GENERAL REEVALUATION REPORT AND

SUPPLEMENTAL ENVIRONMENTAL

IMPACT STATEMENT II:

RIO GRANDE FLOODWAY,

SAN ACACIA TO BOSQUE DEL APACHE UNIT,

SOCORRO COUNTY, NEW MEXICO

APPENDIX F-7

Cost Estimates

COST ESTIMATE

1. ACCOUNT NARRATIVES

1.1 GENERAL PROJECT

This project consists of constructing approximately 41.7 miles of engineered levee along the Rio Grande in central New Mexico. The project will extend on the west bank of the Rio Grande from the upper end of the U.S. Bureau of Reclamation's low-flow conveyance channel at the San Acacia Diversion Dam to the Tiffany Basin which is roughly 28 miles from the end of the conveyance channel at Elephant Butte Reservoir. The estimate represents the cost to construct Alternative A which is the Tentatively Selected Plan.

The assumed cost sharing with the project sponsor is 85.74 percent federal dollars to 14.26 percent non-federal dollars. At this point in the design process there is no specified contracting mechanism, but the acquisition assumption for the estimate is this will be a small business competitive IFB (lowest price).

The project is first broken into segments with varying lengths chosen for their natural end points. Each segment can function, when finished, independent of other segments. Each segment is then broken into smaller phases. It is anticipated that this project will be constructed in no less than 20 phases with an approximate duration of 1 year for each phase. Project phase size is controlled by anticipated annual funding amount throughout the project with the final phase in each segment picking up any additional construction needed to complete the segment. Table 2 shows each of the construction phases and segments and the major features of construction contained within each phase.

The prime contractor for every phase of the project is estimated as a heavy civil oriented contractor who will subcontract some portions of the work. Subcontracted work will include all concrete work, rock blasting and processing and trucking. This size of contractor is the basis for estimate crew numbers, sizes and production rates and this contractor is reasonably estimated to be capable of performing more than the annual funding amount of work per year. Refer to "Schedule For Design And Construction" for activity durations based on production rates used to build the estimate. Items such as overtime or shift work are not included in the estimate as they are not required to complete the work in the assumed 1 year allotted time per phase.

Contractor field office overhead, job office overhead and profit are applied in the estimate as running percentages of the costs. As the design is finalized prior to construction the job office overhead will be detailed for each specific phase. The contractor is also assumed to be a predominately local contractor or predominately staffed with local personnel at rates consistent with local wage determinations for the area. The estimate does not directly account for additional costs associated with providing subsistence for non-local workers. This is accounted for in the risk analysis and resulting contingencies used for the estimate to reflect the possibility that some subsistence may ultimately be necessary.

1.2 ACCOUNT 01- LANDS AND DAMAGES

The majority of the real estate required for the levee footprint, temporary construction easement, and staging areas has already been secured by the MRGCD on behalf of Reclamation as part of previous federally funded projects. The local sponsors will only credit land cost required for the construction of the project for parcels of land that they do not own. The estimate for realty costs was provided by the local district Realty Specialist and is the basis for realty costs in the project estimate.

- It is estimated that approximately 300 additional acres of land are needed for staging and waste areas required for the construction of the project. Most of the land is located within the Tiffany Basin. This land will be procured for the start of Phase 1 as waste will be generated shortly after levee construction starts.
- Other realty costs not specifically attributable to a phase are distributed among all phases weighted by the physical length of the phase.
- Contingency for this item is applied by the Realty Specialist at 20% and is intended to cover uncertainty in land values and unknown resolution of land ownership and is included in the cost value. Additional contingency is not provided in the estimate upper levels.

1.2 ACCOUNT 02 - RELOCATIONS

Approximately 16 miles of an existing fiber optic line are required to be relocated to allow construction of the southern end of the levee. The line is operated by a local utility owner in the existing easement. It is anticipated that required relocation of this utility will be at the expense of the utility owner and the cost is not included in the government estimate.

1.3 ACCOUNT 09 - CHANNELS AND CANALS

Overbank excavation and channel widening are required at the northern end of the project site in the area of the San Acacia Diversion Dam. It is projected that excavation of the east bank of river terrace will effectively alleviate erosive velocities that threaten the integrity of the new proposed levee. Channel widening will increase the cross sectional flow area and subsequently decrease the velocity.

- 10 acres of clearing and grubbing is required. It is assumed that the clearing consists of small trees and brush. All of the debris is disposed at a local landfill assumed to be within a 30 mile radius of the project site. The clearing crew consists of a dozer, equipment operator, and laborers. The productivity rate is assumed to be approximately 0.33 acres per hour.
- Quantities for the amount of material to be excavated were provided by the local District General Engineering Section. It is estimated that approximately 152,650 cubic yards of material will be excavated. The excavated material is hauled and dumped at a waste area located within a 46 mile distance from the work area. The excavation crew consists of a hydraulic excavator with an equipment operator. The productivity rate is assumed to be 80 cubic yards be hour. A portable cofferdam system is assumed for protection from water flow during earthmoving operations.
- A temporary 0.5 mile haul road is required to access the overbank excavation/ channel widening site. The temporary crossing consists of an earthen ramp with a 15 foot top width and 2.5 to 1 foot side slopes. Six 60-inch corrugated metal pipes are used to allow low flows to pass through the crossing to maintain a wet river channel during construction. The earthen material for the haul road comes from a borrow area, and the pipe comes from an area vendor and is delivered to the job site. The haul road is constructed using a crew consisting of a hydraulic excavator, front end loader, roller, water truck, and laborers. It is assumed that the temporary haul road is built in 48 hours and demolished in 40 hours.
- Contingency for this account is based on the limited amount of design available at this stage. It is expected that quantities will vary somewhat as the design progresses, but current estimated quantities are reasonable.

1.4 ACCOUNT 11- LEVEES AND FLOODWALLS

This account encompasses the majority of the work for this project. The new levee which will replace the existing spoil bank will have a trapezoidal cross-section with a 15-foot-wide crest. Side slopes would vary between 1 vertical to 2.5 horizontal and 1 vertical to 3 horizontal, depending on the height of the levee. The levee height ranges from 1 foot at the northern end to 14 feet at the southern end and per data supplied by the local District General Engineering Section will require approximately 4,600,000 cubic yards of random fill for construction. For levee heights greater than 5 feet, perforated pipe toe drains, discharge pipes into the Low Flow Conveyance Channel, and risers as well as an 8-foot-wide by 4-foot-high inspection trench with 1V:1H side slopes are required. In addition, a 2-foot-wide bentonite slurry trench will extend from 2 feet below the levee embankment crest to 5 feet into the foundation material for levee heights over 5 feet. Material making up the existing spoil bank is used to construct the new levee except for select material such as bentonite clay and rock rip rap. Additional material is spoiled on the landside of the levee where easements permit (typically along the upper reach of the levee) to avoid long distance hauling of waste. Despite the disposal of spoil material along the upper reach of the levee, approximately 2,900,000 loose cubic yards of excess material will be spoiled at an approved location outside the levee footprint. For the estimate this is assumed to be the Tiffany Basin waste area.

Some segments of the new levee require toe scour protection. The protected segments range from 500 to 5,000 feet in length, and the total length of erosion protection is approximately 35,500 linear feet (6.7 miles). Rip rap protection will blanket the riverward slope of the levee from crest to toe, and is buried to a depth of 6.5 to 12 feet beneath the levee toe. “Launchable” rip rap is buried below the ground surface at the toe of the levee for potential scour depths greater than 12 feet but not exceeding 17 feet. Rock sizes used for rip rap vary from 0.75 to 3.5 feet depending on the velocities at the potential scour location. The estimate is based on rock quantities and sizes provided by the local District General Engineering Section.

Levee Earthwork

- Due to flood risks no more than 1 mile of levee will be allowed to be open at any given time. A system will be developed so that the construction activities including excavation, hauling, processing, and construction of the new levee are cycled in order to satisfy the condition of only having 1 mile of levee open at any given time. For the estimate it is assumed this protection is provided by a portable cofferdam system which is quickly and easily relocated as construction progresses.
- It is assumed the entire required fill for the new levee is obtained from the existing spoil levee. The material is excavated and then hauled to a material processing area within an average 0.75 mile radius of the job site. The excavation crew consists of a hydraulic excavator and equipment operator. The productivity rate is assumed to be 200 cubic yards per hour.
- The processed material will be stockpiled at the screening area until it is hauled off to the area where it will be utilized. A 25 percent shrink factor and a 10 percent non usable material factor are assumed for the screening operation required for the spoil material processing.
- The material required for the construction of the new levee is hauled from a stockpile area within an average 0.25 mile radius of the job site. It is estimated that the loading and hauling from the stockpile is accomplished by a crew consisting of a loader, dump trucks, and laborers. The productivity is assumed to be 165 cubic yards per hour.
- It is estimated that the new levee is constructed in six inch lifts to reach required compaction. A crew consisting of a hydraulic excavator, compaction roller and water truck with required operators can accomplish the placement and compaction of the fill material at the rate of 165 cubic yards per hour.

- Unused material not needed for the construction of the new levee will be deposited in either the land side of the new levee or the Tiffany Basin.
- For material deposited on the land side of the new levee the quantities were generated by analyzing levee heights throughout the alignment and providing average cross sections of waste material that the given height could allow. It is assumed that the material will be hauled within an average 1 mile radius of the job site to the area where it will be deposited.
- It is estimated that the material to be spoiled on the land side of the new levee will be placed by dumping the material onto the sloped side of the engineered levee with rear dump body dump trucks. The productivity rate for depositing material is assumed to be 200 cubic yards per hour.
- The remaining spoil levee material not be for the construction of the new levee is hauled to the assumed dump site (Tiffany Basin). It was estimated that several trucking subcontractors will be required to support this operation.
- To develop approximate hauling distances to the waste area the entire levee alignment is broken up into 9 sections and the midpoint of each segment is used to compute the haul distance to the waste area (Tiffany Basin). The use of only Tiffany Basin for waste material disposal is the basis for the estimate as it is a known workable plan. It is possible that throughout the course of the long term project other closer areas may be identified by the designers or contractors. This possibility is investigated in the project risk analysis and could provide potential savings.
- The area to be covered by the spoils within Tiffany basin is calculated to be approximately 300 acres with at a depth of 6.5 feet for the selected plan. Screened oversized waste (large rocks) not appropriate for random fill, are separately stockpiled for use as rip rap thus reducing the required rip rap quantity.
- Levee tie backs are required at San Lorenzo Arroyo and Socorro Arroyo. It is assumed that the levee tie backs follow the same construction methodology as the engineered levee and include the same requirements with the exception of a slurry trench and toe drain system.
- Contingency for the levee earthwork are based on the current level of design and potential differences between assumed and actual production rates. It is expected that future levee design refinements will change overall quantities, and risk analysis investigates the effects of quantity and production rate differences from the estimate assumptions.

Levee Drainage System

- The toe drain system required for seepage control consists of a perforated main line with risers and clean-outs every 300 feet and outlets every 900 feet throughout the entire alignment. It is estimated that six inch diameter plastic pipe are utilized in the system. The pipe material is purchased from an area supplier and is delivered to the job site. A crew consisting of a pipe layer and laborers places the pipe. The productivity rate is assumed to be 40 linear feet per hour.

- The placement of the toe drain system requires the excavation and backfilling of soil material and installation of rock filter material, a product of the riprap excavation and processing operation. It is estimated that a portion of the excavated soil material is stockpiled for reuse in the backfill operation with the remainder being spread along the access road. It is estimated that a crew consisting of a loader/backhoe and laborer is utilized for the excavation operation. The assumed productivity rate is 18 cubic yards per hour .

Slurry Trench

- A 2 foot wide slurry trench with a depth that is dependent on the levee height is the current slurry trench design. It is estimated that bentonite will be added to the levee soil at a proportion of five percent by weight, (2.85 lbs/cf) to create the impervious backfill. Additionally, a slurry mix will contain 22.5 pounds of bentonite per 42 gallons of water and will fill the excavated trench prior to backfilling with the core material. The bentonite will be purchased from an offsite source and will be delivered to the job site for mixing in each operation.
- The trench excavation will be accomplished by a hydraulic excavator and the assumed productivity rate is 55 cubic yards per hour. The removed material is assumed to be trucked to a plant for mixing with bentonite and then trucked back to the wall backfilling operation. The average haul distance will be 5 miles. Backfilling is accomplished by bulldozer. During trench excavation and before backfilling the trench will be filled with a bentonite slurry. This slurry will be created in a mobile or skid mounted venturi type mixer and pumped into the trench to seal the trench walls.

Riprap

- Based on neat line in-place quantities provided by the local District General Engineering Section, it is estimated that a total of 525,000 cubic yards of in situ material needs to be excavated for the current riprap design. It is assumed that the rip rap material comes from an unknown borrow source at the northern end of the project. A swell factor of 55% is assumed from in-place to blasted state. The rock excavation is accomplished utilizing a 6" diameter hole, 18x12 blast hole pattern, 30 linear foot hole depth, 4 feet of sub drilling, and a 1.0 lb/cy powder factor. It is assumed that the blasting agent is ANFO. A crew consisting of three air trac drills, blaster, and two helpers is utilized for the excavation operation. The assumed productivity rate for drilling is 115 linear feet per hour and the productivity rate for blasting is 895 pounds per hour. It is assumed that the worked performed for the blasting is accomplished by a subcontractor.

- The riprap design calls for a wide range of riprap sizes which need to be screened and processed. For rip rap screening and processing a non usable factor of 30% is assumed. It is also assumed that the screening/ processing area is within two thirds of a mile from the excavation area. It is estimated that the processing of the riprap is accomplished by a crew consisting of front end loaders, screening plant, and grizzlies. The productivity rate is assumed to be 110 cubic yards per hour. After the material is processed it is hauled to the project site which is at an approximate distance of 25 miles.
- Contingency for this item is based primarily on the unknown location for the quarry site. The risk analysis considers the possibility that the actual quarry will be located farther or closer to the project than the assumed distance of 25 miles.

Clearing and Grubbing

- Clearing and grubbing is required throughout the entire levee alignment. It is assumed that trees and small brush are removed. Trees are chipped on site and disposed of at a local landfill located within a thirty mile radius of the job site. The clearing and grubbing is accomplished using a crew consisting of hydraulic excavator, bulldozer, front end loader, chipper, dump trucks, and laborers.

Care and Diversion of Water

- The project requirements state that there cannot be a break in the levee; therefore a temporary dike system will be required. It is assumed that the temporary dike systems is constructed in two sections that have a maximum length of 1/2 mile. Breaking the temporary dike system into two sections allows for a more efficient construction for the new levee and mitigates the interruptions that are caused by the requirement for a temporary dike system. Costs for a *Portadam* type of cofferdam are used in the estimate. Once the first section of the dike is complete the new levee construction can began while the second section of the temporary dike system is constructed. When the new levee correlated with the first dike section is complete the first section of the dike system will be relocated behind the second section. This leap frog process will continue until the completion of the new levee and will allows the linear construction of the levee to continue without having a breach in the protection.
- It is estimated that construction of the deep toe portions of the riprap protection require dewatering for placement. The toe key for the riprap slope protection will have a minimum depth of 5 feet and a maximum depth of 17 feet. For the estimate the water table in the excavation exists 8’ below the levee toe. The dewatering is accomplished using a deep well type system consisting of wells placed at 50' on center.
- The depth of the wells is varied based on the depth of the construction excavation. Each well will have an electric submersible pump and discharge piping. Power is estimated to

be supplied by a skid mounted generator which can power a line of pumps up to 500 ft long. It is estimated that the pumps are operated continuously for the duration of the toe riprap placement. The crew consists of a truck mounted well drilling rig, loader/backhoe and pipe layers for the drilling and installation of the wells and construction of the discharge piping system. The electrical system for powering the pumps is constructed by a crew of electricians. A crew of a skilled laborer is used part time to maintain the system while operating.

Brown Arroyo Structure

- A major gated reinforced concrete structure is required at the confluences of the Brown Arroyo and the Rio Grande. Quantities for the estimate originate from take offs performed by the Cost Engineering Section on the current drawings for the structure.
- It is assumed that care and diversion of water is not necessary to minimize effects from flows. It is also assumed based on the location of the structure and the relatively shallow depth of the excavation required for the foundation construction that dewatering is not necessary to construct the turndowns.
- The foundation for the structure consists of a concrete slab with turndowns, the low flow section and the stem for the wall to finish grade. The wall section consists of the concrete from finish grade to top of structure.
- The structure is cast in place and requires wooden formwork. A factor of 12 percent is included to account for waste and braces. It is estimated that the structure requires 100 pounds of steel reinforcement per cubic yard concrete as detailed reinforcing drawings are not available at this design stage. A 12 percent factor is also included to account for high chairs, tie wire, and laps. Concrete includes a factor of 8 percent to account for losses and waste. It is assumed that all of the materials and supplies are purchased from an area and delivered to the job site.
- The Brown Arroyo Structure also requires the placement of 8 - 7' x 10' and 2 - 10' x 10' slide gates. It is estimated that the gates are purchased from an area supplier and are delivered to the job site. The gates are placed by a crew consisting of a crane at half time, operator, steel workers, and a laborer.
- The structure requires the placement of 500 linear feet of pedestrian railing along the walkway for fall protection. It is assumed that the railing is fabricated by an offsite source and is delivered to the job site. It is estimated that the railing is placed by a crew consisting of a crane, man lift, steel workers, and laborers.
- Upstream and downstream adjacent to the structure riprap is required for scour protection. The area south of the structure is filled and graded, but not protected with rock as is the cast for the upstream area beyond the structure apron. The riprap is assumed to be 21" dumped rock for all areas and is obtained from the rip rap operations associated with the main levee construction.

Upstream Construction / San Acacia Diversion Dam Improvements

Soil Cement Armoring

- Quantities and area to be armored were provided by the local District General Engineering Section. It is assumed that approximately 1500' of the area to be soil cement protected requires the diversion of the river in the area. It is assumed that the diversion will be accomplished using a portable dam system in conjunction with a well dewatering operation. It is also assumed that the channel widening will be done before this diversion takes place to provide a larger area for the diverted water to flow in. It is estimated that the diversion will be in place for approximately 3 months to include time for setup / teardown and completion of the armoring work.
- It is estimated that the construction of the soil cement armoring requires the clearing and grubbing trees and small brush. Trees are chipped and disposed of at a local landfill, within a thirty mile radius of the job site. Clearing and grubbing activities are accomplished using a crew consisting of hydraulic excavator, bulldozer, front end loader, chipper, dump trucks, and laborers.
- It is assumed that 314,247 cubic yards of excavation is required in order to place the soil cement at the required scour depth. The material is removed using a bulldozer and temporarily stockpiled adjacent to the work area. The crew consists of a tracked bulldozer with operator. The crew operates at an assumed productivity rate of 70 cubic yards per hour.
- A total of 95,079 cubic yards of soil cement mixture is required to be placed and compacted to construct the armoring in the vicinity of the San Acacia Diversion Dam. The soil cement is batched at an on-site batch plant with local soil and imported cement and trucked to the placement location. It is assumed that the soil cement is placed utilizing an excavator taking material from a bedding box loaded by a loader. The material will be compacted on the slope using a smooth drum roller and a deadman and winch system. It is estimated that material can be placed at a rate of 80 cubic yards per hour.

Roller Compacted Concrete Armoring

- Roller Compacted Concrete armoring is required in the vicinity of the San Acacia diversion outlet to the irrigation system. Approximately 5,764 cubic yards of material is excavated by bulldozer from the area requiring RCC armoring. The bulk of the material is hauled off by the main levee construction operation.

- Detailed design is not available at this design stage so the estimate assumes that the roller compacted concrete cap is constructed in 1' lifts at a width possible to lay down with a paving machine. Compaction of the material is done by a double drum roller after placement.
- The concrete required for the RCC is provided by an on-site batch plant located in the vicinity of the worksite and material is trucked from the batch plant to the laydown machine. The placement of the RCC is done at an assumed productivity rate of 100 cubic yards per hour.

Concrete Floodwall

- The upstream construction features also include the construction of a concrete floodwall. Current drawings depict the general layout of the wall and quantities were derived from this and a draft cross-section of the wall by the Cost Engineering Section. Detailed reinforcement drawings are not available so the estimate assumes a reinforcement density.
- The concrete floodwall is assumed to have a cross sectional area of 109 square feet. The footing of the structure is cast first followed the by the wall. A waterstop is assumed to be required to be installed in the construction joint between the wall foundation and the wall. The floodwall also includes a 2 ft x 2 ft toe drain.
- It is assumed that 100 pounds of steel reinforcing will be required per cubic yard of concrete. A factor of 12 percent will be included to account for high chairs, tie wire, laps, and waste. The material required for the reinforcing is purchased from an area supplier and delivered to the job site.
- Wooden forms are used for forming the structure. A 12 percent factor is allowed for waste, braces, etc. All of the material required for the formwork is purchased from an area supplier. It is estimated that a crew consisting of 3 carpenters and a laborer is used for the formwork operation.
- Concrete is be produced at the batch plant on site. A factor of 8 percent is included to account for losses and waste. It is estimated that a crew consisting of masons and laborers will be utilized for the placing of the concrete along with a pump and operator.

Culvert Extensions

- The design calls for 5 existing 7’ x 7’ concrete box culverts to be extended approximately 380 feet to allow the construction of the proposed floodwall. The culverts are assumed to be cast in place and require steel reinforcing. This portion of the work also includes the extension of approximately 65 feet of an existing 5 feet (diameter) corrugated metal pipe. It is assumed that all supplies and material are purchased from an area supplier and are delivered to the job site.

2. COST ESTIMATE

2.1 MCACES COST ESTIMATE

The general intent in the preparation of the project baseline cost estimate was to create an independent, detailed estimate reflective of the level of design available at the time of preparation. The estimate is ordered at the upper level into the planned phases for construction. Below the phase level the estimate is organized into the Civil Works Breakdown Structure in accordance with ETL 1110-2-573. The estimate was prepared using the current MCACES Unit Price Book, the current MII Equipment Region 6 database (2009) and current Davis-Bacon Wage Rates for Heavy Construction in Socorro County (06 Jan 2012). All costs are current as of the estimate preparation date (Feb 2012).

Total Project Cost for Alternative A Base + 4 feet is estimated to be $290,237,000 with contingency and escalation included. A summary of the estimate breakdown per cost account is included as Table 2. The Total Project Cost Summary sheet is included showing the total project cost with contingency escalated through planned project completion as Table 3.

3. RISK ANALYSIS

3.1 COST AND SCHEDULE RISK ANALYSIS

A formal risk analysis was performed on the selected plan and the results of the analysis are included in this appendix as a separate attachment. The analysis was started by gathering a team consisting of PDT members and Cost Engineering personnel. The team identified various project elements where uncertainties exist which could impact the estimated total project schedule and/or cost.

These items were assembled into a risk register and each item was assigned a value for the likeliness of occurrence and the amount of possible impact the item could have on the project cost and project schedule relative to the current cost estimate assumptions. Items deemed by the team to rate a “moderate” or higher risk were then further analyzed by producing anticipated best case, worse case and most likely values.

This data was then processed using Crystal Ball software by the Cost Engineering DX to produce the final risk analysis reports. Contingency is applied at 15.8% to the estimate representing the value with an 80% confidence of successful execution and completion. The complete Cost and Schedule Risk Analysis is included as a separate report to this appendix.

SCHEDULE FOR DESIGN AND CONSTRUCTION

1. PROJECT SCHEDULE

1.1 GENERAL

The San Acacia Levee Improvements is projected to have an overall project duration of 20 years. Microsoft Project 2007 critical path method design and construction schedules are included in the appendix as Fig 1 for design details and Fig 2 for construction details. The duration of the project is dictated by the anticipated amount of annual funding received each year. Design for each phase is assumed to take place the fiscal quarters before the construction of each phase. Design of Phase 1 of the project is planned for the 3rd and 4th quarters of fiscal year 2012 with a Phase 1 contract award and Notice to Proceed in the first quarter of fiscal year 2013. Each phase is assumed to follow in sequential order each following year until all phases are complete.

Due to funding controlling the amount of work completed each phase, the overall project schedule is relatively immune to delays and typical schedule risks. It is anticipated that a medium sized contractor will have ample time each phase to complete the required work. Schedule delays within the phase are unlikely to delay work past the scheduled end of the phase. If such a delay was to occur, the delayed work would not affect work on the subsequent phase because of the large distances between work areas and a subsequent phase’s work not being dependent on the previous phase being complete. This same reasoning makes it possible to not receive funding during a year and make it up in following years by awarding multiple phases in a single year.

These scenarios are taken into account in the risk analysis for the cost and schedule and the result is a schedule that is at low risk of being delayed overall. This in turn results in low risk to the cost increasing because of schedule delays due to the many opportunities available to complete work without affecting the final completion date.

1.2 DESIGN SCHEDULE

The design schedule is phased to follow the overall project phasing with each construction phase being designed in the period before award. Phase design is expected to be repetitive in nature and will generally involve taking each 35% design through to completion without major revisions. It is anticipated that each design will require approximately 140 working days to complete and is assumed to be designed and advertised by local District personnel. The schedule as depicted is also based on a normal 40 hour 5 day workweek inclusive of normal holidays.

For similar reasons as stated in 1.1 General the overall design schedule is also flexible and not easily delayed. There are multiple opportunities to design phases throughout the project and the designs are relatively independent from one another. The risk analysis shows that design delays have little chance of creating a delay to the total project completion. A printout of the detailed design schedule is included as Fig 1. In this figure the construction activities are reduced to a summary bar to aid readability.

1.3 CONSTRUCTION SCHEDULE

The construction schedule is broken into 20 phases with each phase controlled by the amount of anticipated funding for each year. The phase 1 construction is planned for an early fiscal year 2013 first quarter notice to proceed with each phase following in turn each fiscal year through to project completion. This results in a final project completion in June 2032. A printout of the estimated construction schedule detail is included as Fig 2. In this figure the design activities are reduced to a summary bar in each phase to aid readability.

Construction activities for the schedule mirror the construction activities from the cost estimate. The durations for each of the activities are also derived from the production rates and quantities used in the cost estimate. A spreadsheet was used to take the production rate and quantity for each activity and calculate a workday duration for the activity. This value is then used in the schedule.

Logic was created in the schedule to reflect the anticipated construction pattern in each phase. Activities are expected to flow from initial clearing to existing levee excavation, material processing and then new levee fill construction. During the fill construction the levee slurry trench and drainage features will be installed. Riprap installation is the last item to be installed when completing a portion of levee. This order of activities is expected to be followed as each levee piece is constructed within a phase. The phase fully completes when the entire levee is constructed and the area is stabilized by seeding. The schedule logic contains many start to start and finish to finish relationships with appropriate lag as the majority of items will start shortly after the preceding operation is far enough ahead. In the same vein the majority of activities cannot complete without the preceding activity having been completed a few days ahead. The activity that tends to drive this logic is the fill construction of the new levee. Only a couple of phases have construction that is independent of the main levee construction. This dependence of activities on the main levee fill construction means that the prime contractor will be controlling the overall pace of the work and the time that subcontractors will be on site. Opportunities for subcontractors to finish work at a separate pace generally do not exist.

When the estimate production rates are input into the schedule it is apparent that ample time is available for each phase to be completed. This is without making assumptions that multiple crews are performing the same activity in different locations at the same time. The schedule as depicted is also based on a normal 40 hour 5 day workweek inclusive of normal holidays. The time available creates a low risk that production or other schedule delays can adversely affect the overall project schedule as the contractor has opportunity to work multiple levee pieces at the same time as well as shift work or overtime to make up for delays.

Outside influences are also considered in the schedule. The project is located in an area where warm year round temperatures allow all year construction so winter shutdowns are very unlikely. Endangered species are a factor, but if they are present are felt to likely only affect a small portion of a phase temporarily (during a nesting season). The phase construction will be able to continue around the area. There is potential for construction to be delayed by rainfall events, but outside of a catastrophic flood event delays should be limited to a few days which can easily be made up given the time available in the schedule. These items are addressed in the risk register and are inputs to the full Cost and Schedule Risk Analysis which is provided as a separate attachment to this appendix.

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

Program Year (Budget EC): 2014
Effective Price Level Date: 1 OCT 13

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	BASE COST TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	FIRST COST TOTAL ($K)	FULLY FUNDED PROJECT ESTIMATE Spent Thru: 1-Oct-13 ($K)		COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
02	RELOCATIONS			-		-								
09	CHANNELS & CANALS	$4,431	$692	15.6%	$5,123		$4,431	$692	**$5,123**			$5,005	$781	$5,786
11	LEVEES & FLOODWALLS	$166,939	$26,059	15.6%	$192,998		$166,939	$26,059	**$192,998**	$ 14,664		$195,876	$30,576	$241,116
	CONSTRUCTION ESTIMATE TOTALS:	$171,370	$26,751		**$198,121**		$171,370	$26,751	**$198,121**	14,664		$200,881	$31,357	$246,902
01	LANDS AND DAMAGES*	$873	$126	14.4%	$999		$873	$126	**$999**			$1,034	$149	$1,183
30	PLANNING, ENGINEERING & DESIGN	$8,542	$1,333	15.6%	$9,875		$8,542	$1,333	**$9,875**			$12,411	$1,937	$14,348
31	CONSTRUCTION MANAGEMENT	$13,900	$2,170	15.6%	$16,070		$13,900	$2,170	**$16,070**			$20,872	$3,258	$24,130
	PROJECT COST TOTALS:	$194,685	$30,380	15.6%	**$225,065**		$194,685	$30,380	**$225,065**	14,664		$235,197	$36,702	$286,563

* Lands and Damages Cost contingency applied by Real Estate

ESTIMATED FEDERAL COST:	85.74%	**$233,126**
ESTIMATED NON-FEDERAL COST:	14.26%	**$53,437**
ESTIMATED TOTAL PROJECT COST:		**$286,563**

CHIEF, COST ENGINEERING, Michael Prudhomme

PROJECT MANAGER, Jerry Nieto

CHIEF, REAL ESTATE, Karen Kennedy

CHIEF, PLANNING, Kristopher Schafer

CHIEF, ENGINEERING, Ben Alanis

CHIEF, CONSTRUCTION, Carlos Salazar

O&M OUTSIDE OF TOTAL PROJECT COST: $0

****** CONTRACT COST SUMMARY ******

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

Estimate Prepared: 1-Oct-13
Effective Price Level: 1-Oct-13

Program Year (Budget EC): 2014
Effective Price Level Date: 1 OCT 13

FULLY FUNDED PROJECT ESTIMATE

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	PHASE 1													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$9,976	$1,557	16%	$11,533		$9,976	$1,557	$11,533	2013Q2	-1.5%	$9,826	$1,534	$11,360
	CONSTRUCTION ESTIMATE TOTALS:	$9,976	$1,557	16%	**$11,533**		$9,976	$1,557	$11,533			$9,826	$1,534	$11,360
01	LANDS AND DAMAGES	$44	$6	14%	$471		$44	$6	$50	2013Q2	-1.5%	$43	$6	$50
30	PLANNING, ENGINEERING & DESIGN	$429	$67	16%	$496		$429	$67	$496	2013Q1	-1.7%	$422	$66	$487
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2013Q2	-1.5%	$685	$107	$792
	CONTRACT COST TOTALS:	$11,144	$1,739		**$12,883**		$11,144	$1,739	$12,883			$10,976	$1,713	**$12,689**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

Estimate Prepared: 1-Oct-13
Effective Price Level: 1 OCT 14

Program Year (Budget EC): 2014
Effective Price Level Date: 1 OCT 13

FULLY FUNDED PROJECT ESTIMATE

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
	PHASE 2													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$9,140	$1,427	16%	$10,567		$9,140	$1,427	$10,567	2014Q2	0.4%	$9,176	$1,432	$10,608
	CONSTRUCTION ESTIMATE TOTALS:	$9,140	$1,427	16%	**$10,567**		$9,140	$1,427	$10,567			$9,176	$1,432	$10,608
01	LANDS AND DAMAGES	$44	$6	14%	$61		$44	$6	$50	2014Q2	0.4%	$44	$6	$51
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2013Q3	-1.0%	$423	$66	$489
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2014Q2	0.5%	$698	$109	$807
	CONTRACT COST TOTALS:	$10,306	$1,608		**$11,914**		$10,306	$1,608	$11,914			$10,341	$1,614	**$11,955**

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

Estimate Prepared: 1-Oct-13
Effective Price Level: 1 OCT 14

Program Year (Budget EC): 2014
Effective Price Level Date: 1 OCT 13

FULLY FUNDED PROJECT ESTIMATE

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	PHASE 3													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$11,030	$1,722	16%	$12,752		$11,030	$1,722	$12,752	2015Q2	2.3%	$11,286	$1,762	$13,048
	CONSTRUCTION ESTIMATE TOTALS:	$11,030	$1,722	16%	**$12,752**		$11,030	$1,722	$12,752			$11,286	$1,762	$13,048
01	LANDS AND DAMAGES	$44	$6	14%	$33		$44	$6	$50	2015Q2	2.3%	$45	$6	$52
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2014Q3	1.5%	$434	$68	$501
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2015Q2	4.7%	$728	$114	$841
	CONTRACT COST TOTALS:	$12,196	$1,903		**$14,099**		$12,196	$1,903	$14,099			$12,493	$1,950	**$14,442**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

	Estimate Prepared: 1-Oct-13 Effective Price Level: 1 OCT 14					Program Year (Budget EC): 2014 Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	TOTAL ($K) *J*	Mid-Point Date *P*	ESC (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
	PHASE 4													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$8,680	$1,355	16%	$10,035		$8,680	$1,355	$10,035	2016Q2	4.3%	$9,050	$1,413	$10,463
	CONSTRUCTION ESTIMATE TOTALS:	$8,680	$1,355	16%	**$10,035**		$8,680	$1,355	$10,035			$9,050	$1,413	$10,463
01	LANDS AND DAMAGES	$44	$6	14%	$55		$44	$6	$50	2016Q2	4.3%	$46	$7	$52
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2015Q3	5.8%	$452	$71	$522
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2016Q2	9.1%	$758	$118	$877
	CONTRACT COST TOTALS:	$9,846	$1,536		**$11,382**		$9,846	$1,536	$11,382			$10,306	$1,608	**$11,915**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

	Estimate Prepared: 1-Oct-13 Effective Price Level: 1 OCT 14					Program Year (Budget EC): 2014 Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	PHASE 5													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$8,379	$1,308	16%	$9,687		$8,379	$1,308	$9,687	2017Q2	6.2%	$8,902	$1,390	$10,292
	CONSTRUCTION ESTIMATE TOTALS:	$8,379	$1,308	16%	**$9,687**		$8,379	$1,308	$9,687			$8,902	$1,390	$10,292
01	LANDS AND DAMAGES	$44	$6	14%	$23		$44	$6	$50	2017Q2	6.2%	$47	$7	$53
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2016Q3	10.3%	$471	$74	$544
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2017Q2	13.8%	$791	$123	$914
	CONTRACT COST TOTALS:	$9,545	$1,489		**$11,034**		$9,545	$1,489	$11,034			$10,211	$1,593	**$11,804**

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

Estimate Prepared: 1-Oct-13
Effective Price Level: 1 OCT 14

Program Year (Budget EC): 2014
Effective Price Level Date: 1 OCT 13

FULLY FUNDED PROJECT ESTIMATE

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
	PHASE 6													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$8,337	$1,301	16%	$9,638		$8,337	$1,301	$9,638	2018Q2	8.3%	$9,026	$1,409	$10,435
	CONSTRUCTION ESTIMATE TOTALS:	$8,337	$1,301	16%	**$9,638**		$8,337	$1,301	$9,638			$9,026	$1,409	$10,435
01	LANDS AND DAMAGES	$44	$6	14%	$65		$44	$6	$50	2018Q2	8.3%	$48	$7	$54
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2017Q3	15.0%	$491	$77	$568
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2018Q2	18.7%	$825	$129	$954
	CONTRACT COST TOTALS:	$9,503	$1,483		**$10,986**		$9,503	$1,483	$10,986			$10,390	$1,621	**$12,011**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

	Estimate Prepared:	1-Oct-13				Program Year (Budget EC):			2014					
	Effective Price Level:	1 OCT 14				Effective Price Level Date:			1 OCT 13	FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
	PHASE 7													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$8,058	$1,258	16%	$9,316		$8,058	$1,258	$9,316	2019Q2	10.3%	$8,890	$1,388	$10,277
	CONSTRUCTION ESTIMATE TOTALS:	$8,058	$1,258	16%	**$9,316**		$8,058	$1,258	$9,316			$8,890	$1,388	$10,277
01	LANDS AND DAMAGES	$44	$6	14%	$66		$44	$6	$50	2019Q2	10.3%	$49	$7	$56
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2018Q3	20.0%	$512	$80	$592
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2019Q2	23.8%	$860	$134	$995
	CONTRACT COST TOTALS:	$9,224	$1,439		**$10,663**		$9,224	$1,439	$10,663			$10,311	$1,609	**$11,920**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

Estimate Prepared: 1-Oct-13
Effective Price Level: 1 OCT 14

Program Year (Budget EC): 2014
Effective Price Level Date: 1 OCT 13

FULLY FUNDED PROJECT ESTIMATE

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	PHASE 8													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS	$4,431	$692	16%	$5,123		$4,431	$692	$5,123	2020Q3	13.0%	$5,005	$781	$5,786
11	LEVEES & FLOODWALLS	$15,473	$2,415	16%	$17,888		$15,473	$2,415	$17,888	2020Q3	13.0%	$17,477	$2,728	$20,206
	CONSTRUCTION ESTIMATE TOTALS:	$19,904	$3,107	16%	**$23,011**		$19,904	$3,107	$23,011			$22,483	$3,510	$25,992
01	LANDS AND DAMAGES	$44	$6	14%	$41		$44	$6	$50	2020Q2	12.4%	$49	$7	$57
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2019Q3	25.1%	$534	$83	$618
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2020Q3	30.5%	$907	$142	$1,049
	CONTRACT COST TOTALS:	$21,070	$3,288		**$24,358**		$21,070	$3,288	$24,358			$23,973	$3,742	**$27,715**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: San Acacia Levee Improvements (P2 322189)
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DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

	Estimate Prepared: 1-Oct-13 / Effective Price Level: 1 OCT 14					Program Year (Budget EC): 2014 / Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
	PHASE 9													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$7,740	$1,208	16%	$8,948		$7,740	$1,208	$8,948	2021Q2	14.6%	$8,867	$1,384	$10,251
	CONSTRUCTION ESTIMATE TOTALS:	$7,740	$1,208	16%	**$8,948**		$7,740	$1,208	$8,948			$8,867	$1,384	$10,251
01	LANDS AND DAMAGES	$44	$6	14%	$42		$44	$6	$50	2021Q2	14.6%	$50	$7	$58
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2020Q3	30.5%	$557	$87	$644
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2021Q2	34.7%	$936	$146	$1,082
	CONTRACT COST TOTALS:	$8,906	$1,390		**$10,296**		$8,906	$1,390	$10,296			$10,410	$1,624	**$12,035**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

Estimate Prepared: 1-Oct-13
Effective Price Level: 1 OCT 14

Program Year (Budget EC): 2014
Effective Price Level Date: 1 OCT 13

FULLY FUNDED PROJECT ESTIMATE

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
	PHASE 10													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$7,292	$1,138	16%	$8,430		$7,292	$1,138	$8,430	2022Q2	16.7%	$8,512	$1,329	$9,841
	CONSTRUCTION ESTIMATE TOTALS:	$7,292	$1,138	16%	**$8,430**		$7,292	$1,138	$8,430			$8,512	$1,329	$9,841
01	LANDS AND DAMAGES	$44	$6	14%	$43		$44	$6	$50	2022Q2	16.7%	$51	$7	$59
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2021Q3	36.2%	$581	$91	$672
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2022Q2	40.6%	$977	$153	$1,130
	CONTRACT COST TOTALS:	$8,458	$1,320		**$9,778**		$8,458	$1,320	$9,778			$10,122	$1,579	**$11,701**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

	Estimate Prepared: 1-Oct-13 Effective Price Level: 1 OCT 14					Program Year (Budget EC): 2014 Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	PHASE 11													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$7,175	$1,120	16%	$8,295		$7,175	$1,120	$8,295	2023Q2	18.9%	$8,535	$1,332	$9,867
	CONSTRUCTION ESTIMATE TOTALS:	$7,175	$1,120	16%	**$8,295**		$7,175	$1,120	$8,295			$8,535	$1,332	$9,867
01	LANDS AND DAMAGES	$44	$6	14%	$49		$44	$6	$50	2023Q2	19.0%	$52	$8	$60
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2022Q3	42.2%	$607	$95	$702
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2023Q2	46.9%	$1,021	$159	$1,181
	CONTRACT COST TOTALS:	$8,341	$1,301		**$9,642**		$8,341	$1,301	$9,642			$10,215	$1,594	**$11,809**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

	Estimate Prepared: 1-Oct-13 Effective Price Level: 1 OCT 14					Program Year (Budget EC): 2014 Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	PHASE 12													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$4,532	$707	16%	$5,239		$4,532	$707	$5,239	2024Q2	21.2%	$5,493	$857	$6,351
	CONSTRUCTION ESTIMATE TOTALS:	$4,532	$707	16%	**$5,239**		$4,532	$707	$5,239			$5,493	$857	$6,351
01	LANDS AND DAMAGES	$44	$6	14%	$31		$44	$6	$50	2024Q2	21.2%	$53	$8	$61
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2023Q3	48.6%	$634	$99	$733
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2024Q2	53.5%	$1,067	$167	$1,234
	CONTRACT COST TOTALS:	$5,698	$889		**$6,587**		$5,698	$889	$6,587			$7,248	$1,131	**$8,379**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

	Estimate Prepared: 1-Oct-13 Effective Price Level: 1 OCT 14					Program Year (Budget EC): 2014 Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	PHASE 13													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$7,117	$1,111	16%	$8,228		$7,117	$1,111	$8,228	2025Q2	23.5%	$8,790	$1,372	$10,163
	CONSTRUCTION ESTIMATE TOTALS:	$7,117	$1,111	16%	**$8,228**		$7,117	$1,111	$8,228			$8,790	$1,372	$10,163
01	LANDS AND DAMAGES	$44	$6	14%	$44		$44	$6	$50	2025Q2	23.5%	$54	$8	$62
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2024Q3	55.3%	$663	$104	$767
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2025Q2	60.6%	$1,116	$174	$1,290
	CONTRACT COST TOTALS:	$8,283	$1,292		**$9,575**		$8,283	$1,292	$9,575			$10,624	$1,658	**$12,282**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

Estimate Prepared: 1-Oct-13
Effective Price Level: 1 OCT 14

Program Year (Budget EC): 2014
Effective Price Level Date: 1 OCT 13

FULLY FUNDED PROJECT ESTIMATE

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	PHASE 14													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$6,866	$1,072	16%	$7,938		$6,866	$1,072	$7,938	2026Q2	25.9%	$8,642	$1,349	$9,990
	CONSTRUCTION ESTIMATE TOTALS:	$6,866	$1,072	16%	**$7,938**		$6,866	$1,072	$7,938			$8,642	$1,349	$9,990
01	LANDS AND DAMAGES	$43	$6	14%	$42		$43	$6	$49	2026Q2	25.9%	$54	$8	$62
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2025Q3	62.5%	$694	$108	$802
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2026Q2	68.2%	$1,169	$182	$1,351
	CONTRACT COST TOTALS:	$8,031	$1,253		**$9,284**		$8,031	$1,253	$9,284			$10,558	$1,647	**$12,206**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

	Estimate Prepared: 1-Oct-13 Effective Price Level: 1 OCT 14					Program Year (Budget EC): 2014 Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
	PHASE 15													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$6,838	$1,067	16%	$7,905		$6,838	$1,067	$7,905	2027Q2	28.3%	$8,770	$1,369	$10,139
	CONSTRUCTION ESTIMATE TOTALS:	$6,838	$1,067	16%	**$7,905**		$6,838	$1,067	$7,905			$8,770	$1,369	$10,139
01	LANDS AND DAMAGES	$43	$6	14%	$44		$43	$6	$49	2027Q2	28.3%	$55	$8	$63
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2026Q3	70.2%	$727	$113	$840
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2027Q2	76.2%	$1,225	$191	$1,416
	CONTRACT COST TOTALS:	$8,003	$1,249		**$9,252**		$8,003	$1,249	$9,252			$10,776	$1,682	**$12,458**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

	Estimate Prepared: 1-Oct-13 / Effective Price Level: 1 OCT 14					Program Year (Budget EC): 2014 / Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
	PHASE 16													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$11,537	$1,801	16%	$13,338		$11,537	$1,801	$13,338	2028Q2	30.7%	$15,077	$2,354	$17,431
	CONSTRUCTION ESTIMATE TOTALS:	$11,537	$1,801	16%	**$13,338**		$11,537	$1,801	$13,338			$15,077	$2,354	$17,431
01	LANDS AND DAMAGES	$43	$6	14%	$65		$43	$6	$49	2028Q2	30.7%	$56	$8	$64
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2027Q3	78.4%	$762	$119	$881
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2028Q2	84.9%	$1,285	$201	$1,485
	CONTRACT COST TOTALS:	$12,702	$1,982		**$14,684**		$12,702	$1,982	$14,684			$17,180	$2,681	**$19,861**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

	Estimate Prepared: 1-Oct-13 / Effective Price Level: 1 OCT 14					Program Year (Budget EC): 2014 / Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
	PHASE 17													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$6,414	$1,001	16%	$7,415		$6,414	$1,001	$7,415	2029Q2	33.2%	$8,542	$1,333	$9,875
	CONSTRUCTION ESTIMATE TOTALS:	$6,414	$1,001	16%	**$7,415**		$6,414	$1,001	$7,415			$8,542	$1,333	$9,875
01	LANDS AND DAMAGES	$43	$6	14%	$49		$43	$6	$49	2029Q2	33.2%	$57	$8	$66
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2028Q3	87.1%	$799	$125	$924
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2029Q2	93.9%	$1,348	$210	$1,558
	CONTRACT COST TOTALS:	$7,579	$1,183		**$8,762**		$7,579	$1,183	$8,762			$10,746	$1,677	**$12,422**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

	Estimate Prepared: 1-Oct-13 Effective Price Level: 1 OCT 14					Program Year (Budget EC): 2014 Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
	PHASE 18													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$6,228	$972	16%	$7,200		$6,228	$972	$7,200	2030Q2	35.7%	$8,451	$1,319	$9,771
	CONSTRUCTION ESTIMATE TOTALS:	$6,228	$972	16%	**$7,200**		$6,228	$972	$7,200			$8,451	$1,319	$9,771
01	LANDS AND DAMAGES	$43	$6	14%	$37		$43	$6	$49	2030Q2	35.7%	$58	$8	$67
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2029Q3	96.4%	$839	$131	$969
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2030Q2	103.8%	$1,416	$221	$1,638
	CONTRACT COST TOTALS:	$7,393	$1,154		**$8,547**		$7,393	$1,154	$8,547			$10,765	$1,680	**$12,444**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
	Estimate Prepared: 1-Oct-13 / Effective Price Level: 1 OCT 14					Program Year (Budget EC): 2014 / Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	PHASE 19													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$6,141	$959	16%	$7,100		$6,141	$959	$7,100	2031Q2	38.3%	$8,492	$1,326	$9,817
	CONSTRUCTION ESTIMATE TOTALS:	$6,141	$959	16%	**$7,100**		$6,141	$959	$7,100			$8,492	$1,326	$9,817
01	LANDS AND DAMAGES	$43	$6	14%	$36		$43	$6	$49	2031Q2	38.3%	$59	$9	$68
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2030Q3	106.5%	$882	$138	$1,019
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2031Q2	114.4%	$1,490	$233	$1,723
	CONTRACT COST TOTALS:	$7,306	$1,140		**$8,446**		$7,306	$1,140	$8,446			$10,923	$1,704	**$12,627**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: San Acacia Levee Improvements (P2 322189)
LOCATION: Socorro County, New Mexico
This Estimate reflects the scope and schedule in report; San Acacia Levee Improvements - GRR - 2012

DISTRICT: SPA Albuquerque, NM PREPARED: 9/25/2013
POC: CHIEF, COST ENGINEERING, Michael Prudhomme

Estimate Prepared: 1-Oct-13
Effective Price Level: 1 OCT 14

Program Year (Budget EC): 2014
Effective Price Level Date: 1 OCT 13

FULLY FUNDED PROJECT ESTIMATE

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
	PHASE 20													
02	RELOCATIONS			16%										
09	CHANNELS & CANALS			16%										
11	LEVEES & FLOODWALLS	$9,986	$1,559	16%	$11,545		$9,986	$1,559	$11,545	2032Q2	40.9%	$14,071	$2,196	$16,267
	CONSTRUCTION ESTIMATE TOTALS:	$9,986	$1,559	16%	**$11,545**		$9,986	$1,559	$11,545			$14,071	$2,196	$16,267
01	LANDS AND DAMAGES	$43	$6	14%	$25		$43	$6	$49	2032Q2	40.9%	$61	$9	$69
30	PLANNING, ENGINEERING & DESIGN	$427	$67	16%	$494		$427	$67	$494	2031Q3	117.2%	$928	$145	$1,072
31	CONSTRUCTION MANAGEMENT	$695	$108	16%	$803		$695	$108	$803	2032Q2	125.8%	$1,569	$245	$1,814
	CONTRACT COST TOTALS:	$11,151	$1,740		**$12,891**		$11,151	$1,740	$12,891			$16,628	$2,595	**$19,223**

San Acacia Alt A Base +4 FY 14 Updated Estimate
Rio Grande Floodway
San Acacia Levee Improvements Alternative A Base +4
Socorro County, New Mexico

This project consists of constructing approximately 41.7 miles of engineered levee along the Rio Grande in central New Mexico. The project will extend on the west bank of the Rio Grande from the upper end of the U.S. Bureau of Reclamation's low-flow conveyance channel at the San Acacia Diversion Dam to the Tiffany Basin which is roughly 28 miles from the end of the conveyance channel at Elephant Butte Reservoir. The estimate represents the cost to construct Alternative A Base +4 which is the Tentatively Selected Plan.

Estimated by	P. Gonzalez, B. Davis, J. Crooker-Flint
Designed by	USACE Albuquerque District
Prepared by	P. Gonzalez, B. Davis, J. Crooker-Flint
Preparation Date	9/24/2013
Effective Date of Pricing	10/1/2013
Estimated Construction Time	7,300 Days

Description	UOM	Quantity	CostToPrime	ContractCost	ProjectCost
BID SCHEDULE REPORT			**135,322,071.07**	**194,531,140.07**	**194,531,140.07**
Alternative A	**EA**	**1.00**	**135,322,071.07**	**194,531,140.07**	**194,531,140.07**
Base Levee +4	**EA**	**1.00**	**135,322,071.07**	**194,531,140.07**	**194,531,140.07**
Phase 1 - Sta 645+00 to 800+00	**LS**	**1.00**	**7,801,525.02**	**11,426,693.14**	**11,426,693.14**
Lands and Damages	**LS**	**1.00**	**0.00**	**327,267.00**	**327,267.00**
Levees and Floodwalls	**LS**	**1.00**	**7,333,339.33**	**9,975,780.48**	**9,975,780.48**
Planning Engineering and Design	**LS**	**1.00**	**178,666.79**	**428,800.30**	**428,800.30**
Construction Management	**LS**	**1.00**	**289,518.90**	**694,845.36**	**694,845.36**
Phase 2 - Sta 800+00 to 950+00	**LS**	**1.00**	**7,186,149.95**	**10,282,611.46**	**10,282,611.46**
Lands and Damages	**LS**	**1.00**	**0.00**	**21,267.00**	**21,267.00**
Levees and Floodwalls	**LS**	**1.00**	**6,718,894.28**	**9,139,930.86**	**9,139,930.86**
Planning Engineering and Design	**LS**	**1.00**	**177,736.77**	**426,568.24**	**426,568.24**
Construction Management	**LS**	**1.00**	**289,518.90**	**694,845.36**	**694,845.36**
Phase 3 - Sta 950+00 to 1030+00	**LS**	**1.00**	**8,575,975.10**	**12,173,235.90**	**12,173,235.90**
Lands and Damages	**LS**	**1.00**	**0.00**	**21,267.00**	**21,267.00**
Levees and Floodwalls	**LS**	**1.00**	**8,108,719.43**	**11,030,555.30**	**11,030,555.30**
Planning Engineering and Design	**LS**	**1.00**	**177,736.77**	**426,568.24**	**426,568.24**
Construction Management	**LS**	**1.00**	**289,518.90**	**694,845.36**	**694,845.36**
Phase 4 - Sta 145+00 to 262+00	**LS**	**1.00**	**6,847,997.71**	**9,822,611.95**	**9,822,611.95**
Lands and Damages	**LS**	**1.00**	**0.00**	**21,267.00**	**21,267.00**
Levees and Floodwalls	**LS**	**1.00**	**6,380,742.05**	**8,679,931.35**	**8,679,931.35**
Planning Engineering and Design	**LS**	**1.00**	**177,736.77**	**426,568.24**	**426,568.24**
Construction Management	**LS**	**1.00**	**289,518.90**	**694,845.36**	**694,845.36**
Phase 5 - Sta 262+00 to 319+00	**LS**	**1.00**	**6,626,902.41**	**9,521,848.80**	**9,521,848.80**
Lands and Damages	**LS**	**1.00**	**0.00**	**21,267.00**	**21,267.00**
Levees and Floodwalls	**LS**	**1.00**	**6,159,646.74**	**8,379,168.20**	**8,379,168.20**
Planning Engineering and Design	**LS**	**1.00**	**177,736.77**	**426,568.24**	**426,568.24**
Construction Management	**LS**	**1.00**	**289,518.90**	**694,845.36**	**694,845.36**
Phase 6 - Sta 319+00 to 479+00	**LS**	**1.00**	**6,596,145.17**	**9,480,008.72**	**9,480,008.72**
Lands and Damages	**LS**	**1.00**	**0.00**	**21,267.00**	**21,267.00**

Currency in US dollars

Description	UOM	Quantity	CostToPrime	ContractCost	ProjectCost
Levees and Floodwalls	LS	1.00	6,128,889.50	8,337,328.12	8,337,328.12
Planning Engineering and Design	LS	1.00	177,736.77	426,568.24	426,568.24
Construction Management	LS	1.00	289,518.90	694,845.36	694,845.36
Phase 7 - Sta 479+00 to 640+00	LS	1.00	6,391,290.16	9,201,337.79	9,201,337.79
Lands and Damages	LS	1.00	0.00	21,267.00	21,267.00
Levees and Floodwalls	LS	1.00	5,924,034.50	8,058,657.19	8,058,657.19
Planning Engineering and Design	LS	1.00	177,736.77	426,568.24	426,568.24
Construction Management	LS	1.00	289,518.90	694,845.36	694,845.36
Phase 8 - Sta 68+00 to 145+00 and Upstream Improvements	LS	1.00	15,098,898.60	21,046,581.32	21,046,581.32
Lands and Damages	LS	1.00	0.00	21,267.00	21,267.00
Channels and Canals	LS	1.00	3,257,584.96	4,431,398.98	4,431,398.98
Levees and Floodwalls	LS	1.00	11,374,057.97	15,472,501.74	15,472,501.74
Planning Engineering and Design	LS	1.00	177,736.77	426,568.24	426,568.24
Construction Management	LS	1.00	289,518.90	694,845.36	694,845.36
Phase 9 - Sta 1030+00 to 1134+00	LS	1.00	6,157,015.13	8,882,645.82	8,882,645.82
Lands and Damages	LS	1.00	0.00	21,267.00	21,267.00
Levees and Floodwalls	LS	1.00	5,689,759.46	7,739,965.22	7,739,965.22
Planning Engineering and Design	LS	1.00	177,736.77	426,568.24	426,568.24
Construction Management	LS	1.00	289,518.90	694,845.36	694,845.36
Phase 10 - Sta 1134+00 to 1240+00	LS	1.00	5,827,420.94	8,434,288.11	8,434,288.11
Lands and Damages	LS	1.00	0.00	21,267.00	21,267.00
Levees and Floodwalls	LS	1.00	5,360,165.28	7,291,607.51	7,291,607.51
Planning Engineering and Design	LS	1.00	177,736.77	426,568.24	426,568.24
Construction Management	LS	1.00	289,518.90	694,845.36	694,845.36
Phase 11 - Sta 1240+00 to 1355+00	LS	1.00	5,741,616.66	8,317,565.75	8,317,565.75
Lands and Damages	LS	1.00	0.00	21,267.00	21,267.00
Levees and Floodwalls	LS	1.00	5,274,360.99	7,174,885.15	7,174,885.15
Planning Engineering and Design	LS	1.00	177,736.77	426,568.24	426,568.24
Construction Management	LS	1.00	289,518.90	694,845.36	694,845.36
Phase 12 - Sta 1355+00 to 1432+00	LS	1.00	3,798,535.30	5,674,328.85	5,674,328.85

Labor ID: EQ ID: EP09R06 Currency in US dollars TRACES MII Version 4.1

Description	UOM	Quantity	CostToPrime	ContractCost	ProjectCost
Lands and Damages	LS	1.00	0.00	21,267.00	21,267.00
Levees and Floodwalls	LS	1.00	3,331,279.63	4,531,648.25	4,531,648.25
Planning Engineering and Design	LS	1.00	177,736.77	426,568.24	426,568.24
Construction Management	LS	1.00	289,518.90	694,845.36	694,845.36
Phase 13 - Sta 1432+00 to 1539+00	LS	1.00	5,698,814.77	8,259,340.94	8,259,340.94
Lands and Damages	LS	1.00	0.00	21,267.00	21,267.00
Levees and Floodwalls	LS	1.00	5,231,559.10	7,116,660.34	7,116,660.34
Planning Engineering and Design	LS	1.00	177,736.77	426,568.24	426,568.24
Construction Management	LS	1.00	289,518.90	694,845.36	694,845.36
Phase 14 - Sta 1539+00 to 1643+00	LS	1.00	5,514,528.52	8,008,650.35	8,008,650.35
Lands and Damages	LS	1.00	0.00	21,267.00	21,267.00
Levees and Floodwalls	LS	1.00	5,047,272.85	6,865,969.74	6,865,969.74
Planning Engineering and Design	LS	1.00	177,736.77	426,568.24	426,568.24
Construction Management	LS	1.00	289,518.90	694,845.36	694,845.36
Phase 15 - Sta 1643+00 to 1750+00	LS	1.00	5,493,958.82	7,980,668.71	7,980,668.71
Lands and Damages	LS	1.00	0.00	21,267.00	21,267.00
Levees and Floodwalls	LS	1.00	5,026,703.15	6,837,988.11	6,837,988.11
Planning Engineering and Design	LS	1.00	177,736.77	426,568.24	426,568.24
Construction Management	LS	1.00	289,518.90	694,845.36	694,845.36
Phase 16 - Sta 1750+00 to 1910+00	LS	1.00	8,947,927.44	12,679,214.80	12,679,214.80
Lands and Damages	LS	1.00	0.00	21,267.00	21,267.00
Levees and Floodwalls	LS	1.00	8,480,671.78	11,536,534.20	11,536,534.20
Planning Engineering and Design	LS	1.00	177,736.77	426,568.24	426,568.24
Construction Management	LS	1.00	289,518.90	694,845.36	694,845.36
Phase 17 - Sta 1910+00 to 2030+00	LS	1.00	5,182,357.31	7,556,787.03	7,556,787.03
Lands and Damages	LS	1.00	0.00	21,267.00	21,267.00
Levees and Floodwalls	LS	1.00	4,715,101.64	6,414,106.43	6,414,106.43
Planning Engineering and Design	LS	1.00	177,736.77	426,568.24	426,568.24
Construction Management	LS	1.00	289,518.90	694,845.36	694,845.36
Phase 18 - Sta 2030+00 to 2122+00	LS	1.00	5,045,234.77	7,370,254.76	7,370,254.76

Currency in US dollars

Description	UOM	Quantity	CostToPrime	ContractCost	ProjectCost
Lands and Damages	**LS**	**1.00**	**0.00**	**21,267.00**	**21,267.00**
Levees and Floodwalls	**LS**	**1.00**	**4,577,979.10**	**6,227,574.16**	**6,227,574.16**
Planning Engineering and Design	**LS**	**1.00**	**177,736.77**	**426,568.24**	**426,568.24**
Construction Management	**LS**	**1.00**	**289,518.90**	**694,845.36**	**694,845.36**
Phase 19 - Sta 2122+00 to 2210+00	**LS**	**1.00**	**4,981,360.18**	**7,283,364.08**	**7,283,364.08**
Lands and Damages	**LS**	**1.00**	**0.00**	**21,267.00**	**21,267.00**
Levees and Floodwalls	**LS**	**1.00**	**4,514,104.51**	**6,140,683.48**	**6,140,683.48**
Planning Engineering and Design	**LS**	**1.00**	**177,736.77**	**426,568.24**	**426,568.24**
Construction Management	**LS**	**1.00**	**289,518.90**	**694,845.36**	**694,845.36**
Phase 20 - Sta 2210+00 to 2271+00	**LS**	**1.00**	**7,808,417.12**	**11,129,101.77**	**11,129,101.77**
Lands and Damages	**LS**	**1.00**	**0.00**	**21,267.00**	**21,267.00**
Levees and Floodwalls	**LS**	**1.00**	**7,341,161.45**	**9,986,421.17**	**9,986,421.17**
Planning Engineering and Design	**LS**	**1.00**	**177,736.77**	**426,568.24**	**426,568.24**
Construction Management	**LS**	**1.00**	**289,518.90**	**694,845.36**	**694,845.36**

Currency in US dollars

Description	JOOH	HOOH	Profit	Bond	Excise
	0.0000%	*0.0000%*	*0.0000%*	*0.0000%*	*0.0000%*
Subcontracted Work	0.00	0.00	0.00	0.00	0.00

Currency in US dollars

US Army Corps of Engineers®

San Acacia to Bosque Del Apache GRR

Alternative A+4 – Tentatively Selected Plan

Project Cost and Schedule Risk Analysis Report

Prepared for:

U.S. Army Corps of Engineers,
Albuquerque District

Prepared by:

U.S. Army Corps of Engineers
Cost Engineering Technical Center of Expertise, Walla Walla

March 15, 2012

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EXECUTIVE SUMMARY

Update 25 Sep 2013: *The cost estimate for the San Acacia to Bosque Del Apache project was updated September of 2013 to bring the estimate to a FY14 price level. The significant adjustments made to the estimate were to update the 01 Lands and Damages costs to reflect the costs reported in the Real Estate report as well as costs associated with 02 Relocations. The estimate has also been adjusted to reflect current fuel pricing. Overall, the increase in the base cost of the project increased only slightly and the items originally modeled are unchanged. The contingency percentage remains the same; therefore, heavier reliance is placed on the contingency as a percent than the computed dollars for reporting purposes.*

Under the auspices of the US Army Corps of Engineers (USACE), Albuquerque District, this report presents a recommendation for the project cost and schedule contingencies for the San Acacia to Bosque Del Apache General Reevaluation Report (GRR). In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008, a formal risk analysis study was conducted for the development of contingency on the project cost. The purpose of this risk analysis study was to establish project contingencies by identifying and measuring the cost and schedule impact of project uncertainties with respect to the estimated project cost.

Specific to the San Acacia Project, the project cost (base case at price level) is estimated at approximately $196 Million. Based on the results of the analysis, the Cost Engineering Technical Center of Expertise for Civil Works (Walla Walla District) recommends a contingency value of $31 Million, or 16%. This contingency includes $30.9 Million (15.8%) for cost growth potential due to risk analyzed in the base cost estimate and $119,000 (0.05%) for cost growth potential due to risk analyzed in the baseline schedule.

Walla Walla Cost TCX performed risk analysis using the *Monte Carlo* technique, producing the aforementioned contingencies and identifying key risk drivers.

The following table ES-1 portrays the development of contingencies (16%). The contingency is based on an 80% confidence level, as per USACE Civil Works guidance.

Table ES-1. Contingency Analysis Table

Base Case Cost Estimate	**$239,774,406**	
Confidence Level	**Value ($$)**	**Contingency (%)**
5%	$178,307,680	-8.29%

50%	$208,381,209	7.18%
80%	**$225,066,251**	**15.76%**
95%	$241,456,252	24.19%

The following table ES-2 portrays the full costs of the recommended alternative based on the anticipated contracts. The costs are intended to address the congressional request of estimates to implement the project. The contingency is based on an 80% confidence level, as per accepted USACE Civil Works guidance.

Table ES-2. Cost Summary

SAN ACACIA to BOSQUE DEL APACHE		**COST ($1,000)**	**CNTG ($1,000)**	**TOTAL ($1,000)**
01	LANDS AND DAMAGES	1,323[1]		1,323[1]
02	RELOCATIONS	2,437	384	2,822
09	CHANNELS AND CANALS	4,111	648	4,759
11	LEVEES AND FLOODWALLS	163,261	25,737	188,998
30	PLANNING, ENGINEERING AND DESIGN	9,013	1,421	10,434
31	CONSTRUCTION MANAGEMENT	15,596	2,459	18,054
	TOTAL PROJECT COSTS	**195,741[2]**	**30,857**	**226,598[2]**
	Schedule Completion with Contingency	**2 Jun 2032**	**2 months**	**30 Jul 2032**

Notes:
1) Costs include the recommended contingency of 16%, with the exception of the 01 Lands and Damages Account, which includes an incorporated contingency of 30% (per separate studies performed by others).
2) Costs exclude O&M and Life Cycle Cost estimates.

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS

The key cost risk drivers identified through sensitivity analysis were Risks CON-2 (Levee Construction Productivity), LD-3 (Alternate Disposal Site), FL-3 (Future Fuel Costs), and CON-1 (Equipment Fuel Stationing), which together contribute an absolute value of over 71 percent of the statistical cost variance.

The key schedule risk drivers identified through sensitivity analysis were Risk PR-2 (Funding Issues), and INT-1/EXT-1 (Unknown Internal and External Risk), which together contribute an absolute value of 99 percent of the statistical schedule variance.

Recommendations, as detailed within the main report, include the implementation of cost and schedule contingencies, further iterative study of risks throughout the project life-cycle, potential mitigation throughout the PED phase, and proactive monitoring and control of risk identified in this study.

MAIN REPORT

1.0 PURPOSE

Under the auspices of the US Army Corps of Engineers (USACE), Albuquerque District, this report presents a recommendation for the project cost and schedule contingencies for the San Acacia to Bosque Del Apache General Reevaluation Report (GRR).

2.0 BACKGROUND

The Tentatively Selected Plan (TSP) reflects feasibility level planning and design for an approximately 43-mile long levee along the west bank of the Rio Grande from the SADD to a location approximately 15-miles north of the upper extent of Elephant Butte reservoir near Tiffany Basin. The major feature of the plan is replacement of the existing spoil bank within its current alignment. Levee performance of the TSP is designed to maximize net benefits efficiently which results in a levee system that will pass the 1% chance exceedance with 98.8% assurance. This levee height corresponds to 4-feet above the water surface elevation of the 1% chance exceedance event.

This project consists of constructing approximately 41.7-miles of engineered levee along the Rio Grande in central New Mexico. The project will extend on the west bank of the Rio Grande from the upper end of the U.S. Bureau of Reclamation's low-flow conveyance channel at the San Acacia Diversion Dam to the Tiffany Basin which is roughly 28-miles from the end of the conveyance channel at Elephant Butte Reservoir. The estimate represents the cost to construct Alternative A which is the TSP.

Albuquerque District is preparing a Feasibility Report. As a part of this effort, Albuquerque District requested that the USACE Cost Engineering Technical Center of Expertise for Civil Works (Cost Engineering TCX) provide an agency technical review (ATR) of the cost estimate and schedule. That tasking also included providing a risk analysis study to establish the resulting contingencies.

3.0 REPORT SCOPE

The scope of the risk analysis report is to calculate and present the cost and schedule contingencies at the 80 percent confidence level using the risk analysis processes, as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. The report presents the contingency results for cost risks for all project features. The study and presentation does not include consideration for life cycle costs.

3.1 Project Scope

The formal process included extensive involvement of the PDT for risk identification and the development of the risk register. The analysis process evaluated the base case Micro Computer Aided Cost Estimating System (MCACES) cost estimate, schedule, and funding profiles using Crystal Ball software to conduct a *Monte Carlo* simulation and statistical sensitivity analysis, per the guidance in Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

The project technical scope, estimates and schedules were developed and presented by the Albuquerque District. Consequently, these documents serve as the basis for the risk analysis.

The scope of this study addresses the identification of problems, needs, opportunities and potential solutions that are viable from an economic, environmental, and engineering viewpoint.

3.2 USACE Risk Analysis Process

The risk analysis process for this study follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering TCX. The risk analysis process reflected within this report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, cost and schedule risk analysis should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting and scheduling.

In addition to broadly defined risk analysis standards and recommended practices, this risk analysis was performed to meet the requirements and recommendations of the following documents and sources:

- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering TCX.

- Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008.

- Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

4.0 METHODOLOGY / PROCESS

The Walla Walla Cost Engineering TCX performed the Cost and Schedule Risk Analysis, relying on local Albuquerque District staff to provide expertise and information gathering. The Cost Engineering TCX ATR Coordinator facilitated a risk identification meeting on site with the Albuquerque PDT on August 4, 2011. The initial risk identification meeting also included qualitative analysis to produce a risk register that served as the framework for the risk analysis.

Subsequent to major project design decisions, final risk discussion took place January through February 2012. The cost and schedule risk models were completed and results reported on March 4, 2012. The PDT held sanity checks of the risk analysis, and additional analysis between March 4, 2012 and March 7, 2012. This resulted in revisions to the risk analysis with results reported on March 15, 2011.

The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve any desired level of cost confidence.

In simple terms, contingency is an amount added to an estimate to allow for items, conditions or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk of project overruns. The less risk that project leadership is willing to accept the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The Cost TCX guidance for cost and schedule risk analysis generally focuses on the 80-percent level of confidence (P80) for cost contingency calculation. It should be noted that use of P80 as a decision criteria is a risk averse approach (whereas the use of P50 would be a risk neutral approach, and use of levels less than 50 percent would be risk seeking). Thus, a P80 confidence level results in greater contingency as compared to a P50 confidence level. The selection of contingency at a particular confidence level is ultimately the decision and responsibility of the project's District and/or Division management.

The risk analysis process uses *Monte Carlo* techniques to determine probabilities and contingency. The *Monte Carlo* techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format.

The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results are provided in Section 6.

4.1 Identify and Assess Risk Factors

Identifying the risk factors via the PDT is considered a qualitative process that results in establishing a risk register that serves as the document for the quantitative study using the Crystal Ball risk software. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

Formal PDT meetings were held for the purposes of identifying and assessing risk factors. The formal meeting conducted on August 4, 2011 included the following:

Name	Organization	Title
Jerry Nieto	USACE - SPA	Project Management
Mark Doles	USACE - SPA	Plan Formulation
Rob Browning	USACE - SPA	Economics
William DeRagon	USACE - SPA	Environmental Studies
Greg Everhart	USACE - SPA	Cultural Resources
Ryan Gronewold	USACE - SPA	Hydraulics
Darrel Eidson	USACE - SPA	Sediment
Bruce Jordan	USACE - SPA	Geotechnical
Corina Chavez	USACE - SPA	Civil Engineering
John Stages	USACE - SPA	Structural Engineering
Steven Wagner	USACE - SPA	HTRW/Environmental Engr.
Michael	USACE - SPA	Cost Engineering
Marvin Urban	USACE - SPA	Real Estate
Jacob Chavez	USACE - SPA	Construction
Leslie Molina	USACE - SPA	Contracting
James Neubauer	USACE - NWW	Cost TCX - Risk Facilitator

The initial formal meetings focused primarily on risk factor identification using brainstorming techniques, but also included some facilitated discussions based on risk factors common to projects of similar scope and geographic location. Subsequent meetings focused primarily on risk factor assessment and quantification.

Additionally, numerous conference calls and informal meetings were conducted throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment.

4.2 Quantify Risk Factor Impacts

The quantitative impacts of risk factors on project plans were analyzed using a combination of professional judgment, empirical data and analytical techniques. Risk factor impacts were quantified using probability distributions (density functions) because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involved multiple project team disciplines and functions. However, the quantification process relied more extensively on collaboration between cost engineering and risk analysis team members with lesser inputs from other functions and disciplines. This process used an iterative approach to estimate the following elements of each risk factor:

- Maximum possible value for the risk factor
- Minimum possible value for the risk factor
- Most likely value (the statistical mode), if applicable
- Nature of the probability density function used to approximate risk factor uncertainty
- Mathematical correlations between risk factors
- Affected cost estimate and schedule elements

The resulting product from the PDT discussions is captured within a risk register as presented in section 6 for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

4.3 Analyze Cost Estimate and Schedule Contingency

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate and schedule. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the PDT. Contingencies are calculated by applying only the moderate and high level risks identified for each option (i.e., low-level risks are typically not considered, but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate, the contingency is calculated as the difference between the P80 cost forecast and the baseline cost estimate. Each option-specific contingency is then allocated on a civil works feature level based on the dollar-weighted relative risk of each feature as quantified by *Monte Carlo* simulation. Standard deviation is used as the feature-specific measure of risk for contingency allocation purposes. This approach results in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

5.0 PROJECT ASSUMPTIONS

The following data sources and assumptions were used in quantifying the costs associated with the San Acacia project.

a. The Albuquerque District provided MII MCACES (Micro-Computer Aided Cost Estimating Software) files electronically. The files transmitted and downloaded on February 22, 2012 were the basis for the initial cost and schedule risk analyses. The files transmitted and downloaded on March 15, 2012 were the basis for the final cost and schedule risk analyses.

b. The cost comparisons and risk analyses performed and reflected within this report are based on design scope and estimates that are at the feasibility level.

c. Schedules are analyzed for impact to the project cost in terms of both uncaptured escalation (variance from OMB factors and the local market) and unavoidable fixed contract costs and/or languishing federal administration costs incurred throughout delay. Specific to the San Acacia project, the schedule was analyzed only for impacts due to residual fixed costs.

d. Per the CWCCIS Historical State Adjustment Factors in EM 1110-2-1304, State Adjustment Factor for the State of New Mexico is 0.95, meaning that the average inflation for the project area is assumed to be 5% lower than the national average for inflation. Therefore, it is assumed that the project inflations experienced are similar to OMB inflation factors for future construction. Thus, the risk analyses accounted for no escalation over and above the national average.

e. Per the data in the estimate, the Job Office Overhead (JOOH) percentage for the Prime Contractor is 10%. However, since engineering and construction is occurring seasonally over 20 separate phases, a weighted average based on overall duration versus construction duration was calculated. The assumed residual fixed cost rate for construction is 10%, while the residual fixed cost rate during the feasibility, PED, and inactivity periods has historically been approximately 5%. Using this calculation, the overall weight average percentage is 7.5%. Thus, the assumed residual fixed cost rate for this project is 7.5%. For the P80 schedule, this comprises approximately 0.05% of the total contingency (or 0.06% of the base case project cost) due to the accrual of residual fixed costs associated with delay.

f. The Cost TCX guidance generally focuses on the eighty-percent level of confidence (P80) for cost contingency calculation. For this risk analysis, the eighty-percent level of confidence (P80) was used. It should be noted that the use of P80 as a decision criteria is a moderately risk averse approach, generally resulting in higher cost contingencies. However, the P80 level of confidence also assumes a small degree of risk that the recommended contingencies may be inadequate to capture actual project costs.

g. Only high and moderate risk level impacts, as identified in the risk register, were considered for the purposes of calculating cost contingency. Low level risk impacts should be maintained in project management documentation, and reviewed at each project milestone to determine if they should be placed on the risk “watch list”.

6.0 RESULTS

The cost and schedule risk analysis results are provided in the following sections. In addition to contingency calculation results, sensitivity analyses are presented to provide decision makers with an understanding of variability and the key contributors to the cause of this variability.

6.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis. The actual risk register is provided in Appendix A. The complete risk register includes low level risks, as well as additional information regarding the nature and impacts of each risk.

It is important to note that a risk register can be an effective tool for managing identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, and schedule are further refined, especially on large projects with extended schedules. Recommended uses of the risk register going forward include:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
- Providing project sponsors, stakeholders, and leadership/management with a

documented framework from which risk status can be reported in the context of project controls.
- Communicating risk management issues.
- Providing a mechanism for eliciting feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

6.2 Cost Contingency and Sensitivity Analysis

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project cost at intervals of confidence (probability).

Table 1 provides the construction cost contingencies calculated for the P80 confidence level and rounded to the nearest thousand. The construction cost contingencies for the P50 and P100 confidence levels are also provided for illustrative purposes only.

Contingency was quantified as approximately $31 Million at the P80 confidence level (16% of the baseline cost estimate). For comparison, the cost contingency at the P50 and P100 confidence levels was quantified as 7% and 38% of the baseline cost estimate, respectively.

Table 1. Project Cost Contingency Summary

Risk Analysis Forecast	Baseline Estimate	Total Contingency[1,2] ($)	Total Contingency (%)
50% Confidence Level			
Project Cost	$208,381,209	$13,963,249	7.18%
80% Confidence Level			
Project Cost	$225,066,251	$30,648,290	15.76%
100% Confidence Level			
Project Cost	$267,543,810	$73,125,849	37.61%

Notes:
1) These figures combine uncertainty in the baseline cost estimates and schedule.
2) A P100 confidence level is an abstract concept for illustration only, as the nature of risk and uncertainty (specifically the presence of “unknown unknowns”) makes 100% confidence a theoretical impossibility.

6.2.1 Sensitivity Analysis

Sensitivity analysis generally ranks the relative impact of each risk/opportunity as a percentage of total cost uncertainty. The Crystal Ball software uses a statistical measure (contribution to variance) that approximates the impact of each risk/opportunity contributing to variability of cost outcomes during *Monte Carlo* simulation.

Key cost drivers identified in the sensitivity analysis can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle. Together with the risk register, sensitivity analysis results can also be used to support development of strategies to eliminate, mitigate, accept or transfer key risks.

6.2.2 Sensitivity Analysis Results

The risks/opportunities considered as key or primary cost drivers are ranked in order of importance in contribution to variance bar charts. Opportunities that have a potential to reduce project cost and are shown with a negative sign; risks are shown with a positive sign to reflect the potential to increase project cost. A longer bar in the sensitivity analysis chart represents a greater potential impact to project cost.

Figure 1 presents a sensitivity analysis for cost growth risk from the high level cost risks identified in the risk register. Likewise, Figure 2 presents a sensitivity analysis for schedule growth risk from the high level schedule risks identified in the risk register.

6.3 Schedule and Contingency Risk Analysis

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project duration at intervals of confidence (probability).

Table 2 provides the schedule duration contingencies calculated for the P80 confidence level. The schedule duration contingencies for the P50 and P100 confidence levels are also provided for illustrative purposes.

Schedule duration contingency was quantified as 2 months based on the P80 level of confidence. These contingencies were used to calculate the projected residual fixed cost impact of project delays that are included in the Table 1 presentation of total cost contingency. The schedule contingencies were calculated by applying the high level schedule risks identified in the risk register for each option to the durations of critical path and near critical path tasks.

The schedule was not resource loaded and contained open-ended tasks and non-zero lags (gaps in the logic between tasks) that limit the overall utility of the schedule risk analysis. These issues should be considered as limitations in the utility of the schedule contingency data presented. Schedule contingency impacts presented in this analysis are based solely on projected residual fixed costs.

Table 2. Schedule Duration Contingency Summary

Risk Analysis Forecast	Baseline Schedule Duration (months)	Contingency[1] (months)
50% Confidence Level		
Project Duration	236	-0.5
80% Confidence Level		
Project Duration	236	1.9
100% Confidence Level		
Project Duration	236	54

Notes:
1) The schedule was not resource loaded and contained open-ended tasks and non-zero lags (gaps in the logic between tasks) that limit the overall utility of the schedule risk analysis. These issues should be considered as limitations in the utility of the schedule contingency data presented in Table 2.
2) A P100 confidence level is an abstract concept for illustration only, as the nature of risk and uncertainty (specifically the presence of "unknown unknowns") makes 100% confidence a theoretical impossibility.

