# STORMWATER DRAINAGE PLANNING

## The Colonias of the Lower Rio Grande Valley (LRGV)

*Located within the Counties of Cameron, Hidalgo, and Willacy*

## Phase 2 Report

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# Executive Summary

The purpose of the Stormwater Drainage Planning project is to develop the necessary drainage planning required to "...examine the infrastructure needs in the Colonias, in particular the use of (Community Development Block Grant) CDBG disaster recovery funds to provide drainage improvements to correct flooding problems in the wake of Hurricane Dolly, and the historical provision of public infrastructure and housing assistance to meet those needs in border and non-border Colonias." The project area is defined as the Colonias in the Lower Rio Grande Valley (LRGV) area, consisting of Cameron County, Hidalgo County and Willacy County.

***The project goal is to examine the drainage infrastructure needs of the Colonias and identify drainage study and infrastructure gaps that need to be filled in order address the drainage issues.***

The project is focused on the evaluation of all Colonias (1039) as defined by the Office of the Secretary of State (SOS) and the Attorney General of Texas Office (OAG). This Stormwater Drainage Planning project was conducted in three phases. The first phase was the compilation of existing data to assess the needs of the Colonias (Phase 1A). This second phase was the refinement of the Colonia assessment (Phase 1B). The purpose of the Colonia assessment is to ultimately identify the Colonias with the greatest need for drainage study and infrastructure necessary to address local drainage issues. The third, final, phase was the localized analyses of 78 LRGV Colonias (Phase 2). Through Phases 1A and 1B, the project team identified Colonias with the highest potential of flooding that experience structural damage. The remaining project funds were utilized to perform specific localized Colonia analysis to address the frequent local flooding for the Colonias identified as experiencing structural flooding. This report summarizes the Phase 2 goals, activities, methodologies, assumptions, and results.

The flood mitigation concepts discussed in this report are conceptual evaluations of potential flood mitigation solutions. These high-level feasibility concepts may be refined through subsequent preliminary engineering analysis and coordination with project Stakeholders. The localized analysis was conducted to identify areas at risk, potential mitigation solutions, and one recommended flood mitigation project. Potential flood mitigation alternatives were evaluated based upon a high-level feasibility of each proposed alternative, its cost effectiveness, and the potential for implementation.

Since the study area covered three counties with varying drainage standards, the study team selected uniform mitigation goals that could be applied across all three counties. These goals were selected by evaluating federal, state and local drainage standards, common practices, and previous available studies. It was decided that the mitigation goals for this project would be as follows: protect structures from the 10% (10-year) local storm event; convey the 10% (10-year) local drainage in a storm drainage system; and retain the 4% (25-year) local drainage using a detention or retention pond.

In conclusion, the study team has examined the risks and needs of the Colonias to ultimately identify drainage infrastructure projects to address the drainage issues in the Lower Rio Grande Valley. Based on the analysis, many of the identified projects are considered cost-effective having a benefit cost ratio greater than 1.0. Identification of cost-effective projects increase the likelihood of identifying alternatives that have a viable funding source; thus making the study recommendations more likely to be implemented.

Once it should be noted that the localized assessment includes the hydrologic and hydraulic analyses of localized flooding event, but does not evaluate flooding or impacts from the regional drainage system. The regional system is still a concern to all Colonias and developments in the LRGV, since it is the main infrastructure to move water out of the region. Consideration in the future should be given to supplement this study to evaluate the regional system.

# Introduction

The Lower Rio Grande Valley (LRGV) has a history of severe flooding, and in recent years frequent flooding continues to damage structures and infrastructure in the area. Severe and frequent flooding is attributed to insufficient drainage systems, low permeability of the soils, and inadequate topographic relief causing extensive flood and economic damage throughout the LRGV. With continued growth, even yearly rainfall events quickly overwhelm the local infrastructure and cause flooding issues where the excess stormwater cannot reach the channels and ponds of the districts and counties charged with conveying stormwater to receiving waters. Much of the regional infrastructure was originally constructed to convey agricultural runoff with limited design capacity.

Although there have been many drainage studies conducted in the LRGV, Colonias have not been the focus of these studies. More specifically, flood mitigation solutions have not been identified for the Colonias of the LRGV. This Stormwater Drainage Planning study is focused on the identification of risks and needs of the Colonias in order to address the drainage issues. Through this Phase 2 effort, localized analyses for 78 high risk Colonias was conducted to understand the overall complexity of the drainage issues, define each Colonia's level of risk, and identify localized solutions. It should be noted that the localized assessment includes the hydrologic and hydraulic analyses of localized flooding event, but does not evaluate flooding or impacts from the regional drainage system. The ultimate goal of the study was to identify an array of potential mitigation options and recommend one (1) feasible cost-effective solution to mitigate flood hazard risks for each of the evaluated high risk Colonias.

At the completion of Phase 1B, the Colonias were categorized by the severity of flooding and if the flooding is caused by local conditions or due to a regional system. The localized analysis focused on the A1 and B1 categories as described below and are listed in Table 1.

## *Colonia Categories*

**A1. Colonias that require Localized Solutions with Structure Flooding** – Category A1 Colonias include Colonias that have localized drainage problems, meaning that the drainage problems are due to the topology and lack of drainage infrastructure and proper outfalls within the Colonia. These Colonias also show evidence of structure flooding (i.e. inside the structure/home or effecting the structural components of the structure/home) either via resident survey, observation of high water marks during site visits, or a professional engineer's best judgment)

**B1. Colonias that require Regional Solutions with Structure Flooding** – Category B1 Colonias include Colonias that are affected by regional flooding problems, meaning that water from a larger regional waterway is causing flooding within the Colonia. A regional waterway could include creek, river, or regional drainage way operated by a Drainage District. Many of these Colonias are within the limits of the 100-year floodplain. These Colonias also show evidence of structure flooding (i.e. inside the structure/home or effecting the structural components of the structure/home) either via resident survey, observation of high water marks during site visits, or a professional engineer's best judgment.

**Table 1. Evaluated Colonias**

| Colonia Name | County | Category | Colonia Name | County | Category |
|---|---|---|---|---|---|
| Cameron Park | Cameron | A1 | North Santa Cruz Subd | Hidalgo | A1 |
| Colonia Iglesia Antigua | Cameron | A1 | Olivarez #10 | Hidalgo | A1 |
| Coronado | Cameron | A1 | Olivarez #6 | Hidalgo | A1 |
| Dakota Mobile Home Park | Cameron | A1 | Olivarez 17 | Hidalgo | A1 |
| Del Mar Heights | Cameron | A1 | Owassa Rd/Tower Rd | Hidalgo | A1 |
| Eggers | Cameron | A1 | Penitas | Hidalgo | A1 |
| Glenwood Acres | Cameron | A1 | Perezville | Hidalgo | A1 |
| Grande Acres | Cameron | A1 | R.C. Babb Subd #3 and 4 | Hidalgo | A1 |

| Colonia Name | County | Category | Colonia Name | County | Category |
|---|---|---|---|---|---|
| Green Valley Farms | Cameron | A1 | Ramirez Estates | Hidalgo | A1 |
| La Coma | Cameron | A1 | Reina Del Sol Mobile Home Esta | Hidalgo | A1 |
| La Feria Gardens | Cameron | A1 | River Road Subd. | Hidalgo | A1 |
| Lago | Cameron | A1 | Ruthven #1 | Hidalgo | A1 |
| Las Yescas | Cameron | A1 | Salida del Sol Estates Subd. | Hidalgo | A1 |
| Longoria Townsite | Cameron | A1 | South Fork Subd. | Hidalgo | A1 |
| Lourdes Street | Cameron | A1 | Southside Village | Hidalgo | A1 |
| Nogal St. | Cameron | A1 | Sun Valley Estates | Hidalgo | A1 |
| Paredes Estates | Cameron | A1 | V&C | Hidalgo | A1 |
| Pennsylvania Avenue | Cameron | A1 | Val Verde Grove | Hidalgo | A1 |
| Santa Maria | Cameron | A1 | Val Verde North Subd. | Hidalgo | A1 |
| Santa Rosa #13 | Cameron | A1 | Victoria Belen | Hidalgo | A1 |
| Santa Rosa Annex | Cameron | A1 | Welch Tract | Hidalgo | A1 |
| Alberta Estates #2 | Hidalgo | A1 | Lasara | Willacy | A1 |
| Arriaga Subd. | Hidalgo | A1 | Bar #3 | Hidalgo | B1 |
| Basham #12 | Hidalgo | A1 | Bernal Heights #1 | Hidalgo | B1 |
| Basham #4 | Hidalgo | A1 | Blue Star Enterprises #2 | Hidalgo | B1 |
| Capisallo Park | Hidalgo | A1 | Colonia Tijerina | Hidalgo | B1 |
| Chapa #5 | Hidalgo | A1 | Hoehn Drive Subd. | Hidalgo | B1 |
| Chapa Subdivision | Hidalgo | A1 | Imperial Subd. | Hidalgo | B1 |
| Chula Vista Acres | Hidalgo | A1 | La Blanca Heights | Hidalgo | B1 |
| Cotter Tract | Hidalgo | A1 | Rankin Subd. | Hidalgo | B1 |
| Cuellar Subd. #1 | Hidalgo | A1 | Reina Subd. | Hidalgo | B1 |
| El Gato | Hidalgo | A1 | Ruthven Subd. #2 | Hidalgo | B1 |
| Enrique Bazan Subd. | Hidalgo | A1 | Southern Breeze Subd. | Hidalgo | B1 |
| Hilda Subd. | Hidalgo | A1 | Umberto Garcia Jr. Subd. | Hidalgo | B1 |
| J.R. Subdivision #2 | Hidalgo | A1 | Val Verde Acres | Hidalgo | B1 |
| Linda Vista Estates | Hidalgo | A1 | Tierra Bella Subd. | Hidalgo | B1 |
| Los Trevinos Subd. #3 | Hidalgo | A1 | Olmito | Cameron | B1 |
| Los Treviños Subd. #4 | Hidalgo | A1 | Cuevitas | Hidalgo | B1 |
| Los Trevinos Subd. #5 | Hidalgo | A1 | Green Valley Development Subd. | Hidalgo | B1 |

## Public Outreach and Meetings

The study team had originally scoped a total of four Phase 2 public meetings; however during planning meetings with the General Land Office and Texas Water Development Board the team adjusted the scope to only include two meetings with a greater focus toward the LRGV governing entities. This shift in focus was performed in order to inform and educate the LRGV governing entities of the study, study results, and project deliverables. Most drainage projects in the LRGV are initiated by these governing entities. The team hopes that the conceptual mitigation solutions identified in this study might be eventually funded and implemented with the support from the local governing entities.

