediment Deposition. If the entrance geometry to the culvert and the slope of the approach channel are improperly designed to convey both floodwaters and sediment during the design flood, much of the sediment load of a stream will likely be deposited in the headwater pool at the culvert inlet. The volume of sediment deposited depends not only on the entrance geometry of a culvert and the slope of the approach channel, but also on the culvert capacity relative to the floodwater discharge and sediment inflow, the duration of the ponding condition, the geometry of the ponding area, and the size of the sediments in transport. Sediment deposition decreases channel (and culvert) capacity, increases the potential for overbank flooding and avulsions, and requires maintenance to restore conveyance capacity. Culverts that do not obstruct the main channel will have less frequent impacts on channel stability.

b. Scour-Hole Formation. A scour hole may form at the culvert outlet due to accelerated velocity through the culvert, discharge of sediment-deprived water, and turbulence at the culvert/channel interface.

c. Long-Term Degradation. Where a significant percentage of the sediment load is deposited upstream of a culvert due to headwater ponding, discharge of clear water may lead to channel degradation downstream until the channel slope adjusts to the new sediment supply. Oversized (relative to channel width and floodplain geometry) culvert structures, which increase the width of the channel in order to minimize the height or depth of ponding, can also have detrimental impacts to both upstream and downstream properties.

d. Long-Term Aggradation. Increasing the width of a channel to accommodate a culvert structure may change the sediment-transport capacity of the channel. During frequent events or events lesser than the design capacity of the culvert structure, sediment may be deposited in the channel section that has been widened. Accumulation of

sediment may decrease both the capacity of the channel and the capacity of the structure, ultimately resulting in flooding impacts to adjacent properties. Culverts that do not obstruct the main channel will have less frequent impacts on channel stability than culverts that block the main channel.

3.6 Levees & Embankments

In addition to any other rules, policies, and standards that may apply, the following criteria shall apply in the Study Area,

3.6.1 Criteria

a. The use of levees for flood-control purposes is discouraged in the Lee Moore Wash Basin Management Study area. Nevertheless, FEMA does have specific criteria relating to the design, construction, maintenance, and certification of levees. Flood-control levees constructed within the Study Area must meet current effective FEMA policies to be considered as flood-control structures. Engineers proposing to use levees for flood-control purposes should verify that the most current FEMA levee criteria are being used.

b. The structural integrity and potential for failure of existing earthen levees shall be evaluated within the Study Area. The foundation investigation shall consist of borings, test pits, and other subsurface explorations, as deemed necessary. These investigations shall assess soil and rock stability and groundwater conditions. Laboratory testing of undisturbed and remolded soil specimens and rock samples shall be required, as well as stability and settlement analyses and fissure studies, unless it is demonstrated by a Registered Professional Engineer (P.E.) or Profession Geologist (P.G.), to the satisfaction of the floodplain management agency having jurisdiction, that these analyses are not necessary.

c. Unless a current hydrologic/hydraulic study is available, a hydrologic and hydraulic evaluation shall be performed by a P.E. to evaluate levee performance and the level of protection provided. Hydraulic analyses

shall be conducted to determine flood elevations for stream reaches affected by the levee. The analyses shall include flood depth and velocity data for the 100-year as well as the top-of-levee event. An assessment of impacts on the levee of the 100-year and top-of-levee flood depths and velocities, as well as impacts on adjacent property and structures, shall also be provided to the satisfaction of the floodplain management agency having jurisdiction.

d. In the course of due diligence and site analyses, developers and their engineers should evaluate the watershed for the presence of any levees or levee-type embankments.

e. No levee may be constructed for the purpose of storing, conserving, or retarding water, or for any other purpose, unless the person or governmental agency desiring the construction has been authorized by the local community having floodplain management jurisdiction. Potential future development of areas upstream, downstream, and adjacent to the levee shall be considered in the levee design. The levee shall operate safely during all floods up to the design flood elevation. The levee must be protected from, or designed to prevent, erosive velocities along the structure and its foundation.

f. FEMA requires that hydrologic, hydraulic, and geotechnical analysis shall be completed, and plans and specifications prepared, by a P.E. for design of all new levees. FEMA also requires that the basis, references, calculations, and conclusions relative to hydrologic, hydraulic, and structural design studies be provided in a design report. Design procedures established by the United States Army Corps of Engineers (USACE) and FEMA are generally accepted as sound engineering practice. A written summary of the design references and assumptions used shall be included in the information submitted to the local community having floodplain-management jurisdiction.

g. Hydraulic analyses shall be conducted to determine flood elevations for stream reaches affected by the construction of a levee. The analyses must provide flood depth and velocity data for the 100-year and top-of-levee flood events. For construction of new levees, the flood depths and

velocities must be determined with and without the levee in place. The impact of increased flood depths and velocities on affected properties and structures with a levee in place must be provided. The levee must be protected from, or designed to prevent, erosive velocities along the structure and its foundation. FEMA regulations also require that all levees providing 100-year flood protection be certified by FEMA. Design Reports shall include:

i. Discharge/probability data
ii. Hydrographs
iii. Valley cross-sections
iv. Descriptive hydraulic information concerning bridges and other structures that influence the hydraulic characteristics of the watercourse
v. Scour calculations/erosion control design
vi. Stream elevation-discharge-storage data
vii. Stream flood routings and flood profiles
viii. Operation and Maintenance Manual
ix. Freeboard calculations

h. Design plans and specifications shall be prepared by a P.E. in accordance with the standards of the floodplain management agency having jurisdiction, and shall contain all necessary legal easements for access to, and maintenance of, the structure. A Levee Inspection Report shall be prepared for the owner by a registered P.E.

i. It is the levee owner's responsibility to fund and conduct inspection, maintenance, and repair of levees. For each levee, a regular schedule shall be established for inspection and maintenance purposes. Easements shall be obtained, as needed, to facilitate access to, and maintenance of, the structure. Special funding districts may be set up for this purpose.

j. All plans to remove, to alter, or to permanently repair a levee must be prepared by a P.E., and must be approved by the local agency having floodplain management jurisdiction.

3.6.2 Rationale

Levees and levee-type embankments are located throughout the Lee Moore Wash Basin Management Study Area. Levees have the potential to divert, concentrate, obstruct or impound surface water runoff.

For the purposes of this study, an embankment is defined as any artificial barrier that diverts, retards, or obstructs runoff. A levee is defined as any artificial barrier, together with any appurtenant facility, that diverts or restrains the flow of a stream or other body of water for the purpose of protecting an area from inundation by floodwaters. A levee-type embankment may be built for other reasons, for example, to form a stock pond, or serve as a non-engineered diversion berm or directional training dikes, but it is considered to function like a levee.

3.7 Channelization

In addition to any other rules, policies, and standards that may apply, the following criteria shall apply in the Study Area.

3.7.1 Criteria

Channelization generally impacts the natural environment in several ways, as listed below. Proposals for channelization in the Lee Moore Wash Basin Management Study area shall address the following:

a. *Velocity.* Channelization generally increases channel velocities. Because sediment-transport rate is exponentially related to velocity, increased channel velocities lead to increased erosion potential.

b. *Depth.* Channelization can increase the flow depth by eliminating the floodplain area available for conveyance and by concentrating flows. Increased flow depths result in greater scour depths and higher channel velocities.

c. *Discharge.* Channelization may eliminate the area available for storage of floodwaters on the floodplain, resulting in decreased attenuation of

flows and increased peak discharges downstream. Increased peak discharges are associated with increased sediment-transport rates and erosion potential.

d. *Design Standard.* In Pima County engineered flood-control channels are typically designed to a 100-year design standard. Therefore, damage may occur to development adjacent to a 100-year channel (or to the channel itself) if a peak flow rate greater than than the peak of a 100-year event were to occur. If design discharges change due to watershed changes or as a result of revisions to hydrologic modeling standards, mitigation solutions may be required to maintain the same standard of protection.

e. *Design Life.* Engineered structures have a limited design life, thus they require regular inspection, maintenance, and eventual replacement. All channelization shall be in compliance with the Development Criteria for Maintenance.

f. *Equilibrium Slope.* As a result of increases in discharge, velocity, and depth typically associated with channelization, the new stable-channel bottom slope will generally be flatter than the previously existing natural channel slope. This change results in long-term degradation as the system attempts to reach a new state of dynamic equilibrium.

g. *Habitat.* Channelization caused by proposed development typically reduces the natural floodplain and streambank habitat, and may require habitat mitigation.

h. *Sediment Supply.* Channel bank erosion is an important source of sediment supply for the streams in the study area. Construction of bank protection eliminates this source of sediment supply, thus increasing the likelihood of channel bank erosion of adjacent and downstream reaches.

i. *Downstream Impacts.* An increase in the local instability should be expected at the outlet of a channelized reach due to changes in velocity, sediment supply, habitat impacts, and discharge. Depending on the channel geometry, the expected response can range from lateral erosion

and scour to sediment deposition and overbank flooding. Channelization should be allowed only when it can be demonstrated that long-term or short-term offsite impacts to channel stability are mitigated; that downstream reaches are adequately protected from erosion and flooding; and that a long-term inspection and maintenance program is implemented.

j. *Environmental Compatibility.* When structural flood-control measures are necessary, their design and installation should complement the environment and be accomplished with the least disturbance to the natural setting. Design guidelines and standards for structural flood-control improvements are provided in the *Drainage Design and Riparian Ordinance Manuals* of local communities.

k. *Vegetation Management.* Channelization typically eliminates much of the natural vegetation. If the channel is not designed to accommodate vegetation, then vegetation management shall be required.