Figure 1. Cost Sensitivity Analysis

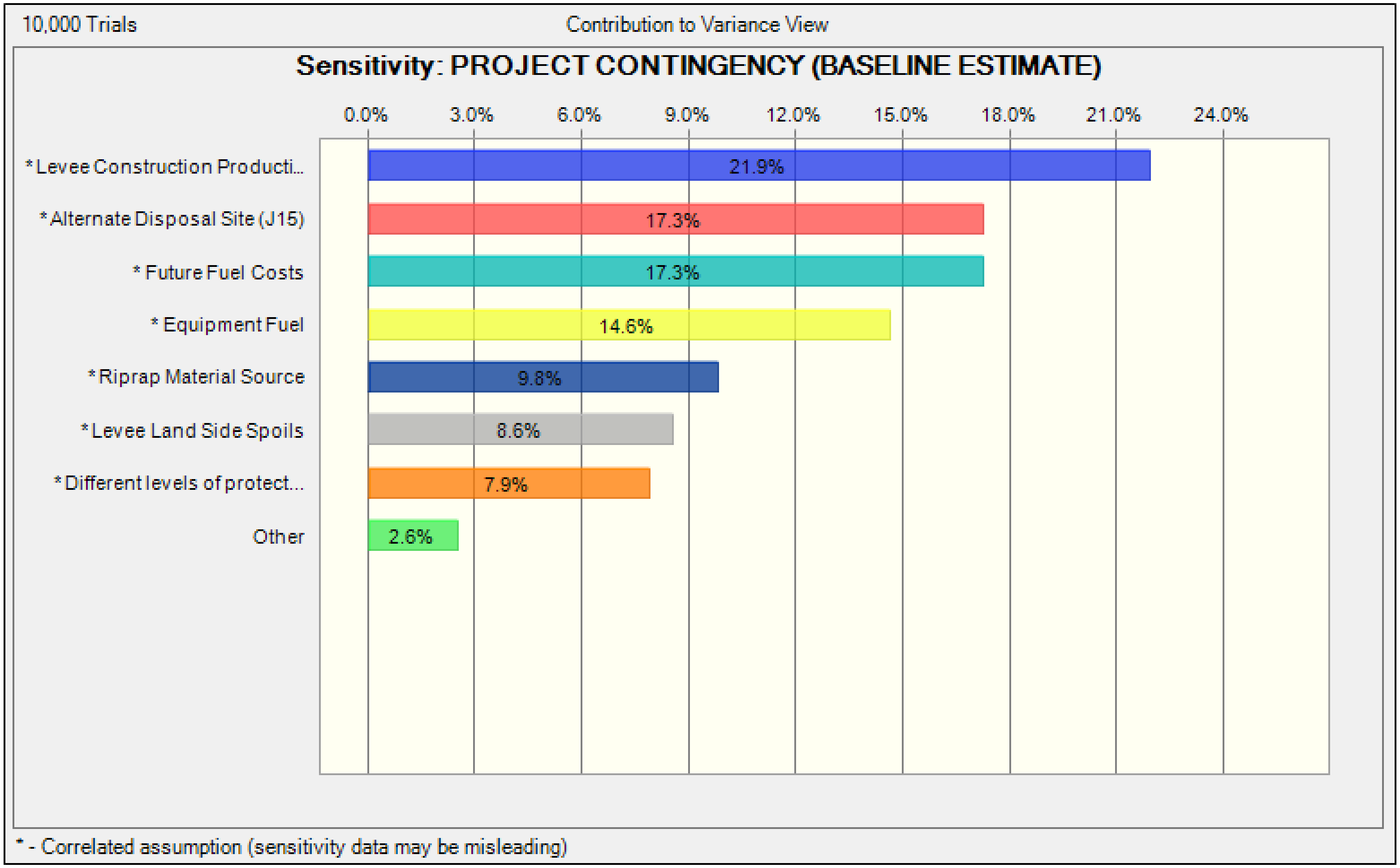
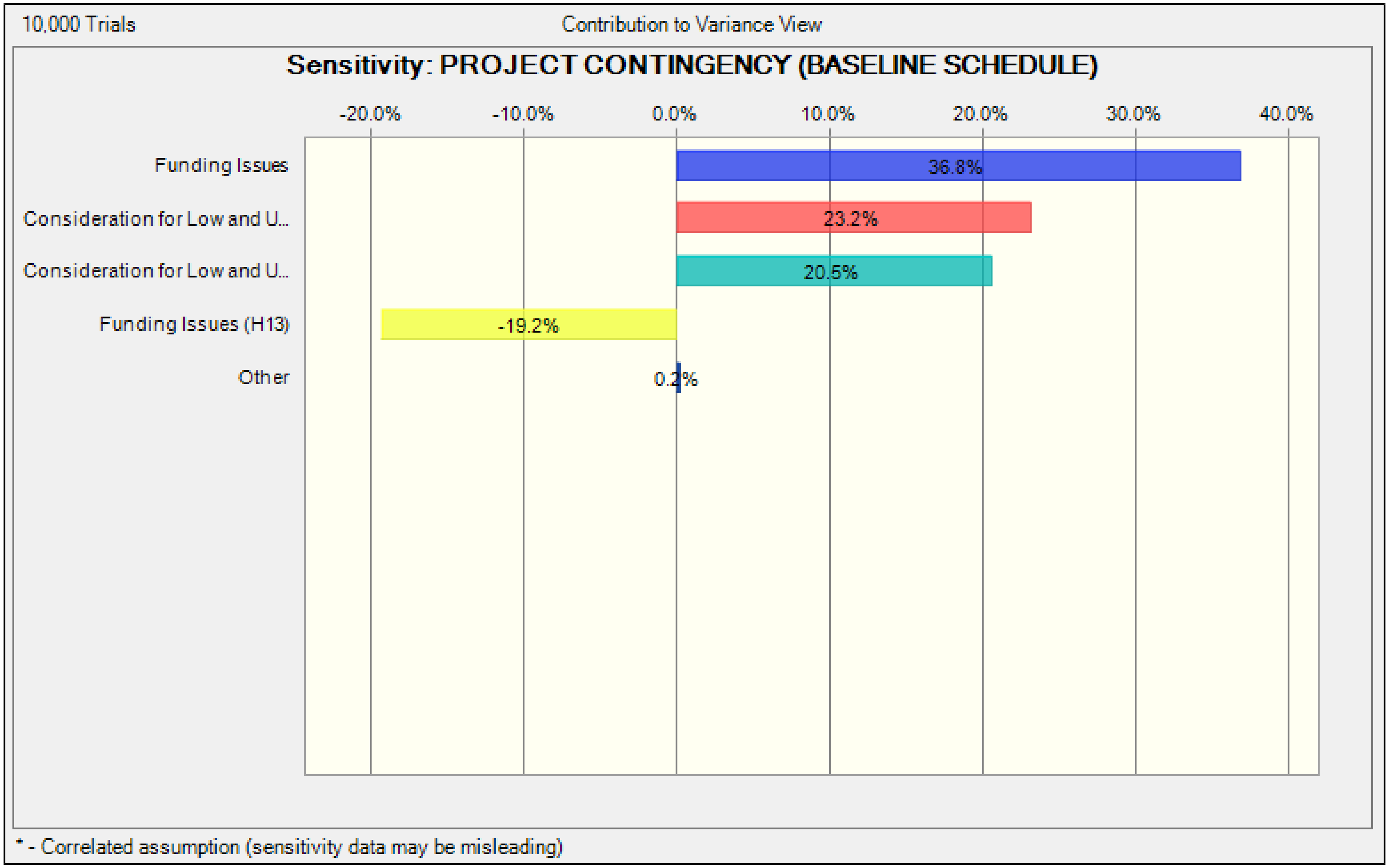


Figure 2. Schedule Sensitivity Analysis



7.0 MAJOR FINDINGS/OBSERVATIONS/RECOMMENDATIONS

This section provides a summary of significant risk analysis results that are identified in the preceding sections of the report. Risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. Because of the potential for use of risk analysis results for such diverse purposes, this section also reiterates and highlights important steps, logic, key assumptions, limitations, and decisions to help ensure that the risk analysis results are appropriately interpreted.

7.1 Major Findings/Observations

Project cost comparison summaries are provided in Table 3 and Figure 3. Additional major findings and observations of the risk analysis are listed below.

1. The key cost risk drivers identified through sensitivity analysis were Risks CON-2 (Levee Construction Productivity), LD-3 (Alternate Disposal Site), FL-3 (Future Fuel Costs), and CON-1 (Equipment Fuel Stationing), which together contribute an absolute value of over 71 percent of the statistical cost variance.

2. The key schedule risk drivers identified through sensitivity analysis were Risk PR-2 (Funding Issues), and INT-1/EXT-1 (Unknown Internal and External Risk), which together contribute an absolute value of 99 percent of the statistical schedule variance.

3. Operation and maintenance activities were not included in the cost estimate or schedules. Therefore, a full lifecycle risk analysis could not be performed. Risk analysis results or conclusions could be significantly different if the necessary operation and maintenance activities were included.

Table 3. Project Cost Comparison Summary (Uncertainty Analysis)

Confidence Level	Project Cost ($)	Contingency ($)	Contingency (%)
P0	**$158,248,152**	**($36,169,809)**	**-18.60%**
P5	**$178,307,680**	**$(16,110,281)**	**-8.29%**
P10	**$184,639,450**	**$(9,778,511)**	**-5.03%**
P15	**$189,295,964**	**$(5,121,997)**	**-2.63%**
P20	**$193,548,082**	**$(869,878)**	**-0.45%**
P25	**$196,892,359**	**$2,474,398**	**1.27%**
P30	**$199,263,020**	**$4,845,059**	**2.49%**
P35	**$201,578,944**	**$7,160,983**	**3.68%**
P40	**$203,833,984**	**$9,416,024**	**4.84%**
P45	**$206,048,182**	**$11,630,222**	**5.98%**
P50	**$208,381,209**	**$13,963,249**	**7.18%**
P55	**$210,899,801**	**$16,481,840**	**8.48%**
P60	**$213,570,135**	**$19,152,174**	**9.85%**
P65	**$216,237,230**	**$21,819,269**	**11.22%**
P70	**$218,902,987**	**$24,485,027**	**12.59%**
P75	**$221,805,550**	**$27,387,589**	**14.09%**
P80	**$225,066,251**	**$30,648,290**	**15.76%**
P85	**$228,799,520**	**$34,381,559**	**17.68%**
P90	**$233,612,145**	**$39,194,184**	**20.16%**
P95	**$241,456,252**	**$47,038,291**	**24.19%**
P100	**$267,543,810**	**$73,125,849**	**37.61%**

Figure 3. Project Cost Summary (Uncertainty Analysis)

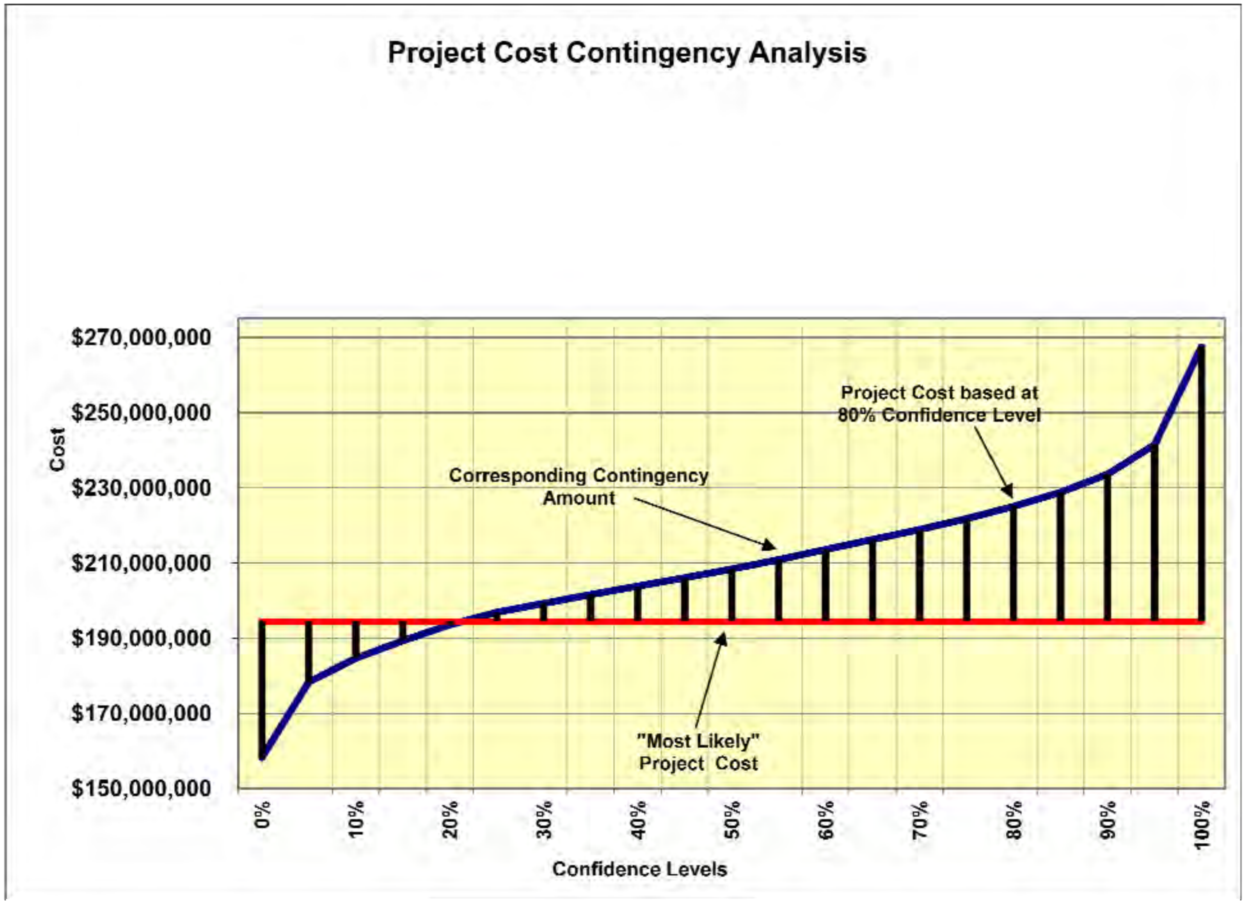
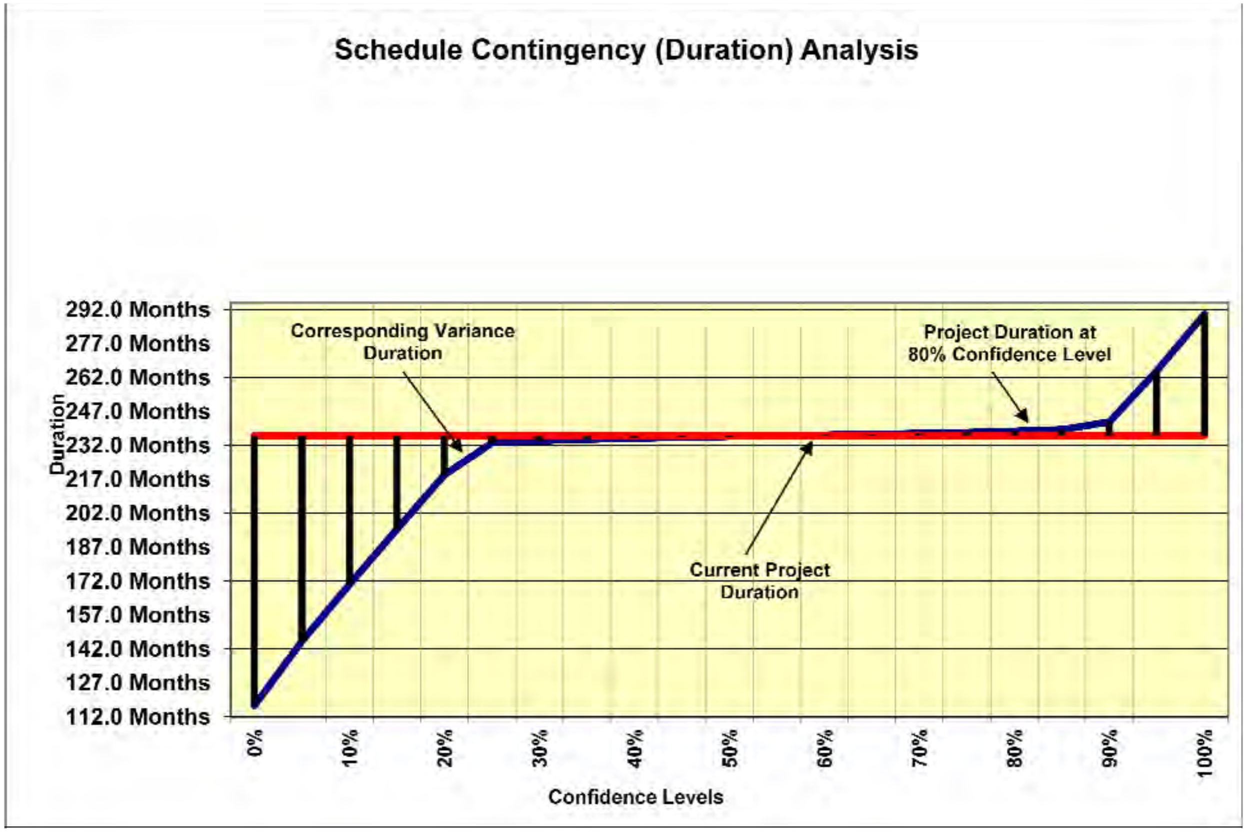


Figure 4. Project Duration Summary (Uncertainty Analysis)



7.2 Recommendations

Risk Management is an all-encompassing, iterative, and life-cycle process of project management. The Project Management Institute's (PMI) *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, *4th edition*, states that "project risk management includes the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project." Risk identification and analysis are processes within the knowledge area of risk management. Its outputs pertinent to this effort include the risk register, risk quantification (risk analysis model), contingency report, and the sensitivity analysis.

The intended use of these outputs is implementation by the project leadership with respect to risk responses (such as mitigation) and risk monitoring and control. In short, the effectiveness of the project risk management effort requires that the proactive management of risks not conclude with the study completed in this report.

The Cost and Schedule Risk Analysis (CSRA) produced by the PDT identifies issues that require the development of subsequent risk response and mitigation plans. This section provides a list of recommendations for continued management of the risks identified and analyzed in this study. Note that this list is not all inclusive and should not substitute a formal risk management and response plan.

1. Key Cost Risk Drivers: The key cost risk drivers identified through sensitivity analysis were Risks CON-2 (Levee Construction Productivity), LD-3 (Alternate Disposal Site), FL-3 (Future Fuel Costs), and CON-1 (Equipment Fuel Stationing), which together contribute an absolute value of over 71 percent of the statistical cost variance.

a) Levee Construction Productivity: Project leadership should attempt to capture and predict the ultimate project methodology to the maximum extent possible. It is imperative to identify all features of work and probable methodologies prior to project authorization, continuing to refine scoping details during the Pre-Construction Engineering and Design (PED Phase). Ultimately, this is an external risk, and its impacts must be communicated to management, and funds should be maintained in project reserve for treatment of this risk.

b) Alternate Disposal Site: Project leadership should attempt to capture and determine the likelihood of improving the costs due to the disposal site locations to the maximum extent possible. It is imperative to identify all features of work and probable methodologies prior to project authorization, continuing to refine scoping details during the Pre-Construction Engineering and Design (PED Phase). Ultimately, this is an external risk, and its impacts must be communicated to management, and funds should be maintained in project reserve for treatment of this risk.

c) Future Fuel Costs: Project leadership should ensure that cost engineering is properly resourced to provide project baseline updates to capture market trends and predict the impact of rising fuel prices. Ultimately, this is an external risk, and its impacts must be communicated to management, and funds should be maintained in project reserve for treatment of this risk.

d) Equipment Fuel Stationing: Project leadership should ensure that cost engineering is properly resourced to provide project baseline updates to capture market trends and predict the impact of equipment fuel stationing methodologies. Project leadership should also ensure that the PDT is aware of any regulatory changes that may impact the project methodologies and techniques. Ultimately, this is an external risk, and its impacts must be communicated to management, and funds should be maintained in project reserve for treatment of this risk.

2. Key Schedule Risk Drivers: The key schedule risk drivers identified through sensitivity analysis were Risk PR-2 (Funding Issues), and INT-1/EXT-1 (Unknown Internal and External Risk), which together contribute an absolute value of 99 percent of the statistical schedule variance.

a) Project Competing with Other Projects for Funding: Project leadership should communicate the impacts of this risk to management. Ultimately, this is an external risk, and its impacts must be communicated to management, and funds should be maintained in project reserve for treatment of this risk.

b) Unknown Internal/External Risk: Project leadership should proactively identify and manage risk throughout the project life cycle. The risk register included in this study should be updated and maintained, especially as the project reaches significant milestones. Risks identified as low or having low impact should be monitored on the project watch list, and updated if there are any significant changes.

3. Risk Management: Project leadership should use of the outputs created during the risk analysis effort as tools in future risk management processes. The risk register should be updated at each major project milestone. The results of the sensitivity analysis may also be used for response planning strategy and development. These tools should be used in conjunction with regular risk review meetings.

4. Risk Analysis Updates: Project leadership should review risk items identified in the original risk register and add others, as required, throughout the project life-cycle. Risks should be reviewed for status and reevaluation (using qualitative measure, at a minimum) and placed on risk management watch lists if any risk's likelihood or impact significantly increases. Project leadership should also be mindful of the potential for secondary (new risks created specifically by the response to an original risk) and residual risks (risks that remain and have unintended impact following response).

APPENDIX A

SPA - San Acacia to Bosque Del Apache - Alternative A+4 TSP

Risk Level

Likelihood of Occurrence					
Very Likely	Low	Moderate	High	High	High
Likely	Low	Moderate	High	High	High
Unlikely	Low	Low	Moderate	Moderate	High
Very Unlikely	Low	Low	Low	Low	High
	Negligible	Marginal	Significant	Critical	Crisis

Impact or Consequence of Occurrence

Project Scope Narrative: The Tentatively Selected Plan reflects feasibility level planning and design for an approximately 43 mile long levee along the west bank of the Rio Grande from the SADD to a location approximately 15 miles north of the upper extent of Elephant Butte reservoir near Tiffany Basin. The major feature of the plan is replacement of the existing spoil bank within its current alignment. Levee performance of the Tentatively Selected Plan is designed to maximize net benefits efficiently which results in a levee system that will pass the 1% chance exceedance with 98.8% assurance. This levee height corresponds to 4 feet above the water surface elevation of the 1% chance exceedance event. This project consists of constructing approximately 41.7 miles of engineered levee along the Rio Grande in central New Mexico. The project will extend on the west bank of the Rio Grande from the upper end of the U.S. Bureau of Reclamation's low-flow conveyance channel at the San Acacia Diversion Dam to the Tiffany Basin which is roughly 28 miles from the end of the conveyance channel at Elephant Butte Reservoir. The estimate represents the cost to construct Alternative A which is the Tentatively Selected Plan.

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost			Sensitivity	Project Schedule			Responsibility/POC	Affected Project Component
				Likelihood*	Impact*	Risk Level*	% change	Likelihood*	Impact*	Risk Level*		
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influenc												
	PROJECT & PROGRAM MGMT											
PPM-1	Project Sequencing (Internal Impacts)	It is assumed that 20 contracts will be required to complete the project. Project sequencing might impact cost and schedules.	The 20 phases making up the project will all require different scopes of work. Individual phase schedules and costs will depend on which features are required for a particular phase. This may potentially impact the 30 and 31 accounts.	Likely	Negligible	LOW		Unlikely	Marginal	LOW	Cost Engineering	Project Cost & Schedule
PPM-2	Sponsor Obligations	The proposed cost sharing is 82% federal dollars to 18% non-federal dollars.	The project will require a continuous funding stream of approximately $12.2 million every year during construction. Throughout the life of the project, the sponsor will need to provide their share of the cost. This includes both sunk costs and construction costs. If the local sponsor cannot meet cost sharing obligations the project schedule will be impacted.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	Project Sponsor(s)	Project Cost & Schedule
PPM-3	Project Schedule	The project is currently running on a compressed schedule to meet all requirements. Review times and sponsor/stake holder participation may require additional time.	Our schedule is very optimistic that the PDT will accomplish all required tasks to award the first phase of construction before the end of FY12. If there is a slip in the schedule for any of the activities that follow the critical path then the planned date for the start of construction will be missed.	Likely	Negligible	LOW		Likely	Negligible	LOW	Project Manager	Project Cost & Schedule
PPM-4	Project Reviews (External)	The project may require additional reviews before it is approved (ATR, IEPR, Federal Agency Reviews)	Having more reviews will impact the PED costs (account 30) and may potentially delay the project. Also, additional reviews may stop the project if it is determined that the project needs to be reevaluated.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	Project Manager	Project Cost & Schedule
PPM-5	Compressed Schedule (Feasibility and PED)	The current compressed schedule may impact the quality of the delivered project.	The PDT is confident with the design for the current product. However, different approaches for the design of some of the features in the project could have been analyzed and compared to what is proposed. This would have confirmed that the team selected best alternatives.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	Geotechnical/Civil Design	Project Schedule
PPM-6	Turnover Cleanup Cost	Operation and maintenance requirements for the project have not been established.	An average cost for devegetation, rodent prevention, erosion repair, and rip rap/haul road/toe drain maintenance have been included. The extent or frequency of the required O&M is still unknown.	Likely	Marginal	MODERATE		Unlikely	Marginal	LOW	Environmental	Contract Cost
PPM-7	Additional Levee Easement	Portions of the levee alignment fall outside of current MRGCD jurisdiction.	MRGCD needs to acquire the required easement. Acquiring the necessary easement may impact the total schedule since the PPA connote be signed without an agreement to acquire the easement.	Likely	Negligible	LOW		Unlikely	Marginal	LOW	Real Estate	Project Cost & Schedule
PPM-8	1948 Authorization Scope	The current authorization scope is vague. It may have different interpretations at district, division, and HQ levels.	The PDT is comfortable that the current project meets the authorized scope. However, a final approval from division and HQ is still pending.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	District Management	Project Schedule
PPM-9	Scope Evolution	Over time the scope of the project may evolve and potentially result in a cost increase.	Future surveys and investigations will show additional design refinements which tend to increase cost. Possible refinements may include additional areas requiring rip rap protection and additional material requiring excavation and disposal.	Likely	Negligible	LOW		Likely	Negligible	LOW	Geotechnical/Civil Design	Project Cost & Schedule
PPM-10	Staffing Turnover	Throughout the duration of the project there will be inexperienced or new staff.	Its is assumed that the project will require no less than 20 years to complete. Throughout the life of the project PDT members will likely change. Adding new members to the project may reduce efficiency in the design process the will impact the schedule.	Unlikely	Marginal	LOW		Likely	Negligible	LOW	Technical Lead	Project Schedule

PPM-11	Coordination/ Communication Concerns	The project requires many parties to communicate effectively.	Effective communication among the local sponsors, the public and other federal agencies in critical to follow the proposed schedule. A break in communication may delay a task that follows the critical path for the completion of the project and therefore effect the schedule.	Unlikely	Negligible	LOW		Unlikely	Marginal	LOW	Project Manager	Project Schedule
PPM-12	Evolving Guidance	New guidance being applied retroactively to old projects.	Technical guidance is expected to change throughout the life on the project that may deem our design obsolete. The cost and schedule for the project will be significantly effected if new methods will be required to be applied to the current design.	Very Unlikely	Significant	LOW		Unlikely	Marginal	LOW	N/A	Project Cost & Schedule

	CONTRACT ACQUISITION RISKS											
CA-1	Defined Acquisition Strategy	The acquisition assumption is that this will be a design/bid/build IFB (lowest price).	Initial intent is that it will be an IFB with a possibility for change in acquisition strategy over the years. Change of strategy could impact cost and schedule.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	Contracting	Project Cost & Schedule
CA-2	Small Business Acquisition	Small business acquisition might drive up bid cost and possibly decrease competition.	The phases for this project will be small enough to be issued to small business contractors, but not large enough to issue to large construction firms. This might drive up bid cost and possibly decrease competition since not many small contractors will have the capabilities to perform the work. Also, the phases will be large enough that they would not sole source 8A..	Unlikely	Negligible	LOW		Likely	Negligible	LOW	Contracting	Project Cost & Schedule
CA-3	Additional Phases	Adding additional phases to the project will increase the required efforts by the contracting team.	Creating more phases for the project will result in the need for more design packages and additional submittal reviews. This additional effort will increase to total project cost	Unlikely	Marginal	LOW		Likely	Negligible	LOW	Project Manager	Project Cost & Schedule
CA-4	Riprap Design Subcontractor	The material to be used as riprap for erosion control will be excavated from a designated borrow area through blasting by an experienced subcontractor.	A qualified and experienced blasting subcontractor will be used for a portion of the work. Due to the limited number of qualified contractors in the area an out of state contractor is expected. This will have an effect on the bid cost.	Likely	Negligible	LOW		Unlikely	Marginal	LOW	Cost Engineering	Project Cost
CA-5	Specialized Contractor	The construction of the slurry trench required by the levee design needs to be performed by a specialized contractor.	There is a limited number of local contractors with experience in the construction of slurry trenches. Most likely an out of state contractor will be subcontracted to perform the work. This will drive up the project cost.	Likely	Marginal	MODERATE	+1.28/+1.81	Unlikely	Marginal	LOW	Cost Engineering	Project Cost
CA-6	Trucking Subcontractors	A significant portion of the work required for the construction of the new levee is the transportation of waste material.	The general contractor for the project will probably not have the capabilities of performing all of the required hauling for the job. Instead, several trucking subcontractor will be used. This will drive up the bid cost for this portion of the work. The estimate has already accounted for the hauling being performed by a subcontractor so the risk of cost increase is reduced.	Likely	Negligible	LOW		Unlikely	Marginal	LOW	Cost Engineering	Project Cost
CA-7	Specialized Equipment Contractor	The screening of spoil material required for the new levee will be performed by specialized equipment.	An equipment contractor will be required to provide the specialized screening plant. The accessibility of the needed equipment is still unclear. The need for specialized equipment has the ability to affect project duration and cost	Likely	Negligible	LOW		Unlikely	Marginal	LOW	Cost Engineering	Project Cost & Schedule
	TECHNICAL RISKS											
TL-1	Upper End Construction	There current estimate includes features with very preliminary designs that are required at the upper end of the project.	The team is not confident that the existing dam will support the flows created by a 100 year event. The design includes additional features that will stop water from flowing into the low flow conveyance channel. The design for those features will be finalized during the plans and specification phase. The costs for those features are not expected to change significantly.	Unlikely	Marginal	LOW		Likely	Negligible	LOW	Geotechnical/Civil Design	Project Cost
TL-2	Brown Arroyo Closure Structure	The design for the Brown Arroyo structure is outdated. It is based on the existing conditions at that time when it was designed.	The project currently uses a concrete structure that was designed in the early 1990's. Some of the conditions governing the design for the structure have changed. The design needs to be updated to account for present conditions. Closure gates may need to be resized	Likely	Negligible	LOW		Unlikely	Negligible	LOW	Structural Design	Project Cost
TL-3	Levee Tiebacks	The new levee must tie into a certified structure.	Due to the level of design there is limited information on how the new levee will tie into existing features. There are two areas where this must happen: the San Lorenzo Arroyo and the Socorro Arroyo. It is assumed that the levee tie ins will have similar requirements as the new engineered levee and will follow the same construction methodology.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	Geotechnical/Civil Design	Project Cost
TL-4	San Lorenzo Arroyo	Questionable assurance of risk at San Lorenzo Arroyo	The design needs to be analyzed at the San Lorenzo Arroyo since the 100yr +4 water level backs up into the arroyo. The design is not expected to change.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	Hydrology/Hydraulic Design	Project Cost
TL-5	Riprap Design	Throughout the life of the project, the profile of the river might undergo several changes which would create a need for the riprap design to be restudied.	It is anticipated that this project will be constructed in no less than 20 phases with an approximate duration of 1 year each. Through the course of the project the profile of the river will change which will require the riprap design to be updated. The updated riprap design might call for additional locations with riprap.	Unlikely	Marginal	LOW		Unlikely	Negligible	LOW	Hydrology/Hydraulic Design	Project Cost
TL-6	Overbank Lowering Elevation	The current design elevation is based on the 10 year water surface elevation of 2002 cross sections.	Channel morphology has changed since 2002. The current plan requires the excavation of 152,650 cubic yards of material. The change in morphology may require the excavation of additional material for lowering the channel overbank.	Likely	Negligible	LOW		Unlikely	Negligible	LOW	Hydrology/Hydraulic Design	Project Cost
TL-7	Levee Access	The owner might want to have access onto the levee crest for maintenance purposes at various locations of the levee alignment.	The current design does not account for any type of access onto the levee crest. Additional features to includes access ramps and turn-around can be added throughout the levee. These will generate additional cost for construction but will also create savings in spoil hauling cost.	Very Likely	Negligible	LOW		Likely	Negligible	LOW	Geotechnical/Civil Design	Project Cost
TL-8	Riprap Quantities	The current rip rap design is preliminary and subject to changes	The current quantities used for the design are conservative throughout the project. Rip rap thickness and size is subject to change in the final design. Rip rap placement areas are also subject to change.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	Hydrology/Hydraulic Design	Project Cost

TL-9	Earthwork quantities	The earthwork quantities used for the estimate are based on old survey data.	The quantities used for the cost estimate are based on data generated from surveys performed in 2007. These surveys must be verified with current existing conditions. The quantities used for the cost estimate are not expected to increase significantly.	Likely	Negligible	LOW		Unlikely	Negligible	LOW	Geotechnical/Civil Design	Project Cost
TL-10	Seepage Design	The seepage design may be conservative.	The current plan is conservative and potentially redundant with respect to seepage. The alternative incorporates both a slurry trench and toe drain. The seepage design will be analyzed during the plans and specification phase but it is not expected to change significantly.	Unlikely	Marginal	LOW		Unlikely	Negligible	LOW	Geotechnical/Civil Design	Project Cost
TL-11	Slope Stability	The side slopes of the levee at the southern end of the project may be conservative	The current levee side slopes may be conservative. Changes can be made that could increase the slopes from 3:1 to 2.5:1 at the southern end. This will decrease the cost for screening material and constructing that portion of the new levee but it will also slightly increase the cost for hauling off excess material. The change of slope is not expected to significantly impact the cost of the project.	Unlikely	Negligible	LOW		Unlikely	Negligible	LOW	Geotechnical/Civil Design	Project Cost
TL-12	Different levels of protection	There is a potential opportunity to drive down the cost of the project by providing different levels of protection between the southern and northern ends.	By balancing cut and fill we can drive down the cost since we will decrease the amount of material that will be needed to be hauled. This will provide an opportunity to decrease the hauling cost.	Unlikely	Significant	MODERATE		Likely	Negligible	LOW	Geotechnical/Civil Design	Project Cost & Schedule
	LANDS AND DAMAGES RISKS											
LD-1	Assumed Waste Area (Tiffany Basin)	The land owners of the assumed waste area at Tiffany Basin have not been identified.	The identification of the correct land owners for the assumed waste area is needed. The land that makes up this area may have clouded titles. Friendly condemnation may be required to acquire the land. The schedule of the project will be impacted if the land for this area cannot be acquired.	Unlikely	Marginal	LOW		Very Unlikely	Marginal	LOW	Real Estate	Project Cost & Schedule
LD-2	Other Federal Agencies	Various permits will be required from different government agencies	The required permits will demand coordination with different agencies. A delay with any of the required permits might have impacts on schedule.	Unlikely	Negligible	LOW		Unlikely	Negligible	LOW	Real Estate	Project Schedule
LD-3	Alternate Disposal Site	There is an opportunity for a shorter haul distance if an alternate disposal site can be identified.	The current estimate assumes a waste area located at the southern end of the project site. This is conservative in respect to haul distances. A different waste area located around the mid point of the new levee alignment will result in a potential cost savings.	Likely	Significant	HIGH		Unlikely	Marginal	LOW	Real Estate	Project Cost & Schedule
LD-4	Utility Relocation	An existing fiber optic line runs through a 16 mile span of the levee alignment.	The owner will be responsible for relocation costs of any existing utilities that may interfere with the project. It is known that the southern 16 miles of the project contain a fiber optic line that will need to be relocated. This will affect some of the final years of construction.	Unlikely	Marginal	LOW		Likely	Negligible	LOW	Construction	Project Schedule
LD-5	Railroad Embankment	The upstream design may impact the existing railroad embankment.	The current design may affect existing railroad embankment at the northern end of the project. To accomplish the proposed construction, the existing railroad embankment needs to be investigated and permission must be obtain from railroad authorities. Easements that allow the construction activities near the railroad embankment may be required.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	Real Estate	Project Schedule
LD-6	Unknown Utilities	The construction site may contain unidentified underground utilities that must be avoided.	The construction of the new levee requires excavation activities that may damage existing utilities. The construction site must be surveyed to identify existing utilities. A suitable excavation method should be implemented to avoid damaging the utilities. Since the project is in a rural area outside of city limits there is a low risk of damaging existing utilities.	Unlikely	Negligible	LOW		Unlikely	Marginal	LOW	Construction	Project Cost
LD-7	Real Estate Contingency	Real estate acquisitions may contain unforeseen risks not covered by contingency.	The real estate section has included a 30% contingency in their estimate. However, the 30% contingency might not be enough to capture all risks since some issues are still unclear.	Likely	Negligible	LOW		Very Unlikely	Negligible	LOW	Real Estate	Project Cost
LD-8	O&M LERRD	LERRD O&M needs have not been identified.	Easements for O&M work may be needed once LERRD O&M requirements are identified. At this point there isn't much information about possible requirements but this concern is likely to affect the cost of the project.	Likely	Negligible	LOW		Very Unlikely	Negligible	LOW	Construction	Project Cost

	REGULATORY AND ENVIRONMENTAL											
RE-1	HTW Concerns	The railroad ROW may contain contaminated soils.	Assessments will be required on soil to verify that it does not contain any type of hazardous materials. Previous investigation did not determine any type of concerns but the 2006 report needs to be updated to increase its validity.	Unlikely	Marginal	LOW		Unlikely	Negligible	LOW	Environmental	Project Cost
RE-2	Archeological Resources Update	Additional project assumptions may increase the chance of finding more archeological sites.	The project is assuming the usage of existing access routes, staging and disposal areas. If any of these assumptions change, additional surveys may be required to locate any possible archeological sites.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	Environmental	Project Schedule
RE-3	Unknown Cultural Resource Impacts	The proposed project might effect cultural resources downstream due to changes in stage.	The downstream end of the project site will require additional surveys to determine what the impacts will be to any existing cultural resources caused by changes in stage. A rise of less than 1 foot for the 100yr+4 design is expected..	Unlikely	Negligible	LOW		Unlikely	Marginal	LOW	Environmental	Project Cost & Schedule
RE-4	Overbank Cultural Site.	There is a possibility of losing a cultural site due to erosion at the northern end of the project.	The planned overbank excavation may cause some erosion which will affect an existing cultural site. The design will need to include slope stabilization measures to protect this area.	Likely	Negligible	LOW		Unlikely	Marginal	LOW	Geotechnical/Civil Design	Project Cost
RE-5	Pending NEPA compliance	Unknown share holder issues or mitigation.	Additional mitigation or design requirements may be necessary in order to meet NEPA compliance.	Unlikely	Marginal	LOW		Likely	Negligible	LOW	Environmental	Project Cost & Schedule
RE-6	Regulatory Litigation	Unknown designer mitigation requirements.	New mitigation requirements might include mitigation outside of project area. Mitigation assigned requirements are expected.	Likely	Negligible	LOW		Unlikely	Marginal	LOW	Environmental	Project Cost & Schedule
RE-7	Endangered Species	Endangered species act consultation has not been started. It might provide the project with additional requirements.	Mitigation requirements have not been negotiated. There is a potential increase in the 1 to 1 planting ratio. This may include real estate, plant installation and plant establishment period.	Likely	Negligible	LOW		Likely	Negligible	LOW	Environmental	Project Cost & Schedule
RE-8	Rio Grande Silvery Minnow	Diversion and care of water is needed to avoid impacts on wildlife	Rio Grande Silvery Minnow are commonly found throughout the project location. An adequate diversion and care of water plan is required to avoid negative impacts to the population. Additional measures may be required to protect the species. The species may be affected by activities for the river crossing access and installation of riprap. Care and diversion of water measures have been included as part of the estimate but requirements may change depending on existing conditions.	Likely	Negligible	LOW		Unlikely	Marginal	LOW	Environmental	Project Cost
RE-9	Southwestern Willow Flycatcher	Flycatchers are commonly found adjacent to the levee at the southern 13 miles of construction site.	The Southwestern Willow Flycatcher can be found in the southern 13 miles of the project area. There is a possibility that the population can move to other project locations. Since this is a protected species construction activities are not allowed between April 15 through August 15 when the species is present. The project area will be surveyed yearly before the start of any construction activity.	Likely	Negligible	LOW		Likely	Marginal	MODERATE	Environmental	Project Cost & Schedule
	CONSTRUCTION RISKS											
CON-1	Equipment Fuel	Fueling staging locations are not identified.	Heavy equipment will be utilized for every aspect of this project. The excavation activities require the use of a large tracked hydraulic excavator with limited mobility. It is essential that a safe and efficient refueling operation is established so that productivity rates are not affected. Additional time and cost for fueling equipment is necessary. It is felt it is likely that requirements will be such that a significant cost impact is possible. Schedule impacts would likely be negligible relative to the overall project duration.	Likely	Significant	HIGH		Likely	Negligible	LOW	Construction	Project Cost & Schedule
CON-2	Levee Construction Productivity	The productivity rate for building the new engineered levee is not conservative enough.	It is estimated that a crew consisting of a hydraulic excavator, compaction roller and water truck with required operators can accomplish the placement and compaction of the fill material at the rate of 165 cubic yards per hour. This production rate may not be conservative enough since the amount of passes required by the compaction roller to reach the desired compaction is still unknown. The actual production rate is likely to vary from estimated and changes could have a marginal impact on cost with the large amount of earthwork on the project. Schedule impact is negligible due to the ample time for work to be complete each phase.	Likely	Marginal	MODERATE		Likely	Negligible	LOW	Construction	Project Schedule
CON-3	Construction Constraints	The plan of operation requires that no more than one mile of levee is open at any given time during the construction of the new engineered levee.	Due to flood risks no more than 1 mile of levee will be open at any given time. A system will be developed so that the construction activities (excavation, hauling, processing, and the construction of the new levee) are cycled in order to satisfy the condition of only having 1 mile of levee open at any given time. Coordination of all these ongoing construction activities could lead to reduced productivity. Our current estimate is conservative for these operations, so cost impacts are unlikely and would be marginal. Schedule impacts are unlikely and are negligible.	Unlikely	Marginal	LOW		Unlikely	Negligible	LOW	Construction	Project Cost

CON-4	Crest Elevation Refinement	There is no gentle change in levee heights at structures. Instead the change in elevation is done very abruptly.	Crest elevation refinement may be implemented to create subtle transitions in elevation changes required on the levee. This crest elevation refinement may be needed for constructability purposes. Fill quantities are expected to increase and haul quantities will decrease. The refinement is likely to occur, but the offsetting cost and savings result in a negligible impact to project cost. Schedule impact is unlikely and negligible.	Likely	Negligible	LOW		Unlikely	Marginal	LOW	Geotechnical/Civil Design	Project Cost
CON-5	Construction Access (Northern End)	The current existing conditions only allow for limited access for construction at the upstream construction site.	Due to the existing conditions, construction activities are pinched between river and the railroad embankment. This potentially creates constructability issues due to the lack of working space. The construction activities at this site will require the use of smaller less productive equipment. Some loss of production is likely, but the risk is limited to a small portion of the project area. The impact costs would be negligible as are the schedule impacts.	Likely	Negligible	LOW		Unlikely	Marginal	LOW	Construction	Project Cost
CON-6	Drainage System Maintenance	Maintenance and repairs will be required on the implemented drainage system until the project is turned over to the owner.	Maintenance which includes cleaning the toe drain system and removing any debris that may block flow will be required to keep the system functioning properly, Also any risers, outlets, or clean-outs that are damaged during any construction or levee maintenance activities will need to be replaced. This cost would be absorbed by the contractor and would not be a government cost so the impact is negligible and schedule impact is negligible.	Likely	Negligible	LOW		Unlikely	Negligible	LOW	Construction	Project Cost
CON-7	Overbank Excavation Access	A temporary haul road that crosses the river is required to access the site for the channel and overbank work.	The temporary crossing will consist of an earthen ramp with 60-inch corrugated metal pipes to allow low flows to pass through the crossing to maintain a wet river channel during construction. The earthen material for the haul road will come from a borrow area, and the pipe will come from an area vendor which will be delivered to the job site. There is risk involved in temporary water diversion during road construction and a possibility of the haul road being washed out during a large runoff event. The design is based on expected events so an unlikely event would have to occur to cause a marginal impact to the cost and schedule for the project.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	Construction	Project Cost & Schedule
CON-8	Riprap Material Excavation	All of the material that will be used as riprap will be generated by drilling and blasting a designated borrow source.	The excavation of the riprap material will be accomplished by blasting. It is estimated that the rock excavation will be accomplished utilizing a 6" diameter hole, 18x12 blast hole pattern, 30 linear foot hole depth, 4 feet of sub drilling, and a 1.0 lb/cy powder factor. It is assumed that the blasting agent will be ANFO. Every aspect of the rip rap excavation is risky and includes many assumptions. Critical assumptions include : production rates for blasting, production rates for processing, swell/ processing factors and hauling distances. Actual construction activities varying enough from the estimate to create marginal cost and schedule impacts are unlikely given a reasonably conservative estimate.	Very Unlikely	Significant	LOW		Unlikely	Marginal	LOW	Construction	Project Cost & Schedule
CON-9	Trucking Operations	The hauling of spoil material to the assumed dump site will require a massive trucking operation with crews of multiple dump trucks.	A major aspect of the project is hauling off excess material not needed for the construction of the new levee to an assumed dump site. Dump trucks will constantly be traveling on the establish haul routes transporting waste material. The magnitude of the excess material that requires hauling might impact the productivity of the activity due to congestion. It is likely to occur occasionally, but the overall impact to the cost and schedule is negligible. There are long haul distances and also the possibility that the contractor will be disposing of material in a waste area elsewhere.	Likely	Negligible	LOW		Likely	Negligible	LOW	Construction	Project Cost
CON-10	Project Phasing	Project phasing needs to adhere to construction constraints for stand alone contracts.	The project requires completed construction phases that are stand alone in case funding dries up and future work is cancelled. Due to funding constraints the estimate is broken up into phases that break up the entire levee alignment into 6 segments. The 6 segments typically require 3 to 6 phases to complete and were set up to be stand alone projects. There is still some risk that full segments may not be completed if funding issues stop the project. It is unlikely that a segment would be halted, but there could be marginal costs involved to adapt the endpoint to the existing levee. Similar is true for impact to the schedule.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	Project Sponsor(s)	Project Cost & Schedule
CON-11	Changes During Construction	Scope of work may change throughout the life of the project.	Construction modifications or claims are possible throughout the life of the project. These will bring additional contracting efforts and may increase the total project cost. The work in general is not complex and is repetitive. A change or condition that would create a marginal impact to the cost and / or schedule is unlikely.	Likely	Negligible	LOW		Likely	Negligible	LOW	Construction	Project Cost & Schedule

	ESTIMATE AND SCHEDULE RISKS											
EST-1	Drainage Design Excavation	Excavated material not used for backfilling operations for the drainage system will require hauling to an off site location.	It was estimated that material not needed for backfilling operations required by the toe drain system would be spread out on the existing access roads. If the material cannot be spoiled on site additional hauling to a suitable dump site would be required. This additional hauling would have an effect on the cost for the project. It is likely that some extra material may have to be hauled, but the quantity relative to the total waste quantity make the impact negligible. Schedule is unlikely to be affected in any appreciable way.	Likely	Negligible	LOW		Unlikely	Negligible	LOW	Cost Engineering	Project Cost
EST-2	Riprap Material Source	The borrow source for the required rip rap material has not been confirmed.	It is estimated that approximately 464,117 cy of in situ material needs to be excavated to obtain the required material for the current riprap and filter blanket designs. It was assumed that the borrow source would be at an average distance of 25 miles from the project site. If an adequate borrow site cannot be identified within a 25 mile radius the bid cost is expected to be higher. Also, real estat costs for the borrow site have not been investigated. The likelihood the source will be at a different distance than estimated is likely and this would have a significant impact on the cost of the riprap. It is unlikely that this would translate into an overall schedule delay of marginal size.	Likely	Significant	HIGH		Unlikely	Marginal	LOW	Cost Engineering	Project Cost & Schedule
EST-3	Assumed Waste Area	It was assumed that the Tiffany Basin located at the south end of the project site will serve as the project disposal site	It is estimated that a total of 2,945,319 cubic yards of material not needed for the construction of the new levee will be dumped at the Tiffany Basin. Although it has not been confirmed whether the basin can serve as the disposal site, it is expected to be determined as a disposal site before the start of construction. This may be considered a conservative assumption. Having at least one known waste area is critical to the cost of the project, but it is very unlikely that material would be disposed of at an even further distance raising costs and having a significant impact on the schedule.	Very Unlikely	Critical	LOW		Very Unlikely	Significant	LOW	Cost Engineering	Project Cost & Schedule
EST-4	Levee Land Side Spoils	It is not clear how much material will be spoiled on the land side of the new engineered levee.	The cost estimate reflects that approximately 340,000 cubic yards of unused material would be spoiled on the land side of the new levee. This quantity was generated by analyzing levee heights throughout the alignment and providing average cross sections of waste material that the given height could allow. This provided a preliminary level quantity. The overall cost impact is felt to be marginal and i is likely that the preliminary quantity will change. A marginal schedule impact is possible as a result but is unlikely to occur.	Likely	Marginal	MODERATE		Unlikely	Marginal	LOW	Cost Engineering	Project Cost
EST-5	Upstream Construction Design	The project development team has not decided what the best design will be for the required level of protection at the northern end of the project.	There is still some uncertainty on the design method to be used for the required level of protection. Currently the tentative design consists of a concrete floodwall with a rolle compacted concrete and soil cement embankment. There is a possibility that a the design will change before construction. Design changes due to refinements are likely however the cost and schedule impact of these refinements is felt to be negligible due to a conservative preliminary design.	Likely	Negligible	LOW		Likely	Negligible	LOW	Cost Engineering	Project Cost & Schedule
EST-6	Slurry Trench Design	The slurry trench design may require a wider cross section.	A 2 FT wide trench with a depth that is dependent on the levee height was assumed for the current slurry trench design. This design might be revised and require a wider trench. Increasing the width of the trench will increase the total volume of material to be excavated and amount of bentonite slurry that is needed. Because the slurry trench extends through the majority of the levee cost impact is considered marginal and refinement of the dimensions is likely. The change creating a marginal impact to the schedule is unlikely.	Likely	Marginal	MODERATE		Unlikely	Marginal	LOW	Cost Engineering	Project Cost
EST-7	Fill Material Properties	Material properties might not be suitable for the construction of an engineered levee.	It was estimated that the required fill for the engineered levee will be obtained from a borrow source (existing spoil bank levee) with limited testing. If a percentage of this material is not suitable for the construction for the new levee, then a new borrow source would need to be identified. Having a different borrow source will have a significant impact on the total project cost. Confidence in the quality of the existing material makes this very unlikely to occur but the impact would be critical. Similar is true for schedule impact because of slow production from borrow haul.	Very Unlikely	Critical	LOW		Very Unlikely	Significant	LOW	Cost Engineering	Project Cost

EST-8	Construction Duration	Assumptions for developing the cost estimate is based on 20 years of construction.	The construction duration was developed considering the estimated level of annual funding. It is estimated that there will be a consistent funding stream of $12 million per year. If the project takes longer than 20 years to be finalized, then escalation will add a significant cost to the estimate. Drastic changes to this would have significant cost impact, but the likelihood of this changing is very unlikely because the project is programmed in this manner. The same is true for impact caused to the schedule.	Very Unlikely	Significant	LOW		Very Unlikely	Significant	LOW	Cost Engineering	Project Cost & Schedule
	ECONOMICS RISKS											
FL-1	Construction Period	A long project duration requires a higher escalation cost.	The current plan is a 20 year construction period at an approximated rate of 12.2 million per year. A longer construction duration increases cost since the escalation percentage increases over the years. A higher project cost can decrease the B/C ration which can stop the project. Drastic changes to this would have significant cost impact, but the likelihood of this changing is very unlikely because the project is programmed in this manner. The same is true for impact caused to the schedule.	Very Unlikely	Significant	LOW		Very Unlikely	Significant	LOW	Project Manager	Project Cost & Schedule
FL-2	Locally Preferred Plan	Sponsor might want a different plan.	We do not anticipate that the sponsor would want a different option than the tentative selected plan provided by the Army Corps of Engineers. Changing the selected plan would have marginal schedule and cost impact, but is unlikely due to the close coordination and review done by the Corps and sponsor.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	Project Sponsor(s)	Project Cost & Schedule
FL-3	Future Fuel Costs	The cost for fuel will fluctuate during the life of the project.	Fuel plays a vital role in the majority of the construction activities for the project. Its is expected that throughout the life of the project the cost for fuel will fluctuate. Still, it is assumed that escalation will account for some of the increase in cost. This results in a likely occurrence and a marginal cost impact because of the large amount of equipment used for this project. Schedule impact is unlikely and negligible as this will not affect production.	Likely	Marginal	MODERATE		Unlikely	Negligible	LOW	Cost Engineering	Project Cost
FL-4	Increasing PVC Costs	The cost of pvc that is required for the drainage design is subject to change throughout the course of the project.	Plastic construction products such as PVC are petroleum based products that are subject to cost fluctuations throughout the years. The toe drain system for the project requires PVC pipe which will fluctuate in cost over the years. Fluctuations are likely, but the overall cost impact to the project is negligible as the pvc material cost is small in relation to the whole project. Impact to the schedule is unlikely and would be negligible as this is a price increase.	Likely	Negligible	LOW		Unlikely	Marginal	LOW	Cost Engineering	Project Cost
FL-5	Fluctuating Cement Cost	The cost for cement will vary throughout the life of the project.	Due to changes in demand and other factors the cost for cement has fluctuated in the past. It is expected that the cost of cement will vary throughout the construction of the project. Fluctuation are likely to occur throughout the project, but the overall cost is negligible as cement constitutes only a small portion of the project cost. Schedule would not be affected by price changes.	Likely	Negligible	LOW		Unlikely	Negligible	LOW	Cost Engineering	Project Cost
FL-6	Varying Steel Prices	The cost for reinforcing steel has been varying significantly in the past years.	Steel production is energy intensive which makes it prone to fluctuations in cost. The cost for the steel is expected to rise throughout the life of the project. Although likely the impact to the project cost and schedule is negligible as steel is not used in significant amounts on this project.	Likely	Negligible	LOW		Unlikely	Negligible	LOW	Cost Engineering	Project Cost
FL-7	Employee Salaries	The current inflation index could be unrealistic with salary rates.	Throughout the duration of the project employee salaries are expected to change. If the inflation index continues to rise then employee salaries might reach a level that could impact the total project cost. Overall project cost increases in time are considered in escalation applied therefore it is unlikely that pay would change beyond what is assumed in the estimate. The impact to project cost and schedule is negligible.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	Cost Engineering	Project Cost

	External Risks (External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influenc											
PR-1	Natural Disasters	Extreme weather events may effect the construction of the project.	The project location is prone to extreme weather events tha may impact the schedule for the project. Flash floods and wild fires are some of these events that may cause construction delays and increase the cost for the project. Potential exists for significant cost and schedule impact, bu the likelihood of such a catastrophic event is very unlikely. Estimate and design assume that the levee is never permitted to be breached during the entire project. Temporary measures must be in place where levee construction is taking place.	Very Unlikely	Significant	LOW		Very Unlikely	Significant	LOW	N/A	Project Cost & Schedule
PR-2	Funding Issues	The project requires a minimum of 20 years of an uninterrupted funding stream.	Due to the long duration of the project there is some risk that sponsors or conges will not be able to meet financial obligations to fund the construction of the project. If the funding stream is not consistent, the total project cost is expected to increase. Based on current information it is unlikely that the funding obligations will not be met as they are relatively small amounts of money. The impact to cost and schedule from the disruptions would be marginal.	Unlikely	Significant	MODERATE		Unlikely	Significant	MODERATE	Project Sponsor(s)	Project Cost & Schedule
PR-3	Internal Resource Availability	Other district priorities could impact design schedule.	Issues for meeting the design schedule may surface depending on different USACE District priorities. Team member might be working on various projects and some may take precedence. Understaffing of the project could have a marginal impact on cost and schedule, but it is unlikely that District priorities would change in such a way as to create this situation.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	District Management	Project Schedule
PR-4	Market Conditions/ Bid Competition	Market conditions will be different every year that a new phase is awarded.	The cost for constructing the levee will depend on existing market trends. Some years may bring more aggressive bidding climates which will lower the overall project costs. Others will offer a less aggressive climate which may drive up the costs. It is likely given the long duration of the project that overall economic climate will vary and cost impact will be marginal. A marginal impact to the schedule is possible, but unlikely as most of the risk is associated with cost to do the work as opposed to speed of construction.	Likely	Marginal	MODERATE		Unlikely	Marginal	LOW	Cost Engineering	Project Cost
PR-5	Weather	Project operations may be delayed due to unfavorable weather conditions.	The estimate and construction schedule do not account for any weather delays. Delays caused by winter months and rain event are expected throughout the project site. These are expected to affect the project cost and schedule. Some weather days are likely, but the local project climate is very conducive to year round construction. Overall cost or schedule impact is negligible.	Likely	Negligible	LOW		Likely	Negligible	LOW	Construction	Project Cost & Schedule
PR-6	Labor Resources	Local area does not have labor resources to construct the project	The project requires a labor force that is not commonly found in the local area. This may create labor shortages and the need for subsistence and per diem allowances for various labor elements. This is likely to impact the cost of the project and if a majority of the workforce is from out of area the impact could be significant. The impact to the schedule is negligible and unlikely as this is primarily a cost of the labor force and not related to productivity of the labor force.	Likely	Significant	HIGH		Unlikely	Marginal	LOW	Construction	Project Cost

*Likelihood, Impact, and Risk Level to be verified through market research and analysis (conducted by cost engineer).

1. Risk/Opportunity identified with reference to the Risk Identification Checklist and through deliberation and study of the PDT.
2. Discussions and Concerns elaborates on Risk/Opportunity Events and includes any assumptions or findings (should contain information pertinent to eventual study and analysis of event's impact to project).
3. Likelihood is a measure of the probability of the event occurring -**Very Unlikely**, **Unlikely**, **Moderately Likely**, **Likely**, **Very Likely.** The likelihood of the event will be the same for both Cost and Schedule, regardless of impact.
4. Impact is a measure of the event's effect on project objectives with relation to scope, cost, and/or schedule -**Negligible**, **Marginal**, **Significant**, **Critical**, or **Crisis.** Impacts on Project Cost may vary in severity from impacts on Project Schedule.
5. Risk Level is the resultant of Likelihood and Impac**Low**, **Moderate**, or **High**. Refer to the matrix located at top of page.
6. Variance Distribution refers to the behavior of the individual risk item with respect to its potential effects on Project Cost and Schedule. For example, an item with clearly defined parameters and a solid most likely scenario would probably follow a triangular or normal distribution. A risk item for which the PDT has little data or probability of modeling with respect to effects on cost or schedule (i.e. "anyone's guess") would probably follow a uniform or discrete uniform distribution.
7. The responsibility or POC is the entity responsible as the Subject Matter Expert (SME) for action, monitoring, or information on the PDT for the identified risk or opportunity.
8. Correlation recognizes those risk events that may be related to one another. Care should be given to ensure the risks are handled correctly without a "double counting."
9. Affected Project Component identifies the specific item of the project to which the risk directly or strongly correlates.
10. Project Implications identifies whether or not the risk item affects project cost, project schedule, or both. The PDT is responsible for conducting studies for both Project Cost and for Project Schedule.
11. Results of the risk identification process are studied and further developed by the Cost Engineer, then analyzed through the Monte Carlo Analysis Method for Cost (Contingency) and Schedule (Escalation) Growth.

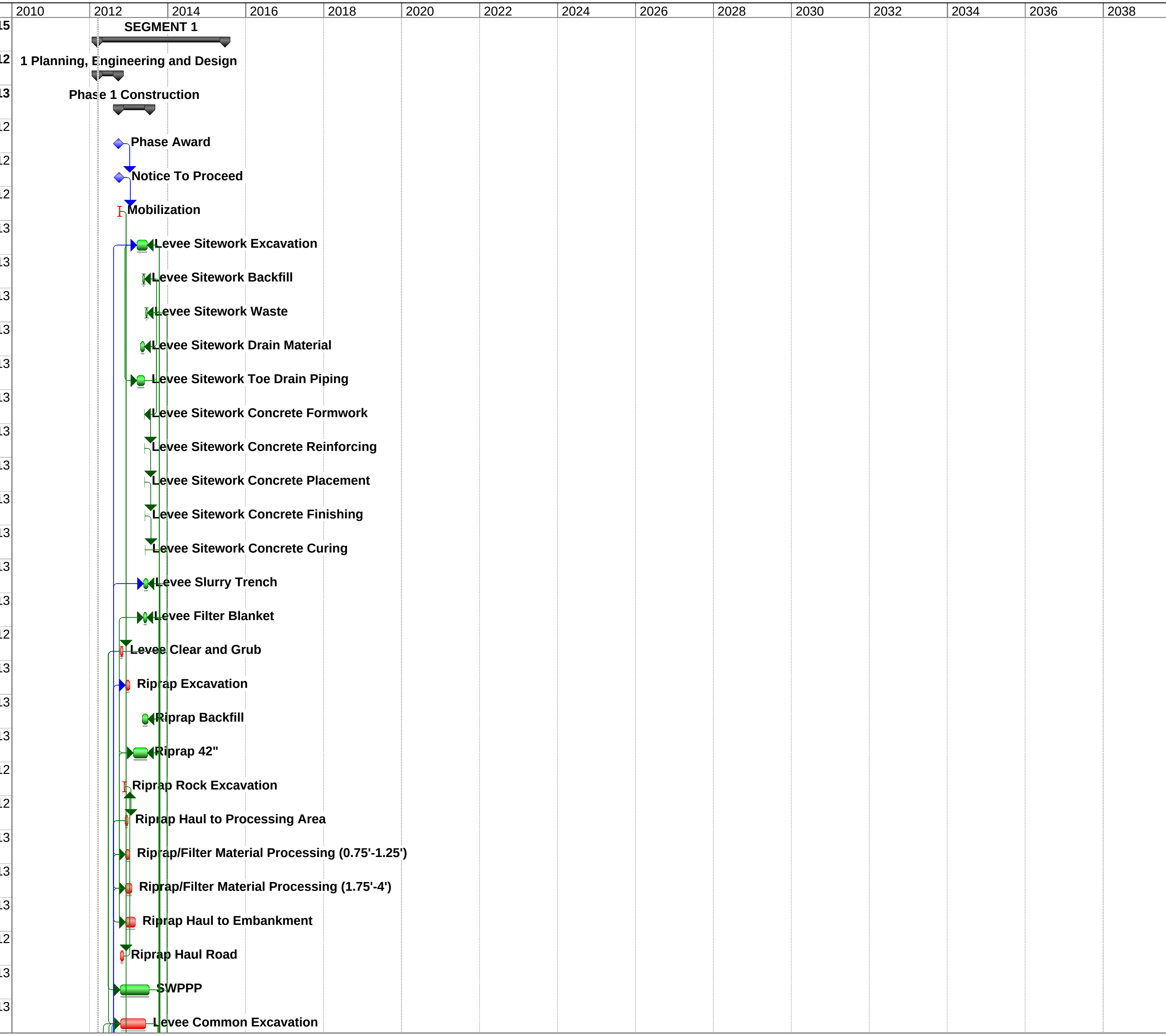
San Acacia Levee Improvements
Phasing Features Matrix

	SEGMENT 1			SEGMENT 2				SEGMENT 3	SEGMENT 4	
	PHASE 1 645+00-800+00	PHASE 2 800+00-950+00	PHASE 3 950+00-1030+00	PHASE 4 145+00-262+00	PHASE 5 262+00-319+00	PHASE 6 319+00-479+00	PHASE 7 479+00-640+00	PHASE 8 68+00-145+00 SADD Improve	PHASE 9 1030+00-1134+00	PHASE 10 1134+00-1240+00
Description										
Channel Construction										
Clearing and Grubbing								X		
Excavation, Common								X		
Waste								X		
Haul Road								X		
Levee Construction										
Drainage										
Drain Material	X	X	X	X	X	X	X	X	X	X
Piping, Toe Drain	X	X	X	X	X	X	X	X	X	X
Care and Diversion of Water										
Portable Cofferdam	X	X	X	X	X	X	X	X	X	X
Dewatering	X		X		X			X		
Associated General Items										
Site Work										
Slurry Trench	X	X	X	X	X	X	X	X	X	X
Filter Blanket	X	X	X	X	X	X	X	X	X	X
Clearing and Grubbing	X	X	X	X	X	X	X	X	X	X
Riprap										
Excavation, Common [Riprap]	X		X	X	X			X	X	X
Backfill [Riprap]	X			X	X				X	X
Haul Excess Excavation Waste	X		X	X				X	X	X
9 Inch (0.75') Thick Riprap										X
15 Inch (1.25') Thick Riprap										
21 Inch (1.75') Thick Riprap			X						X	
30 Inch (2.50') Thick Riprap			X							
42 Inch (3.50') Thick Riprap	X							X		
48 Inch (4.00') Thick Riprap					X					
Launchable Riprap			X		X			X		
Rock Excavation	X	X	X	X	X	X	X	X	X	X
Riprap Processing	X	X	X	X	X	X	X	X	X	X
Levee Earthwork Alt. A (100yr + 4ft)										
Excavation, Common (Haul to Processing Stockpile includes quantity	X	X	X	X	X	X	X	X	X	X
Screening Operation	X	X	X	X	X	X	X	X	X	X
Levee Construction	X	X	X	X	X	X	X	X	X	X
Haul spoils to land side of Levee	X	X	X	X	X	X	X	X	X	X
Sta. 80+00 to 325+00 Hauling				X	X			X		
Sta. 325+00 to 575+00 Hauling						X	X			
Sta. 575+00 to 825+00 Hauling	X	X				X	X			
Sta. 825+00 to 985+00 Hauling		X	X							
Sta. 985+00 to 1230+00 Hauling			X						X	X
Sta. 1230+00 to 1480+00 Hauling										X
Sta. 1480+00 to 1730+00 Hauling										
Sta. 1730+00 to 1980+00 Hauling										
Sta. 1980+00 to 2263+97 Hauling										
Upstream Construction										
Soil Cement								X		
Roller Compacted Concrete Armoring								X		
Floodwall								X		
Irrigation Bridge Box Cover								X		
Culvert Extensions								X		
Mob / Demob Batching Plant								X		
Brown Arroyo										
Flood Wall Structure			X							
Other Items										
Levee Tie Back, San Lorenzo Arroyo				X				X		
Levee Tie Back, Socorro Arroyo	X						X			
Utility Relocation										

San Acacia Levee Improvements
Phasing Features Matrix

		SEGMENT 5					SEGMENT 6			
Description	**PHASE 11** 1240+00-1355+00	**PHASE 12** 1355+00-1432+00	**PHASE 13** 1432+00-1539+00	**PHASE 14** 1539+00-1643+00	**PHASE 15** 1643+00-1750+00	**PHASE 16** 1750+00-1910+00	**PHASE 17** 1910+00-2030+00	**PHASE 18** 2030+00-2122+00	**PHASE 19** 2122+00-2210+00	**PHASE 20** 2210+00-2271+00
Channel Construction										
Clearing and Grubbing										
Excavation, Common										
Waste										
Haul Road										
Levee Construction										
Drainage										
Drain Material	X	X	X	X	X	X	X	X	X	X
Piping, Toe Drain	X	X	X	X	X	X	X	X	X	X
Care and Diversion of Water										
Portable Cofferdam	X	X	X	X	X	X	X	X	X	X
Dewatering										X
Associated General Items										
Site Work										
Slurry Trench	X	X	X	X	X	X	X	X	X	X
Filter Blanket	X	X	X	X	X	X	X	X	X	X
Clearing and Grubbing	X	X	X	X	X	X	X	X	X	X
Riprap										
Excavation, Common [Riprap]	X	X		X		X				X
Backfill [Riprap]	X	X		X		X				X
Haul Excess Excavation Waste	X	X		X		X				X
9 Inch (0.75') Thick Riprap	X	X		X		X				
15 Inch (1.25') Thick Riprap										X
21 Inch (1.75') Thick Riprap										
30 Inch (2.50') Thick Riprap										
42 Inch (3.50') Thick Riprap										
48 Inch (4.00') Thick Riprap										
Launchable Riprap										X
Rock Excavation	X	X	X	X	X	X	X	X	X	X
Riprap Processing	X	X	X	X	X	X	X	X	X	X
Levee Earthwork Alt. A (100yr + 4ft)										
Excavation, Common (Haul to Processing Stockpile includes quantity	X	X	X	X	X	X	X	X	X	X
Screening Operation	X	X	X	X	X	X	X	X	X	X
Levee Construction	X	X	X	X	X	X	X	X	X	X
Haul spoils to land side of Levee	X								X	
Sta. 80+00 to 325+00 Hauling										
Sta. 325+00 to 575+00 Hauling										
Sta. 575+00 to 825+00 Hauling										
Sta. 825+00 to 985+00 Hauling										
Sta. 985+00 to 1230+00 Hauling										
Sta. 1230+00 to 1480+00 Hauling	X	X	X							
Sta. 1480+00 to 1730+00 Hauling			X	X	X					
Sta. 1730+00 to 1980+00 Hauling					X	X	X			
Sta. 1980+00 to 2263+97 Hauling							X	X	X	
Upstream Construction										
Soil Cement										
Roller Compacted Concrete Armoring										
Floodwall										
Irrigation Bridge Box Cover										
Culvert Extensions										
Mob / Demob Batching Plant										
Brown Arroyo										
Flood Wall Structure										
Other Items										
Levee Tie Back, San Lorenzo Arroyo										
Levee Tie Back, Socorro Arroyo										
Utility Relocation		X								

ID	Task Name	Duration	Early Start	Early Finish
1	**SEGMENT 1**	**825 days**	**Tue 3/13/12**	**Tue 6/23/15**
2	**Phase 1 Planning, Engineering and Design**	**140 days**	**Tue 3/13/12**	**Thu 9/27/12**
4	**Phase 1 Construction**	**202 days**	**Fri 9/28/12**	**Fri 7/19/13**
5	Phase Award	0 days	Fri 9/28/12	Fri 9/28/12
6	Notice To Proceed	0 days	Thu 10/4/12	Thu 10/4/12
7	Mobilization	5 days	Fri 10/5/12	Fri 10/12/12
8	Levee Sitework Excavation	68 days	Wed 3/20/13	Mon 6/24/13
9	Levee Sitework Backfill	13 days	Mon 5/13/13	Thu 5/30/13
10	Levee Sitework Waste	11 days	Mon 6/10/13	Mon 6/24/13
11	Levee Sitework Drain Material	27 days	Mon 4/22/13	Wed 5/29/13
12	Levee Sitework Toe Drain Piping	49 days	Thu 3/21/13	Wed 5/29/13
13	Levee Sitework Concrete Formwork	2 days	Tue 5/28/13	Wed 5/29/13
14	Levee Sitework Concrete Reinforcing	1 day	Thu 5/30/13	Thu 5/30/13
15	Levee Sitework Concrete Placement	1 day	Fri 5/31/13	Fri 5/31/13
16	Levee Sitework Concrete Finishing	1 day	Mon 6/3/13	Mon 6/3/13
17	Levee Sitework Concrete Curing	1 day	Tue 6/4/13	Tue 6/4/13
18	Levee Slurry Trench	28 days	Wed 5/22/13	Mon 7/1/13
19	Levee Filter Blanket	24 days	Mon 5/20/13	Fri 6/21/13
20	Levee Clear and Grub	19 days	Mon 10/15/12	Thu 11/8/12
21	Riprap Excavation	27 days	Tue 12/4/12	Fri 1/11/13
22	Riprap Backfill	36 days	Fri 5/10/13	Mon 7/1/13
23	Riprap 42"	92 days	Fri 2/15/13	Wed 6/26/13
24	Riprap Rock Excavation	6 days	Mon 11/19/12	Tue 11/27/12
25	Riprap Haul to Processing Area	20 days	Wed 11/28/12	Wed 12/26/12
26	Riprap/Filter Material Processing (0.75'-1.25')	28 days	Mon 12/3/12	Fri 1/11/13
27	Riprap/Filter Material Processing (1.75'-4')	41 days	Mon 12/3/12	Thu 1/31/13
28	Riprap Haul to Embankment	61 days	Tue 12/4/12	Mon 3/4/13
29	Riprap Haul Road	24 days	Mon 10/15/12	Fri 11/16/12
30	SWPPP	187 days	Mon 10/15/12	Fri 7/12/13
31	Levee Common Excavation	161 days	Thu 10/18/12	Mon 6/10/13



Project: San Acacia Alt A Base + 4
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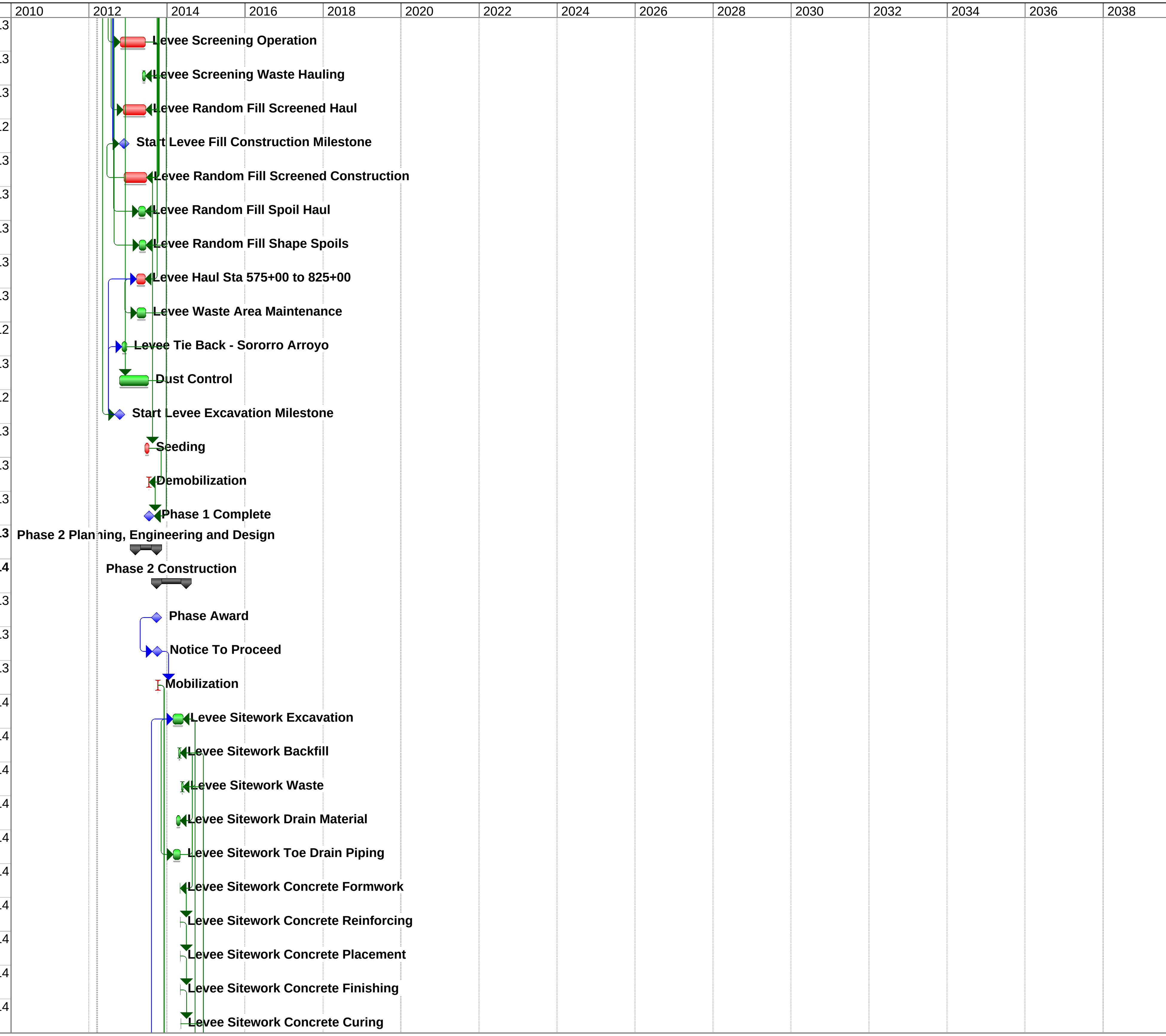
Task		Split		Milestone		Project Summary		External Milestone	
Critical Task		Progress		Summary		External Tasks		Deadline	

ID	Task Name	Duration	Early Start	Early Finish
32	Levee Screening Operation	161 days	Tue 10/23/12	Thu 6/13/13
33	Levee Screening Waste Hauling	20 days	Fri 5/17/13	Fri 6/14/13
34	Levee Random Fill Screened Haul	145 days	Mon 11/19/12	Mon 6/17/13
35	Start Levee Fill Construction Milestone	0 days	Tue 11/27/12	Tue 11/27/12
36	Levee Random Fill Screened Construction	145 days	Tue 11/27/12	Mon 6/24/13
37	Levee Random Fill Spoil Haul	44 days	Fri 4/12/13	Thu 6/13/13
38	Levee Random Fill Shape Spoils	44 days	Wed 4/17/13	Tue 6/18/13
39	Levee Haul Sta 575+00 to 825+00	57 days	Mon 3/25/13	Wed 6/12/13
40	Levee Waste Area Maintenance	57 days	Thu 3/28/13	Mon 6/17/13
41	Levee Tie Back - Sororro Arroyo	30 days	Thu 11/8/12	Fri 12/21/12
42	Dust Control	187 days	Mon 10/15/12	Fri 7/12/13
43	Start Levee Excavation Milestone	0 days	Thu 10/18/12	Thu 10/18/12
44	Seeding	26 days	Tue 6/11/13	Wed 7/17/13
45	Demobilization	5 days	Mon 7/15/13	Fri 7/19/13
46	Phase 1 Complete	0 days	Fri 7/19/13	Fri 7/19/13
47	**Phase 2 Planning, Engineering and Design**	**140 days**	**Wed 3/13/13**	**Fri 9/27/13**
49	**Phase 2 Construction**	**190 days**	**Sat 9/28/13**	**Wed 7/2/14**
50	Phase Award	0 days	Sat 9/28/13	Sat 9/28/13
51	Notice To Proceed	0 days	Fri 10/4/13	Fri 10/4/13
52	Mobilization	5 days	Mon 10/7/13	Fri 10/11/13
53	Levee Sitework Excavation	66 days	Fri 2/28/14	Mon 6/2/14
54	Levee Sitework Backfill	13 days	Mon 4/21/14	Wed 5/7/14
55	Levee Sitework Waste	10 days	Mon 5/19/14	Mon 6/2/14
56	Levee Sitework Drain Material	26 days	Tue 4/1/14	Tue 5/6/14
57	Levee Sitework Toe Drain Piping	47 days	Mon 3/3/14	Tue 5/6/14
58	Levee Sitework Concrete Formwork	2 days	Mon 5/5/14	Tue 5/6/14
59	Levee Sitework Concrete Reinforcing	1 day	Wed 5/7/14	Wed 5/7/14
60	Levee Sitework Concrete Placement	1 day	Thu 5/8/14	Thu 5/8/14
61	Levee Sitework Concrete Finishing	1 day	Fri 5/9/14	Fri 5/9/14
62	Levee Sitework Concrete Curing	1 day	Mon 5/12/14	Mon 5/12/14



Project: San Acacia Alt A Base + 4
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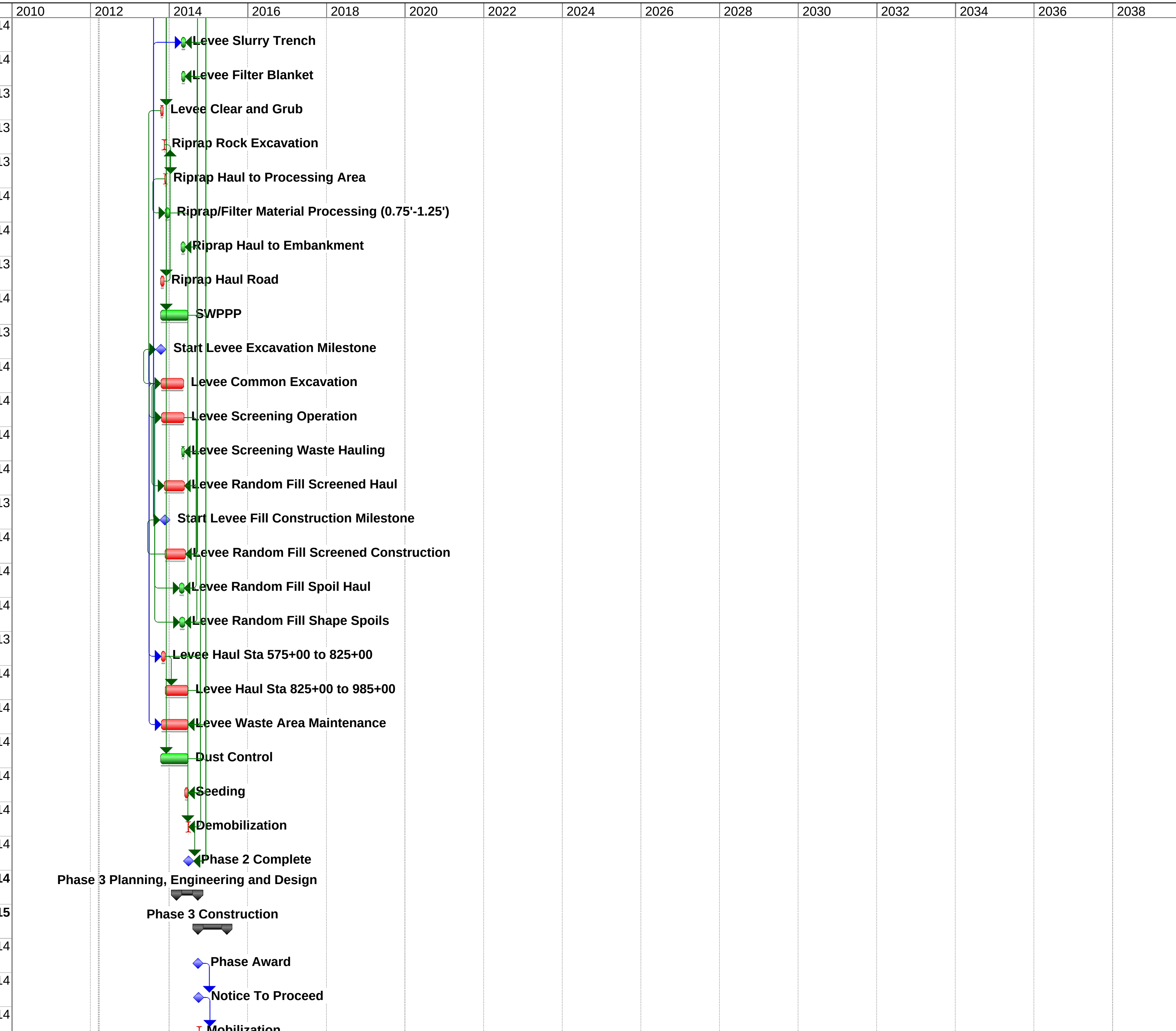
Task | Split | Milestone | Project Summary | External Milestone
Critical Task | Progress | Summary | External Tasks | Deadline