The first meeting was established by State Senator Eddie Lucio, Jr. and the Chairman of the Texas Water Development Board (TWDB), the Honorable Bech Bruun. The Senator's office invited local governing entities, key drainage leaders, and advocacy groups for a brief description of the Stormwater Drainage Study and information regarding various funding programs and sources that could be used to implement drainage projects. The meeting was held on October 21, 2016 at the Lower Rio Grande Valley Development Council in Weslaco, Texas.

The study's final public meeting was held on December 7, 2016 at the Lower Rio Grande Valley Development Council in Weslaco, Texas. Meeting attendees listened to a short presentation to gain information about the drainage study, flood risks, and outcomes of the study. Appendix A includes a summary report of these meetings including: website updates, advertisements, presentations, and photos from each meeting. Data associated with the public meeting is documented in Appendix A.

Throughout the project, the study team developed and maintained a project website at www.lrgvdrainage.org. The website was used in an effort to keep the public informed of the project status in between the project phases and public meetings. An additional benefit of using this website was that the public could easily switch between English and Spanish at the click of a button. The website has been updated with the final 78 localized analyses reports. In addition to study updates and products, the study team developed and posted a page on the website to display available tools and references regarding flooding programs, flood protection, flood education, and government contacts in the LRGV.

## Hydrologic and Hydraulic Methodology

The localized analyses of 78 high risk Colonias was conducted using two-dimensional (2D) hydrodynamic models, Innovyze InfoWorks SD and ICM software. The model integrates hydrologic and hydraulic modeling and simulates the interactions of the underground storm drainage system and the movement of the overland flow using a three-dimensional digital terrain model of the existing ground surface. A complete model consists of three basic building blocks: the network model, the terrain model and the rainfall event. The network model contains the relevant project information regarding inlets, manholes, storm pipes, culverts and open channel sections. The entire watershed is divided into smaller discrete subcatchments each draining to an inlet. The computation of a runoff hydrograph is performed for each defined subcatchment and is subsequently routed throughout the fully connected network to more accurately represent the routing of both underground and overland runoff through the entire system. Runoff and routing models for each subcatchment and the corresponding hydrologic parameters such as curve number (CN) values and roughness coefficient are specified for each subcatchment. The following paragraphs explain the data sources and assumptions used to perform the hydrologic and hydraulic analyses.

### *Terrain*

LiDAR data was obtained in the three county area from TWDB's Texas Natural Resource Information System (TNRIS). Ground surface elevations were extracted from the provided LiDAR to generate a seamless bare earth terrain dataset. This dataset was compiled as part of Phase 1A. This terrain allows analysis on any scale, from local to regional, as Colonias' size and complexity vary from Colonia to Colonia. The LRGV LiDAR source information provided by the TWDB's TNRIS Group is listed in Table 2.

**Table 2. LiDAR Source Information**

| Year | Source | Accuracy (Meters) |
|---|---|---|
| 2004 | Hidalgo FCD | 1 |
| 2008 | USGS | 1.2 |
| 2011 | USGS | 1.5 |
| 2006 | IBWC | 0.7 |
| 2011 | IBWC | 0.7 |

In addition to the study and project specific data, geospatial data from State and Federal agencies were compiled to develop the base map data for this LRGV project. This base map data includes roadways, drainage lines, parcel boundaries, jurisdictional boundaries, etc.

### *Field Reconnaissance and Survey*

In order to better evaluate the Colonia, an initial 2D model was established and simulated to determine drainage patterns and areas where survey should be obtained. This process made the field reconnaissance and field survey tasks more efficient and beneficial. Surveyed items included storm drainage systems, finished floor elevations, roadway elevations, cross-sections of drainage ditches, and other key drainage features. These collected surveys were also used validate the accuracy LiDAR topography.

## Precipitation

Rainfall totals for the frequency evaluations were obtained from the Technical Paper No. 40 - Rainfall Frequency Atlas of the United States in Hidalgo County. Rainfall totals for the frequency evaluations were obtained from the Cameron County Drainage Criteria Manual for Cameron and Willacy Counties. A Soil Conservation (SCS) Type-III twenty-four hour duration storm was used for the various frequency event simulations. The storm depths per County are summarized in Table 3.

**Table 3. SCS Type-III Precipitation Depths**

| Flood Recurrence Interval | Storm Depths (Inches) | |
|---|---|---|
| | Hidalgo County | Cameron and Willacy Counties |
| 50% (2-year) | 3.2 | 4.7 |
| 20% (5-year) | 4.4 | 6.4 |
| 10 (10-year) | 5.4 | 7.4 |
| 4% (25-year) | 6.8 | 9.0 |
| 1% (100-year) | 9.4 | 11.1 |

Pre-project (existing) condition analysis was conducted using a "rain on mesh" approach. This approach directly applies rainfall to the ground surface rather than using a catchment basin approach. The "rain on mesh" was utilized for the existing condition analysis in order to better understand the existing condition shallow ponding that occurs in throughout the Colonia.

Flood mitigation post-project (proposed) condition analysis was conducted using delineated catchment basins. This approach is conservative in the manner that it assumes the majority of precipitation reaches the proposed drainage features. Although conservative, this approach allows for the propose drainage infrastructure to be sized to carry flow from the entire drainage area. It should be noted that this analysis is considered conceptual and should be further refined prior to implementation. If the project is advanced, the final designed project would need to evaluate lot drainage to determine if lots should be graded consistent with this approach.

## Soil Types

Soils information was obtained from the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database for Hidalgo, Cameron and Willacy Counties published in 2013. Each soil type was assigned a hydric soil classification. Hydric soils (Types C and D) typically indicate that the area is prone to flooding.

## Runoff Losses

Runoff losses were computed using the Soil Conservation Service (SCS) Loss Rate Method. Assumed runoff curve numbers (CN) for the various soil conditions and land uses are consistent with the Texas Department of Transportation (TxDOT) Hydraulic Design Manual, Chapter 4, Section 13, Tables 4-19 and 4-20. Composite CN values were utilized incorporating impervious cover. This assumption was confirmed by visual inspection based on field reconnaissance and current digital orthophotos. Composite (soil based) CN's were assigned for each land use type using GIS Tools. Antecedent Runoff Condition II is assumed for this study to represent the losses throughout the LRGV. Impervious cover for smaller Colonias was identified by hand delineating the impervious areas using digital orthophotos. Impervious cover for larger Colonias was computed using land use assumptions as displayed in Table 4. Similar to the CN assumptions, the percent impervious assumptions assume a fully developed percent impervious cover per lot.

**Table 4. Percent Impervious Assumptions**

| Colonia Plat | Percent Impervious |
|---|---|
| 1/8 acre lots | 65% |
| 1/4 acre lots | 38% |
| 1/3 acre lots | 30% |
| 1/2 acre lots | 25% |
| 1 acre lots | 20% |

### *Unit Hydrograph and Routing*

The Soil Conservation Service (SCS) dimensionless unit hydrograph was selected to define the unit hydrograph's overall shape and timing. The 2D model uses the Storm Water Mathematical Model (SWMM) approach that combines the land cover and watershed slope to compute timing and storage of the watershed.

### *Hydraulic Computations*

Hydraulic computations are made using the Saint-Venant conservation equations of mass and momentum and the conveyance function is based on the Manning equation. Surface flow is routed using a 2D zone consisting of a triangular mesh that incorporates data from the terrain model, existing structures potentially blocking its flow and land roughness coefficients. The InfoWorks ICM 2D engine will consider any mesh element in which the depth of water is lower than the depth parameter (0.039 inches), to be dry. It will consider the momentum of the water in any mesh element in which the depth of water is lower than this value to be zero. And it will also consider the velocity of the water in any mesh element in which the velocity of water is lower than this value to be zero. Hydraulic computations are performed using a high-resolution Godunov-type scheme in finite volumes for the 2D shallow-water equations.

### *Roughness Values*

Manning's roughness values (N-values) were established for pervious, impervious, and developed lots. In order to account for the changing roughness values on the ground, a polygon shapefile was created and applied to the 2D surface. In general pervious areas were represented using a 0.025 n-value and impervious areas were represented using a 0.013 n-value. Other roughness values were selected in accordance with the TxDOT Hydraulic Design Manual, Chapter 4, Section 11, and Tables 4-7 through 4-9.