3.7.2 Rationale

Channelization is defined as the construction of an engineered channel, with bank protection and grade-control structures as needed. Channelization shall be allowed only when it can be demonstrated that no long-term or short-term offsite impacts to channel stability are likely, and that downstream reaches would be adequately protected from flooding and erosion, and that a long-term inspection and maintenance program would be implemented.

Where structural flood-control measures are necessary, their design and installation should limit disturbance to the natural setting. All channelization shall comply with local riparian ordinances and design guidelines and standards for structural flood-control improvements. Channelization standards are provided in the *Pima County Drainage and Channel Design Standards for Local Drainage*, in the *State Standards* developed by the Arizona Department of Water Resources, and in the City of Tucson *Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona*.

SECTION 4: NON-STRUCTURAL/REGULATORY CATEGORIES

4.1 Erosion-Hazard Setbacks

In addition to any other rules, policies, and standards that may apply, the following criteria shall apply in the Study Area.

4.1.1 Criteria

a. In the portion of the Study Area that exhibits riverine flow conditions, current (or future revisions to) erosion-hazard regulations apply.

b. In the portion of the Study Area that exhibits distributary flow conditions, the following criteria apply:

   i. When the 100-year peak discharge of the watercourse is less than 500 cfs, the following setbacks shall apply:
      1. For individual channels that convey bankfull flows less than 100 cfs the setback shall be 10 feet, as measured from the edge of the bank of the channel or braid.
      2. For channels that can convey bankfull flows greater than 100 cfs the setback shall be 25 feet, as measured from the edge of the bank of the channel or braid.

   ii. When the 100-year peak discharge of the watercourse is between 500 and 2000 cfs, the following setbacks shall apply:
      1. For individual channels that convey bankfull flows less than 100 cfs the setback shall be 10 feet, as measured from the edge of the channel or braid bank.
      2. For channels that can convey bankfull flows greater than 100 cfs the setback shall be 25 feet, as measured from the edge of the channel or braid bank
      3. For channels that can convey bankfull flows greater than 500 cfs the setback shall be 50 feet, as measured from the edge of the channel or braid bank.

iii. When the 100-year peak discharge of the watercourse is between 2000 and 5000 cfs, the following setbacks shall apply:
    1. For individual channels that convey bankfull flows less than 500 cfs the setback shall be 25 feet, as measured from the edge of the channel or braid bank.
    2. For channels that can convey bankfull flows greater than 500 cfs the setback shall be 50 feet, as measured from the edge of the channel or braid bank.
    3. For channels that can convey bankfull flows greater than 1000 cfs the setback shall be 75 feet, as measured from the edge of the channel or braid bank.

c. Alternative safe setbacks that differ from the setbacks established above may be proposed, based upon submittal of technical justification to the floodplain management agency having jurisdiction.

d. For existing legal lots recorded prior to the adoption of this study, and which are now, by virtue of this study, located in an adopted flow corridor within a distributary channel, the erosion-hazard setback and foundation design for any proposed structure shall be prepared by an Arizona-registered civil engineer, and shall be submitted to the local authority having floodplain management jurisdiction for review and approval.

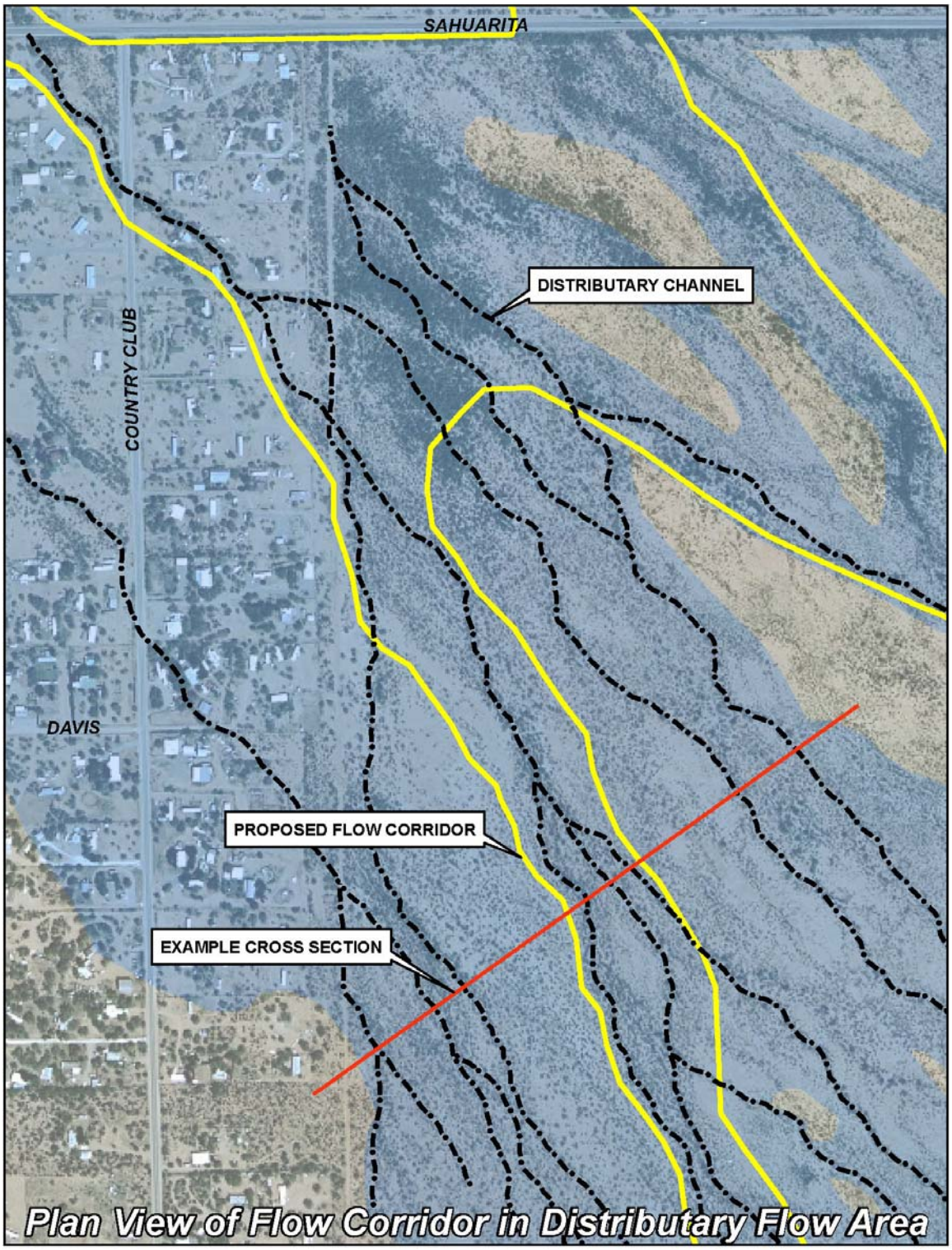
4.1.2 Rationale

In the Study Area severe erosion, both lateral and vertical, may occur over a short periods of time, as a result of a large flood; or, over a longer peroid of time as the result of a series of smaller floods. Since conventional hydraulic engineering methods do not account for erosion hazards, the local jurisdictions have established erosion-hazard setbacks along watercourses to minimize erosion damage and potential loss of life and property. These setbacks have been developed for riverine flow conditions. Approximately one-third of the Study Area (primarily the northern portion) exhibits riverine flow, and current City, County, and Town erosion-hazard regulations appear to work well in these areas. However, these regulations are not as readily applicable in distributary flow areas, like those which exist in many areas of the Lee Moore Wash Watershed.