ID	Task Name	Duration	Early Start	Early Finish
63	Levee Slurry Trench	26 days	Fri 4/25/14	Mon 6/2/14
64	Levee Filter Blanket	24 days	Mon 4/28/14	Fri 5/30/14
65	Levee Clear and Grub	18 days	Tue 10/15/13	Thu 11/7/13
66	Riprap Rock Excavation	3 days	Mon 11/18/13	Wed 11/20/13
67	Riprap Haul to Processing Area	9 days	Thu 11/21/13	Wed 12/4/13
68	Riprap/Filter Material Processing (0.75'-1.25')	27 days	Tue 11/26/13	Mon 1/6/14
69	Riprap Haul to Embankment	27 days	Wed 4/23/14	Fri 5/30/14
70	Riprap Haul Road	23 days	Tue 10/15/13	Fri 11/15/13
71	SWPPP	177 days	Tue 10/15/13	Fri 6/27/14
72	Start Levee Excavation Milestone	0 days	Fri 10/18/13	Fri 10/18/13
73	Levee Common Excavation	145 days	Fri 10/18/13	Fri 5/16/14
74	Levee Screening Operation	145 days	Wed 10/23/13	Wed 5/21/14
75	Levee Screening Waste Hauling	18 days	Tue 4/29/14	Thu 5/22/14
76	Levee Random Fill Screened Haul	130 days	Mon 11/18/13	Fri 5/23/14
77	Start Levee Fill Construction Milestone	0 days	Mon 11/25/13	Mon 11/25/13
78	Levee Random Fill Screened Construction	130 days	Mon 11/25/13	Mon 6/2/14
79	Levee Random Fill Spoil Haul	33 days	Mon 4/7/14	Wed 5/21/14
80	Levee Random Fill Shape Spoils	33 days	Thu 4/10/14	Tue 5/27/14
81	Levee Haul Sta 575+00 to 825+00	26 days	Mon 10/21/13	Tue 11/26/13
82	Levee Haul Sta 825+00 to 985+00	147 days	Wed 11/27/13	Fri 6/27/14
83	Levee Waste Area Maintenance	172 days	Tue 10/22/13	Fri 6/27/14
84	Dust Control	177 days	Tue 10/15/13	Fri 6/27/14
85	Seeding	25 days	Tue 5/27/14	Mon 6/30/14
86	Demobilization	5 days	Thu 6/26/14	Wed 7/2/14
87	Phase 2 Complete	0 days	Wed 7/2/14	Wed 7/2/14
88	**Phase 3 Planning, Engineering and Design**	**140 days**	**Wed 3/12/14**	**Fri 9/26/14**
90	**Phase 3 Construction**	**184 days**	**Sun 9/28/14**	**Tue 6/23/15**
91	Phase Award	0 days	Sun 9/28/14	Sun 9/28/14
92	Notice To Proceed	0 days	Fri 10/3/14	Fri 10/3/14
93	Mobilization	5 days	Mon 10/6/14	Fri 10/10/14



Project: San Acacia Alt A Base + 4
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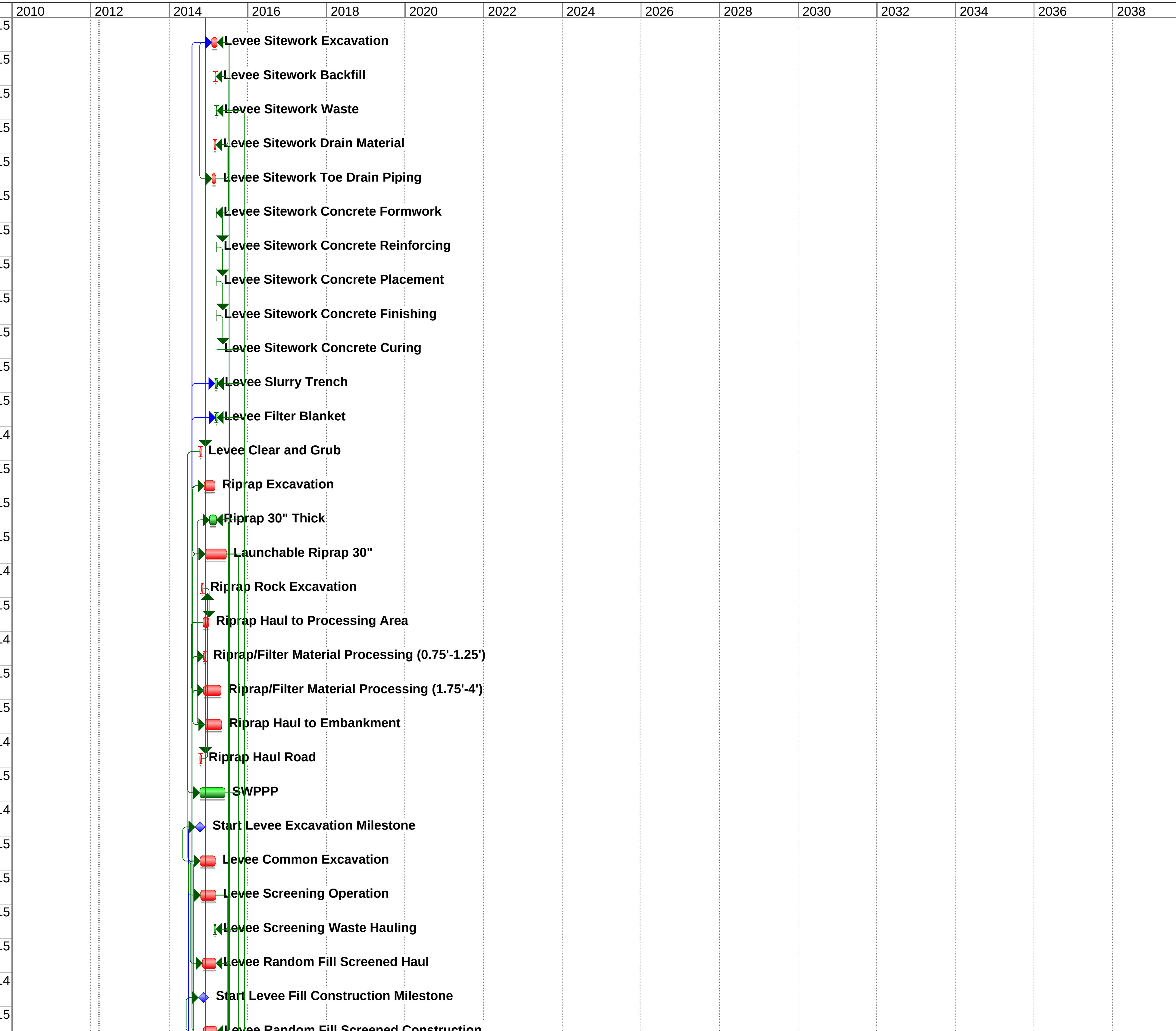
Task | Split | Milestone | Project Summary | External Milestone
Critical Task | Progress | Summary | External Tasks | Deadline

ID	Task Name	Duration	Early Start	Early Finish
94	Levee Sitework Excavation	35 days	Mon 2/2/15	Mon 3/23/15
95	Levee Sitework Backfill	7 days	Thu 3/5/15	Fri 3/13/15
96	Levee Sitework Waste	6 days	Mon 3/16/15	Mon 3/23/15
97	Levee Sitework Drain Material	14 days	Mon 2/23/15	Thu 3/12/15
98	Levee Sitework Toe Drain Piping	25 days	Wed 2/4/15	Wed 3/11/15
99	Levee Sitework Concrete Formwork	1 day	Tue 3/17/15	Tue 3/17/15
100	Levee Sitework Concrete Reinforcing	1 day	Wed 3/18/15	Wed 3/18/15
101	Levee Sitework Concrete Placement	1 day	Thu 3/19/15	Thu 3/19/15
102	Levee Sitework Concrete Finishing	1 day	Fri 3/20/15	Fri 3/20/15
103	Levee Sitework Concrete Curing	1 day	Mon 3/23/15	Mon 3/23/15
104	Levee Slurry Trench	17 days	Thu 3/5/15	Fri 3/27/15
105	Levee Filter Blanket	13 days	Mon 3/9/15	Wed 3/25/15
106	Levee Clear and Grub	10 days	Tue 10/14/14	Mon 10/27/14
107	Riprap Excavation	67 days	Mon 11/24/14	Tue 3/3/15
108	Riprap 30" Thick	45 days	Mon 1/12/15	Tue 3/17/15
109	Launchable Riprap 30"	137 days	Tue 12/2/14	Wed 6/17/15
110	Riprap Rock Excavation	9 days	Thu 10/30/14	Wed 11/12/14
111	Riprap Haul to Processing Area	35 days	Thu 11/13/14	Mon 1/5/15
112	Riprap/Filter Material Processing (0.75'-1.25')	15 days	Tue 11/18/14	Tue 12/9/14
113	Riprap/Filter Material Processing (1.75'-4')	111 days	Tue 11/18/14	Tue 4/28/15
114	Riprap Haul to Embankment	107 days	Tue 12/2/14	Tue 5/5/15
115	Riprap Haul Road	12 days	Tue 10/14/14	Wed 10/29/14
116	SWPPP	162 days	Tue 10/14/14	Fri 6/5/15
117	Start Levee Excavation Milestone	0 days	Fri 10/17/14	Fri 10/17/14
118	Levee Common Excavation	95 days	Fri 10/17/14	Fri 3/6/15
119	Levee Screening Operation	95 days	Wed 10/22/14	Wed 3/11/15
120	Levee Screening Waste Hauling	12 days	Wed 2/25/15	Thu 3/12/15
121	Levee Random Fill Screened Haul	85 days	Fri 11/7/14	Fri 3/13/15
122	Start Levee Fill Construction Milestone	0 days	Mon 11/17/14	Mon 11/17/14
123	Levee Random Fill Screened Construction	85 days	Mon 11/17/14	Fri 3/20/15



Project: San Acacia Alt A Base + 4
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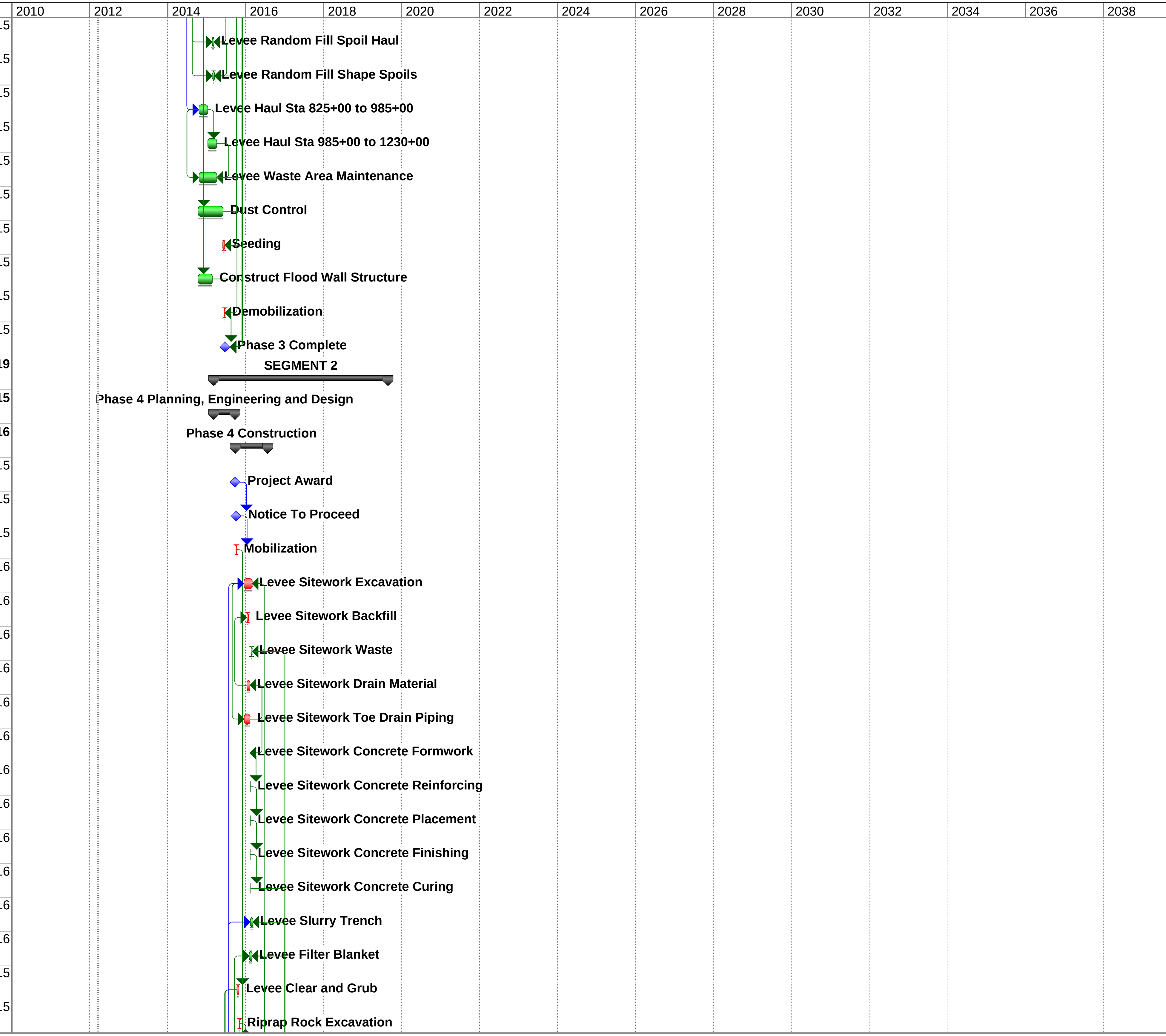
Task	Split	Milestone	Project Summary	External Milestone
Critical Task	Progress	Summary	External Tasks	Deadline

ID	Task Name	Duration	Early Start	Early Finish
124	Levee Random Fill Spoil Haul	12 days	Tue 2/24/15	Wed 3/11/15
125	Levee Random Fill Shape Spoils	12 days	Fri 2/27/15	Mon 3/16/15
126	Levee Haul Sta 825+00 to 985+00	55 days	Wed 10/22/14	Mon 1/12/15
127	Levee Haul Sta 985+00 to 1230+00	58 days	Tue 1/13/15	Mon 4/6/15
128	Levee Waste Area Maintenance	113 days	Thu 10/23/14	Tue 4/7/15
129	Dust Control	162 days	Tue 10/14/14	Fri 6/5/15
130	Seeding	14 days	Tue 6/2/15	Fri 6/19/15
131	Construct Flood Wall Structure	90 days	Tue 10/14/14	Tue 2/24/15
132	Demobilization	5 days	Wed 6/17/15	Tue 6/23/15
133	Phase 3 Complete	0 days	Tue 6/23/15	Tue 6/23/15
134	**SEGMENT 2**	**1124 days**	**Wed 3/11/15**	**Wed 8/28/19**
135	**Phase 4 Planning, Engineering and Design**	**140 days**	**Wed 3/11/15**	**Fri 9/25/15**
137	**Phase 4 Construction**	**209 days**	**Mon 9/28/15**	**Wed 7/27/16**
138	Project Award	0 days	Mon 9/28/15	Mon 9/28/15
139	Notice To Proceed	0 days	Fri 10/2/15	Fri 10/2/15
140	Mobilization	5 days	Mon 10/5/15	Fri 10/9/15
141	Levee Sitework Excavation	51 days	Fri 12/18/15	Thu 3/3/16
142	Levee Sitework Backfill	10 days	Fri 1/15/16	Fri 1/29/16
143	Levee Sitework Waste	8 days	Tue 2/23/16	Thu 3/3/16
144	Levee Sitework Drain Material	21 days	Thu 1/14/16	Fri 2/12/16
145	Levee Sitework Toe Drain Piping	37 days	Mon 12/21/15	Fri 2/12/16
146	Levee Sitework Concrete Formwork	2 days	Thu 2/11/16	Fri 2/12/16
147	Levee Sitework Concrete Reinforcing	1 day	Tue 2/16/16	Tue 2/16/16
148	Levee Sitework Concrete Placement	1 day	Wed 2/17/16	Wed 2/17/16
149	Levee Sitework Concrete Finishing	1 day	Thu 2/18/16	Thu 2/18/16
150	Levee Sitework Concrete Curing	1 day	Fri 2/19/16	Fri 2/19/16
151	Levee Slurry Trench	18 days	Tue 2/16/16	Thu 3/10/16
152	Levee Filter Blanket	18 days	Fri 2/5/16	Wed 3/2/16
153	Levee Clear and Grub	14 days	Tue 10/13/15	Fri 10/30/15
154	Riprap Rock Excavation	2 days	Fri 11/6/15	Mon 11/9/15



Project: San Acacia Alt A Base + 4
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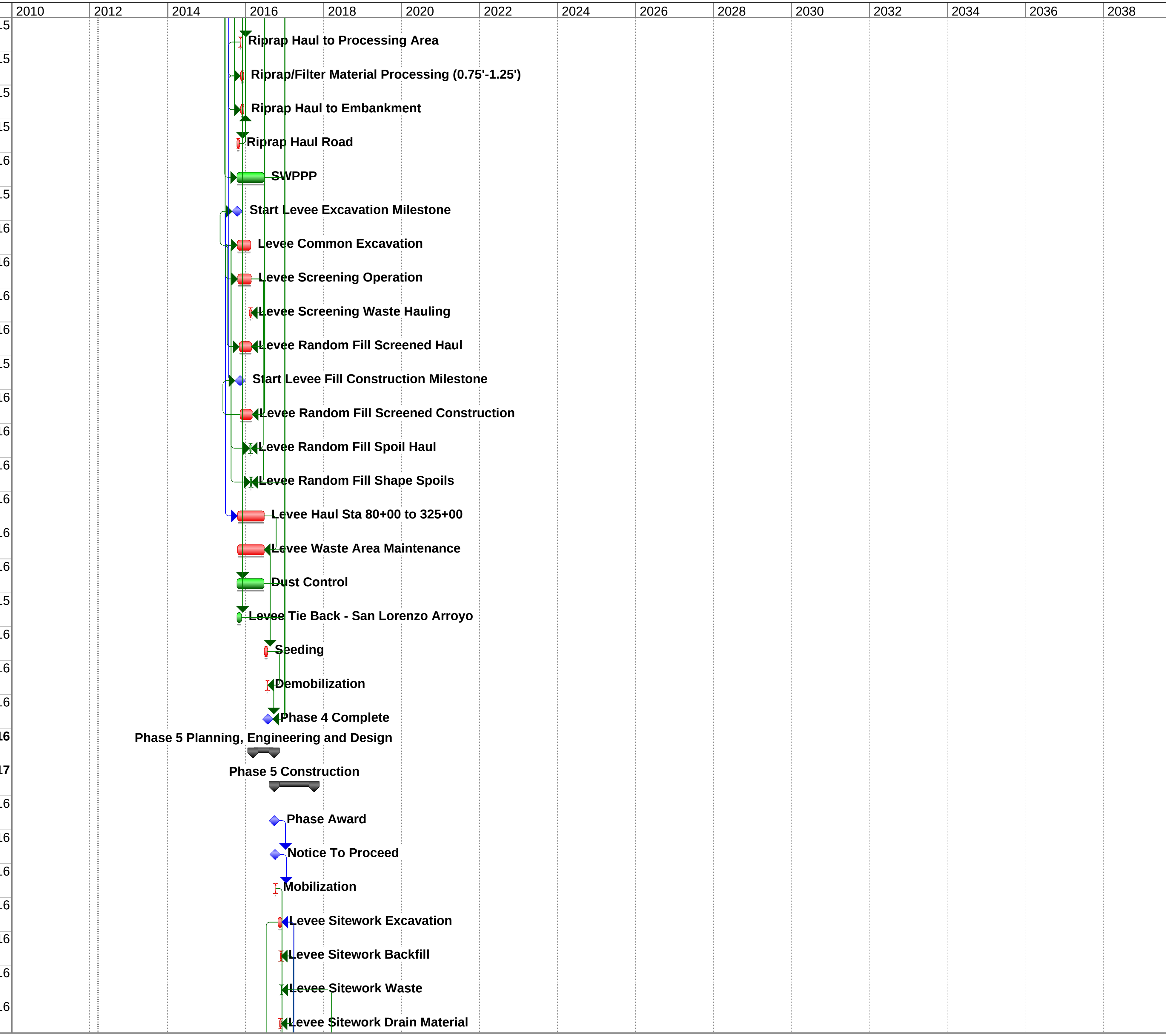
Task	Split	Milestone	Project Summary	External Milestone	
Critical Task	Progress	Summary	External Tasks	Deadline	

ID	Task Name	Duration	Early Start	Early Finish
155	Riprap Haul to Processing Area	7 days	Tue 11/10/15	Thu 11/19/15
156	Riprap/Filter Material Processing (0.75'-1.25')	21 days	Mon 11/16/15	Tue 12/15/15
157	Riprap Haul to Embankment	21 days	Tue 11/17/15	Wed 12/16/15
158	Riprap Haul Road	18 days	Tue 10/13/15	Thu 11/5/15
159	SWPPP	175 days	Tue 10/13/15	Wed 6/22/16
160	Start Levee Excavation Milestone	0 days	Fri 10/16/15	Fri 10/16/15
161	Levee Common Excavation	84 days	Fri 10/16/15	Thu 2/18/16
162	Levee Screening Operation	84 days	Wed 10/21/15	Tue 2/23/16
163	Levee Screening Waste Hauling	11 days	Tue 2/9/16	Wed 2/24/16
164	Levee Random Fill Screened Haul	76 days	Wed 11/4/15	Thu 2/25/16
165	Start Levee Fill Construction Milestone	0 days	Thu 11/12/15	Thu 11/12/15
166	Levee Random Fill Screened Construction	76 days	Thu 11/12/15	Thu 3/3/16
167	Levee Random Fill Spoil Haul	9 days	Wed 2/10/16	Tue 2/23/16
168	Levee Random Fill Shape Spoils	9 days	Tue 2/16/16	Fri 2/26/16
169	Levee Haul Sta 80+00 to 325+00	173 days	Mon 10/19/15	Fri 6/24/16
170	Levee Waste Area Maintenance	173 days	Mon 10/19/15	Fri 6/24/16
171	Dust Control	175 days	Tue 10/13/15	Wed 6/22/16
172	Levee Tie Back - San Lorenzo Arroyo	30 days	Tue 10/13/15	Tue 11/24/15
173	Seeding	20 days	Mon 6/27/16	Mon 7/25/16
174	Demobilization	5 days	Thu 7/21/16	Wed 7/27/16
175	Phase 4 Complete	0 days	Wed 7/27/16	Wed 7/27/16
176	**Phase 5 Planning, Engineering and Design**	**140 days**	**Fri 3/11/16**	**Tue 9/27/16**
178	**Phase 5 Construction**	**257 days**	**Wed 9/28/16**	**Thu 10/5/17**
179	Phase Award	0 days	Wed 9/28/16	Wed 9/28/16
180	Notice To Proceed	0 days	Tue 10/4/16	Tue 10/4/16
181	Mobilization	5 days	Wed 10/5/16	Wed 10/12/16
182	Levee Sitework Excavation	25 days	Tue 11/1/16	Wed 12/7/16
183	Levee Sitework Backfill	5 days	Fri 11/25/16	Thu 12/1/16
184	Levee Sitework Waste	4 days	Fri 12/2/16	Wed 12/7/16
185	Levee Sitework Drain Material	10 days	Wed 11/16/16	Wed 11/30/16



Project: San Acacia Alt A Base + 4
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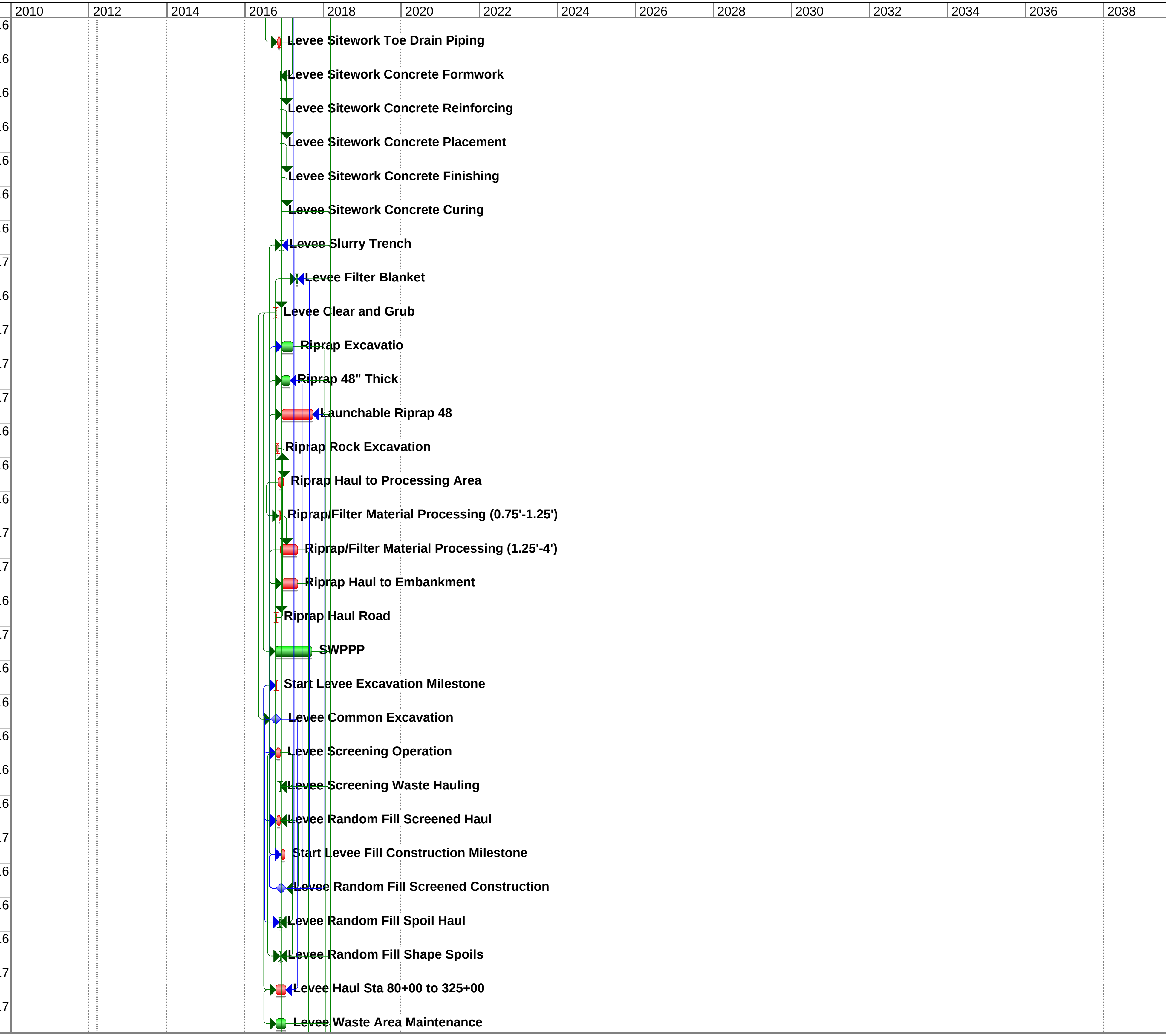
Task	Split	Milestone	Project Summary	External Milestone	
Critical Task	Progress	Summary	External Tasks	Deadline	

ID	Task Name	Duration	Early Start	Early Finish
186	Levee Sitework Toe Drain Piping	18 days	Thu 11/3/16	Wed 11/30/16
187	Levee Sitework Concrete Formwork	1 day	Wed 11/30/16	Wed 11/30/16
188	Levee Sitework Concrete Reinforcing	1 day	Thu 12/1/16	Thu 12/1/16
189	Levee Sitework Concrete Placement	1 day	Fri 12/2/16	Fri 12/2/16
190	Levee Sitework Concrete Finishing	1 day	Mon 12/5/16	Mon 12/5/16
191	Levee Sitework Concrete Curing	1 day	Tue 12/6/16	Tue 12/6/16
192	Levee Slurry Trench	6 days	Thu 12/8/16	Thu 12/15/16
193	Levee Filter Blanket	9 days	Fri 4/28/17	Wed 5/10/17
194	Levee Clear and Grub	7 days	Thu 10/13/16	Fri 10/21/16
195	Riprap Excavatio	70 days	Thu 12/15/16	Tue 3/28/17
196	Riprap 48" Thick	50 days	Thu 12/15/16	Tue 2/28/17
197	Launchable Riprap 48	201 days	Wed 12/14/16	Fri 9/29/17
198	Riprap Rock Excavation	9 days	Wed 10/26/16	Mon 11/7/16
199	Riprap Haul to Processing Area	34 days	Tue 11/8/16	Wed 12/28/16
200	Riprap/Filter Material Processing (0.75'-1.25')	11 days	Mon 11/14/16	Tue 11/29/16
201	Riprap/Filter Material Processing (1.25'-4')	111 days	Wed 11/30/16	Tue 5/9/17
202	Riprap Haul to Embankment	102 days	Wed 12/14/16	Wed 5/10/17
203	Riprap Haul Road	9 days	Thu 10/13/16	Tue 10/25/16
204	SWPPP	235 days	Thu 10/13/16	Tue 9/19/17
205	Start Levee Excavation Milestone	6 days	Tue 10/18/16	Tue 10/25/16
206	Levee Common Excavation	0 days	Mon 10/17/16	Mon 10/17/16
207	Levee Screening Operation	25 days	Fri 10/21/16	Mon 11/28/16
208	Levee Screening Waste Hauling	3 days	Fri 11/25/16	Tue 11/29/16
209	Levee Random Fill Screened Haul	23 days	Thu 10/27/16	Wed 11/30/16
210	Start Levee Fill Construction Milestone	23 days	Thu 12/8/16	Wed 1/11/17
211	Levee Random Fill Screened Construction	0 days	Wed 12/7/16	Wed 12/7/16
212	Levee Random Fill Spoil Haul	5 days	Mon 11/21/16	Mon 11/28/16
213	Levee Random Fill Shape Spoils	5 days	Fri 11/25/16	Thu 12/1/16
214	Levee Haul Sta 80+00 to 325+00	62 days	Wed 10/19/16	Thu 1/19/17
215	Levee Waste Area Maintenance	62 days	Thu 10/20/16	Fri 1/20/17



Project: San Acacia Alt A Base + 4
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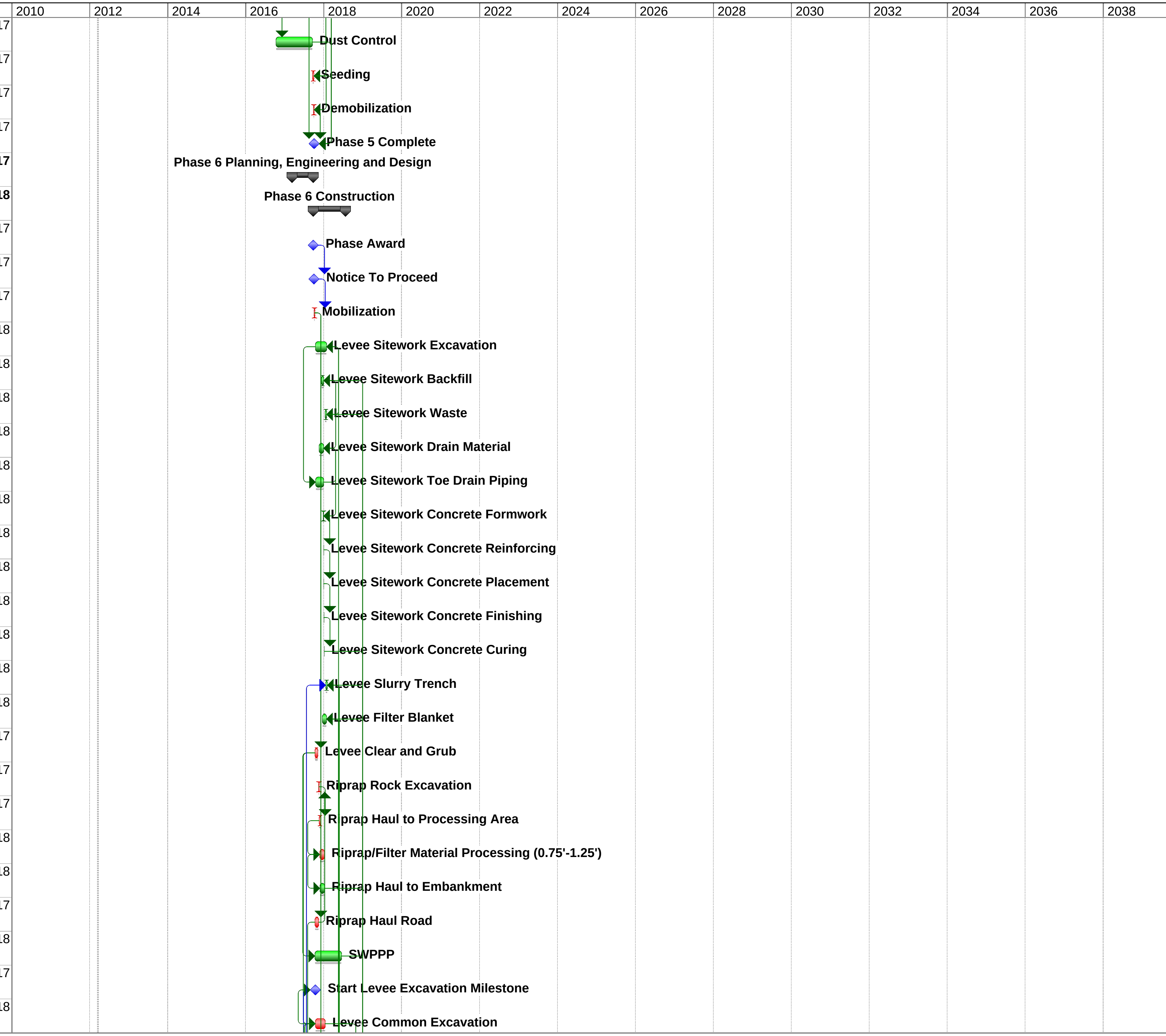
Task | Critical Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

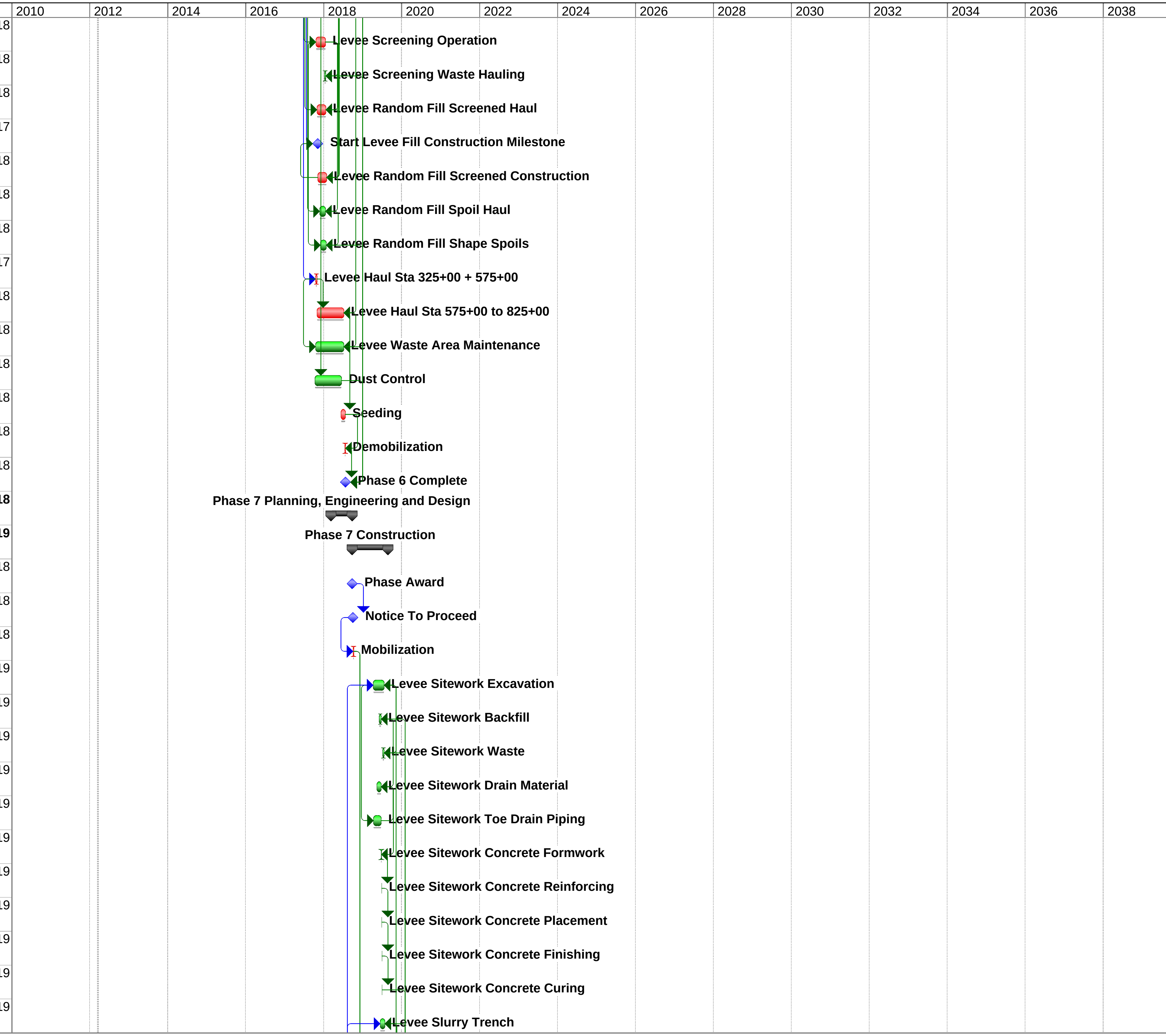
ID	Task Name	Duration	Early Start	Early Finish
216	Dust Control	235 days	Thu 10/13/16	Tue 9/19/17
217	Seeding	10 days	Wed 9/20/17	Tue 10/3/17
218	Demobilization	5 days	Fri 9/29/17	Thu 10/5/17
219	Phase 5 Complete	0 days	Thu 10/5/17	Thu 10/5/17
220	**Phase 6 Planning, Engineering and Design**	**140 days**	**Mon 3/13/17**	**Wed 9/27/17**
222	**Phase 6 Construction**	**207 days**	**Thu 9/28/17**	**Thu 7/26/18**
223	Phase Award	0 days	Thu 9/28/17	Thu 9/28/17
224	Notice To Proceed	0 days	Wed 10/4/17	Wed 10/4/17
225	Mobilization	5 days	Thu 10/5/17	Thu 10/12/17
226	Levee Sitework Excavation	70 days	Wed 10/18/17	Tue 1/30/18
227	Levee Sitework Backfill	14 days	Wed 12/13/17	Wed 1/3/18
228	Levee Sitework Waste	11 days	Tue 1/16/18	Tue 1/30/18
229	Levee Sitework Drain Material	28 days	Tue 11/21/17	Tue 1/2/18
230	Levee Sitework Toe Drain Piping	50 days	Thu 10/19/17	Tue 1/2/18
231	Levee Sitework Concrete Formwork	2 days	Fri 12/29/17	Tue 1/2/18
232	Levee Sitework Concrete Reinforcing	1 day	Wed 1/3/18	Wed 1/3/18
233	Levee Sitework Concrete Placement	1 day	Thu 1/4/18	Thu 1/4/18
234	Levee Sitework Concrete Finishing	1 day	Fri 1/5/18	Fri 1/5/18
235	Levee Sitework Concrete Curing	1 day	Mon 1/8/18	Mon 1/8/18
236	Levee Slurry Trench	12 days	Mon 1/22/18	Tue 2/6/18
237	Levee Filter Blanket	25 days	Thu 12/21/17	Mon 1/29/18
238	Levee Clear and Grub	19 days	Fri 10/13/17	Wed 11/8/17
239	Riprap Rock Excavation	3 days	Fri 11/17/17	Tue 11/21/17
240	Riprap Haul to Processing Area	10 days	Wed 11/22/17	Wed 12/6/17
241	Riprap/Filter Material Processing (0.75'-1.25')	29 days	Tue 11/28/17	Tue 1/9/18
242	Riprap Haul to Embankment	29 days	Wed 11/29/17	Wed 1/10/18
243	Riprap Haul Road	24 days	Fri 10/13/17	Thu 11/16/17
244	SWPPP	170 days	Fri 10/13/17	Mon 6/18/18
245	Start Levee Excavation Milestone	0 days	Wed 10/18/17	Wed 10/18/17
246	Levee Common Excavation	60 days	Wed 10/18/17	Tue 1/16/18



Project: San Acacia Alt A Base + 4
Date: Wed 3/14/12

Task | Split | Milestone | Project Summary | External Milestone
Critical Task | Progress | Summary | External Tasks | Deadline

ID	Task Name	Duration	Early Start	Early Finish
247	Levee Screening Operation	60 days	Mon 10/23/17	Fri 1/19/18
248	Levee Screening Waste Hauling	8 days	Wed 1/10/18	Mon 1/22/18
249	Levee Random Fill Screened Haul	54 days	Thu 11/2/17	Tue 1/23/18
250	Start Levee Fill Construction Milestone	0 days	Thu 11/9/17	Thu 11/9/17
251	Levee Random Fill Screened Construction	54 days	Thu 11/9/17	Tue 1/30/18
252	Levee Random Fill Spoil Haul	37 days	Mon 11/27/17	Fri 1/19/18
253	Levee Random Fill Shape Spoils	37 days	Mon 12/4/17	Fri 1/26/18
254	Levee Haul Sta 325+00 + 575+00	10 days	Thu 10/19/17	Wed 11/1/17
255	Levee Haul Sta 575+00 to 825+00	171 days	Thu 11/2/17	Tue 7/10/18
256	Levee Waste Area Maintenance	181 days	Thu 10/19/17	Tue 7/10/18
257	Dust Control	170 days	Fri 10/13/17	Mon 6/18/18
258	Seeding	27 days	Fri 6/15/18	Tue 7/24/18
259	Demobilization	5 days	Fri 7/20/18	Thu 7/26/18
260	Phase 6 Complete	0 days	Thu 7/26/18	Thu 7/26/18
261	**Phase 7 Planning, Engineering and Design**	**140 days**	**Tue 3/13/18**	**Thu 9/27/18**
263	**Phase 7 Construction**	**230 days**	**Fri 9/28/18**	**Wed 8/28/19**
264	Phase Award	0 days	Fri 9/28/18	Fri 9/28/18
265	Notice To Proceed	0 days	Thu 10/4/18	Thu 10/4/18
266	Mobilization	5 days	Fri 10/5/18	Fri 10/12/18
267	Levee Sitework Excavation	71 days	Fri 4/12/19	Tue 7/23/19
268	Levee Sitework Backfill	14 days	Fri 6/7/19	Wed 6/26/19
269	Levee Sitework Waste	11 days	Tue 7/9/19	Tue 7/23/19
270	Levee Sitework Drain Material	28 days	Thu 5/16/19	Tue 6/25/19
271	Levee Sitework Toe Drain Piping	51 days	Mon 4/15/19	Tue 6/25/19
272	Levee Sitework Concrete Formwork	3 days	Wed 6/26/19	Fri 6/28/19
273	Levee Sitework Concrete Reinforcing	1 day	Mon 7/1/19	Mon 7/1/19
274	Levee Sitework Concrete Placement	1 day	Tue 7/2/19	Tue 7/2/19
275	Levee Sitework Concrete Finishing	1 day	Wed 7/3/19	Wed 7/3/19
276	Levee Sitework Concrete Curing	1 day	Fri 7/5/19	Fri 7/5/19
277	Levee Slurry Trench	31 days	Mon 6/17/19	Tue 7/30/19



Project: San Acacia Alt A Base + 4
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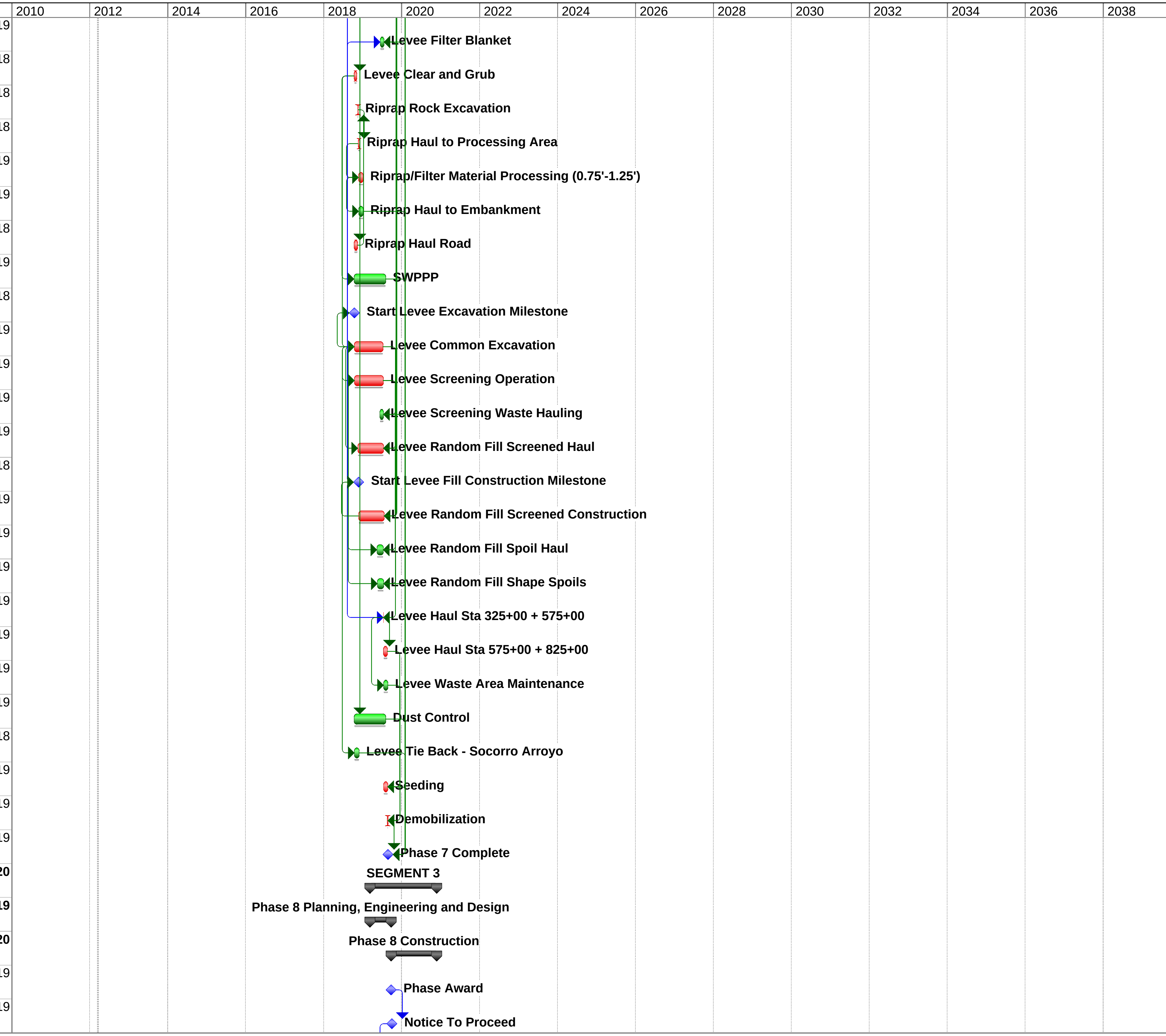
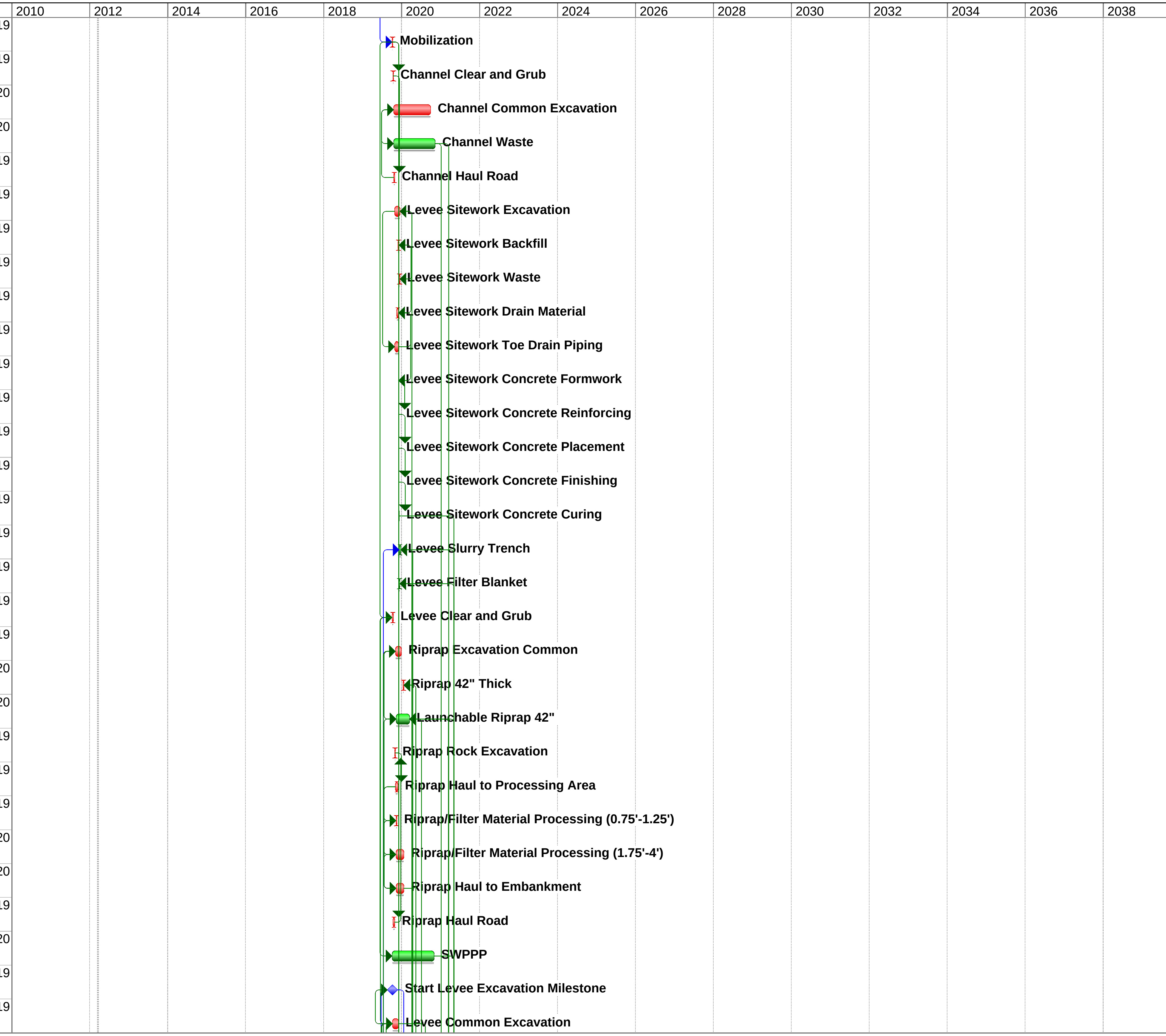
Task		Split		Milestone		Project Summary		External Milestone	
Critical Task		Progress		Summary		External Tasks		Deadline	

ID	Task Name	Duration	Early Start	Early Finish
278	Levee Filter Blanket	25 days	Mon 6/17/19	Mon 7/22/19
279	Levee Clear and Grub	19 days	Mon 10/15/18	Thu 11/8/18
280	Riprap Rock Excavation	3 days	Mon 11/19/18	Wed 11/21/18
281	Riprap Haul to Processing Area	10 days	Fri 11/23/18	Thu 12/6/18
282	Riprap/Filter Material Processing (0.75'-1.25')	29 days	Mon 11/26/18	Mon 1/7/19
283	Riprap Haul to Embankment	29 days	Tue 11/27/18	Tue 1/8/19
284	Riprap Haul Road	24 days	Mon 10/15/18	Fri 11/16/18
285	SWPPP	205 days	Mon 10/15/18	Wed 8/7/19
286	Start Levee Excavation Milestone	0 days	Thu 10/18/18	Thu 10/18/18
287	Levee Common Excavation	184 days	Thu 10/18/18	Fri 7/12/19
288	Levee Screening Operation	184 days	Fri 10/19/18	Mon 7/15/19
289	Levee Screening Waste Hauling	23 days	Thu 6/13/19	Tue 7/16/19
290	Levee Random Fill Screened Haul	165 days	Mon 11/19/18	Tue 7/16/19
291	Start Levee Fill Construction Milestone	0 days	Tue 11/27/18	Tue 11/27/18
292	Levee Random Fill Screened Construction	165 days	Tue 11/27/18	Tue 7/23/19
293	Levee Random Fill Spoil Haul	40 days	Fri 5/17/19	Mon 7/15/19
294	Levee Random Fill Shape Spoils	40 days	Wed 5/22/19	Thu 7/18/19
295	Levee Haul Sta 325+00 + 575+00	1 day	Tue 7/16/19	Tue 7/16/19
296	Levee Haul Sta 575+00 + 825+00	27 days	Wed 7/17/19	Thu 8/22/19
297	Levee Waste Area Maintenance	28 days	Fri 7/19/19	Tue 8/27/19
298	Dust Control	205 days	Mon 10/15/18	Wed 8/7/19
299	Levee Tie Back - Socorro Arroyo	30 days	Thu 10/18/18	Fri 11/30/18
300	Seeding	27 days	Fri 7/19/19	Mon 8/26/19
301	Demobilization	5 days	Thu 8/22/19	Wed 8/28/19
302	Phase 7 Complete	0 days	Wed 8/28/19	Wed 8/28/19
303	**SEGMENT 3**	**432 days**	**Wed 3/13/19**	**Fri 11/27/20**
304	**Phase 8 Planning, Engineering and Design**	**140 days**	**Wed 3/13/19**	**Fri 9/27/19**
306	**Phase 8 Construction**	**292 days**	**Sat 9/28/19**	**Fri 11/27/20**
307	Phase Award	0 days	Sat 9/28/19	Sat 9/28/19
308	Notice To Proceed	0 days	Fri 10/4/19	Fri 10/4/19



Project: San Acacia Alt A Base + 4 Date: Wed 3/14/12	Task	Split	Milestone	Project Summary	External Milestone
	Critical Task	Progress	Summary	External Tasks	Deadline

ID	Task Name	Duration	Early Start	Early Finish
309	Mobilization	5 days	Mon 10/7/19	Fri 10/11/19
310	Channel Clear and Grub	4 days	Tue 10/15/19	Fri 10/18/19
311	Channel Common Excavation	239 days	Mon 10/21/19	Wed 9/30/20
312	Channel Waste	268 days	Mon 10/21/19	Thu 11/12/20
313	Channel Haul Road	8 days	Mon 10/21/19	Wed 10/30/19
314	Levee Sitework Excavation	34 days	Wed 10/30/19	Wed 12/18/19
315	Levee Sitework Backfill	7 days	Fri 11/29/19	Mon 12/9/19
316	Levee Sitework Waste	5 days	Thu 12/12/19	Wed 12/18/19
317	Levee Sitework Drain Material	14 days	Mon 11/18/19	Fri 12/6/19
318	Levee Sitework Toe Drain Piping	25 days	Thu 10/31/19	Fri 12/6/19
319	Levee Sitework Concrete Formwork	1 day	Fri 12/6/19	Fri 12/6/19
320	Levee Sitework Concrete Reinforcing	1 day	Mon 12/9/19	Mon 12/9/19
321	Levee Sitework Concrete Placement	1 day	Tue 12/10/19	Tue 12/10/19
322	Levee Sitework Concrete Finishing	1 day	Wed 12/11/19	Wed 12/11/19
323	Levee Sitework Concrete Curing	1 day	Thu 12/12/19	Thu 12/12/19
324	Levee Slurry Trench	10 days	Thu 12/12/19	Thu 12/26/19
325	Levee Filter Blanket	6 days	Tue 12/10/19	Tue 12/17/19
326	Levee Clear and Grub	9 days	Mon 10/7/19	Fri 10/18/19
327	Riprap Excavation Common	36 days	Thu 11/7/19	Tue 12/31/19
328	Riprap 42" Thick	6 days	Thu 1/16/20	Fri 1/24/20
329	Launchable Riprap 42"	85 days	Wed 11/13/19	Tue 3/17/20
330	Riprap Rock Excavation	4 days	Thu 10/31/19	Tue 11/5/19
331	Riprap Haul to Processing Area	16 days	Wed 11/6/19	Fri 11/29/19
332	Riprap/Filter Material Processing (0.75'-1.25')	7 days	Tue 11/12/19	Wed 11/20/19
333	Riprap/Filter Material Processing (1.75'-4')	49 days	Tue 11/12/19	Thu 1/23/20
334	Riprap Haul to Embankment	48 days	Wed 11/13/19	Thu 1/23/20
335	Riprap Haul Road	12 days	Tue 10/15/19	Wed 10/30/19
336	SWPPP	270 days	Mon 10/7/19	Mon 11/2/20
337	Start Levee Excavation Milestone	0 days	Thu 10/10/19	Thu 10/10/19
338	Levee Common Excavation	37 days	Thu 10/10/19	Wed 12/4/19



Project: San Acacia Alt A Base + 4
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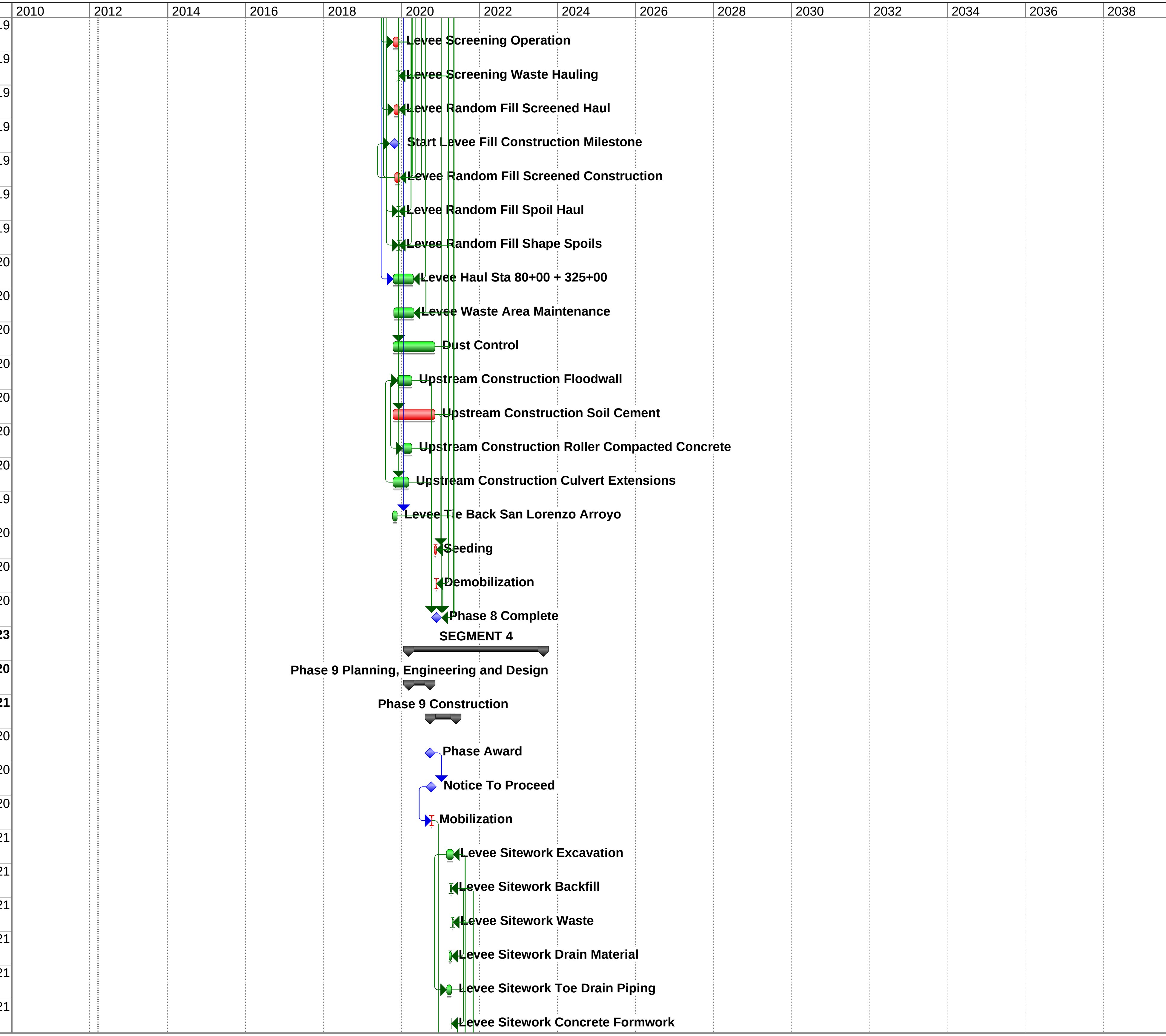
Task	Split	Milestone	Project Summary	External Milestone	
Critical Task	Progress	Summary	External Tasks	Deadline	

ID	Task Name	Duration	Early Start	Early Finish
339	Levee Screening Operation	37 days	Wed 10/16/19	Mon 12/9/19
340	Levee Screening Waste Hauling	5 days	Wed 12/4/19	Tue 12/10/19
341	Levee Random Fill Screened Haul	33 days	Thu 10/24/19	Wed 12/11/19
342	Start Levee Fill Construction Milestone	0 days	Thu 10/31/19	Thu 10/31/19
343	Levee Random Fill Screened Construction	33 days	Thu 10/31/19	Wed 12/18/19
344	Levee Random Fill Spoil Haul	5 days	Tue 12/3/19	Mon 12/9/19
345	Levee Random Fill Shape Spoils	5 days	Fri 12/6/19	Thu 12/12/19
346	Levee Haul Sta 80+00 + 325+00	130 days	Wed 10/16/19	Wed 4/22/20
347	Levee Waste Area Maintenance	130 days	Mon 10/21/19	Mon 4/27/20
348	Dust Control	270 days	Tue 10/15/19	Mon 11/9/20
349	Upstream Construction Floodwall	90 days	Wed 11/27/19	Tue 4/7/20
350	Upstream Construction Soil Cement	270 days	Tue 10/15/19	Mon 11/9/20
351	Upstream Construction Roller Compacted Concrete	60 days	Mon 1/13/20	Tue 4/7/20
352	Upstream Construction Culvert Extensions	100 days	Tue 10/15/19	Tue 3/10/20
353	Levee Tie Back San Lorenzo Arroyo	30 days	Thu 10/10/19	Fri 11/22/19
354	Seeding	13 days	Thu 11/5/20	Tue 11/24/20
355	Demobilization	5 days	Fri 11/20/20	Fri 11/27/20
356	Phase 8 Complete	0 days	Fri 11/27/20	Fri 11/27/20
357	**SEGMENT 4**	**869 days**	**Wed 3/11/20**	**Wed 8/23/23**
358	**Phase 9 Planning, Engineering and Design**	**140 days**	**Wed 3/11/20**	**Fri 9/25/20**
360	**Phase 9 Construction**	**167 days**	**Mon 9/28/20**	**Thu 5/27/21**
361	Phase Award	0 days	Mon 9/28/20	Mon 9/28/20
362	Notice To Proceed	0 days	Tue 10/6/20	Tue 10/6/20
363	Mobilization	5 days	Wed 10/7/20	Wed 10/14/20
364	Levee Sitework Excavation	46 days	Fri 2/26/21	Fri 4/30/21
365	Levee Sitework Backfill	9 days	Mon 4/5/21	Thu 4/15/21
366	Levee Sitework Waste	7 days	Thu 4/22/21	Fri 4/30/21
367	Levee Sitework Drain Material	18 days	Mon 3/22/21	Wed 4/14/21
368	Levee Sitework Toe Drain Piping	33 days	Mon 3/1/21	Wed 4/14/21
369	Levee Sitework Concrete Formwork	2 days	Tue 4/13/21	Wed 4/14/21



Project: San Acacia Alt A Base + 4
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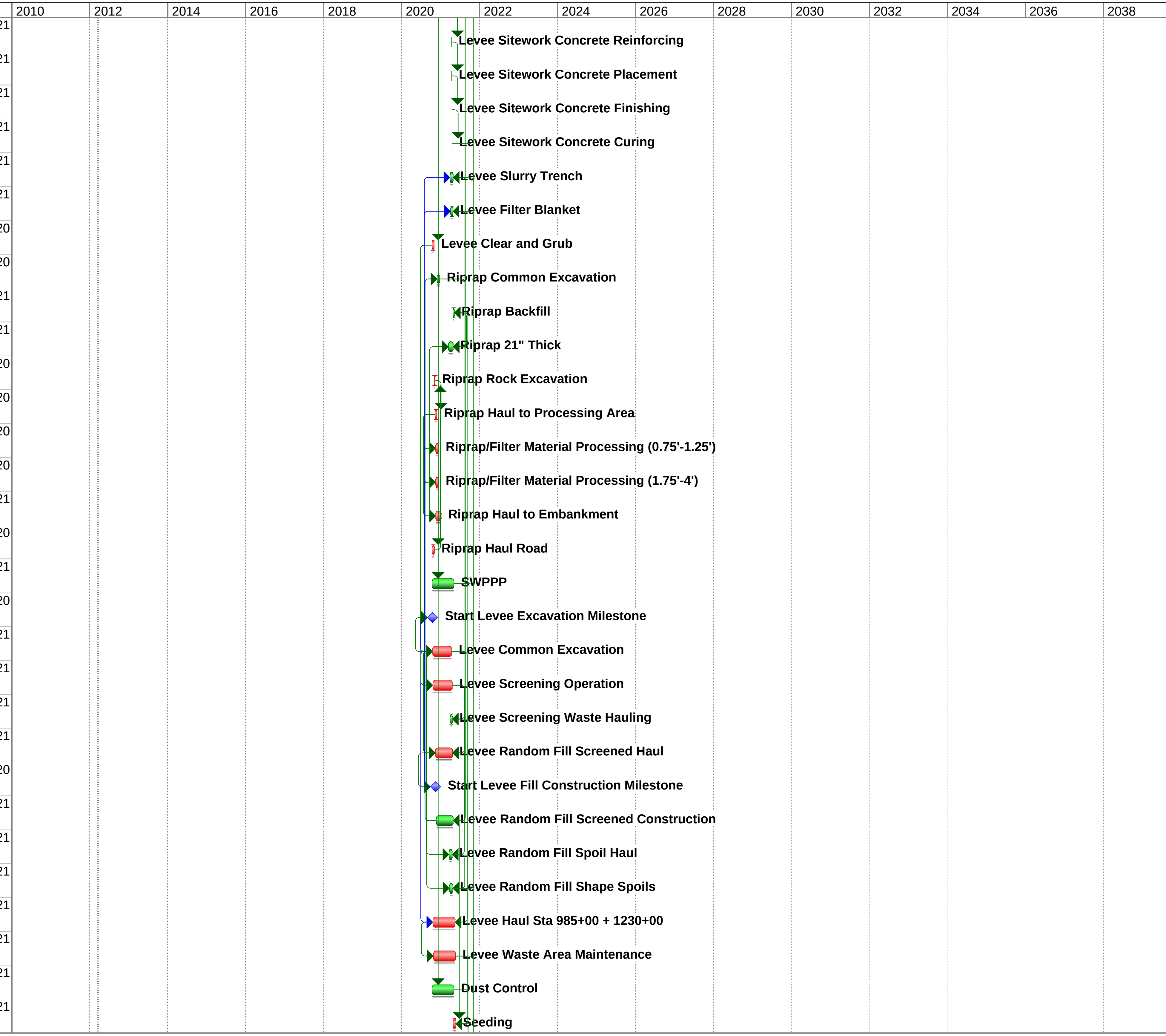
Task		Split		Milestone		Project Summary		External Milestone	
Critical Task		Progress		Summary		External Tasks		Deadline	

ID	Task Name	Duration	Early Start	Early Finish
370	Levee Sitework Concrete Reinforcing	1 day	Thu 4/15/21	Thu 4/15/21
371	Levee Sitework Concrete Placement	1 day	Fri 4/16/21	Fri 4/16/21
372	Levee Sitework Concrete Finishing	1 day	Mon 4/19/21	Mon 4/19/21
373	Levee Sitework Concrete Curing	1 day	Tue 4/20/21	Tue 4/20/21
374	Levee Slurry Trench	22 days	Thu 4/1/21	Fri 4/30/21
375	Levee Filter Blanket	17 days	Tue 4/6/21	Wed 4/28/21
376	Levee Clear and Grub	13 days	Thu 10/15/20	Mon 11/2/20
377	Riprap Common Excavation	18 days	Tue 12/1/20	Thu 12/24/20
378	Riprap Backfill	10 days	Wed 4/28/21	Tue 5/11/21
379	Riprap 21" Thick	33 days	Wed 3/17/21	Fri 4/30/21
380	Riprap Rock Excavation	3 days	Fri 11/6/20	Tue 11/10/20
381	Riprap Haul to Processing Area	11 days	Thu 11/12/20	Fri 11/27/20
382	Riprap/Filter Material Processing (0.75'-1.25')	19 days	Tue 11/17/20	Mon 12/14/20
383	Riprap/Filter Material Processing (1.75'-4')	19 days	Tue 11/17/20	Mon 12/14/20
384	Riprap Haul to Embankment	34 days	Wed 11/18/20	Thu 1/7/21
385	Riprap Haul Road	16 days	Thu 10/15/20	Thu 11/5/20
386	SWPPP	140 days	Thu 10/15/20	Thu 5/6/21
387	Start Levee Excavation Milestone	0 days	Tue 10/20/20	Tue 10/20/20
388	Levee Common Excavation	123 days	Tue 10/20/20	Fri 4/16/21
389	Levee Screening Operation	123 days	Fri 10/23/20	Wed 4/21/21
390	Levee Screening Waste Hauling	15 days	Fri 4/2/21	Thu 4/22/21
391	Levee Random Fill Screened Haul	110 days	Mon 11/16/20	Fri 4/23/21
392	Start Levee Fill Construction Milestone	0 days	Mon 11/16/20	Mon 11/16/20
393	Levee Random Fill Screened Construction	110 days	Mon 11/23/20	Fri 4/30/21
394	Levee Random Fill Spoil Haul	22 days	Tue 3/23/21	Wed 4/21/21
395	Levee Random Fill Shape Spoils	22 days	Fri 3/26/21	Mon 4/26/21
396	Levee Haul Sta 985+00 + 1230+00	142 days	Fri 10/23/20	Tue 5/18/21
397	Levee Waste Area Maintenance	142 days	Wed 10/28/20	Fri 5/21/21
398	Dust Control	140 days	Thu 10/15/20	Thu 5/6/21
399	Seeding	18 days	Fri 4/30/21	Tue 5/25/21



Project: San Acacia Alt A Base + 4
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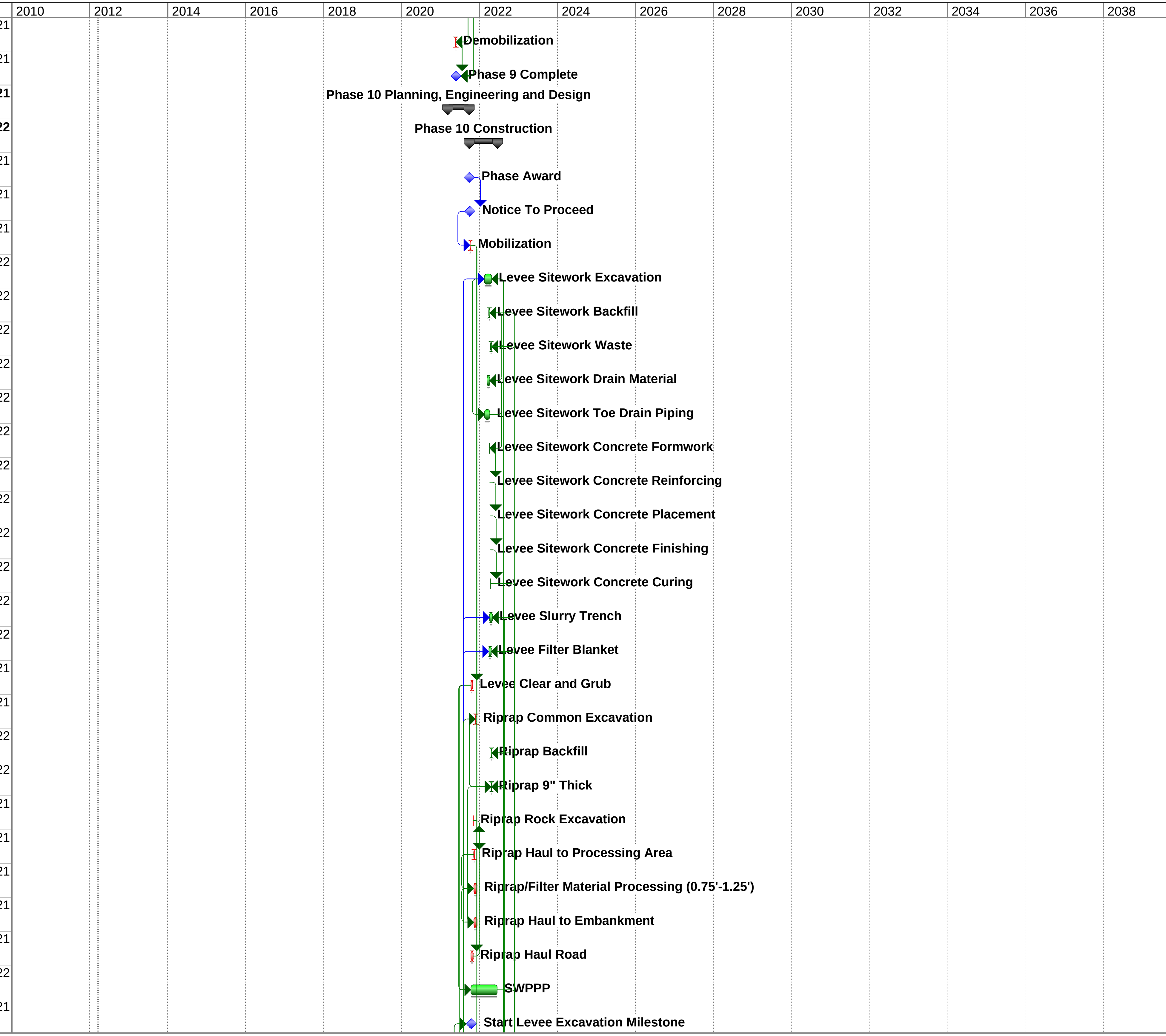
Task | Split | Milestone | Project Summary | External Milestone
Critical Task | Progress | Summary | External Tasks | Deadline

ID	Task Name	Duration	Early Start	Early Finish
400	Demobilization	5 days	Fri 5/21/21	Thu 5/27/21
401	Phase 9 Complete	0 days	Thu 5/27/21	Thu 5/27/21
402	**Phase 10 Planning, Engineering and Design**	**140 days**	**Thu 3/11/21**	**Mon 9/27/21**
404	**Phase 10 Construction**	**182 days**	**Tue 9/28/21**	**Mon 6/20/22**
405	Phase Award	0 days	Tue 9/28/21	Tue 9/28/21
406	Notice To Proceed	0 days	Mon 10/4/21	Mon 10/4/21
407	Mobilization	5 days	Tue 10/5/21	Tue 10/12/21
408	Levee Sitework Excavation	47 days	Thu 2/17/22	Mon 4/25/22
409	Levee Sitework Backfill	9 days	Tue 3/29/22	Fri 4/8/22
410	Levee Sitework Waste	7 days	Fri 4/15/22	Mon 4/25/22
411	Levee Sitework Drain Material	19 days	Mon 3/14/22	Thu 4/7/22
412	Levee Sitework Toe Drain Piping	34 days	Fri 2/18/22	Thu 4/7/22
413	Levee Sitework Concrete Formwork	2 days	Wed 4/6/22	Thu 4/7/22
414	Levee Sitework Concrete Reinforcing	1 day	Fri 4/8/22	Fri 4/8/22
415	Levee Sitework Concrete Placement	1 day	Mon 4/11/22	Mon 4/11/22
416	Levee Sitework Concrete Finishing	1 day	Tue 4/12/22	Tue 4/12/22
417	Levee Sitework Concrete Curing	1 day	Wed 4/13/22	Wed 4/13/22
418	Levee Slurry Trench	20 days	Tue 4/5/22	Mon 5/2/22
419	Levee Filter Blanket	17 days	Thu 3/31/22	Fri 4/22/22
420	Levee Clear and Grub	13 days	Wed 10/13/21	Fri 10/29/21
421	Riprap Common Excavation	3 days	Fri 11/26/21	Tue 11/30/21
422	Riprap Backfill	5 days	Wed 4/20/22	Tue 4/26/22
423	Riprap 9" Thick	3 days	Thu 4/21/22	Mon 4/25/22
424	Riprap Rock Excavation	2 days	Thu 11/4/21	Fri 11/5/21
425	Riprap Haul to Processing Area	7 days	Mon 11/8/21	Wed 11/17/21
426	Riprap/Filter Material Processing (0.75'-1.25')	21 days	Tue 11/9/21	Thu 12/9/21
427	Riprap Haul to Embankment	21 days	Wed 11/10/21	Fri 12/10/21
428	Riprap Haul Road	16 days	Wed 10/13/21	Wed 11/3/21
429	SWPPP	170 days	Wed 10/13/21	Thu 6/16/22
430	Start Levee Excavation Milestone	0 days	Mon 10/18/21	Mon 10/18/21



Project: San Acacia Alt A Base + 4
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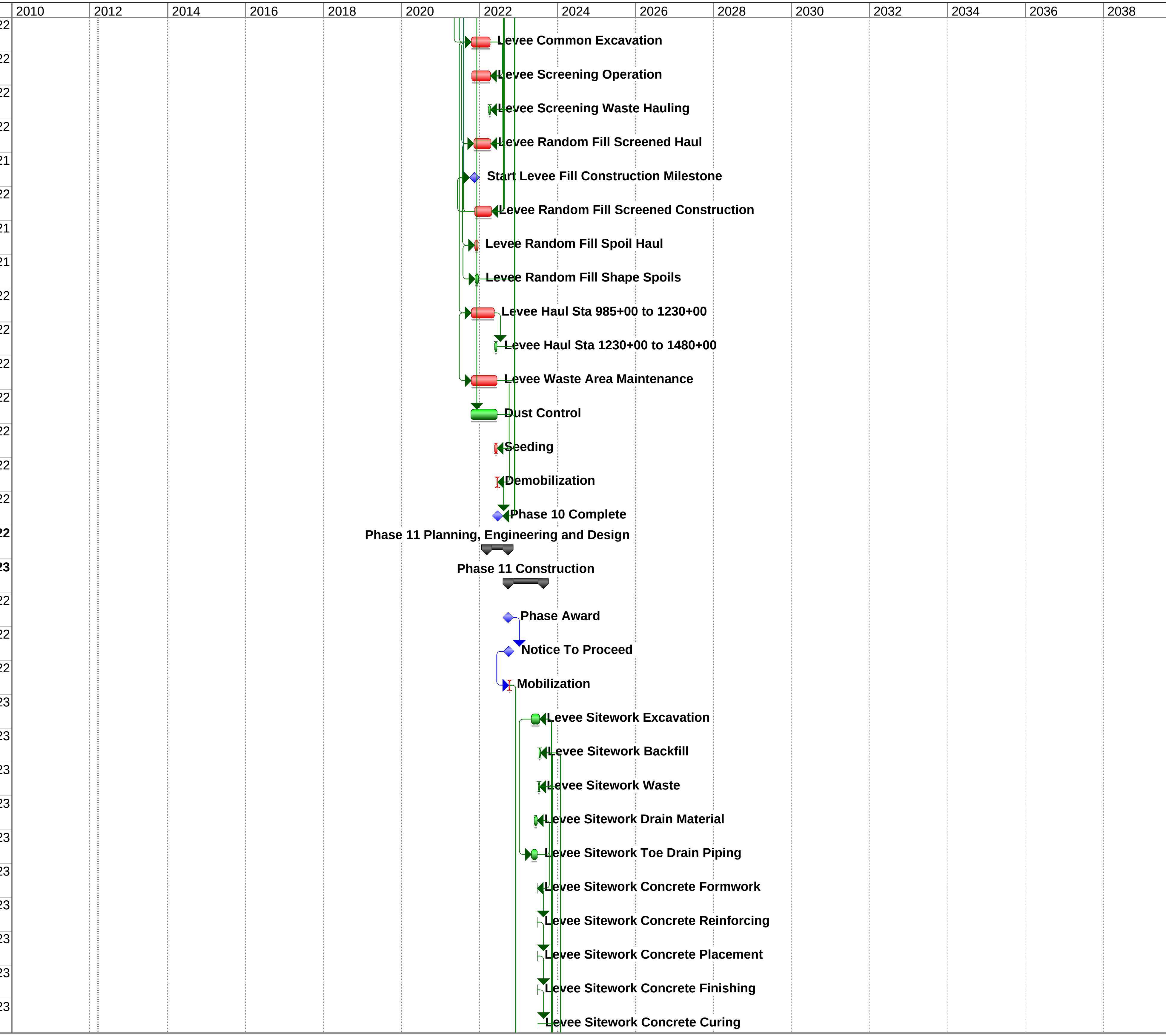
Task	Split	Milestone	Project Summary	External Milestone
Critical Task	Progress	Summary	External Tasks	Deadline

ID	Task Name	Duration	Early Start	Early Finish
431	Levee Common Excavation	120 days	Mon 10/18/21	Mon 4/11/22
432	Levee Screening Operation	120 days	Thu 10/21/21	Thu 4/14/22
433	Levee Screening Waste Hauling	15 days	Mon 3/28/22	Fri 4/15/22
434	Levee Random Fill Screened Haul	108 days	Wed 11/10/21	Mon 4/18/22
435	Start Levee Fill Construction Milestone	0 days	Thu 11/18/21	Thu 11/18/21
436	Levee Random Fill Screened Construction	108 days	Thu 11/18/21	Mon 4/25/22
437	Levee Random Fill Spoil Haul	22 days	Thu 11/18/21	Mon 12/20/21
438	Levee Random Fill Shape Spoils	22 days	Mon 11/22/21	Wed 12/22/21
439	Levee Haul Sta 985+00 to 1230+00	149 days	Mon 10/18/21	Fri 5/20/22
440	Levee Haul Sta 1230+00 to 1480+00	16 days	Mon 5/23/22	Tue 6/14/22
441	Levee Waste Area Maintenance	165 days	Mon 10/18/21	Tue 6/14/22
442	Dust Control	170 days	Wed 10/13/21	Thu 6/16/22
443	Seeding	18 days	Mon 5/23/22	Thu 6/16/22
444	Demobilization	5 days	Tue 6/14/22	Mon 6/20/22
445	Phase 10 Complete	0 days	Mon 6/20/22	Mon 6/20/22
446	**Phase 11 Planning, Engineering and Design**	**140 days**	**Fri 3/11/22**	**Tue 9/27/22**
448	**Phase 11 Construction**	**227 days**	**Wed 9/28/22**	**Wed 8/23/23**
449	Phase Award	0 days	Wed 9/28/22	Wed 9/28/22
450	Notice To Proceed	0 days	Tue 10/4/22	Tue 10/4/22
451	Mobilization	5 days	Wed 10/5/22	Wed 10/12/22
452	Levee Sitework Excavation	53 days	Wed 5/3/23	Tue 7/18/23
453	Levee Sitework Backfill	11 days	Wed 7/12/23	Wed 7/26/23
454	Levee Sitework Waste	8 days	Fri 7/7/23	Tue 7/18/23
455	Levee Sitework Drain Material	21 days	Tue 5/30/23	Tue 6/27/23
456	Levee Sitework Toe Drain Piping	38 days	Thu 5/4/23	Tue 6/27/23
457	Levee Sitework Concrete Formwork	2 days	Mon 6/26/23	Tue 6/27/23
458	Levee Sitework Concrete Reinforcing	1 day	Wed 6/28/23	Wed 6/28/23
459	Levee Sitework Concrete Placement	1 day	Thu 6/29/23	Thu 6/29/23
460	Levee Sitework Concrete Finishing	1 day	Fri 6/30/23	Fri 6/30/23
461	Levee Sitework Concrete Curing	1 day	Mon 7/3/23	Mon 7/3/23