### *Boundary Conditions*

Without knowing the downstream capacities of the regional systems, the downstream ditches are considered bank full for this analysis. These boundary conditions may be refined at a later date if the downstream system capacities are identified. It is also possible that the downstream diches are overcapacity, but this analysis does not consider flooding impacts from the regional system.

## Flood Mitigation

The flood mitigation concepts discussed in this report are conceptual evaluations of potential flood mitigation solutions. These high-level feasibility concepts may be refined through subsequent preliminary engineering analysis and coordination with project Stakeholders. The localized analysis was conducted to identify areas at risk, potential mitigation solutions, and one recommended flood mitigation project. Potential flood mitigation alternatives were evaluated based upon a high-level feasibility of each proposed alternative, its cost effectiveness, and the potential for implementation. The ultimate objective of the study was to identify an array of potential mitigation options and recommend one (1) feasible cost-effective solution to mitigate flood hazard risks for each of the evaluated high priority Colonias.

## Mitigation Goals/Criteria

Since the study area covered three counties with varying drainage standards, the study team selected uniform mitigation goals that could be applied across all three counties. These goals were selected by evaluating federal, state and local drainage standards, common practices, and previous available studies. It was decided that the mitigation goals for this project would be as follows.

1. Protect structures from the 10% (10-year) local storm event.
2. Convey the 10% (10-year) local drainage in a storm drainage system.
3. Retain the 4% (25-year) local drainage using a detention or retention pond.

As these goals were applied during the localized mitigation analyses, it was found that there were instances where the goals could not be met. For example, some structures are located in low areas within Colonias that could not be mitigated with cost effective solutions. In these cases, the study team proposed drainage improvement that best mitigate flooding within the Colonias but may leave a few low lying structures at risk of flooding during the 10% (10-year) local storm event.

Proposed storm drainage systems include underground storm drainage infrastructure (pipes) and open drainage ditches as applicable for each Colonia. Without knowing the downstream capacities of the regional systems, the study team selected a conservative retention option. This approach significantly reduces the risk of adversely impacting neighboring properties. The team is aware that this retention approach may not be appropriate or desired in all jurisdictions. In such cases, the outfall components and structures may be refined through subsequent preliminary engineering analysis and coordination with project Stakeholders prior to implementation.

## Potential Mitigation Options

As the team evaluated each Colonia, a list of viable mitigation options was developed. These options include structural and non-structural mitigation solutions. Typically, the viable structural flood mitigation options include installation or improvements to underground drainage systems, open ditch drainage systems or swales, detention/retention ponds, existing driveway and roadway culvert improvements, and roadway improvements including curb and gutters. Non-structural alternatives include elevating flood prone structures, buyout or purchase of flood prone structures, updating or improving land use zoning designations, and updating or improving construction regulations.

## Recommended Mitigation Project

A recommended project is proposed for each Colonia based upon a high-level feasibility of each proposed alternative, its cost effectiveness, and the potential for implementation. Using the list of potential options combined with the existing condition terrain, drainage patterns, drainage systems, and 2D analyses; the study team selected one project for recommended implementation. The proposed drainage improvements were modeled and evaluated using a 2D hydrodynamic model. The 2D model results enabled the team to efficiently evaluate the mitigation benefits of the proposed project.

Each recommended project includes a detailed description of the recommended project, potential challenges in the event the project is evaluated for implementation, estimate of probable cost, project benefits, and a conceptual plan.

## Estimate of Probable Cost

An estimate of probable construction cost was developed for each recommended project. Unit prices for probable construction costs were developed using the Texas Department of Transportation bid tabulations from projects within the Rio Grande Valley dated 2014-2015. It should be noted that the provided estimates

of probable cost exclude costs associated with land acquisition, easement acquisition, unforeseen utility adjustments, and costs associated with permitting. As projects are further refined for implementation, these estimates should be further evaluated.

### *Project Benefits*

The cost effectiveness analysis in study was primarily focused on the computation of avoided structural (homes and buildings) damages. The study team used FEMA's Flood Module Benefit Cost Analysis (BCA) software to estimate avoided structural damages. Using FEMA's BCA software significantly increases the likelihood of identifying alternatives that have a viable funding source; thus making the study recommendations more likely to be implementable. The methodologies and assumptions of the benefit analysis are provided below.

Following the completion of the hydrologic and hydraulic analysis, it was identified that several Colonias experience significant flooding of roadways and lots but may not experience significant structural damages. Although additional project benefits cannot be qualified with a cost value, several additional benefits were identified as supplemental information for each recommended project. The localized analyses reports identify the pre- and post-project inundated structures, inundated lots, and linear feet of inundated roadways for each flood recurrence interval. In addition to these tabulated values, the localized analyses reports also include maps displaying the pre- and post-project flood inundation areas within the Colonias for each flood recurrence interval. The project benefits were identified as follows.

- *Inundated Structures* – The number of inundated structures was based strictly on finished floor elevations compared to computed water surface elevations. If the finished floor elevation was less than the computed water surface elevation, the structure was counted as inundated for that specific flood event.
- *Inundated Lots* – The number of inundated lots was based strictly on the inundation maps and therefore do not count as inundated if the depth of flooding is less than the mapped depth of flooding in the provided graphics. Many lots in the Colonia display significant decreases or near removal of the floodplain, but were still counted as inundated if they displayed any inundation in the lot.
- *Inundated Roadways* – The inundated roadways were measured in linear feet along the centerline of roadways within the Colonia as well as adjacent roadways that serve the Colonia within the drainage boundary. Roadways were considered inundated if the inundation maps displayed flooding over the centerline of the roadway.

As the identified projects are considered for implementation, other potential project benefits may include a refined identification of public safety benefits, cost analysis, available funding sources, permitting requirements, timelines for implementation, etc.

## Benefit Analysis

After the recommended project analysis was complete the resulting data was then used in FEMA's Benefit Cost Analysis (BCA) model version 5.1 to determine flood damage reduction for the recommended project. The BCA model is used to calculate a present value of pre- and post-project damages that are estimated to occur over the useful life of the project (in our case, 50 years) and divides the estimated damage reduction (i.e. benefits) by the cost of the project. The estimated damages are based on varying flood depth scenarios for different storm events and flood elevations. The storm events and flood elevations were determined using the updated hydrologic and hydraulic analyses. FEMA's Full-Data Riverine module was used to calculate the structural replacement flood damage reduction. The mitigation benefits of the recommended project are divided by the project cost to yield the benefit-cost ratio. The Benefit Cost Analysis Technical report is located in Appendix B.

## Structural Damages for Mitigation Project

Properties within the 1% (100-year) floodplain were included in this analysis. Data for each structure was established as follows:

- *Property ID* – Obtained as best as possible from the Hidalgo, Cameron, and Willacy County Appraisal District records for properties inside the existing condition 1% (100-year) floodplain footprint.
- *LiDAR Elevation* – Obtained as the lowest ground elevation within the structure footprint. This same location was used to establish the hydraulic data necessary for the BCA analysis.
- *Estimated Finished Floor Elevations* – A few structures were surveyed to obtain finished floor elevations. The surveyed finished floor elevations were utilized to evaluate the following assumptions. Estimated finished floor elevations were established compared to the ground surface elevation. Ground surface elevations for each structure were extracted from LiDAR. The finished floor elevations were estimated as follows:
  - Mobile homes were assumed to be 3 feet above grade,
  - Structures with a pier and beam foundation were assumed to be 1.5 feet above grade, and
  - Structures with a slab on grade foundation were assumed to be 0.5 feet above grade.

  Foundation types were established by visual inspection, as well as, by photo verification from available published photos.
- *Square Footage of Structure* – Established using appraisal district records of livable square footage for each structure.
- *Type of Construction* – Established using appraisal district records and verified using visual inspection and photo verifications from available published photos.
- *Appraisal Values* – Established using appraisal district records of the improvement and land values.
- *Building Replacement Values* – The current Marshall and Swift dollar per square foot based on the structure type, size and quality of construction was used to estimate replacement costs.
- *Contents Damages* – All contents damages were calculated using the FEMA BCA default assumption of 30% of structure replacement value.
- Water Surface Elevations – Pre-Project (existing) Condition and Post-Project (proposed) condition water surface elevation rates were established from the 2D model for each structure and each simulated storm event.
- *Flow Rates* – Pre-Project (existing) Condition and Post-Project (proposed) condition flow rates were established from the 2D model for each structure and each simulated storm event.

The FEMA BCA software (Version 5.1, DFA module) was used to calculate the net present value of the avoided damages as a result of the recommended flood mitigation project.

## Additional Flood Control Projects

In addition to the BCA completed for the recommended flood mitigation project, the cost of structural elevation and acquisition/demolition was also evaluated. These additional analysis were only completed for structures for which there were calculated avoided damages for a mitigation project. Structures with no calculated avoided damages identified in the drainage project were considered out of harm's way and were not analyzed for acquisition or elevation. The following assumptions were used to compute these additional analyses.

- *Structural Elevation* - The following assumptions were used to compute elevation costs.
  1. The CAD square footage of the home was multiplies by $75 per square foot as an estimated cost of elevation.

Benefits for structural elevation are equal than those for drainage project as elevation of a structure would remove the property from risk, but the property will still have a similar residual risk as the drainage project.