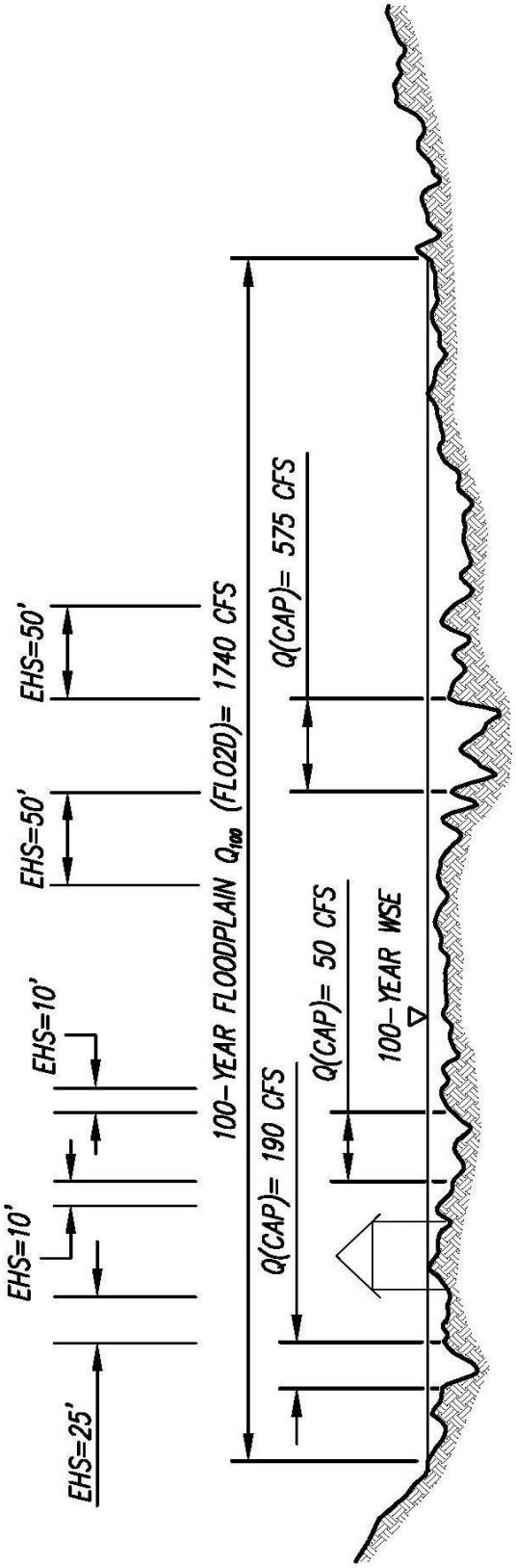
In distributary flow areas, water flows within, or back and forth between, multiple channels or “braids” during a single event or a series of flooding events. Typically these braids are contained within the regulatory floodplain, but they convey considerably less water than traditional riverine low-flow channels. In order to establish Development Criteria with more appropriate erosion-hazard setbacks for distributary flow areas, the following have been evaluated:

a. 100-year floodplain depths greater than 0.5 feet
b. Capacity of a channel or braid, as measured by its ability to convey a given range of discharges (Q), measured in cubic feet per second (cfs).
c. Velocity of flow within a channel or braid during the 100-year flood, as measured in feet per second (fps).
d. The potential for a channel or braid to increase its flow capacity due to geomorphic processes, such as erosion, deposition, or avulsion.
e. Location of a channel or braid as to whether it is located either within or without an adopted or revised flow corridor.

These factors have been utilized to establish a minimum lateral erosion-hazard setback from the primary bank of a channel or braid, as identified in the Criteria contained herein.



Plan View of Flow Corridor in Distributary Flow Area



EROSION HAZARD SETBACK CONCEPT
DISTRIBUTARY FLOW CHANNELS

VERTICAL EXAG: 50:1
N.T.S.

4.2 Flow Corridors

In addition to any other rules, policies, and standards that may apply, the following criteria shall apply in the Study Area.

4.2.1 Criteria

a. Flow corridors established and defined as part of the Lee Moore Wash Basin Management Study shall be maintained in their natural state, except as described below.

b. Private and public development shall preserve the flow corridors identified in the Lee Moore Wash Basin Management Study to the fullest extent possible.

c. A 50-foot recreation easement may be provided on both sides of all adopted and any modified flow corridors, if required by the agency having jurisdiction.

d. Modifications to the flow-corridor width and location may be granted by the floodplain management agency having jurisdiction. Prior to approving such a modification, the jurisdictional agency shall consult with other floodplain management agencies with jurisdiction and private property owners within the Lee Moore Wash Basin Management Study area that may be impacted by the proposed modification. The purpose of the consultation is to ensure that the integrity of the backbone natural drainage infrastructure system is maintained. There are several flow-corridor modification administrative thresholds, as described below:

    i. Those modifications granted by the Chief Engineer or Floodplain Administrator of the floodplain management agency having jurisdiction when (1) the modifications are made only on parcels of land which are within one political jurisdiction and for which 100% of the land owners consent to the modifications in writing, and (2) the proposed modifications result in collection and release of water that is maintained at pre-existing flow rates

and collected and released at the same pre-development locations.

ii. Those modifications granted by the Chief Engineers or Floodplain Administrators of the floodplain management agencies having jurisdiction when (1) the modifications are made only on parcels of land which are within several political jurisdictions and for which 100% of the land owners consent to the modifications in writing, and (2) the proposed modifications result in collection and release of water that is maintained at pre-existing flow rates and collected and released at the same pre-development locations.

iii. Those modifications of a flow corridor within an adopted Special Flood Hazard area, as designated by FEMA, shall need a variance conforming to the requirements of the National Flood Insurance Program, as provided within 44CFR66. Prior to scheduling a variance hearing, the agency with jurisdiction shall consult with and obtain concurrence from the other local government agencies within the Study Area. The purpose of the consultation is to ensure that the integrity of the backbone natural drainage infrastructure system is maintained. Variances shall be filed with the Chief Engineers or Floodplain Administrators of the floodplain management agencies having jurisdiction, and shall follow the procedures outlined by each of those agencies having jurisdiction in those areas within which the proposed flow-corridor modifications lie.

e. Flow corridors may be used for non-paved, non-motorized vehicular trail use in compliance with other local, state, and federal regulations.

f. Flow corridors may be used for regional habitat restoration projects, but may not be used as Riparian Habitat Mitigation Areas.

g. Underground utility-construction activities are not allowed in flow corridors, except that generally perpendicular crossings of major utilities may be allowed if demonstrated, as necessary, for public health and safety purposes. When demonstration of need has been documented, these crossings shall comply with the “Utility Crossing Development

Criteria for the Lee Moore Wash Basin Management Study."

h. Roadway crossings of flow corridors should create minimal disturbance. When needed, these crossings shall comply with the "Road Crossing Development Criteria for the Lee Moore Wash Basin Management Study."

4.2.2 Rationale

As land is developed, there is a need to identify and preserve a backbone natural drainage system for the efficient conveyance of stormwaters and floodwaters. Preservation of existing flow paths in their natural condition allows for the conveyance of post-development drainage while maintaining the natural functions of the floodplain. Current City, County and Town Floodplain Management Ordinances allow for limited encroachment into the 100-year floodplain, based on engineering analysis and compliance with other applicable ordinances.

Identification and preservation of flow corridors in the watershed, prior to development, will provide a backbone natural drainage infrastructure "blueprint" for new development that will minimize future flood hazards and losses. Flow-corridor preservation, in conjunction with other drainage and environmental ordinances, will reduce development impacts and costs, and will provide environmental benefits by maintaining existing flow paths, optimizing system sediment balance, and providing continuity for wildlife corridors.

The flow corridors adopted as part of this Study have been delineated using the following criteria:

a. For that portion of the Study Area located west of the Pima County Conservation Land System boundary, flow corridors are generally identified as follows:
   i. the limits of the 10-year floodplain in distributary flow areas; and
   ii. the floodway or primary channel bank limits, whichever is greater, in the riverine flow areas.