Project: San Acacia Alt A Base + 4
Date: Wed 3/14/12

Task	Split	Milestone	Project Summary	External Milestone
Critical Task	Progress	Summary	External Tasks	Deadline

ID	Task Name	Duration	Early Start	Early Finish
462	Levee Slurry Trench	25 days	Wed 6/28/23	Wed 8/2/23
463	Levee Filter Blanket	18 days	Thu 6/29/23	Tue 7/25/23
464	Levee Clear and Grub	14 days	Thu 10/13/22	Tue 11/1/22
465	Riprap Common Excavation	12 days	Mon 12/5/22	Tue 12/20/22
466	Riprap Backfill	23 days	Fri 6/23/23	Wed 7/26/23
467	Riprap 9" Thick	12 days	Mon 12/12/22	Wed 12/28/22
468	Riprap Rock Excavation	3 days	Tue 11/8/22	Thu 11/10/22
469	Riprap Haul to Processing Area	9 days	Mon 11/14/22	Fri 11/25/22
470	Riprap/Filter Material Processing (0.75'-1.25')	27 days	Tue 11/15/22	Thu 12/22/22
471	Riprap Haul to Embankment	27 days	Wed 11/16/22	Fri 12/23/22
472	Riprap Haul Road	18 days	Thu 10/13/22	Mon 11/7/22
473	SWPPP	13 days	Thu 10/13/22	Mon 10/31/22
474	Start Levee Excavation Milestone	0 days	Tue 10/18/22	Tue 10/18/22
475	Levee Common Excavation	185 days	Tue 10/18/22	Thu 7/13/23
476	Levee Screening Operation	185 days	Fri 10/21/22	Tue 7/18/23
477	Levee Screening Waste Hauling	23 days	Fri 6/16/23	Wed 7/19/23
478	Levee Random Fill Screened Haul	167 days	Fri 11/18/22	Wed 7/19/23
479	Start Levee Fill Construction Milestone	0 days	Mon 11/28/22	Mon 11/28/22
480	Levee Random Fill Screened Construction	167 days	Mon 11/28/22	Wed 7/26/23
481	Levee Random Fill Spoil Haul	19 days	Mon 11/28/22	Thu 12/22/22
482	Levee Random Fill Shape Spoils	19 days	Wed 11/30/22	Tue 12/27/22
483	Levee Haul Sta 1230+00 to 1480+00	65 days	Fri 10/21/22	Thu 1/26/23
484	Levee Waste Area Maintenance	65 days	Fri 10/21/22	Thu 1/26/23
485	Dust Control	146 days	Thu 10/13/22	Fri 5/12/23
486	Seeding	20 days	Tue 7/25/23	Mon 8/21/23
487	Demobilization	5 days	Thu 8/17/23	Wed 8/23/23
488	Phase 11 Complete	0 days	Wed 8/23/23	Wed 8/23/23
489	**SEGMENT 5**	**1465 days**	**Mon 3/13/23**	**Wed 1/10/29**
490	**Phase 12 Planning, Engineering and Design**	**140 days**	**Mon 3/13/23**	**Wed 9/27/23**
492	**Phase 12 Construction**	**152 days**	**Thu 9/28/23**	**Tue 5/7/24**

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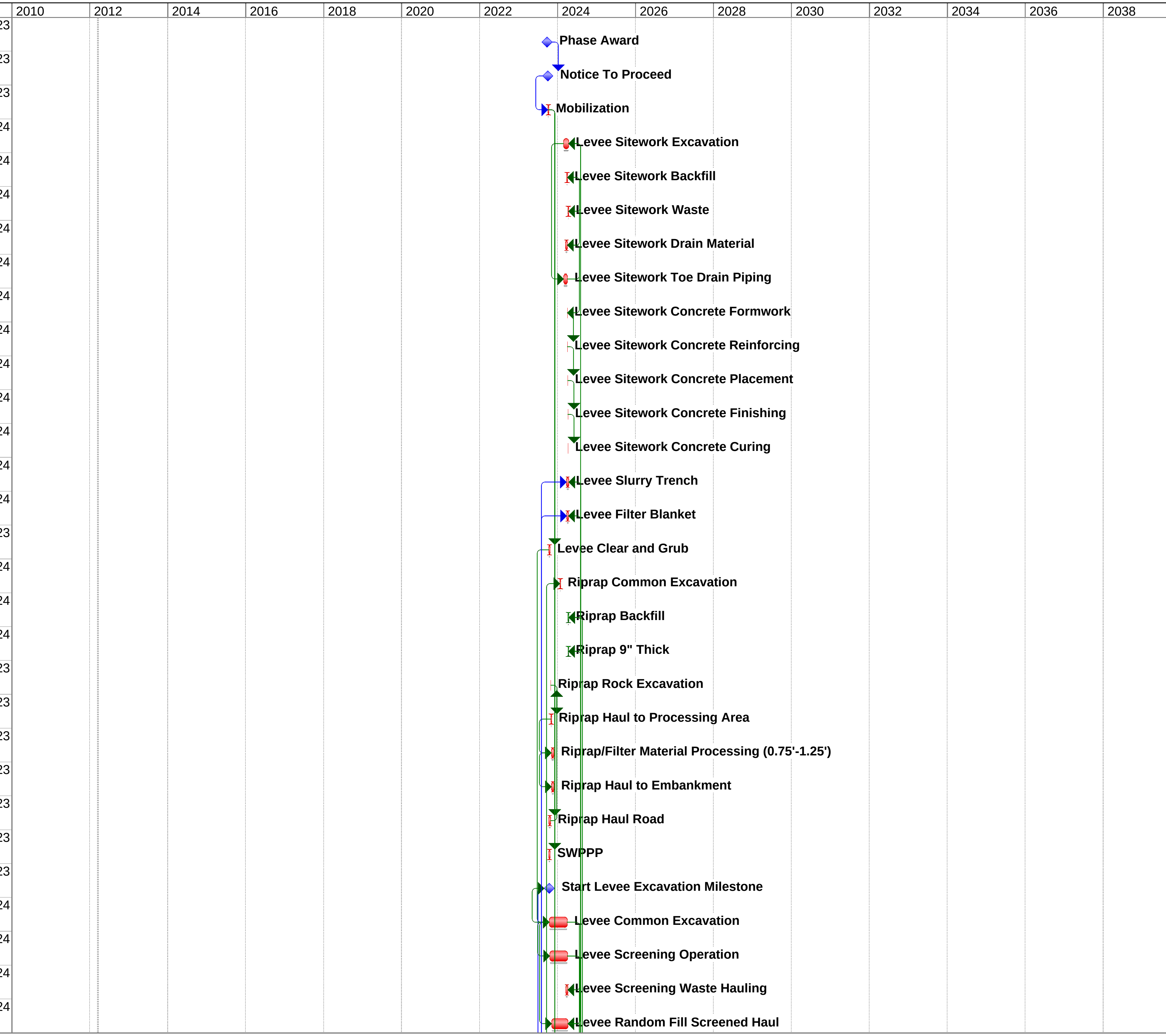
Task		Split		Milestone		Project Summary		External Milestone	
Critical Task		Progress		Summary		External Tasks		Deadline	

ID	Task Name	Duration	Early Start	Early Finish
493	Phase Award	0 days	Thu 9/28/23	Thu 9/28/23
494	Notice To Proceed	0 days	Wed 10/4/23	Wed 10/4/23
495	Mobilization	5 days	Thu 10/5/23	Thu 10/12/23
496	Levee Sitework Excavation	34 days	Thu 2/29/24	Tue 4/16/24
497	Levee Sitework Backfill	7 days	Thu 3/28/24	Fri 4/5/24
498	Levee Sitework Waste	5 days	Wed 4/10/24	Tue 4/16/24
499	Levee Sitework Drain Material	14 days	Mon 3/18/24	Thu 4/4/24
500	Levee Sitework Toe Drain Piping	25 days	Fri 3/1/24	Thu 4/4/24
501	Levee Sitework Concrete Formwork	1 day	Thu 4/4/24	Thu 4/4/24
502	Levee Sitework Concrete Reinforcing	1 day	Fri 4/5/24	Fri 4/5/24
503	Levee Sitework Concrete Placement	1 day	Mon 4/8/24	Mon 4/8/24
504	Levee Sitework Concrete Finishing	1 day	Tue 4/9/24	Tue 4/9/24
505	Levee Sitework Concrete Curing	1 day	Wed 4/10/24	Wed 4/10/24
506	Levee Slurry Trench	16 days	Wed 3/27/24	Wed 4/17/24
507	Levee Filter Blanket	12 days	Fri 3/29/24	Mon 4/15/24
508	Levee Clear and Grub	9 days	Fri 10/13/23	Wed 10/25/23
509	Riprap Common Excavation	4 days	Fri 1/26/24	Wed 1/31/24
510	Riprap Backfill	7 days	Tue 4/9/24	Wed 4/17/24
511	Riprap 9" Thick	4 days	Thu 4/11/24	Tue 4/16/24
512	Riprap Rock Excavation	2 days	Tue 10/31/23	Wed 11/1/23
513	Riprap Haul to Processing Area	5 days	Thu 11/2/23	Wed 11/8/23
514	Riprap/Filter Material Processing (0.75'-1.25')	16 days	Tue 11/7/23	Thu 11/30/23
515	Riprap Haul to Embankment	16 days	Wed 11/8/23	Fri 12/1/23
516	Riprap Haul Road	12 days	Fri 10/13/23	Mon 10/30/23
517	SWPPP	9 days	Fri 10/13/23	Wed 10/25/23
518	Start Levee Excavation Milestone	0 days	Wed 10/18/23	Wed 10/18/23
519	Levee Common Excavation	114 days	Wed 10/18/23	Tue 4/2/24
520	Levee Screening Operation	114 days	Mon 10/23/23	Fri 4/5/24
521	Levee Screening Waste Hauling	14 days	Wed 3/20/24	Mon 4/8/24
522	Levee Random Fill Screened Haul	102 days	Fri 11/10/23	Tue 4/9/24



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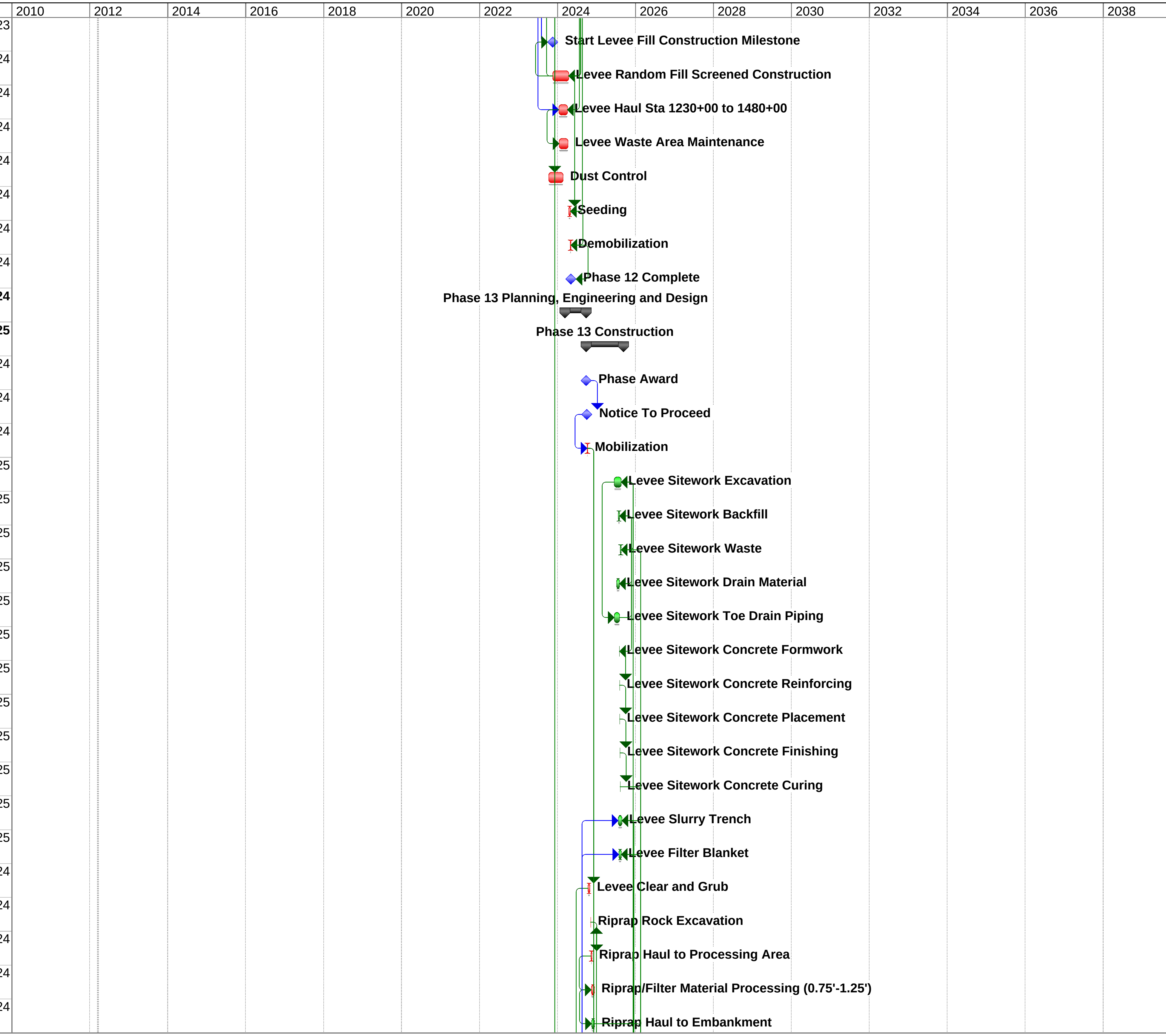
Task	Split	Milestone	Project Summary	External Milestone
Critical Task	Progress	Summary	External Tasks	Deadline

ID	Task Name	Duration	Early Start	Early Finish
523	Start Levee Fill Construction Milestone	0 days	Mon 11/20/23	Mon 11/20/23
524	Levee Random Fill Screened Construction	102 days	Mon 11/20/23	Tue 4/16/24
525	Levee Haul Sta 1230+00 to 1480+00	57 days	Tue 1/16/24	Thu 4/4/24
526	Levee Waste Area Maintenance	57 days	Fri 1/19/24	Tue 4/9/24
527	Dust Control	90 days	Fri 10/13/23	Fri 2/23/24
528	Seeding	13 days	Wed 4/17/24	Fri 5/3/24
529	Demobilization	5 days	Wed 5/1/24	Tue 5/7/24
530	Phase 12 Complete	0 days	Tue 5/7/24	Tue 5/7/24
531	**Phase 13 Planning, Engineering and Design**	**140 days**	**Wed 3/13/24**	**Fri 9/27/24**
533	**Phase 13 Construction**	**240 days**	**Sat 9/28/24**	**Fri 9/12/25**
534	Phase Award	0 days	Sat 9/28/24	Sat 9/28/24
535	Notice To Proceed	0 days	Fri 10/4/24	Fri 10/4/24
536	Mobilization	5 days	Mon 10/7/24	Fri 10/11/24
537	Levee Sitework Excavation	47 days	Tue 6/17/25	Thu 8/21/25
538	Levee Sitework Backfill	9 days	Fri 7/25/25	Wed 8/6/25
539	Levee Sitework Waste	7 days	Wed 8/13/25	Thu 8/21/25
540	Levee Sitework Drain Material	19 days	Thu 7/10/25	Tue 8/5/25
541	Levee Sitework Toe Drain Piping	34 days	Wed 6/18/25	Tue 8/5/25
542	Levee Sitework Concrete Formwork	2 days	Tue 8/5/25	Wed 8/6/25
543	Levee Sitework Concrete Reinforcing	1 day	Thu 8/7/25	Thu 8/7/25
544	Levee Sitework Concrete Placement	1 day	Fri 8/8/25	Fri 8/8/25
545	Levee Sitework Concrete Finishing	1 day	Mon 8/11/25	Mon 8/11/25
546	Levee Sitework Concrete Curing	1 day	Tue 8/12/25	Tue 8/12/25
547	Levee Slurry Trench	25 days	Fri 7/25/25	Thu 8/28/25
548	Levee Filter Blanket	17 days	Thu 7/31/25	Fri 8/22/25
549	Levee Clear and Grub	13 days	Tue 10/15/24	Thu 10/31/24
550	Riprap Rock Excavation	2 days	Thu 11/7/24	Fri 11/8/24
551	Riprap Haul to Processing Area	7 days	Tue 11/12/24	Wed 11/20/24
552	Riprap/Filter Material Processing (0.75'-1.25')	19 days	Fri 11/15/24	Thu 12/12/24
553	Riprap Haul to Embankment	19 days	Mon 11/18/24	Fri 12/13/24



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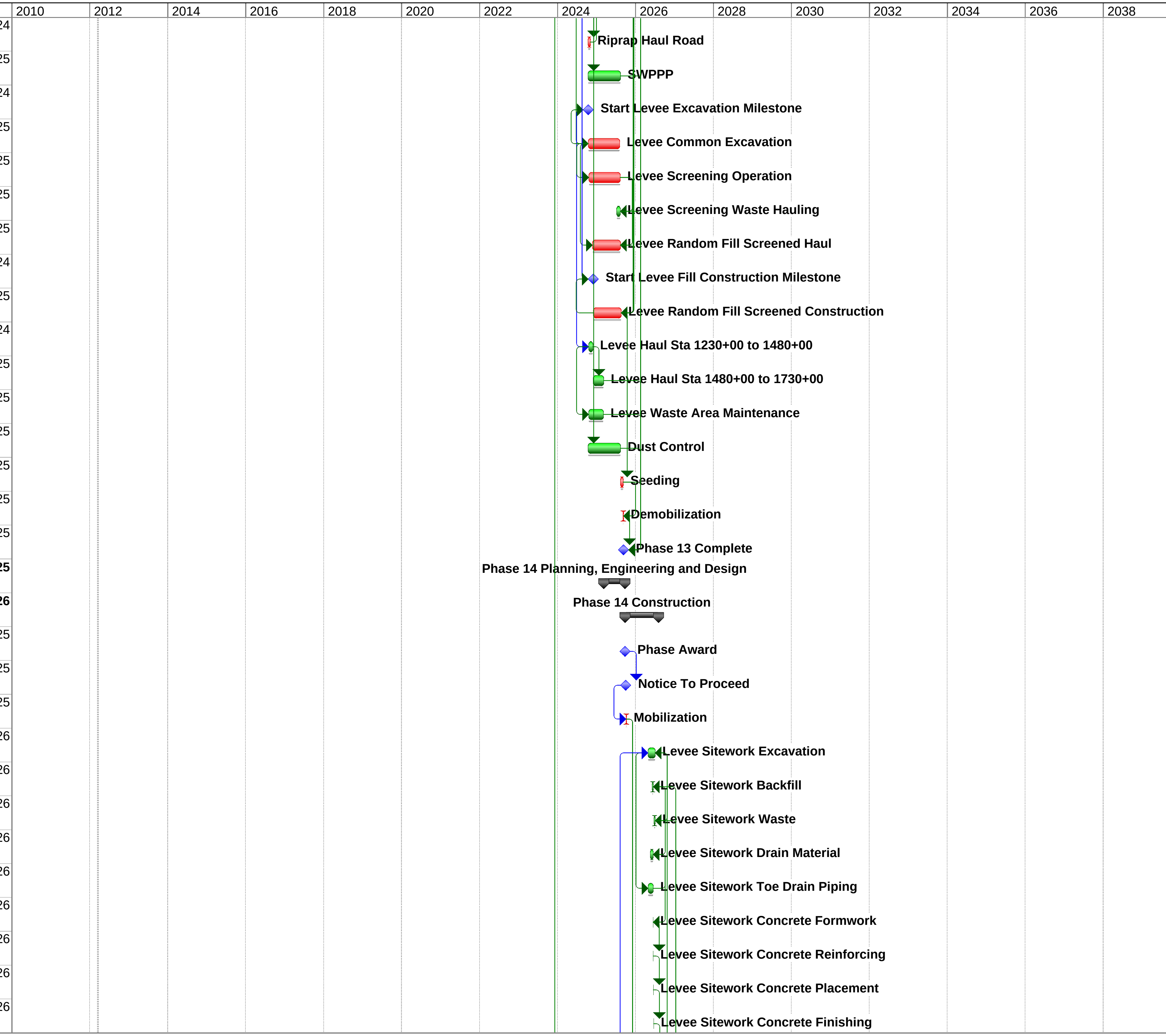
Task		Split		Milestone	◆	Project Summary		External Milestone	◆
Critical Task		Progress		Summary		External Tasks		Deadline	⇩

ID	Task Name	Duration	Early Start	Early Finish
554	Riprap Haul Road	17 days	Tue 10/15/24	Wed 11/6/24
555	SWPPP	211 days	Tue 10/15/24	Fri 8/15/25
556	Start Levee Excavation Milestone	0 days	Fri 10/18/24	Fri 10/18/24
557	Levee Common Excavation	202 days	Fri 10/18/24	Thu 8/7/25
558	Levee Screening Operation	202 days	Wed 10/23/24	Tue 8/12/25
559	Levee Screening Waste Hauling	25 days	Thu 7/10/25	Wed 8/13/25
560	Levee Random Fill Screened Haul	181 days	Tue 11/26/24	Thu 8/14/25
561	Start Levee Fill Construction Milestone	0 days	Wed 12/4/24	Wed 12/4/24
562	Levee Random Fill Screened Construction	181 days	Wed 12/4/24	Thu 8/21/25
563	Levee Haul Sta 1230+00 to 1480+00	28 days	Mon 10/21/24	Fri 11/29/24
564	Levee Haul Sta 1480+00 to 1730+00	67 days	Mon 12/2/24	Mon 3/10/25
565	Levee Waste Area Maintenance	94 days	Mon 10/21/24	Fri 3/7/25
566	Dust Control	211 days	Tue 10/15/24	Fri 8/15/25
567	Seeding	18 days	Fri 8/15/25	Wed 9/10/25
568	Demobilization	5 days	Mon 9/8/25	Fri 9/12/25
569	Phase 13 Complete	0 days	Fri 9/12/25	Fri 9/12/25
570	**Phase 14 Planning, Engineering and Design**	**140 days**	**Wed 3/12/25**	**Fri 9/26/25**
572	**Phase 14 Construction**	**216 days**	**Sun 9/28/25**	**Fri 8/7/26**
573	Phase Award	0 days	Sun 9/28/25	Sun 9/28/25
574	Notice To Proceed	0 days	Fri 10/3/25	Fri 10/3/25
575	Mobilization	5 days	Mon 10/6/25	Fri 10/10/25
576	Levee Sitework Excavation	46 days	Thu 4/30/26	Mon 7/6/26
577	Levee Sitework Backfill	9 days	Mon 6/8/26	Thu 6/18/26
578	Levee Sitework Waste	7 days	Thu 6/25/26	Mon 7/6/26
579	Levee Sitework Drain Material	18 days	Fri 5/22/26	Wed 6/17/26
580	Levee Sitework Toe Drain Piping	33 days	Fri 5/1/26	Wed 6/17/26
581	Levee Sitework Concrete Formwork	2 days	Tue 6/16/26	Wed 6/17/26
582	Levee Sitework Concrete Reinforcing	1 day	Thu 6/18/26	Thu 6/18/26
583	Levee Sitework Concrete Placement	1 day	Fri 6/19/26	Fri 6/19/26
584	Levee Sitework Concrete Finishing	1 day	Mon 6/22/26	Mon 6/22/26



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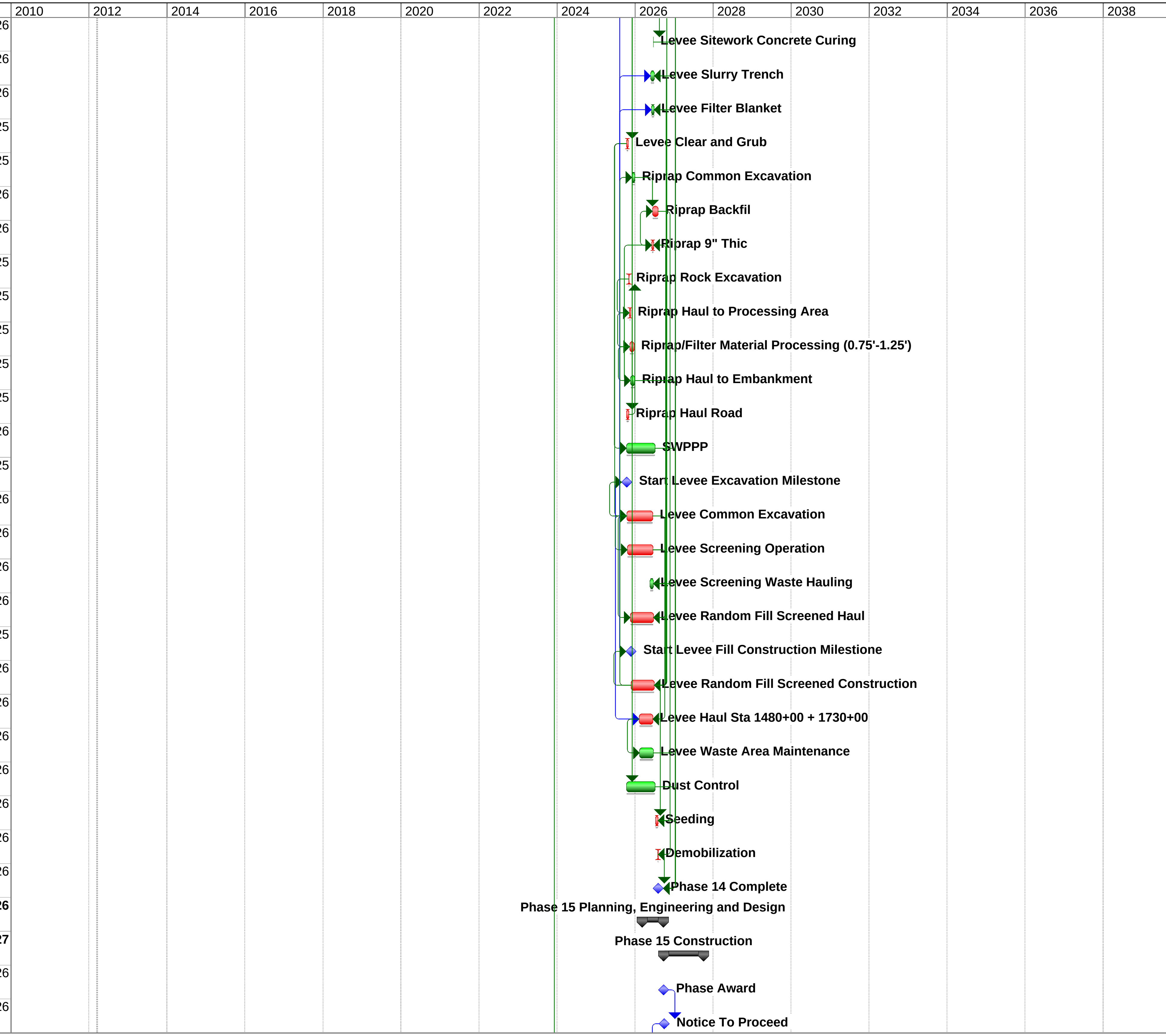
Task		Split		Milestone		Project Summary		External Milestone	
Critical Task		Progress		Summary		External Tasks		Deadline	

ID	Task Name	Duration	Early Start	Early Finish
585	Levee Sitework Concrete Curing	1 day	Tue 6/23/26	Tue 6/23/26
586	Levee Slurry Trench	25 days	Thu 5/28/26	Wed 7/1/26
587	Levee Filter Blanket	17 days	Fri 6/5/26	Mon 6/29/26
588	Levee Clear and Grub	13 days	Tue 10/14/25	Thu 10/30/25
589	Riprap Common Excavation	19 days	Thu 12/4/25	Wed 12/31/25
590	Riprap Backfil	37 days	Mon 6/15/26	Wed 8/5/26
591	Riprap 9" Thic	14 days	Mon 6/8/26	Thu 6/25/26
592	Riprap Rock Excavation	3 days	Wed 11/5/25	Fri 11/7/25
593	Riprap Haul to Processing Area	9 days	Mon 11/10/25	Fri 11/21/25
594	Riprap/Filter Material Processing (0.75'-1.25')	27 days	Fri 11/14/25	Tue 12/23/25
595	Riprap Haul to Embankment	27 days	Fri 11/21/25	Wed 12/31/25
596	Riprap Haul Road	16 days	Tue 10/14/25	Tue 11/4/25
597	SWPPP	184 days	Tue 10/14/25	Wed 7/8/26
598	Start Levee Excavation Milestone	0 days	Fri 10/17/25	Fri 10/17/25
599	Levee Common Excavation	166 days	Fri 10/17/25	Tue 6/16/26
600	Levee Screening Operation	166 days	Wed 10/22/25	Fri 6/19/26
601	Levee Screening Waste Hauling	21 days	Fri 5/22/26	Mon 6/22/26
602	Levee Random Fill Screened Haul	149 days	Wed 11/19/25	Tue 6/23/26
603	Start Levee Fill Construction Milestone	0 days	Wed 11/26/25	Wed 11/26/25
604	Levee Random Fill Screened Construction	149 days	Wed 11/26/25	Tue 6/30/26
605	Levee Haul Sta 1480+00 + 1730+00	90 days	Tue 2/10/26	Wed 6/17/26
606	Levee Waste Area Maintenance	90 days	Fri 2/13/26	Mon 6/22/26
607	Dust Control	184 days	Tue 10/14/25	Wed 7/8/26
608	Seeding	18 days	Mon 7/13/26	Wed 8/5/26
609	Demobilization	5 days	Mon 8/3/26	Fri 8/7/26
610	Phase 14 Complete	0 days	Fri 8/7/26	Fri 8/7/26
611	**Phase 15 Planning, Engineering and Design**	**140 days**	**Wed 3/11/26**	**Fri 9/25/26**
613	**Phase 15 Construction**	**258 days**	**Mon 9/28/26**	**Wed 10/6/27**
614	Phase Award	0 days	Mon 9/28/26	Mon 9/28/26
615	Notice To Proceed	0 days	Fri 10/2/26	Fri 10/2/26



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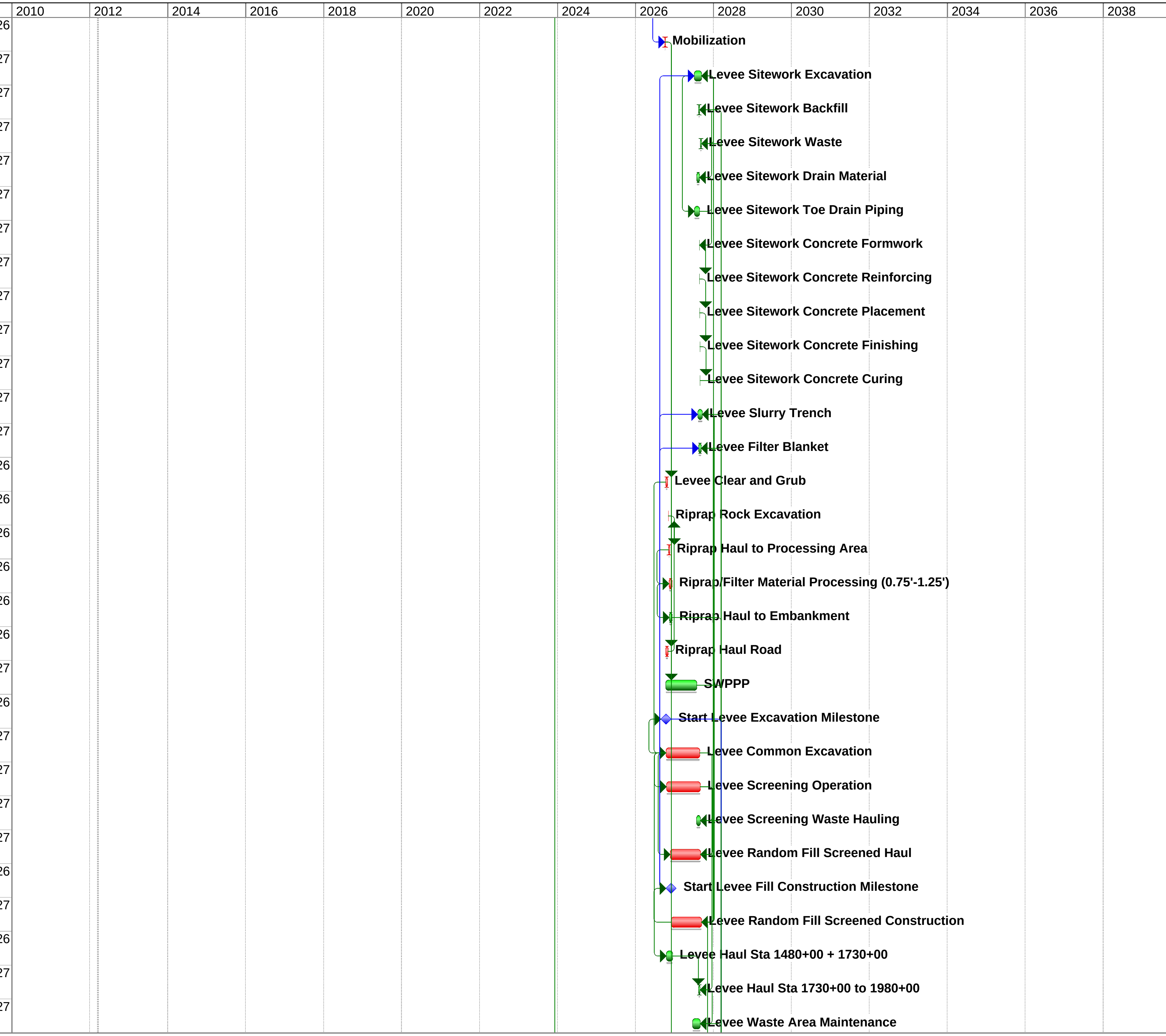
Task	Split	Milestone	Project Summary	External Milestone	
Critical Task	Progress	Summary	External Tasks	Deadline	

ID	Task Name	Duration	Early Start	Early Finish
616	Mobilization	5 days	Mon 10/5/26	Fri 10/9/26
617	Levee Sitework Excavation	47 days	Thu 7/8/27	Mon 9/13/27
618	Levee Sitework Backfill	9 days	Mon 8/16/27	Thu 8/26/27
619	Levee Sitework Waste	7 days	Thu 9/2/27	Mon 9/13/27
620	Levee Sitework Drain Material	19 days	Fri 7/30/27	Wed 8/25/27
621	Levee Sitework Toe Drain Piping	34 days	Fri 7/9/27	Wed 8/25/27
622	Levee Sitework Concrete Formwork	2 days	Tue 8/24/27	Wed 8/25/27
623	Levee Sitework Concrete Reinforcing	1 day	Thu 8/26/27	Thu 8/26/27
624	Levee Sitework Concrete Placement	1 day	Fri 8/27/27	Fri 8/27/27
625	Levee Sitework Concrete Finishing	1 day	Mon 8/30/27	Mon 8/30/27
626	Levee Sitework Concrete Curing	1 day	Tue 8/31/27	Tue 8/31/27
627	Levee Slurry Trench	29 days	Tue 8/10/27	Mon 9/20/27
628	Levee Filter Blanket	17 days	Wed 8/18/27	Fri 9/10/27
629	Levee Clear and Grub	13 days	Tue 10/13/26	Thu 10/29/26
630	Riprap Rock Excavation	2 days	Thu 11/5/26	Fri 11/6/26
631	Riprap Haul to Processing Area	7 days	Mon 11/9/26	Wed 11/18/26
632	Riprap/Filter Material Processing (0.75'-1.25')	19 days	Fri 11/13/26	Thu 12/10/26
633	Riprap Haul to Embankment	19 days	Mon 11/16/26	Fri 12/11/26
634	Riprap Haul Road	17 days	Tue 10/13/26	Wed 11/4/26
635	SWPPP	201 days	Tue 10/13/26	Fri 7/30/27
636	Start Levee Excavation Milestone	0 days	Fri 10/16/26	Fri 10/16/26
637	Levee Common Excavation	218 days	Fri 10/16/26	Fri 8/27/27
638	Levee Screening Operation	218 days	Wed 10/21/26	Wed 9/1/27
639	Levee Screening Waste Hauling	27 days	Wed 7/28/27	Thu 9/2/27
640	Levee Random Fill Screened Haul	196 days	Wed 11/25/26	Fri 9/3/27
641	Start Levee Fill Construction Milestone	0 days	Thu 12/3/26	Thu 12/3/26
642	Levee Random Fill Screened Construction	196 days	Thu 12/3/26	Mon 9/13/27
643	Levee Haul Sta 1480+00 + 1730+00	41 days	Mon 10/19/26	Wed 12/16/26
644	Levee Haul Sta 1730+00 to 1980+00	11 days	Mon 8/16/27	Mon 8/30/27
645	Levee Waste Area Maintenance	51 days	Mon 6/21/27	Tue 8/31/27



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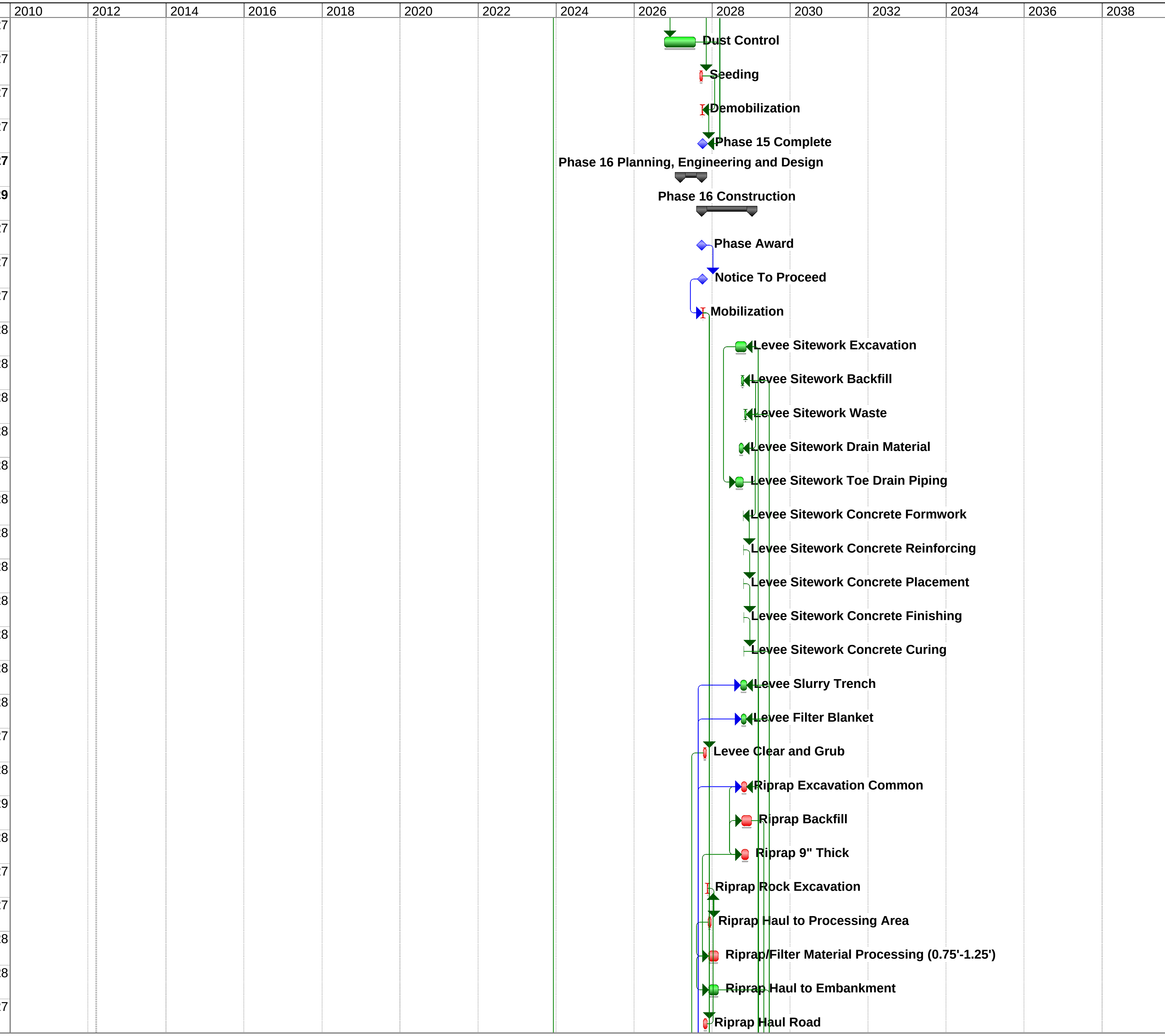
Task	Split	Milestone	Project Summary	External Milestone
Critical Task	Progress	Summary	External Tasks	Deadline

ID	Task Name	Duration	Early Start	Early Finish
646	Dust Control	201 days	Tue 10/13/26	Fri 7/30/27
647	Seeding	18 days	Thu 9/9/27	Mon 10/4/27
648	Demobilization	5 days	Thu 9/30/27	Wed 10/6/27
649	Phase 15 Complete	0 days	Wed 10/6/27	Wed 10/6/27
650	**Phase 16 Planning, Engineering and Design**	**140 days**	**Thu 3/11/27**	**Mon 9/27/27**
652	**Phase 16 Construction**	**322 days**	**Tue 9/28/27**	**Wed 1/10/29**
653	Phase Award	0 days	Tue 9/28/27	Tue 9/28/27
654	Notice To Proceed	0 days	Mon 10/4/27	Mon 10/4/27
655	Mobilization	5 days	Tue 10/5/27	Tue 10/12/27
656	Levee Sitework Excavation	70 days	Wed 8/9/28	Fri 11/17/28
657	Levee Sitework Backfill	14 days	Tue 10/3/28	Mon 10/23/28
658	Levee Sitework Waste	11 days	Thu 11/2/28	Fri 11/17/28
659	Levee Sitework Drain Material	28 days	Tue 9/12/28	Fri 10/20/28
660	Levee Sitework Toe Drain Piping	50 days	Thu 8/10/28	Fri 10/20/28
661	Levee Sitework Concrete Formwork	2 days	Thu 10/19/28	Fri 10/20/28
662	Levee Sitework Concrete Reinforcing	1 day	Mon 10/23/28	Mon 10/23/28
663	Levee Sitework Concrete Placement	1 day	Tue 10/24/28	Tue 10/24/28
664	Levee Sitework Concrete Finishing	1 day	Wed 10/25/28	Wed 10/25/28
665	Levee Sitework Concrete Curing	1 day	Thu 10/26/28	Thu 10/26/28
666	Levee Slurry Trench	38 days	Tue 9/26/28	Mon 11/20/28
667	Levee Filter Blanket	32 days	Mon 10/2/28	Thu 11/16/28
668	Levee Clear and Grub	19 days	Wed 10/13/27	Mon 11/8/27
669	Riprap Excavation Common	32 days	Wed 10/4/28	Mon 11/20/28
670	Riprap Backfill	61 days	Fri 10/6/28	Fri 1/5/29
671	Riprap 9" Thick	42 days	Thu 10/5/28	Wed 12/6/28
672	Riprap Rock Excavation	6 days	Wed 11/17/27	Wed 11/24/27
673	Riprap Haul to Processing Area	20 days	Fri 11/26/27	Thu 12/23/27
674	Riprap/Filter Material Processing (0.75'-1.25')	60 days	Wed 12/1/27	Mon 2/28/28
675	Riprap Haul to Embankment	60 days	Thu 12/2/27	Tue 2/29/28
676	Riprap Haul Road	24 days	Wed 10/13/27	Tue 11/16/27



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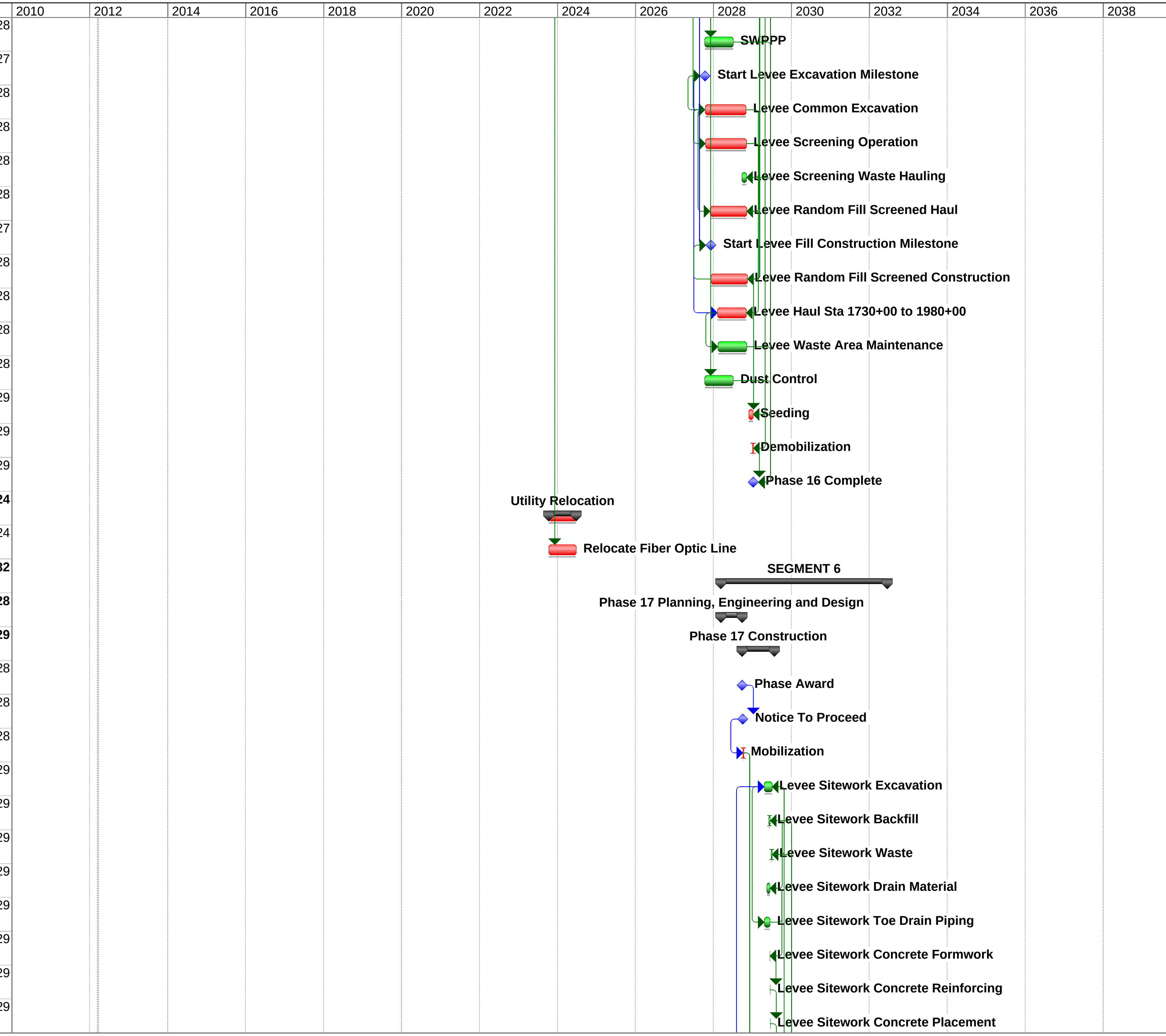
Task		Split		Milestone		Project Summary		External Milestone	
Critical Task		Progress		Summary		External Tasks		Deadline	

ID	Task Name	Duration	Early Start	Early Finish
677	SWPPP	184 days	Wed 10/13/27	Thu 7/6/28
678	Start Levee Excavation Milestone	0 days	Mon 10/18/27	Mon 10/18/27
679	Levee Common Excavation	264 days	Mon 10/18/27	Thu 11/2/28
680	Levee Screening Operation	264 days	Thu 10/21/27	Tue 11/7/28
681	Levee Screening Waste Hauling	32 days	Mon 9/25/28	Wed 11/8/28
682	Levee Random Fill Screened Haul	237 days	Fri 12/3/27	Thu 11/9/28
683	Start Levee Fill Construction Milestone	0 days	Fri 12/10/27	Fri 12/10/27
684	Levee Random Fill Screened Construction	237 days	Fri 12/10/27	Fri 11/17/28
685	Levee Haul Sta 1730+00 to 1980+00	188 days	Thu 2/10/28	Mon 11/6/28
686	Levee Waste Area Maintenance	188 days	Tue 2/15/28	Thu 11/9/28
687	Dust Control	184 days	Wed 10/13/27	Thu 7/6/28
688	Seeding	27 days	Wed 11/29/28	Mon 1/8/29
689	Demobilization	5 days	Thu 1/4/29	Wed 1/10/29
690	Phase 16 Complete	0 days	Wed 1/10/29	Wed 1/10/29
849	**Utility Relocation**	**176 days**	**Fri 10/13/23**	**Tue 6/25/24**
850	Relocate Fiber Optic Line	176 days	Fri 10/13/23	Tue 6/25/24
691	**SEGMENT 6**	**1074 days**	**Mon 3/13/28**	**Fri 6/18/32**
692	**Phase 17 Planning, Engineering and Design**	**140 days**	**Mon 3/13/28**	**Wed 9/27/28**
694	**Phase 17 Construction**	**208 days**	**Thu 9/28/28**	**Fri 7/27/29**
695	Phase Award	0 days	Thu 9/28/28	Thu 9/28/28
696	Notice To Proceed	0 days	Wed 10/4/28	Wed 10/4/28
697	Mobilization	5 days	Thu 10/5/28	Thu 10/12/28
698	Levee Sitework Excavation	53 days	Mon 4/23/29	Fri 7/6/29
699	Levee Sitework Backfill	11 days	Mon 6/4/29	Mon 6/18/29
700	Levee Sitework Waste	8 days	Tue 6/26/29	Fri 7/6/29
701	Levee Sitework Drain Material	21 days	Thu 5/17/29	Fri 6/15/29
702	Levee Sitework Toe Drain Piping	38 days	Tue 4/24/29	Fri 6/15/29
703	Levee Sitework Concrete Formwork	2 days	Thu 6/14/29	Fri 6/15/29
704	Levee Sitework Concrete Reinforcing	1 day	Mon 6/18/29	Mon 6/18/29
705	Levee Sitework Concrete Placement	1 day	Tue 6/19/29	Tue 6/19/29



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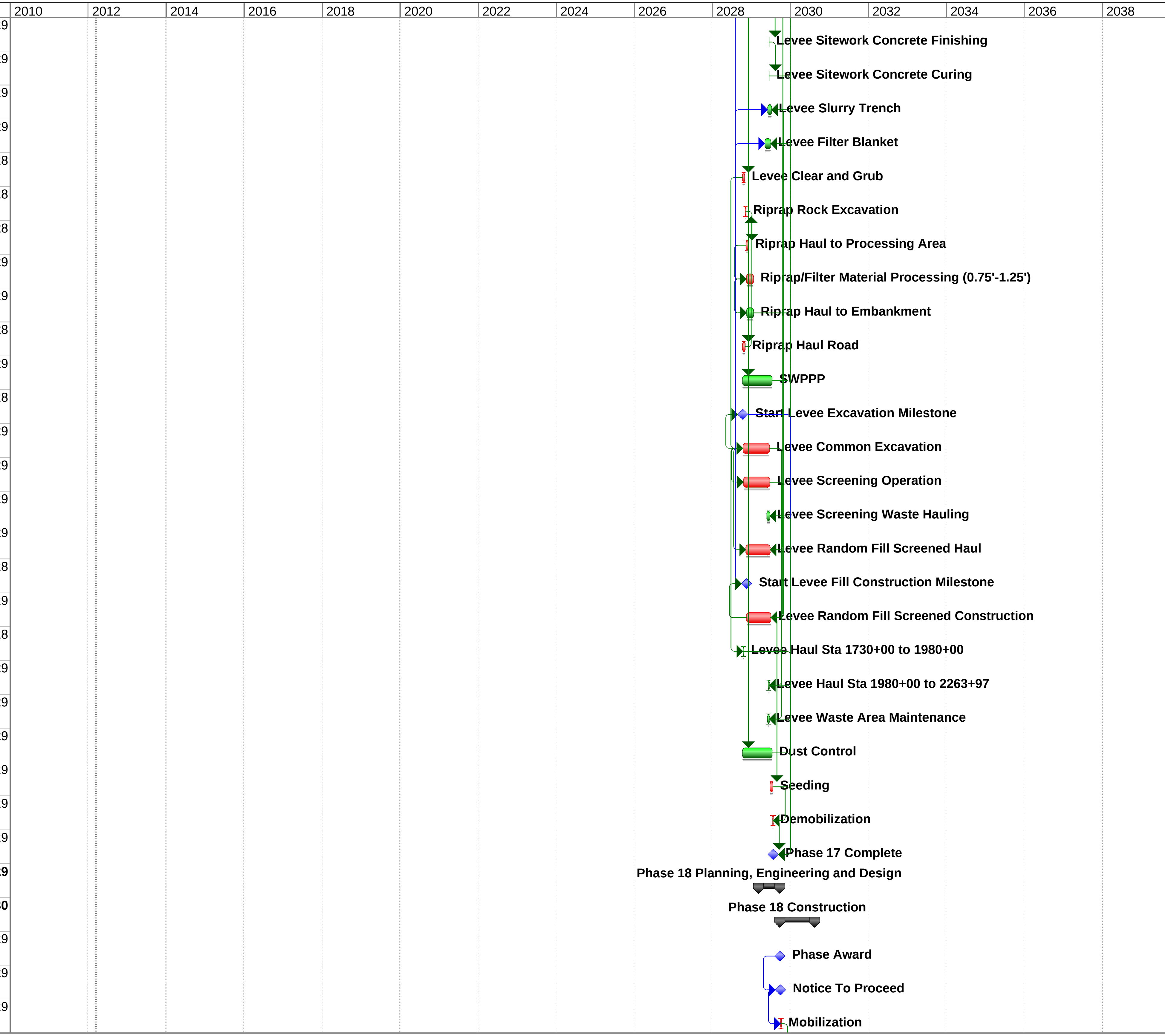
Task	Split	Milestone	Project Summary	External Milestone
Critical Task	Progress	Summary	External Tasks	Deadline

ID	Task Name	Duration	Early Start	Early Finish
706	Levee Sitework Concrete Finishing	1 day	Wed 6/20/29	Wed 6/20/29
707	Levee Sitework Concrete Curing	1 day	Thu 6/21/29	Thu 6/21/29
708	Levee Slurry Trench	27 days	Wed 6/6/29	Fri 7/13/29
709	Levee Filter Blanket	38 days	Fri 5/11/29	Thu 7/5/29
710	Levee Clear and Grub	14 days	Fri 10/13/28	Wed 11/1/28
711	Riprap Rock Excavation	4 days	Wed 11/8/28	Tue 11/14/28
712	Riprap Haul to Processing Area	14 days	Wed 11/15/28	Tue 12/5/28
713	Riprap/Filter Material Processing (0.75'-1.25')	43 days	Mon 11/20/28	Tue 1/23/29
714	Riprap Haul to Embankment	43 days	Tue 11/21/28	Wed 1/24/29
715	Riprap Haul Road	18 days	Fri 10/13/28	Tue 11/7/28
716	SWPPP	190 days	Fri 10/13/28	Tue 7/17/29
717	Start Levee Excavation Milestone	0 days	Wed 10/18/28	Wed 10/18/28
718	Levee Common Excavation	170 days	Wed 10/18/28	Thu 6/21/29
719	Levee Screening Operation	170 days	Mon 10/23/28	Tue 6/26/29
720	Levee Screening Waste Hauling	22 days	Tue 5/29/29	Wed 6/27/29
721	Levee Random Fill Screened Haul	157 days	Tue 11/14/28	Thu 6/28/29
722	Start Levee Fill Construction Milestone	0 days	Tue 11/21/28	Tue 11/21/28
723	Levee Random Fill Screened Construction	157 days	Tue 11/21/28	Fri 7/6/29
724	Levee Haul Sta 1730+00 to 1980+00	5 days	Thu 10/19/28	Wed 10/25/28
725	Levee Haul Sta 1980+00 to 2263+97	9 days	Mon 6/11/29	Thu 6/21/29
726	Levee Waste Area Maintenance	13 days	Tue 6/5/29	Thu 6/21/29
727	Dust Control	190 days	Fri 10/13/28	Tue 7/17/29
728	Seeding	20 days	Wed 6/27/29	Wed 7/25/29
729	Demobilization	5 days	Mon 7/23/29	Fri 7/27/29
730	Phase 17 Complete	0 days	Fri 7/27/29	Fri 7/27/29
731	**Phase 18 Planning, Engineering and Design**	**140 days**	**Tue 3/13/29**	**Thu 9/27/29**
733	**Phase 18 Construction**	**224 days**	**Fri 9/28/29**	**Tue 8/20/30**
734	Phase Award	0 days	Fri 9/28/29	Fri 9/28/29
735	Notice To Proceed	0 days	Thu 10/4/29	Thu 10/4/29
736	Mobilization	5 days	Fri 10/5/29	Fri 10/12/29



Project: San Acacia Alt A Base + 4
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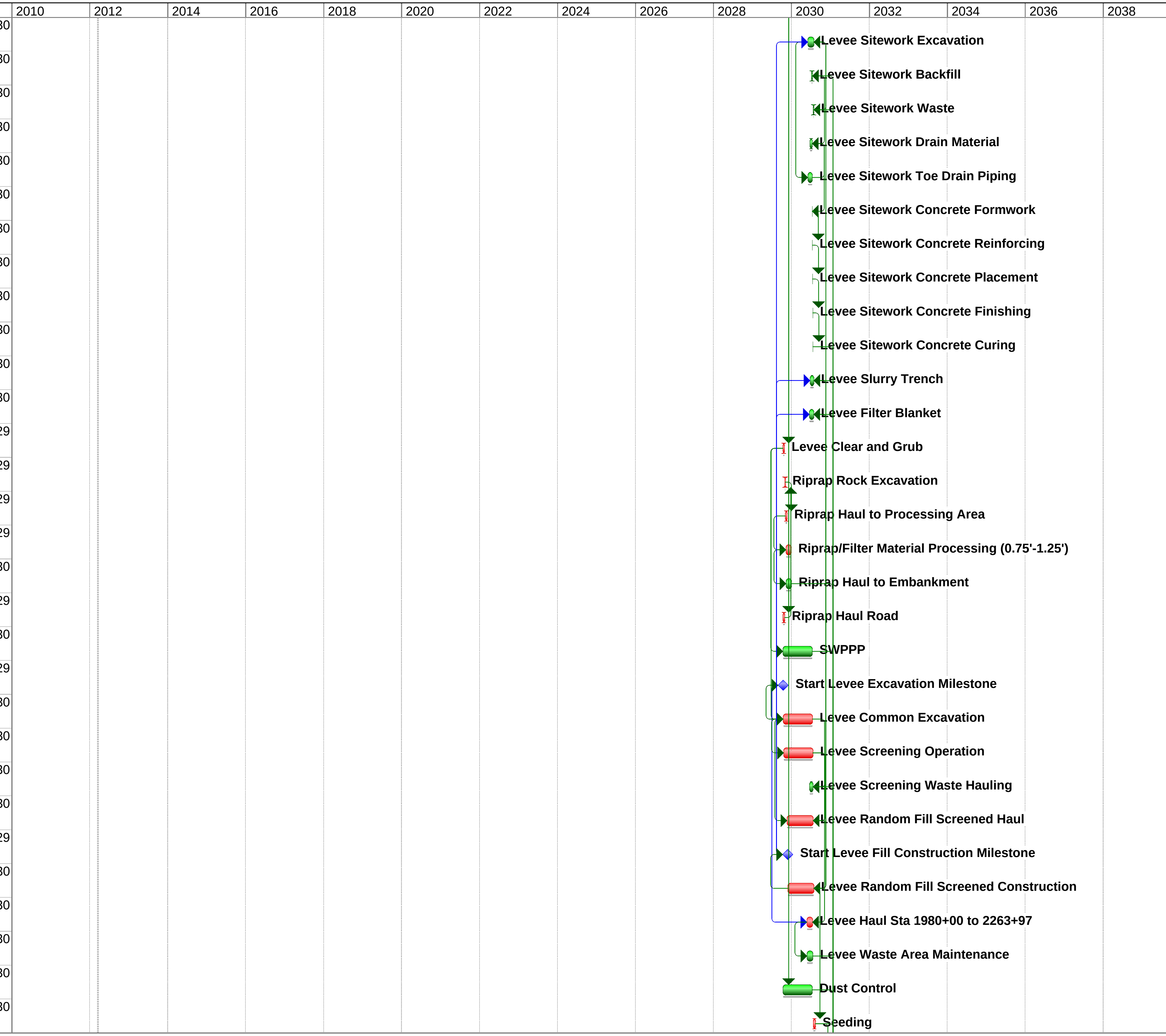
Task | Split | Milestone | Project Summary | External Milestone
Critical Task | Progress | Summary | External Tasks | Deadline

ID	Task Name	Duration	Early Start	Early Finish
737	Levee Sitework Excavation	41 days	Wed 6/5/30	Thu 8/1/30
738	Levee Sitework Backfill	8 days	Tue 7/9/30	Thu 7/18/30
739	Levee Sitework Waste	6 days	Thu 7/25/30	Thu 8/1/30
740	Levee Sitework Drain Material	16 days	Tue 6/25/30	Wed 7/17/30
741	Levee Sitework Toe Drain Piping	29 days	Thu 6/6/30	Wed 7/17/30
742	Levee Sitework Concrete Formwork	2 days	Tue 7/16/30	Wed 7/17/30
743	Levee Sitework Concrete Reinforcing	1 day	Thu 7/18/30	Thu 7/18/30
744	Levee Sitework Concrete Placement	1 day	Fri 7/19/30	Fri 7/19/30
745	Levee Sitework Concrete Finishing	1 day	Mon 7/22/30	Mon 7/22/30
746	Levee Sitework Concrete Curing	1 day	Tue 7/23/30	Tue 7/23/30
747	Levee Slurry Trench	25 days	Thu 6/27/30	Thu 8/1/30
748	Levee Filter Blanket	29 days	Thu 6/20/30	Wed 7/31/30
749	Levee Clear and Grub	11 days	Mon 10/15/29	Mon 10/29/29
750	Riprap Rock Excavation	3 days	Fri 11/2/29	Tue 11/6/29
751	Riprap Haul to Processing Area	11 days	Wed 11/7/29	Fri 11/23/29
752	Riprap/Filter Material Processing (0.75'-1.25')	33 days	Tue 11/13/29	Mon 12/31/29
753	Riprap Haul to Embankment	33 days	Wed 11/14/29	Wed 1/2/30
754	Riprap Haul Road	14 days	Mon 10/15/29	Thu 11/1/29
755	SWPPP	190 days	Mon 10/15/29	Wed 7/17/30
756	Start Levee Excavation Milestone	0 days	Thu 10/18/29	Thu 10/18/29
757	Levee Common Excavation	188 days	Thu 10/18/29	Thu 7/18/30
758	Levee Screening Operation	188 days	Tue 10/23/29	Tue 7/23/30
759	Levee Screening Waste Hauling	23 days	Fri 6/21/30	Wed 7/24/30
760	Levee Random Fill Screened Haul	169 days	Fri 11/23/29	Thu 7/25/30
761	Start Levee Fill Construction Milestone	0 days	Fri 11/30/29	Fri 11/30/29
762	Levee Random Fill Screened Construction	169 days	Fri 11/30/29	Thu 8/1/30
763	Levee Haul Sta 1980+00 to 2263+97	38 days	Tue 5/28/30	Fri 7/19/30
764	Levee Waste Area Maintenance	38 days	Wed 5/29/30	Mon 7/22/30
765	Dust Control	190 days	Mon 10/15/29	Wed 7/17/30
766	Seeding	16 days	Fri 7/26/30	Fri 8/16/30



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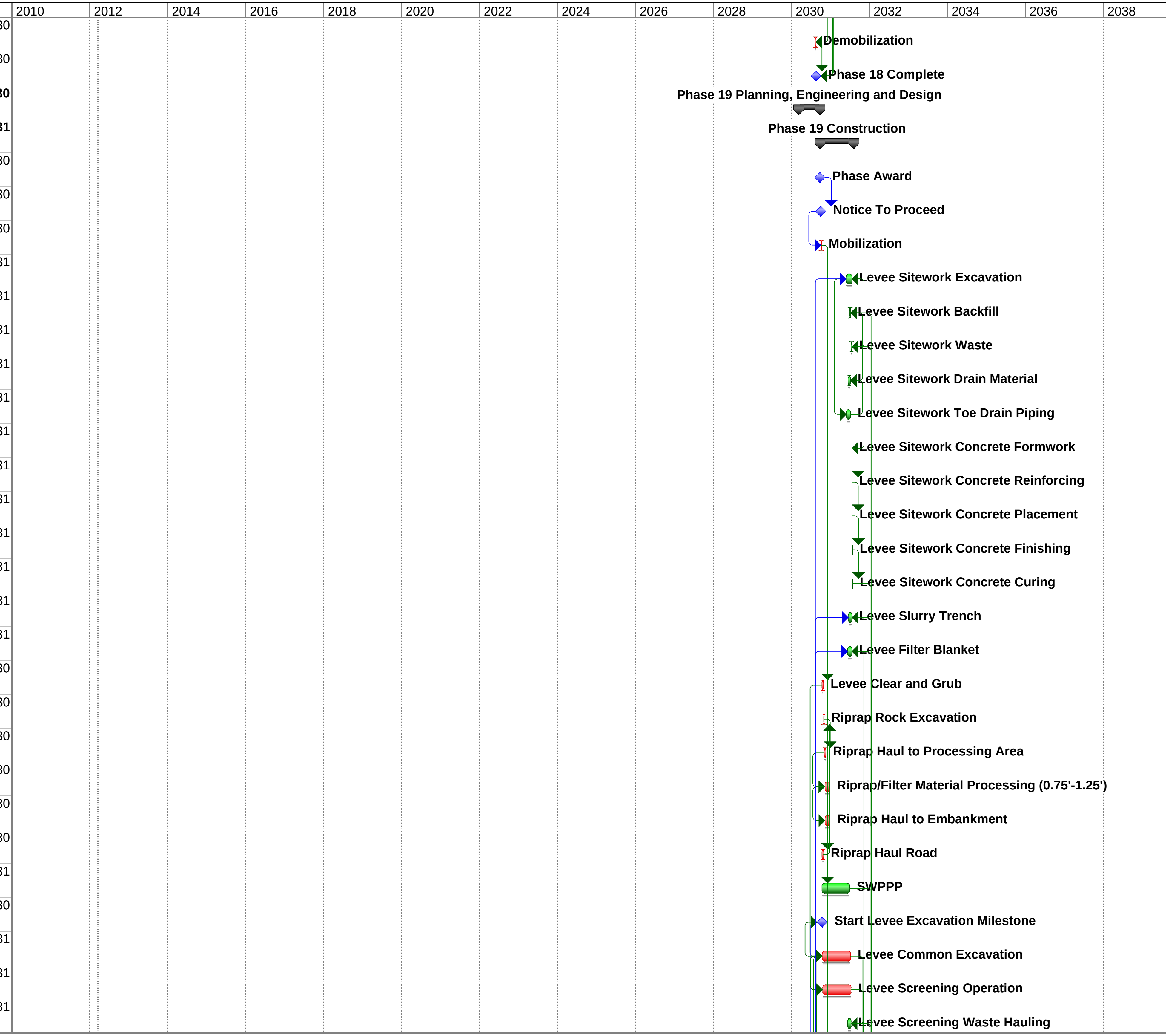
Task	Split	Milestone	Project Summary	External Milestone
Critical Task	Progress	Summary	External Tasks	Deadline

ID	Task Name	Duration	Early Start	Early Finish
767	Demobilization	5 days	Wed 8/14/30	Tue 8/20/30
768	Phase 18 Complete	0 days	Tue 8/20/30	Tue 8/20/30
769	**Phase 19 Planning, Engineering and Design**	**140 days**	**Wed 3/13/30**	**Fri 9/27/30**
771	**Phase 19 Construction**	**217 days**	**Sat 9/28/30**	**Mon 8/11/31**
772	Phase Award	0 days	Sat 9/28/30	Sat 9/28/30
773	Notice To Proceed	0 days	Fri 10/4/30	Fri 10/4/30
774	Mobilization	5 days	Mon 10/7/30	Fri 10/11/30
775	Levee Sitework Excavation	39 days	Fri 5/30/31	Thu 7/24/31
776	Levee Sitework Backfill	8 days	Tue 7/1/31	Fri 7/11/31
777	Levee Sitework Waste	6 days	Thu 7/17/31	Thu 7/24/31
778	Levee Sitework Drain Material	16 days	Wed 6/18/31	Thu 7/10/31
779	Levee Sitework Toe Drain Piping	28 days	Mon 6/2/31	Thu 7/10/31
780	Levee Sitework Concrete Formwork	2 days	Wed 7/23/31	Thu 7/24/31
781	Levee Sitework Concrete Reinforcing	1 day	Fri 7/25/31	Fri 7/25/31
782	Levee Sitework Concrete Placement	1 day	Mon 7/28/31	Mon 7/28/31
783	Levee Sitework Concrete Finishing	1 day	Tue 7/29/31	Tue 7/29/31
784	Levee Sitework Concrete Curing	1 day	Wed 7/30/31	Wed 7/30/31
785	Levee Slurry Trench	24 days	Fri 6/20/31	Thu 7/24/31
786	Levee Filter Blanket	28 days	Fri 6/13/31	Wed 7/23/31
787	Levee Clear and Grub	11 days	Tue 10/15/30	Tue 10/29/30
788	Riprap Rock Excavation	3 days	Fri 11/1/30	Tue 11/5/30
789	Riprap Haul to Processing Area	11 days	Wed 11/6/30	Thu 11/21/30
790	Riprap/Filter Material Processing (0.75'-1.25')	32 days	Tue 11/12/30	Fri 12/27/30
791	Riprap Haul to Embankment	32 days	Wed 11/13/30	Mon 12/30/30
792	Riprap Haul Road	13 days	Tue 10/15/30	Thu 10/31/30
793	SWPPP	180 days	Tue 10/15/30	Wed 7/2/31
794	Start Levee Excavation Milestone	0 days	Fri 10/18/30	Fri 10/18/30
795	Levee Common Excavation	182 days	Fri 10/18/30	Thu 7/10/31
796	Levee Screening Operation	182 days	Wed 10/23/30	Tue 7/15/31
797	Levee Screening Waste Hauling	23 days	Fri 6/13/31	Wed 7/16/31



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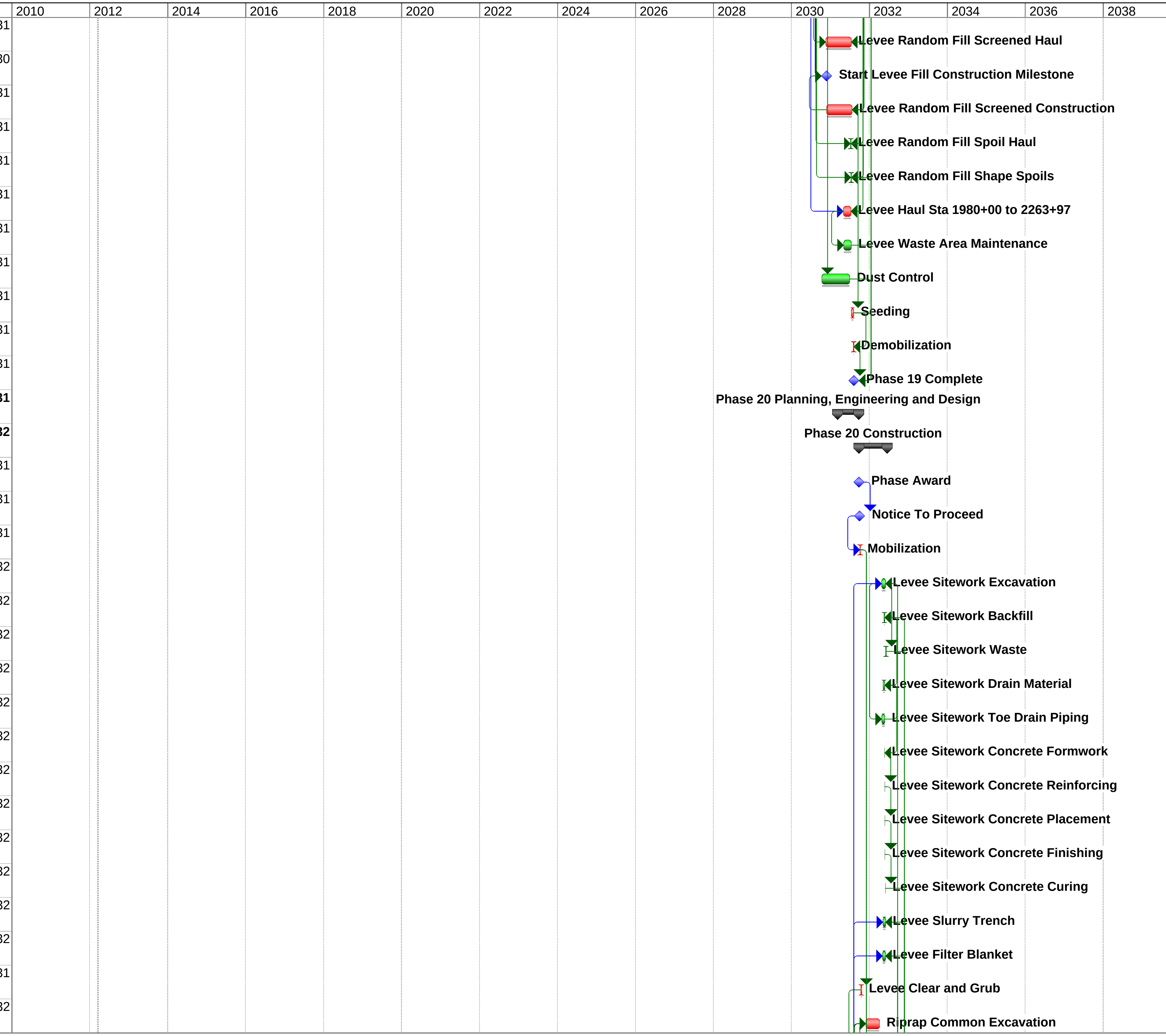
Task | Split | Milestone | Project Summary | External Milestone
Critical Task | Progress | Summary | External Tasks | Deadline

ID	Task Name	Duration	Early Start	Early Finish
798	Levee Random Fill Screened Haul	164 days	Thu 11/21/30	Thu 7/17/31
799	Start Levee Fill Construction Milestone	0 days	Fri 11/29/30	Fri 11/29/30
800	Levee Random Fill Screened Construction	164 days	Fri 11/29/30	Thu 7/24/31
801	Levee Random Fill Spoil Haul	4 days	Thu 7/10/31	Tue 7/15/31
802	Levee Random Fill Shape Spoils	4 days	Tue 7/15/31	Fri 7/18/31
803	Levee Haul Sta 1980+00 to 2263+97	49 days	Mon 5/5/31	Mon 7/14/31
804	Levee Waste Area Maintenance	49 days	Thu 5/8/31	Thu 7/17/31
805	Dust Control	180 days	Tue 10/15/30	Wed 7/2/31
806	Seeding	15 days	Fri 7/18/31	Thu 8/7/31
807	Demobilization	5 days	Tue 8/5/31	Mon 8/11/31
808	Phase 19 Complete	0 days	Mon 8/11/31	Mon 8/11/31
809	**Phase 20 Planning, Engineering and Design**	**140 days**	**Wed 3/12/31**	**Fri 9/26/31**
811	**Phase 20 Construction**	**182 days**	**Sun 9/28/31**	**Fri 6/18/32**
812	Phase Award	0 days	Sun 9/28/31	Sun 9/28/31
813	Notice To Proceed	0 days	Fri 10/3/31	Fri 10/3/31
814	Mobilization	5 days	Mon 10/6/31	Fri 10/10/31
815	Levee Sitework Excavation	27 days	Tue 4/27/32	Thu 6/3/32
816	Levee Sitework Backfill	6 days	Wed 5/19/32	Wed 5/26/32
817	Levee Sitework Waste	4 days	Fri 6/4/32	Wed 6/9/32
818	Levee Sitework Drain Material	11 days	Tue 5/11/32	Tue 5/25/32
819	Levee Sitework Toe Drain Piping	20 days	Wed 4/28/32	Tue 5/25/32
820	Levee Sitework Concrete Formwork	1 day	Tue 5/25/32	Tue 5/25/32
821	Levee Sitework Concrete Reinforcing	1 day	Wed 5/26/32	Wed 5/26/32
822	Levee Sitework Concrete Placement	1 day	Thu 5/27/32	Thu 5/27/32
823	Levee Sitework Concrete Finishing	1 day	Fri 5/28/32	Fri 5/28/32
824	Levee Sitework Concrete Curing	1 day	Tue 6/1/32	Tue 6/1/32
825	Levee Slurry Trench	18 days	Mon 5/10/32	Thu 6/3/32
826	Levee Filter Blanket	19 days	Thu 5/6/32	Wed 6/2/32
827	Levee Clear and Grub	8 days	Tue 10/14/31	Thu 10/23/31
828	Riprap Common Excavation	87 days	Tue 12/2/31	Tue 4/6/32



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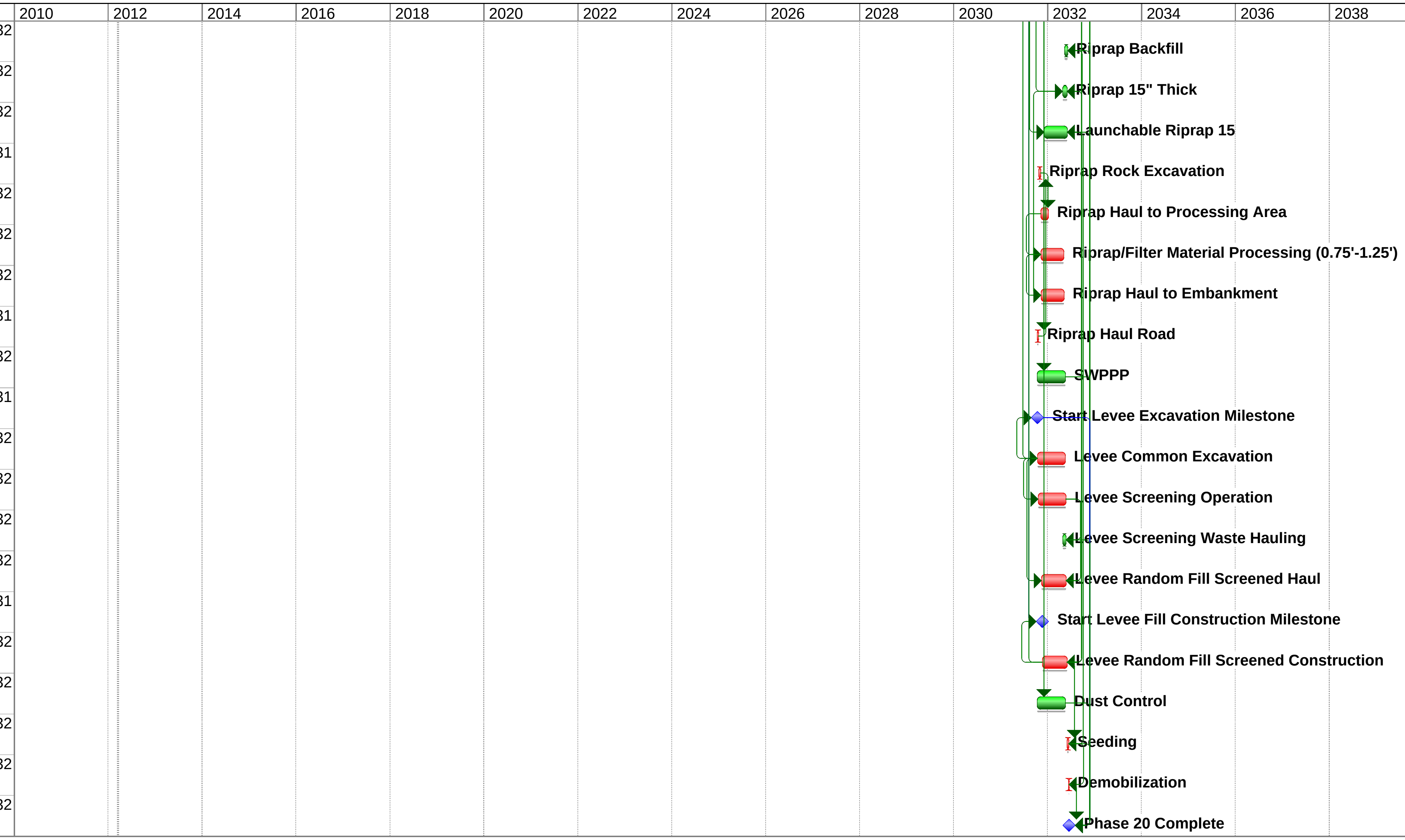
Task	Split	Milestone	Project Summary	External Milestone
Critical Task	Progress	Summary	External Tasks	Deadline