- *Acquisition/Supplemental Housing/Demolition* - The following assumptions were used to compute acquisition/demolition costs.
  1. Total appraisal value (improvements and land) was multiplied by 1.5 for an estimate of market value.
  2. To the computed market value, we added $31,000 for supplemental housing to provide an offset for the anticipated cost of comparable replacement housing outside a flood prone area.
  3. An estimate of demolition cost of $5,000 per property was used.

  Benefits for acquisition are higher than those for drainage and elevation as acquisition permanently removes the properties from homes way, with no residual risk.

## Localized Analysis Documentation

Localized analysis reports were developed for each evaluated Coloina. These reports were developed and populated to document the hydrologic and hydraulic analyses, identified areas at risk, potential mitigation solutions, one recommended mitigation project, an estimate of probable construction cost of the recommended project, project benefits, benefit-cost analysis, inundation maps, and a recommended project conceptual plan. The localized analysis reports are provided in Appendix C.

Once again, it should be noted that the localized assessment includes the hydrologic and hydraulic analyses of localized flooding event, but does not evaluate flooding or impacts from the regional drainage system. The study team identified an array of potential mitigation options and recommend one (1) feasible cost-effective solution to mitigate flood hazard risks for each of the 78 evaluated high risk Colonias. A summary table of the results are provided below as a quick reference. A more detailed summary is located in Appendix C.

**Table 5. Localized Analysis Summary**

| Colonia Name | County | 1% (100-year) Protected Inundated Structures | Drainage Improvement Project | | Elevate Structures Project | | Acquisition/Demolition Project | |
|---|---|---|---|---|---|---|---|---|
| | | | Cost | Benefit-Cost Ratio | Cost | Benefit-Cost Ratio | Cost | Benefit-Cost Ratio |
| Cameron Park | Cameron | 113 | $8,837,211 | 3.08 | $20,616,225 | 1.32 | $21,118,569 | 3.31 |
| Colonia Iglesia Antigua | Cameron | 6 | $1,654,594 | 0.12 | $86,925 | 2.32 | $279,820 | 0.75 |
| Coronado | Cameron | 7 | $1,853,479 | 1.11 | $951,900 | 2.16 | $855,928 | 3.95 |
| Dakota Mobile Home Park | Cameron | 2 | $614,562 | 0.77 | $208,350 | 2.27 | $230,605 | 2.14 |
| Del Mar Heights | Cameron | 1 | $637,715 | 0.66 | $272,755 | 1.54 | $145,527 | 4.45 |
| Eggers | Cameron | 5 | $709,460 | 3.09 | $778,500 | 2.81 | $640,229 | 3.87 |
| Glenwood Acres | Cameron | 3 | $2,551,371 | 0.18 | $314,175 | 1.43 | $334,911 | 4.43 |
| Grande Acres | Cameron | 2 | $630,295 | 0.34 | $169,800 | 1.24 | $114,539 | 1.93 |
| Green Valley Farms | Cameron | 2 | $51,986,870 | 0.03 | $979,425 | 1.46 | $1,301,737 | 2.34 |
| La Coma | Cameron | 1 | $1,084,356 | 0.30 | $302,475 | 1.07 | $229,813 | 3.15 |
| La Feria Gardens | Cameron | 0 | $1,717,418 | 0.00 | $0 | N/A | $0 | N/A |
| Lago | Cameron | 4 | $853,798 | 0.70 | $451,350 | 1.32 | $389,916 | 0.53 |
| Las Yescas | Cameron | 3 | $826,404 | 2.66 | $331,800 | 6.62 | $295,972 | 7.46 |
| Longoria Townsite | Cameron | 2 | $694,021 | 0.90 | $225,300 | 2.78 | $237,307 | 3.74 |
| Lourdes Street | Cameron | 8 | $1,461,573 | 4.15 | $841,350 | 7.20 | $728,190 | 8.61 |
| Nogal St. | Cameron | 1 | $1,272,999 | 0.32 | $1,097,712 | 0.37 | $126,033 | 14.33 |
| Paredes Estates | Cameron | 2 | $564,116 | 1.05 | $269,775 | 2.20 | $263,662 | 2.32 |

| Colonia Name | County | 1% (100-year) Protected Inundated Structures | Drainage Improvement Project | | Elevate Structures Project | | Acquisition/Demolition Project | |
|---|---|---|---|---|---|---|---|---|
| | | | Cost | Benefit-Cost Ratio | Cost | Benefit-Cost Ratio | Cost | Benefit-Cost Ratio |
| Pennsylvania Avenue | Cameron | 3 | $394,970 | 1.76 | $483,525 | 1.44 | $548,271 | 2.05 |
| Santa Maria | Cameron | 8 | $2,379,820 | 3.06 | $1,128,975 | 6.45 | $1,005,060 | 7.92 |
| Santa Rosa #13 | Cameron | 1 | $24,935 | 1.53 | $117,000 | 0.33 | $103,268 | 2.39 |
| Santa Rosa Annex | Cameron | 3 | $641,672 | 1.25 | $202,200 | 3.96 | $242,359 | 4.29 |
| Alberta Estates #2 | Hidalgo | 14 | $1,632,506 | 1.91 | $1,509,525 | 2.06 | $1,908,959 | 1.84 |
| Arriaga Subd. | Hidalgo | 1 | $576,030 | 0.38 | $123,600 | 1.76 | $90,350 | 2.52 |
| Basham #12 | Hidalgo | 4 | $1,688,057 | 0.10 | $495,975 | 0.34 | $402,547 | 2.13 |
| Basham #4 | Hidalgo | 2 | $647,470 | 2.78 | $230,550 | 7.80 | $263,227 | 7.06 |
| Capisallo Park | Hidalgo | 9 | $2,967,645 | 1.44 | $903,525 | 4.73 | $697,940 | 4.07 |
| Chapa #5 | Hidalgo | 1 | $709,421 | 0.08 | $21,600 | 2.72 | $64,412 | 0.98 |
| Chapa Subdivision | Hidalgo | 3 | $289,846 | 1.21 | $329,100 | 1.06 | $505,085 | 1.21 |
| Chula Vista Acres | Hidalgo | 4 | $1,121,561 | 1.41 | $1,855,050 | 0.85 | $2,153,794 | 2.77 |
| Cotter Tract | Hidalgo | 26 | $893,880 | 16.90 | $3,737,400 | 4.04 | $4,200,663 | 3.78 |
| Cuellar Subd. #1 | Hidalgo | 0 | $39,598 | 0.00 | $0 | N/A | $0 | N/A |
| El Gato | Hidalgo | 2 | $2,490,649 | 0.35 | $384,900 | 2.26 | $469,598 | 5.42 |
| Enrique Bazan Subd. | Hidalgo | 2 | $481,950 | 2.01 | $108,675 | 8.90 | $121,977 | 8.20 |
| Hilda Subd. | Hidalgo | 2 | $1,743,773 | 0.31 | $242,700 | 2.26 | $213,547 | 2.67 |
| J.R. Subdivision #2 | Hidalgo | 5 | $266,880 | 3.92 | $570,600 | 1.83 | $657,395 | 2.03 |
| Linda Vista Estates | Hidalgo | 4 | $3,238,300 | 2.80 | $2,450,775 | 3.70 | $2,782,319 | 4.18 |
| Los Trevinos Subd. #3 | Hidalgo | 4 | $1,070,445 | 0.43 | $474,750 | 0.98 | $441,200 | 2.54 |
| Los Treviños Subd. #4 | Hidalgo | 0 | $931,626 | 0.00 | $0 | N/A | $0 | N/A |
| Los Trevinos Subd. #5 | Hidalgo | 0 | $63,765 | 0.00 | $0 | N/A | $0 | N/A |
| North Santa Cruz Subd | Hidalgo | 0 | $156,246 | 0.00 | $0 | N/A | $0 | N/A |
| Olivarez #10 | Hidalgo | 3 | $482,835 | 1.47 | $390,600 | 1.82 | $487,775 | 1.87 |
| Olivarez #6 | Hidalgo | 5 | $1,093,558 | 1.77 | $1,120,500 | 1.72 | $1,021,260 | 1.98 |
| Olivarez 17 | Hidalgo | 1 | $391,333 | 2.45 | $639,300 | 1.50 | $460,320 | 2.65 |
| Owassa Rd/Tower Rd | Hidalgo | 3 | $945,298 | 1.24 | $279,900 | 4.20 | $345,111 | 3.55 |
| Penitas | Hidalgo | 56 | $13,836,407 | 2.27 | $13,783,688 | 2.28 | $16,347,611 | 2.00 |
| Perezville | Hidalgo | 10 | $2,347,060 | 0.97 | $1,694,700 | 1.35 | $1,346,170 | 3.75 |
| R.C. Babb Subd #3 and 4 | Hidalgo | 5 | $406,894 | 10.07 | $824,625 | 4.97 | $929,484 | 5.48 |
| Ramirez Estates | Hidalgo | 9 | $1,513,405 | 0.97 | $918,150 | 1.60 | $896,906 | 2.40 |
| Reina Del Sol Mobile Home Esta | Hidalgo | 10 | $1,035,164 | 4.60 | $1,350,375 | 3.53 | $1,363,874 | 3.64 |
| River Road Subd. | Hidalgo | 5 | $1,239,551 | 1.45 | $479,400 | 3.75 | $391,704 | 5.41 |
| Ruthven #1 | Hidalgo | 2 | $1,001,319 | 0.38 | $142,500 | 2.70 | $119,398 | 3.33 |
| Salida del Sol Estates Subd. | Hidalgo | 5 | $2,384,200 | 0.23 | $348,150 | 1.58 | $346,918 | 1.64 |
| South Fork Subd. | Hidalgo | 7 | $4,399,927 | 0.79 | $2,445,525 | 1.41 | $2,687,932 | 2.38 |
| Southside Village | Hidalgo | 6 | $776,511 | 5.72 | $627,150 | 7.09 | $621,464 | 7.39 |
| Sun Valley Estates | Hidalgo | 0 | $532,914 | 0.00 | $0 | N/A | $0 | N/A |
| V&C | Hidalgo | 8 | $966,798 | 0.96 | $519,300 | 1.78 | $546,818 | 1.78 |
| Val Verde Grove | Hidalgo | 0 | $1,157,133 | 0.00 | $0 | N/A | $0 | N/A |
| Val Verde North Subd. | Hidalgo | 3 | $829,221 | 0.74 | $303,000 | 2.03 | $377,424 | 1.71 |
| Victoria Belen | Hidalgo | 0 | $346,636 | 0.00 | $0 | N/A | $0 | N/A |
| Welch Tract | Hidalgo | 26 | $893,880 | 16.90 | $3,737,400 | 4.04 | $4,200,663 | 3.78 |