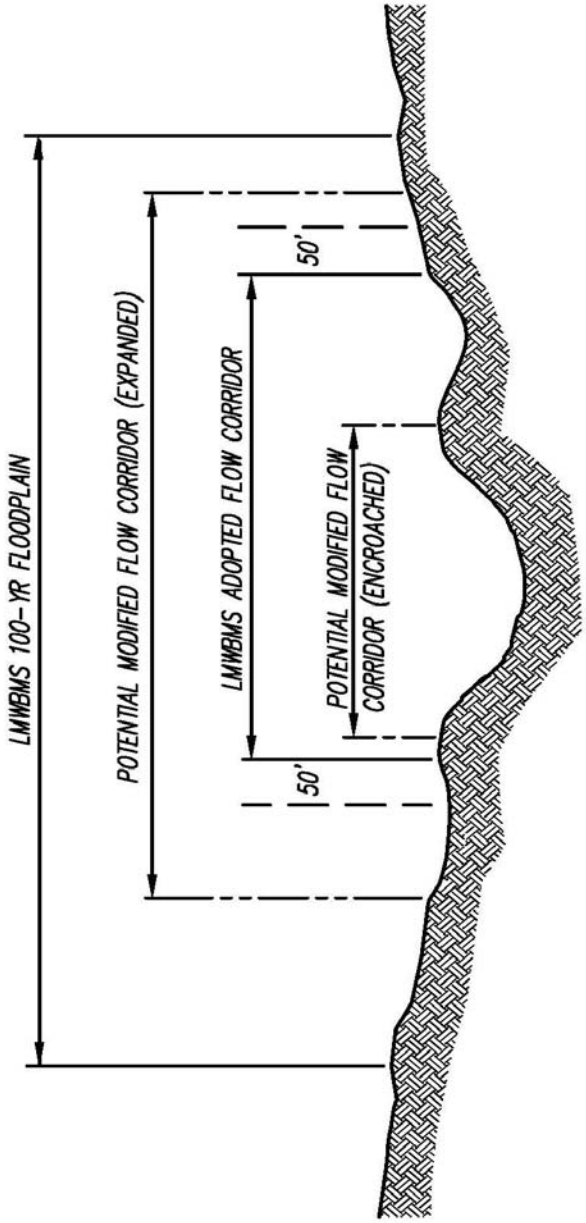
b. For that portion of the Study Area located east of the Conservation Land

System boundary, flow corridors are generally identified as the limits of the 100-year floodplain.

c. Flow Corridors must convey the 100-year peak flow for all distributary flow in the flow corridor, including any abandoned braids replaced by the flow corridor.

d. The flow corridors and their limits are graphically depicted on the Lee Moore Wash Basin Management Study Flow Corridor and Floodplain Delineation Maps.

These limits may be reduced or expanded based on current information at the time of application (See exhibits in Lee Moore Wash Basin Management Study).



FLOW CORRIDOR SCHEMATIC
LMWBMS ADOPTED VS POTENTIAL MODIFICATIONS
BASED ON MORE DETAILED INFORMATION

N.T.S.

NOTE: A 50' RECREATION EASEMENT SHALL BE PROVIDED ON BOTH SIDES OF THE ADOPTED AND ANY POTENTIAL MODIFICATION.

4.3 Water Harvesting

In addition to any other rules, policies, and standards that may apply, the following criteria shall apply in the Study Area.

4.3.1 Criteria

a. Installation of water-harvesting earthworks (localized depressions, French drains, and other small-scale water-harvesting features that facilitate the concentration and infiltration of harvested stormwater into the soil for beneficial use) is strongly encouraged throughout the Lee Moore Wash watershed at all residential and commercial sites.

b. If requested, credit for a volumetric reduction of stormwater as a result of using water-harvesting techniques shall be given by the floodplain management agency having jurisdiction.

c. Water harvesting is strongly encouraged in the rights-of-way of public roads to decrease the contribution of roadway runoff to regional stormwater volumes.

d. The size and location of water-harvesting earthworks should be determined on a site-specific basis.

e. To increase effectiveness, install multiple small earthworks throughout a site, starting at the highest elevation of the site. Use the harvested water to supplement irrigation needs of plants placed within or adjacent to the earthworks. Plants should be placed in or near earthworks based on their tolerance for temporary inundation. Earthworks placed in proximity to existing plants should be constructed to prevent disturbance of existing roots of trees and shrubs.

f. Stormwater detention basins can contain and slowly release large volumes of stormwater, and also support vegetation, making them ideal as water-harvesting structures. The functions of properly designed multi-purpose stormwater detention basins can include stormwater

management, support of native vegetation, creation of wildlife habitat, and active and passive recreation. Multi-purpose stormwater detention basins should be designed according to guidance from relevant jurisdictions.

g. Small-scale water-harvesting earthworks shall be designed and maintained to ensure that harvested water infiltrates into the subsurface within 24 hours of catchment. Sites with clayey soils or near-surface caliche might require percolation tests to determine if water harvesting is advisable for basins deeper than 6 inches. Cost of long-term maintenance of functionality of stormwater controls should be considered when analyzing viability of decentralized stormwater management.

h. Water-harvesting earthworks shall be designed and constructed to prevent backup of pooled stormwater into onsite structures or anywhere off site.

4.3.2 Rationale

Water harvesting is a technique for concentrating stormwater runoff into depressions in the soil in locations where vegetation can benefit from increased water infiltration.

Water harvesting is also conducted by collecting stormwater runoff in above- or below-ground tanks for storage until later use for landscape irrigation or other beneficial purposes. From a flood-control and stormwater-management perspective, water harvesting can assist in the infiltration of stormwater runoff on individual sites, reducing offsite flows that contribute to regional stormwater management challenges.

Other benefits of water harvesting accrue regionally. Harvesting the first flush of runoff from an urban site sequesters pollutants in the soil, rather than allowing it to flow into the waters of the US. Water harvesting can be an excellent tool for controlling stormwater quality. Therefore, to increase the beneficial use of water harvesting all new commercial sites, common areas of new subdivisions, public buildings, and public right-of-ways shall be strongly encouraged to be

constructed with water-harvesting features that assist, in general terms, with meeting landscape water needs.

Specific sites benefit from water harvesting through the reduction in potable water costs due to reduced potable irrigation demand. In some cases, required stormwater detention basins can be reduced in size because of increased water harvesting in other parts of the site. Given the regional and individual site benefits of water harvesting, it should be put to extensive use in the Lee Moore Wash watershed.

Guidance on techniques, sizes, and functions of various water-harvesting earthworks can be found in the City of Tucson Water Harvesting Guidance Manual, which is online at:
(http://dot.tucsonaz.gov/stormwater/downloads/2006WaterHarvesting.pdf),

and at several websites:
http://www.watershedmg.org/ and http://www.harvestingrainwater.com/

among many other sources.

4.4 Disturbance Envelopes

In addition to any other rules, policies, and standards that may apply, the following criteria shall apply in the Study Area, as justified in the rationale.

4.4.1 Criteria

a. Development is limited in regulatory floodplain areas. No more than 60 percent of the portion of the parcel in the regulatory floodplain may be permanently disturbed; and all improvements (including, but not limited to, roof-bearing structures; retention areas; cleared and grubbed areas, such as horse corrals; landscaping with permanent irrigation; and areas with impervious ground cover and/or barriers that preclude infiltration) shall be located within this area. The cap of 60 percent of disturbance area in the regulatory floodplain is adopted for drainage purposes, and does not override zoning requirements or entitlements.

b. The full limits of the proposed disturbance in the regulatory floodplain, as provided herein by these criteria, shall be shown on the submitted site plan or plat. Areas within the 100-year floodplain, but outside the disturbance envelope, shall not be disturbed, except as outlined herein, without approval of the Floodplain Management agency having jurisdiction.

c. For the contractor's use and for inspection purposes, prior to issuance of the building permit boundaries of the area to be disturbed must be delineated on the property with physical markers. Locations of the physical markers shall be delineated on the site plan submitted for the building permit.

d. Temporary disturbance in excess of the 60% is allowed for utility installation, temporary construction access, and temporary stockpiling of construction related materials. Revegetation of these areas is required and must be completed prior to issuance of a final certificate of occupancy. Revegetation methods shall be consistent with regulations of the floodplain management agency having jurisdiction.

4.4.2 Rationale

A disturbance envelope is the area on a single lot, within or outside of a subdivision, which may be altered from its natural state during development of the lot. The rationale for providing for limitations of the disturbance envelope is twofold.

a. The placement of fill in and disturbance of the regulatory floodplain may have adverse impacts on adjacent properties (i.e. increase in water-surface elevation, diversion of flow, increase in flow velocity, and increase in erosion).

b. The removal of vegetation and other disturbance of the natural ground results in rainfall no longer being intercepted by the native plants and soils, thus more of this rainfall becomes runoff. Also, plant roots and other biological activity associated with vegetation increase the rate at which rainfall infiltrates into the soil. The combined result of lot

disturbance is an increase in both the magnitude and frequency of runoff from the disturbed area.