ID	Task Name	Duration	Early Start	Early Finish
829	Riprap Backfill	17 days	Fri 5/14/32	Tue 6/8/32
830	Riprap 15" Thick	25 days	Thu 4/29/32	Thu 6/3/32
831	Launchable Riprap 15	125 days	Mon 12/8/31	Fri 6/4/32
832	Riprap Rock Excavation	11 days	Mon 10/27/31	Mon 11/10/31
833	Riprap Haul to Processing Area	40 days	Wed 11/12/31	Fri 1/9/32
834	Riprap/Filter Material Processing (0.75'-1.25')	122 days	Thu 11/13/31	Fri 5/7/32
835	Riprap Haul to Embankment	122 days	Fri 11/14/31	Mon 5/10/32
836	Riprap Haul Road	9 days	Tue 10/14/31	Fri 10/24/31
837	SWPPP	153 days	Tue 10/14/31	Fri 5/21/32
838	Start Levee Excavation Milestone	0 days	Fri 10/17/31	Fri 10/17/31
839	Levee Common Excavation	148 days	Fri 10/17/31	Wed 5/19/32
840	Levee Screening Operation	148 days	Wed 10/22/31	Mon 5/24/32
841	Levee Screening Waste Hauling	18 days	Fri 4/30/32	Tue 5/25/32
842	Levee Random Fill Screened Haul	133 days	Mon 11/17/31	Wed 5/26/32
843	Start Levee Fill Construction Milestone	0 days	Mon 11/24/31	Mon 11/24/31
844	Levee Random Fill Screened Construction	133 days	Mon 11/24/31	Thu 6/3/32
845	Dust Control	153 days	Tue 10/14/31	Fri 5/21/32
846	Seeding	11 days	Wed 6/2/32	Wed 6/16/32
847	Demobilization	5 days	Mon 6/14/32	Fri 6/18/32
848	Phase 20 Complete	0 days	Fri 6/18/32	Fri 6/18/32



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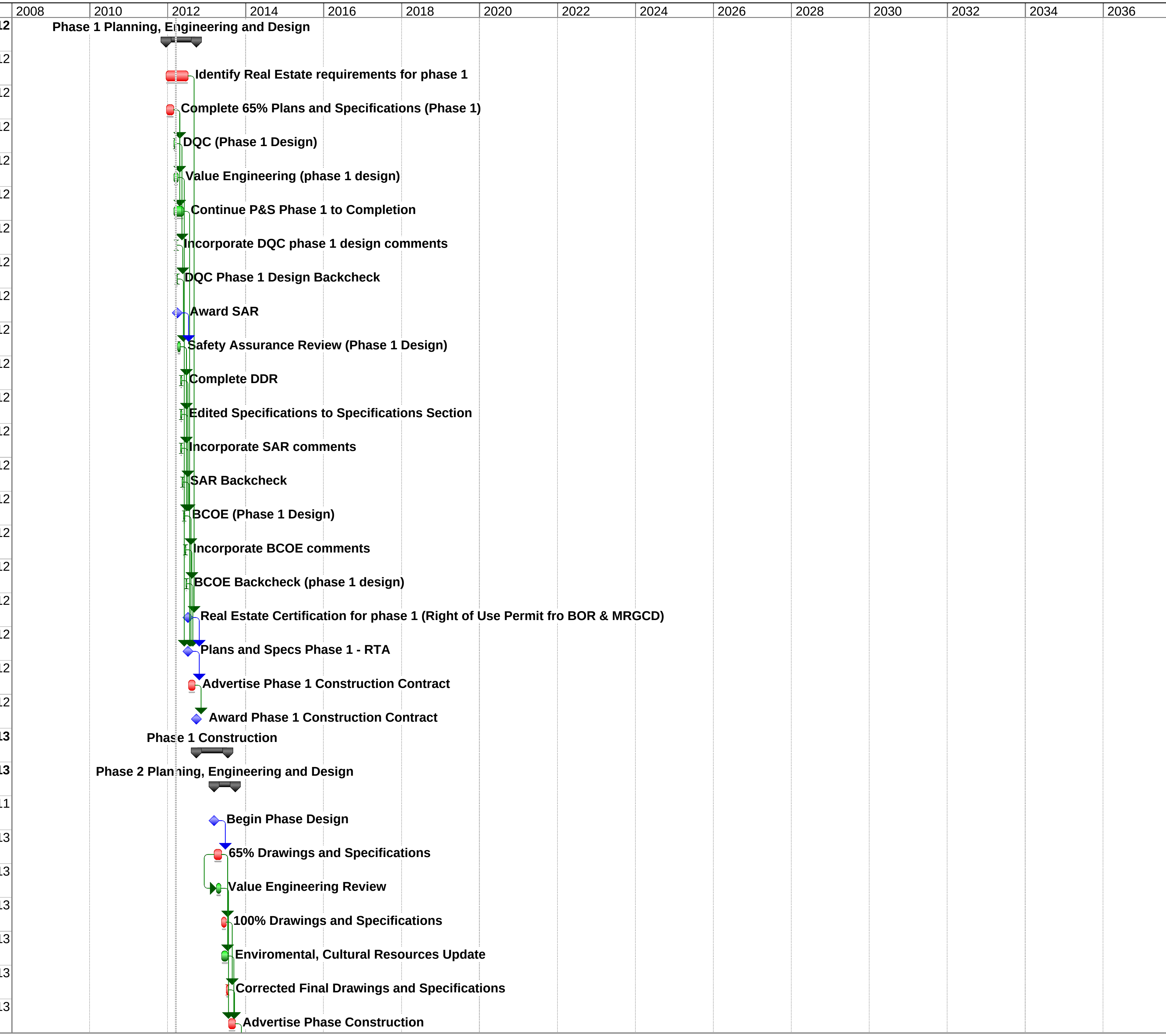
Task	Split	Milestone	Project Summary	External Milestone
Critical Task	Progress	Summary	External Tasks	Deadline

ID	Task Name	Duration	Early Start	Early Finish
1	**Phase 1 Planning, Engineering and Design**	**199 days**	**Mon 12/19/11**	**Fri 9/28/12**
2	Identify Real Estate requirements for phase 1	143 days	Mon 12/19/11	Wed 7/11/12
3	Complete 65% Plans and Specifications (Phase 1)	45 days	Fri 12/23/11	Tue 2/28/12
4	DQC (Phase 1 Design)	14 days	Wed 2/29/12	Mon 3/19/12
5	Value Engineering (phase 1 design)	30 days	Wed 2/29/12	Tue 4/10/12
6	Continue P&S Phase 1 to Completion	65 days	Wed 2/29/12	Wed 5/30/12
7	Incorporate DQC phase 1 design comments	5 days	Tue 3/20/12	Mon 3/26/12
8	DQC Phase 1 Design Backcheck	5 days	Tue 3/27/12	Mon 4/2/12
9	Award SAR	0 days	Tue 4/3/12	Tue 4/3/12
10	Safety Assurance Review (Phase 1 Design)	20 days	Tue 4/3/12	Mon 4/30/12
11	Complete DDR	10 days	Tue 5/1/12	Mon 5/14/12
12	Edited Specifications to Specifications Section	10 days	Tue 5/1/12	Mon 5/14/12
13	Incorporate SAR comments	10 days	Tue 5/1/12	Mon 5/14/12
14	SAR Backcheck	9 days	Tue 5/15/12	Fri 5/25/12
15	BCOE (Phase 1 Design)	10 days	Tue 5/29/12	Mon 6/11/12
16	Incorporate BCOE comments	7 days	Tue 6/12/12	Wed 6/20/12
17	BCOE Backcheck (phase 1 design)	7 days	Thu 6/21/12	Fri 6/29/12
18	Real Estate Certification for phase 1 (Right of Use Permit fro BOR & MRGCD)	0 days	Wed 7/11/12	Wed 7/11/12
19	Plans and Specs Phase 1 - RTA	0 days	Wed 7/11/12	Wed 7/11/12
20	Advertise Phase 1 Construction Contract	44 days	Mon 7/16/12	Fri 9/14/12
21	Award Phase 1 Construction Contract	0 days	Fri 9/28/12	Fri 9/28/12
22	**Phase 1 Construction**	**202 days**	**Fri 9/28/12**	**Fri 7/19/13**
24	**Phase 2 Planning, Engineering and Design**	**140 days**	**Wed 3/13/13**	**Fri 9/27/13**
25	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
26	65% Drawings and Specifications	50 days	Wed 3/13/13	Tue 5/21/13
30	Value Engineering Review	30 days	Wed 4/3/13	Tue 5/14/13
27	100% Drawings and Specifications	30 days	Wed 5/22/13	Wed 7/3/13
31	Enviromental, Cultural Resources Update	40 days	Wed 5/22/13	Thu 7/18/13
28	Corrected Final Drawings and Specifications	15 days	Fri 7/5/13	Thu 7/25/13
29	Advertise Phase Construction	45 days	Fri 7/26/13	Fri 9/27/13



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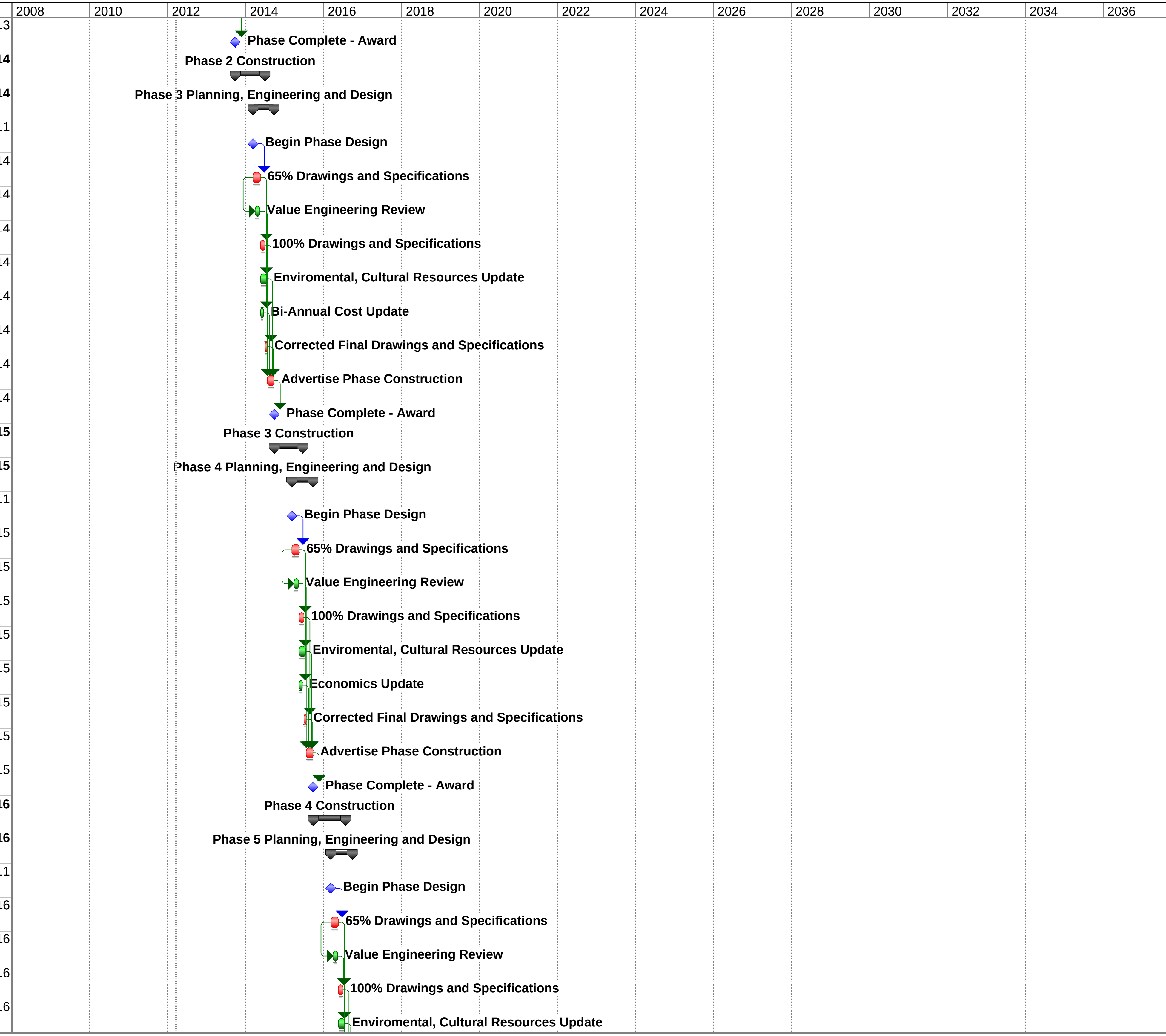
Task	Split	Milestone	Project Summary	External Milestone
Critical Task	Progress	Summary	External Tasks	Deadline

ID	Task Name	Duration	Early Start	Early Finish
32	Phase Complete - Award	0 days	Fri 9/27/13	Fri 9/27/13
33	**Phase 2 Construction**	**190 days**	**Sat 9/28/13**	**Wed 7/2/14**
35	**Phase 3 Planning, Engineering and Design**	**140 days**	**Wed 3/12/14**	**Fri 9/26/14**
36	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
37	65% Drawings and Specifications	50 days	Wed 3/12/14	Tue 5/20/14
38	Value Engineering Review	30 days	Wed 4/2/14	Tue 5/13/14
39	100% Drawings and Specifications	30 days	Wed 5/21/14	Wed 7/2/14
40	Enviromental, Cultural Resources Update	40 days	Wed 5/21/14	Thu 7/17/14
41	Bi-Annual Cost Update	20 days	Wed 5/21/14	Wed 6/18/14
42	Corrected Final Drawings and Specifications	15 days	Thu 7/3/14	Thu 7/24/14
43	Advertise Phase Construction	45 days	Fri 7/25/14	Fri 9/26/14
44	Phase Complete - Award	0 days	Fri 9/26/14	Fri 9/26/14
45	**Phase 3 Construction**	**184 days**	**Sun 9/28/14**	**Tue 6/23/15**
47	**Phase 4 Planning, Engineering and Design**	**140 days**	**Wed 3/11/15**	**Fri 9/25/15**
48	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
49	65% Drawings and Specifications	50 days	Wed 3/11/15	Tue 5/19/15
50	Value Engineering Review	30 days	Wed 4/1/15	Tue 5/12/15
51	100% Drawings and Specifications	30 days	Wed 5/20/15	Wed 7/1/15
52	Enviromental, Cultural Resources Update	40 days	Wed 5/20/15	Thu 7/16/15
53	Economics Update	20 days	Wed 5/20/15	Wed 6/17/15
54	Corrected Final Drawings and Specifications	15 days	Thu 7/2/15	Thu 7/23/15
55	Advertise Phase Construction	45 days	Fri 7/24/15	Fri 9/25/15
56	Phase Complete - Award	0 days	Fri 9/25/15	Fri 9/25/15
57	**Phase 4 Construction**	**209 days**	**Mon 9/28/15**	**Wed 7/27/16**
59	**Phase 5 Planning, Engineering and Design**	**140 days**	**Fri 3/11/16**	**Tue 9/27/16**
60	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
61	65% Drawings and Specifications	50 days	Fri 3/11/16	Thu 5/19/16
62	Value Engineering Review	30 days	Fri 4/1/16	Thu 5/12/16
63	100% Drawings and Specifications	30 days	Fri 5/20/16	Fri 7/1/16
64	Enviromental, Cultural Resources Update	40 days	Fri 5/20/16	Mon 7/18/16



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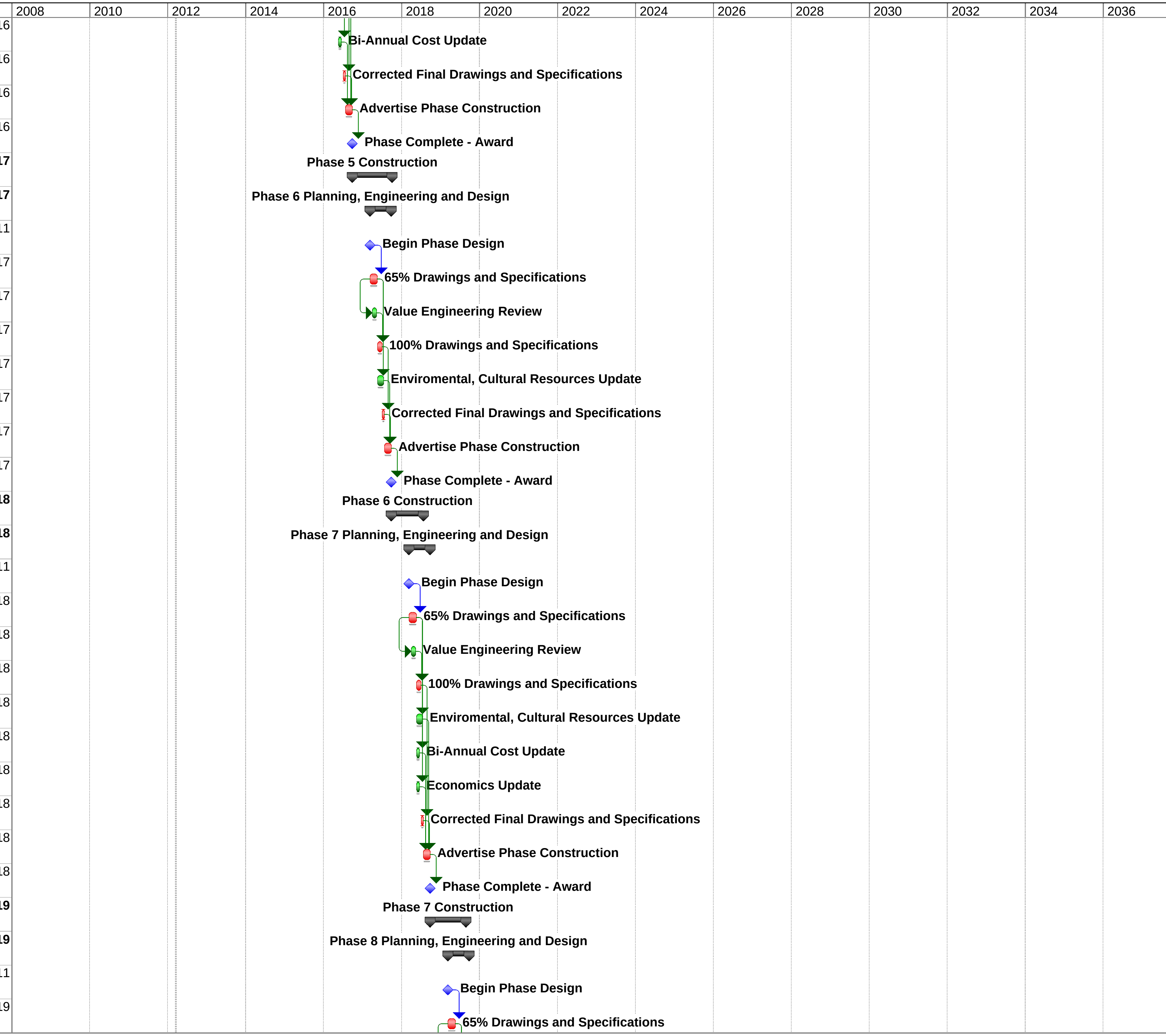
Task | Split | Milestone | Project Summary | External Milestone
Critical Task | Progress | Summary | External Tasks | Deadline

ID	Task Name	Duration	Early Start	Early Finish
65	Bi-Annual Cost Update	20 days	Fri 5/20/16	Fri 6/17/16
66	Corrected Final Drawings and Specifications	15 days	Tue 7/5/16	Mon 7/25/16
67	Advertise Phase Construction	45 days	Tue 7/26/16	Tue 9/27/16
68	Phase Complete - Award	0 days	Tue 9/27/16	Tue 9/27/16
69	**Phase 5 Construction**	**257 days**	**Wed 9/28/16**	**Thu 10/5/17**
71	**Phase 6 Planning, Engineering and Design**	**140 days**	**Mon 3/13/17**	**Wed 9/27/17**
72	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
73	65% Drawings and Specifications	50 days	Mon 3/13/17	Fri 5/19/17
74	Value Engineering Review	30 days	Mon 4/3/17	Fri 5/12/17
75	100% Drawings and Specifications	30 days	Mon 5/22/17	Mon 7/3/17
76	Enviromental, Cultural Resources Update	40 days	Mon 5/22/17	Tue 7/18/17
77	Corrected Final Drawings and Specifications	15 days	Wed 7/5/17	Tue 7/25/17
78	Advertise Phase Construction	45 days	Wed 7/26/17	Wed 9/27/17
79	Phase Complete - Award	0 days	Wed 9/27/17	Wed 9/27/17
80	**Phase 6 Construction**	**207 days**	**Thu 9/28/17**	**Thu 7/26/18**
82	**Phase 7 Planning, Engineering and Design**	**140 days**	**Tue 3/13/18**	**Thu 9/27/18**
83	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
84	65% Drawings and Specifications	50 days	Tue 3/13/18	Mon 5/21/18
85	Value Engineering Review	30 days	Tue 4/3/18	Mon 5/14/18
86	100% Drawings and Specifications	30 days	Tue 5/22/18	Tue 7/3/18
87	Enviromental, Cultural Resources Update	40 days	Tue 5/22/18	Wed 7/18/18
88	Bi-Annual Cost Update	20 days	Tue 5/22/18	Tue 6/19/18
89	Economics Update	20 days	Tue 5/22/18	Tue 6/19/18
90	Corrected Final Drawings and Specifications	15 days	Thu 7/5/18	Wed 7/25/18
91	Advertise Phase Construction	45 days	Thu 7/26/18	Thu 9/27/18
92	Phase Complete - Award	0 days	Thu 9/27/18	Thu 9/27/18
93	**Phase 7 Construction**	**230 days**	**Fri 9/28/18**	**Wed 8/28/19**
95	**Phase 8 Planning, Engineering and Design**	**140 days**	**Wed 3/13/19**	**Fri 9/27/19**
96	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
97	65% Drawings and Specifications	50 days	Wed 3/13/19	Tue 5/21/19



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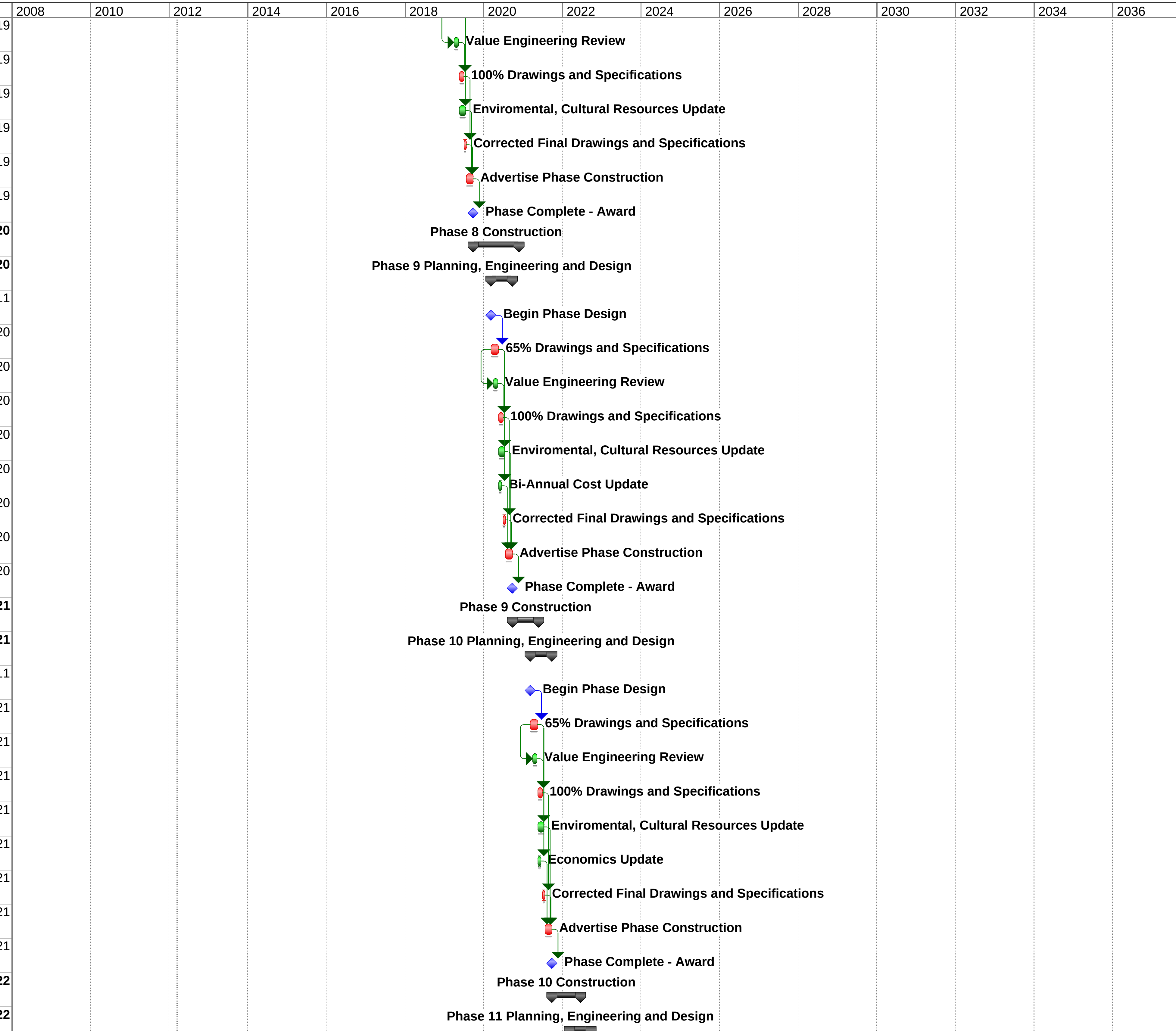
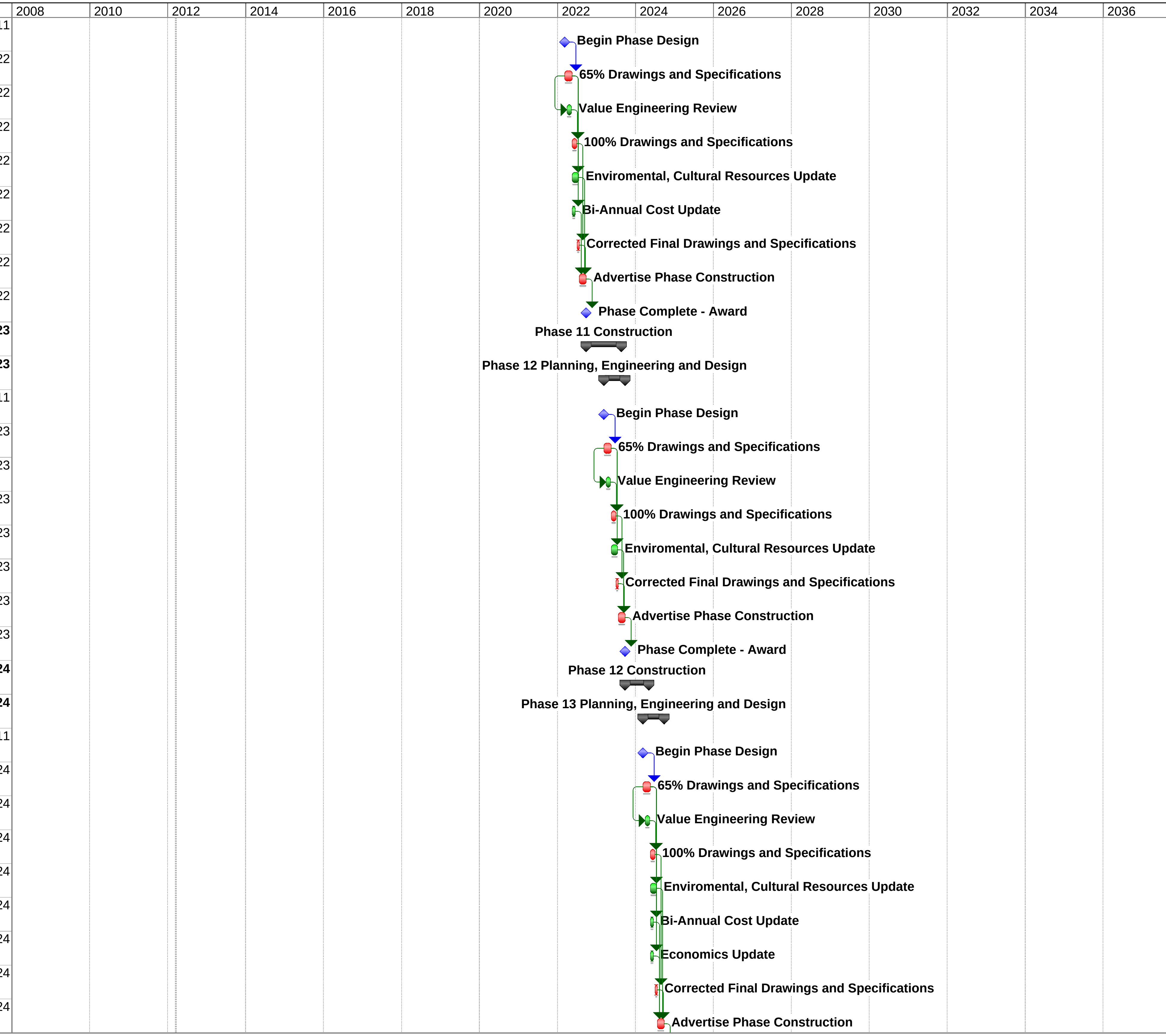
ID	Task Name	Duration	Early Start	Early Finish
98	Value Engineering Review	30 days	Wed 4/3/19	Tue 5/14/19
99	100% Drawings and Specifications	30 days	Wed 5/22/19	Wed 7/3/19
100	Enviromental, Cultural Resources Update	40 days	Wed 5/22/19	Thu 7/18/19
101	Corrected Final Drawings and Specifications	15 days	Fri 7/5/19	Thu 7/25/19
102	Advertise Phase Construction	45 days	Fri 7/26/19	Fri 9/27/19
103	Phase Complete - Award	0 days	Fri 9/27/19	Fri 9/27/19
104	**Phase 8 Construction**	**292 days**	**Sat 9/28/19**	**Fri 11/27/20**
106	**Phase 9 Planning, Engineering and Design**	**140 days**	**Wed 3/11/20**	**Fri 9/25/20**
107	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
108	65% Drawings and Specifications	50 days	Wed 3/11/20	Tue 5/19/20
109	Value Engineering Review	30 days	Wed 4/1/20	Tue 5/12/20
110	100% Drawings and Specifications	30 days	Wed 5/20/20	Wed 7/1/20
111	Enviromental, Cultural Resources Update	40 days	Wed 5/20/20	Thu 7/16/20
112	Bi-Annual Cost Update	20 days	Wed 5/20/20	Wed 6/17/20
113	Corrected Final Drawings and Specifications	15 days	Thu 7/2/20	Thu 7/23/20
114	Advertise Phase Construction	45 days	Fri 7/24/20	Fri 9/25/20
115	Phase Complete - Award	0 days	Fri 9/25/20	Fri 9/25/20
116	**Phase 9 Construction**	**167 days**	**Mon 9/28/20**	**Thu 5/27/21**
118	**Phase 10 Planning, Engineering and Design**	**140 days**	**Thu 3/11/21**	**Mon 9/27/21**
119	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
120	65% Drawings and Specifications	50 days	Thu 3/11/21	Wed 5/19/21
121	Value Engineering Review	30 days	Thu 4/1/21	Wed 5/12/21
122	100% Drawings and Specifications	30 days	Thu 5/20/21	Thu 7/1/21
123	Enviromental, Cultural Resources Update	40 days	Thu 5/20/21	Fri 7/16/21
124	Economics Update	20 days	Thu 5/20/21	Thu 6/17/21
125	Corrected Final Drawings and Specifications	15 days	Fri 7/2/21	Fri 7/23/21
126	Advertise Phase Construction	45 days	Mon 7/26/21	Mon 9/27/21
127	Phase Complete - Award	0 days	Mon 9/27/21	Mon 9/27/21
128	**Phase 10 Construction**	**182 days**	**Tue 9/28/21**	**Mon 6/20/22**
130	**Phase 11 Planning, Engineering and Design**	**140 days**	**Fri 3/11/22**	**Tue 9/27/22**



Project: San Acacia Alt A Base + 4
Date: Wed 3/14/12

Task	Split	Milestone	Project Summary	External Milestone	
Critical Task	Progress	Summary	External Tasks	Deadline	

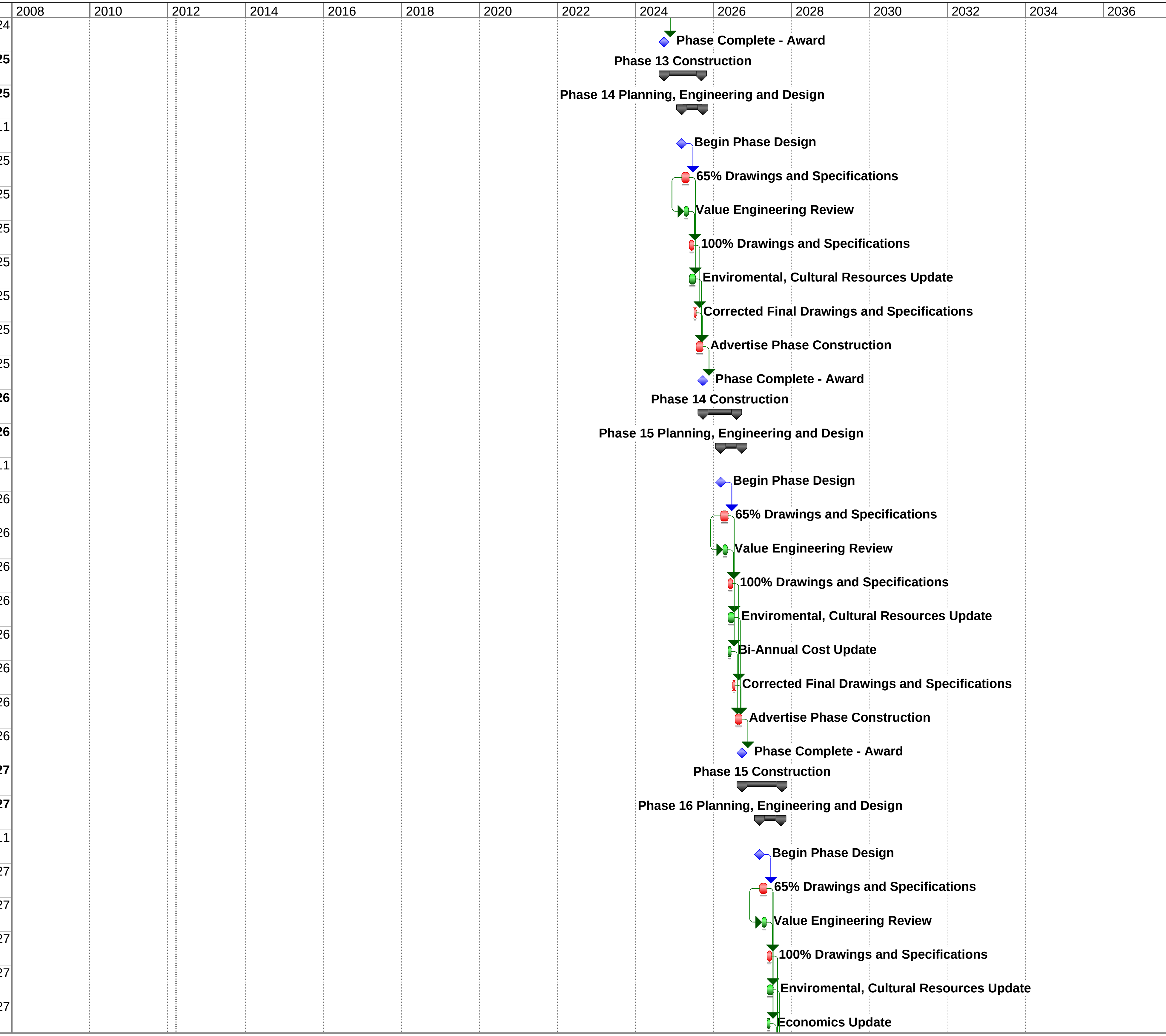
ID	Task Name	Duration	Early Start	Early Finish
131	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
132	65% Drawings and Specifications	50 days	Fri 3/11/22	Thu 5/19/22
133	Value Engineering Review	30 days	Fri 4/1/22	Thu 5/12/22
134	100% Drawings and Specifications	30 days	Fri 5/20/22	Fri 7/1/22
135	Enviromental, Cultural Resources Update	40 days	Fri 5/20/22	Mon 7/18/22
136	Bi-Annual Cost Update	20 days	Fri 5/20/22	Fri 6/17/22
137	Corrected Final Drawings and Specifications	15 days	Tue 7/5/22	Mon 7/25/22
138	Advertise Phase Construction	45 days	Tue 7/26/22	Tue 9/27/22
139	Phase Complete - Award	0 days	Tue 9/27/22	Tue 9/27/22
140	**Phase 11 Construction**	**227 days**	**Wed 9/28/22**	**Wed 8/23/23**
142	**Phase 12 Planning, Engineering and Design**	**140 days**	**Mon 3/13/23**	**Wed 9/27/23**
143	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
144	65% Drawings and Specifications	50 days	Mon 3/13/23	Fri 5/19/23
145	Value Engineering Review	30 days	Mon 4/3/23	Fri 5/12/23
146	100% Drawings and Specifications	30 days	Mon 5/22/23	Mon 7/3/23
147	Enviromental, Cultural Resources Update	40 days	Mon 5/22/23	Tue 7/18/23
148	Corrected Final Drawings and Specifications	15 days	Wed 7/5/23	Tue 7/25/23
149	Advertise Phase Construction	45 days	Wed 7/26/23	Wed 9/27/23
150	Phase Complete - Award	0 days	Wed 9/27/23	Wed 9/27/23
151	**Phase 12 Construction**	**152 days**	**Thu 9/28/23**	**Tue 5/7/24**
153	**Phase 13 Planning, Engineering and Design**	**140 days**	**Wed 3/13/24**	**Fri 9/27/24**
154	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
155	65% Drawings and Specifications	50 days	Wed 3/13/24	Tue 5/21/24
156	Value Engineering Review	30 days	Wed 4/3/24	Tue 5/14/24
157	100% Drawings and Specifications	30 days	Wed 5/22/24	Wed 7/3/24
158	Enviromental, Cultural Resources Update	40 days	Wed 5/22/24	Thu 7/18/24
159	Bi-Annual Cost Update	20 days	Wed 5/22/24	Wed 6/19/24
160	Economics Update	20 days	Wed 5/22/24	Wed 6/19/24
161	Corrected Final Drawings and Specifications	15 days	Fri 7/5/24	Thu 7/25/24
162	Advertise Phase Construction	45 days	Fri 7/26/24	Fri 9/27/24



Project: San Acacia Alt A Base + 4
Date: Wed 3/14/12

Task | Split | Milestone | Project Summary | External Milestone
Critical Task | Progress | Summary | External Tasks | Deadline

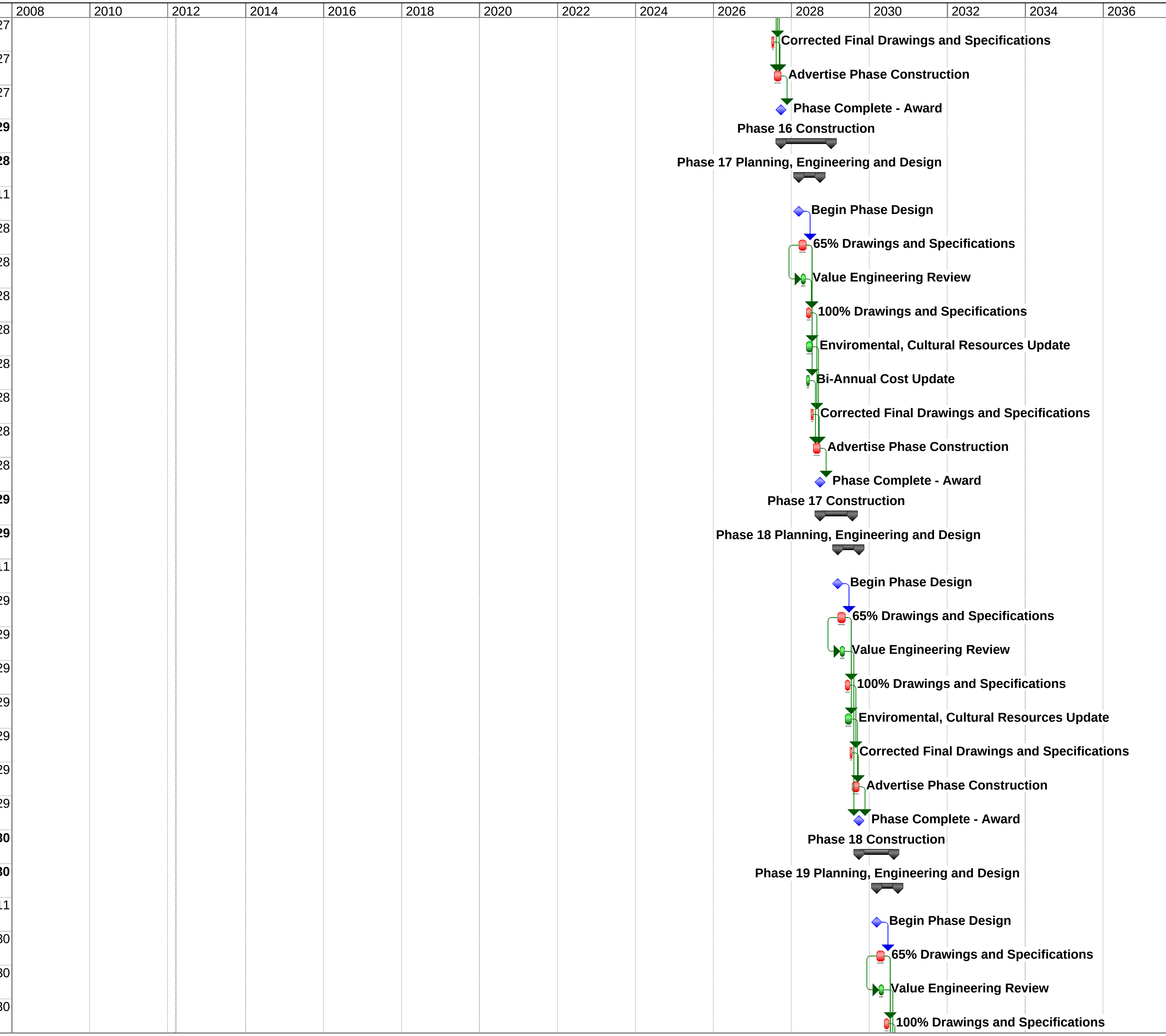
ID	Task Name	Duration	Early Start	Early Finish
163	Phase Complete - Award	0 days	Fri 9/27/24	Fri 9/27/24
164	**Phase 13 Construction**	**240 days**	**Sat 9/28/24**	**Fri 9/12/25**
166	**Phase 14 Planning, Engineering and Design**	**140 days**	**Wed 3/12/25**	**Fri 9/26/25**
167	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
168	65% Drawings and Specifications	50 days	Wed 3/12/25	Tue 5/20/25
169	Value Engineering Review	30 days	Wed 4/2/25	Tue 5/13/25
170	100% Drawings and Specifications	30 days	Wed 5/21/25	Wed 7/2/25
171	Enviromental, Cultural Resources Update	40 days	Wed 5/21/25	Thu 7/17/25
172	Corrected Final Drawings and Specifications	15 days	Thu 7/3/25	Thu 7/24/25
173	Advertise Phase Construction	45 days	Fri 7/25/25	Fri 9/26/25
174	Phase Complete - Award	0 days	Fri 9/26/25	Fri 9/26/25
175	**Phase 14 Construction**	**216 days**	**Sun 9/28/25**	**Fri 8/7/26**
177	**Phase 15 Planning, Engineering and Design**	**140 days**	**Wed 3/11/26**	**Fri 9/25/26**
178	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
179	65% Drawings and Specifications	50 days	Wed 3/11/26	Tue 5/19/26
180	Value Engineering Review	30 days	Wed 4/1/26	Tue 5/12/26
181	100% Drawings and Specifications	30 days	Wed 5/20/26	Wed 7/1/26
182	Enviromental, Cultural Resources Update	40 days	Wed 5/20/26	Thu 7/16/26
183	Bi-Annual Cost Update	20 days	Wed 5/20/26	Wed 6/17/26
184	Corrected Final Drawings and Specifications	15 days	Thu 7/2/26	Thu 7/23/26
185	Advertise Phase Construction	45 days	Fri 7/24/26	Fri 9/25/26
186	Phase Complete - Award	0 days	Fri 9/25/26	Fri 9/25/26
187	**Phase 15 Construction**	**258 days**	**Mon 9/28/26**	**Wed 10/6/27**
189	**Phase 16 Planning, Engineering and Design**	**140 days**	**Thu 3/11/27**	**Mon 9/27/27**
190	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
191	65% Drawings and Specifications	50 days	Thu 3/11/27	Wed 5/19/27
192	Value Engineering Review	30 days	Thu 4/1/27	Wed 5/12/27
193	100% Drawings and Specifications	30 days	Thu 5/20/27	Thu 7/1/27
194	Enviromental, Cultural Resources Update	40 days	Thu 5/20/27	Fri 7/16/27
195	Economics Update	20 days	Thu 5/20/27	Thu 6/17/27



Project: San Acacia Alt A Base + 4
Date: Wed 3/14/12

Task	Split	Milestone	Project Summary	External Milestone
Critical Task	Progress	Summary	External Tasks	Deadline

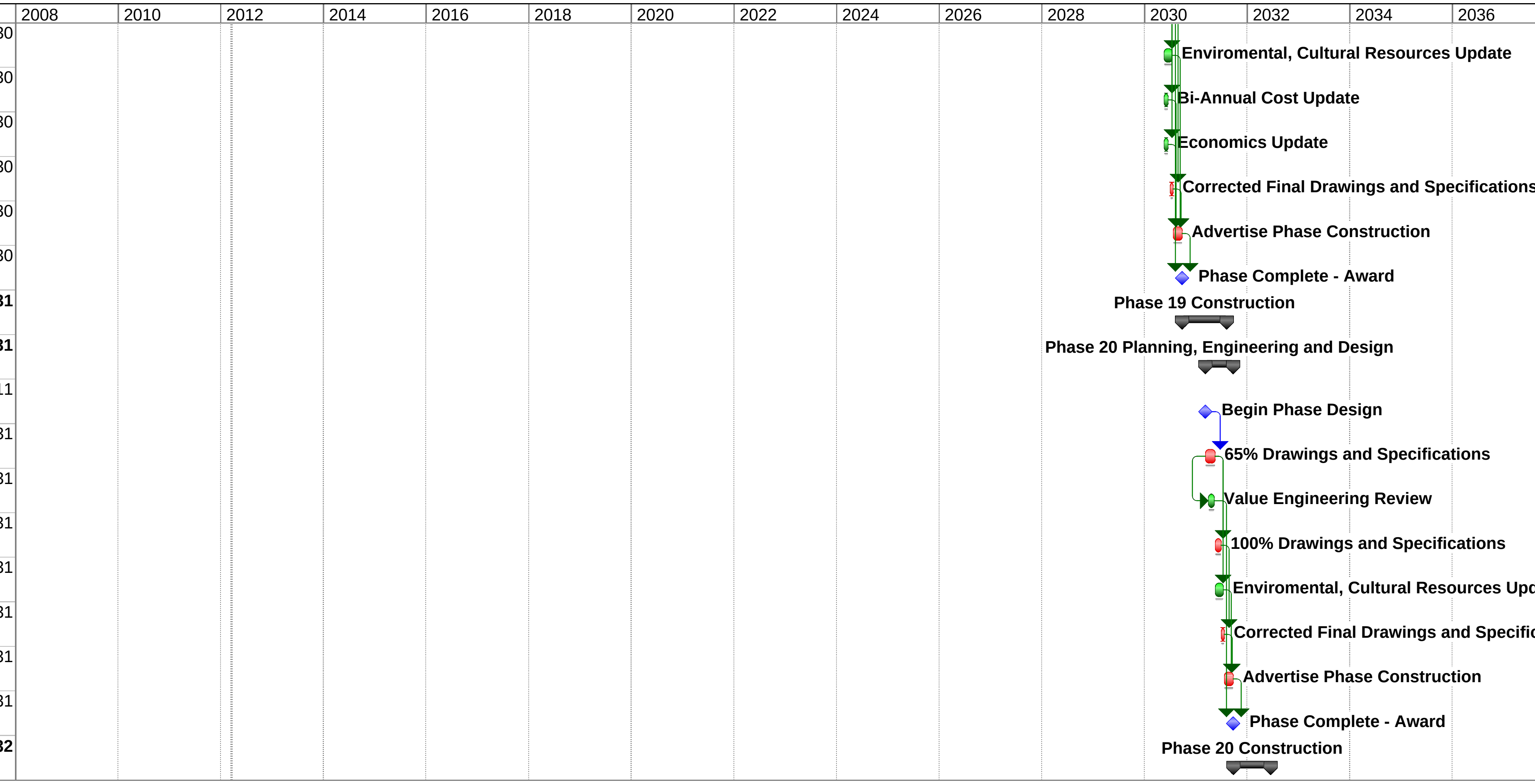
ID	Task Name	Duration	Early Start	Early Finish
196	Corrected Final Drawings and Specifications	15 days	Fri 7/2/27	Fri 7/23/27
197	Advertise Phase Construction	45 days	Mon 7/26/27	Mon 9/27/27
198	Phase Complete - Award	0 days	Mon 9/27/27	Mon 9/27/27
199	**Phase 16 Construction**	**322 days**	**Tue 9/28/27**	**Wed 1/10/29**
201	**Phase 17 Planning, Engineering and Design**	**140 days**	**Mon 3/13/28**	**Wed 9/27/28**
202	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
203	65% Drawings and Specifications	50 days	Mon 3/13/28	Fri 5/19/28
204	Value Engineering Review	30 days	Mon 4/3/28	Fri 5/12/28
205	100% Drawings and Specifications	30 days	Mon 5/22/28	Mon 7/3/28
206	Enviromental, Cultural Resources Update	40 days	Mon 5/22/28	Tue 7/18/28
207	Bi-Annual Cost Update	20 days	Mon 5/22/28	Mon 6/19/28
208	Corrected Final Drawings and Specifications	15 days	Wed 7/5/28	Tue 7/25/28
209	Advertise Phase Construction	45 days	Wed 7/26/28	Wed 9/27/28
210	Phase Complete - Award	0 days	Wed 9/27/28	Wed 9/27/28
211	**Phase 17 Construction**	**208 days**	**Thu 9/28/28**	**Fri 7/27/29**
213	**Phase 18 Planning, Engineering and Design**	**140 days**	**Tue 3/13/29**	**Thu 9/27/29**
214	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
215	65% Drawings and Specifications	50 days	Tue 3/13/29	Mon 5/21/29
216	Value Engineering Review	30 days	Tue 4/3/29	Mon 5/14/29
217	100% Drawings and Specifications	30 days	Tue 5/22/29	Tue 7/3/29
218	Enviromental, Cultural Resources Update	40 days	Tue 5/22/29	Wed 7/18/29
219	Corrected Final Drawings and Specifications	15 days	Thu 7/5/29	Wed 7/25/29
220	Advertise Phase Construction	45 days	Thu 7/26/29	Thu 9/27/29
221	Phase Complete - Award	0 days	Thu 9/27/29	Thu 9/27/29
222	**Phase 18 Construction**	**224 days**	**Fri 9/28/29**	**Tue 8/20/30**
224	**Phase 19 Planning, Engineering and Design**	**140 days**	**Wed 3/13/30**	**Fri 9/27/30**
225	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
226	65% Drawings and Specifications	50 days	Wed 3/13/30	Tue 5/21/30
227	Value Engineering Review	30 days	Wed 4/3/30	Tue 5/14/30
228	100% Drawings and Specifications	30 days	Wed 5/22/30	Wed 7/3/30



Project: San Acacia Alt A Base + 4
Date: Wed 3/14/12

Task | Split | Milestone | Project Summary | External Milestone
Critical Task | Progress | Summary | External Tasks | Deadline

ID	Task Name	Duration	Early Start	Early Finish
229	Enviromental, Cultural Resources Update	40 days	Wed 5/22/30	Thu 7/18/30
230	Bi-Annual Cost Update	20 days	Wed 5/22/30	Wed 6/19/30
231	Economics Update	20 days	Wed 5/22/30	Wed 6/19/30
232	Corrected Final Drawings and Specifications	15 days	Fri 7/5/30	Thu 7/25/30
233	Advertise Phase Construction	45 days	Fri 7/26/30	Fri 9/27/30
234	Phase Complete - Award	0 days	Fri 9/27/30	Fri 9/27/30
235	**Phase 19 Construction**	**217 days**	**Sat 9/28/30**	**Mon 8/11/31**
237	**Phase 20 Planning, Engineering and Design**	**140 days**	**Wed 3/12/31**	**Fri 9/26/31**
238	Begin Phase Design	0 days	Fri 10/14/11	Fri 10/14/11
239	65% Drawings and Specifications	50 days	Wed 3/12/31	Tue 5/20/31
240	Value Engineering Review	30 days	Wed 4/2/31	Tue 5/13/31
241	100% Drawings and Specifications	30 days	Wed 5/21/31	Wed 7/2/31
242	Enviromental, Cultural Resources Update	40 days	Wed 5/21/31	Thu 7/17/31
243	Corrected Final Drawings and Specifications	15 days	Thu 7/3/31	Thu 7/24/31
244	Advertise Phase Construction	45 days	Fri 7/25/31	Fri 9/26/31
245	Phase Complete - Award	0 days	Fri 9/26/31	Fri 9/26/31
246	**Phase 20 Construction**	**182 days**	**Sun 9/28/31**	**Fri 6/18/32**



Project: San Acacia Alt A Base + 4
Date: Wed 3/14/12

Task	Split	Milestone	Project Summary	External Milestone
Critical Task	Progress	Summary	External Tasks	Deadline

GENERAL REEVALUATION REPORT AND

SUPPLEMENTAL ENVIRONMENTAL

IMPACT STATEMENT II:

RIO GRANDE FLOODWAY,

SAN ACACIA TO BOSQUE DEL APACHE UNIT,

SOCORRO COUNTY, NEW MEXICO

APPENDIX F-8

Cultural Resources

GENERAL REEVALUATION REPORT AND SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT II

RIO GRANDE FLOODWAY,

SAN ACACIA TO BOSQUE DEL APACHE UNIT,

SOCORRO COUNTY, NEW MEXICO

UPDATE ADDED JULY 2012
(September 2009)

Appendix F-8
Cultural Resources

US Army Corps of Engineers
Albuquerque District
South Pacific Division

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CORRESPONDENCE:
USACE Tribal Scoping Letters and Native American Tribal Responses

UPDATE JULY 2012 - Cultural Resources and Archaeological Data

2009 Culture History:

TABLES

CORRESPONDENCE:

USACE Consultation with the New Mexico State Historic Preservation Officer (SHPO)

ia\Cultural Resources\SHPO consultation

- 1997-11-03 SHPO 054201 concur San Marcial BNSF RR Bridge.pdf
- 1997-11-05 SHPO 054093 concur San Acacia to San Marcial levee.pdf
- 1998 SHPO 055280 San Pascual consultation w plan.pdf
- 2005 SHPO 074310 San Pascual consultation.pdf
- 2009-11-10 SHPO 088135 concur San Acacia to BdA geologic drilling.pdf
- 2011-08-02 San Acacia to BdA SHPO letter.pdf
- 2011-09-12 SHPO 092670 concur San Acacia to BdA SanAcaciaBankLowering.pdf
- 2012-03-21 SHPO San Acacia Final ltr SanAc floodwall n Tiffany Basin survey.pdf
- 2012-04-17 San Acacia to BdA tiffany basin SHPO concur 094140.pdf

ET-RSW
11/5/97

054201

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA, NE
ALBUQUERQUE, NEW MEXICO 87109-3435
FAX (505) 342-3199

Reply to
Attention of:

October 24, 1997

Engineering and Planning Division
Planning Branch

RECEIVED
OCT 28 1997

Lynne Sebastian, Ph.D.
State Historic Preservation Officer
State Historic Preservation Bureau
228 East Palace Avenue, Room 101
Santa Fe, New Mexico 87503

Dear Dr. Sebastian:

In accordance with 36 CFR 800.5, the Substitution Agreement between your office and the Advisory Council on Historic Preservation (under 36 CFR 800.7) and the Programmatic Memorandum of Agreement for our levee rehabilitation program, the U.S. Army Corps of Engineers, Albuquerque District (Corps), is providing to your office information regarding our cultural resources and historic properties investigations associated with the rehabilitation of the Middle Rio Grande Levee system. We seek your concurrence with our determinations regarding portions of this undertaking and their potential effects on historic and cultural resources.

Recent design changes for the San Acacia Reach of the Middle Rio Grande Levee Rehabilitation Project call for the removal of an existing railroad bridge near San Marcial, Socorro County, New Mexico. The bridge is located in UTM Zone 13 at 3728300 N and 315290 E. The bridge is currently in use by the Burlington Northern Santa Fe Railway, the bridge's owner. The bridge was originally constructed circa 1930. Although the bridge has been raised a total of 18 feet as a result of aggradation of the local river bed, the superstructure remains essentially unchanged since its construction. The bridge is a "Warren Through-Truss" design. The bridge is composed of five 149-foot long steel trusses on timber and concrete piers. The total length of the structure is 853 feet.

The Corps has evaluated the structure using the system developed by the New Mexico State Highway and Transportation Department (SHD) in consultation with your office. The bridge scored 72 points out of the 108 points possible, placing it in the top one-third of the rating. This value appears to be consistent with those ratings given similar highway structures. Given the structure's age, relative rarity as an engineering feature, and its long-term historic function in south central New Mexican commerce, the Corps believes the bridge to be eligible for inclusion on the National Register of Historic Places.

The San Marcial Railroad Bridge is situated such that it produces a severe constriction in the Rio Grande River floodway during periods of high flows. The negative effects of the current situation are increased water surface elevations upstream of the structure requiring more extensive levee construction and impaired water resource operations throughout the Middle Rio Grande Valley. Limited flexibility in water operations in turn has a deleterious impact on riparian and riverine ecosystems along the Rio Grande. Replacement of the bridge with a more modern structure on a different site is considered crucial to effective flood control, efficient and beneficial water operations, and habitat improvement for endangered species. These widespread environmental benefits considerably offset adverse impacts to the historic context of the area through the loss of the structure.

The Corps proposes to market the structure for reuse in another location and the recordation of the structure according to Level II standards of the Historic American Engineering Record. A considerable amount of documentation in the form of engineered drawings and photography are available for the structure and an historic narrative shall be produced to complete the documentation package. With your concurrence on our determination, we shall begin consultation with your office on the content, extent, and distribution of the final mitigation document.

We shall continue to coordinate with your office as construction plans continue to mature. We look forward to our continuing consultations regarding this extensive undertaking. Please contact Dr. Ronald Kneebone at (505) 342-3355 with any questions or comments that you may have.

Sincerely,

Mark C. Harberg

Mark C. Harberg
Chief, Environmental Section

Enclosure

Copy Furnished: (w/o enclosure)
Don Klima, Director
Advisory Council on Historic Preservation
Office of Planning and Review
12136 W Bayaud Ave. #330
Lakewood, CO 80228-2115

I CONCUR Lyn Sebastian 11-3-97
LYNNE SEBASTIAN, PH.D.
NEW MEXICO STATE HISTORIC PRESERVATION OFFICER

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA, NE
ALBUQUERQUE, NEW MEXICO 87109-3435
FAX (505) 342-3199

Reply to Attention of:

054093

October 3, 1997

RECEIVED OCT 10 1997 HISTORIC PRESERVATION DIVISION

Engineering and Technical
Services Division
Planning and Environment
Branch

Lynne Sebastian, Ph.D.
State Historic Preservation
Officer
State Historic Preservation
Bureau
228 East Palace Avenue, Room 101
Santa Fe, New Mexico 87503

Dear Dr. Sebastian:

In accordance with 36 CFR 800.5, the Substitution Agreement between your office and the Advisory Council on Historic Preservation (under 36 CFR 800.7) and the Programmatic Memorandum of Agreement for our levee rehabilitation program, the U.S. Army Corps of Engineers (Corps), Albuquerque District, is providing to your office information regarding our cultural resources and historic properties investigations associated with the rehabilitation of the Middle Rio Grande levee system. We seek your concurrence with our determinations regarding portions of this undertaking and their potential effects on historic and cultural resources.

The Corps has conducted a cultural resources inventory of the alignment of the San Acacia to San Marcial Reach of the Middle Rio Grande levee system. In addition, resource inventories were conducted along access routes to ten "Habitat Improvement Features" (HIFs) located in the Rio Grande flood plain. We have previously consulted with Mr. Dan Riley of your office regarding these habitat features by telephone. As a result of this conversation, it was agreed that survey within the flood plain would be counter-productive and uninformative and that our inventory should focus on access routes to HIFs. The results of this inventory are provided in the enclosed letter report from our contractor, the Office of Contract Archaeology - University of New Mexico.

In summary, no historic properties or features and only two isolated artifacts were identified along the 45 miles of the existing spoilbank levee, the area to be directly impacted by construction activities. The Corps believes that the two separate isolated artifacts, lacking spatial context and integrity, do not meet the criteria for eligibility to the National Register of

Historic Places. The Corps has provided to your office our documentation of the existing spoilbank levee and its attendant historic context under separate cover (Historical Documentation of Middle Rio Grande Flood Protection Projects, K. Lynn Berry and Karen Lewis, 1997). Given that no historic or cultural properties or features have been identified along the construction area and that the existing spoilbank has been adequately documented to mitigate its rehabilitation, the Corps is of the opinion that actual construction activities will have no effect on the historic resources of the region.

As noted, the inventory also included proposed access routes to areas identified for habitat improvement. Construction activities in these HIFs will consist of excavation of a channel from the Rio Grande into areas that are only marginally exposed to periodic inundation under current conditions. Because of their location in the Rio Grande flood plain, it is extremely unlikely that cultural or historic resources would be found there. Survey of the access routes into these areas, however, identified numerous historic properties. As cited in the enclosed report, access to all ten of the proposed HIFs will primarily be along an unnumbered and unpaved road that parallels the Rio Grande on its eastern or left-hand margin. Numerous historic properties have been previously documented along this road and were confirmed by our inventory. Access from this artery into the bosque HIF locations can also be attained along existing unpaved roads in five instances. Access to the five remaining HIFs will necessitate traversing previously undisturbed areas. Surveys of these undisturbed areas found that two proposed access routes would impact previously unrecorded historic properties (LA 119574 and LA 119575). Both of these sites are large, complex, multi-component artifact scatters that have the potential for structural feature remains. As such, the Corps considers them eligible for inclusion on the National Register of Historic Places.

Given the density and size of historic properties associated with access to the HIF areas, the Corps believes that the most prudent action to take is to avoid the properties involved. To ensure no impacts to these properties, the Corps proposes a three-fold avoidance plan. First, prior to construction, the Corps shall clearly demarcate access routes that detour around all identified historic properties and ensure contractor adherence to their use. Second, the Corps shall employ minimal efforts to improve existing roadways, including the preclusion of improvements along existing roads through known properties. Third, the Corps shall undertake extensive monitoring by qualified archaeological professionals of construction activities as they occur to ensure rapid identification and protection of any previously unrecorded historic properties. Therefore, because limited use of existing roads without improvements should not affect historic properties to an extent any greater than that already produced by road construction and the implementation of a rigorous avoidance plan, the Corps is of the opinion that construction activities associated with habitat improvement will have no effect on the historic and cultural resources of the region.

We shall continue to coordinate with your office as construction plans continue to mature. We look forward to our continuing consultations regarding this extensive undertaking. Please contact Dr. Ronald Kneebone at (505) 342-3355 with any questions or comments that you may have.

Sincerely,

John D. Schelberg
for Mark C. Harberg
Chief, Environmental Section

Enclosure

Copy Furnished (w/o enclosure):

Claudia Nissley, Director
Western Office of Project Review
Advisory Council on Historic
Preservation
730 Simms Street, Room 401
Golden, Colorado 80401

I CONCUR 11-5-97
for LYNNE SEBASTIAN, PH.D.
NEW MEXICO STATE HISTORIC PRESERVATION OFFICER

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 Jefferson Plaza, NE
Albuquerque, New Mexico 87109-3435

Reply to Attention of:

ET-P

April 29, 1998

0003280

Engineering and Planning Division
Planning Branch

Lynne Sebastian, Ph.D.
State Historic Preservation Officer
State Historic Preservation Bureau
228 East Palace Avenue, Room 101
Santa Fe, New Mexico 87503

MAY - 4 1998

Dear Dr. Sebastian:

In accordance with 36 CFR 800.5 and the Substitution Agreement between your office and the Advisory Council on Historic Preservation (under 36 CFR 800.7), the U.S. Army Corps of Engineers (Corps), Albuquerque District, is seeking your concurrence with our determinations regarding historic property associated with water operations along the Middle Rio Grande, New Mexico. The Corps is authorized under PL 86-645: Title II: Flood Control Section 201: Rio Grande Basin (as amended), to manage releases from its reservoirs to evacuate water storage as rapidly as downstream conditions permit.

In the summer of 1997, LA 487 was subjected to flooding from the Rio Grande. As a result, a multi-agency task group consisting of the U.S. Fish and Wildlife Service Service; under Section 110 of the National Historic Preservation Act), the Bureau of Reclamation (Reclamation; under the Flood Control Acts of 1948 [PL 858], 1950 [PL 516]), and the U.S. Army Corps of Engineers (Corps) was convened to address the issue and suggest a potential course of action for protecting the site in the future. As a result of their investigations, it was determined that high flows of the type that inundated LA 487 are beneficial and desirable for a variety of environmental and water delivery reasons. Therefore, LA 487 shall be vulnerable to periodic high flows along the middle Rio Grande. It was agreed that a flood control structure would be needed to protect the site and allow the desired flows along the Rio Grande.

San Pasqual is located on the east bank of the Rio Grande within the Bosque del Apache National Wildlife Refuge. Since the property is located on lands managed by the Service and is being affected by waters controlled in part by both the Corps and Reclamation, the multi-agency task group was formed. The agencies, in consultation with your office, have determined San Pasqual to be an extremely significant historic property eligible for inclusion on the National Register of Historic Places. The agencies acknowledge the consultation responsibilities of Reclamation and the Corps under Section 106 and of the Service under Section 110 of the National Historic Preservation Act of 1966 (as amended).

The agencies have agreed to cooperate in developing a phased approach to the protection of LA 487. Until an effective flood control structure can be designed and constructed, the Corps and Reclamation shall manage flows within their control to ensure that San Pasqual is not subjected to further flooding. All three agencies shall cooperate in the design of the needed flood control plan. The Service shall develop initial design data by conducting subsurface testing to establish three important variables. First, testing shall determine the presence or absence of material deposits in the floodplain immediately adjacent to LA 487. Second, testing shall determine soil characteristics important for the ultimate design of a protective structure for the site. Third, testing shall assess the degree of water seepage on San Pasqual through subsurface percolation. The Corps and Reclamation shall cooperate in a study of the floodplain to determine additional design parameters for the needed structure.

In the near term, before an effective flood control structure is constructed, the Corps shall employ existing procedures for the protection of property and resources to safeguard the site. LA 487 has been added to the list of Areas of Concern used by the Corps to identify specific locations, usually individual features, vulnerable to high flow regimes in the Rio Grande. During snowmelt runoff, usually beginning in early April, it is normal procedure for the Corps to begin monitoring known areas of concern in the Rio Grande floodplain below Cochiti Dam when the combined releases from Cochiti and Jemez Canyon Reservoirs exceed approximately 4,000 cubic feet per second (cfs). This monitoring is achieved through direct visual field inspection either by Corps' personnel or in coordination with Reclamation's Socorro Field Division staff. Areas of concern are periodically inspected as we increase releases to ensure no adverse impacts occur. If snowmelt runoff increases abruptly, combined releases from Cochiti and Jemez Canyon Dams are staged at approximately 500 cfs increments to allow adequate time to monitor river conditions before the next increase. When weather predictions indicate increased runoff from uncontrolled drainages (e.g., Rio Salado and Rio Puerco) releases are held back to prevent damage to sensitive areas.

We caution, however, that the Rio Grande is a dynamic natural system not completely under the control of any agency. Complete protection cannot be afforded the site in the absence of an adequate flood control structure. As mentioned, Cochiti and Jemez Canyon Dams are control nodes operated by the Corps. Between Cochiti and LA 487, there are, however, additional uncontrolled drainages some of which are known to experience very high flows. Unpredictably, high rainfall events on one or more of these drainages, principally the Salado and Puerco Rivers, may produce damages at San Pasqual. In addition, flooding is not a simple function of the volume of water moving along a river course. Control of flows is complicated by the large amount of silt carried in the river. Silt "plugs" may form at relatively predictable locations, but unfortunately, with relatively unpredictable results. The flooding at San Pasqual in 1997 was believed to be the result of one such silt plug.

In summary, the large prehispanic pueblo of San Pasqual (LA 487) has been noted by the Corps as being vulnerable to damages from Rio Grande flows. The Corps, Reclamation, and the Service are cooperating with your office to provide protection for the site. Ultimately, it is the opinion of the agencies that a flood control structure such as a dike, berm, or levee will be required to provide adequate protection. The agencies are currently cooperating in identifying the appropriate authorization to provide for the construction. In the interim, the Service will be conducting a program of testing to determine the extent of cultural deposits and characterize subsurface soils. At the same time the Corps and Reclamation are analyzing characteristics of the river channel, adjacent to the site, to adequately understand the dynamics in play that produce flooding at San Pasqual.

Until a protective structure is built, the Corps shall manage Rio Grande flows within its control in a manner that shall protect the site from future flooding. The Corps shall not pass flows through Cochiti and Jemez Canyon Dams that produced flooding at LA 487. The effects of this policy on water delivery along the remainder of the river are difficult to predict. In most years, there should be no adverse impacts to Rio Grande water usage. Under certain scenarios, however, it is possible that water may not be provided for particular activities, principally habitat improvement projects that require high flows that produce overbank flooding. In addition, given the stochastic nature of the movement of sediment through the river, it may be impossible to provide overbank flooding normally available at relatively low flow rates.

To aid you in your evaluation of the issues and undertaking, a copy of the testing design and accompanying illustrations are enclosed for your review and comment. Pursuant to 36 CFR 800.11, should any unanticipated events or results from testing be encountered, the Corps shall consult further with your office.

If you have any questions or require additional information, please contact Dr. Ronald Kneebone of my staff at (505) 342-3355; FAX [505] 342-3199.

Sincerely,

Mark C. Harberg

Mark Harberg
Chief, Environmental Section

I CONCUR Lynne Sebastian
DR. LYNNE SEBASTIAN,
NEW MEXICO STATE HISTORIC PRESERVATION OFFICER

Enclosure

Copy Furnished:

Mr. Don Klima, Director
Office of Planning and Review
12136 W Bayaud Ave. #330
Lakewood, CO 80228-2115

Ms. Jennifer Fowler-Propst
U.S. Fish and Wildlife Service
2105 Osuna Road, Northeast
Albuquerque, New Mexico 87113

Mr. Garry M. Rowe
Area Manager
U.S. Bureau of Reclamation
Albuquerque Area Office
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Albuquerque, New Mexico 87102-2162

Mr. Steve Vandiver
Colorado Division of Water Resources
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Alamosa, Colorado 81101-0269

Mr. Jay Groseclose
New Mexico Interstate Stream Commission
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Santa Fe, New Mexico 87504-5102

Dr. Conrad G. Keyes, Jr.
Engineer Advisor for Texas
Rio Grande Compact Commission
P.O. Box 1917
El Paso, Texas 79950-1917

Ms. Nancy Kaufman
Regional Director
U.S. Fish & Wildlife Service
P.O. Box 1306
Albuquerque, New Mexico 87103-1306

Archaeological and Geophysical Testing Design
San Pasqual Pueblo, LA 487

San Pasqual Pueblo (LA 487) is located on the east bank of the Rio Grande in south central New Mexico near the southern boundary of the Bosque del Apache National Wildlife Refuge (Figure 1; UTM Zone 13, 324920 E, 3735480 N). The site, the largest Piro Pueblo in the Rio Abajo District, is located on the western margin of a low terrace which protrudes into the Rio Grande floodplain. The site is currently administered by the U.S. Fish and Wildlife Service. The site is approximately 220 meters on a side totaling nearly 5 hectares in area. Located at San Pasqual are the remains of a multi-roomblock pueblo constructed of adobe blocks. Weathering of the structure has caused significant slumping of structural features resulting in the virtual disappearance of visible wall alignments. The surface of the site is littered with thousands ground and chipped stone lithic fragments as well as innumerable pottery fragments.

LA 487 was a large multi-storied adobe building with four plazas. The complex contained from 750 to 1500 rooms and was occupied over a span of four to five centuries (ca. AD 1200 to AD 1680; Marshall n.d.). The site is situated adjacent to the Camino Real de Tierra Adentro and evidence of colonial era Hispanic religious architecture is also present at the site. Investigation of the site is extremely limited confined to a visit in 1930 by Yeo and grab samples by Marshall and Walt (1984). No accurate map has been produced of the site nor any controlled excavations performed.

In the summer of 1997, LA 487 was subjected to flooding from the Rio Grande. As a result, a multi-agency task group consisting of the U.S. Fish and Wildlife Service (Service), the Bureau of Reclamation (Bureau), and the U.S. Army Corps of Engineers (Corps) was convened to address the issue and suggest a potential course of action for protecting the site in the future. As a result of their investigations, it was determined that high flows of the type that inundated LA 487 are beneficial and desirable for a variety of environmental and managerial reasons. Therefore, LA 487 shall be vulnerable to periodic high flows along the middle Rio Grande. It was agreed that a flood control structure would be needed to protect the site and allow the desired flows along the Rio Grande.

The agencies, in consultation with the New Mexico State Historic Preservation Officer (NMSHPO), have determined San Pasqual to be an extremely significant historic property eligible for inclusion on the National Register of Historic Places. The agencies acknowledge the consultation responsibilities of the Bureau and the Corps under Section 106 and of the Service under Section 110 of the National Historic Preservation Act of 1966 (as amended). All involved agencies have agreed to cooperate in the development of a strategy for the protection of the site.

The agencies have agreed upon a phased approach to protection of LA 487. Until an effective flood control structure can be designed and constructed, the Corps and Bureau shall manage flows within their control to ensure that San Pasqual is not subjected to further flooding. All three agencies shall cooperate in the design of the needed flood control plan. The Service shall develop

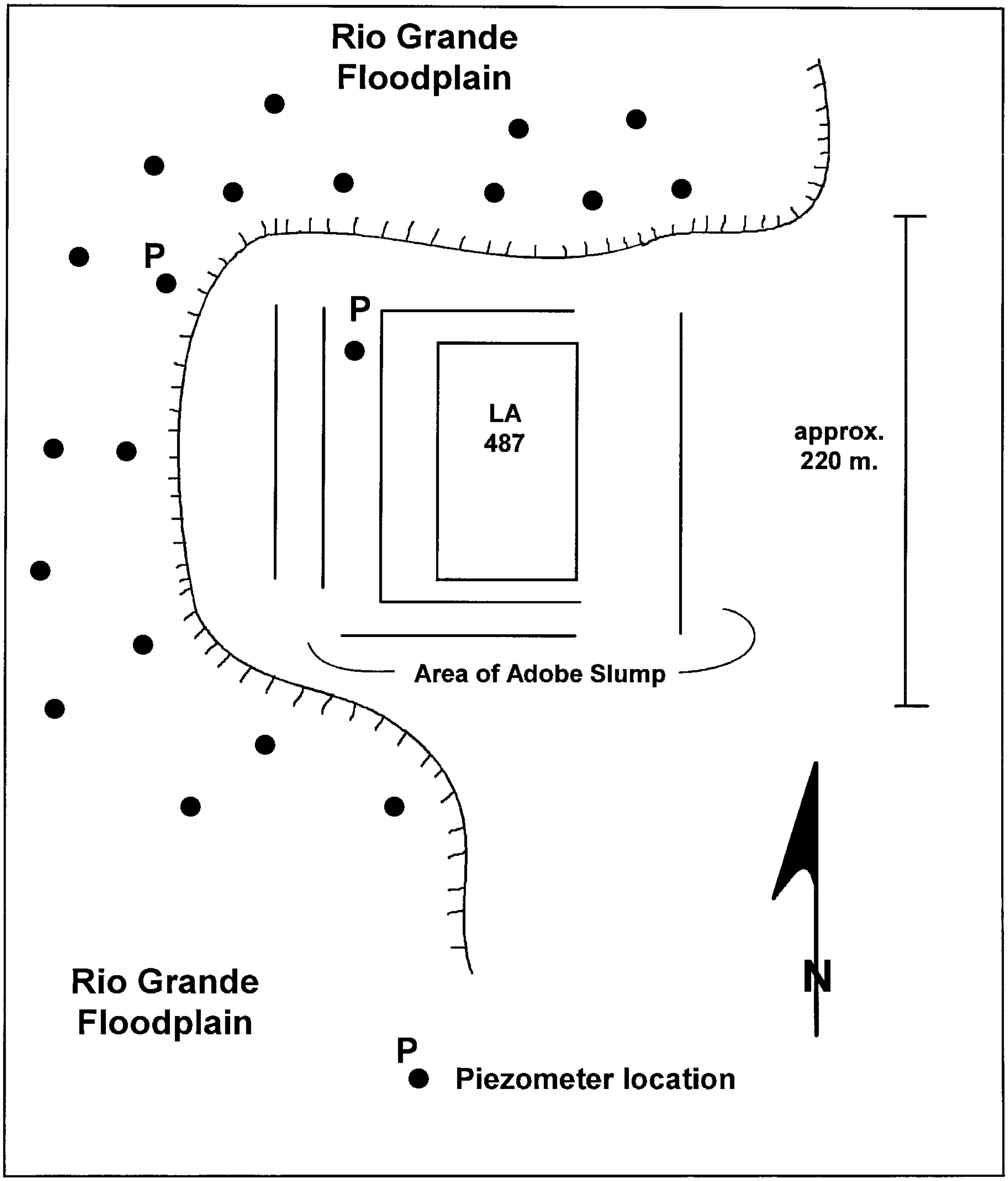

Figure 1: Sketch Map Showing Site and Project Area Locations.

Figure 2
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For Official Use Only

Public Disclosure of
Archaeological Site Locations
is Prohibited by 16 U.S.C. 470hh (36 CFR 296.18)

initial design data by conducting subsurface testing. The testing program will establish three important variables. First, testing shall determine the presence or absence of material deposits in the floodplain immediately adjacent to LA 487. Second, testing shall determine soil characteristics important for the ultimate design of a protective structure for the site. Third, testing shall assess the degree of water seepage on San Pasqual through subsurface percolation. The Corps and the Bureau shall cooperate in a study of the floodplain to determine additional design parameters for the needed structure.

The subsurface testing methodology shall consist of the drilling of a minimum of twenty (20) auger holes spaced as evenly as possible along the western margins of the slumped roomblock (see Figure 2). This number of drill holes shall provide for drilling every 25-50 meters (approx.). The drilling pattern shall consist minimally of two tiers of drill holes radiating out into the floodplain from the edge of the site. There are no expectations of locating subsurface remains in the floodplain. Should remains be identified, however, the cooperating agencies shall reconvene to consult on an appropriate strategy for further investigations. Data from the floodplain test drilling shall establish two important conditions, soil permeability and water table depth. In addition to the program of floodplain drilling, a single drill hole shall be located within the architecture of San Pasqual. This drill hole shall establish depth of subsurface deposits within the slumped adobe architecture, the depth of the water table, and the degree of seepage into site deposits. A minimum of two of the auger holes, one of which will be the drill hole with the site's architecture, shall be made into permanent monitor wells. Periodic piezometer readings shall be made at these locations to monitor fluctuations in groundwater level and subsurface percolation.

A report of the results of testing shall be produced and distributed to the agencies and the NMSHPO. The report shall consist of a narrative summarizing the results of the auger tests and suggesting recommendations for further actions, data observations in tabular form, maps showing the locations of drill holes (including aerial photography), and other graphic representations as necessary to interpret the testing results. Data from the testing program shall be employed to provide baseline physical conditions upon which the design of a protective structure may be based. The information gained shall be used in conjunction with hydrologic data generated by the Corps and Bureau to provide the greatest degree of protection possible to the site. The agencies shall consult regularly with the NMSHPO on the progress of the study and its results.

References:

1984 Marshall and Walt, **Rio Abajo: Prehistory and History of a Rio Grande Province**. New Mexico Historic Preservation Division.

n.d. Marshall, *San Pasqual Pueblo: Statement of Significance*. Document on file with U.S. Fish and Wildlife Service, Region 2, Albuquerque, NM.

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

May 10, 2005

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

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RECEIVED
MAY 12 2005
LMM/JWM
HISTORIC PRESERVATION DIVISION

Ms. Katherine Slick
State Historic Preservation Officer
New Mexico Department of Cultural Affairs
Historic Preservation Division
228 East Palace Avenue, Room 320
Santa Fe, New Mexico 87501

Rec'd back 5-31-2005
GDE

Re: HPD Consultation No. 055280

Dear Ms. Slick:

Pursuant to 36 CFR Part 800, the U.S. Army Corps of Engineers (Corps), Albuquerque District, is seeking your concurrence in our determination of "No Adverse Effect to Historic Properties" regarding spring and summer 2005 water operations along the Middle Rio Grande, New Mexico. The Corps is authorized under PL 86-645: Title II: Flood Control Section 201: Rio Grande Basin (as amended), to manage releases from its reservoirs to evacuate water storage as rapidly as downstream conditions permit.

The Corps, in coordination with the Bureau of Reclamation (Reclamation) under the Flood Control Acts of 1948 [PL 858] and 1950 [PL 516], manages reservoir releases within New Mexico. Although New Mexico as well as most of the West has been in a drought situation over the last several years, this winter brought a heavy snow pact to the mountainous areas that supply runoff to the Rio Grande watershed. In anticipation of high spring and early summer runoff, the Corps is planning for the potential of localized flooding along the Rio Grande in New Mexico, and therefore anticipating the need for timely reservoir releases to manage river flows and alleviate the potential threat of flooding.

Due to the threat of localized flooding, the Corps is reviewing their list of Areas of Concern that are vulnerable to high flow regimes in the Middle Rio Grande Valley. One site previously identified as being vulnerable is the San Pasqual archaeological site (LA487), a Piro pueblo ruin (see HPD Consultation No. 055280, dated May 1998; copy attached for your convenience). San Pasqual is located along the east bank of the Rio Grande within the Bosque del Apache National Wildlife Refuge on lands managed by the U.S. Fish and Wildlife Service (Service), Region 2. San Pasqual was subjected to flooding in the summer of 1997 (see the Service's Trip Report Memorandum; copy attached for your convenience). Upon the discovery of flooding at the San Pasqual site, the Corps and Reclamation agreed that they shall manage flows within their control to ensure that San Pasqual is not subjected to further flooding. At the time of our 1998 consultation, the Corps, Reclamation, the Service, and your office, determined that the extremely significant San Pasqual site is eligible for inclusion on the National Register of Historic Places.