| Colonia Name | County | 1% (100-year) Protected Inundated Structures | Drainage Improvement Project | | Elevate Structures Project | | Acquisition/Demolition Project | |
|---|---|---|---|---|---|---|---|---|
| | | | Cost | Benefit-Cost Ratio | Cost | Benefit-Cost Ratio | Cost | Benefit-Cost Ratio |
| Lasara | Willacy | 12 | $3,334,439 | 3.37 | $3,091,200 | 3.64 | $2,557,263 | 5.16 |
| Bar #3 | Hidalgo | 11 | $1,199,801 | 5.86 | $1,528,125 | 4.60 | $1,231,792 | 5.89 |
| Bernal Heights #1 | Hidalgo | 3 | $384,092 | 1.33 | $211,500 | 2.41 | $282,771 | 1.90 |
| Blue Star Enterprises #2 | Hidalgo | 12 | $1,469,068 | 1.57 | $1,599,900 | 1.44 | $1,567,434 | 3.35 |
| Colonia Tijerina | Hidalgo | 9 | $1,371,617 | 1.28 | $848,775 | 2.06 | $967,161 | 1.90 |
| Hoehn Drive Subd. | Hidalgo | 13 | $2,837,474 | 5.64 | $3,983,550 | 4.02 | $4,004,582 | 4.16 |
| Imperial Subd. | Hidalgo | 4 | $440,833 | 5.29 | $544,800 | 4.28 | $410,530 | 5.89 |
| La Blanca Heights | Hidalgo | 9 | $1,523,792 | 0.52 | $367,875 | 2.15 | $381,014 | 2.17 |
| Rankin Subd. | Hidalgo | 2 | $755,332 | 0.55 | $175,950 | 2.35 | $253,398 | 1.71 |
| Reina Subd. | Hidalgo | 0 | $323,264 | 0.00 | $0 | N/A | $0 | N/A |
| Ruthven Subd. #2 | Hidalgo | 3 | $805,466 | 3.26 | $438,000 | 6.00 | $528,604 | 5.17 |
| Southern Breeze Subd. | Hidalgo | 9 | $1,304,296 | 3.99 | $1,088,475 | 4.78 | $1,279,442 | 4.23 |
| Umberto Garcia Jr. Subd. | Hidalgo | 0 | $410,801 | 0.00 | $0 | N/A | $0 | N/A |
| Val Verde Acres | Hidalgo | 8 | $1,206,548 | 1.44 | $1,122,150 | 1.55 | $1,212,922 | 1.50 |
| Tierra Bella Subd. | Hidalgo | 11 | $956,301 | 7.80 | $1,316,850 | 5.66 | $1,158,951 | 6.68 |
| Olmito | Cameron | 126 | $39,369,330 | 1.87 | $23,469,900 | 3.14 | $27,564,960 | 6.83 |
| Cuevitas | Hidalgo | 8 | $1,343,237 | 1.97 | $698,925 | 3.79 | $607,831 | 4.55 |
| Green Valley Development Subd. | Hidalgo | 12 | $428,115 | 15.00 | $1,402,725 | 4.58 | $1,452,911 | 4.67 |

In conclusion, the study team has examined the risks and needs of the Colonias to ultimately identify drainage infrastructure projects to address the drainage issues in the Lower Rio Grande Valley. Based on the analysis, many of the identified projects are considered cost-effective having a benefit cost ratio greater than 1.0. Identification of cost-effective projects increase the likelihood of identifying alternatives that have a viable funding source; thus making the study recommendations more likely to be implemented.

# REFERENCES

1. Lower Rio Grande Valley Development Council (LRGVDC). Lower Rio Grande Regional Economic Adjustment Plan for Building Disaster Resilient Communities. Austin, TX. S&B Infrastructure, LTD. 2011.
2. Lower Rio Grande Valley Development Council (LRGVDC). Needs Assessment. Lower Rio Grande Valley Hurricane Dolly recovery program. Baton Rouge, LA. URS Corporation. 2011.
3. Texas Secretary of State (SOS). 79th Regular Session of the Texas Legislature. Senate Bill 827. www.sos.state.tx.us/border/colonias/legislation.shtml. 2005.
4. Innovyze. InfoWorks Integrated Catchment Modeling System. 2015-2016.
5. Texas Department of Transportation (TxDOT). Hydraulic Design Manual. Texas. 2016.
6. Environmental Systems Research Institute, Esri's ArcGIS Version 10.1, 2012.
7. U.S. Department of Commerce, Weather Bureau. Technical Paper No. 40, Rainfall Frequency Atlas of the United States, for Durations from 30 Minutes to 24 Hours in Return Periods from 1 to 100 years, Washington D.C., May 1961.
8. Office of Management and Budget. OBM Circular A-94. Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs. Washington D.C. October 1992.

# Appendix A


*"Filling the Gap"*

Lower Rio Grande Valley Development Council – Weslaco, Texas
December 7, 2016

PROJECT TEAM:

JSW & Associates, Inc.
Hazard Mitigation Consultants

HALFF

RPS Espey

Brown, Leal & Associates
R. Gutierrez Engineering
ERO Architects

Administered by the Texas Water Development Board

# History of the Study

STORMWATER DRAINAGE PLANNING FOR THE COLONIAS OF THE LOWER RIO GRANDE VALLEY
"Filling the Gap"

- What is a Colonia
  - The term "Colonia," in Spanish means a community or neighborhood. A Colonia is "a residential area along the Texas-Mexico border that may lack some of the most basic living necessities, such as potable water and sewer systems, electricity, paved roads, and safe and sanitary housing."

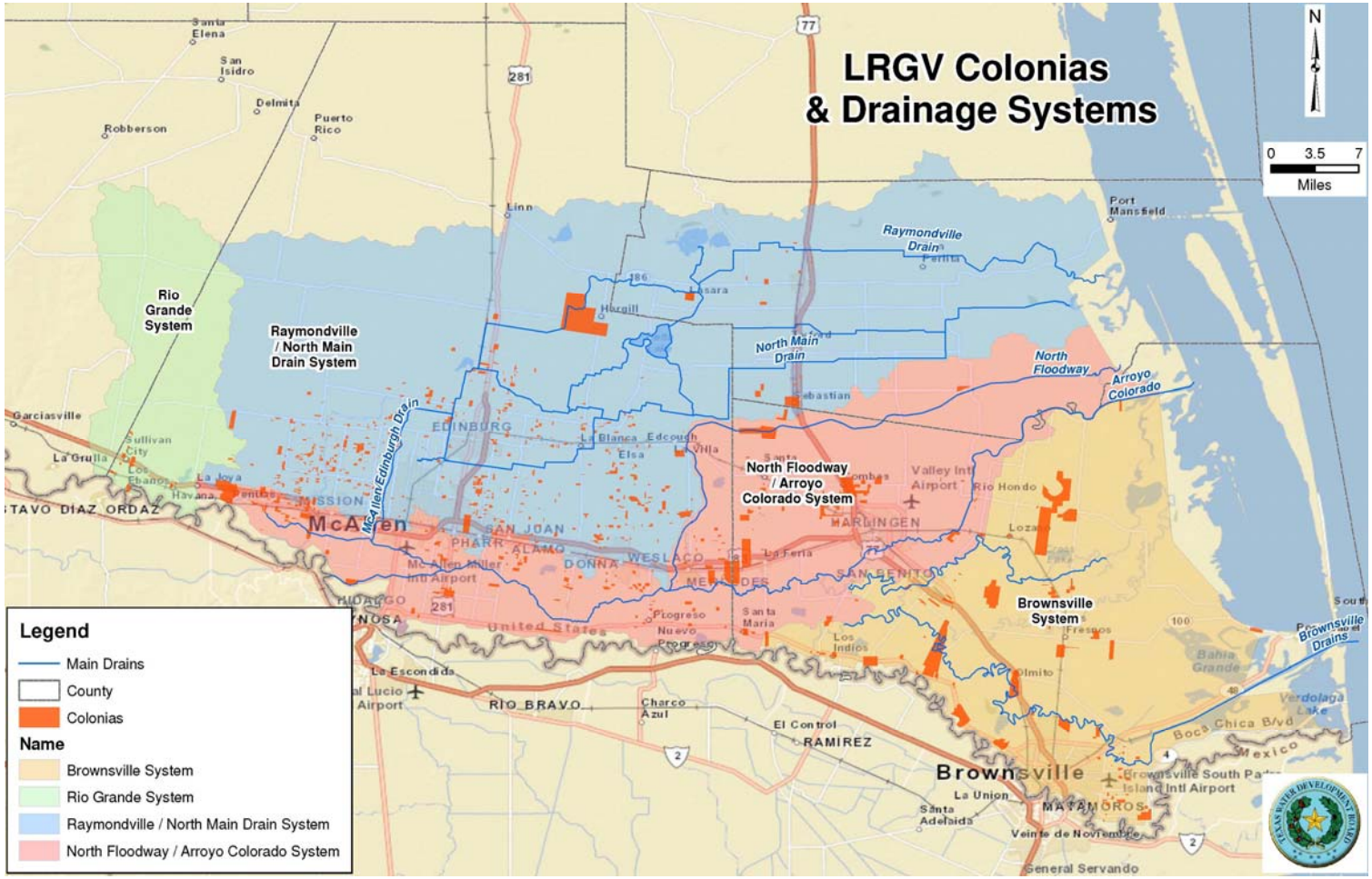
- Project Goal:
  - To examine the drainage infrastructure needs of the Colonias and identify drainage study and infrastructure gaps that need to be filled in order to address drainage issues.