Another consequence of the disturbance of the natural areas is a disruption and partial elimination of habitat for wildlife. Preservation and maintenance of an undisturbed lot area enhances opportunities for use by wildlife.

4.5 Walls & Fences

In addition to any other rules, policies, and standards that may apply, the following additional criteria shall apply in the Study Area, as justified in the rationale.

4.5.1 Criteria

a. Prior to construction, any wall or fence proposed on a lot that is impacted by the 100-year floodplain shall be subject to review and approval by the local authority having floodplain management jurisdiction.

b. Fences and walls are prohibited within floodways and constructed drainageways.

c. When proposed in a regulatory floodplain, only open-type fences such as pipe rail, split rail, or barbed wire shall be allowed on or within 25 feet of property boundary lines. Block walls and other fences such as chain link and chicken-wire fences, which are not considered open-type fencing, are prohibited on or within 25 feet of property boundary lines.

d. When proposed in a regulatory floodplain, chain link, chicken wire, or other fences may be allowed if the fence is 25 feet or more from all property boundary lines, the bottom of the fence is elevated to at least the base flood elevation, and the fence completely spans any low-flow wash channels.

e. When proposed in a regulatory floodplain, block walls may be allowed if the wall is 25 feet or more from all property boundary lines, is designed

and constructed to provide at least 50% flow-through openings, and the wall avoids any low-flow wash channels.

f. When proposed in a regulatory floodplain, a solid interior “courtyard” wall may be allowed immediately downslope or upslope of the principle dwelling unit as long as the wall does not provide more than 15 feet of additional encroachment as measured perpendicular to the direction of flow, and is greater than 50 feet from any property line.

g. Other solid fences and walls proposed in a regulatory floodplain shall demonstrate to the satisfaction of the Floodplain Administrator that there is no adverse impact to neighboring properties as a result of the proposed improvement.

4.5.2 Rationale

Fences and walls can significantly obstruct flow. Consequently, construction of these improvements is prohibited within floodways and constructed drainageways, and should be avoided or minimized in regulatory floodplains. If fences or walls are necessary, certain design considerations apply, including elevating the bottom of the fence to at or above the base flood elevation within the regulatory floodplain limits, offsetting the wall or fence from the property line to allow drainage, and providing sufficient flow-through openings in otherwise solid walls. Fences and walls that cross natural washes, channels, or flow paths shall be elevated to pass bankfull flows without obstruction, and should provide openings to convey the 100-year flood with no adverse offsite impacts. Solid perimeter walls should be set back from property lines to provide flow conveyance between lots, or should be designed to pass drainage (accounting for blockage by vegetation or debris and scour), with no adverse impacts on neighboring properties. In other words, it must be demonstrated to the satisfaction of the Floodplain Administrator that there is no increase in peak discharge, flow depth, flow velocity, or flow diversion resulting from the proposed improvement(s).

SECTION 5: MAINTENANCE

5.1 Inspection and Maintenance Practices

In addition to any other rules, policies, and standards that may apply, the following criteria shall apply in the Study Area.

5.1.1 Criteria

All Facilities:

The following shall be addressed in a maintenance plan:

a. Routine (quarterly) inspection and maintenance/cleanup for activities such as trash removal, fence repair, landscaping etc.

b. Periodic (annual) inspection and maintenance/repairs to ensure the structural integrity of the facility, as well as to insure physical integrity relative to aggradation or degradation, vandalism, vegetative invasion, etc.

c. Post-storm or flooding maintenance/repairs to address significant aggradation and degradation episodes, damage to the structural integrity of the facility, or maintenance/ repairs, as warranted, to restore the flood-control functionality.

Inspection and Maintenance responsibility:

When drainage infrastructure is dedicated to the public, it shall be the responsibility of the local jurisdiction having authority to perform the inspection and maintenance responsibilities described herein.

When the drainage infrastructure is privately maintained, the entity that has inspection and maintenance responsibility shall be established at the time of review of the Development Plan or Subdivision Plat. Also, a mechanism to ensure adequate resources for routine and annual inspections and any necessary maintenance shall be provided and disclosed in the Conditions, Covenants, and Restrictions, and/or on the Plan or Plat, as appropriate.

Stormwater Detention Basins (including associated landscaping):

Routine maintenance activities will be based on the results of the required quarterly inspections of stormwater detention basins, and associated landscaping, if applicable. The floors of stormwater detention basins will be cleaned of all trash and debris that can clog outlet structures during floods. Outlet structures will also be inspected and cleaned of any debris on a regular and routine basis. Landscaping shall be trimmed to design levels, and trimmings shall be disposed of at an approved facility (not in conveyance channels or stormwater detention basins). Gravel or decomposed granite will be maintained at design levels, which may include sweeping and replacement to assure adequate functionality.

Periodic Maintenance for Stormwater Detention Basins:

Routine inspection and maintenance activities will be based on the results of the required annual inspections. If regular and routine inspections reveal that no damage has occurred from minor storms or vandalism, then major maintenance need only be performed at 3-year intervals, or longer if justified.

a. Basin Bottom. Measurements of basin floor elevations will be taken if the inspection reveals signs of sediment aggradation or degradation. The elevations will then be compared to the design and as-built condition. If existing elevations are found to be, on average, more than one foot different than design elevations, the floodplain management agency having jurisdiction or a designated responsible party will be notified immediately for a determination as to what course of action, if any, is needed.

b. Basin Side-Slopes. Detention basin side-slopes will be inspected for signs of rill erosion, embankment cracking, or sloughing due to slope instability. If the erosion, cracking, or sloughing is minor, then the slopes may be re-graded to re-establish the design grades. If major grading is needed, and it will significantly disturb established vegetation, then the floodplain management agency having jurisdiction or a designated responsible party will be notified immediately for a determination as to what course of action, if any, is needed.

c. Other. A visual inspection will be completed of all surface structural components including, but not limited to, inlet and outlet structures, scour protection and erosion-control, access areas, and recreational facilities. They will be evaluated for signs of distress, sulfate attack, cracking, differential settlement, tilting, surface-water ponding near the foundations, or unauthorized modifications. Minor repairs will be made, as needed, but before any major repairs are conducted the floodplain management agency having jurisdiction or a designated responsible party will be notified immediately for a determination as to what course of action, if any, is needed.

The results of all Periodic Maintenance Activities will be documented and available for review by both the floodplain management agency having jurisdiction and the designated responsible party. After completion, all maintenance activities performed as a result of the annual inspection will be photographed, and a description of the activity and its costs will be documented and filed with the floodplain management agency having jurisdiction and the designated responsible party**.**

Post-Storm Maintenance for Stormwater Detention Basins:

Post-storm inspections should be performed as soon as it is feasibly possible to do so after significant storms have subsided. Although designed for 100-year flow conditions, the system is still susceptible to damage during more frequent flow events. A post-storm maintenance inspection shall be completed after the occurrence of a rainfall of 1.5 inches in 3 hours, or similar event, regardless of any reported flooding. During prolonged storm events, daily monitoring of the flood-control structures, particularly the stormwater detention basins, should be conducted. Online precipitation gauge data is available from the Pima County Regional Flood Control District to assist in evaluating rainfall events.

The results of all post-storm maintenance will be documented and available for review by both the floodplain management agency having jurisdiction and the designated responsible party. If major damage has occurred due to a flow event, then the floodplain management agency having jurisdiction or a designated responsible party will be notified immediately for a determination as to what

course of action, if any, is needed.

Annual Inspections:

Annual inspections are intended to assess the system's operating condition, and should identify larger-scale repair and maintenance items. These inspections shall be performed by an Arizona registered Civil Engineer, who shall provide a certification letter indicating that the maintenance is consistent with the approved maintenance plan and the criteria in this document. If this is not the case, then the appropriate jurisdiction shall be immediately notified.