In addition to the 1998 consultation regarding concerns for San Pasqual, the cooperating agencies submitted an agreed upon preliminary plan that called for archaeological testing and subsequent construction of flood protection at San Pasqual (copy attached for your convenience). To date, the Corps has no knowledge that the recommended testing or that construction of flood protective works at San Pasqual has been initiated by the Service. Therefore, the site remains to be vulnerable to flooding. The Corps and Reclamation shall continue to manage flows within their control to ensure that San Pasqual is not subjected to further flooding.

In recent years, the Corps has conducted several cultural resources surveys in the immediate vicinity of Albuquerque. Numerous archaeological sites (see the attached list) have been identified in the floodplain within the flood control levees. These sites are all remnants of historic and primarily earthen structures associated with irrigation and drainage ditches and canals, early flood control structures, and/or pilings associated with historic bridge alignments across the river. All of these structures, or portions thereof, have been subjected to overbank inundation numerous times in the past. Spring and summer overbank flows for 2005 may inundate portions of these historic structures; however, overbank inundation should not be severe and it is therefore anticipated that there would be no adverse effect.

One additional historic structure of concern is the San Marcial railroad bridge. The railroad bridge is still in use by the Burlington Northern - Santa Fe Railway. Numerous rehabilitation projects have occurred in the past in an effort to maintain the viability of the bridge. The Corps, Reclamation, and Service are currently monitoring the river for overbank flows at these sites and structures.

Based on the available information and on monitoring efforts, the Corps is of the opinion that there would be "No Adverse Effect to Historic Properties" by the proposed reservoir releases.

Pursuant to 36 C.F.R. 800.11, should previously unknown artifacts or cultural resource manifestations be encountered during water operations along the Rio Grande, reservoir releases would be managed to minimize impacts in consultation with the New Mexico State Historic Preservation Officer, coordinating agencies, and with Native American Tribes that may have concerns in the area.

If you have questions or require additional information regarding water operations along the Rio Grande, please contact Dr. Ronald Kneebone, Tribal Liason, at (505) 342-3355, Mr. Gregory Everhart, Archaeologist, at (505) 342-3352 or Mr. John Schelberg, Archaeologist, at (505) 342-3359.

Sincerely,

Julie A. Hall
Chief, Environmental
Resources Branch

5/26/05 I CONCUR for KATHERINE SLICK
Date NEW MEXICO STATE HISTORIC PRESERVATION OFFICER

We strongly recommend that the cooperating agencies carry out their plan as proposed in 1998 to conduct testing and flood protection at San Pasqual.

Enclosures

Copy Furnished: (w/o enclosures)

Don Klima, Director
Advisory Council on Historic Preservation
Office of Planning and Review
12136 W. Bayaud Ave., #330
Lakewood, Colorado 80228-2115

Mr. Dale Hall
Regional Director
U.S. Fish and Wildlife Service
500 Gold Avenue, SW
Albuquerque, New Mexico 87102

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
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November 9, 2009

088135

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

Ms. Jan Biella
Interim State Historic Preservation Officer
New Mexico Department of Cultural Affairs
Historic Preservation Division
Bataan Memorial Building
407 Galisteo Street, Suite 236
Santa Fe, New Mexico 87501

NOV 10

Dear Ms. Biella:

Pursuant to 36 CFR Part 800, the U.S. Army Corps of Engineers (Corps), Albuquerque District, in cooperation with the Bureau of Reclamation (BOR), is seeking your concurrence in our determination of "no adverse effect to historic properties" for geological drilling associated with the Rio Grande Floodway, San Acacia to Bosque del Apache Unit, Socorro County, New Mexico. This project is focusing on the levee system from the diversion dam at San Acacia to the BNSF railroad bridge across the Rio Grande at San Marcial. The project will only occur on the levees on the west side of the Rio Grande. The proposed project is funded for 18.5 miles; however, we are seeking your concurrence for the total project length of approximately 44 miles north-to-south as we are anticipating additional funding and the drilling will be exactly the same. The Corps authority to conduct the project is provided by the Flood Control Act on 1948. Funding for the project is provided by the American Recovery and Reinvestment Act.

This drilling project is identical to the Bernalillo to Belen project discussed in our letter of August 20, 2009, (HPD log number 087510, copy enclosed). The long-term project consists of the reconstruction of the non-engineered spoil-bank levees to improve flood damage reduction along the Rio Grande from Bernalillo to the headwaters of Elephant Butte Reservoir. The levee is divided into units for the purpose of hydraulic investigations, funding, and other Corps management considerations.

The purpose of the proposed drilling and the sampling protocols are identical to those described in the August 20, 2009 letter (HPD Log 087510). Approximately 700 bore holes are required over the 44 mile-long project area. Three holes are planned every 1,000 feet: one in the maintenance road on the land side; one in the levee; and one in the river side. Fewer holes may be drilled due to dense stands of vegetation or other impediments to vehicular access on the levee's river side. Post-Katrina levee protocol allows for the relocation of a hole or even not drilling in an area of cultural or biological concern. There will be no blading or other ground disturbance in order to facilitate vehicular access.

The levee itself is historic, built in the 1930s by the Middle Rio Grande Conservancy District (MRGCD) and rehabilitated and expanded by the Corps and Bureau of Reclamation in the 1950s. As an artificial earthen spoil-bank feature, the Corps finds that drilling in the levee will not adversely affect those elements of the levee that make it eligible for listing on the National Register of Historic Places (NRHP). Access and staging for the project will use existing roads and facilities.

The levee is a spoil-bank levee constructed using nearby sediment. A maintenance road parallels the levee on the landward side and the drilling will occur within this maintenance road. The river side has been subject to construction-related disturbance and frequent channel modifications and the drilling will be within 15 to 20 feet of the levee toe. A Corps archaeologist and biologist will conduct a site visit of proposed locations to ensure that the proposed drilling areas have been previously disturbed, and, if not, will move those locations to disturbed areas or recommend no drilling for that specific segment. This project is very low impact; on similar projects, bore holes are not visible even a few months after drilling. The Corps finds that there will be no adverse effect to historic properties caused by drilling on either side of the levee.

An on-line records check of the New Mexico Cultural Resources Information System (NMCRIS) database was conducted by Lance Lundquist in December, 2007. Within the entire west-side flood plain (from the rivers edge to the bluffs an area vastly larger than the project area), 44 historic properties have been identified. Of these, 75 percent (33 sites) date to the historic period, 14 percent (six sites) date to the prehistoric period, one has both prehistoric and historic components, and four are of unknown temporal affiliation. With the exception of the levee itself, there are no know historic properties within 50 meters of the currently proposed drilling locations

There are no known tribal concerns associated with this project based on the 2007 Upper Rio Grande Water Operations Environmental Impact Statement.

The concurrence request specified in this letter is specific to the drilling, which the Corps considers to have no adverse effect to historic properties. If this project moves forward, the Corps will fulfill its Section 106 of the NHPA duties for those phases. It is anticipated that due to the historic nature of the levee, as well as the impacts associated with staging and construction on other potential historic properties, replacing the existing 44 mile levee system would involve adverse effects to historic properties. As the planning phase continues, we will continue to involve your office and consult as required by Section 106.

Pursuant to 36 CFR 800.13, should previously unknown historic properties be encountered during drilling, work would cease in the immediate vicinity of the resource. A determination of significance would be made, and further consultation would be conducted with your office and with American Indian Tribes that have cultural concerns in the area.

In sum, we seek your concurrence in our determination of "no adverse effect to historic properties" related to geologic drilling for this project. If you have questions regarding the Rio Grande Floodway, San Acacia to Bosque del Apache Unit, Socorro County, New Mexico project, please contact John D. Schelberg, archaeologist, at (505) 342-3359 or Lance Lundquist, archaeologist, at (505) 342-3671.

Sincerely,

Julie Alcon
Chief, Environmental Resources
Section

11/10/09
Date

I CONCUR

FOR Jan Biella
New Mexico State Historic
Preservation Officer

Enclosures

1. Project Location Map
2. New Mexico State Historic Preservation Office letter

Copy furnished w/Enclosures:

Mr. Mark Hungerford, Archaeologist
U.S. Bureau of Reclamation
Albuquerque Area Office
555 Broadway Blvd., NE
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DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

August 2, 2011

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

Ms. Jan Biella
Interim State Historic Preservation Officer
New Mexico Department of Cultural Affairs
Historic Preservation Division
Bataan Memorial Building
407 Galisteo Street, Suite 236
Santa Fe, New Mexico 87501

Re: HPD Consultation No's. 054201, 054093, 088135

Dear Ms. Biella:

The U.S. Army Corps of Engineers (Corps), Albuquerque District, is planning a levee rehabilitation project for a portion of the Rio Grande Floodway in Socorro County, New Mexico. The existing levee is located along the west side of the Rio Grande in what is known as the San Acacia to Bosque del Apache reach of the Rio Grande Floodway (Enclosure No. 1). The Preliminary Preferred Plan consists of rehabilitation of the existing spoil-bank levee (non-engineered) by constructing a structurally sound, engineered earthen levee extending approximately 43 miles along the west bank of the Rio Grande, from the San Acacia Diversion Dam to Tiffany Junction(Enclosure No. 1). The Corps is seeking your concurrence in our determination of "No Historic Properties Affected" for a new element of the Preliminary Preferred Plan, identified as the San Acacia Overbank Lowering Area, as described below.

The engineered levee would follow the alignment of the existing spoil-bank levee that parallels the U.S. Bureau of Reclamation's (Reclamation) Low Flow Conveyance Channel (LFCC). The local sponsor, the Middle Rio Grande Conservancy District (MRGCD), supports the Preliminary Preferred Plan. A draft of the Supplemental Environmental Impact Statement will be posted to the Corps' Albuquerque District web page (http://www.spa.usace.army.mil/fonsi/) in the near future.

The study area of the current project, called the San Acacia to Bosque Del Apache Unit, is one unit within the comprehensive plan of development for flood control in the Rio Grande Basin, New Mexico that was authorized by the Flood Control Acts of 1948 (P.L. 80-858, Section 203) and 1950 (P.L. 81-516), in accordance with the recommendations of the Chief of Engineers, as found in House Document No. 243, 81st Congress, 1st Session, dated April 5, 1948. The Authority provided a comprehensive plan for coordinated development of water resource and flood risk management on the Rio Grande, by the Corps and Bureau of Reclamation, commencing near Truth or Consequences at about river mile 123 extending upstream to the lower end of the Rio Grande Canyon 14 miles upstream from Española, New Mexico at about river mile 394. The comprehensive plan included channel rectification, improvement of irrigation works, dredging, construction of three reservoirs and levee enlargement and construction. A November 1947 agreement delegated responsibility for channel rectification and maintenance to the Bureau of Reclamation and facilities for local flood protection to the Corps of Engineers.

As described in the 1948 report, levees had previously been constructed by local interests through parts of the Espanola and Middle Valley of the Rio Grande. The levees were not uniform as to grade, section or standard of construction and it was proposed to modify and supplement the existing levees. Since authorized in 1948, no levee rehabilitation projects have been constructed in the San Acacia to Bosque del Apache reach.

Pursuant to 36 CFR 800.2, consulting parties in the Section 106 process identified for the proposed San Acacia to Bosque del Apache Levee Rehabilitation Project (Undertaking) include the Corps, the U.S. Bureau of Reclamation, the MRGCD, and your office. Consistent with the Department of Defense's American Indian and Alaska Native Policy, signed by Secretary of Defense William S. Cohen on October 20, 1998, and based on the State of New Mexico Indian Affairs Department and Historic Preservation Division's 2011 Native American Consultations List, on July 5, 2011, Native American tribes that have indicated they have concerns in Socorro County were sent scoping letters regarding the proposed project. The Corps has previously submitted scoping letters to this tribal list on various aspects of this project in August of 2002 and February of 2006. To date, the Corps has received no indication of tribal concerns regarding this project. No Traditional Cultural Properties are known to occur within or adjacent to the proposed project area.

The Corps has previously consulted with the New Mexico State Historic Preservation Officer (SHPO) regarding various aspects of the proposed Undertaking. On November 3, 1997, your office concurred that there would be no adverse effect to historic properties for the proposed removal/relocation of the historic 1930s BNSF railway bridge located near San Marcial (HPD Consultation No. 054201; Enclosure No. 2). Although bridge removal was considered during initial planning, the Corps subsequently determined that they had no authority to pursue any activity regarding the bridge; therefore, bridge removal is no longer a project alternative. On November 5, 1997, your office concurred that there would be no adverse effect to historic properties for the proposed reconstruction of 45 miles of the existing spoil bank levee within the existing alignment and for several access roads (HPD Consultation No. 054093; Enclosure No. 3). The current Preliminary Preferred Plan includes approximately 43 miles of levee rehabilitation. On November 10, 2009, your office concurred that there would be no adverse effect to historic properties for proposed geologic drilling along the existing alignment and on the existing spoil bank levee (HPD Consultation No. 088135; Enclosure No. 4).

In support of those Section 106 consultation letters, the Corps submitted two archaeological survey reports and other related documentation for mitigation of the adverse effect to MRGCD's historic 1930s levee and irrigation water delivery system. Those reports include the following: Berry and Lewis 1997; Doleman 1997; Van Citters 2000; Chapman and Actis 2007; and Dodge and Santillanes 2007 (Enclosure No. 5).

Of the 210 archaeological sites that are known to occur in the vicinity of the 43 mile project area, approximately 40 archaeological sites along the west-side and 37 archaeological sites along the east side of the Rio Grande channel, located within or immediately adjacent to the flood plain, have been subjected to or have the potential to have been affected by some unknown amount of historic flooding related effects. The Future Without Project and the Future With Project Alternatives, including the Preliminary Preferred Alternative, would not change the potential for effects from future flooding to these sites.

Now, pursuant to 36 CFR Part 800, the Corps is seeking your concurrence in our determination of "No Historic Properties Affected" for a new element of the Preliminary Preferred Plan. The new construction element, identified as the San Acacia Overbank Lowering Area, is located on the river bend immediately downstream of the San Acacia Diversion Dam. The San Acacia Diversion Dam is located at the upstream end of the 43-mile levee project. On this river bend, the Rio Grande channel is significantly degraded. Proposed work would include the placement of protective rock rip-rap on the outside of the river bend (northwest) adjacent to the BNSF railroad grade, and lowering and shaping the overbank area on the inside of the river bend (southeast) (Enclosures 6 and 7).

Pursuant to 36 CFR 800.4, the Area of Potential Effects (APE) for the San Acacia Overbank Lowering Area is approximately 17.4 acres. As shown in Enclosures No. 7, the light blue area represents the sand bank that would be excavated to the depth of the existing river channel; the light green area would be excavated and shaped on a 1 to 10 (vertical to horizontal) slope. All work would be confined to the river channel and sand bank. This excavation would reduce river flow velocity around the river bend, thereby providing flood protection to the BNSF railway grade, Reclamation's LFCC, and the community of San Acacia and adjacent farm land.

Pursuant to 36 CFR 800.4(b), on May 26, 2011, Corps archaeologists conducted a site visit to the San Acacia Overbank Lowering Area to verify the location of known archaeological resources in relation to the proposed construction area. The San Acacia

Overbank Lowering Area is located on land managed by the U.S. Fish and Wildlife Service's Sevilleta National Wildlife Refuge. Prior to the site visit, an archival literature search, and searches of the New Mexico Archaeological Records Management Section (ARMS) database, the State Register of Cultural Properties, and the National Register of Historic Places (NRHP) were completed. Supported with information gathered from archival records, the Corps' site visit found that two archaeological sites located in the area (LA 31705 and LA 31706) are approximately 250 feet or more away from the project area and therefore of sufficient distance that they would not be affected. The limit of surface artifacts observed during the site visit occur along the gravel terrace above the floodplain as generally shown along the red line shown on Enclosure No 7. The Corps site visit verified that no archaeological resources occur on the river sand bank and per previous discussions with your office, that it is highly unlikely that historic properties or cultural materials of significant antiquity or that would retain archaeological integrity would occur within areas of the Rio Grande's historic active channel that include the sand bank in the San Acacia Overbank Lowering Area. The Corps is of the opinion that improvements to the river channel would result in no historic properties affected. The Corps seeks you concurrence with this determination.

In summary, the Corps has previously consulted with your office regarding reconstruction of 45 miles of earthen levee extending along the west bank of the Rio Grande in the San Acacia to Bosque del Apache reach of the Rio Grande Floodway. The Preliminary Preferred Plan now consists of 43 miles of levee reconstruction. An archaeological survey of the levee alignment was conducted and no archaeological sites are located within or adjacent to the existing levee. The Preliminary Preferred Plan will stay within the existing levee alignment and will use existing access roads and preapproved staging areas that have been disturbed and used for similar purposes in the past. The 1930s MRGCD levee and irrigation system is considered to be historic; therefore, the Corps has previously submitted documentation as mitigation (as noted above in HPD Consultation Letter No. 054093 [Enclosure No. 3] and listed in Enclosure No. 5). Geologic drilling was previously accomplished along and on the existing levee. Your office has concurred with the Corps' determination of no adverse effect to historic properties for this levee reconstruction work (as noted above in HPD Consultation Letter No. 088135 [Enclosure No. 4]).

The Corps is currently seeking your concurrence in our determination of "No Historic Properties Affected" for the new construction element of the Preliminary Preferred Plan, identified as the San Acacia Overbank Lowering Area.

Should previously undiscovered artifacts or features be unearthed during construction, work will be stopped in the immediate vicinity of the find, a determination of significance made, and the Corps will consult with your office and with American Indian tribes that may have concerns in the project area as to the best course of action.

If you have questions or require additional information regarding the Preliminary Preferred Plan for the proposed 43-mile San Acacia to Bosque del Apache Levee Rehabilitation Project, please contact Gregory Everhart, archaeologist, at (505) 342-3352 or myself at (505) 342-3281.

Sincerely,

Julie Alcon
Chief, Environmental
Resources Section

I CONCUR ______________________

____
Date

JAN BIELLA
INTERIM NEW MEXICO STATE
HISTORIC PRESERVATION OFFICER

Enclosures

Copies furnished w/ enclosures:

Ms. Cheryl Rolland
Manager
U.S. Bureau of Reclamation
Albuquerque Area Office
Facilities and Lands Division
555 Broadway Boulevard NE, Suite 100
Albuquerque, New Mexico 87102

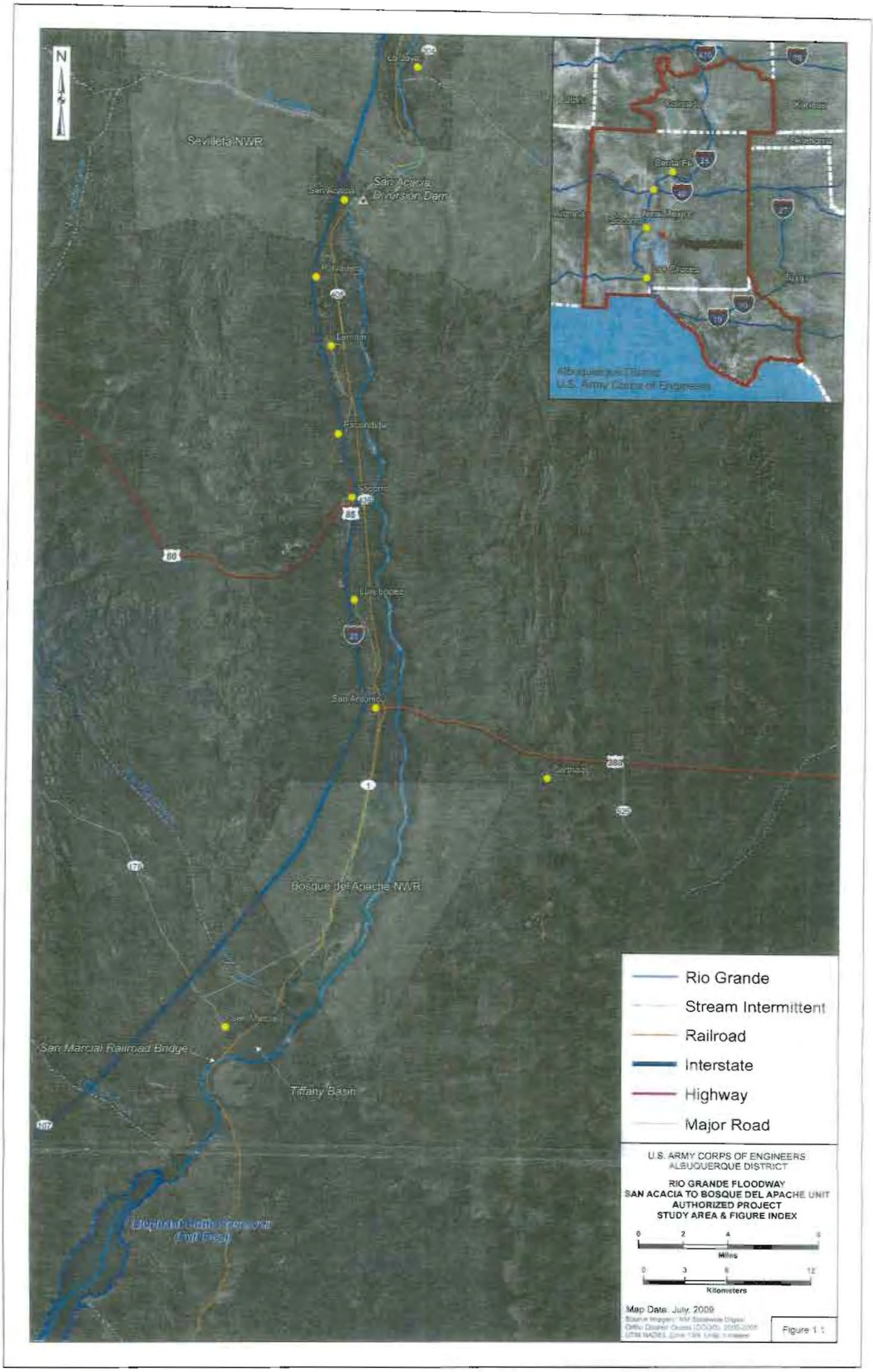
Mr. Mark Hungerford
Archaeologist
U.S. Bureau of Reclamation
Albuquerque Area Office
Facilities and Lands Division
555 Broadway Boulevard NE, Suite 100
Albuquerque, New Mexico 87102

Mr. Ray Gomez P.E.
Assistant Engineer
Middle Rio Grande Conservancy District
PO Box 581
Albuquerque, New Mexico 87103

Ms. Kathy Granillo
Refuge Manager
U.S. Fish and Wildlife Service
Sevilleta National Wildlife Refuge
PO Box 1248
Socorro, New Mexico 87801

Enclosure No. 1

Figure 1.1 Study Area



Enclosure No. 2

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA, NE
ALBUQUERQUE, NEW MEXICO 87109-3435
FAX (505) 342-3199

Reply to Attention of

ET-P
11/5/97

October 24, 1997

Engineering and Planning Division
Planning Branch

Lynne Sebastian, Ph.D.
State Historic Preservation Officer
State Historic Preservation Bureau
228 East Palace Avenue, Room 101
Santa Fe, New Mexico 87503

Dear Dr. Sebastian:

In accordance with 36 CFR 800.5, the Substitution Agreement between your office and the Advisory Council on Historic Preservation (under 36 CFR 800.7) and the Programmatic Memorandum of Agreement for our levee rehabilitation program, the U.S. Army Corps of Engineers, Albuquerque District (Corps), is providing to your office information regarding our cultural resources and historic properties investigations associated with the rehabilitation of the Middle Rio Grande Levee system. We seek your concurrence with our determinations regarding portions of this undertaking and their potential effects on historic and cultural resources.

Recent design changes for the San Acacia Reach of the Middle Rio Grande Levee Rehabilitation Project call for the removal of an existing railroad bridge near San Marcial, Socorro County, New Mexico. The bridge is located in UTM Zone 13 at 3728300 N and 315290 E. The bridge is currently in use by the Burlington Northern Santa Fe Railway, the bridge's owner. The bridge was originally constructed circa 1930. Although the bridge has been raised a total of 18 feet as a result of aggradation of the local river bed, the superstructure remains essentially unchanged since its construction. The bridge is a "Warren Through-Truss" design. The bridge is composed of five 149-foot long steel trusses on timber and concrete piers. The total length of the structure is 853 feet.

The Corps has evaluated the structure using the system developed by the New Mexico State Highway and Transportation Department (SHD) in consultation with your office. The bridge scored 72 points out of the 108 points possible, placing it in the top one-third of the rating. This value appears to be consistent with those ratings given similar highway structures. Given the structure's age, relative rarity as an engineering feature, and its long-term historic function in south central New Mexican commerce, the Corps believes the bridge to be eligible for inclusion on the National Register of Historic Places.

The San Marcial Railroad Bridge is situated such that it produces a severe constriction in the Rio Grande River floodway during periods of high flows. The negative effects of the current situation are increased water surface elevations upstream of the structure requiring more extensive levee construction and impaired water resource operations throughout the Middle Rio Grande Valley. Limited flexibility in water operations in turn has a deleterious impact on riparian and riverine ecosystems along the Rio Grande. Replacement of the bridge with a more modern structure on a different site is considered crucial to effective flood control, efficient and beneficial water operations, and habitat improvement for endangered species. These widespread environmental benefits considerably offset adverse impacts to the historic context of the area through the loss of the structure.

The Corps proposes to market the structure for reuse in another location and the recordation of the structure according to Level II standards of the Historic American Engineering Record. A considerable amount of documentation in the form of engineered drawings and photography are available for the structure and an historic narrative shall be produced to complete the documentation package. With your concurrence on our determination, we shall begin consultation with your office on the content, extent, and distribution of the final mitigation document.

We shall continue to coordinate with your office as construction plans continue to mature. We look forward to our continuing consultations regarding this extensive undertaking. Please contact Dr. Ronald Kneebone at (505) 342-3355 with any questions or comments that you may have.

Sincerely,

Mark C. Harberg

Mark C. Harberg
Chief, Environmental Section

Enclosure

Copy Furnished: (w/o enclosure)
Don Klima, Director
Advisory Council on Historic Preservation
Office of Planning and Review
12136 W Bayaud Ave. #330
Lakewood, CO 80228-2115

I CONCUR Ly Sebastian 3 17
LYNNE SEBASTIAN, PH.D.
NEW MEXICO STATE HISTORIC PRESERVATION OFFICER

Enclosure No. 3

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA, NE
ALBUQUERQUE, NEW MEXICO 87109-3435
FAX (505) 342-3199

Reply to
Attention of

October 3, 1997

Engineering and Technical
Services Division
Planning and Environment
Branch

Lynne Sebastian, Ph.D.
State Historic Preservation
Officer
State Historic Preservation
Bureau
228 East Palace Avenue, Room 101
Santa Fe, New Mexico 87503

Dear Dr. Sebastian:

In accordance with 36 CFR 800.5, the Substitution Agreement between your office and the Advisory Council on Historic Preservation (under 36 CFR 800.7) and the Programmatic Memorandum of Agreement for our levee rehabilitation program, the U.S. Army Corps of Engineers (Corps), Albuquerque District, is providing to your office information regarding our cultural resources and historic properties investigations associated with the rehabilitation of the Middle Rio Grande levee system. We seek your concurrence with our determinations regarding portions of this undertaking and their potential effects on historic and cultural resources.

The Corps has conducted a cultural resources inventory of the alignment of the San Acacia to San Marcial Reach of the Middle Rio Grande levee system. In addition, resource inventories were conducted along access routes to ten "Habitat Improvement Features" (HIFs) located in the Rio Grande flood plain. We have previously consulted with Mr. Dan Riley of your office regarding these habitat features by telephone. As a result of this conversation, it was agreed that survey within the flood plain would be counter-productive and uninformative and that our inventory should focus on access routes to HIFs. The results of this inventory are provided in the enclosed letter report from our contractor, the Office of Contract Archaeology - University of New Mexico.

In summary, no historic properties or features and only two isolated artifacts were identified along the 45 miles of the existing spoilbank levee, the area to be directly impacted by construction activities. The Corps believes that the two separate isolated artifacts, lacking spatial context and integrity, do not meet the criteria for eligibility to the National Register of

Historic Places. The Corps has provided to your office our documentation of the existing spoilbank levee and its attendant historic context under separate cover (Historical Documentation of Middle Rio Grande Flood Protection Projects, K. Lynn Berry and Karen Lewis, 1997). Given that no historic or cultural properties or features have been identified along the construction area and that the existing spoilbank has been adequately documented to mitigate its rehabilitation, the Corps is of the opinion that actual construction activities will have no effect on the historic resources of the region.

As noted, the inventory also included proposed access routes to areas identified for habitat improvement. Construction activities in these HIFs will consist of excavation of a channel from the Rio Grande into areas that are only marginally exposed to periodic inundation under current conditions. Because of their location in the Rio Grande flood plain, it is extremely unlikely that cultural or historic resources would be found there. Survey of the access routes into these areas, however, identified numerous historic properties. As cited in the enclosed report, access to all ten of the proposed HIFs will primarily be along an unnumbered and unpaved road that parallels the Rio Grande on its eastern or left-hand margin. Numerous historic properties have been previously documented along this road and were confirmed by our inventory. Access from this artery into the bosque HIF locations can also be attained along existing unpaved roads in five instances. Access to the five remaining HIFs will necessitate traversing previously undisturbed areas. Surveys of these undisturbed areas found that two proposed access routes would impact previously unrecorded historic properties (LA 119574 and LA 119575). Both of these sites are large, complex, multi-component artifact scatters that have the potential for structural feature remains. As such, the Corps considers them eligible for inclusion on the National Register of Historic Places.

Given the density and size of historic properties associated with access to the HIF areas, the Corps believes that the most prudent action to take is to avoid the properties involved. To ensure no impacts to these properties, the Corps proposes a three-fold avoidance plan. First, prior to construction, the Corps shall clearly demarcate access routes that detour around all identified historic properties and ensure contractor adherence to their use. Second, the Corps shall employ minimal efforts to improve existing roadways, including the preclusion of improvements along existing roads through known properties. Third, the Corps shall undertake extensive monitoring by qualified archaeological professionals of construction activities as they occur to ensure rapid identification and protection of any previously unrecorded historic properties. Therefore, because limited use of existing roads without improvements should not affect historic properties to an extent any greater than that already produced by road construction and the implementation of a rigorous avoidance plan, the Corps is of the opinion that construction activities associated with habitat improvement will have no effect on the historic and cultural resources of the region.

We shall continue to coordinate with your office as construction plans continue to mature. We look forward to our continuing consultations regarding this extensive undertaking. Please contact Dr. Ronald Kneebone at (505) 342-3355 with any questions or comments that you may have.

Sincerely,

Mark C. Harberg
Chief, Environmental Section

Enclosure

Copy Furnished (w/o enclosure):

Claudia Nissley, Director
Western Office of Project Review
Advisory Council on Historic Preservation
730 Simms Street, Room 401
Golden, Colorado 80401

I CONCUR 11-5-97
for LYNNE SEBASTIAN, PH.D.
NEW MEXICO STATE HISTORIC PRESERVATION OFFICER

Enclosure No. 4

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

November 9, 2009

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

Ms. Jan Biella
Interim State Historic Preservation Officer
New Mexico Department of Cultural Affairs
Historic Preservation Division
Bataan Memorial Building
407 Galisteo Street, Suite 236
Santa Fe, New Mexico 87501

Dear Ms. Biella:

Pursuant to 36 CFR Part 800, the U.S. Army Corps of Engineers (Corps), Albuquerque District, in cooperation with the Bureau of Reclamation (BOR), is seeking your concurrence in our determination of "no adverse effect to historic properties" for geological drilling associated with the Rio Grande Floodway, San Acacia to Bosque del Apache Unit, Socorro County, New Mexico. This project is focusing on the levee system from the diversion dam at San Acacia to the BNSF railroad bridge across the Rio Grande at San Marcial. The project will only occur on the levees on the west side of the Rio Grande. The proposed project is funded for 18.5 miles; however, we are seeking your concurrence for the total project length of approximately 44 miles north to south as we are anticipating additional funding and the drilling will be exactly the same. The Corps authority to conduct the project is provided by the Flood Control Act on 1948. Funding for the project is provided by the American Recovery and Reinvestment Act.

This drilling project is identical to the Bernalillo to Belen project discussed in our letter of August 20, 2009, (HPD log number 087510, copy enclosed). The long-term project consists of the reconstruction of the non-engineered spoil bank levees to improve flood damage reduction along the Rio Grande from Bernalillo to the headwaters of Elephant Butte Reservoir. The levee is divided into units for the purpose of hydraulic investigations, funding, and other Corps management considerations.

The purpose of the proposed drilling and the sampling protocols are identical to those described in the August 20, 2009 letter (HPD Log 087510). Approximately 700 bore holes are required over the 44 mile-long project area. Three holes are planned every 1,000 feet: one in the maintenance road on the land side; one in the levee; and one in the river side. Fewer holes may be drilled due to dense stands of vegetation or other impediments to vehicular access on the levee's river side. Post-Katrina levee protocol allows for the relocation of a hole or even not drilling in an area of cultural or biological concern. There will be no blading or other ground disturbance in order to facilitate vehicular access.

The levee itself is historic, built in the 1930s by the Middle Rio Grande Conservancy District (MRGCD) and rehabilitated and expanded by the Corps and Bureau of Reclamation in the 1950s. As an artificial earthen spoil-bank feature, the Corps finds that drilling in the levee will not adversely affect those elements of the levee that make it eligible for listing on the National Register of Historic Places (NRHP). Access and staging for the project will use existing roads and facilities.

The levee is a spoil-bank levee constructed using nearby sediment. A maintenance road parallels the levee on the landward side and the drilling will occur within this maintenance road. The river side has been subject to construction-related disturbance and frequent channel modifications and the drilling will be within 15 to 20 feet of the levee toe. A Corps archaeologist and biologist will conduct a site visit of proposed locations to ensure that the proposed drilling areas have been previously disturbed, and, if not, will move those locations to disturbed areas or recommend no drilling for that specific segment. This project is very low impact; on similar projects, bore holes are not visible even a few months after drilling. The Corps finds that there will be no adverse effect to historic properties caused by drilling on either side of the levee.

An on-line records check of the New Mexico Cultural Resources Information System (NMCRIS) database was conducted by Lance Lundquist in December, 2007. Within the entire west-side flood plain (from the rivers edge to the bluffs an area vastly larger than the project area), 44 historic properties have been identified. Of these, 75 percent (33 sites) date to the historic period, 14 percent (six sites) date to the prehistoric period, one has both prehistoric and historic components, and four are of unknown temporal affiliation. With the exception of the levee itself, there are no know historic properties within 50 meters of the currently proposed drilling locations

There are no known tribal concerns associated with this project based on the 2007 Upper Rio Grande Water Operations Environmental Impact Statement.

The concurrence request specified in this letter is specific to the drilling, which the Corps considers to have no adverse effect to historic properties. If this project moves forward, the Corps will fulfill its Section 106 of the NHPA duties for those phases. It is anticipated that due to the historic nature of the levee, as well as the impacts associated with staging and construction on other potential historic properties, replacing the existing 44 mile levee system would involve adverse effects to historic properties. As the planning phase continues, we will continue to involve your office and consult as required by Section 106.

Pursuant to 36 CFR 800.13, should previously unknown historic properties be encountered during drilling, work would cease in the immediate vicinity of the resource. A determination of significance would be made, and further consultation would be conducted with your office and with American Indian Tribes that have cultural concerns in the area.

In sum, we seek your concurrence in our determination of "no adverse effect to historic properties" related to geologic drilling for this project. If you have questions regarding the Rio Grande Floodway, San Acacia to Bosque del Apache Unit, Socorro County, New Mexico project, please contact John D. Schelberg, archaeologist, at (505) 342-3359 or Lance Lundquist, archaeologist, at (505) 342-3671.

Sincerely,

Julie Alcon
Chief, Environmental Resources
Section

I CONCUR ______________________
Jan Biella
New Mexico State Historic
Preservation Officer

____
Date

Enclosures

1. Project Location Map
2. New Mexico State Historic Preservation Office letter

Copy furnished w/Enclosures:

Mr. Mark Hungerford, Archaeologist
U.S. Bureau of Reclamation
Albuquerque Area Office
555 Broadway Blvd., NE
Suite 100
Albuquerque, NM 87102-2352

Enclosure No. 5:
Cultural Resources References List

Berry, K. Lynn and Karen Lewis
1997 **Historical Documentation of Middle Rio Grande Flood Protection Projects, Corrales to San Marcial**. UNM-OCA Report No. 185-555 (NMCRIS No. 59879). Prepared by University of New Mexico, Office of Contract Archeology, Albuquerque. Prepared for the U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, Contract No. DACW47-94-D-0019, Delivery Order No. 0006.

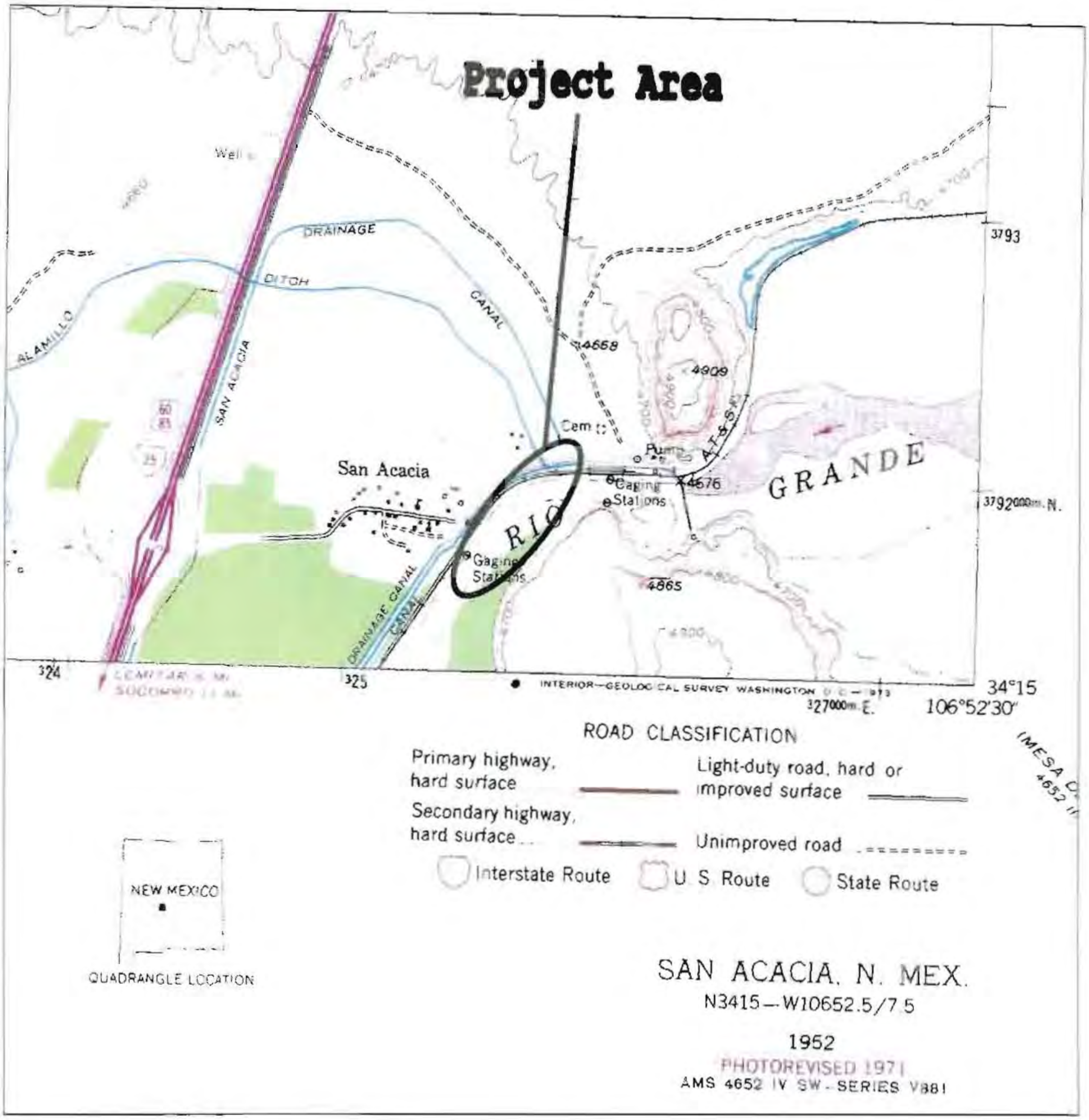
Chapman, Richard C. and Adrienne Actis
2007 **Cultural Resources Survey for the BNSF Railroad Relocation at San Marcial, Socorro County, New Mexico**. UNM-OCA Report No. 185-888 (NMCRIS No. 103335). Prepared by University of New Mexico, Office of Contract Archeology, Albuquerque. Prepared for the U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, Contract No. W912PP-06-D-0001, Delivery Order No. 0003.

Doleman, William H.
1997 **Cultural Resources Survey Isleta to Belen and San Acacia to San Marcial**. UNM-OCA Report No. 185-606 (NMCRIS No. 58373). Prepared by University of New Mexico, Office of Contract Archeology, Albuquerque. Prepared for the U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, Contract No. DACW-D-94-0019, Delivery Order No. 13.

Dodge, William A. and Abraham Santillanes
2007 **Controlling the Floods: The Role of the U.S. Army Corps of Engineers in the History of the Middle Rio Grande Conservancy District**. Prepared by Van Citters: Historic Preservation, LLC., Albuquerque. Prepared for the U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, Contract No. W912PP-06-F-0053.

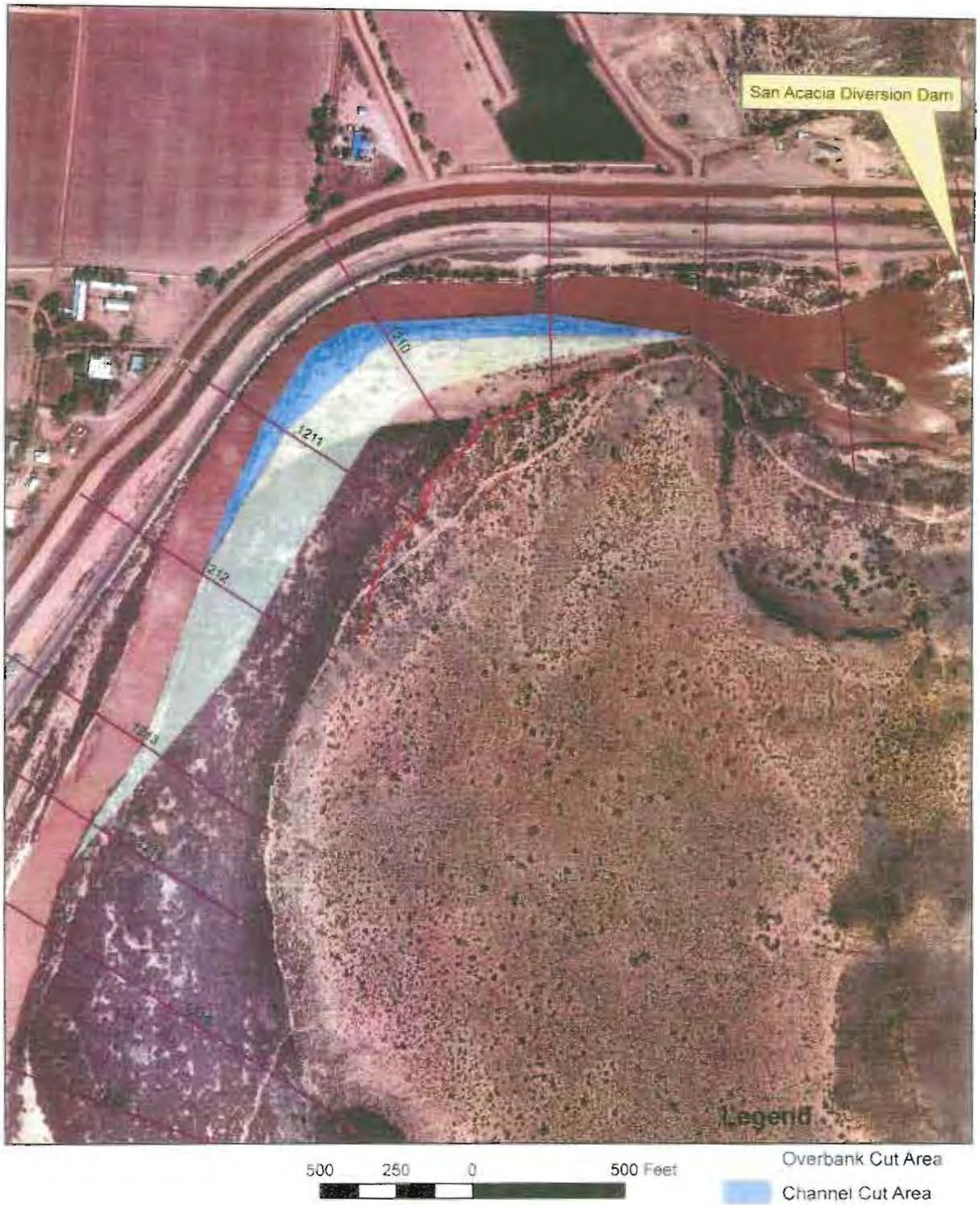
Van Citters, Karen
2000 **Historic Engineering Overview of the San Marcial Railroad Bridge**. UNM-OCA Report No. 185-665. Prepared by Van Citters: Historic Preservation, Albuquerque, and the University of New Mexico, Office of Contract Archeology, Albuquerque. Prepared for the U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, Military Interdepartmental Purchase Request No. W81G6993355113.

Enclosure No. 6.



Enclosure No. 7. The San Acacia Overbank Lowering Area is located on land managed by the U.S. Fish and Wildlife Service's Sevilleta National Wildlife Refuge.

San Acacia Overbank Excavation



DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

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RECEIVED

AUG - 4 2011

HISTORIC PRESERVATION DIVISION

August 2, 2011

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

Ms. Jan Biella
Interim State Historic Preservation Officer
New Mexico Department of Cultural Affairs
Historic Preservation Division
Bataan Memorial Building
407 Galisteo Street, Suite 236
Santa Fe, New Mexico 87501

Re: HPD Consultation No's. 054201, 054093, 088135

Dear Ms. Biella:

The U.S. Army Corps of Engineers (Corps), Albuquerque District, is planning a levee rehabilitation project for a portion of the Rio Grande Floodway in Socorro County, New Mexico. The existing levee is located along the west side of the Rio Grande in what is known as the San Acacia to Bosque del Apache reach of the Rio Grande Floodway (Enclosure No. 1). The Preliminary Preferred Plan consists of rehabilitation of the existing spoil-bank levee (non-engineered) by constructing a structurally sound, engineered earthen levee extending approximately 43 miles along the west bank of the Rio Grande, from the San Acacia Diversion Dam to Tiffany Junction(Enclosure No. 1). The Corps is seeking your concurrence in our determination of "No Historic Properties Affected" for a new element of the Preliminary Preferred Plan, identified as the San Acacia Overbank Lowering Area, as described below.

The engineered levee would follow the alignment of the existing spoil-bank levee that parallels the U.S. Bureau of Reclamation's (Reclamation) Low Flow Conveyance Channel (LFCC). The local sponsor, the Middle Rio Grande Conservancy District (MRGCD), supports the Preliminary Preferred Plan. A draft of the Supplemental Environmental Impact Statement will be posted to the Corps' Albuquerque District web page (http://www.spa.usace.army.mil/fonsi/) in the near future.

The study area of the current project, called the San Acacia to Bosque Del Apache Unit, is one unit within the comprehensive plan of development for flood control in the Rio Grande Basin, New Mexico that was authorized by the Flood Control Acts of 1948 (P.L. 80-858, Section 203) and 1950 (P.L. 81-516), in accordance with the recommendations of the Chief of Engineers, as found in House Document No. 243, 81st Congress, 1st Session, dated April 5, 1948. The Authority provided a comprehensive plan for coordinated development of water resource and flood risk management on the Rio Grande, by the Corps and Bureau of Reclamation, commencing near Truth or Consequences at about river mile 123 extending upstream to the lower end of the Rio Grande Canyon 14 miles upstream from Española, New Mexico at about river mile 394. The comprehensive plan included channel rectification, improvement of irrigation works, dredging, construction of three reservoirs and levee enlargement and construction. A November 1947 agreement delegated responsibility for channel rectification and maintenance to the Bureau of Reclamation and facilities for local flood protection to the Corps of Engineers.

As described in the 1948 report, levees had previously been constructed by local interests through parts of the Espanola and Middle Valley of the Rio Grande. The levees were not uniform as to grade, section or standard of construction and it was proposed to modify and supplement the existing levees. Since authorized in 1948, no levee rehabilitation projects have been constructed in the San Acacia to Bosque del Apache reach.

Pursuant to 36 CFR 800.2, consulting parties in the Section 106 process identified for the proposed San Acacia to Bosque del Apache Levee Rehabilitation Project (Undertaking) include the Corps, the U.S. Bureau of Reclamation, the MRGCD, and your office. Consistent with the Department of Defense's American Indian and Alaska Native Policy, signed by Secretary of Defense William S. Cohen on October 20, 1998, and based on the State of New Mexico Indian Affairs Department and Historic Preservation Division's 2011 Native American Consultations List, on July 5, 2011, Native American tribes that have indicated they have concerns in Socorro County were sent scoping letters regarding the proposed project. The Corps has previously submitted scoping letters to this tribal list on various aspects of this project in August of 2002 and February of 2006. To date, the Corps has received no indication of tribal concerns regarding this project. No Traditional Cultural Properties are known to occur within or adjacent to the proposed project area.

The Corps has previously consulted with the New Mexico State Historic Preservation Officer (SHPO) regarding various aspects of the proposed Undertaking. On November 3, 1997, your office concurred that there would be no adverse effect to historic properties for the proposed removal/relocation of the historic 1930s BNSF railway bridge located near San Marcial (HPD Consultation No. 054201; Enclosure No. 2). Although bridge removal was considered during initial planning, the Corps subsequently determined that they had no authority to pursue any activity regarding the bridge; therefore, bridge removal is no longer a project alternative. On November 5, 1997, your office concurred that there would be no adverse effect to historic properties for the proposed reconstruction of 45 miles of the existing spoil bank levee within the existing alignment and for several access roads (HPD Consultation No. 054093; Enclosure No. 3). The current Preliminary Preferred Plan includes approximately 43 miles of levee rehabilitation. On November 10, 2009, your office concurred that there would be no adverse effect to historic properties for proposed geologic drilling along the existing alignment and on the existing spoil bank levee (HPD Consultation No. 088135; Enclosure No. 4).

In support of those Section 106 consultation letters, the Corps submitted two archaeological survey reports and other related documentation for mitigation of the adverse effect to MRGCD's historic 1930s levee and irrigation water delivery system. Those reports include the following: Berry and Lewis 1997; Doleman 1997; Van Citters 2000; Chapman and Actis 2007; and Dodge and Santillanes 2007 (Enclosure No. 5).

Of the 210 archaeological sites that are known to occur in the vicinity of the 43 mile project area, approximately 40 archaeological sites along the west-side and 37 archaeological sites along the east side of the Rio Grande channel, located within or immediately adjacent to the flood plain, have been subjected to or have the potential to have been affected by some unknown amount of historic flooding related effects. The Future Without Project and the Future With Project Alternatives, including the Preliminary Preferred Alternative, would not change the potential for effects from future flooding to these sites.

Now, pursuant to 36 CFR Part 800, the Corps is seeking your concurrence in our determination of "No Historic Properties Affected" for a new element of the Preliminary Preferred Plan. The new construction element, identified as the San Acacia Overbank Lowering Area, is located on the river bend immediately downstream of the San Acacia Diversion Dam. The San Acacia Diversion Dam is located at the upstream end of the 43-mile levee project. On this river bend, the Rio Grande channel is significantly degraded. Proposed work would include the placement of protective rock rip-rap on the outside of the river bend (northwest) adjacent to the BNSF railroad grade, and lowering and shaping the overbank area on the inside of the river bend (southeast) (Enclosures 6 and 7).

Pursuant to 36 CFR 800.4, the Area of Potential Effects (APE) for the San Acacia Overbank Lowering Area is approximately 17.4 acres. As shown in Enclosures No. 7, the light blue area represents the sand bank that would be excavated to the depth of the existing river channel; the light green area would be excavated and shaped on a 1 to 10 (vertical to horizontal) slope. All work would be confined to the river channel and sand bank. This excavation would reduce river flow velocity around the river bend, thereby providing flood protection to the BNSF railway grade, Reclamation's LFCC, and the community of San Acacia and adjacent farm land.

Pursuant to 36 CFR 800.4(b), on May 26, 2011, Corps archaeologists conducted a site visit to the San Acacia Overbank Lowering Area to verify the location of known archaeological resources in relation to the proposed construction area. The San Acacia

Overbank Lowering Area is located on land managed by the U.S. Fish and Wildlife Service's Sevilleta National Wildlife Refuge. Prior to the site visit, an archival literature search, and searches of the New Mexico Archaeological Records Management Section (ARMS) database, the State Register of Cultural Properties, and the National Register of Historic Places (NRHP) were completed. Supported with information gathered from archival records, the Corps' site visit found that two archaeological sites located in the area (LA 31705 and LA 31706) are approximately 250 feet or more away from the project area and therefore of sufficient distance that they would not be affected. The limit of surface artifacts observed during the site visit occur along the gravel terrace above the floodplain as generally shown along the red line shown on Enclosure No 7. The Corps site visit verified that no archaeological resources occur on the river sand bank and per previous discussions with your office, that it is highly unlikely that historic properties or cultural materials of significant antiquity or that would retain archaeological integrity would occur within areas of the Rio Grande's historic active channel that include the sand bank in the San Acacia Overbank Lowering Area. The Corps is of the opinion that improvements to the river channel would result in no historic properties affected. The Corps seeks you concurrence with this determination.

In summary, the Corps has previously consulted with your office regarding reconstruction of 45 miles of earthen levee extending along the west bank of the Rio Grande in the San Acacia to Bosque del Apache reach of the Rio Grande Floodway. The Preliminary Preferred Plan now consists of 43 miles of levee reconstruction. An archaeological survey of the levee alignment was conducted and no archaeological sites are located within or adjacent to the existing levee. The Preliminary Preferred Plan will stay within the existing levee alignment and will use existing access roads and preapproved staging areas that have been disturbed and used for similar purposes in the past. The 1930s MRGCD levee and irrigation system is considered to be historic; therefore, the Corps has previously submitted documentation as mitigation (as noted above in HPD Consultation Letter No. 054093 [Enclosure No. 3] and listed in Enclosure No. 5). Geologic drilling was previously accomplished along and on the existing levee. Your office has concurred with the Corps' determination of no adverse effect to historic properties for this levee reconstruction work (as noted above in HPD Consultation Letter No. 088135 [Enclosure No. 4]).

The Corps is currently seeking your concurrence in our determination of "No Historic Properties Affected" for the new construction element of the Preliminary Preferred Plan, identified as the San Acacia Overbank Lowering Area.

Should previously undiscovered artifacts or features be unearthed during construction, work will be stopped in the immediate vicinity of the find, a determination of significance made, and the Corps will consult with your office and with American Indian tribes that may have concerns in the project area as to the best course of action.

If you have questions or require additional information regarding the Preliminary Preferred Plan for the proposed 43-mile San Acacia to Bosque del Apache Levee Rehabilitation Project, please contact Gregory Everhart, archaeologist, at (505) 342-3352 or myself at (505) 342-3281.

Sincerely,

Julie Alcon
Chief, Environmental
Resources Section

9. 12. 2011
Date

I CONCUR John R Eston For
JAN BIELLA
INTERIM NEW MEXICO STATE
HISTORIC PRESERVATION OFFICER

Enclosures

Copies furnished w/ enclosures:

Ms. Cheryl Rolland
Manager
U.S. Bureau of Reclamation
Albuquerque Area Office
Facilities and Lands Division
555 Broadway Boulevard NE, Suite 100
Albuquerque, New Mexico 87102

Mr. Mark Hungerford
Archaeologist
U.S. Bureau of Reclamation
Albuquerque Area Office
Facilities and Lands Division
555 Broadway Boulevard NE, Suite 100
Albuquerque, New Mexico 87102

Mr. Ray Gomez P.E.
Assistant Engineer
Middle Rio Grande Conservancy District
PO Box 581
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Ms. Kathy Granillo
Refuge Manager
U.S. Fish and Wildlife Service
Sevilleta National Wildlife Refuge
PO Box 1248
Socorro, New Mexico 87801

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

March 21, 2012

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

Ms. Jan Biella
Interim State Historic Preservation Officer
New Mexico Department of Cultural Affairs
Historic Preservation Division
Bataan Memorial Building
407 Galisteo Street, Suite 236
Santa Fe, New Mexico 87501

Re: HPD Consultation Numbers 054201, 054093, 088135, 092670

Dear Ms. Biella:

Pursuant to 36 CFR Part 800, the U.S. Army Corps of Engineers (Corps), Albuquerque District, in cooperation with the project Sponsor, the Middle Rio Grande Conservancy District (MRGCD), is continuing our consultation regarding the proposed levee rehabilitation project for the San Acacia to Bosque del Apache reach of the Rio Grande Floodway in Socorro County, New Mexico. The Recommended Plan consists of rehabilitation of the existing non-engineered spoil-bank levee by constructing a structurally sound, engineered earthen levee extending approximately 43 miles along the west bank of the Rio Grande, from the San Acacia Diversion Dam to Tiffany Junction. The Corps seeks your concurrence in our determinations regarding three elements of this project:

1) A determination of **no historic properties affected** for the construction of a floodwall and levee tie-in to high ground near the San Acacia Diversion Dam;
2) A determination of **no adverse effect to historic properties** by rehabilitation of U.S. Bureau of Reclamation (BOR) facilities near the San Acacia Diversion Dam;
3) A determination of **no historic properties affected** for the use of the northern portion of the Tiffany Basin for an earthen spoil/waste disposal area.

Each of these elements is described below, along with explanations of our determinations. A draft of the Supplemental Environmental Impact Statement for the project will be posted to the Corps' Albuquerque District web page (http://www.spa.usace.army.mil/fonsi/) in the near future.

Floodwall and Levee Tie-In

One part of the Recommended Plan calls for the construction of a concrete floodwall and levee tie-in to a hillside immediately adjacent to the BNSF railway grade and northeast of the 1930s San Acacia Diversion Dam (Enclosures 1 and 2). On February 29, Corps archaeologists Gregory Everhart, Jonathan Van Hoose, Jeremy Decker, Ariane Pinson, and Christopher Parrish conducted a site visit to the area immediately adjacent to and northeast of the San Acacia Diversion Dam and BNSF railway grade, where the levee and new concrete floodwall will tie in to the hillside. The site visit verified that this area was previously disturbed by quarrying and construction activities. The Corps is of the opinion that construction of the headwall and levee tie-in to high ground will result in **no historic properties affected**. The Corps seeks your concurrence with this determination.

Rehabilitation of BOR Facilities

Construction activities near the San Acacia Diversion Dam also include the in-kind replacement of the Bureau of Reclamation's (BOR's) five existing seven-by-seven-foot CBC Conveyance Channel headworks that divert river water to the Low Flow Conveyance (LFC) Channel (Enclosures 1 and 2). These features were constructed in the 1950s by the BOR for managing irrigation water flows diverted from the river. Construction will also add one five-foot-diameter arch corrugated metal pipe extension, 65 feet in length, to the headworks of the Socorro Main Canal. The APE for the floodwall and the rehabilitation of both headworks is approximately 2.7 acres in size. The Corps is of the opinion that the proposed in-kind replacement of BOR's five LFC Channel headworks and the addition of a pipe extension to Socorro Main Canal headworks will result in **no adverse effect to historic properties**. The Corps seeks your concurrence with this determination.

Use of Tiffany Basin as Spoil Area

During planning for the proposed project, Corps engineers determined that approximately 302 acres would be necessary for disposal of excess earthen materials during construction of the proposed engineered levee, and have preliminarily chosen a location in the Tiffany Basin for sediment disposal. This proposed project area is located in the northern portion of this low basin area that sits lower than the (perched) Rio Grande channel. The proposed project area is approximately 302 acres; the APE is approximately 377 acres (Enclosure 3).

On February 28, 2012, prior to the field survey, a search of the Archaeological Records Management Section's (ARMS) database found no historic properties documented within the area; however, no archaeological surveys had been conducted in the area. On February 29 and March 1, 2012, Corps archaeologists conducted a pedestrian archaeological survey of the proposed spoil area. Survey of this area was problematic due to the extremely high density of tamarisk vegetation covering large portions of the project area; as a result, only 183 acres (or 49 percent) of the 377-acre APE could be surveyed, and ground surface visibility in this area was often restricted (Enclosure 4).

Corps personnel discovered no historic properties during the course of the survey, with the exception of three isolated occurrences (IOs), which were recorded in the field: 1) one small scatter of rocks; 2) one small standing, thin-walled metal pipe; and 3) one historic Clorox bleach bottle. The Corps determines that these three IOs are not eligible for nomination to the National Register of Historic Places and that no further work is necessary.

While vegetation and visibility made it impossible to survey 100 percent of the APE, other available lines of evidence suggest that the vast majority (and possibly all) of the APE is unlikely to contain undisturbed sediments and intact cultural deposits. Utilizing a series of historic maps and aerial imagery, the Corps investigation determined that the majority of the APE was significantly disturbed within the last 100 years by two processes: the existence of the Rio Grande active river channel and floodplain within the current APE, and intensive ground disturbance through farming, BOR construction activities between 1951-1959, and other subsequent blading / bulldozing. By delineating the visible boundaries of both the river channel and human ground disturbance on maps from 1918 and aerial imagery from 1935 and 1962, the Corps determined that a minimum of 248 acres (66 percent of the APE) has been heavily disturbed in the last century (Enclosure 5). When combined with the 183 acres surveyed (some of which overlapped the known disturbance areas), the Corps determines that 309 acres (82 percent) of the APE is highly unlikely to contain historic properties. Further, the geographic extent of recent disturbance is a conservative estimate; given the fact that the entire APE was once active floodplain, the likelihood of any intact historic properties in the remainder of the APE is low. The Corps is therefore of the opinion that use of the area as a waste sediment disposal area would result in **no historic properties affected.** The Corps seeks your concurrence with this determination.

Reconstruction of the 43-mile levee is planned to be conducted in phases over approximately 14 to 20 years, dependent upon the availability of funding. While use of the Tiffany Basin Spoil Area is part of the current plan, as planning and project design for each phase is formalized, the Corps will seek other, less costly locations for the disposal of excess earthen materials. Possibilities would include existing gravel quarry areas on the gravel terraces above the floodplain all along the river valley. If such areas are identified and determined viable for disposal, the Corps will consult with the SHPO on those locations at that time.

Please find enclosed for your review, our archaeological survey report entitled *A Site Visit to the San Acacia Diversion Dam and a Cultural Resources Inventory of Approximately 377 Acres for the Proposed Tiffany Basin Spoil Area, San Acacia to Bosque del Apache Levee Rehabilitation Project, Socorro County, New Mexico* (Corps Report No. USACE-ABQ-2012-001; NMCRIS No. 123307).

Pursuant to 36 CFR 800.2, consulting parties in the Section 106 process identified for the proposed San Acacia to Bosque del Apache Levee Rehabilitation Project (Undertaking) include the Corps, the MRGCD, the BOR, the U.S. Fish and Wildlife Service, Sevilleta National Wildlife Refuge, and your office. Consistent with the Department of Defense's American Indian and Alaska Native Policy, signed by Secretary of Defense William S. Cohen on October 20, 1998, and based on the State of New Mexico Indian Affairs Department and Historic Preservation Division's 2012 Native American Consultations List, Native American tribes that have indicated they have concerns in Socorro County have been sent scoping letters regarding the proposed project activities near the San Acacia Diversion Dam and the Tiffany Basin waste disposal area. The Corps has previously submitted scoping letters to Tribal entities on various aspects of this project in August 2002, February 2006, and July 2011. To date, the Corps has received no indication of tribal concerns regarding this project. No Traditional Cultural Properties and no Indian Trust

Assets are known to occur within or adjacent to the proposed project area.

In summary and pursuant to 36 CFR 800, the Corps seeks your concurrence with our determinations of **no historic properties affected, no adverse effect to historic properties**, and **no historic properties affected** by the three actions described above.

Should previously undiscovered artifacts or features be unearthed during construction, work will be stopped in the immediate vicinity of the find, a determination of significance made, and the Corps will consult with your office and with Native American tribes that may have concerns in the project area as to the best course of action.

If you have questions or require additional information regarding the Recommended Plan for the proposed 43-mile San Acacia to Bosque del Apache Levee Rehabilitation Project, please contact Gregory Everhart, archaeologist, at (505) 342-3352 or myself at (505) 342-3281.

Sincerely,

Julie Alcon
Chief, Environmental
Resources Section

I CONCUR ______________________

____
Date

JAN BIELLA
INTERIM NEW MEXICO STATE
HISTORIC PRESERVATION OFFICER

Enclosures

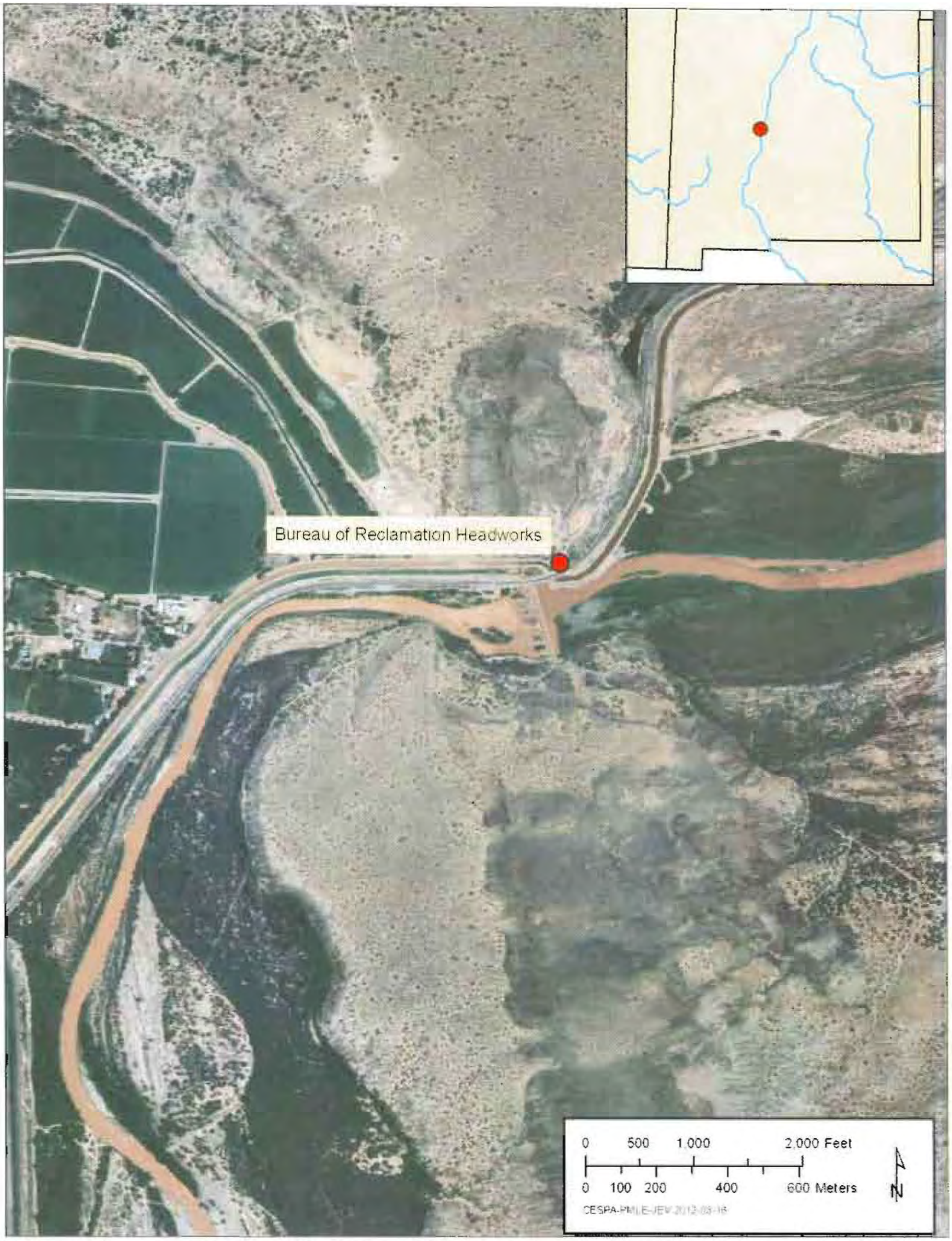
Copies furnished with Enclosures:

Mr. Ray Gomez P.E.
Assistant Engineer
Middle Rio Grande Conservancy District
PO Box 581
Albuquerque, New Mexico 87103

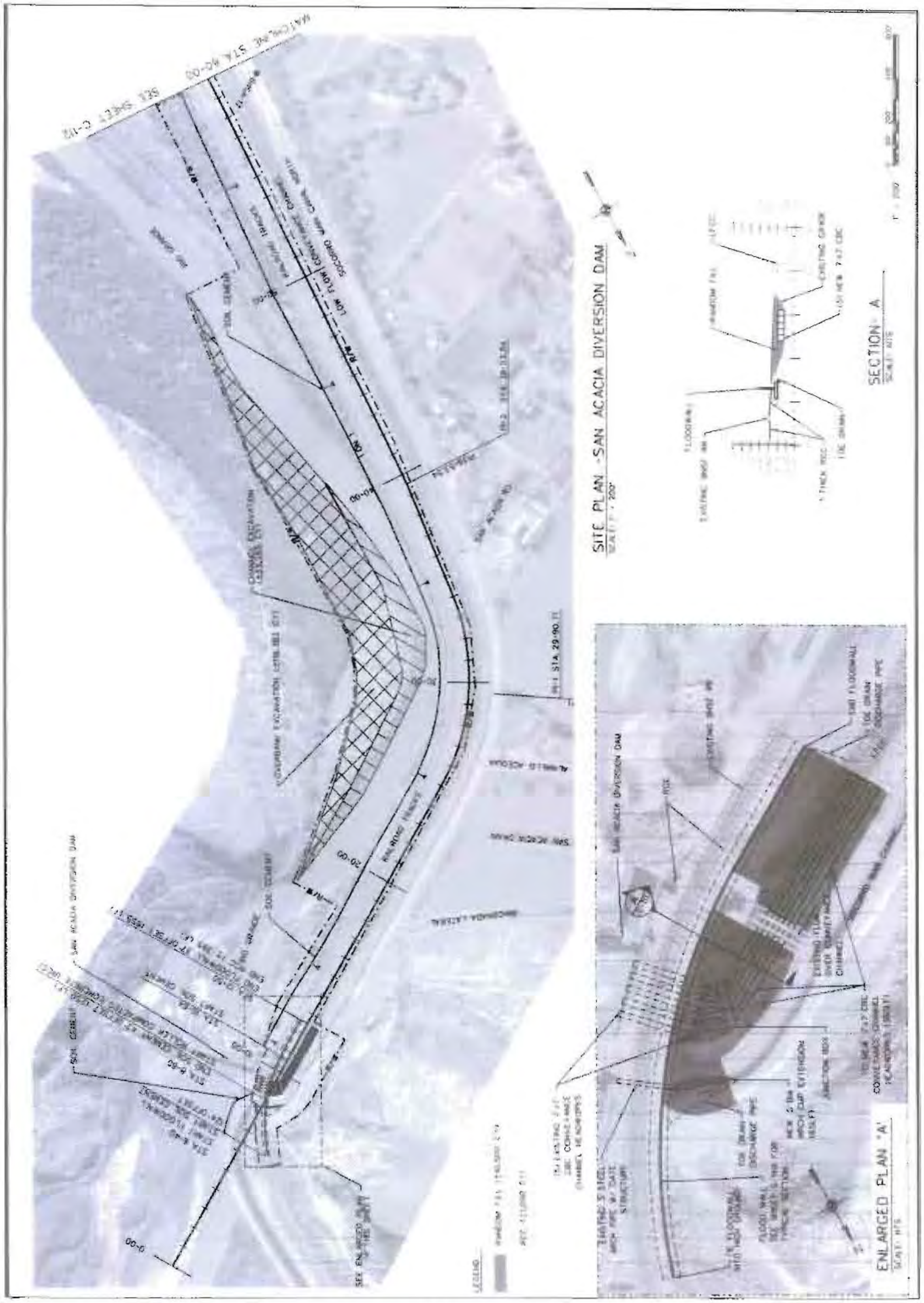
Ms. Cheryl Rolland
Manager
U.S. Bureau of Reclamation
Albuquerque Area Office
Facilities and Lands Division
555 Broadway Boulevard NE, Suite 100
Albuquerque, New Mexico 87102

Mr. Mark Hungerford
Archaeologist
U.S. Bureau of Reclamation
Albuquerque Area Office
Facilities and Lands Division
555 Broadway Boulevard NE, Suite 100
Albuquerque, New Mexico 87102

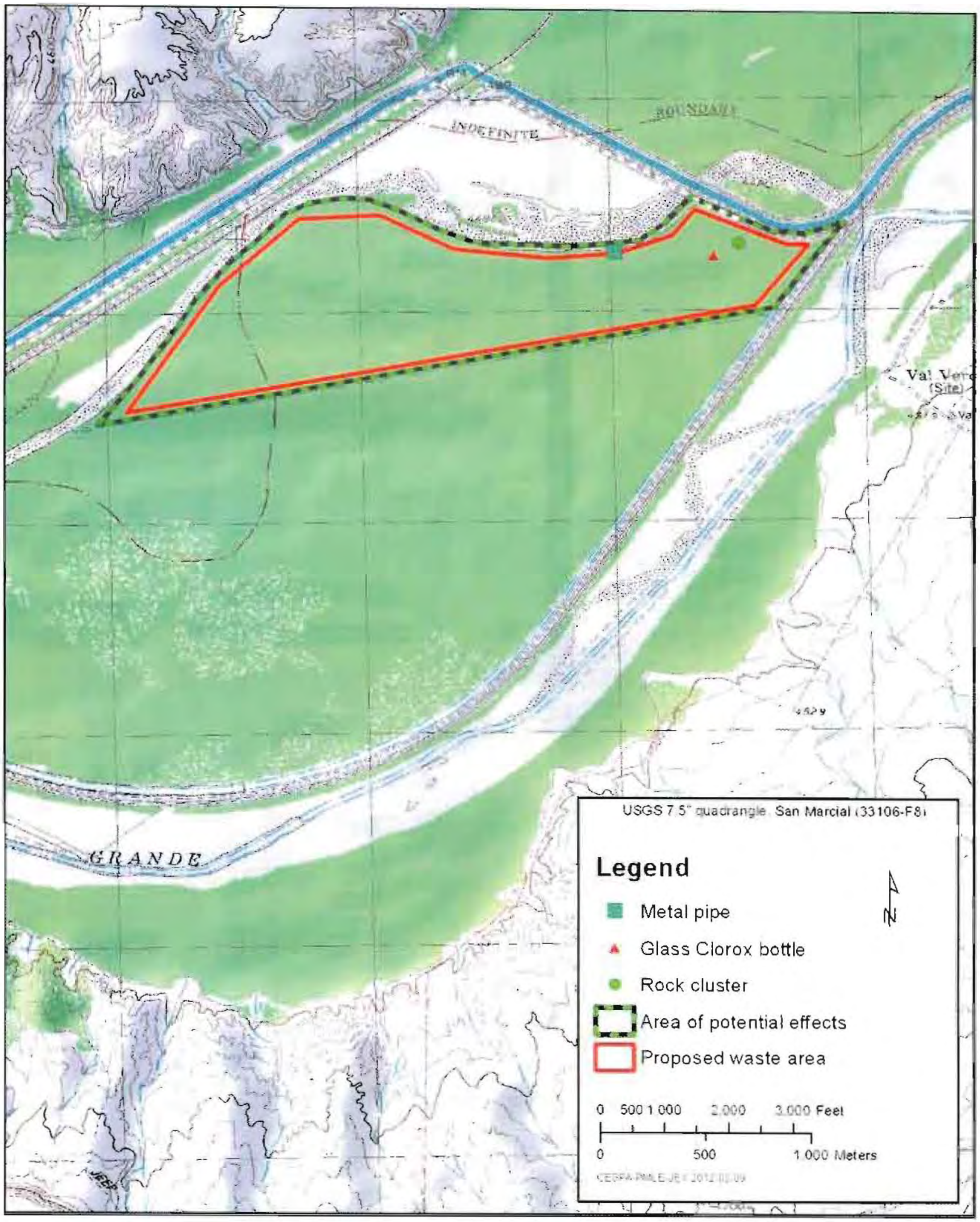
Ms. Kathy Granillo
Refuge Manager
U.S. Fish and Wildlife Service
Sevilleta National Wildlife Refuge
PO Box 1248
Socorro, New Mexico 87801



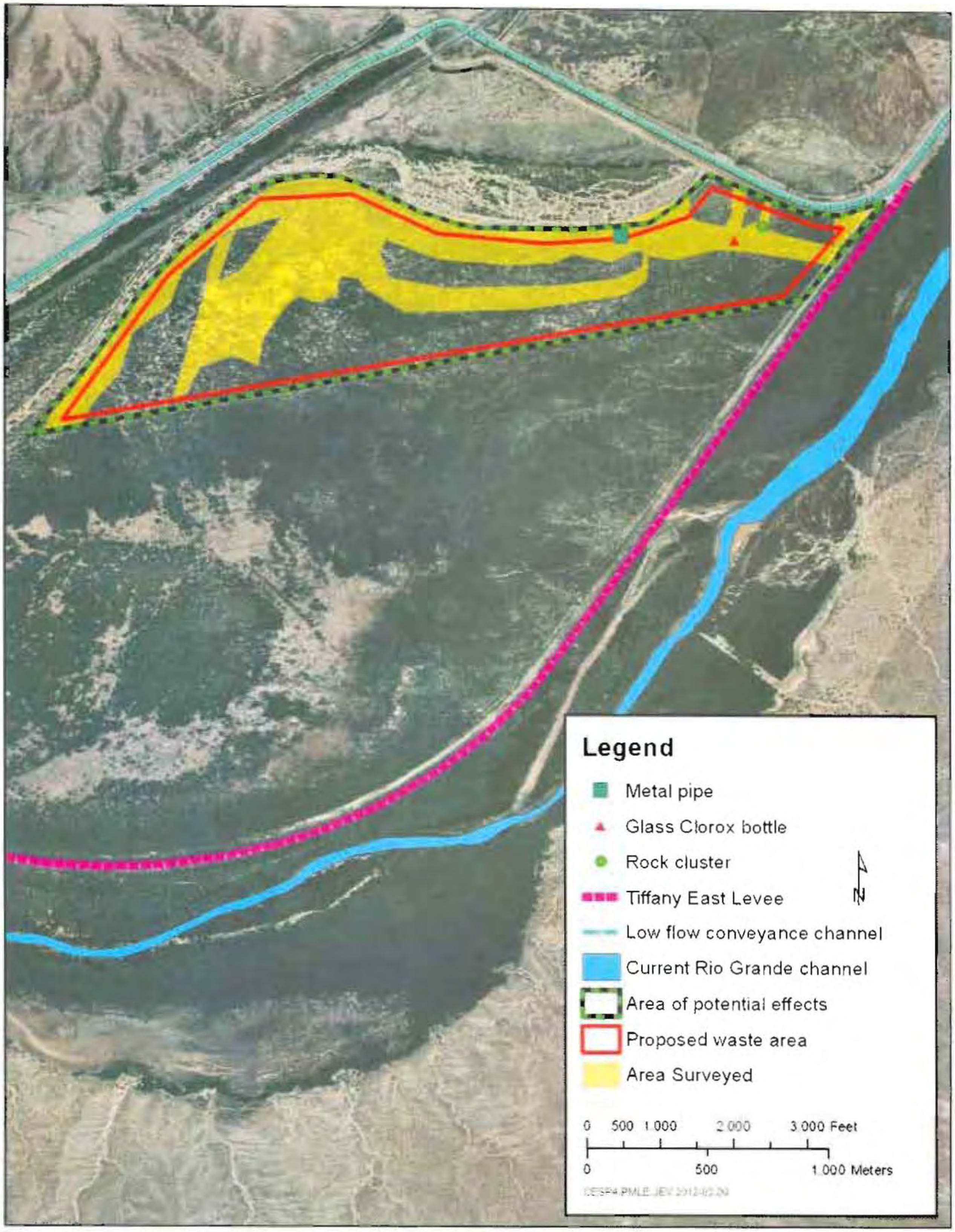
Enclosure 1. Location of levee tie-in area, and Bureau of Reclamation headworks (to be replaced in kind).