- Funding:
  - State of Texas Funding following Hurricanes Dolly and Ike
  - Funded by CDBG appropriations and administered by TWDB

# Planning Area

STORMWATER DRAINAGE PLANNING FOR THE COLONIAS OF THE LOWER RIO GRANDE VALLEY
"Filling the Gap"

- 3 County Focus: Hidalgo, Cameron and Willacy
- 1,039 OAG and SOS Colonias



# Flooding in the LRGV

STORMWATER DRAINAGE PLANNING FOR THE COLONIAS OF THE LOWER RIO GRANDE VALLEY
"Filling the Gap"

- LRGV is floodprone
- Large Drainage Area with 6 Main Outfalls

IBWC South Drain at Highway 281 in Pharr

# About the Study

STORMWATER DRAINAGE PLANNING FOR THE COLONIAS OF THE LOWER RIO GRANDE VALLEY
"Filling the Gap"

- Colonia Assessment
  - » Identify Colonias & Location
  - » Risk
  - » Need
- Finding the Gap
  - » Evaluate why Colonias Flood
- Filling the Gap
  - » Evaluate Solutions

# Phase 1 Summary

STORMWATER DRAINAGE PLANNING FOR THE COLONIAS OF THE LOWER RIO GRANDE VALLEY
"Filling the Gap"

- Outreach
  - » Public Meetings
  - » Colonia Representatives
- Data Collection
  - » List & Location of Colonias
  - » Catalog existing Studies & Projects
    - Examine existing stormwater drainage studies.
    - Identify projects that reduce flood risk for colonias within the three counties.
- Colonia Assessment
  - » Ultimately identify the Colonias with the greatest need (risk of flooding) for drainage study and infrastructure necessary to address drainage issues.

# Phase 1 : Studies & Projects Catalog

- Compiled Database
  - » Location
  - » Study/Report Details
    - Name
    - Date
    - Associated Modeling
    - Funding Source
  - » Project Details
    - Name
    - Date
    - Associated Study
    - Associated Modeling and/or Design
    - Project Status
    - Funding Source

| Study/Report Catalog | Notes: |
|---|---|
| Report/Study Title | List report or study title. |
| Report/Study Date | List report or study completion date. |
| Report Available | Is the report available? |
| Model Available | Is the model available? |
| Model Platform | What modeling platform was used? (HMS, RAS, XP-SWMM, ICPR, etc.) |
| Model Run | Does the model run? |
| Geospatial model | Is the model geospatial? |
| Spatial Data Available | Is the geospatial data available? |
| Projects Identified | Did the report/study identify projects for flood mitigation? |
| Projects Designed | Were the identified projects analyzed/designed? Ready for construction? |
| Projects Funded | Is funding secured for projects? |
| Funding Source | List the funding source. (FEMA, USACE, Bond, etc.) |
| Projects Implemented | Has the project been constructed? |

| Identified Project Catalog | Notes: |
|---|---|
| Projects Identifier | List project name or identifier. |
| Project Planned | Was the identified project analyzed/designed? Ready for construction? |
| Project Cost | How much does the designed project cost? |
| Funding Secured | Is funding secured for project? |
| Funding Source | List the funding source. (FEMA, USACE, Bond, etc.) |
| Project Implemented | Has the project been constructed? |
| Project Impact | Briefly explain the impact or results of project. |
| Report/Study Title | List report or study title. |
| Report/Study Date | List report or study completion date. |
| Report Available | Is the report available? |
| Model Available | Is the model available? |
| Model Platform | What modeling platform was used? (HMS, RAS, XP-SWMM, ICPR, etc.) |
| Model Run | Does the model run? |
| Geospatial model | Is the model geospatial? |
| Spatial Data Available | Is the geospatial data available? |
| Design Sheets Available | Are the project design plans available? |
| Design Format | What is the format of the design plans? (PDF, CADD, GIS, etc.) |
| Design Status | What is the status of the design? |
| Survey Available | Is survey data available? |
| Survey Data Format | What is the format of the survey data? (PDF, ASCII, text, CADD, etc.) |

# Phase 1: Colonia Assessment

STORMWATER DRAINAGE PLANNING FOR THE COLONIAS OF THE LOWER RIO GRANDE VALLEY

*"Filling the Gap"*

| | People | | Community | | Risk | | | | Infrastructure | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Score** | **Low to Moderate Income** | **Population** | **City Boundary** | **Drainage District** | **Historic Flooding[1]** | **Floodplains** | **Low Terrain[2]** | **Hydric Soil Survey** | **Model Subdivision Community** | **Existing Drainage Infrastructure** | **Identified Mitigation Project** |
| 5 | LMI (>75%) | 1000+ | Outside City Limit | Outside | Frequent flooding of homes | Inside Floodway | > 80% | C & D | No | Red | No Project |
| 4 | | 500-999 | | | Some flooding of homes | 100-year | 60-80% | | | | |
| 3 | Mixed (51-75%) | 250-499 | Inside City ETJ | | Standing water in lots | | 40-60% | A/D, B/D & C/D | Unknown | Yellow or Unknown | Planned |
| 2 | | 100-249 | | | Street Flooding | 500-year | 20-40% | | | | |
| 1 | Non-LMI (-500) | <100 | In City Limit (-500) | Inside | Rare | Outside | 1-20% | A & B | Yes (-500) | Green | Funded |
| **Weight** | **25** | **15** | **7** | **3** | **6** | **11** | **17** | **6** | **3** | **3** | **4** |
| **%** | **40** | | **10** | | **40** | | | | **10** | | |

- People (40%)
- Community (10%)
- Risk (40%)
- Infrastructure (10%)

# Phase 1: Colonia Assessment Validation

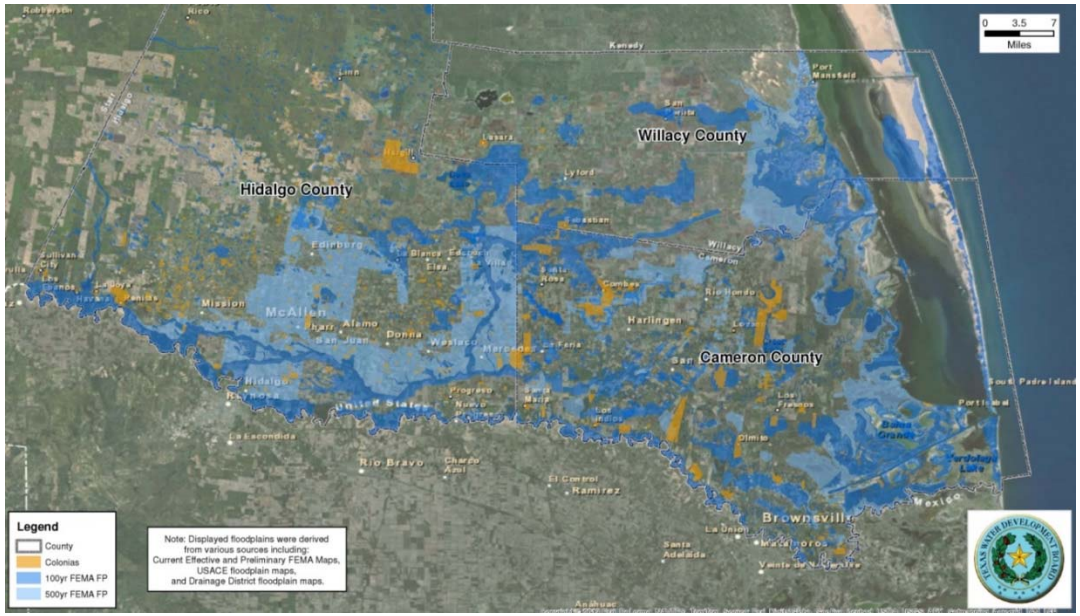
STORMWATER DRAINAGE PLANNING FOR THE COLONIAS OF THE LOWER RIO GRANDE VALLEY
"Filling the Gap"

- Outreach and Site Visits
  - » 4 Public Workshops with Colonia Stakeholder Assistance
  - » 404 Site Visits to observe site conditions and validate desktop data
  - » Survey Residents
- Colonia Categorization
  - » A1 – Localized Solutions with Structure Flooding
  - » A2 – Localized Solutions with Nuisance (Roadway, Lot, Maintenance Flooding)
  - » B1 – Regional Solutions with Structure Flooding
  - » B2 – Regional Solutions with Nuisance (Roadway, Lot, Maintenance Flooding)
  - » C – Colonias that may not have Possible Solution
  - » D – Colonias that may not be Impacted