These inspections are intended to evaluate how the facilities have changed from their as-built condition. Detailed photo documentation provides a permanent record of changing conditions, and is strongly recommended. For example, cracks can be carefully monitored by placing a scale/ruler within a photo. These inspections should typically be performed mid-year, prior to the monsoon season after high spring flows have subsided. Annual inspection records should be maintained by the floodplain management agency having jurisdiction or a designated responsible party. Key items to be evaluated include:

a. *Crest Height*: monitor crest elevation of any embankments to ensure design freeboard height is maintained.

b. *Embankment Integrity*: monitor and address cracking of embankments to mitigate piping through the embankment or foundation, or slope instability.

c. *Vegetation*: ensure vegetative cover is maintained to reduce erosion during flood events, while maintaining size-control in order to avoid root damage.

d. *Embankment Crests*: ensure all-weather driving surface is maintained along embankment crest, for maintenance purposes.

e. *Erosion*: monitor areas for the development of erosion or undercutting of any flood-control structures.

f. *Sediment Build-Up*: monitor the depth of sediment deposition in the base of the culvert, channel, or stormwater detention basin.

g. *Rodent Activity*: monitor rodent activity (e.g., burrows) which may increase the potential for embankment foundation piping.

h. *Structural Integrity*: monitor the condition of all erosion-control walls for signs of distress, sulfate attack, cracking, differential settlement, tilting, surface-water ponding near the foundations, or any unauthorized modifications.

Post-Storm Inspections:

Post-storm inspections should be performed as soon as possible after flood conditions have subsided. Although flood-control systems are usually designed for 100-year flow conditions, they may incur damage during more frequent flow conditions. Post-storm inspection records should be kept and maintained by the floodplain management agency having jurisdiction or a designated responsible party. Items to be inspected after storm flows have subsided are listed below:

a. Vegetation: high-flow erosion damage

b. Earthen Fill: slope and bank-protection integrity, and seepage through the embankment face

c. Culverts: culverts to ensure free-flowing conditions

d. Embankment crests: in event of overtopping, check that concentrated flow areas do not develop

e. Erosion: monitor the improvements for indications of erosion

f. Sediment Build-Up: monitor the depth of sediment deposition at the base of the channel

Field-inspection reports shall include, at a minimum:

a. A description of the facility's current condition, for the entire length of the improvements. It is important to note areas where erosion is, or will likely become, a problem.

b. A description of the existing vegetation, if any, and the loss of any vegetation, together with comments and/or recommendations regarding the need for the addition and/or removal of any vegetation that may impede the flow within the wash, or which may need to be replaced for erosion control.

c. Comments and/or notes, with photographs where necessary, of unauthorized uses of the facility, unauthorized dumping, and/or damage to the system components.

d. Comments and/or notes, with photographs if necessary, of any damage to any culverts, irrigation pipes, utilities, etc.

e. Recommendations for remedial actions needed to preserve the integrity of the facility and its designated function.

f. The report shall note any change of land use adjacent to the wash.

g. Inspect, and include comments in the report, regarding existing utilities in or adjacent to the wash that may have been impacted by a storm event.

h. Inspect for sediment, silt, debris, trash, or deleterious material. Where depths of sedimentation are excessive, where debris causes flow restrictions, or where trash has accumulated, removal shall be required.

A field-inspection report shall be completed; and, if requested by a complaint, the floodplain management agency having jurisdiction can request a field-inspection report within 15 days of receipt of said complaint.

A field-inspection report shall be completed on a daily basis during times of high flow. Immediately after the waters have receded, a field-inspection shall be conducted as described herein.

5.1.2 Rationale

The purpose of this Development Criteria is to provide procedural guidelines for a systematic approach to monitoring, operating, and maintaining regional stormwater detention basins and other flood-control facilities in the Study Area, for the overall purpose of enhanced public safety. Currently there are no local guidelines or criteria outlined or documented anywhere regarding inspection and maintenance procedures, and this Development Criteria is being written to help rectify this situation. Monitoring, operating, and inspection/maintenance plans should be commensurate with the scale and complexity of the improvement. Basic guidelines are provided herein; however, specific plans should be developed for each facility, as warranted. The importance of conducting routine inspections as part of any operating plan cannot be overstated, as early detection of gradual changes can reduce overall maintenance costs and the likelihood of major failure of the facility in the future.

Channels, levees, stormwater detention basins, culverts and erosion-control walls in the Study Area shall be inspected at least once a year. During high flows, facility conditions shall be routinely monitored each day, and thoroughly inspected after the flows subside. It is anticipated that multiple agencies will be responsible for funding the monitoring, operating, and maintenance activities in the Study Area. These agencies will likely include the following:

a. Town of Sahuarita
b. Pima County Regional Flood Control District
c. City of Tucson
d. Homeowner Associations
e. Special Districts Maintenance

Operating and inspection/maintenance activities shall be performed by the floodplain management agency having jurisdiction, or a designated responsible party. All records, including inspection, maintenance, and flow monitoring, shall be kept on file with the floodplain management agency having jurisdiction.

SECTION 6: SUMMARY

6.1 Summary

The major components of future alternatives involve generating Development Criteria, intended to provide regulations and guidelines for future development within the area, and the delineation of a network of flow corridors throughout the study area. Public education and outreach, as well as recommending modifications or changes to future roadway alignments to avoid floodprone areas, were also recommended alternatives associated with the future analyses.
The Public Involvement Plan for this project was designed to fulfill the promise of "consult" on the International Association for Public Participation (IAP2) Spectrum of Public Participation: to keep the public informed, listen to and acknowledge concerns and aspirations, and provide feedback on how the public input was considered in the decision. The goal of the plan was to bring more information into the study for consideration, provide additional perspectives on alternatives in order to reach the best outcome, and greater public understanding, support and acceptance of the study and its final outcome. The plan outlined 12 stakeholder workgroup meetings, 12 individual stakeholder meetings and six public meetings (three rounds of two meetings).

The actual effort materialized as seven workgroup meetings (three rounds of two meetings - one for public agencies and one for private organizations; the final meeting combined both public and private), seven stakeholder meetings (one each with Diamond Ventures, Pima Association of Governments, Arizona State Land Department, Southern Arizona Home Builders Association and Tucson Water, and two with City of Tucson staff), three rounds of two public meetings (each round included a meeting on both the east and west sides of the study area, for a more inclusive approach), and an additional two (2) public meetings were held in the Summit area to address specific flooding and drainage needs in that area. Additionally, 10 focus group meetings were held with staff from both public agencies and private organizations to collaboratively discuss and edit the Development Criteria for the LMWBMS.

The Development Criteria identified herein are part of the non-structural Recommended Alternative of the LMWBMS. Adherence to these development criteria will lessen the adverse impacts of urbanization and decrease the cost of

flooding for the public and private sectors. Over the past few decades that the County has been managing floodplain areas, it has become apparent that there is a lack of tools to adequately manage individual lot development, especially in distributary flow areas. In addition, as part of this basin management study, it was determined that Development Criteria which focused both on single-family development on individual lots, standard subdivisions and/or large master planned developments could reduce flood and related damage within the Lee Moore Wash watershed. As a result, a major component of the study presented herein establishes preferred, natural flow corridors to convey flows within these areas, as illustrated in Exhibit C.

Approximately 48% of the LMWBMS area is owned by the state of Arizona and managed by the Arizona State Land Department (ASLD). ASLD manages lands in compliance with the Enabling Act, the Arizona Constitution, and Arizona Revised Statutes Title 37 which require that State Trust Lands be managed in the best interests of the designated State Trust beneficiaries. As such, certain elements of the Development Criteria may not have the same regulatory compliance authority with regards to State Trust Lands as it does to land owned by others. The principles, policies and practices contained within the Design Criteria provide a useful method for insuring a consistent and comprehensive approach to floodplain management within the Study area; therefore it is in the best interest of all land owners and jurisdictions to comply with these Development Criteria to the fullest extent possible.