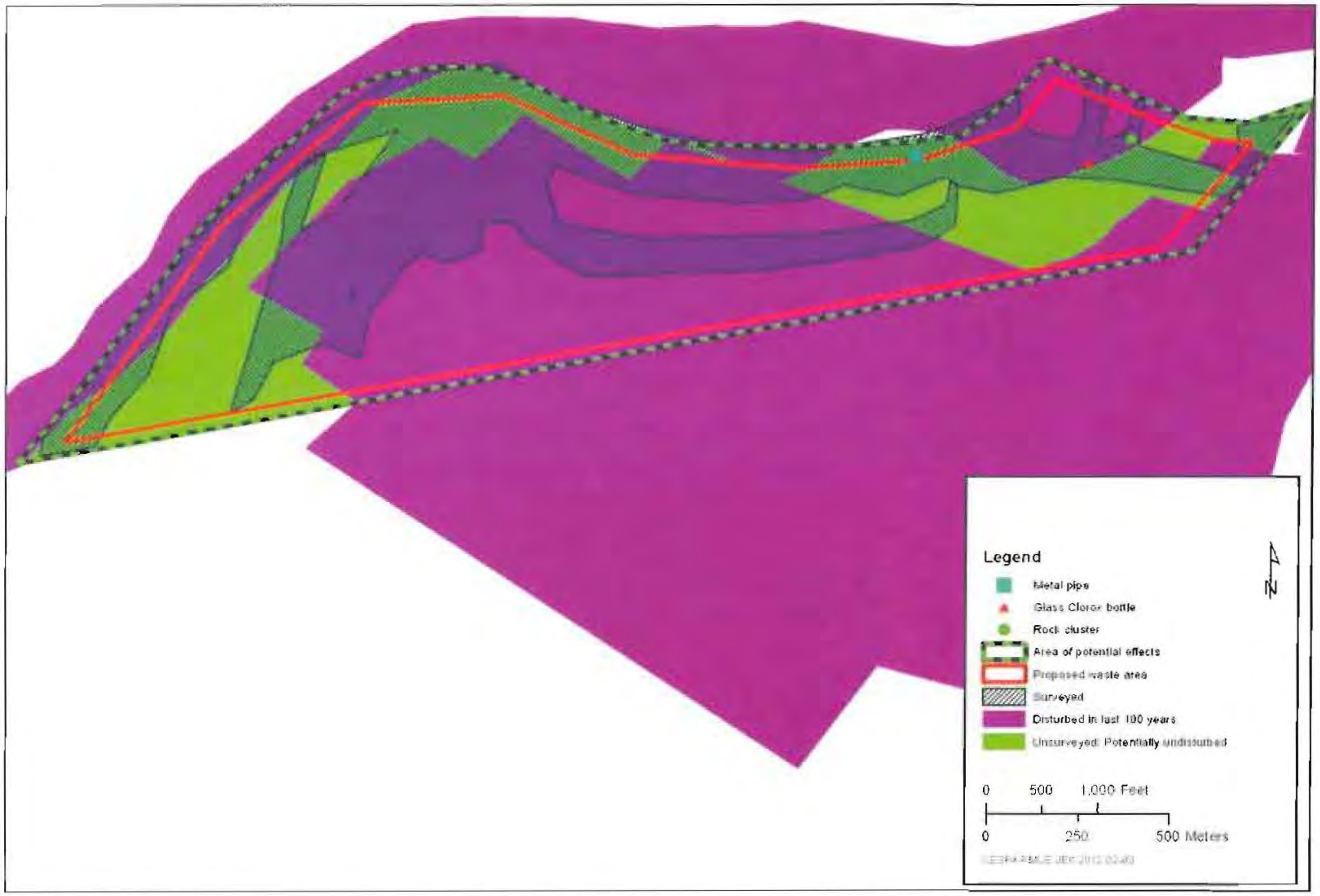
Enclosure 2. San Acacia to Bosque del Apache Unit, Engineer Drawing, Site Plan – San Acacia Diversion Dam, (draft) Sheet No. C-111.



Enclosure 3. Project Area and APE with locations of IO's (USGS 7.5-Minute Quadrangle map: San Marcial [33106-F8]).



Enclosure 4. Project Area, APE, and archaeological survey area (2009 NAIP Imagery).



Enclosure 5. **This map is a composite that shows project area, APE, and area covered by the Corps 2012 archaeological survey. It also shows the areas of previous ground disturbance (purple), which includes the location of the active river channel, 1917-1918 farm fields, 1935 farm fields, and 1962 blading. It also shows the unsurveyed portions of the project area for which recent disturbance could not be confirmed (green).**

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

March 21, 2012

94140

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

RECEIVED
Bob
HISTORIC PRESERVATION DIVISION
Rec'd 4-19-2012
GDE

Ms. Jan Biella
Interim State Historic Preservation Officer
New Mexico Department of Cultural Affairs
Historic Preservation Division
Bataan Memorial Building
407 Galisteo Street, Suite 236
Santa Fe, New Mexico 87501

Re: HPD Consultation Numbers 054201, 054093, 088135, 092670

Dear Ms. Biella:

Pursuant to 36 CFR Part 800, the U.S. Army Corps of Engineers (Corps), Albuquerque District, in cooperation with the project Sponsor, the Middle Rio Grande Conservancy District (MRGCD), is continuing our consultation regarding the proposed levee rehabilitation project for the San Acacia to Bosque del Apache reach of the Rio Grande Floodway in Socorro County, New Mexico. The Recommended Plan consists of rehabilitation of the existing non-engineered spoil-bank levee by constructing a structurally sound, engineered earthen levee extending approximately 43 miles along the west bank of the Rio Grande, from the San Acacia Diversion Dam to Tiffany Junction. The Corps seeks your concurrence in our determinations regarding three elements of this project:

1) A determination of **no historic properties affected** for the construction of a floodwall and levee tie-in to high ground near the San Acacia Diversion Dam;
2) A determination of **no adverse effect to historic properties** by rehabilitation of U.S. Bureau of Reclamation (BOR) facilities near the San Acacia Diversion Dam;
3) A determination of **no historic properties affected** for the use of the northern portion of the Tiffany Basin for an earthen spoil/waste disposal area.

Each of these elements is described below, along with explanations of our determinations. A draft of the Supplemental Environmental Impact Statement for the project will be posted to the Corps' Albuquerque District web page (http://www.spa.usace.army.mil/fonsi/) in the near future.

Floodwall and Levee Tie-In

One part of the Recommended Plan calls for the construction of a concrete floodwall and levee tie-in to a hillside immediately adjacent to the BNSF railway grade and northeast of the 1930s San Acacia Diversion Dam (Enclosures 1 and 2). On February 29, Corps archaeologists Gregory Everhart, Jonathan Van Hoose, Jeremy Decker, Ariane Pinson, and Christopher Parrish conducted a site visit to the area immediately adjacent to and northeast of the San Acacia Diversion Dam and BNSF railway grade, where the levee and new concrete floodwall will tie in to the hillside. The site visit verified that this area was previously disturbed by quarrying and construction activities. The Corps is of the opinion that construction of the headwall and levee tie-in to high ground will result in **no historic properties affected**. The Corps seeks your concurrence with this determination.

Rehabilitation of BOR Facilities

Construction activities near the San Acacia Diversion Dam also include the in-kind replacement of the Bureau of Reclamation's (BOR's) five existing seven-by-seven-foot CBC Conveyance Channel headworks that divert river water to the Low Flow Conveyance (LFC) Channel (Enclosures 1 and 2). These features were constructed in the 1950s by the BOR for managing irrigation water flows diverted from the river. Construction will also add one five-foot-diameter arch corrugated metal pipe extension, 65 feet in length, to the headworks of the Socorro Main Canal. The APE for the floodwall and the rehabilitation of both headworks is approximately 2.7 acres in size. The Corps is of the opinion that the proposed in-kind replacement of BOR's five LFC Channel headworks and the addition of a pipe extension to Socorro Main Canal headworks will result in **no adverse effect to historic properties**. The Corps seeks your concurrence with this determination.

Use of Tiffany Basin as Spoil Area

During planning for the proposed project, Corps engineers determined that approximately 302 acres would be necessary for disposal of excess earthen materials during construction of the proposed engineered levee, and have preliminarily chosen a location in the Tiffany Basin for sediment disposal. This proposed project area is located in the northern portion of this low basin area that sits lower than the (perched) Rio Grande channel. The proposed project area is approximately 302 acres; the APE is approximately 377 acres (Enclosure 3).

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Pursuant to 36 CFR 800.2, consulting parties in the Section 106 process identified for the proposed San Acacia to Bosque del Apache Levee Rehabilitation Project (Undertaking) include the Corps, the MRGCD, the BOR, the U.S. Fish and Wildlife Service, Sevilleta National Wildlife Refuge, and your office. Consistent with the Department of Defense's American Indian and Alaska Native Policy, signed by Secretary of Defense William S. Cohen on October 20, 1998, and based on the State of New Mexico Indian Affairs Department and Historic Preservation Division's 2012 Native American Consultations List, Native American tribes that have indicated they have concerns in Socorro County have been sent scoping letters regarding the proposed project activities near the San Acacia Diversion Dam and the Tiffany Basin waste disposal area. The Corps has previously submitted scoping letters to Tribal entities on various aspects of this project in August 2002, February 2006, and July 2011. To date, the Corps has received no indication of tribal concerns regarding this project. No Traditional Cultural Properties and no Indian Trust

Assets are known to occur within or adjacent to the proposed project area.

In summary and pursuant to 36 CFR 800, the Corps seeks your concurrence with our determinations of **no historic properties affected, no adverse effect to historic properties**, and **no historic properties affected** by the three actions described above.

Should previously undiscovered artifacts or features be unearthed during construction, work will be stopped in the immediate vicinity of the find, a determination of significance made, and the Corps will consult with your office and with Native American tribes that may have concerns in the project area as to the best course of action.

If you have questions or require additional information regarding the Recommended Plan for the proposed 43-mile San Acacia to Bosque del Apache Levee Rehabilitation Project, please contact Gregory Everhart, archaeologist, at (505) 342-3352 or myself at (505) 342-3281.

Sincerely,

Julie Alcon
Chief, Environmental
Resources Section

17-April-2012
Date

I CONCUR
for
JAN BIELLA
INTERIM NEW MEXICO STATE
HISTORIC PRESERVATION OFFICER

Enclosures

Copies furnished with Enclosures:

Mr. Ray Gomez P.E.
Assistant Engineer
Middle Rio Grande Conservancy District
PO Box 581
Albuquerque, New Mexico 87103

Ms. Cheryl Rolland
Manager
U.S. Bureau of Reclamation
Albuquerque Area Office
Facilities and Lands Division
555 Broadway Boulevard NE, Suite 100
Albuquerque, New Mexico 87102

Mr. Mark Hungerford
Archaeologist
U.S. Bureau of Reclamation
Albuquerque Area Office
Facilities and Lands Division
555 Broadway Boulevard NE, Suite 100
Albuquerque, New Mexico 87102

Ms. Kathy Granillo
Refuge Manager
U.S. Fish and Wildlife Service
Sevilleta National Wildlife Refuge
PO Box 1248
Socorro, New Mexico 87801

CORRESPONDENCE:

USACE Tribal Scoping Letters and Native American Tribal Responses

a\Cultural Resources\Tribal scoping n responses

- 2002-08-16 USACE Tribal scoping San Acacia to San Marcial monitor wells drillin...
- 2006-02-21 USACE Tribal scoping San Marcial BNSF RR bridge n 4-mile track rel...
- 2006-03-03 Isleta Pueblo no concerns w BNSF bridge n track.pdf
- 2006-03-07 White Mtn Apache no concerns BNSF bridge n track.pdf
- 2006-03-13 Comanche no concerns BNSF bridge n track.pdf
- 2006-03-13 Hopi no concerns BNSF bridge n track.pdf
- 2011-07-05 USACE San Acacia tribal scoping letter.pdf
- 2011-07-12 San Acacia Hopi no concerns.pdf
- 2011-07-25 San Acacia to BdA Navajo no concerns.pdf
- 2011-07-29 USACE San Acacia to BdA Unit Tribal Scoping Letter Ysleta del Sur.pdf
- 2011-08-02 San Acacia Isleta Pueblo no concerns.pdf
- 2011-08-24 San Acacia to BdA levee Ysleta del Sur no concerns.pdf
- 2011-09-06 San Acacia to BdA bank lowering area NavajoNation no concerns.pdf
- 2012-03-27 USACE TRIBAL San Acacia to BdA Tiffany Basin FINAL scoping letter....
- 2012-04-02 San Acacia to BdA for Tiffany Basin Hopi concur.pdf
- 2012-04-10 San Acacia to BdA tiffany basin Isleta del Sur no concerns.pdf
- 2012-04-26 San Acacia to BdA Navajo no concerns.pdf
- 2012-05-01 San Acacia to BdA Tiffany basin Hopi no concerns.pdf

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA, NE
ALBUQUERQUE, NEW MEXICO 87109-3435
FAX (505) 342-3199

Reply to
Attention of:

AUG 16 2002

Engineering and Construction Division
Environmental Resources Branch

Mr. Wayne Taylor, Jr., Chairman
Hopi Tribe
P.O. Box 123
Kykotsmovi, Arizona 86039

Dear Mr. Taylor:

In conjunction with the proposed San Acacia Surface Water/Groundwater Investigation, the New Mexico Interstate Stream Commission (NMISC) and the U.S. Army Corps of Engineers (Corps), Albuquerque District, are proposing to install up to 80 boreholes and 25 staff gauges along seven transects across the Low Flow Conveyance Channel between San Acacia Diversion Dam and the delta of Elephant Butte Reservoir. Within this river reach, competing demands for water, including agriculture, municipal use, wildlife habitat, and Rio Grande compact delivery requirements, necessitate a better understanding of the water budget. The purpose of the investigation is to collect data required to better understand the interactions between surface water and groundwater in this river reach. The entire project area lies within the historic floodplain of the Rio Grande.

Each well will be monitored monthly for three years. There will be one aquifer pumping test on each transect during the first year. The proposed transects are shown on the enclosed figure. Whenever possible, the transects have been located within or adjacent to disturbed areas and existing roads. Some previously undisturbed areas are also included. Due to the nature of the investigation, there is some latitude for placement of the wells and environmentally or culturally sensitive locations will be avoided. Inventories to identify and evaluate environmental, archaeological, and historic resources have been conducted by SWCA Environmental Consultants (SWCA), and the reports are in preparation. An Environmental Assessment is being prepared, and you will receive a draft for your review and comment. SWCA will provide you copies of the reports as they are completed and information regarding project impacts on identified resources, should you so request.

We are contacting the Hopi Tribe to gather information on tribal concerns about traditional cultural properties or other issues within the proposed project locations. You may provide information in writing or, at your request, a meeting with personnel from the Corps, NMISC, or SWCA staff can be arranged to discuss any concerns you may

F:|user|Ecrack|Jotm|TAYLOR + each respective name have about this project. We will maintain strict confidentiality with regard to certain types of information concerning traditional religious and/or cultural historic properties that may be affected by this proposed undertaking. We would also appreciate suggestions about other groups that we should contact regarding this project.

A response within 30 days from date of receipt would be appreciated. Please feel free to contact John D. Schelberg, (505) 342-3359, john.d.schelberg@usace.army.mil; or Mary Quirolo, SWCA Ethnographer, 1(800) 828-8499, mquirolo@swca.com if you have questions or need additional information.

I have also furnished a copy of this letter to Leigh J. Kuwanwisiwma, Director, Cultural Preservation Office, of your organization.

Sincerely,

Dana R. Hurst
Lieutenant Colonel, EN
District Engineer

Enclosure

Mr. Wayne Taylor, Jr., Chairman
Hopi Tribe
P.O. Box 123
Kykotsmovi, AZ 86039

Mr. Leigh J. Kuwansisiwma, Director
Cultural Preservation Office
Hopi Tribe
P.O. Box 123
Kykotsmovi, AZ 86039

Mr. Kelsey A. Begaye, President
Navajo Nation
P.O. Box 4950
Window Rock, AZ 86515

Alan S. Downer, Ph.D.
Navajo Nation Historic Preservation Department
P.O. Box 4950
Window Rock, AZ 86515

Ms. Ruey Darrow, Chairwoman
Fort Sill Apache Tribe
Route 2, Box 121
Apache, OK 73006

Mr. Michael Darrow
Tribal Historian
Route 2, Box 121
Apache, OK 73006

Ms. Sara Misquez, President
Mescalero Apache Tribe
P.O. Box 227
Mescalero, NM 88340

Ms. Donna Stern-McFadden
Resource Management and Protection
P.O. Box 227
Mescalero, NM 88340

Mr. Dallas Massey, Sr., Chairman
White Mountain Apache Tribe
P.O. Box 587
Whiteriver, AZ 85941

Mr. John Welch
Tribal Historic Preservation Officer
White Mountain Apache Tribe
P.O. Box 587
Whiteriver, AZ 85941

Honorable Alvino Lucero
Pueblo of Isleta
P.O. Box 1270
Isleta, NM 87022

Mr. Jim Piatt, Environmental Officer
Pueblo of Isleta
P.O. Box 1270
Isleta, NM 87022

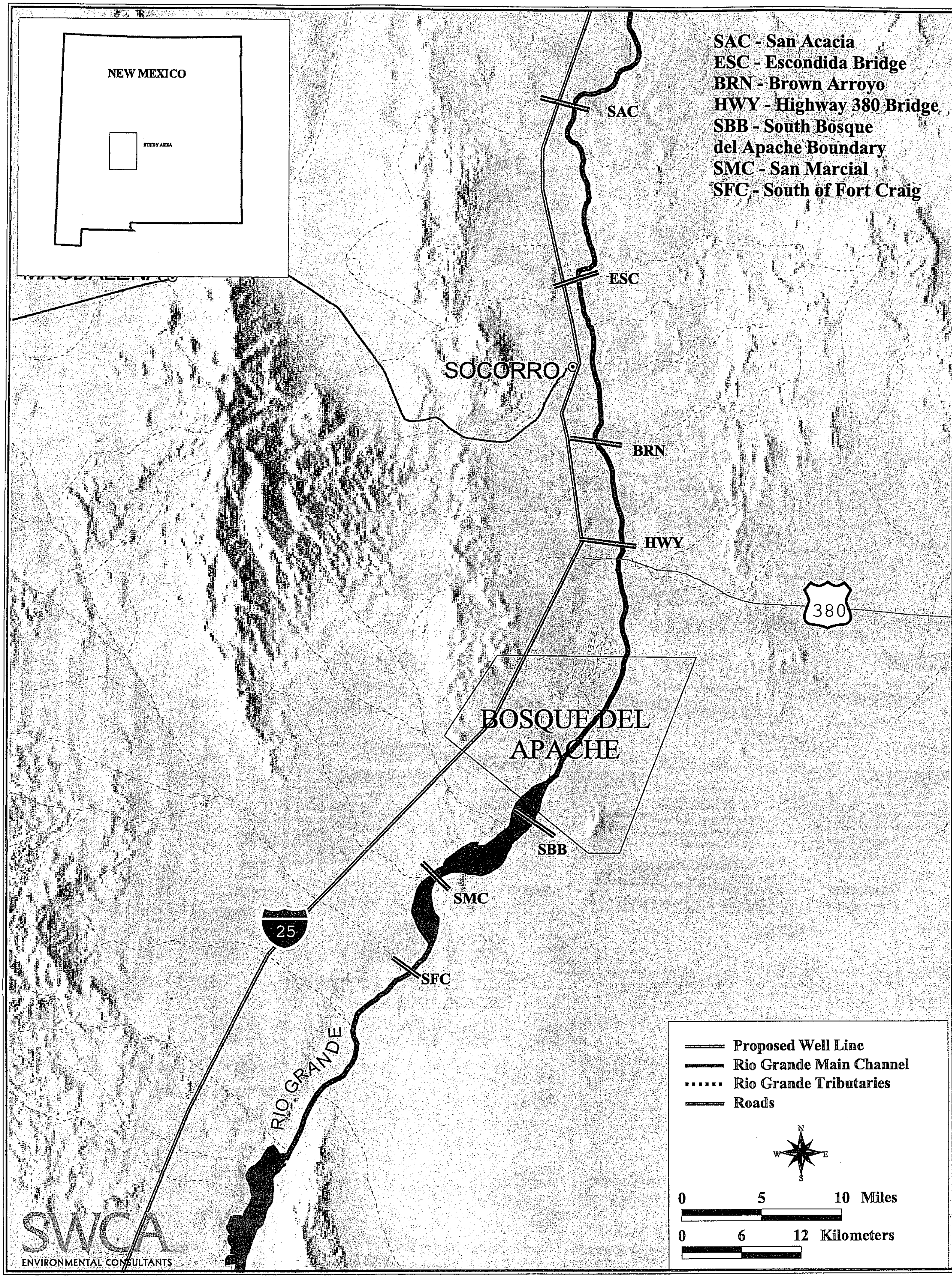

Figure 1. Proposed Well Lines for Below San Acacia Surface Water/ Groundwater Investigation

Copy

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

February 21, 2006

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

Honorable Jason Johnson
Governor, Acoma Pueblo
P.O. Box 309
Acoma, New Mexico 87034

Dear Governor Johnson:

The U.S. Army Corps of Engineers (Corps), Albuquerque District is studying the feasibility of constructing a new railroad bridge over the Rio Grande and relocating a four-mile segment of the Burlington Northern Santa Fe (BNSF) Railroad at San Marcial, Socorro County, New Mexico. Due to the existing BNSF bridge's proximity to the headwaters of Elephant Butte Reservoir, the bridge's constriction of the river, and the consequent slowing of the river, sediment deposition is increasing and the elevation of the riverbed is rising. The proposed project is located on an unplatted portion of the San Marcial, New Mexico USGS quadrangle map (Pedro Armendaires Grant No. 33) and an unplatted portion of the Ft. Craig USGS quadrangle map (Pedro Armendaires Grant No. 34). A map showing the project area is enclosed for your review.

A variety of ground-disturbing activities may occur as the feasibility study progresses. Initially, a series of six-inch diameter holes will be drilled in order to define the geological substrate. If construction is approved, the proposed right-of-way will be cleared of vegetation, and the track and a new bridge will be built. The existing bridge will be removed.

The Corps is offering you the opportunity to bring to our attention any concerns or comments regarding the potential effects of this project on Indian Trust assets, traditional cultural properties, sacred sites, biological resources, and any other significant issues that you may have regarding the proposed railroad realignment.

Please provide written comments by March 25, 2006. If you have any questions or require more information regarding the Railroad Relocation at San Marcial, please contact John Schelberg Ph.D., archaeologist, at (505) 342-3359. Thank you for your attention to this matter.

Sincerely,

Julie A. Hall, Chief
Environmental Resources Section

Enclosure

2006 – Tribal mailing list – Socorro County, NM

American Indian tribes that have indicated that they have cultural resources concerns in Socorro County.

Pueblo of Acoma
Comanche Indian Tribe
Fort Sill Apache Tribe
Hopi Tribe
Pueblo of Isleta
Kiowa Tribe
Mescalero Apache Tribe
Navajo Nation
White Mountain Apache Tribe

OFFICE OF THE GOVERNOR

505-869-3111 / 6333
FAX: 505-869-4236

PUEBLO OF ISLETA
P.O. BOX 1270 ISLETA, NM 87022

March 3, 2006

Julie A. Hall, Chief
Environmental Resources Section
Department of the Army
Albuquerque District, Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, NM 87109-3435

Dear Ms. Hall:

This letter is in response to your correspondence dated February 21, 2006, regarding the proposed construction of a new railroad bridge over the Rio Grande and relocation of a four-mile segment of the Burlington Northern Santa Fe Railroad at San Marcial, Socorro County, New Mexico.

I am pleased to inform you that this project will not have an impact on religious or cultural sites affiliated with the Pueblo of Isleta. However, in the event that discoveries are found during construction, we would appreciate being advised of such findings.

Thank you for your consideration in contacting this office to express your concerns.

Sincerely,

PUEBLO OF ISLETA

Robert Benavides
Governor

cc: files

Fogle, Cheryl SPA

From: Mark Altaha [markaltaha@wmat.nsn.us]

Sent: Tuesday, March 07, 2006 1:46 PM

To: Fogle, Cheryl SPA

Subject: Rio Grande Bridge / Relocating of BNSF

Please forward to John Schelberg Ph.D. Archaeologist.

Mr.Schelburg,

Please be advised the White Mountain Apache tribe feels there is no threat to potential Tradtional Cultural Properties and/or sacred places that may occur in the Area of Potential Effect and the proposed project may proceed as planned. Should there be further concerns regarding the said project please do not hesitate to contact our office for further assistance.

Thank you,

Mark T. Altaha
White Mountain Apache Tribe
Historic Preservation Office

COMANCHE TRIBE
NAGPRA

March 13, 2006

Julie Hall, Chief
Department of the Army
Albuquerque District, Corps of Engineers
Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section
4101 Jefferson Plaza NE
Albuquerque, NM 87109-3435

Re: Consultation regarding the construction of a new railroad bridge over the Rio Grande and relocating a four-mile segment of the Burlington Northern Santa Fe Railroad at San Marcial, Socorro County, NM

Dear Ms. Hall:

Thank you for your letter of February 21st regarding the planned project as referenced above.

At this time, the Comanche Nation has no immediate concerns or issues regarding the project; however, please keep us informed of the project progress. We also would like to receive any archaeological reports and findings for the project area.

If in the process of the project human remains or archaeological items are discovered, we request that you immediately cease the project work and notify us so that we may discuss appropriate disposition with you and the other Tribal Nations that may be affected by such discoveries.

We look forward to your reports as activities proceed.

Sincerely,

Fred Nahwooksy

Fred Nahwooksy, NAGPRA Coordinator

PO Box 908 • Lawton, Oklahoma 73502 • PHONE: (580) 492-3740 • FAX: (580) 492-3745

THE HOPI TRIBE

Ivan L. Sidney, Sr.
Chairman

Todd D. Honyaoma, Sr.
Vice Chairman

March 13, 2006

Department of the Army
Albuquerque District, Corps of Engineers PMLE
4101 Jefferson Plaza, NE
Albuquerque, New Mexico 87109

Dear Sir/Madam:

Your department had submitted to our Cultural Preservation Office of the Hopi Tribal Government a feasibility study of constructing a new railroad bridge over several location areas. I am forwarding this information to you that include their findings, opinions, and comments concerning your project.

If you have any questions or concerns regarding the contents, please feel free to call me at any time. I can be reached at my office at 928-734-3114. Thank you.

Sincerely,

Art Batala, Chief Executive Assistant
Office of the Vice Chairman

xc: Lyle J. Balenquah, Arch. Program Mgr., Hopi CPO
File

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

July 5, 2011

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Division

Honorable Ben Shelly
President, Navajo Nation
Post Office Box 9000
Window Rock, Arizona 86515

Dear President Shelly:

The U.S. Army Corps of Engineers (Corps), Albuquerque District, is planning a levee rehabilitation project for a portion of the Rio Grande Floodway in Socorro County, New Mexico. The existing levee is located along the west side of the Rio Grande in what is known as the San Acacia to Bosque del Apache reach of the Rio Grande Floodway. The Preliminary Preferred Plan consists of an earthen levee extending approximately 43 miles along the west bank of the Rio Grande, from the San Acacia Diversion Dam to Tiffany Junction. Tiffany Junction is approximately 3 miles north of the San Marcial BNSF Railroad Bridge (See Enclosure 1, Map Figure 1.1). The plan consists of reconstructing the existing spoil bank (non-engineered) levee to form a structurally sound levee paralleling the U.S. Bureau of Reclamation's (Reclamation) Low Flow Conveyance Channel (LFCC). The local sponsor, the Middle Rio Grande Conservancy District (MRGCD), supports the Preliminary Preferred Plan. A draft of the Supplemental Environmental Impact Statement will be posted to the Corps' Albuquerque District web page (http://www.spa.usace.army.mil/fonsi/) in the near future.

The study area of the current project, San Acacia to Bosque Del Apache Unit, is one unit within the comprehensive plan of development for flood control in the Rio Grande Basin, New Mexico that was authorized by the Flood Control Acts of 1948 (P.L. 80-858, Section 203) and 1950 (P.L. 81-516), in accordance with the recommendations of the Chief of Engineers, as found in House Document No. 243, 81st Congress, 1st Session, dated April 5, 1948. The Authority provided a comprehensive plan for coordinated development, by the Corps and Bureau of Reclamation, of water resource and flood risk management on the Rio Grande commencing near Truth or Consequences at about river mile 123 extending upstream to the lower end of the Rio Grande Canyon 14 miles upstream from Española, New Mexico at about river mile 394. The comprehensive plan included channel rectification, improvement of irrigation works, dredging, construction of three reservoirs and levee

enlargement and construction. A November 1947 agreement delegated responsibility for channel rectification and maintenance to the Bureau of Reclamation and facilities for local flood protection to the Corps of Engineers.

As described in the 1948 report, levees had been constructed by local interests through parts of the Espanola and Middle Valley of the Rio Grande. The levees were not uniform as to grade, section or standard of construction and it was proposed to modify and supplement the existing levees. Since authorized in 1948, no levee rehabilitation projects have been constructed in the San Acacia to Bosque del Apache reach.

In 1997, the Corps contracted with the University of New Mexico's Office of Contract Archeology to conduct archaeological surveys of the levee alignment and other areas of the recommended plan's construction area. With the exception of the existing, historic 1930s MRGCD irrigation system, levee, and Reclamation's LFCC, completed in 1959, no archaeological sites, historic properties, or features were identified within the proposed levee reconstruction zone or access routes. No Traditional Cultural Properties are known to occur within or adjacent to the project area. As a part of planning for this project, the Corps, with our letter dated August 16, 2002, has previously submitted tribal scoping letters to tribes with concerns within Socorro County regarding the drilling of groundwater monitoring wells (copy attached for your convenience, Enclosure 2). With our tribal scoping letter dated February 21, 2006, the Corps informed tribes with concerns in Socorro County about studying the feasibility of constructing a new railroad bridge and the relocation of approximately 4 miles of track for the proposed railroad-Rio Grande crossing near San Marcial (copy attached for your convenience, Enclosure 3). Responses were received from the Pueblo of Isleta, the White Mountain Apache Tribe, the Comanche Tribe, and the Hopi Tribe. All of these stated they had no concerns regarding construction work for the San Marcial railroad crossing.

Based on the results of the Corps' archaeological investigations of the San Acacia to San Marcial reach, the Corps is of the opinion that reconstruction of the 43-mile levee would result in no historic properties affected. On November 5, 1997, the NM State Historic Preservation Officer (SHPO) concurred with the Corps determination of no effect for the then recommended alternative which followed the same alignment as the presently recommended plan (SHPO Consultation No. 054093). The Corps has previously submitted additional documentation to the SHPO for mitigation of effects to the MRGCD irrigation system, levee, and Reclamation's LFCC (Berry and Lewis 1997; Van Citters 2000; Dodge and Santillanes 2007). The SHPO has also concurred that it is

highly unlikely that historic properties or cultural materials of significant antiquity or archaeological integrity would occur within areas of the Rio Grande's historic active channel.

There are two important aspects of the proposed project. The first is that the on-going modeling of river flows and projected volumes of water during flood events indicate that the proposed engineered levee may be smaller in both height and width than the existing spoil-bank levee. The second is that the material in the spoil-bank levee would be used in the rehabilitation of the proposed engineered levee. Therefore, all of the construction will occur in areas originally disturbed during construction of the levee and the low-flow conveyance channel, and no new quarry areas for fill would be required. Access for construction already exists on a network of paved and dirt roads, and to the extent possible, staging locations for equipment will be in previously disturbed locations. There are no archaeological sites within these disturbed areas.

Subsequent to the 1997 SHPO concurrence of no effect for the 43-mile levee rehabilitation project, Corps' engineers determined that as a new element of the Preliminary Preferred Plan, bank protection work would need to be constructed on the river bend immediately downstream of the San Acacia Diversion Dam. The San Acacia Diversion Dam is located at the upstream end of the 43-mile levee project. The Rio Grande channel on this river bend is significantly degraded. Proposed work in this San Acacia Overbank Lowering Area (see Enclosure 1, Map Figures 2 and 3) would include the placement of protective rock rip-rap on the outside of the river bend (northwest) adjacent to the BNSF railroad grade, and lowering and shaping the overbank area on the inside of the river bend (southeast). The light blue area shown in Map Figure 3 represents the sand bank that would be excavated to the depth of the existing river channel; the light green area would be excavated on a 1 to 10 slope. All work would be confined to the river channel and sand bank. This excavation would reduce river flow velocity around the river bend; thereby providing flood protection to the BNSF railway grade, Reclamation's LFCC, and the community of San Acacia and adjacent farm land.

On May 26, 2011, Corps archaeologists conducted a site visit to the San Acacia Overbank Lowering Area to verify the location of known archaeological resources in relation to the proposed construction area. Supported with information gathered from archival records, the Corps' site visit found that archaeological resources in the area are of sufficient distance away from the project area that they would not be affected. The Corps is of the opinion that improvements to the river channel would result in no effect to historic properties. This San Acacia project area is on land managed by the U.S. Fish and Wildlife Service, Sevilleta National Wildlife Refuge.

The Corps is seeking input for consideration during planning of the project. The purpose of this scoping letter is to provide you with the opportunity to submit concerns or comments you may have regarding potential effects for the proposed project. Specifically, any concerns you may have regarding the environment such as natural, biological, or cultural resources; wildlife, vegetation, and special status species; air, water, or sound quality; aesthetics; health and safety; or Indian Trust Assets that may occur in the project area. Your input will be used in preparing an environmental impact statement to comply with the National Environmental Policy Act.

Please provide written comments regarding environmental concerns to William DeRagon, Biologist (William.deragon@usace.army.mil); and, comments regarding cultural resources to Gregory D. Everhart, Archaeologist (Gregory.d.everhart@usace.army.mil), at the above address. If you have any questions or require additional information on the San Acacia to Bosque del Apache levee rehabilitation project, please contact Mr. DeRagon at (505) 342-3358, Mr. Everhart at (505) 342-3352, or myself at (505) 342-3281.

Sincerely,

for Andrea Hummel

Julie Alcon
Chief, Environmental Resources Section

Enclosures

Copy furnished w/Encl:

2011 - Tribal mailing list - Socorro County, NM
American Indian tribes that have indicated that they have cultural resources concerns in Socorro County.

Pueblo of Acoma
Comanche Indian Tribe
Fort Sill Apache Tribe
Hopi Tribe
Pueblo of Isleta
Kiowa Tribe
Mescalero Apache Tribe
Navajo Nation
White Mountain Apache Tribe

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

July 5, 2011

RECEIVED
JUL 11 2011
BY: [signature]

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Division

Honorable Leroy Shingoitewa
Chairman, Hopi Tribal Council
Post Office Box 123
Kykotsmovi, Arizona 86039

Rec'd 7-14-2011
GDE

Dear Chairman Shingoitewa:

The U.S. Army Corps of Engineers (Corps), Albuquerque District, is planning a levee rehabilitation project for a portion of the Rio Grande Floodway in Socorro County, New Mexico. The existing levee is located along the west side of the Rio Grande in what is known as the San Acacia to Bosque del Apache reach of the Rio Grande Floodway. The Preliminary Preferred Plan consists of an earthen levee extending approximately 43 miles along the west bank of the Rio Grande, from the San Acacia Diversion Dam to Tiffany Junction. Tiffany Junction is approximately 3 miles north of the San Marcial BNSF Railroad Bridge (See Enclosure 1, Map Figure 1.1). The plan consists of reconstructing the existing spoil bank (non-engineered) levee to form a structurally sound levee paralleling the U.S. Bureau of Reclamation's (Reclamation) Low Flow Conveyance Channel (LFCC). The local sponsor, the Middle Rio Grande Conservancy District (MRGCD), supports the Preliminary Preferred Plan. A draft of the Supplemental Environmental Impact Statement will be posted to the Corps' Albuquerque District web page (http://www.spa.usace.army.mil/fonsi/) in the near future.

The study area of the current project, San Acacia to Bosque Del Apache Unit, is one unit within the comprehensive plan of development for flood control in the Rio Grande Basin, New Mexico that was authorized by the Flood Control Acts of 1948 (P.L. 80-858, Section 203) and 1950 (P.L. 81-516), in accordance with the recommendations of the Chief of Engineers, as found in House Document No. 243, 81st Congress, 1st Session, dated April 5, 1948. The Authority provided a comprehensive plan for coordinated development, by the Corps and Bureau of Reclamation, of water resource and flood risk management on the Rio Grande commencing near Truth or Consequences at about river mile 123 extending upstream to the lower end of the Rio Grande Canyon 14 miles upstream from Española, New Mexico at about river mile 394. The comprehensive plan included channel rectification, improvement of irrigation works, dredging, construction of three reservoirs and levee

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As described in the 1948 report, levees had been constructed by local interests through parts of the Espanola and Middle Valley of the Rio Grande. The levees were not uniform as to grade, section or standard of construction and it was proposed to modify and supplement the existing levees. Since authorized in 1948, no levee rehabilitation projects have been constructed in the San Acacia to Bosque del Apache reach.

In 1997, the Corps contracted with the University of New Mexico's Office of Contract Archeology to conduct archaeological surveys of the levee alignment and other areas of the recommended plan's construction area. With the exception of the existing, historic 1930s MRGCD irrigation system, levee, and Reclamation's LFCC, completed in 1959, no archaeological sites, historic properties, or features were identified within the proposed levee reconstruction zone or access routes. No Traditional Cultural Properties are known to occur within or adjacent to the project area. As a part of planning for this project, the Corps, with our letter dated August 16, 2002, has previously submitted tribal scoping letters to tribes with concerns within Socorro County regarding the drilling of groundwater monitoring wells (copy attached for your convenience, Enclosure 2). With our tribal scoping letter dated February 21, 2006, the Corps informed tribes with concerns in Socorro County about studying the feasibility of constructing a new railroad bridge and the relocation of approximately 4 miles of track for the proposed railroad-Rio Grande crossing near San Marcial (copy attached for your convenience, Enclosure 3). Responses were received from the Pueblo of Isleta, the White Mountain Apache Tribe, the Comanche Tribe, and the Hopi Tribe. All of these stated they had no concerns regarding construction work for the San Marcial railroad crossing.

Based on the results of the Corps' archaeological investigations of the San Acacia to San Marcial reach, the Corps is of the opinion that reconstruction of the 43-mile levee would result in no historic properties affected. On November 5, 1997, the NM State Historic Preservation Officer (SHPO) concurred with the Corps determination of no effect for the then recommended alternative which followed the same alignment as the presently recommended plan (SHPO Consultation No. 054093). The Corps has previously submitted additional documentation to the SHPO for mitigation of effects to the MRGCD irrigation system, levee, and Reclamation's LFCC (Berry and Lewis 1997; Van Citters 2000; Dodge and Santillanes 2007). The SHPO has also concurred that it is

highly unlikely that historic properties or cultural materials of significant antiquity or archaeological integrity would occur within areas of the Rio Grande's historic active channel.

There are two important aspects of the proposed project. The first is that the on-going modeling of river flows and projected volumes of water during flood events indicate that the proposed engineered levee may be smaller in both height and width than the existing spoil-bank levee. The second is that the material in the spoil-bank levee would be used in the rehabilitation of the proposed engineered levee. Therefore, all of the construction will occur in areas originally disturbed during construction of the levee and the low-flow conveyance channel, and no new quarry areas for fill would be required. Access for construction already exists on a network of paved and dirt roads, and to the extent possible, staging locations for equipment will be in previously disturbed locations. There are no archaeological sites within these disturbed areas.

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The Corps is seeking input for consideration during planning of the project. The purpose of this scoping letter is to provide you with the opportunity to submit concerns or comments you may have regarding potential effects for the proposed project. Specifically, any concerns you may have regarding the environment such as natural, biological, or cultural resources; wildlife, vegetation, and special status species; air, water, or sound quality; aesthetics; health and safety; or Indian Trust Assets that may occur in the project area. Your input will be used in preparing an environmental impact statement to comply with the National Environmental Policy Act.

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Sincerely,

Andrea Hummel

for Julie Alcon
Chief, Environmental Resources
Section

Enclosures

No historic properties
significant to the
Hopi Tribe affected

for
Kuwanwisiwma
7-12-11

Copy furnished w/Encl:

2011 - Tribal mailing list - Socorro County, NM
American Indian tribes that have indicated that they have cultural resources concerns in Socorro County.

Pueblo of Acoma
Comanche Indian Tribe
Fort Sill Apache Tribe
Hopi Tribe
Pueblo of Isleta
Kiowa Tribe
Mescalero Apache Tribe
Navajo Nation
White Mountain Apache Tribe

THE NAVAJO NATION

BEN SHELLY
PRESIDENT

REX LEE JIM
VICE-PRESIDENT

July 25, 2010

Rec'd 8-24-2011
GDE

Julie Alcon, Chief
Environmental Resource Section
Department of the Army
Albuquerque district
4101 Jefferson Plaza NE
Albuquerque, NM 87109

Dear Ms. Alcon:

Our apology for an oversight and missing the deadline date of your request, and that the Navajo Nation Historic Preservation Department – Traditional Culture Program (NNHPD-TCP) is in receipt of the proposed project where the US Army Corps of Engineers, Albuquerque District, is planning a levee rehabilitation project for a portion of the Rio Grande Floodway in Socorro County, New Mexico.

After reviewing your consultation documents, NNHPD-TCP has concluded the proposed undertaking/project area **will not impact** Navajo traditional cultural resources. The NNHPD-TCP, on behalf of the Navajo Nation has concerns at this time.

However, the determination made by the NNHPD-TCP does not necessarily mean that the Navajo Nation has no interest or concerns with the proposed project. If the proposed project inadvertently discovers habitation site, plant gathering areas, human remains and objects of cultural patrimony the NNHPD-TCP request that we be notified respectively in accordance with the Native American Graves Protection and Repatriation Act (NAGPRA).

The NNHPD-TCP appreciates the US Army's consultation efforts, pursuant to 36 CFR Pt. 800.1 (c)(2)(iii). Should you have any additional concerns and/or questions, do not hesitate to contact me electronically at tony@navajohistoricpreservation.org or telephone at 928-871-7750.

Sincerely,

Tony H. Joe, Jr., Supervisory Anthropologist *(Section 106 Consultations)*
Historic Preservation Department – Traditional Culture Program

TCP 11-295
CC: Office File/Chrono

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

July 29, 2011

Planning, Project and Program Management Division
Planning Branch, Environmental Resources Section

Honorable Frank K. Paiz
Governor, Ysleta del Sur Pueblo
117 S. Old Pueblo Road
El Paso, Texas 79907

Dear Governor Paiz:

The U.S. Army Corps of Engineers (Corps), Albuquerque District, is planning a levee rehabilitation project for a portion of the Rio Grande Floodway in Socorro County, New Mexico. The existing levee is located along the west side of the Rio Grande in what is known as the San Acacia to Bosque del Apache reach of the Rio Grande Floodway. The Preliminary Preferred Plan consists of an earthen levee extending approximately 43 miles along the west bank of the Rio Grande, from the San Acacia Diversion Dam to Tiffany Junction. Tiffany Junction is approximately 3 miles north of the San Marcial BNSF Railroad Bridge (See Enclosure 1, Map Figure 1.1). The plan consists of reconstructing the existing spoil bank (non-engineered) levee to form a structurally sound levee paralleling the U.S. Bureau of Reclamation's (Reclamation) Low Flow Conveyance Channel (LFCC). The local sponsor, the Middle Rio Grande Conservancy District (MRGCD), supports the Preliminary Preferred Plan. A draft of the Supplemental Environmental Impact Statement will be posted to the Corps' Albuquerque District web page (http://www.spa.usace.army.mil/fonsi/) in the near future.

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If you have any questions or require additional information on the San Acacia to Bosque del Apache levee rehabilitation project, please contact Mr. DeRagon at (505) 342-3358, Mr. Everhart at (505) 342-3352 or myself at (505) 342-3281.

Sincerely,

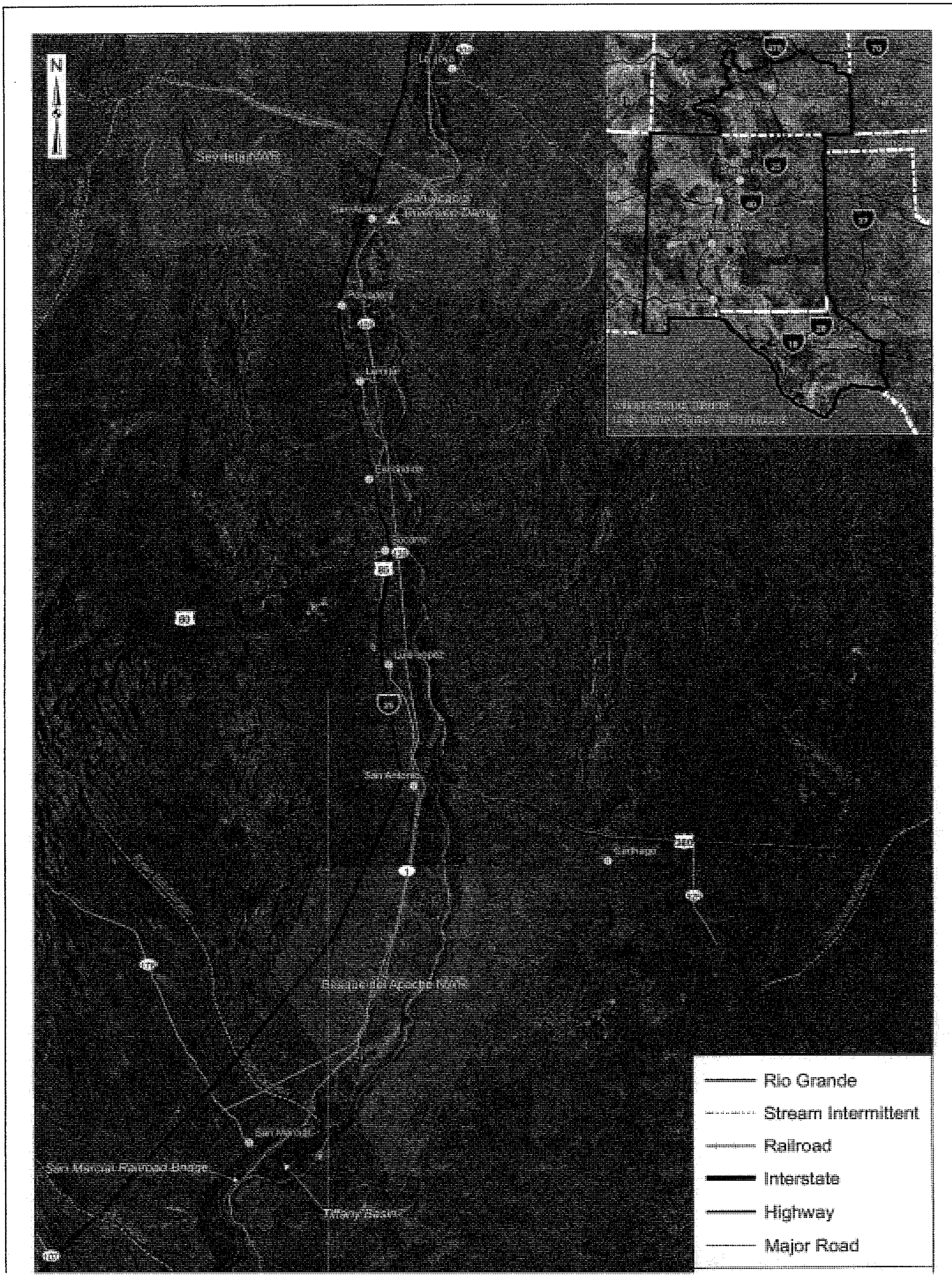
Julie Alcon
Chief, Environmental Resources Section

Enclosures

Copy furnished w/Encl:
Javier Loera, Tribal Historic Preservation Officer

Enclosure 1, Figure 1

Figure 1.1 Study Area



Enclosure 1, Figure 2

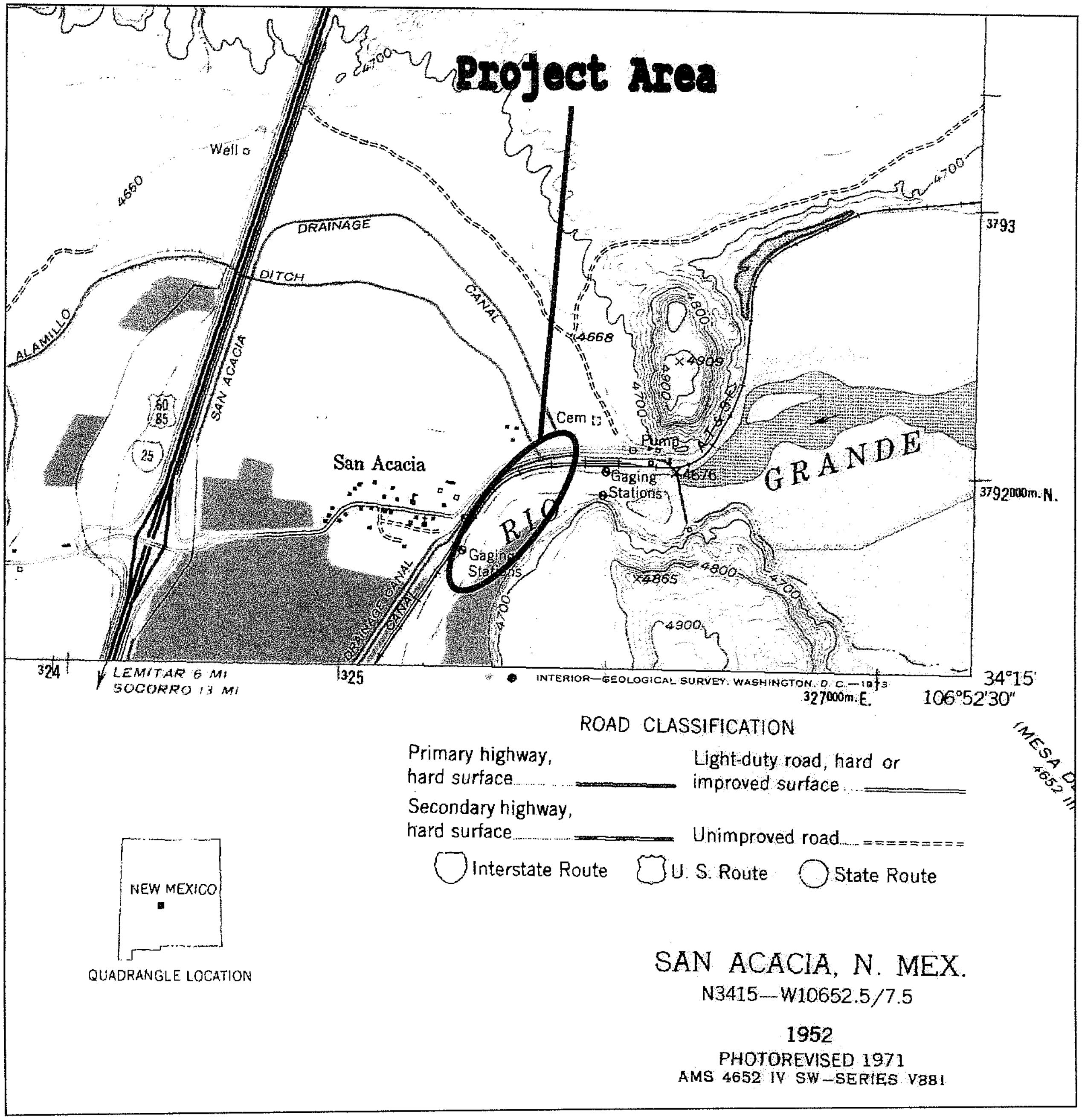
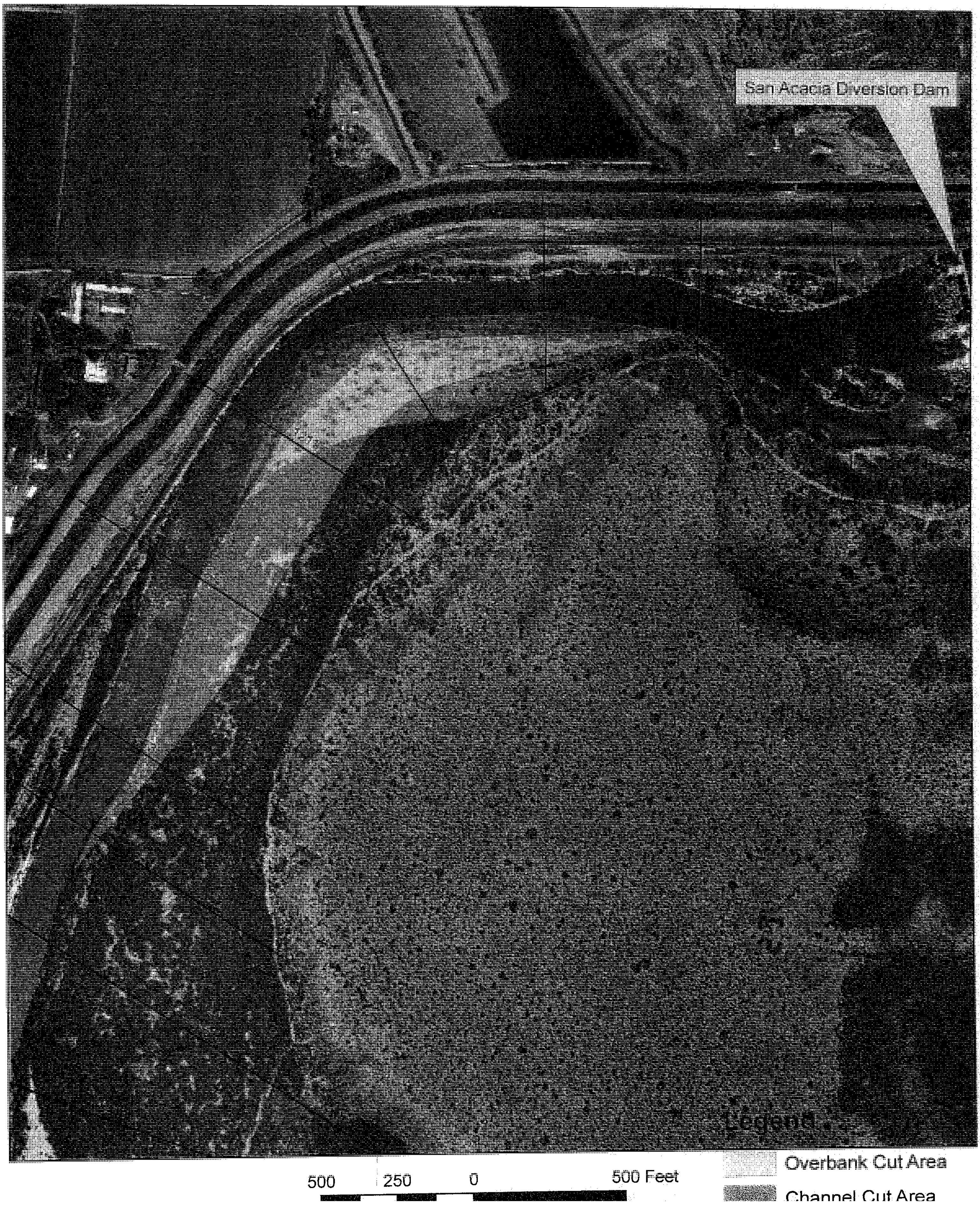


Figure 2: Approximate Location of San Acacia Overbank Lowering Project Area. Adapted from USGS 7.5-Minute Quadrangle Map: San Acacia, NM (34106-c8; 1952, PhotoRevised 1971). Prepared by Corps archaeologist, Gregory D. Everhart, June 30, 2011.

Enclosure 1, Figure 3

San Acacia Overbank Excavation



Enclosure 2

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA, NE
ALBUQUERQUE, NEW MEXICO 87109-3435
FAX (505) 342-3199

Reply to
Attention of:

AUG 16 2002

Engineering and Construction Division
Environmental Resources Branch

Mr. Wayne Taylor, Jr., Chairman
Hopi Tribe
P.O. Box 123
Kykotsmovi, Arizona 86039

Dear Mr. Taylor:

In conjunction with the proposed San Acacia Surface Water/Groundwater Investigation, the New Mexico Interstate Stream Commission (NMISC) and the U.S. Army Corps of Engineers (Corps), Albuquerque District, are proposing to install up to 80 boreholes and 25 staff gauges along seven transects across the Low Flow Conveyance Channel between San Acacia Diversion Dam and the delta of Elephant Butte Reservoir. Within this river reach, competing demands for water, including agriculture, municipal use, wildlife habitat, and Rio Grande compact delivery requirements, necessitate a better understanding of the water budget. The purpose of the investigation is to collect data required to better understand the interactions between surface water and groundwater in this river reach. The entire project area lies within the historic floodplain of the Rio Grande.

Each well will be monitored monthly for three years. There will be one aquifer pumping test on each transect during the first year. The proposed transects are shown on the enclosed figure. Whenever possible, the transects have been located within or adjacent to disturbed areas and existing roads. Some previously undisturbed areas are also included. Due to the nature of the investigation, there is some latitude for placement of the wells and environmentally or culturally sensitive locations will be avoided. Inventories to identify and evaluate environmental, archaeological, and historic resources have been conducted by SWCA Environmental Consultants (SWCA), and the reports are in preparation. An Environmental Assessment is being prepared, and you will receive a draft for your review and comment. SWCA will provide you copies of the reports as they are completed and information regarding project impacts on identified resources, should you so request.

We are contacting the Hopi Tribe to gather information on tribal concerns about traditional cultural properties or other issues within the proposed project locations. You may provide information in writing or, at your request, a meeting with personnel from the Corps, NMISC, or SWCA staff can be arranged to discuss any concerns you may

F:\USER\ECRACC\JOHN\TAYLOR + each respective name have about this project. We will maintain strict confidentiality with regard to certain types of information concerning traditional religious and/or cultural historic properties that may be affected by this proposed undertaking. We would also appreciate suggestions about other groups that we should contact regarding this project.

A response within 30 days from date of receipt would be appreciated. Please feel free to contact John D. Schelberg, (505) 342-3359, john.d.schelberg@usace.army.mil; or Mary Quirolo, SWCA Ethnographer, 1(800) 828-8499, mquirolo@swca.com if you have questions or need additional information.

I have also furnished a copy of this letter to Leigh J. Kuwanwisiwma, Director, Cultural Preservation Office, of your organization.

Sincerely,

Dana R. Hurst

Dana R. Hurst
Lieutenant Colonel, EN
District Engineer

Enclosure

Mr. Wayne Taylor, Jr., Chairman
Hopi Tribe
P.O. Box 123
Kykotsmovi, AZ 86039

Mr. Leigh J. Kuwansisiwma, Director
Cultural Preservation Office
Hopi Tribe
P.O. Box 123
Kykotsmovi, AZ 86039

Mr. Kelsey A. Begaye, President
Navajo Nation
P.O. Box 4950
Window Rock, AZ 86515

Alan S. Downer, Ph.D.
Navajo Nation Historic Preservation Department
P.O. Box 4950
Window Rock, AZ 86515

Ms. Ruey Darrow, Chairwoman
Fort Sill Apache Tribe
Route 2, Box 121
Apache, OK 73006

Mr. Michael Darrow
Tribal Historian
Route 2, Box 121
Apache, OK 73006

Ms. Sara Misquez, President
Mescalero Apache Tribe
P.O. Box 227
Mescalero, NM 88340

Ms. Donna Stern-McFadden
Resource Management and Protection
P.O. Box 227
Mescalero, NM 88340

Mr. Dallas Massey, Sr., Chairman
White Mountain Apache Tribe
P.O. Box 587
Whiteriver, AZ 85941

Mr. John Welch
Tribal Historic Preservation Officer
White Mountain Apache Tribe
P.O. Box 587
Whiteriver, AZ 85941

Honorable Alvino Lucero
Pueblo of Isleta
P.O. Box 1270
Isleta, NM 87022

Mr. Jim Piatt, Environmental Officer
Pueblo of Isleta
P.O. Box 1270
Isleta, NM 87022

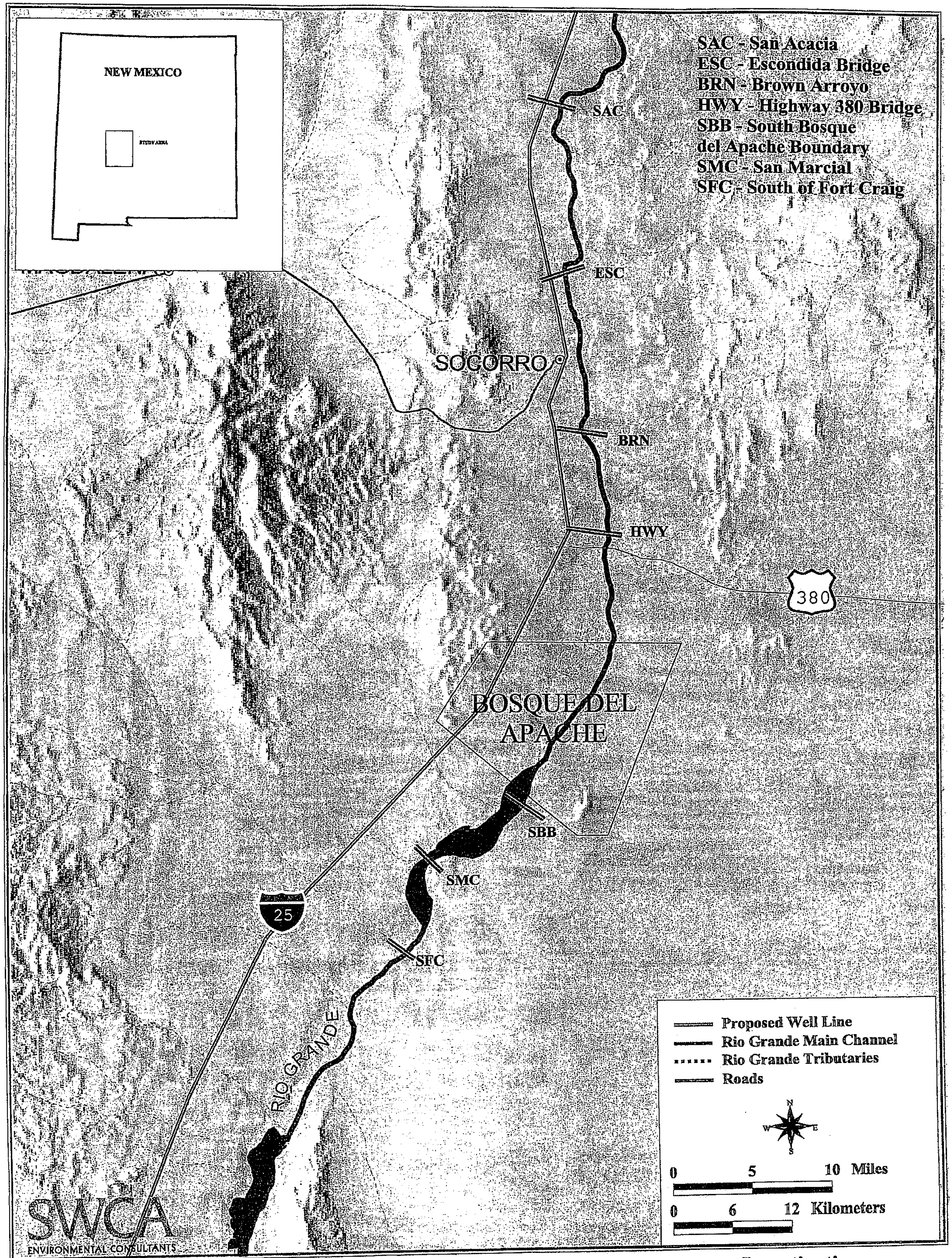


Figure 1. Proposed Well Lines for Below San Acacia Surface Water/ Groundwater Investigation

Enclosure 3.

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

February 21, 2006

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

Honorable Jason Johnson
Governor, Acoma Pueblo
P.O. Box 309
Acoma, New Mexico 87034

Dear Governor Johnson:

The U.S. Army Corps of Engineers (Corps), Albuquerque District is studying the feasibility of constructing a new railroad bridge over the Rio Grande and relocating a four-mile segment of the Burlington Northern Santa Fe (BNSF) Railroad at San Marcial, Socorro County, New Mexico. Due to the existing BNSF bridge's proximity to the headwaters of Elephant Butte Reservoir, the bridge's constriction of the river, and the consequent slowing of the river, sediment deposition is increasing and the elevation of the riverbed is rising. The proposed project is located on an unplatted portion of the San Marcial, New Mexico USGS quadrangle map (Pedro Armendaires Grant No. 33) and an unplatted portion of the Ft. Craig USGS quadrangle map (Pedro Armendaires Grant No. 34). A map showing the project area is enclosed for your review.

A variety of ground-disturbing activities may occur as the feasibility study progresses. Initially, a series of six-inch diameter holes will be drilled in order to define the geological substrate. If construction is approved, the proposed right-of-way will be cleared of vegetation, and the track and a new bridge will be built. The existing bridge will be removed.

The Corps is offering you the opportunity to bring to our attention any concerns or comments regarding the potential effects of this project on Indian Trust assets, traditional cultural properties, sacred sites, biological resources, and any other significant issues that you may have regarding the proposed railroad realignment.

Please provide written comments by March 25, 2006. If you have any questions or require more information regarding the Railroad Relocation at San Marcial, please contact John Schelberg Ph.D., archaeologist, at (505) 342-3359. Thank you for your attention to this matter.

Sincerely,

Julie A. Hall, Chief
Environmental Resources Section

Enclosure

2006 – Tribal mailing list – Socorro County, NM

American Indian tribes that have indicated that they have cultural resources concerns in Socorro County.

Pueblo of Acoma
Comanche Indian Tribe
Fort Sill Apache Tribe
Hopi Tribe
Pueblo of Isleta
Kiowa Tribe
Mescalero Apache Tribe
Navajo Nation
White Mountain Apache Tribe

OFFICE OF THE GOVERNOR

505 869-3111 / 6333
FAX: 505 869-4236

PUEBLO OF ISLETA
P. O. BOX 1270, ISLETA, NM 87022

Rec'd 8-4-2011
COE

August 2, 2011

Julie Alcon
Chief, Environmental Resources
Department of the Army
Albuquerque District, Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, NM 87109-3435

Dear Ms. Alcon:

This letter is in response to your letter regarding the proposed levee rehabilitation in Socorro County, New Mexico. I am pleased to inform you that this project will not have an impact on religious or cultural sites affiliated with the Pueblo of Isleta.

However, in the event that discoveries are found during construction, we would appreciate being advised of such findings. Please forward all environmental assessment plans to our office.

Thank you for your consideration in contacting this office to express our concerns.

Sincerely,

PUEBLO OF ISLETA

Antonio Chewiwi
Lt. Gov.

Frank Lujan,
Governor

Ysleta del Sur Pueblo

Tribal Council – Javier Loera – (War Captain/Tribal Historic Preservation Officer) E-mail jloera@ydsp-nsn.gov

119 South Old Pueblo Road * P.O. Box 17579 * El Paso, Texas 79917 * (915) 859-8053 * Fax: (915) 859-4252

August 24, 2011

Rec'd 9-2-2011
GDE

Julie Alarcon
Department of the Army
Albuquerque District, Corps of Engineers
4101 Jefferson Plaza N.E.
Albuquerque, NM 87109

Dear Ms. Alarcon:

This letter is in response to the correspondence received in our office in which you provide Ysleta del Sur Pueblo the opportunity to comment on the Levee Rehabilitation project for a portion of the Rio Grande Floodway in Socorro County, New Mexico.

While we do not have any comments on the Levee Rehabilitation project for a portion of the Rio Grande Floodway in Socorro County, New Mexico we believe that this project will not adversely affect Traditional, Religious, or culturally significant sites of our Pueblo and have no opposition to it; However, we would like to request consultation should any Human remains of Artifacts unearthed during this project be determined to fall under NAGPRA guidelines. Copies of our Pueblo's Cultural Affiliation Position Paper and Consultation Policy are available upon request.

Thank you for allowing us the opportunity to comment on this project.

Sincerely,

Javier Loera

Javier Loera
War Captain/Tribal Historic Preservation Officer
Ysleta del Sur Pueblo
E-mail: jloera@ydsp-nsn.gov

THE NAVAJO NATION

BEN SHELLY
PRESIDENT

REX LEE JIM
VICE-PRESIDENT

September 6, 2010 — [Sic]

Rec'd 9-20-2011
GDE

Julie Alcon, Chief
Environmental Resources Sec.
Department of the Army
Albuquerque District
4101 Jefferson Plaza NE
Albuquerque, NM 87109-3435

Dear Ms. Alcon:

The Navajo Nation Historic Preservation Department – Traditional Culture Program (NNHPD-TCP) is in receipt of the proposed project where the US Army Corps of Engineers (Corps), Albuquerque District, is planning a levee rehabilitation project for a portion of the Rio Grande Floodway in Socorro County, NM.

After reviewing your consultation documents, NNHPD-TCP has concluded the proposed undertaking/project area **will not impact** Navajo traditional cultural resources. The NNHPD-TCP, on behalf of the Navajo Nation has no concerns at this time.

However, the determination made by the NNHPD-TCP does not necessarily mean that the Navajo Nation has no interest or concerns with the proposed project. If the proposed project inadvertently discovers habitation site, plant gathering areas, human remains and objects of cultural patrimony the NNHPD-TCP request that we be notified respectively in accordance with the Native American Graves Protection and Repatriation Act (NAGPRA).

The NNHPD-TCP appreciates the Department of the Army's consultation efforts, pursuant to 36 CFR Pt. 800.1 (c)(2)(iii). Should you have any additional concerns and/or questions, do not hesitate to contact me electronically at tony@navajohistoricpreservation.org or telephone at 928-871-7750.

Sincerely,

Tony H. Joe, Jr., Supervisory Anthropologist *(Section 106 Consultations)*
Historic Preservation Department – Traditional Culture Program

TCP 11-362
CC: Office File/Chrono

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

March 27, 2012

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

Honorable Frank Paiz
Governor, Pueblo of Ysleta del Sur
P.O. Box 17579, Ysleta Station
El Paso, Texas 79917

Dear Governor Paiz:

The U.S. Army Corps of Engineers (Corps), Albuquerque District, in cooperation with the project sponsor, the Middle Rio Grande Conservancy District (MRGCD), is planning a levee rehabilitation project for a portion of the Rio Grande Floodway in Socorro County, New Mexico. The existing levee is located along the west side of the Rio Grande in what is known as the San Acacia to Bosque del Apache reach of the Rio Grande Floodway. The Recommended Plan consists of an earthen levee extending approximately 43 miles along the west bank of the Rio Grande, from the San Acacia Diversion Dam to Tiffany Junction. San Acacia is located at the north end of the project area; Tiffany Junction is located at the south end of the project area, approximately 3 miles north of the San Marcial BNSF Railroad Bridge (Enclosure 1). The Corps provided a description of the Recommended Plan in our July 2011 Socorro County tribal scoping letter regarding this project (Enclosure 2).

This scoping letter is to notify tribes with concerns in Socorro County about three new elements of the Recommended Plan:

Floodwall and Levee Tie-in

One part of the Recommended Plan calls for the construction of a concrete floodwall and levee tie-in to a hillside immediately adjacent to the BNSF railway grade and northeast of the 1930s San Acacia Diversion Dam (Enclosures 3 and 4). On February 29, 2012, Corps archaeologists conducted a site visit to the area immediately adjacent to and northeast of the San Acacia Diversion Dam and BNSF railway grade, where the levee and new concrete floodwall will tie in to the hillside. The site visit verified that this area was previously disturbed by quarrying and construction activities.

Rehabilitation of U.S. Bureau of Reclamation (BOR) Facilities

Construction activities near the San Acacia Diversion Dam also include the in-kind replacement of the BOR's five existing 7' by 7' CBC Conveyance Channel headworks that divert river water to the Low Flow Conveyance Channel (Enclosures 3 and 4). To the best of our knowledge, these features were constructed in the 1950s by the BOR to manage river flow to Elephant Butte for compact deliveries. Construction will add one 5' diameter arch corrugated metal pipe extension, 65 feet in length, to the headworks of the Socorro Main Canal. This entire area has been previously disturbed. The Area of Potential Effect (APE) for the floodwall and the rehabilitation of both headworks is approximately 2.7 acres in size. Both the San Acacia Diversion Dam and the Low Flow Conveyance Channel are historic structures.

Use of Tiffany Basin as Spoil Area

The existing spoil bank levee contains more earthen materials than is necessary to the construct the new engineered levee, therefore, the excess earthen materials need to be removed. During planning for the proposed project, Corps engineers determined that approximately 302 acres would be necessary for disposal of excess earthen materials, and have preliminarily chosen a location known as the Tiffany Basin for sediment disposal. This proposed project area, located in the northern portion of Tiffany Basin, is a low basin adjacent to the river that sits lower than the Rio Grande channel. The proposed spoil area is approximately 302 acres; the APE is approximately 377 acres (Enclosure 5).

On February 29, 2012 and March 1, 2012, the Corps archaeologists conducted a pedestrian archaeological survey of the Tiffany Basin Spoil Area. No historic properties were observed during the Corps survey with the exception of three isolated occurrences, which were recorded in the field: 1) one small scatter of rocks; 2) one small standing, thin-walled metal pipe; and 3) one historic clorox bleach bottle. The Corps determined these three isolated occurrences are not eligible for nomination to the National Register of Historic Places.

Utilizing a series of historic maps and aerial imagery, the Corps investigation determined that the majority of the APE was significantly disturbed within the last 100 years by two processes: the existence of the Rio Grande active river channel and floodplain within the current APE, and intensive ground disturbance through farming, BOR construction activities between 1951-1959, and other subsequent blading and bulldozing.

Reconstruction of the 43-mile levee is planned to be conducted in phases over approximately 14 to 20 years, dependent upon the availability of funding. While use of the Tiffany Basin Spoil Area is part of the current plan, as planning and project design for each phase is formalized, the Corps will seek other less costly locations for the disposal of excess earthen materials. Possibilities would include existing gravel quarry areas on the gravel terraces above the floodplain all along the river valley.

Since the proposed construction area for the floodwall and levee tie-in near the San Acacia Diversion Dam has been previously disturbed, the Corps is of the opinion that construction of this part of the project will result in no historic properties affected. The proposed rehabilitation of the BOR facilities has also been previously disturbed, and the Corps is of the opinion that rehabilitation of these facilities will result in no adverse effect to historic properties. Based on the negative results of the Corps archaeological survey and investigation of historic mapping and aerial imagery, the Corps is of the opinion that the use of the Tiffany Basin Spoil Area would result in no historic properties affected.

The Corps is seeking input for consideration during planning of the project. The purpose of this scoping letter is to provide you with the opportunity to submit concerns or comments you may have regarding potential effects for the proposed project. Specifically, any concerns you may have regarding the environment such as natural, biological, or cultural resources; wildlife, vegetation, and special status species; air, water, or sound quality; aesthetics; health and safety; or Indian Trust Assets that may occur within or adjacent to the project area. Your input will be used in preparing an environmental impact statement to comply with the National Environmental Policy Act. In the near future, a draft of the Supplemental Environmental Impact Statement for the project will be posted to the Corps' Albuquerque District web page http://www.spa.usace.army.mil/fonsi/.

Please provide written comments at the address above regarding environmental concerns to William DeRagon, Biologist, and comments regarding cultural resources to Gregory D. Everhart, Archaeologist.

If you have any questions or require additional information on the San Acacia to Bosque del Apache Levee Rehabilitation project, please contact Mr. DeRagon at (505) 342-3358 or at william.deragon@usace.army.mil, Mr. Everhart at (505) 342-3352 or at gregory.d.everhart@usace.army.mil or myself at (505) 342-3281 or at julie.a.alcon@usace.army.mil.

Sincerely,

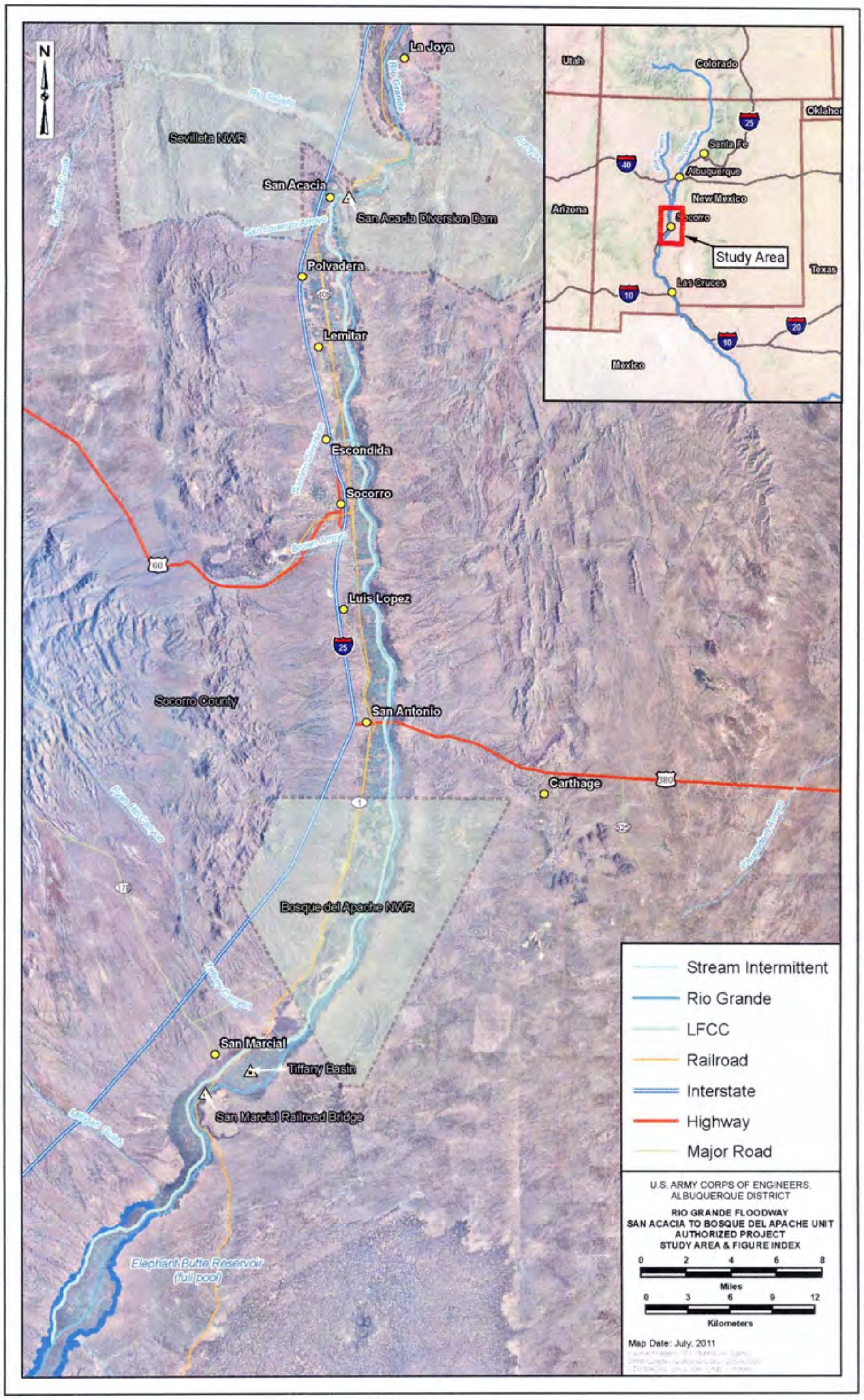
Acting/Julie Alcon
Chief, Environmental Resources
Section

Enclosures

Copy Furnished w/Enclosures:

Mr. Javier Loera
NAGPRA Representative
Pueblo of Ysleta del Sur
P.O. Box 17579, Ysleta Station
El Paso, Texas 79917

Enclosure 1: San Acacia to Bosque del Apache Study Area.



Enclosure 2: 2011 Tribal Scoping letter.

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

July 5, 2011

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Division

Honorable Ben Shelly
President, Navajo Nation
Post Office Box 9000
Window Rock, Arizona 86515

Dear President Shelly:

The U.S. Army Corps of Engineers (Corps), Albuquerque District, is planning a levee rehabilitation project for a portion of the Rio Grande Floodway in Socorro County, New Mexico. The existing levee is located along the west side of the Rio Grande in what is known as the San Acacia to Bosque del Apache reach of the Rio Grande Floodway. The Preliminary Preferred Plan consists of an earthen levee extending approximately 43 miles along the west bank of the Rio Grande, from the San Acacia Diversion Dam to Tiffany Junction. Tiffany Junction is approximately 3 miles north of the San Marcial BNSF Railroad Bridge (See Enclosure 1, Map Figure 1.1). The plan consists of reconstructing the existing spoil bank (non-engineered) levee to form a structurally sound levee paralleling the U.S. Bureau of Reclamation's (Reclamation) Low Flow Conveyance Channel (LFCC). The local sponsor, the Middle Rio Grande Conservancy District (MRGCD), supports the Preliminary Preferred Plan. A draft of the Supplemental Environmental Impact Statement will be posted to the Corps' Albuquerque District web page (http://www.spa.usace.army.mil/fonsi/) in the near future.

The study area of the current project, San Acacia to Bosque Del Apache Unit, is one unit within the comprehensive plan of development for flood control in the Rio Grande Basin, New Mexico that was authorized by the Flood Control Acts of 1948 (P.L. 80-858, Section 203) and 1950 (P.L. 81-516), in accordance with the recommendations of the Chief of Engineers, as found in House Document No. 243, 81st Congress, 1st Session, dated April 5, 1948. The Authority provided a comprehensive plan for coordinated development, by the Corps and Bureau of Reclamation, of water resource and flood risk management on the Rio Grande commencing near Truth or Consequences at about river mile 123 extending upstream to the lower end of the Rio Grande Canyon 14 miles upstream from Española, New Mexico at about river mile 394. The comprehensive plan included channel rectification, improvement of irrigation works, dredging, construction of three reservoirs and levee

enlargement and construction. A November 1947 agreement delegated responsibility for channel rectification and maintenance to the Bureau of Reclamation and facilities for local flood protection to the Corps of Engineers.

As described in the 1948 report, levees had been constructed by local interests through parts of the Espanola and Middle Valley of the Rio Grande. The levees were not uniform as to grade, section or standard of construction and it was proposed to modify and supplement the existing levees. Since authorized in 1948, no levee rehabilitation projects have been constructed in the San Acacia to Bosque del Apache reach.

In 1997, the Corps contracted with the University of New Mexico's Office of Contract Archeology to conduct archaeological surveys of the levee alignment and other areas of the recommended plan's construction area. With the exception of the existing, historic 1930s MRGCD irrigation system, levee, and Reclamation's LFCC, completed in 1959, no archaeological sites, historic properties, or features were identified within the proposed levee reconstruction zone or access routes. No Traditional Cultural Properties are known to occur within or adjacent to the project area. As a part of planning for this project, the Corps, with our letter dated August 16, 2002, has previously submitted tribal scoping letters to tribes with concerns within Socorro County regarding the drilling of groundwater monitoring wells (copy attached for your convenience, Enclosure 2). With our tribal scoping letter dated February 21, 2006, the Corps informed tribes with concerns in Socorro County about studying the feasibility of constructing a new railroad bridge and the relocation of approximately 4 miles of track for the proposed railroad-Rio Grande crossing near San Marcial (copy attached for your convenience, Enclosure 3). Responses were received from the Pueblo of Isleta, the White Mountain Apache Tribe, the Comanche Tribe, and the Hopi Tribe. All of these stated they had no concerns regarding construction work for the San Marcial railroad crossing.

Based on the results of the Corps' archaeological investigations of the San Acacia to San Marcial reach, the Corps is of the opinion that reconstruction of the 43-mile levee would result in no historic properties affected. On November 5, 1997, the NM State Historic Preservation Officer (SHPO) concurred with the Corps determination of no effect for the then recommended alternative which followed the same alignment as the presently recommended plan (SHPO Consultation No. 054093). The Corps has previously submitted additional documentation to the SHPO for mitigation of effects to the MRGCD irrigation system, levee, and Reclamation's LFCC (Berry and Lewis 1997; Van Citters 2000; Dodge and Santillanes 2007). The SHPO has also concurred that it is

highly unlikely that historic properties or cultural materials of significant antiquity or archaeological integrity would occur within areas of the Rio Grande's historic active channel.