# Phase 1: Colonia Assessment Results

STORMWATER DRAINAGE PLANNING FOR THE COLONIAS OF THE LOWER RIO GRANDE VALLEY
"Filling the Gap"

- People Information for all Colonias
  - » 79% of Colonias are considered LMI Communities
  - » 16% of Colonias have a population greater than 250
- Risk Information for all Colonias
  - » 50% not in a designated floodplain
  - » 70% are not in low lying terrain
  - » 78% have non-hydric soils



# Phase 1: Colonia Assessment

STORMWATER DRAINAGE PLANNING FOR THE COLONIAS OF THE LOWER RIO GRANDE VALLEY
"Filling the Gap"

- Categorization Results

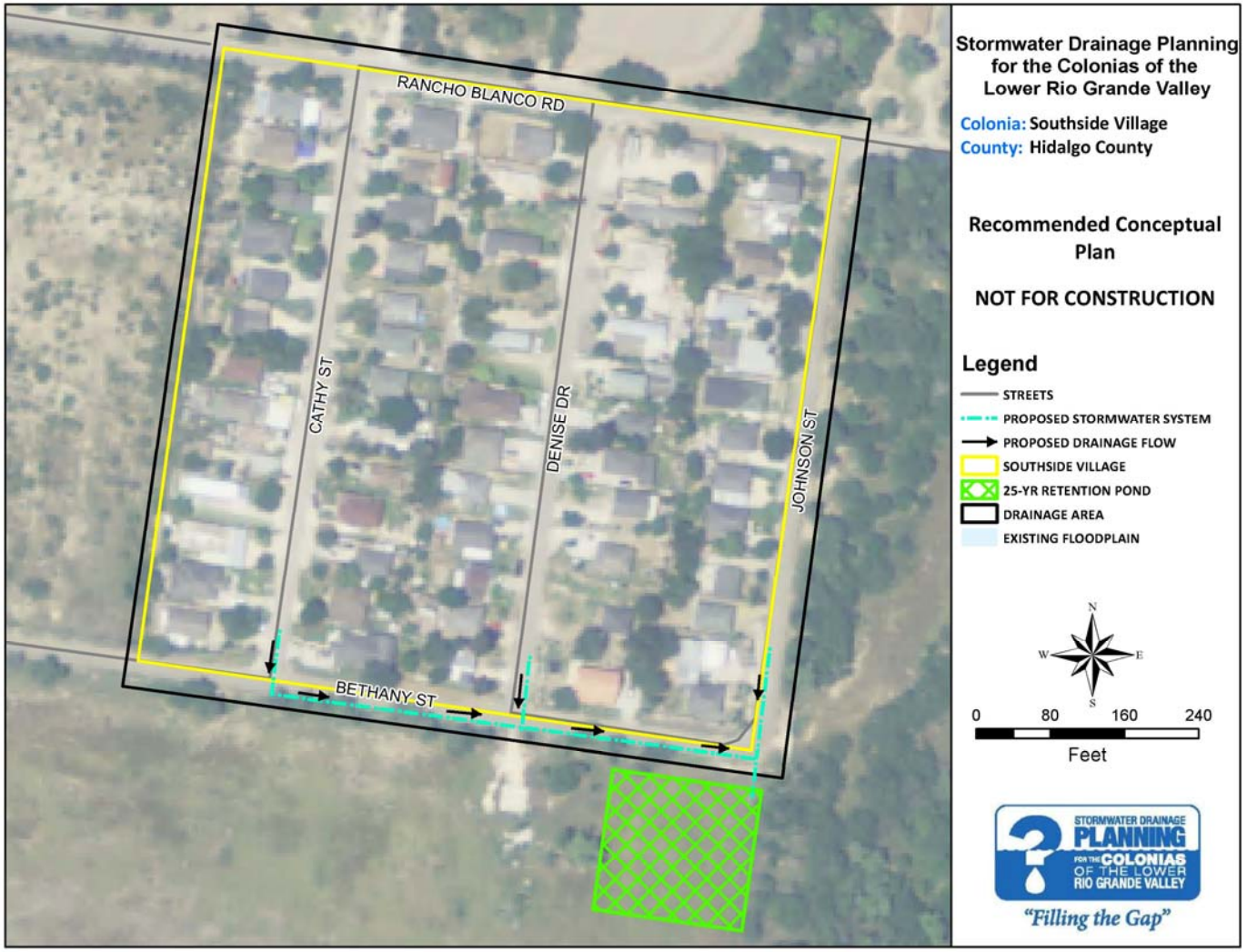
| Category | Summary | Hidalgo | Cameron | Willacy | Hidalgo | Cameron | Willacy |
|---|---|---|---|---|---|---|---|
| A1 (Local / Structure) | 61 | 39 | 21 | 1 | 64% | 34% | 2% |
| A2 (Local / Nuisance) | 215 | 164 | 45 | 6 | 76% | 21% | 3% |
| B1 (Regional / Structure) | 17 | 16 | 1 | 0 | 94% | 6% | 0% |
| B2 (Regional / Nuisance) | 31 | 22 | 9 | 0 | 71% | 29% | 0% |
| C (No solution) | 1 | 1 | 0 | 0 | 100% | 0% | 0% |
| D (No Impact) | 79 | 66 | 13 | 0 | 84% | 16% | 0% |
| **TOTAL** | **404** | **308** | **89** | **7** | **76%** | **22%** | **2%** |
| *All Colonias (OAG and SOS)* | *1039* | *846* | *177* | *16* | *81%* | *17%* | *2%* |

# Phase 2: Localized Analysis

STORMWATER DRAINAGE PLANNING FOR THE COLONIAS OF THE LOWER RIO GRANDE VALLEY
"Filling the Gap"

- Localized analysis of Individual Colonias
  - **Consistent, Accurate, and Defendable Models**
  - **Drainage Standards** (Establish Design Frequencies)
  - **Level of Risk** (Establish Depths of Flooding)
  - **Localized Drainage Solutions**
  - **No Adverse Impact** (Improvements do not negatively impact neighbors)

# Phase 2: Localized Analysis



# Questions

**www.lrgvdrainage.org**

STORMWATER DRAINAGE PLANNING FOR THE COLONIAS OF THE LOWER RIO GRANDE VALLEY

*"Filling the Gap"*

# MEDIA ADVISORY

**FOR IMMEDIATE RELEASE**
**December 16, 2016**

**Contact: Robert Saenz, P.E., C.F.M.**
**Halff Associates, INC.**
**(956) 664-0286**

**LRGVDC Meeting Presentation of the Texas Water Development Board Stormwater Drainage Study for the Colonias**

**(Weslaco, TX)** - The Texas Water Development Board Stormwater Drainage Study for the Colonias of the Lower Rio Grande Valley is nearing completion. This final presentation at the board meeting of the Lower Rio Grande Valley Development Council (LRGVDC) on Wednesday (tomorrow) will summarize the overall project, activities and deliverables.

Who: Lower Rio Grande Valley Development Council Board of Directors Meeting

When: Wednesday, December 7, 12:00 p.m., as part of Agenda Item 9 – Regional Planning and Services, sub item B – HUD Disaster Recovery Funding.

Where: LRGVDC Main Campus, Ken Jones Executive Board Room, 301 West Railroad St., Weslaco, TX

BACKGROUND: This Stormwater Drainage Planning project was conducted in three phases. Initial phases included a colonia assessment of the lower Rio Grande Valley to ultimately identify the colonias with the greatest need for drainage study and infrastructure necessary to address local drainage issues. The third, final phase, was the localized analyses of 78 LRGV colonias. Through the initial phases, the project team identified colonias with the highest potential of flooding that experience structural damage. The remaining project funds were utilized to perform specific localized colonia analysis to address the frequent local flooding for the colonias identified as experiencing structural flooding.

For more information about the Texas Water Development Board Stormwater Drainage Study for the Colonias of the Lower Rio Grande Valley, please contact Robert Saenz, P.E., C.F.M. at (956) 664-0286 or Brian Godinez at (956) 655-4655.

# # #

This email media advisory was sent out 12/6/2016 to all the regional media; and the email base of the LRGVDC board members and all their affiliated entities and organizations (over 200 individuals).

# WEBSITE ANNOUNCEMENT

STORMWATER DRAINAGE PLANNING FOR THE COLONIAS OF THE LOWER RIO GRANDE VALLEY

*"Filling the Gap"*

Home | About the Study | Public Meetings | Project Updates | Tools & Resources | News | FAQ | Contact

*Para español, elije "Spanish"*

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## Home

### LRGVDC Meeting Presentation of the Texas Water Development Board Stormwater Drainage Study for the Colonias

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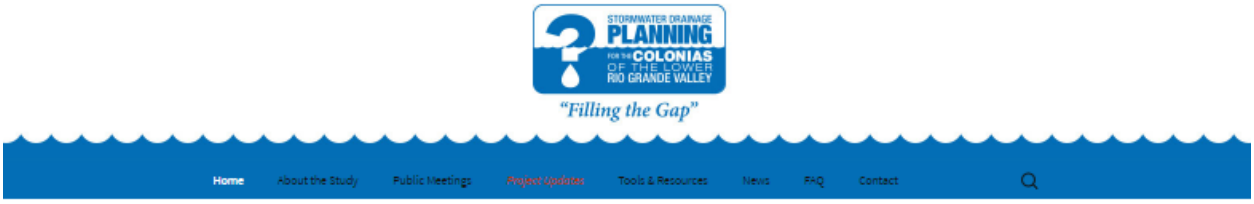
WEBSITE UPDATES:




# Project Updates

The Stormwater Drainage Planning for the Colonias of the Lower Rio Grande Valley Project will take the course of two years to complete the study. During this time, the Team will provide updates on the progress of the study.