SECTION 7: APPENDICES

7.1 Authority

7.1.1 Arizona Revised Statutes

Arizona Revised Statutes Title 48 - Special Taxing Districts. http://www.azleg.gov/ArizonaRevisedStatutes.asp?Title=48

7.2 Drainage and Development Regulations

7.2.1 City of Tucson

City of Tucson Standard Manual for Drainage Design and Floodplain Management in Tucson, Arizona, December 1989, Revised, July 1998. http://tdotmaps.transview.org/mandr/Download/

7.2.2 Pima County Regional Flood Control District

Pima County Title 16, Floodplain and Erosion Hazard Management Ordinance. http://rfcd.pima.gov/rules/

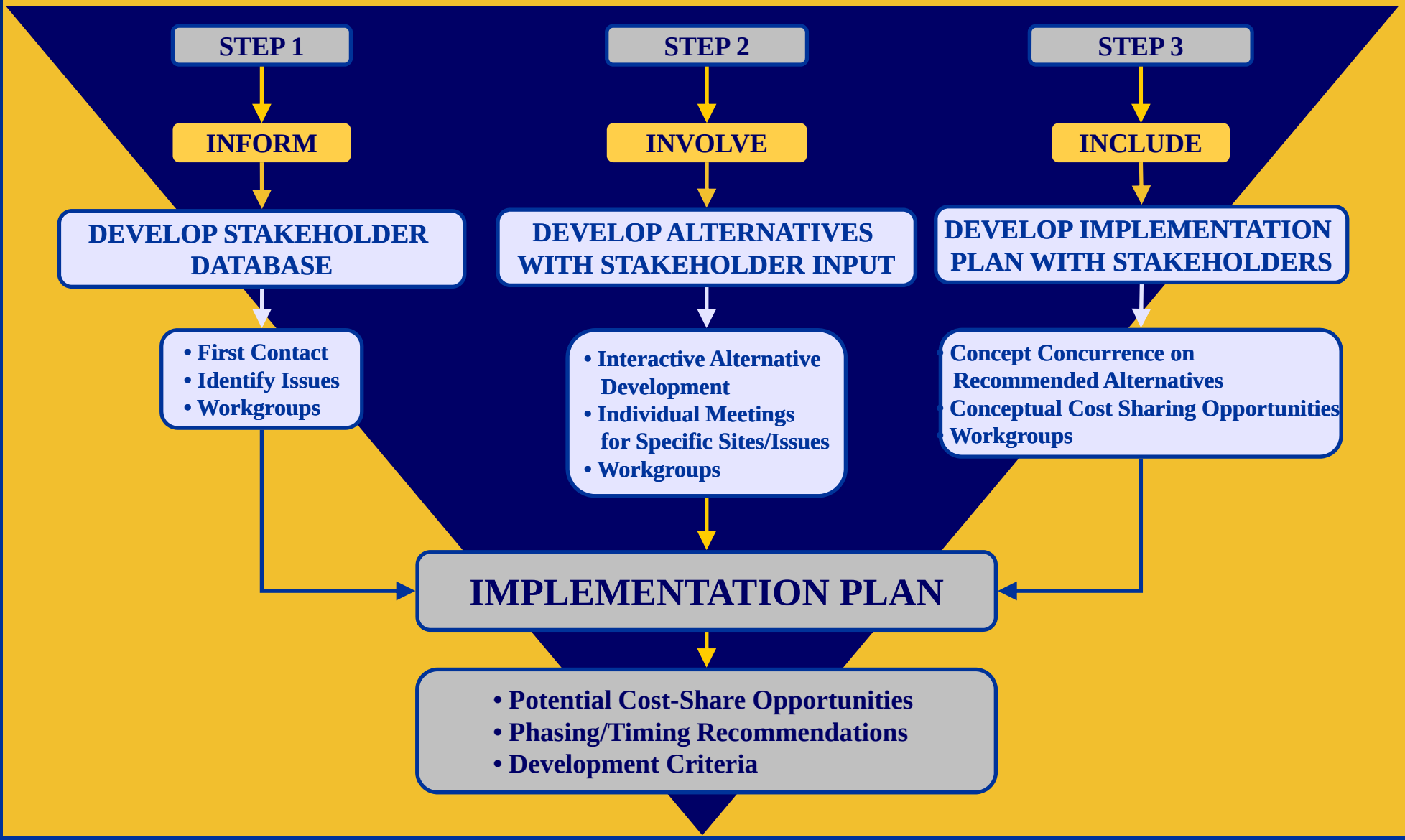
7.2.3 Town of Sahuarita

Sahuarita Town Code, Title 14, Floodplain Management and Right-of-Way. http://www.codepublishing.com/AZ/Sahuarita/Sahuarita14/Sahuarita1405.html#14.05

Appendix F Stakeholder Involvement Flow Chart

LEE MOORE WASH BASIN MANAGEMENT STUDY

STAKEHOLDER INVOLVEMENT FLOW CHART



Appendix G Stakeholder Database

Attended 10/12/06	Sir Title	First Name	Last Name	Company/Agency	Title	Business Address	City	State	Postal Code	Business Fax	Business Phone	E-mail Address
	Mr.	Greg	Fizer	Arizona Department of Corrections, ASPC - Tucson	Warden	10000 S. Wilmot Rd. PO Box 24400	Tucson	AZ	85734	574-7300	574-0024	
	Mr.	Greg	Gentsch	Arizona Department of Transportation		1221 S. Second Ave.	Tucson	AZ	85713	903-9969	388-4262	ggentsch@azdot.gov
	Mr.	Michael	Finkelstein	Center for Biological Diversity	Executive Director	PO Box 710	Tucson	AZ	85702		623-5252 ext. 301	mfinkelstein@biologicaldiversity.org
	Ms.	Andy	McGovern	City of Tucson Department of Transportation		201 N. Stone Ave. 3rd Floor	Tucson	AZ	85701		791-4251	andy.mcgovern@tucsonaz.gov
	Mr.	Jim	Glock	City of Tucson Department of Transportation	Director	201 N. Stone Ave. 6th Floor	Tucson	AZ	85701	791-5641	791-4371	jim.glock@tucsonaz.gov
	Mr.	Frank	Sousa	City of Tucson Department of Transportation		201 N. Stone Ave. 3rd Floor	Tucson	AZ	85701		791-3115 x 307	frank.sousa@tucsonaz.gov
	Mr.	Craig	Gross	City of Tucson Development Services	Deputy Director	201 N. Stone Ave.	Tucson	AZ	85701		791-5550	
	Mr.	Joanne	Hershenhorn	City of Tucson Department of Urban Planning and Design	Lead Planner	149 N. Stone Ave., 4th Floor PO Box 27210	Tucson	AZ	85726-27210		791-4505	joanne.hershenhorn@tucsonaz.gov
	Mr.	Jim	Vogelsberg	City of Tucson Development Services, Floodplain		201 N. Stone Ave., 1st Floor	Tucson	AZ	85701		791-5550	jim.vogelsberg@tucsonaz.gov
	Mr.	Andrew	Singelakis	City of Tucson Department of Transportation	Deputy Director	201 N. Stone Ave., 6th Floor	Tucson	AZ	85701	791-4522	791-4505	andrew.singelakis@tucsonaz.gov
	Mr.	Andy	Squire	City of Tucson, Ward 4	Chief of Staff	8123 E. Poinciana Dr.	Tucson	AZ	85730			Andrew.Squire@tucsonaz.gov
	Mr.	Abe	Marques	City of Tuscon, Ward 5	Administrative Assistant	4300 E. Park Ave.	Tucson	AZ	85714			Abe.Marques@tucsonaz.gov

Attended 10/12/06	Sir Title	First Name	Last Name	Company/Agency	Title	Business Address	City	State	Postal Code	Business Fax	Business Phone	E-mail Address
		Keith	Graves	Coronado National Forest, Nogales Ranger District		303 Old Tucson Rd.	Nogales	AZ	85621	281-2396	281-2296	
				Federal Bureau of Prisons, FCI Tucson		8901 S. Wilmot Rd.	Tucson	AZ	85706	574-7341	574-7100	tcn/execassistant@bop.gov
				Friends of the Santa Cruz River		PO Box 4275	Tubac	AZ	85646		398-9093	
	Mr.	Gary	Hayes	Pima Association of Governments	Executive Director	177 N. Church Ave., Ste. 405	Tucson	AZ	85701	620-6981	792-1093	ghayes@pagnet.org
	Honor able	Ramón	Valadez	Pima County Board of Supervisors, District 2	County Supervisor	130 W Congress St, 11th Floor	Tucson	AZ	85701	884-1152	740-8126	mike.london@pima.gov
	Honor able	Ray	Carroll	Pima County Board of Supervisors, District 4	County Supervisor	130 W Congress St, 11th Floor	Tucson	AZ	85701	740-2721	740-8094	district4@pima.gov
	Ms.	Mary	Hamilton	Pima County Regional Wastewater	Manager,Planning Division	201 N. Stone Avenue	Tucson	AZ	85701-1207	620-0135	740-6641	mary.hamilton@wwm.pima.gov
	Mr.	Paul	Bennett	Pima County DOT	Project Manager	201 N. Stone Avenue,3rd Floor	Tucson	AZ	85701-1207	838-7537	740-6408	paul.bennett@dot.pima.gov
	Mr.	Rick	Ellis	Pima County Department of Transportation		201 N. Stone Ave., 3rd Floor	Tucson	AZ	85701	620-1933	740-6410	rick.ellis@dot.pima.gov
	Mr.	Rafael	Payan	Pima County Natural Resources, Parks and Recreation	Director	3500 W. River Rd.	Tucson	AZ	85741	877-6006	877-6000	pcpr@parks.co.pima.us
	Ms.	Carla	Blackwell	Pima County Planning and Development Services Department	Deputy Director	201 N. Stone Ave., 1st Floor	Tucson	AZ	85701	740-6878	740-6506	carla.blackwell@dsd.pima.gov
	Mr.	Michael	Gritzuk	Pima County Wastewater Management	Director	201 N. Stone Ave., 8th Floor	Tucson	AZ	85701	620-0135	740-6500	

Attended 10/12/06	Sir Title	First Name	Last Name	Company/Agency	Title	Business Address	City	State	Postal Code	Business Fax	Business Phone	E-mail Address
	Ms.	Sue	Clark	Pima Trails Association		P.O. Box 35007	Tucson	AZ	85740	887-0921	577-7919	email@pimatrails.org
	Mr.	Fred	Huff	Sahuarita Unified School District	Transportation Manager	350 W Sahuarita Rd	Green Valley	AZ	85629	393-7033	625-3502 x 1160	freddie_huff@lpsg.com
	Dr.	Jay	St. John	Sahuarita Unified School District	Superintendent	350 W Sahuarita Rd	Green Valley	AZ	85629	625-4609	625-3502	jstjohn@sahuarita.k12.az.us
	Mr.	Paul	Sweum	San Xavier District of Tohono O'Odham Nation	Planning Director	2018 W San Xavier Rd	Tucson	AZ	85746	294-0613		
	Ms.	Janice	Przybyl	Sky Island Alliance		PO Box 41165	Tucson	AZ	85717		624-7083 x 203	janice@skyislandalliance.org
	Mr.	Jon	Baker	Southwest Fair Commission (Pima County Fairgrounds)	Executive Director	11300 S. Houghton Rd.	Tucson	AZ	85747	762-5005	762-9100	jbaker@swfair.com
	Ms.	Roxana	Sanders	Summit View Elementary School	Principal	1900 E Summit St	Tucson	AZ	85706	545-3816	545-3800	roxanas@susd12.org
	Mr.	Raul	Bejarano	Sunnyside Unified School District	Superintendent	2238 E Ginter Rd	Tucson	AZ	85706	545-2121	545-2025	raulb@susd12.org
	Mr.	John	Neunuebel	Town of Sahuarita Planning and Zoning	Planning Director	725 W Via Rancho, Box 879	Sahuarita	AZ	85629	625-9879	648-1972x119	jneunuebel@ci.sahuarita.az.us
	Mr.	Bob	Wech	Town of Sahuarita Public Works	PW Director/Town Engineer	725 W Via Rancho, Box 879	Sahuarita	AZ	85629	625-9879	648-1972 x 104	bwelch@ci.sahuarita.az.us
	Ms.	Sonja	Macys	Tucson Audobon Society	Executive Director	300 E University, Ste 120	Tucson	AZ	85705	623-3476	622-5622	sonjamac@qwest.net
	Mr.	Bob	Mendoza	Union Pacific Railroad		1255 S. Campbell Ave.	Tucson	AZ	85711	322-2631	275-5323/629-2120	

Attended 10/12/06	Sir Title	First Name	Last Name	Company/Agency	Title	Business Address	City	State	Postal Code	Business Fax	Business Phone	E-mail Address
	Mr.	Mark	Heitlinger	University of Arizona, Santa Rita Experimental Range and Wildlife Area	Manager	PO Box 1389	Green Valley	AZ	85622		625-2121	markh@ag.arizona.edu
	Mr.	Calvin	Baker	Vail School District	Superintendent	P.O. Box 800	Vail	AZ	85641	762-2001	762-2004	bakerc@vail.k12.az.us
	Mr.	Albert	Flores	Vail School District	Director of Facilities and Transportation	P.O. Box 800	Vail	AZ	85641	762-2001	762-2050	floresa@vail.k12.az.us
	Mr.	John	Holt	Western Area Power Authority	Environmental Manager	12155 W. Alameda Parkway	Lakewood	CO	80228-8213		602-352-2592	holt@wapa.gov
	Mr.	Brian	Cosson	Arizona Dept. of Water Resources	NFIP Coordinator	500 N. Third Street	Phoenix	AZ	85004	602-417-2423	602-417-2445	btcosson@adwr.state.az.us
	Mr.	Greg	Gamble	The Nature Conservancy	Rapidly Urbanizing Areas Project Director					602-322-6987	602-712-0059	ggamble@tnc.org
	Mr.	Andy	Dinauer	City of Tucson, Department of Transportation	Engineering Administrator	201 N. Stone Ave., 3rd Floor	Tucson	AZ	85701			Andy.Dinauer@tucsonaz.gov
	Mr.	Steve	Pageau	City of Tucson, Department of Transportation	Deputy Director	201 N. Stone Ave., 6th Floor	Tucson	AZ	85701			Steve.Pageau@tucsonaz.gov
	Ms.	Karen	Masbruch	City of Tucson Manager's Office	Assistant City Manager	255 W. Alameda, 10th Floor	Tucson	AZ	85701			Karen.Masbruch@tucsonaz.gov
	Mr.	Albert	Elias	City of Tucson, Department of Urban Planning	Design Director	345 E. Toole Ave.	Tucson	AZ	85701			Albert.Elias@tucsonaz.gov
	Ms.	Leslie	Liberti	City of Tucson, Office of Conservation and Sustainable Development		345 E. Toole Ave.	Tucson	AZ	85701			Leslie.Liberti@tucsonaz.gov
	Mr.	Ernie	Duarte	City of Tucson, Development Services	Department Director	201 N. Stone Ave., 2nd Floor	Tucson	AZ	85701			Ernie.Duarte@tucsonaz.gov

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	Mr.	Matt	Flick	City of Tucson, Development Services	Department Engineering Manager	201 N. Stone Ave., 1st Floor	Tucson	AZ	85701			Matthew.Flick@tucsonaz.gov
	Ms.	Michele	Muench	Arizona State Land Department	Land Deposition	177 North Church, Ste 1100	Tucson	AZ	85701	520-209-4251	520-209-4250	mmuench@land.az.gov
	Mr.	W. Dempsey	Helms	Arizona State Land Department	Engineering Coordinator	177 North Church, Ste 1100	Tucson	AZ	85701	520-209-4251	520-209-4250	dhelms@land.az.gov
	Mr.	Paul	Wichmann	Arizona State Land Department	Director	177 North Church, Ste 1100	Tucson	AZ	85701	520-209-4251	520-209-4250	pwichmann@land.az.gov
	Mr.	Jim	Stahle	Town of Sahuarita	Town Manager	PO Box 879	Sahuarita	AZ	85629	520-399-3330	520-648-1972	staahle@ci.sahuarita.az.us
	Mr.	Jesus	Valdez	Town of Sahuarita	Project Manager	PO Box 879	Sahuarita	AZ	85629	520-399-3339	520-648-1972	jvaldez@ci.sahuarita.az.us
	Ms.	Claire	Zucker	Pima Association of Governments	Watershed Planning Manager	177 N. Church Ave., Suite 405	Tucson	AZ	85701	520-620-6981	520-792-1093 X435	czucker@pagnet.org
	Mr.	John	Liosatos	Pima Association of Governments	Short Range Planning Manager	177 N. Church Ave., Suite 405	Tucson	AZ	85701	520-620-6981	520-792-1093 X517	jliosatos@pagnet.org
		Mary	Kidwell,	Empire-Fagan Coalition	President		PO Box 812	Vail,	AZ	85641	(520) 762-1962	www.empirefagan.org
		Carolyn	Campbell	Coalition for Sonoran Desert Protection								
		Lori	Lustig	SAHBA Southern Arizona Home Builders Association	Gov. liaison	2840 N. Country Club Road	Tucson	AZ	85734	326-8665	795-5114	lustig@sahba.org
		Robert	Iannarino	Diamond Ventures	Project Manager	220 E. River Road	Tucson	AZ	85718-6586	299-5602	577-0200	biannarino@dimondven.com

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	Mr.	Bill	Zimmerman	Pima County Regional Flood Control	Chief Hydrologist	97 E. Congress Street, 3rd Floor	Tucson	AZ	85701	520-243-1821	520-243-1800	bill.zimmerman@rfcd.pima.gov