If you would like to receive email updates, please provide your email here.

## Phase 2 Final Localized Analyses

The Texas Water Development Board Stormwater Drainage Study for the Colonias of the Lower Rio Grande Valley (LRGV) is nearing completion. This Stormwater Drainage Planning project was conducted in three phases. Initial phases included a Colonia assessment of the lower Rio Grande Valley to ultimately identify the colonias with the greatest need for drainage study and infrastructure necessary to address local drainage issues. The third and final phase was the localized analyses of 78 LRGV Colonias. Through the initial phases, the project team identified Colonias with the highest potential of flooding that experience structural damage. The remaining project funds were utilized to perform specific localized Colonia analysis to address the frequent local flooding for the Colonias identified as experiencing structural flooding. Please click the web links below to review these reports.

Click the links below to download the PDF file.

- Alberta Estates #2
- Arriaga
- Bar #3
- Basham #4
- Basham #12
- Bernal Heights
- Blue Star
- Cameron Park
- Chapa #5
- Chapa Sub
- Chula Vista Acres
- Coronado
- Cotter Welch Tract
- Cuellar Subdivision #1
- Cuevitas
- Dakota Mobile Home
- Del Mar Heights
- Eggers
- El Gato
- Enrique Bazan
- Glenwood Acres
- Grande Acres
- Green Valley
- Green Valley Farms
- Hilda Subdivision
- Hoehn Drive
- Iglesia Antigua
- Imperial
- JR #2
- La Blanca
- La Coma
- La Feria
- Lago
- Las Yescas
- Lasara
- Linda Vista
- Longoria Townsite
- Los Treviños #3
- Los Treviños #4
- Los Treviños #5
- Lourdes Street
- Nogal
- NSC
- Olivarez #6
- Olivarez #10
- Olivarez #17
- Owassa Tower
- Paredes
- Penitas
- Pennsylvania Avenue
- Perezville
- Ramirez Estates
- Rankin
- RC Babb #34
- Reina
- Reina del Sol
- River Road
- Ruthven #1
- Ruthven #2
- Salida del Sol
- Santa Maria
- Santa Rosa #13
- Santa Rosa Annex
- South Fork
- Southern Breeze
- Southside Village
- Sun Valley Estates
- Tierra Bella
- Tijerina
- Umberto Garcia
- Val Verde Acres
- Val Verde Grove
- Val Verde North
- VC
- Victoria Belen

*Para español, elije "Spanish"*

Select Language

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# Tools & Resources

Here are some links to help you find more information on what you can do to protect yourself and your home.

- Official Site of the National Flood Insurance Program
  *Access an interactive tool that shows the cost of a flood to your home, inch-by-inch.*
- Valuable Spanish Library
  *To better educate and inform communities about the importance of flood insurance coverage.*
- Information and instructions on Dry Floodproofing a Structure
  *This is a PDF file taken from the "Selecting Appropriate Mitigation Measures for Floodprone Structures" from the FEMA media library.*
- "Flood Damage-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program"
  *Taken from the FEMA media library.*

*Links of other floodplain and emergency management organizations; FEMA resources, Hydrological Resources, NOAA Resources; and many other regional, state and federal resources.*

## Floodplain & Emergency Management Organizations

- Association of State Floodplain Managers
- Emergency Management Association of Texas
- National Association of Flood & Stormwater Management Agencies (NAFSMA)
- National Emergency Management Association
- Texas Floodplain Managers Association
- American Red Cross
- Shelter from the Storm: Disaster Preparedness Guide

## FEMA Resources

- Federal Emergency Management Agency (FEMA)
- Federal Emergency Management Agency (FEMA): Texas
- FloodSmart.gov
- RISKMap
- Ready – Prepare. Plan. Stay Informed.
- National Flood Insurance Program
- NFIP Community Status Book
- HAZUS SoftwareHAZUS Software
- Flood Map Service Center
- Viewing and Printing Firmettes

## Hydrological Resources

- Hydrometeorological Prediction Center
- USGS Realtime Streamflow Data

## NOAA Resources

- Coastal Services Center
- National Oceanic and Atmospheric Administration
- National Weather Service
- National Weather Service Natural Hazard Statistics
- National Weather Service StormReady Program
- NWS Jetstream
- NWS West Gulf River Forecast Center
- Quantitative Precipitation Forecasts
- Storm Prediction Center
- Satellite Images from the NWS
- Texas Interactive Weather Information Network (IWIN)
- Tropical Prediction Center
- Turn Around Don't Drown

## Other Weather Resources

- Fire Weather Information from the Texas Interagency Coordination Center
- The Weather Channel

## State Resources

- Senate Bill 936
- Texas Commission on Environmental Quality (formerly TNRCC)
- Texas General Land Office – Coastal Issues
- Texas Water Codes
- The Division of Emergency Management (Texas Department of Public Safety)
- Texas Water Development Board
- Texas Natural Resources Information System

## Councils of Government

- Lower Rio Grande Valley Development Council
- Middle Rio Grande Development Council
- Rio Grande Council of Governments
- South Texas Development Council

## Other Federal Government Resources

- National Park Service Rivers and Trails Program
- National Centers for Environmental Protection (NCEP)
- US Army Corps of Engineers

- S. Army Corps of Engineers – Fort Worth District
- S. Army Corps of Engineers – Galveston District
- US Geological Survey (USGS)
- United States Geological Survey – Texas

# Appendix B

JSW & Associates, Inc.
Hazard Mitigation Consultants

# BENEFIT COST ANALYSIS TECHNICAL REPORT

The analysis considers risk to structures and their associated contents located within the immediate project area, which are discussed in more detail in the sections below.

## Structure Damages

The benefit/cost ratios for the structures were determined by use of FEMA's Flood Module (5.1) , which calculates a present value of future damages that are estimated to occur over the useful life of the project (in our case, 50 years) and divides that figure into the cost of the project which was undetermined at this time. The estimated future damages are based on varying flood depth scenarios for different storm events and flood flows

In the course of the benefit/cost (B/C) calculation, LiDAR data was obtained which was then used to determine FFE by the addition of a value based on foundation type. The FFE assumptions were validated using a few field surveys. The B/C results include a list of properties and the calculated benefits from this project, named Location A. The spreadsheets include the FFEs, and pre- and post-mitigation hydrology for the 2yr, 5yr, 10yr, 25yr and 100yr events. In completing the B/C runs, we used the FEMA flood models Drainage Improvement assessment and included water surface elevations and steam discharge in one run.

In order to complete the analysis we used the FEMA defaults for a Flood Model Riverine analysis. The LiDAR ground surface elevation was used as the bottom of stream. The client supplied 8 sets of water surface elevations (WSE) for the pre- and post-project conditions for the 2yr, 10yr, 25yr, and 100yr events. These events were used in place of the default 10yr, 50yr, 100yr and 500yr in the analysis.

## Structure Depth-Damage Functions for Residential Uses

Structural damage functions for all residential buildings are FEMA Flood Module defaults. The structures in the analysis were identified as one-story or two-story and assumed no basement. The BRV was determined using the supplied living areas, identified type of construction, and assuming average quality of construction. The Marshall and Swift Cost Estimation guide dated 09/2014 was used to determine the full Building Replacement Value.

## Contents Depth-Damage Functions for Residential Uses

Contents damage functions for all residential buildings are FEMA Full-Data Riverine module defaults. Default contents functions and values were used for all commercial use structures.

## Contents Replacement Value Determinations for Residential Structures

For all structures in the project, the BCA used the FEMA default value.

## Displacement Times and Values

In the FEMA BCA methodology, displacement times and values account for certain additional costs of flooding other than direct damages to structures and contents. These include renting alternative living or work space, extra commuting timing, storage, etc. Current FEMA guidance provides recommended values for these costs, and the FM software provides defaults for displacement times for all use types.
For the residential uses, this BCA uses the FEMA Default Value. The default values for each non-residential use type were also used.

## Results of the Structure Analysis

The results were reported individually in spreadsheets for documentation.

## Additional Benefit Cost Analysis

In addition to the Benefit Cost Analysis completed for a minor flood control project, the cost of elevation and acquisition/demolition was also evaluated. These additional analyses were only completed for homes for which there were calculated avoided damages for a drainage project. Homes with no calculated avoided damages identified in the drainage project were considered out of harm's way and were not analyzed for acquisition and elevation. These results are on the Colonia summary spreadsheet and used the following cost estimation assumptions/ methodology:

### *Acquisition/demolition*

1. Total CAD value (building and land) was multiplied by 1.5 for an estimate of market value
2. To Market Value, we added $31,000 for supplemental housing to provide an offset for the anticipated cost of comparable replacement housing outside a flood prone area
3. $5,000 per property was used as an estimate of demolition cost
4. Benefits for acquisition are higher than those for drainage and elevation as acquisition permanently removes the properties from homes way, with no residual risk.

### *Structure Elevation*

1. The CAD square footage of the home was multiplies by $75/sqft as an estimated cost of elevation.

## Results of the Additional Analysis

The results were reported individually in spreadsheets for documentation.