There are two important aspects of the proposed project. The first is that the on-going modeling of river flows and projected volumes of water during flood events indicate that the proposed engineered levee may be smaller in both height and width than the existing spoil-bank levee. The second is that the material in the spoil-bank levee would be used in the rehabilitation of the proposed engineered levee. Therefore, all of the construction will occur in areas originally disturbed during construction of the levee and the low-flow conveyance channel, and no new quarry areas for fill would be required. Access for construction already exists on a network of paved and dirt roads, and to the extent possible, staging locations for equipment will be in previously disturbed locations. There are no archaeological sites within these disturbed areas.

Subsequent to the 1997 SHPO concurrence of no effect for the 43-mile levee rehabilitation project, Corps' engineers determined that as a new element of the Preliminary Preferred Plan, bank protection work would need to be constructed on the river bend immediately downstream of the San Acacia Diversion Dam. The San Acacia Diversion Dam is located at the upstream end of the 43-mile levee project. The Rio Grande channel on this river bend is significantly degraded. Proposed work in this San Acacia Overbank Lowering Area (see Enclosure 1, Map Figures 2 and 3) would include the placement of protective rock rip-rap on the outside of the river bend (northwest) adjacent to the BNSF railroad grade, and lowering and shaping the overbank area on the inside of the river bend (southeast). The light blue area shown in Map Figure 3 represents the sand bank that would be excavated to the depth of the existing river channel; the light green area would be excavated on a 1 to 10 slope. All work would be confined to the river channel and sand bank. This excavation would reduce river flow velocity around the river bend; thereby providing flood protection to the BNSF railway grade, Reclamation's LFCC, and the community of San Acacia and adjacent farm land.

On May 26, 2011, Corps archaeologists conducted a site visit to the San Acacia Overbank Lowering Area to verify the location of known archaeological resources in relation to the proposed construction area. Supported with information gathered from archival records, the Corps' site visit found that archaeological resources in the area are of sufficient distance away from the project area that they would not be affected. The Corps is of the opinion that improvements to the river channel would result in no effect to historic properties. This San Acacia project area is on land managed by the U.S. Fish and Wildlife Service, Sevilleta National Wildlife Refuge.

The Corps is seeking input for consideration during planning of the project. The purpose of this scoping letter is to provide you with the opportunity to submit concerns or comments you may have regarding potential effects for the proposed project. Specifically, any concerns you may have regarding the environment such as natural, biological, or cultural resources; wildlife, vegetation, and special status species; air, water, or sound quality; aesthetics; health and safety; or Indian Trust Assets that may occur in the project area. Your input will be used in preparing an environmental impact statement to comply with the National Environmental Policy Act.

Please provide written comments regarding environmental concerns to William DeRagon, Biologist (William.deragon@usace.army.mil); and, comments regarding cultural resources to Gregory D. Everhart, Archaeologist (Gregory.d.everhart@usace.army.mil), at the above address. If you have any questions or require additional information on the San Acacia to Bosque del Apache levee rehabilitation project, please contact Mr. DeRagon at (505) 342-3358, Mr. Everhart at (505) 342-3352, or myself at (505) 342-3281.

Sincerely,

Andrea Hummel
for
Julie Alcon
Chief, Environmental Resources
Section

Enclosures

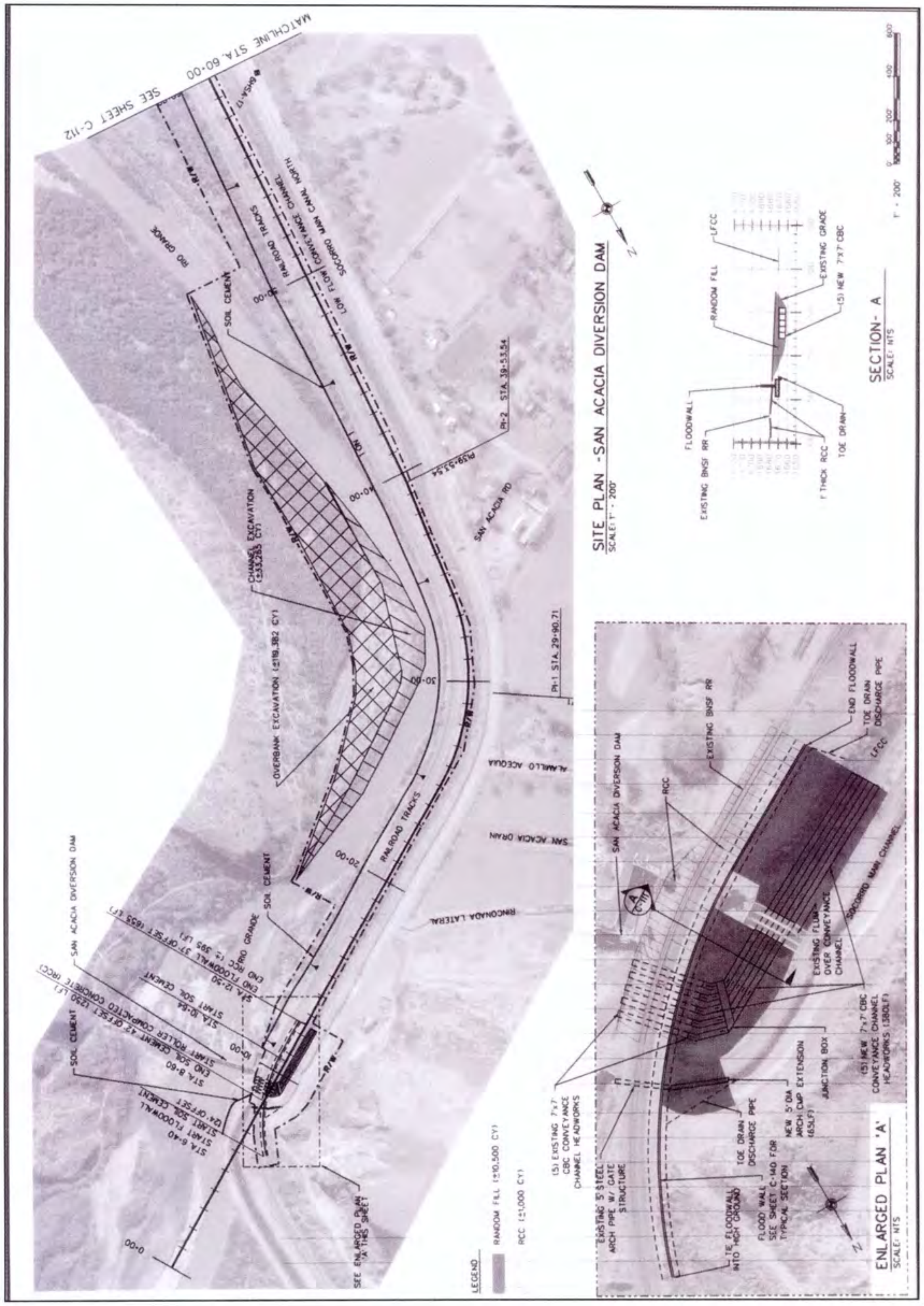
Copy furnished w/Encl:

2011 - Tribal mailing list - Socorro County, NM
American Indian tribes that have indicated that they have cultural resources concerns in Socorro County.

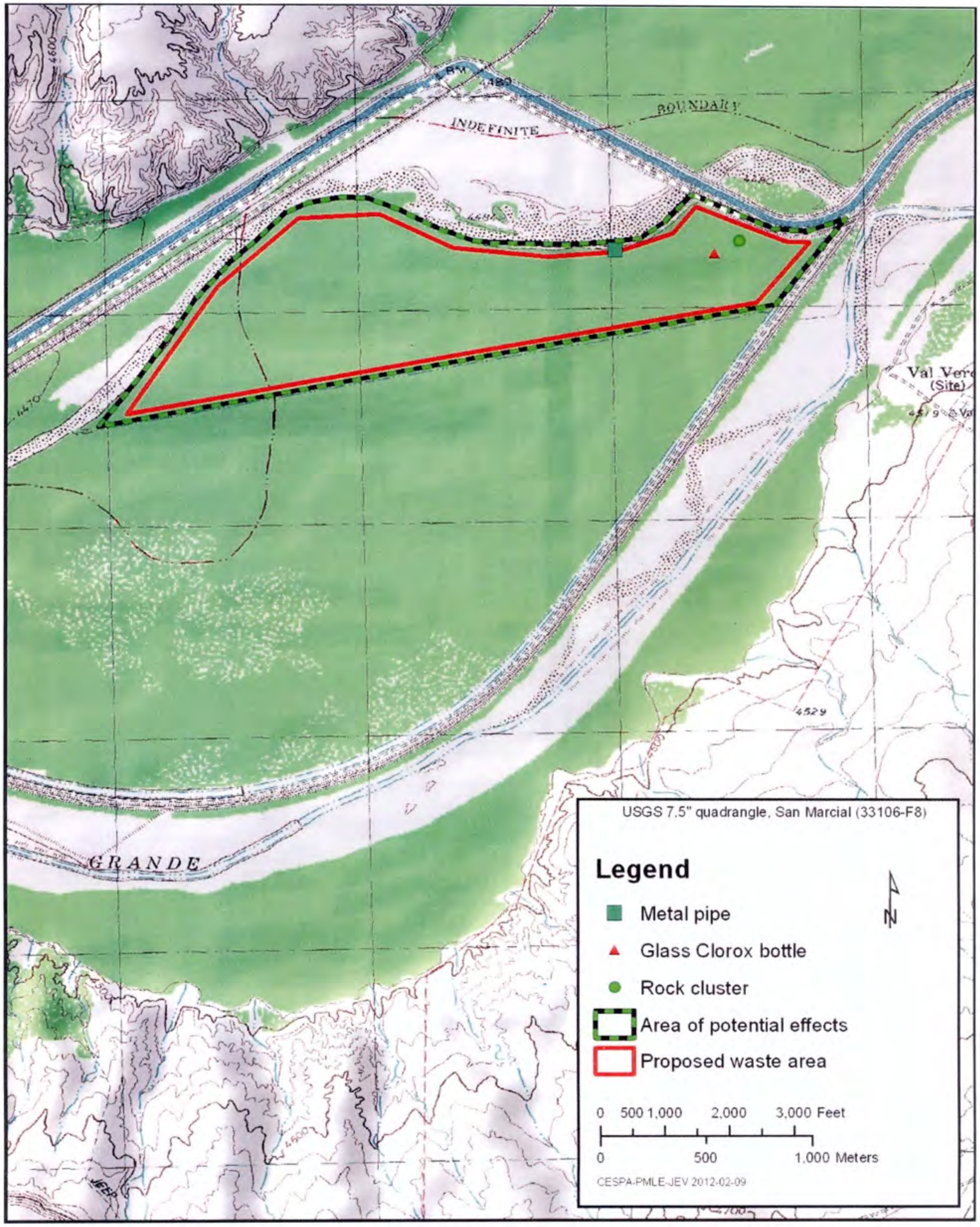
Pueblo of Acoma
Comanche Indian Tribe
Fort Sill Apache Tribe
Hopi Tribe
Pueblo of Isleta
Kiowa Tribe
Mescalero Apache Tribe
Navajo Nation
White Mountain Apache Tribe

Enclosure 3: Location of levee tie-in area and Bureau of Reclamation Low Flow Conveyance Channel headworks (to be replaced in kind).

Enclosure 4: San Acacia to Bosque del Apache Unit, Engineer Drawing, Site Plan - San Acacia Diversion Dam, (draft) Sheet No. C-111.



Enclosure 5: Tiffany Basin Spoil Area and APE with locations of Isolated occurrences (USGS 7.5-Minute Quadrangle map: San Marcial [33106-F8]).



2012 – Tribal Contacts/Mailing List – Socorro County, NM
Native American tribes that have indicated they have cultural concerns in Socorro County, NM.

Pueblo of Acoma
Comanche Indian Tribe
Fort Sill Apache Tribe
Hopi Tribe
Pueblo of Isleta
Kiowa Tribe
Mescalero Apache Tribe
Navajo Nation
White Mountain Apache Tribe
Ysleta del Sur Pueblo

Honorable Randall Vicente
Governor, Pueblo of Acoma
Post Office Box 309
Acoma, New Mexico 87034

CF:
Ms. Theresa Pasqual
Director, Historic Preservation Office
Pueblo of Acoma
Post Office Box 309
Acoma, New Mexico 87034

Honorable Johnny Wauqua
Chairman, Comanche Nation of Oklahoma
Post Office Box 908
Lawton, Oklahoma 73502

CF:
Mr. Jimmy Arterberry
Tribal Historic Preservation Officer
Comanche Nation of Oklahoma
Post Office Box 908
Lawton, Oklahoma 73502

Honorable Jeff Houser
Chairman, Fort Sill Apache Tribe
Route 2, Box 121
Apache, Oklahoma 73006

CF:
Mr. Leland Darrow
Tribal Historian
Fort Sill Apache Tribe
Route 2, Box 121
Apache, Oklahoma 73006

Honorable LeRoy Shingoitewa
Chairman, Hopi Tribal Council
Post Office Box 123
Kykotsmovi, Arizona 86039

cf:
Mr. Leigh Kuwanwisiwma
Director, Cultural Preservation Office
Hopi Tribe
Post Office Box 123
Kykotsmovi, Arizona 86039

Honorable Frank E. Lujan
Governor, Pueblo of Isleta
Post Office Box 1270
Isleta, New Mexico 87022

CF:
Mr. Valentino Jaramillo
Cultural Affairs Committee
Pueblo of Isleta
Post Office Box 1270
Isleta, New Mexico 87022

Michael P. Marshall
Cibola Research Consultants
Post Office Box 743
Corrales, New Mexico 87048

Henry Walt
Cibola Research Consultants
508 Hermosa Street, SE
Albuquerque, New Mexico 87108

Honorable Ronald Twohatchet
Chairman, Kiowa Tribe of Oklahoma
Post Office Box 369
Carnegie, Oklahoma 73015

Jame Eskew
NAGPRA Representative
Kiowa Tribe of Oklahoma
Post Office Box 369
Carnegie, Oklahoma 73015

Honorable Frederic Chino, Sr.
President, Mescalero Apache Tribe
Post Office Box 227
Mescalero, New Mexico 88340

CF:
Ms. Holly Houghten
Tribal Historic Preservation Officer
Mescalero Apache Tribe
Post Office Box 227
Mescalero, New Mexico 88340

Honorable Ben Shelly
President, Navajo Nation
Post Office Box 9000
Window Rock, Arizona 86515

CF:
Alan S. Downer, Ph.D.
Tribal Historic Preservation Officer
Navajo Nation
Post Office Box 4950
Window Rock, Arizona 86515

Honorable Ronnie Lupe
Chairman, White Mountain Apache Tribe
Post Office Box 700
Whiteriver, Arizona 85941

CF:
Mr. Mark Altaha
Historic Preservation Office
White Mountain Apache Tribe
Post Office Box 700
Whiteriver, Arizona 85941

Honorable Frank Paiz
Governor, Pueblo of Ysleta del Sur
Post Office Box 17579, Ysleta Station
El Paso, Texas 79917

CF:
Mr. Javier Loera
NAGPRA Representative
Pueblo of Ysleta del Sur
Post Office Box 17579, Ysleta Station
El Paso, Texas 79917

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

March 27, 2012

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

RECEIVED
APR 0 2 2012
BY: CPO

Honorable Leroy Shingoitewa
Chairman, Hopi Tribal Council
Post Office Box 123
Kykotsmovi, Arizona 86039

Rec'd 4-5-2012
GDE

Dear Chairman Shingoitewa:

The U.S. Army Corps of Engineers (Corps), Albuquerque District, in cooperation with the project sponsor, the Middle Rio Grande Conservancy District (MRGCD), is planning a levee rehabilitation project for a portion of the Rio Grande Floodway in Socorro County, New Mexico. The existing levee is located along the west side of the Rio Grande in what is known as the San Acacia to Bosque del Apache reach of the Rio Grande Floodway. The Recommended Plan consists of an earthen levee extending approximately 43 miles along the west bank of the Rio Grande, from the San Acacia Diversion Dam to Tiffany Junction. San Acacia is located at the north end of the project area; Tiffany Junction is located at the south end of the project area, approximately 3 miles north of the San Marcial BNSF Railroad Bridge (Enclosure 1). The Corps provided a description of the Recommended Plan in our July 2011 Socorro County tribal scoping letter regarding this project (Enclosure 2).

This scoping letter is to notify tribes with concerns in Socorro County about three new elements of the Recommended Plan:

Floodwall and Levee Tie-in
One part of the Recommended Plan calls for the construction of a concrete floodwall and levee tie-in to a hillside immediately adjacent to the BNSF railway grade and northeast of the 1930s San Acacia Diversion Dam (Enclosures 3 and 4). On February 29, 2012, Corps archaeologists conducted a site visit to the area immediately adjacent to and northeast of the San Acacia Diversion Dam and BNSF railway grade, where the levee and new concrete floodwall will tie in to the hillside. The site visit verified that this area was previously disturbed by quarrying and construction activities.

Rehabilitation of U.S. Bureau of Reclamation (BOR) Facilities
Construction activities near the San Acacia Diversion Dam also include the in-kind replacement of the BOR's five existing 7' by 7' CBC Conveyance Channel headworks that divert river water to the Low Flow Conveyance Channel (Enclosures 3 and 4). To the best of our knowledge, these features were constructed in the 1950s by the BOR to manage river flow to Elephant Butte for compact deliveries. Construction will add

one 5' diameter arch corrugated metal pipe extension, 65 feet in length, to the headworks of the Socorro Main Canal. This entire area has been previously disturbed. The Area of Potential Effect (APE) for the floodwall and the rehabilitation of both headworks is approximately 2.7 acres in size. Both the San Acacia Diversion Dam and the Low Flow Conveyance Channel are historic structures.

Use of Tiffany Basin as Spoil Area

The existing spoil bank levee contains more earthen materials than is necessary to the construct the new engineered levee, therefore, the excess earthen materials need to be removed. During planning for the proposed project, Corps engineers determined that approximately 302 acres would be necessary for disposal of excess earthen materials, and have preliminarily chosen a location known as the Tiffany Basin for sediment disposal. This proposed project area, located in the northern portion of Tiffany Basin, is a low basin adjacent to the river that sits lower than the Rio Grande channel. The proposed spoil area is approximately 302 acres; the APE is approximately 377 acres (Enclosure 5).

On February 29, 2012 and March 1, 2012, the Corps archaeologists conducted a pedestrian archaeological survey of the Tiffany Basin Spoil Area. No historic properties were observed during the Corps survey with the exception of three isolated occurrences, which were recorded in the field: 1) one small scatter of rocks; 2) one small standing, thin-walled metal pipe; and 3) one historic clorox bleach bottle. The Corps determined these three isolated occurrences are not eligible for nomination to the National Register of Historic Places.

Utilizing a series of historic maps and aerial imagery, the Corps investigation determined that the majority of the APE was significantly disturbed within the last 100 years by two processes: the existence of the Rio Grande active river channel and floodplain within the current APE, and intensive ground disturbance through farming, BOR construction activities between 1951-1959, and other subsequent blading and bulldozing.

Reconstruction of the 43-mile levee is planned to be conducted in phases over approximately 14 to 20 years, dependent upon the availability of funding. While use of the Tiffany Basin Spoil Area is part of the current plan, as planning and project design for each phase is formalized, the Corps will seek other less costly locations for the disposal of excess earthen materials. Possibilities would include existing gravel quarry areas on the gravel terraces above the floodplain all along the river valley.

Since the proposed construction area for the floodwall and levee tie-in near the San Acacia Diversion Dam has been previously disturbed, the Corps is of the opinion that construction of this part of the project will result in no historic properties affected. The proposed rehabilitation of the BOR facilities has also been previously disturbed, and the Corps is of the opinion that rehabilitation of these facilities will result in no adverse effect to historic properties. Based on the negative results of the Corps archaeological survey and investigation of historic mapping and aerial imagery, the Corps is of the opinion that the use of the Tiffany Basin Spoil Area would result in no historic properties affected.

The Corps is seeking input for consideration during planning of the project. The purpose of this scoping letter is to provide you with the opportunity to submit concerns or comments you may have regarding potential effects for the proposed project. Specifically, any concerns you may have regarding the environment such as natural, biological, or cultural resources; wildlife, vegetation, and special status species; air, water, or sound quality; aesthetics; health and safety; or Indian Trust Assets that may occur within or adjacent to the project area. Your input will be used in preparing an environmental impact statement to comply with the National Environmental Policy Act. In the near future, a draft of the Supplemental Environmental Impact Statement for the project will be posted to the Corps' Albuquerque District web page http://www.spa.usace.army.mil/fonsi/.

Please provide written comments at the address above regarding environmental concerns to William DeRagon, Biologist, and comments regarding cultural resources to Gregory D. Everhart, Archaeologist.

If you have any questions or require additional information on the San Acacia to Bosque del Apache Levee Rehabilitation project, please contact Mr. DeRagon at (505) 342-3358 or at william.deragon@usace.army.mil, Mr. Everhart at (505) 342-3352 or at gregory.d.everhart@usace.army.mil or myself at (505) 342-3281 or at julie.a.alcon@usace.army.mil.

Sincerely,

Acting
Julie Alcon
Chief, Environmental Resources Section

Enclosures

Copy Furnished w/Enclosures:

Mr. Leigh Kuwanwisiwma
Hopi Tribal Council
Director, Cultural Preservation Office
Post Office Box 123
Kykotsmovi, Arizona 86039

Concur
for
Kuwanwisiwma
4-2-12

Ysleta del Sur Pueblo

Tribal Council – Javier Loera – (War Captain/Tribal Historic and Preservation Officer) E-mail jloera@ydsp-nsn.gov

119 South Old Pueblo Road * P.O. Box 17579 * El Paso, Texas 79917 * (915) 859-8053 * Fax: (915) 859-4252

April 10, 2012

Rec'd 4-13-2012
GDE

Mr. Gregory D. Everhart
Archaeologist
Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section
Department of the Army
Albuquerque District, Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, NM 87109-3435

Dear Mr. Everhart:

This letter is in response to the correspondence received in our office in which you provide the Ysleta del Sur Pueblo the opportunity to comment on the U.S. Army Corps of Engineers (Corps), Albuquerque District, in cooperation with the project sponsor, the Middle Rio Grande Conservancy District's (MRGCD) proposed planning of a levee rehabilitation project for a portion of the Rio Grande Floodway in Socorro County, New Mexico.

While we do not have any comments on the proposed undertaking and believe that this project will not adversely affect traditional, religious or culturally significant sites of our Pueblo and have no opposition to it; we would like to request consultation should any human remains or artifacts unearthed during this project be determined to fall under the Native American Graves Protection and Repatriation Act (NAGPRA) guidelines. Copies of our Pueblo's Cultural Affiliation Position Paper and Consultation Policy are available upon request.

Thank you for allowing us the opportunity to comment on the proposed project.

Sincerely,

Javier Loera

Javier Loera
War Captain/Tribal Historic and Preservation Officer
Ysleta del Sur Pueblo

THE
NAVAJO
NATION

Historic Preservation Department, POB 4950, Window Rock, AZ 86515 • PH: 928.871-7198 • FAX: 928.871.7886

BEN SHELLY
PRESIDENT

REX LEE JIM
VICE-PRESIDENT

April 26, 2012

Rec'd 7-5-2012
GDE

Julie Alcon, Chief
Environmental Resources Section
Department of the Army
4101 Jefferson Plaza NE
Albuquerque, NM 87109-3435

Dear Ms. Alcon:

The Historic Preservation Department-Traditional Culture Program (HPD-TCP) is in receipt of the proposed project where the US Army Corps of Engineers, Albuquerque District is planning a levee rehabilitation project for a portion of the Rio Grande Floodway in Socorro County, NM.

After reviewing your consultation documents, HPD-TCP has concluded the proposed undertaking/project area **will no impact** Navajo traditional cultural resources. The HPD-TCP, on behalf of the Navajo Nation has no concerns at this time.

However, the determination made by the HPD-TCP does not necessarily mean that the Navajo Nation has no interest or concerns with the proposed project. *If the proposed project inadvertently discovers habitation sites, plant gathering areas, human remains and objects of cultural patrimony, the HPD-TCP request that we be notified respectively in accordance with the Native American Graves Protection and Repatriation Act (NAGPRA).*

The HPD-TCP appreciates the Department of the Army's consultation efforts, pursuant to 36 CFR Pt. 800.1 (c)(2)(iii). Should you have any additional concerns and/or questions do not hesitate to contact me electronically at tony@navajohistoricpreservation.org or telephone at 928-871-7750.

Sincerely,

Tony H. Joe, Jr., Supervisory Anthropologist (Section 106 Consultations)
Historic Preservation Department-Traditional Culture Program

TCP 12-139
cc: Office File/Chrono

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

RECEIVED

MAR 30 2012

THE HOPI TRIBE
OFFICE OF THE CHAIRMAN

March 27, 2012

Recd 5-4-2012
GDE

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

Honorable Leroy Shingoitewa
Chairman, Hopi Tribal Council
Post Office Box 123
Kykotsmovi, Arizona 86039

CPO/S

Dear Chairman Shingoitewa:

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Sincerely,

Michael D Porter

Julie Alcon
Acting Chief, Environmental Resources Section

Enclosures

Copy Furnished w/Enclosures:

Mr. Leigh Kuwanwisiwma
Hopi Tribal Council
Director, Cultural Preservation Office
Post Office Box 123
Kykotsmovi, Arizona 86039

concur
[illegible]
Kuwanwisiwma
5-1-12

UPDATE JULY 2012 - Cultural Resources and Archaeological Data

In 2012, a search of the New Mexico Historic Preservation Division (NMHPD), Archaeological Records Management Section's (ARMS) New Mexico Cultural Resource Information System (NMCRIS) database (data as of January 31, 2012) was conducted by the U.S. Army Corps of Engineers, Albuquerque District (USACE) to review and verify archaeological site data for the subject 2012 GRR/SEIS-II project area. From the 2007 NMCRIS database search, 210 archaeological sites and other historic properties were found to occur in the general vicinity of the 43-mile levee construction project area. Determinations of eligibility for potential nomination of these sites to the National Register of Historic Places have not been made for the majority of the 210 archaeological sites in the area, therefore, they are considered eligible until official determinations are made. Of the 210 archaeological sites, a total of 85 sites occur within or immediately adjacent to the Area of Potential (flooding) Effect (APE) as depicted in the GRR/SEIS-II, Figures 5.3 – 5.9; approximately 35 are located on the west side and 50 are located on the east side of the existing Middle Rio Grande Conservancy District (MRGCD) spoil bank levee (see Updated Tables 1 and 2 below; data from Tables 1, 2, and 3 from the 2009 Cultural Resources document below have been deleted to not create confusion). Generally, these archaeological sites and other historic properties occur in areas of sufficient distance from the levee construction area that they would not be affected by the levee rehabilitation or they can be avoided.

There are several specific archaeological sites and historic properties that are discussed in the GRR/SEIS-II. These include the following: 1) NM Laboratory of Anthropology (LA) archaeological sites LA282, the Teypama Piro Site, near Socorro and LA287, the Cerro Indian Pueblo, near San Acacia; 2) the existing 1930s BNSF railroad bridge near San Marcial; 3) the remains of the historic town site of San Marcial (LA86992); 4) the prehistoric pueblo ruins of San Pascual (LA487) and Qualacu (LA757) both located within the Bosque del Apache National Wildlife Refuge (BDANWR); 5) the extensive 1930s MRGCD irrigation (canals, primary laterals and drainage ditches) and spoil bank levee system (the levee that is to be reconstructed); and 6) the United States Bureau of Reclamation's (USBR) Low Flow Conveyance Channel (LFCC) and Headworks, and the MRGCD San Acacia Diversion Dam (SADD). All of these archaeological sites and historic properties are either eligible for nomination or are listed on either the State Register of Cultural Properties or the National Register of Historic Places (see 36 CFR § 60.4 for criteria for listing on the National Register; http://www.nps.gov/nr/regulations.htm). A brief description of these historic properties is provided below. The SHPO has concurred with the USACE that it is highly unlikely that historic properties or cultural materials of significant antiquity or archaeological integrity would occur within areas of the Rio Grande's historic active channel (NMHPD Consultation No. 92670; Appendix F-8).

1). A review of the 1992 SEIS and historic properties documentation in 2012, found that two historic properties noted in 1992 SEIS were reported as listed on the National

Register of Historic Places. These include the archaeological sites LA282, the Teypama Piro Site, located near Socorro and LA287, the Cerro Indian Pueblo, located near San Acacia. LA282 was listed on the NM State Register of Cultural Properties, No. 884, on August 12, 1982, and on the National Register of Historic Places, No. 83004179, on October 21, 1983. However, LA287 has not been included on either the State Register or the National Register, although it remains eligible for nomination to both registers. Both of these archaeological sites occur outside of the project area and outside of the APE.

2) The existing BNSF (a.k.a. Burlington Northern Santa Fe) railroad bridge located near San Marcial was constructed in 1930 by the Atchison, Topeka and Santa Fe (AT&SF) Railway and the American Bridge Company. A “Warren Through Truss” design, the No. 1006.A bridge is composed of five 149-foot long steel trusses on timber and concrete piers. The total length of the structure is 853 feet. The USACE evaluated the structure using the system developed by the New Mexico State Highway and Transportation Department in consultation with the New Mexico State Historic Preservation Officer (SHPO) (NMHPD Consultation No 054201; Appendix F-8). It scored 72 points out of a possible 108, placing it in the top one-third of the rating. This value is consistent with the ratings of similar highway structures. Therefore, it is considered to be potentially eligible for listing on the National Register of Historic Places under criteria a, c, and d of 36 CFR § 60.4. Level II Historic American Building Survey documentation has been completed as well as a public report (Van Citters, 2000).

In previous planning and environmental studies for this project, the removal and relocation of the historic BNSF railway bridge was considered as a project alternative. Therefore, it is discussed in several locations in the GRR/SEIS-II and other supporting cultural resources documentation for the project. During the early stages of project planning, the USACE conducted an archaeological survey of a proposed realignment of the railroad grade (Chapman and Actis, 2007). Subsequently, the USACE determined that they had no authority to remove or relocate the BNSF railroad bridge; therefore, removal and relocation of the bridge, although discussed in the following cultural text, is no longer included as a project alternative. The BNSF railway bridge is located outside of the project construction area but is within the APE.

3) The historic town site of San Marcial is located near the southern end of the 43-mile levee construction area, in the southwestern portion of the area known as the Tiffany Basin. Tiffany Basin is a low basin located adjacent to but sits lower than the Rio Grande channel; and therefore is an area potentially subject to flooding. The San Marcial town site, documented as archaeological site LA86992, was once the AT&SF railroad center for the area. Although the town site is estimated to be buried under approximately 30-feet of flood deposited sediment (Van Citters, 2000:13-22, 33), it is considered eligible for nomination to the National Register under criterion d of 36 CFR § 60.4 (NMHPD, 2012). San Marcial is located outside of the project construction area but is within the APE.

4) The prehistoric pueblo ruins of San Pascual (LA487) and Qualacu (LA757) are among approximately 25 archaeological sites located within the Bosque del Apache National Wildlife Refuge (BDANWR) that are located outside of the project construction area but

are within the APE. As noted, all of these sites are considered eligible for nomination to the State and National Registers. The USACE has previously conducted Section 106 (of the NHPA) consultation with the SHPO regarding potential flood related effects to San Pascual and made recommendations to BDANWR regarding potential studies at the site (HPD Consultation No's 055280 and 074310; Appendix F-8). The USACE has concerns that inundation of archaeological sites including San Pascual by flood waters and the resulting saturation has the potential to affect buried archaeological deposits. The USACE and USBR continue to manage river flows within their control to avoid effects to archaeological sites within or immediately adjacent to the floodplain (USACE, 2005, 1998).

5) The extensive 1930s MRGCD irrigation (canals, primary laterals and drainage ditches) and spoil bank levee system (the levee that is to be reconstructed) was reconstructed in the 1950s and 1960s by the USACE and USBR. The MRGCD system, that extends from Cochiti Lake on the north southward, downstream to approximately the northern reaches of Elephant Butte Reservoir, is widely recognized by the Federal, state, and local cultural resources and historic preservation community as being eligible for nomination to the National Register of Historic Places under criteria a, b, and d of 36 CFR § 60.4. These facilities have had far-reaching impacts on water usage, management, and politics from the time of their construction to the present day. The USACE has conducted archaeological survey of the levee alignment and other areas of the recommended plan's proposed construction areas (Doleman, 1997). As a means of mitigating the loss of the original spoil bank levee through reconstruction, the USACE prepared a package of documentation including a historic narrative, engineer drawings, and photographs for the New Mexico Archives and public dissemination; this public report is entitled *Historical Documentation of Middle Rio Grande Flood Protection Projects: Corrales to San Marcial* (Berry and Lewis, 1997). The USACE has previously submitted additional documentation to the SHPO for mitigation of adverse effect to the MRGCD levee and USBR's Low Flow Conveyance Channel (LFCC) (Berry and Lewis, 1997; Van Citters, 2000; Dodge and Santillanes, 2007). For the 43-mile San Acacia to San Marcial reach, the USACE is of the opinion that reconstruction of the levee would result in an adverse effect to historic properties. On November 5, 1997, the SHPO concurred with the USACE determination that the historic documentation of the levee system has mitigated for the adverse effect to historic properties for the then recommended alternative (NMHPD Consultation No. 054093 and 088135; Appendix F-8) which follows the same alignment as the current Alternative A and Alternative A+4ft levees including the recommended plan.

6) MRGCD's San Acacia Diversion Dam (SADD) and the United States Bureau of Reclamation's (USBR) Low Flow Conveyance Channel (LFCC) and Headworks as well as the headworks for the Socorro Main Canal are located at the northern end of the proposed project area, near the historic village of San Acacia (LA5167). The SADD was constructed in the 1930s by the MRGCD for management of irrigation water for distribution to the area near Socorro via the Socorro Main Canal (Ackerly et al. 1997). USBR's LFCC was constructed in the 1950s to manage river flow to Elephant Butte Reservoir for compact deliveries to Mexico. The USBR, in preparation for numerous

operations and maintenance activities on the LFCC, prepared historic documentation of the LFCC (Bischoff, 2001). In 2003, USBR consulted with the SHPO on activities that may cause adverse effects to the LFCC; the SHPO concurred with the USBR determination that the LFCC is "…eligible for listing on the National Register under criterion a, at the local level of significance" (NMHPD Consultation No. 66762, USBR, 2003). As noted, MRGCD's historic 1930s irrigation and spoil bank levee system including the SADD is eligible for nomination to the National Register of Historic Places. The MRGCD, USBR, and BNSF are continually conducting operations and maintenance activities to maintain the structural integrity of their structures. The historic village of San Acacia (LA5167) is located outside of the levee construction area and outside of the APE, therefore, the proposed levee reconstruction project would have no effect to the historic village. While the SADD is located immediately adjacent to the proposed levee reconstruction area, there would be no effect to the SADD. The proposed levee reconstruction plans the in-kind replacement of the USBR's five existing 7 ft by 7 ft CBC Conveyance Channel headworks that divert river water to the LFCC. The USACE has consulted with the SHPO on the proposed action, as noted below.

Regarding future flooding within or immediately adjacent to the Area of Potential (flooding) Effect (APE); the 85 archaeological sites and other historic properties (see Updated Tables 1 and 2 below) have been subjected to or have the potential to have been affected to some unknown extent by historic flooding in the past. In both the 1% Exceedence Probability With- and Without Project scenarios (GRR/SEIS-II, Figures 5.3 - 5.9), all of these sites have the potential to be affected by flooding in the future. Flooding includes effects such as erosive river flows that have the potential to flow over or against the sides of sites or inundation that result in water saturation penetrating buried cultural deposits at archaeological sites. Under all of the future with- and future without project scenarios, including the recommended plan, there is no change in the potential for effects from future flooding to these sites nor to sites located downstream of the project area. Hydrology and hydraulic analysis for all of the Alternative A and Alternative A+ 4ft scenarios, including the recommended plan, show no change to flooding seasonality. As noted in Section 6.2.3 of the GRR/SEIS-II, the hydrology and hydraulics in the Middle Rio Grande valley are highly modified and controlled, and discharge-frequency characteristics of the basin would remain as they are. Average flood flow velocities within the floodway would remain relatively low. There would be a negligible change to volume and duration of flood flows. This would include a slight increase in stage (approximately 6-inches) and flood flow velocities, primarily within the main channel rather than along the margins of the floodplain (as depicted in Figure 6.2 of the GRR/SEIS-II). Therefore the project alternatives including the recommended plan would result in a negligible change from flooding related effects that have occurred in the past.

Recent archaeological survey and cultural resources investigations conducted by the USACE are described below.

On May 26, 2011, USACE archaeologists conducted a site visit to the proposed San Acacia overbank lowering area (immediately downstream of the SADD), a new construction feature of all of the levee alternatives, to verify the location of known archaeological resources in relation to the proposed construction area. For this feature's construction area, the USACE is of the opinion that improvements to the river channel that include the placement of rip-rap on the outside of the river bend adjacent to the BNSF railroad grade and the lowering and shaping of the overbank area on the inside of the river bend to reduce river flow velocities, would result in no effect to historic properties. On September 12, 2011, the SHPO concurred with the USACE determination of no effect for this project area (NMHPD Consultation No. 92670; Appendix F-8).

In 2012, USACE archaeologists determined that they needed to conduct a site visit to verify site conditions for two elements of the recommended plan (located in the same immediate area near the SADD) and to conduct an archaeological survey for the proposed use of the Tiffany Basin spoil area as described below.

Floodwall and Levee Tie-in: One part of the recommended plan calls for the construction of a concrete floodwall and levee tie-in to a hillside immediately adjacent to the BNSF railway grade and northeast of the SADD. On February 29, 2012, USACE archaeologists conducted a site visit to the area immediately adjacent to and northeast of the SADD and BNSF railway grade, where the levee and new concrete floodwall will tie in to the hillside. The site visit verified that this area was previously disturbed by quarrying and construction activities.

Rehabilitation of USBR Facilities: Construction activities near the SADD also include the in-kind replacement of the USBR's five existing 7 ft by 7 ft CBC Conveyance Channel headworks that divert river water to the LFCC. These features were constructed in the 1950s by the USBR to manage river flow to Elephant Butte for compact deliveries. Construction will add one 5 foot diameter arch corrugated metal pipe extension, 65 feet in length, to the headworks of the Socorro Main Canal. This entire area has been previously disturbed. The Area of Potential Effect (APE) for the floodwall/tie-in and the rehabilitation of both headworks is approximately 2.7 acres in size. Both the 1930s SADD and the USBR's 1950s LFCC and headworks and Socorro Main Canal headworks are historic structures.

Use of Tiffany Basin as a Spoil Area: The existing 43-mile spoil bank levee contains more earthen materials than is necessary to the construct the new engineered levee; therefore, the excess earthen materials need to be removed. During planning for the proposed project, USACE engineers determined that approximately 300 acres would be necessary for disposal of excess earthen materials, and have preliminarily chosen a location known as the Tiffany Basin for waste disposal. This proposed spoil area, located in the northern portion of Tiffany Basin, is a low basin adjacent to the river that sits lower than the Rio Grande channel. The proposed spoil area is approximately 300 acres; the APE is approximately 377 acres.

On February 29, 2012 and March 1, 2012, the USACE archaeologists conducted a pedestrian archaeological survey of the spoil area in Tiffany Basin. No historic properties were observed during the USACE survey with the exception of three isolated occurrences, which were recorded in the field: 1) one small scatter of rocks; 2) one small standing, thin-walled metal pipe; and 3) one historic Clorox bleach bottle. The USACE determined these three isolated occurrences are not eligible for nomination to the National Register of Historic Places. Due to the extreme thickness of vegetation, USACE archaeologists were unable to survey the entire Tiffany Basin spoil area APE; however, utilizing a series of historic maps and aerial imagery, the USACE investigation determined that the majority of the spoil area in Tiffany Basin was significantly disturbed within the last 100 years by two processes: the existence of the Rio Grande active river channel and floodplain within the current APE, and intensive ground disturbance due to farming and to USBR construction activities between 1951-1959 that included blading and bulldozing for vegetation removal.

Since the proposed construction area for the floodwall and levee tie-in near the SADD has been previously disturbed, the USACE is of the opinion that construction of this part of the project will result in no historic properties affected. The proposed rehabilitation of the USBR facilities and the Socorro Main Canal headworks has also been previously disturbed, and the USACE is of the opinion that in-kind rehabilitation of these facilities will result in no adverse effect to historic properties. Based on the negative results of the USACE archaeological survey and investigation of historic mapping and aerial imagery (Everhart and Van Hoose 2012), the USACE is of the opinion that the use of the Tiffany Basin spoil area would result in no historic properties affected. On April 17, 2012, the SHPO concurred with the USACE determinations (NMHPD Consultation No.094140; Appendix F-8).

Additional archaeological survey and Section 106 consultation with the SHPO, Native American tribes, and if necessary, the Advisory Council on Historic Preservation, may be required if other alternative/option areas and rights-of-way are included in the project in the future; such as Alternative K, Alternative K+4ft, and the River Mile-108 setback. No known historic properties occur in the immediate vicinity of these project areas. For alternatives that include the River Mile-108 setback, use of the area would likely result in no historic properties affected. Alternatives K and K+4ft that include the construction of an approximately 4-mile engineered Tiffany East Levee that would replace the existing spoil bank, along the same, existing alignment, would likely result in no adverse effect to historic properties. Both the River Mile-108 setback, and Alternatives K and K+4ft occur in portions of the Rio Grande's historic active channel and have been subject to numerous historic flooding events in the past, both prior to and subsequent to the construction of the existing spoil bank. Prehistoric and historic properties that may have been in the area before and after the spoil bank was constructed have likely been washed away or buried in river sediments. Therefore, it is highly unlikely that historic properties or cultural materials of significant antiquity or archaeological integrity would occur in these areas. Potential historic properties that may occur in the vicinity of the Alternative K and K+4ft levees would include the historic communities of Val Verde and La Mesa, the buried remnants of the San Marcial town site, the Val Verde (irrigation) Ditch, the 1862 Civil War Val Verde Battle site, and the alignment of the El Camino Real de Tierra Adentro National Historic Trail.

All undisturbed areas of considered alternatives that may potentially be affected by project related construction activities in the future would be surveyed for the presence or absence of historic properties. All known historic properties would be avoided to the extent possible and newly discovered sites, if found, would be assessed in accordance with 36 CFR Part 60.4 to determine their significance. In most cases, it would be possible to relocate the alignment of a proposed construction road or other impact area in order to avoid known archaeological sites or those that may be discovered during future investigations for any of the alternatives. If avoidance is not possible, the USACE, in consultation with the SHPO and Native American tribes, shall develop a data recovery plan and the approved recovery plan would be implemented prior to initiation of any ground disturbing activities. All USACE construction contracts include a discovery clause: Pursuant to 36 C.F.R. 800.13, should previously unknown artifacts, cultural features, or historic properties be encountered during construction, work would cease in the immediate vicinity of the resource. A determination of significance would be made, and consultation with the State Historic Preservation Officer and Native American tribes that have concerns in the area would be conducted to determine the best course of action.

Tribal Scoping, Traditional Cultural Properties, and Indian Trust Assets

Consistent with the Department of Defense's American Indian and Alaska Native Policy, signed by Secretary of Defense William S. Cohen on October 20, 1998, and based on the State of New Mexico Indian Affairs Department and Historic Preservation Division's 2011 and 2012 Native American Consultations List, government to government tribal scoping letters describing the facets of the project and inviting consultation were sent to the ten Native American Tribes/Pueblos on record as having concerns in Socorro County. The ten tribes include the Pueblos of Acoma, Isleta, and Ysleta del Sur, and the Comanche, Fort Sill Apache, Hopi, Kiowa, Mescalero Apache, Navajo, and White Mountain Apache (Appendix F-8). To date, the USACE has received no tribal concerns regarding the proposed project (Appendix F-8). No traditional cultural properties are known to occur within or adjacent to the project area.

Indian Trust Assets (ITAs) are a legal interest in assets held in trust by the United States Government for Indian tribes or individuals. The United States has an Indian Trust Responsibility to protect and maintain rights reserved by or granted to Indian tribes or individuals by treaties, statues, executive orders, and rights further interpreted by the courts. The Secretary of the Department of the Interior (DOI), acting as the trustee, holds many assets in trust. Some examples of ITAs are lands, minerals, water rights, hunting and fishing rights, titles and money. ITAs cannot be sold, leased, or alienated without the express approval of the United States Government. The Indian Trust Responsibility requires that all Federal agencies take all actions reasonably necessary to protect such trust assets. The Department of Defense's American Indian and Alaska Native Policy, signed by Secretary of Defense William S. Cohen on October 20, 1998, and DOI's Secretarial Order 3175 and the Bureau of Reclamation's (Reclamation) ITA Policy require that the USACE, as the project's Lead Federal Agency, and Reclamation, as the Federal Land Managing Agency, consult with tribes and assess the impacts of its projects on ITAs. If any ITAs are identified and are to be impacted, further consultation on measures to avoid or minimize potential adverse effects will take place. If the project results in adverse impacts, consultation regarding mitigation and/or compensation will take place.

Consistent with the Department of Defense's American Indian and Alaska Native Policy, signed by Secretary of Defense William S. Cohen on October 20, 1998, and based on the State of New Mexico Indian Affairs Department and Historic Preservation Division's 2011 and 2012 Native American Consultations List, government to government tribal scoping letters describing the facets of the project and inviting consultation were sent to ten Native American Tribes/Pueblos that have indicated they have concerns within Socorro County (see this SEIS/GRR-II Appendix F-8). To date, the USACE has received no tribal concerns regarding the proposed project (Appendix F-8). No concerns regarding ITAs have been brought to the attention of the USACE.

Table 1: Archaeological Sites within or Adjacent to the Flood Plain but not in the Project Area, West Side of Existing MRGCD Levee (January 31, 2012 data)

LA Site Number	Occupation Period	Features Present?	Acres
244	Both Historic and Prehistoric	Features Present	1-5 Acres
283	Both Historic and Prehistoric	Features Present	5+ Acres
760	Prehistoric Period	Features Absent	1-5 Acres
761	Prehistoric Period	Features Present	0-1 Acres
791	Both Historic and Prehistoric	Features Present	5+ Acres
8876	Unknown Affiliation	Features Absent	0-1 Acres
31744	Prehistoric Period	Features Present	0-1 Acres
31746	Prehistoric Period	Features Present	1-5 Acres
31748	Historic Period	Features Present	1-5 Acres
50735	Unknown Affiliation	Features Absent	1-5 Acres
54679	Historic Period	Features Present	0-1 Acres
54683	Unknown Affiliation	Features Present	1-5 Acres
57005	Unknown Affiliation	Features Present	0-1 Acres
82274	Historic Period	Features Present	5+ Acres
86992	Historic Period	Features Absent	5+ Acres
104296	Historic Period	Features Present	0-1 Acres
104299	Historic Period	Features Present	0-1 Acres
104301	Historic Period	Features Present	0-1 Acres
104304	Historic Period	Features Present	5+ Acres
104305	Historic Period	Features Present	5+ Acres
104306	Historic Period	Features Present	5+ Acres
110967	Prehistoric Period	Features Absent	1-5 Acres
112743	Historic Period	Features Present	0-1 Acres
114360	Historic Period	Features Present	0-1 Acres
114361	Historic Period	Features Present	0-1 Acres
117620	Historic Period	Features Absent	5+ Acres
118235	Historic Period	Features Present	0-1 Acres
119450	Historic Period	Features Present	0-1 Acres
119451	Historic Period	Features Present	0-1 Acres
119452	Historic Period	Features Present	0-1 Acres
119455	Historic Period	Features Present	0-1 Acres
119462	Unknown Affiliation	Features Absent	0-1 Acres
130363	Historic Period	Features Present	0-1 Acres
160180	Historic Period	Features Present	0-1 Acres
160182	Historic Period	Features Present	0-1 Acres

Table 1 continued

Count of TYPE		TYPE		
OCCUP	Acres	Features Absent	Features Present	Grand Total
Both Historic & Prehistoric	1-5 Acres		1	1
	5+ Acres		2	2
Both Historic & Prehistoric Total			3	3
Historic Period	0-1 Acres		15	15
	1-5 Acres		1	1
	5+ Acres	2	4	6
Historic Period Total		2	20	22
Prehistoric Period	0-1 Acres		2	2
	1-5 Acres	2	1	3
Prehistoric Period Total		2	3	5
Unknown Affiliation	0-1 Acres	2	1	3
	1-5 Acres	1	1	2
Unknown Affiliation Total		3	2	5
Grand Total		7	28	35

Table 2: Archaeological Sites within or Adjacent to the Flood Plain but not in the Project Area, East Side of Existing MRGCD Levee (January 31, 2012 data)

LA Site Number	Occupation Period	Features Present?	Acres
280	Prehistoric Period	Features Absent	Unknown
487	Both Historic & Prehistoric	Features Present	5+ Acres
755	Both Historic & Prehistoric	Features Present	1-5 Acres
757	Both Historic & Prehistoric	Features Present	5+ Acres
758	Prehistoric Period	Features Present	5+ Acres
762	Prehistoric Period	Features Present	5+ Acres
771	Prehistoric Period	Features Absent	0-1 Acres
1097	Prehistoric Period	Features Present	Unknown
4442	Historic Period	Features Absent	5+ Acres
8743	Prehistoric Period	Features Absent	0-1 Acres
8747	Prehistoric Period	Features Absent	Unknown
31681	Both Historic & Prehistoric	Features Absent	0-1 Acres
31683	Prehistoric Period	Features Present	0-1 Acres
31686	Historic Period	Features Present	0-1 Acres
31689	Prehistoric Period	Features Present	1-5 Acres
31704	Unknown Affiliation	Features Present	0-1 Acres
31706	Prehistoric Period	Features Present	5+ Acres
31718	Historic Period	Features Present	5+ Acres
46175	Prehistoric Period	Features Present	0-1 Acres
46176	Unknown Affiliation	Features Present	Unknown
46177	Unknown Affiliation	Features Absent	5+ Acres
49785	Both Historic & Prehistoric	Features Present	Unknown
50274	Historic Period	Features Present	5+ Acres
54001	Prehistoric Period	Features Present	5+ Acres
54002	Prehistoric Period	Features Present	5+ Acres
54003	Prehistoric Period	Features Present	1-5 Acres
54004	Prehistoric Period	Features Absent	0-1 Acres
54006	Prehistoric Period	Features Present	5+ Acres
54007	Prehistoric Period	Features Absent	1-5 Acres
54008	Prehistoric Period	Features Absent	5+ Acres
54009	Prehistoric Period	Features Absent	0-1 Acres
54010	Prehistoric Period	Features Absent	0-1 Acres
54011	Unknown Affiliation	Features Absent	0-1 Acres
54012	Prehistoric Period	Features Present	5+ Acres
54013	Prehistoric Period	Features Absent	5+ Acres
54014	Prehistoric Period	Features Present	5+ Acres
55863	Historic Period	Features Present	0-1 Acres
57007	Prehistoric Period	Features Present	Unknown
57009	Prehistoric Period	Features Present	5+ Acres
68905	Prehistoric Period	Features Present	Unknown
80057	Historic Period	Features Present	5+ Acres

99816	Prehistoric Period	Features Present	5+ Acres
130992	Prehistoric Period	Features Absent	1-5 Acres
135588	Prehistoric Period	Features Absent	Unknown
135866	Historic Period	Features Present	Unknown
138496	Historic Period	Features Absent	5+ Acres
138572	Both Historic & Prehistoric	Features Absent	1-5 Acres
150500	Both Historic & Prehistoric	Features Present	5+ Acres
150501	Historic Period	Features Present	1-5 Acres
157707	Historic Period	Features Present	Unknown

Table 2 continued

Count of TYPE		TYPE		
OCCUP	Acres	Features Absent	Features Present	Grand Total
Both Historic & Prehistoric	0-1 Acres	1		1
	1-5 Acres	1	1	2
	5+ Acres		3	3
	Unknown		1	1
Both Historic & Prehistoric Total		2	5	7
Historic Period	0-1 Acres		2	2
	1-5 Acres		1	1
	5+ Acres	2	3	5
	Unknown		2	2
Historic Period Total		2	8	10
Prehistoric Period	0-1 Acres	5	2	7
	1-5 Acres	2	2	4
	5+ Acres	2	10	12
	Unknown	3	3	6
Prehistoric Period Total		12	17	29
Unknown Affiliation	0-1 Acres	1	1	2
	5+ Acres		1	1
	Unknown		1	1
Unknown Affiliation Total		1	3	4
Grand Total		17	33	50

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2009 Culture History:

CULTURAL RESOURCES

1 INTRODUCTION

In addition to primary sources, this section takes advantage of a recently completed interagency programmatic environmental impact statement (EIS) between the Corps, the Bureau of Reclamation, and the New Mexico Interstate Stream Commission. This 2007 document is concerned with the alternatives and effects of adopting an integrated plan for water operations in the upper Rio Grande Valley. For the purpose of the EIS, the river was divided into 17 segments; reach 14 generally coincides with the study area. The cultural background by temporal period that follows incorporates material from the EIS and provides the overview of the human use of this area for 12,000 years.

The archaeological site summary from the EIS covers a larger area than the study area as a five-kilometer (3.1 mile) wide buffer centered on the river was utilized. Nevertheless, it provides a good summary of adjacent sites and of what could be expected within the study area. A December 2007 file search of the computerized archaeological site files for New Mexico was conducted within one-half mile of either side of the river. The project area, as it was then defined was surveyed on the ground by archaeologists in 1997 (Doleman 1997) and, with the exception of the historic village of San Marcial that was destroyed in several floods in the 1920s, no archaeological sites occur within the levee right-of-way. Sites occur in access roads and habitat improvement areas in the floodplain and upland areas that are no longer part of the project.

As discussed below, the population of this portion of the state has remained low throughout all the time periods of human occupation, and the concomitant number of archaeological sites is low. Given the disturbance caused by the construction of the existing levees and adjacent maintenance roads (and the low flow conveyance channel) and depending on the need for additional access locations, borrow or waste areas (which would be surveyed prior to use), there will be no impacts to archaeological sites as a result of this project. The historic aspects of the levee system through the middle Rio Grande and the BNSF's, San Marcial railroad bridge (also no longer part of this project) have been sufficiently documented in volumes discussed below and no additional historic period recordation of the existing levee is required. Therefore, the reconstruction of the levees will have no effect on the archaeological record of New Mexico.

THE PREHISTORIC PERIOD

The project is located within the archaeologically defined Rio Abajo culture area of the Mogollon area but is sufficiently close to the more northern Ancestral Pueblo (Anasazi) that cultural elements associated with the Ancestral Pueblo also occur. Archaeological sites from all temporal periods, Paleo-Indian big game hunters to Hispanic villages, occur throughout the Rio Abajo (Marshall and Walt 1984:1). The Paleo-Indian Period (ca. 10,000 B.C. to 5,500 B.C.) is represented by small bands of hunter-gathers who lived with the generally migratory and now extinct mega-fauna of the late Pleistocene. The bands followed the herds all the while hunting and scavenging a great variety of animals and gathering plant foods. As a result their sites are frequently ephemeral and not obvious. Paleo-Indian sites are found in a variety of ecological settings, including the margins of ephemeral lakes (playas), ridge lines paralleling large drainages, and uplands adjacent to the Rio Grande (notably in the Cochiti Dam region, well to the north of the project area). Isolated artifacts and a few sites from both Clovis and Folsom occupations occur between the Rio Puerco to below Elephant Butte Reservoir. Clovis material is rare, probably because sites from this time period generally are not found in near-riverine settings. The atlatl or spear thrower was the primary hunting weapon and three major complexes (temporal sub-divisions) are defined based on variability of the stone spear points manufacturing techniques; these include Clovis, Folsom, and Plano (Appendix O, 2007:O-9 through O-10). There are only two Paleo-Indian sites recorded in the greater URGWOPS area of consideration for Reach 14.

The Paleo-Indian Period is followed by the similarly adapted Archaic-period peoples (ca. 5,500 B. C. to A.D. 400); however, they were living in an environmental setting that was comparable to the modern era. The flora, fauna, and semiarid ecosystem were similar to those of today. Hunting remained important throughout the period and included animals of all body sizes; there was a concomitant decrease in spear-point size as the animal's body size decreased. Plant gathering and processing was increasingly relied upon, as suggested by the increase in the frequency of grinding implements. The increased gathering and hunting of smaller animals was necessitated by an increase in the human population and a reduction of unoccupied or unused territory. Social organization probably remained at the family and band level; however, the sites are more visible and more numerous. Even though their ranges were more restricted, they remained mobile and utilized both geographically and seasonally available resources. Temporal and regional distinctions are again based on stylistic variations in the spear points. Projectile point stylistic variation increased dramatically during the Archaic as their mobility was increasingly restricted and interaction with other groups was less frequent. Archaic Period sites are found in a greater variety of elevations and topographical situations than was the case with the preceding Paleo-Indian Period. In the area around the proposed project Archaic Period sites are generally located along the margins of the Rio Grande and on White Sands Missile Range to the east. Sites are generally absent from the Rio Grande floodplains due to channel realignment and erosion; however, they occur relatively frequently in the dune fields and along the escarpments adjacent to the Rio Grande. Restricted territories required strategies to increase food production from less area; therefore, the transition to agriculture was well underway during the terminal Archaic. This adaptive strategy was accompanied by the almost simultaneous appearance of more permanent structures and storage facilities. There are 40 Archaic Period sites recorded in the greater URGWOPS area of consideration for Reach 14 (Appendix O, 2007:O-10 through O-12).

The next major period of cultural differentiation is referred to as Ancestral Pueblo (frequently referred to as Anasazi) in the northern portion of the Southwest and the Mogollon in the southern portion of New Mexico. The name Mogollon stems from work conducted in the late 1940s. About 2,000 years ago there was a shift from mostly nomadic hunting and gathering to more settled agriculturally based strategies that included a component of hunting and gathering. A variety of names exist for different temporal segments in the different geographic subdivisions of southern New Mexico as regional differentiation continues to be expressed in tools and especially pottery styles and designs. While variability occurs, between A.D. 200/300 and A.D. ll00/1200 the inhabitants lived in small villages of ephemeral surface structures and several pit houses. With the exception of ceramics that were mostly variations of undifferentiated brown ware and the use of the bow and arrow, the other tools were not unlike those used during the late Archaic Period. The more substantive houses suggest a more sedentary adaptation as it was necessary to remain in close proximity to the agricultural fields. Toward the end of this time period, villages became larger and more substantive (up to 10 surface rooms and several pit structures) suggesting increased social and economic organization. Locations were occupied that were unutilized in the preceding period. Pottery from other locations is found by archaeologists, suggesting trade and exchange of goods was occurring. For example, Mimbres Mogollon pottery clearly indicates interaction with the western part of New Mexico; however, the nature and intensity of the interaction is currently unknown. Sites from this time period are located in riverine settings, on the adjacent gravel benches, and at the confluences of tributaries with the main stem of the Rio Grande. The availability of permanent water sources appears to be an important factor in these settlements. There are 39 Mesilla Phase (one name for this temporal phase) sites recorded in the greater URGWOPS area of consideration for Reach 14 (Appendix O, 2007:O-17 through O-18).

The next temporal period, the Doña Ana Phase A.D. 1200-1300, was originally proposed in 1948 as a transition between two longer lasting phases, and the transition from predominantly pit house villages to predominantly surface room villages. The phase’s validity and usefulness has been debated ever since, especially as additional archaeological work indicated that the transition between pit houses and surfaces rooms was not a dramatic event taking place in 100 years. Regardless of the name applied, surface rooms became more common, the villages were markedly larger and frequently constructed of adobe, and the named pottery types proliferated. Based on the increases in site size and numbers, the regional population was growing and regional interaction throughout the Southwest and northern Mexico was increasing. Sites occur along the upper terraces of the floodplains and adjacent bluff escarpments of the Rio Grande. Some large sites appear to be situated in defensible locations such as buttes, knolls, and certain river benches. Perhaps coincidentally, this temporal period follows the Chacoan collapse and coincides with the Mesa Verde abandonment and the general depopulation in much of the Anasazi homeland to the west and northwest. There are 26 Doña Ana Phase sites recorded in the greater URGWOPS area of consideration for Reach 14 (Appendix O, 2007:O-18).

The El Paso Phase (also referred to as the late Puebloan, or the Ancestral Piro) dates between A. D. 1300 and 1450/1540 represents the terminal portion of the Mogollon Phase sequence in this area. In the riverine corridor it is characterized by a dramatic population increase, with people aggregated into large plaza-oriented villages constructed of puddled adobe. The increase in village size is clearly seen when comparing 14th and 15th century sites. Many 14th century sites average around 100 ground-floor rooms, contrasted with 200 to 600 rooms in the 15th century. This period marks the first major expansion to the west bank of the Rio Grande. In some locations sites appear to have been paired on the east and west sides of the river (Tainter and Levine 1987:43); however, alluvial terraces and playa margins seem to have been the preferred locations. Regional interaction reached its maximum during this phase as the ceramic assemblage remained varied, types from northern Mexico continued to occur, as did types from southern Arizona. Ornaments manufactured from both Pacific and Gulf Coast marine shell and copper bells from Mexico have been found. Gathering of wild plant material supplemented a variety of agricultural products, and the ground stone used to process these materials increased in number and variety. There are 21 El Paso Phase sites recorded in the greater URGWOPS area of consideration for Reach 14 (Appendix O, 2007:O-18 through O-19).

THE HISTORIC PERIOD

The Spanish Period (1540-1821)

In the Southwest the Historic Period is initiated by the arrival of the Spanish. In New Mexico the Coronado expedition of 1540 was the initial exposure of the indigenous population to Europeans. Between Coronado and the first permanent settlement established by Oñate in 1598 in north-central New Mexico, several other expeditions passed through the area. The early Spanish explorers and settlers recorded observations concerning the Indians they encountered such as their nomadic or settled adaptation, size and layout of the pueblos or camps, room size and function, clothing, crops, and etc. Unfortunately, it is frequently difficult to identify the exact locations or groups they discussed. European diseases and exploitation, warfare, and life-style changes caused a marked decline in the indigenous population and ultimately let to the Pueblo revolt of 1680 when all Europeans in New Mexico were driven to the area around El Paso, Texas. Some Indians accompanied the retreating Spanish, and some of them remained permanently in the El Paso area following the Spanish return to the north. In 1692 the Spanish reentered Santa Fe resulting in an uneasy coexistence between various European and Indian groups. A small revolt localized in the San Juan, Santa Clara area occurred in about 1698; however, it lasted for only one year. As Americans expanded from the east towards the west they displaced many Native American tribes – some of which moved into the Southwest and New Mexico. Such groups as the Apache, Navajo, Utes, and Comanche alternatively traded and raided throughout the Rio Grande Valley. With the exception of the 12-year absence during the Pueblo Revolt, the northern reaches of the Rio Grande remained occupied by Europeans from 1598 through the Spanish Colonial, Mexican, and Euro-Anglo Periods. In contrast, much of the southern portion of the state, including the project area, was not occupied by Europeans until after the end of the Mexican Period, or post-1848.

During the early Spanish explorations they recorded a number of occupied pueblos between El Paso, Texas, and Socorro New Mexico; however, by the mid-1600s the number of larger/named pueblos decreased from 14 to three in this same area. This coincides with a decrease of the number of pueblos in the northern part of the state and suggests a pan-regional population decline and territorial abandonment. The study area was largely uninhabited as it was generally bypassed by the Spanish in their zeal to colonize the northern more populated reaches of the Rio Grande. Even as late as the 19th century, the region between El Paso and Socorro was referred to as *la tierra afuera* (the land outside). Archaeological research has located pre-revolt Piro Pueblos at Sevilleta (ca 1620-1670); Socorro (1626-1680); Qualacu (ca. 1598-1692); San Pascual on Bosque del Apache (pre-1681); and Senecu (ca. 1581-1680) (Appendix O, 2007:O-43).

In addition to the more settled agriculturalists, groups of nomadic hunter-gatherers remained and were described by the Spanish; however, it is difficult to know if different explorers were naming a different group or giving a different name to a previously recorded group. Those in proximity to El Paso (e.g., the Suma groups and the Manso) were better recorded due to the Spanish priests and missions around El Paso but many of them disappeared from the literature and it is unknown who their modern descendants may be. By the end of the 18th century, Spanish explorers mentioned such groups as the Mansas Sumas, Jumanos and later the Apache. These groups lacked the large agricultural villages and populations; therefore, the Spanish colonization policies requiring access to native land and labor were ineffective and they were largely ignored. Unfortunately the Spanish disinterest resulted in little documentary information concerning the Native Americans in southern New Mexico throughout most of the Spanish Period. By 1796, all of the native tribes in the southern area were referred to as Apaches, although numerous regional subgroups were acknowledged as existing. The Mescalero Apaches appear as a group between the 1690s and the 1780s. They were largely undisturbed until the arrival of the Anglos in the 1850s. Their population was quite low, with an estimate of 1,500 in 1847. However, by 1862 systematic military campaigns against the Mescalero began; the survivors were confined to Bosque Redondo and Fort Stanton, approximately 160 and 80 miles to the east, respectively. During this time the Socorro (1815) and *Pedro Armendaris* #34 and #35 (1820) grants were established. Later Anglo accounts indicated that associated settlements struggled throughout much of their early history (Appendix O, 2007:O-46 through O-47).

During the 300-year long Spanish occupation trade and commerce occurred between New Mexico and Mexico City via the *Camino Royal*. Established in the 1500s, the 1200-mile long *El Camino Real de Tierra Adentro* connected the colonial centers of Chihuahua, El Paso, and Santa Fe to Mexico City and was the primary thoroughfare used by missionaries, colonists, soldiers, and commercial interests. The route entered the *Provencia de Nuevo Mexico* below *El Paso del Norte*, crossed the Rio Grande at El Paso, and followed the Rio north to Las Cruces. Here the trail departed and crossed the 125-mile long barren, waterless, desert known as the *Jornada del Muerto* subsequently rejoining the river near the present day San Marcial in the project area. The trail continues along the east bank northward to Santo Domingo and Santa Fe (U.S. Fish and Wildlife Service 1987).

The Mexican Period (1821-1846)
With Mexico's declaration of independence from Spain in 1821, New Mexico became part of the Independent Republic of Mexico under the Treaty of Cordova; the changes in administration had essentially no effect on New Mexico's governmental policies or on the lives of most of the residents. Previously the New Mexico Province was isolated from foreign trade and people by Spanish law and was solely reliant on the *Camino Royal*. The opening of the Santa Fe Trail with its link to Missouri opened the province. For the first time Santa Fe was not the end of the line but rather a midpoint for two important commercial trails, the Santa Fe and the Chihuahua. A stage coach line followed the *Camino Royal* until the 1880s when the Atchison Topeka and Santa Fe railroad constructed its line along the *Camino.* Today what appear to be traces of the *Camino Royal* are visible from the air in the northern Rio Grande, on the east bank of the Rio within the Bosque del Apache Wildlife Refuge, the *Jornada del Muerto* and El Paso areas. Most of these segments have never been verified on the ground (U.S. Fish and Wildlife Service 1987).

During the brief Mexican Period, interaction increased between Americans and the Native Americans and Hispanics of New Mexico. In 1822, New Mexico's population was about 40,000 people and had increased to 55,400 in 1840. The area between Socorro and El Paso remained as it had been during the preceding 200 years – devoid of Mexican occupation. During the latter portion of the Spanish Period, the Utes and Comanches acquired horses and firearms resulting in intense and protracted warfare among native groups. The Mescalero were caught between the Spanish along the Rio Grande to the west and the Plains Indians to the east. The collapse of the Spanish Empire in 1823 and the difficulties the Mexican government had in devising effective policies for the distant portions of their newly acquired realm resulted in another outbreak of warfare. Raiding upon scattered Mexican settlements by the Mescalero Apache and other groups was common during this period. This was one of the factors that resulted in the project area being largely unoccupied by Euro-Americans throughout much of the 18th and 19th centuries (Appendix O, 2007:O-39 and O-47).

During the Mexican Period, several new land grants were established in the southern portion of the state; two, the *Bosque del Apache* and the *Jornada del Muerto/ Armendaris,* are within the study area. In 1845 Antonio Sandoval, a wealthy citizen in Albuquerque, petitioned for and was granted three tracts of land, two for grazing and one for farming. The latter was the *Bosque del Apache* grant . The *Jornada del Muerto* grant was issued in 1846 but overlapped the *Armendaris Fray Cristobal* grant. Armendaris maintained his claim to his land even after abandoning them due to Navajo raids in 1824, and he protested the proposed grant boundaries. The petitioners were prohibited from making improvements until the suit was settled. The matter was resolved some years later when the Court of Private Land Claims rejected the *Jornada del Muerto* land grant (Tainter and Levine 1987:105).

On August 15, 1846, General Stephen Watts Kearny and the Army of the West marched into Las Vegas, New Mexico, and claimed the territory of New Mexico for the United States. Some have argued that the take over may have been negotiated before

Kearny arrived. As Governor Armijo offered no opposition, it has been suggested that James Magoffin, an influential American trader and liaison to Mexico, arranged the 'conquest' with Governor Armijo. Mexican rule ended with the 1848 acquisition of this region (and California) by the United States under the Treaty of Guadalupe-Hidalgo and the 1854 Gadsden Purchase. Given the brevity of this period, the low population density, and raids by nomadic Indians, very few substantive events occurred in the study region (Tainter and Levine 1987:112-113).

The American Period (1846 – Present)

The American entry into the New Mexico Territory in 1846 set in motion long-term changes. With the subsequent defeat of the Mexican army, New Mexico officially became a territory of the United States. However, conditions remained largely unchanged from those observed during the Mexican Period until after the Civil War and the final subjugation of the Apaches in 1881. Among the important factors affecting development of the lower reaches of the Rio were the resolution of water disputes with Mexico and the appearance of large-scale irrigation projects advanced by the Bureau of Reclamation. Hispanic settlements were few in number and generally small. The few Anglos entering the New Mexico Territory gravitated to the existing somewhat larger towns. With the acquisition of these new territories, the United States began its westward expansion in earnest; however, the conquest of New Mexico would not be complete until the nomadic Indians were subdued. Even as late as the mid-1850s, incessant raids by Apaches and Navajos impeded extensive settlement in the southern portion of the state (referred to as the *Rio Abajo*). In February 1852, 143 citizens of Socorro County petitioned the Territorial Governor for protection. In response garrisons were sent to Doña Ana, Socorro, Tome, and Albuquerque. Fort Conrad, built in 1851 just east of Valverde near the project area, offered some protection; however, it was abandoned in 1854 when Fort Craig, also near the project area, was constructed (Tainter and Levine 1987). On February 21, 1862, one of two Civil War battles fought in New Mexico occurred at Valverde, north of the Union-held Fort Craig. In a one-day battle the Confederate forces under General H.H. Sibley defeated the Union detachment under Colonel E.R.S. Canby. The Union forces subsequently surrendered the town of Socorro. Later following a battle at Glorieta in north-central New Mexico, Sibley's forces retreated to Texas but bypassed Fort Craig (Tainter and Levine 1987:115, 118).

Following the Civil War battles in New Mexico, military action against the Navajos and Apaches intensified throughout New Mexico. In the southern part of the state, Lemitar, about 20 miles north of beginning of the project, was attacked in 1863 and 1864 by Navajos living about 15 miles to the west at *Ojo de Cibola.* In 1862 Colonel Christopher (Kit) Carson was ordered by Commander James H. Carleton to round up Mescalero Apaches and Navajos and confine them to an internment camp at Bosque Redondo near Fort Sumner approximately 160 miles east of the project area. Indians from a number of tribes were thrust together regardless their respective animosities. The American government was unable to provide adequate supplies or control the hostilities. The Mescaleros fled Bosque Redondo in 1865 and in 1873 were resettled on a reservation south of fort Stanton in southeastern New Mexico. In 1868 The Navajo were allowed to walk back to their homeland in northeastern Arizona and northwestern New Mexico. By the late 1860s the Indian wars in central New Mexico ended, and permanent Anglo settlements were viable (Tainter and Levine 1987:118-119).

In order to resolve the conflict between Hispanic and American land values and to clear land titles, the Office of the Surveyor General was established in New Mexico in 1854. One goal was to survey the public domain and establish the township grid by which tracts of land could be legally described. The 1855 New Mexico cadastral survey fixed the central meridian control point establishing the principal meridian and baseline for the state's township and ranges within a room block of the Cerro Indian Pueblo archaeological sites (Marshall 1984:147). Between 1854 and 1860 the Rio Grande from Santa Fe to El Paso was surveyed (Tainter and Levine 1987:119). Growth in the southern portion of New Mexico was spurred, in part, by passage of the 1862 Homestead Act and the 1902 Reclamation Act. The Homestead Act allowed up to 160 acres of public land to be claimed by individuals who would gain title to the land following five years of residence and improvements. The 160-acre tracts were insufficient for dry-land farming in much of New Mexico. The 1902 Reclamation Act initiated large-scale irrigation projects throughout the west; Elephant Butte Dam was among these (Appendix O, 2007:O-47 through O-49).

In 1880, the Atchison, Topeka, and Santa Fe (AT&SF) transcontinental railroad reached San Marcial at the terminus of the project area. With the arrival of the railroad, the mining industry expanded at an explosive rate and manufactured goods began to enter New Mexico in unprecedented quantities. Socorro County experienced a minor developmental boom between 1870 and 1893 following the discovery of silver within the Socorro Peak mining district. The boom fizzled in 1893 when the government ceased making silver coins. A smelter was opened in Socorro in 1881 to refine lead carbonate ore extracted from the Magdalena mining district. In 1883 a railroad spur was constructed from Socorro to Magdalena and then south to Kelly and the lead mines. Cattle were driven from the Plains of Saint Augustine to the railhead in Magdalena for shipment to the growing cities of New Mexico and the southwest. By the late 1800s decreasing lead prices forced a closure of the mining and smelting industry in the Socorro area. (In the mid-1990s one of the abandoned lead mines of the Magdalena district was used by the Corps' Waterways Experiment Station for experiments supporting the U.S. Army). The only profitable mine remaining in the immediate area was the Carthage coal field which may have been mined as early as the 1850s to supply Forts Conrad and Craig. The coal field, located about 10 miles south and east of San Antonio, supplied the Socorro smelter with coke. In 1882 the AT&SF constructed a spur from San Antonio in the project area to Carthage to haul the coke. The spur was used until 1894 or 1895, at which time the mine temporarily closed. The mine reopened for large scale commercial production in the early 1900s, and a new railroad, New Mexico Midland Railroad (NMMR) in use from 1906 to 1936, was constructed on the old AT&SF route. Following closure of the Carthage field, the NMMR continued to haul coal from the Tokay mine located two miles south of Carthage. The Tokay field operated from 1915 to about 1950; however, during the last 15 years of operation, coal was trucked to San Antonio (Tainter and Levine 1987:130).

The small village of San Marcial was founded in 1854 by a farmer, Pascual Joyla on the east side of the Rio Grande at the north base of Black Mesa in an area of 5,000 acres between the river and a bluff. He and others provided produce to Fort Conrad, farther to the north. This community was called La Mesa de San Marical (frequently called La Mesa). In 1866, the village was devastated by a flood, and many residents moved to the west side of the river and continued to call it San Marcial. Following the arrival of the railroad *New* San Marcial, at the present-day location, was established to the west of *Old* San Marcial (from 1886) and to the west of the railroad station. Until the arrival of the railroad these were largely self-contained villages with the residents raising the food they needed. On the San Marcial side of the Rio (i.e., west), only about 2,000 of the 5,000 acres could be cultivated – the rest were waterlogged. By 1908, silt from local arroyos and seepage from the river rendered the 2,000 acres useless, and the better land on the east side of the river being farmed by residents of the communities of Val Verde and La Mesa became the farming location for San Marcial. Raising and selling livestock was also important after the Army established a presence between 1963 and the 1880s; however, once the Pedro Armendariz Grant was sold several times and the fences were repaired by 1925, the economic viability of livestock commerce declined greatly (Julyan 1996:317; Van Citters 2000:4).

The arrival of the railroad had the greatest economic impact on San Marcial. A new community, New San Marcial, sprang up to the west of the railroad station and by the early 1900s it was the second largest town in Socorro County. However, its proximity to the river and the fact that it was at essentially the same elevation as the river resulted in perpetual mud and a water table so high that it was impossible to even dig an outhouse. It is reported that through trains (i.e., not making a stop in San Marcial) generated sufficient vibration that the town shook as the waves traveled through the spongy earth. The residents wanted the town moved ("…so we can quit living like pigs in a mud hole.") (idib. 9), but the AT&SF was unwilling to pay the cost. Significant flooding began in 1904. By 1911 a series of shallow ditches through the town carried water back to the river about three-quarters of a mile to the south. The two floods of August and September, 1929, determined San Marcial's fate, as well as La Mesa and other small villages on both sides of the river. Most of the village was covered by a lake, informally named 'San Marcial Lake'. Most of the residents and the railroad moved to the north. The flood of 1937 forced most of the remaining resident out. (Van Citters 2000:4-12). Throughout most of the village the 1929 flood deposited mud up to the house's eaves (e.g., Van Citters 2000:Figure 18).

On January 6, 1912, New Mexico was admitted to the Union as the 47th state. Among the most important factors affecting development in the region was the resolution of water disputes between the United States and Mexico and the initiation of large-scale irrigation and flood control projects by the Bureau of Reclamation and the Corps. Between 1911 and 1916 the Bureau of Reclamation constructed Elephant Butte Dam. During times of surplus, the head waters of its reservoir are within a few miles of the lower end of the study area. In 1923 the Middle Rio Grande Conservancy District was created to develop an efficient irrigation system and to ensure drainage and flood protection for communities situated along the Rio. The Conservancy low-flow conveyance channel parallels the Rio

Grande in the study area (and appears to be on top of San Marcial's main street. A major flood along the Rio in 1929 caused extensive damage to the towns and facilities of Old and New San Marcial, Valverde, and La Mesa (the two former are with in the study area and the latter was situated upstream of Elephant Butte Dam). Following the flood, the AT&SF relocated all of its facilities from San Marcial to Belen. This action sent the local economy into a downward spiral forcing many residents to move from the area in search of work. Today the Middle Rio Grande valley continues to be an important agricultural area. The larger towns of Socorro and San Antonio supply goods and services to neighboring communities and travelers. The New Mexico Institute of Mining and Technology, formerly the New Mexico School of Mines established in 1889 during the mining boom, is located in Socorro which is also county seat.

DISCUSSION

While human occupation of this area has spanned many millennia, the environment was such that the population numbers remained generally low until after the coming of the railroad in the later 1880s and the archaeological site density is lower. While, the construction of the existing levees and maintenance road would have impacted any sites in their path, few sites would have been expected given the proximity to the river and the wandering of the river until after construction of the upstream dams. Additional impacts occurred during the early 1950s Bureau of Reclamation construction of the low flow conveyance channel and adjacent maintenance road. As best as can be determined by comparisons to various maps and aerial photos from 1935 onward, the low flow conveyance channel (essentially) goes down the main street of New San Marcial.

The recommended flood control project is one of a number of Corps' undertakings along the middle Rio Grande. The Corps, in consultation with the New Mexico State Historic Preservation Officer (SHPO), identified the existing levee structures along the Middle Rio Grande as a significant element of the large array of flood control, drainage, and irrigation facilities constructed between the mid-1920s and the 1930s by the Middle Rio Grande Conservancy District. These facilities have had far reaching impacts on water usage and politics from the time of their construction to the present day. As a means of mitigating the loss of the original levee structures through rehabilitation, the Corps prepared a package of documentation including an historic narrative, engineer drawings, and photographs for the New Mexico Archives and public dissemination. The public report is entitled *Historical Documentation of Middle Rio Grande Flood Protection Projects: Corrales to San Marcial* by K. Lynn Berry and Karen Lewis, 1997. A second report documenting the Corps' proposed levee rehabilitation through Albuquerque is due to be published in January 2008. The report, *Controlling the Floods, the Role of the U.S. Army Corps of Engineers in the History of the Middle Rio Grande Conservancy District*, by William A. Dodge and Abraham Santillanes, further documents the climate of the times, reasons behind the construction of the levees, and variations in the design and placement of jetty jacks and other structures.

The railroad bridge crossing the Rio Grande at San Marcial was also documented in conjunction with the planning for this project. The existing railway bridge was constructed in 1930 by the Atchison Topeka and Santa Fe (AT&SF) Railway and the American Bridge Company. A "Warren Through Truss" design, the bridge is composed of five 149-foot long sections of steel trusses on timber and concrete piers. The total length of the structure is 853 feet. The Corps evaluated the structure using the system developed by the New Mexico State Highway and Transportation Department in consultation with the SHPO. It scored 72 points out of a possible 108, placing it in the top one-third of the rating. This value is consistent with the ratings of similar highway structures. It is considered to be potentially eligible for listing on the National Register of Historic Places, given it age, relative rarity, and long-term function in south-central New Mexico commerce. Level II Historic American Building Survey documentation has been completed, as well as a public report entitled *Historic Engineering Overview of the San Marcial Railroad Bridge* by Karen Van Citters, 2000. Reuse of the bridge has been considered; however, it is unsuitable for highway, or vehicle crossing on secondary or limited access roads, due to its style of construction which would not maintain its integrity if directly impacted by an errant vehicle.

In addition to the documentation of the bridge, an archaeological survey for cultural and historic resources was conducted on the west side of the Rio Grande along the 45-mile long existing spoil-bank levee and adjacent land from the San Acacia diversion dam to the existing railroad bridge. In addition, the levee lying east of the railway tracks 3.5 miles north of the railway bridge and the east-west levee segment connecting this levee with the main levee were also surveyed. No sites or features were identified within the proposed levee reconstruction zone (Doleman 1997). For this portion of the project, the Corps is of the opinion that the construction will have no effect on cultural resources.

In April and June 2006, a 200-foot wide corridor centered on the proposed right-of-way (ROW) for the proposed relocation of the Burlington Northern and Santa Fe (BNSF) tracks and railway bridge (formerly the AT&SF) were surveyed for archaeological resources. No archaeological remains were found (Chapman and Actis 2007). Impenetrable stands of salt cedar and Russian Olive prevented surveyor access to all portions of the ROW; however, there is little probability of archaeological remains within the proposed ROW given the project's location with respect to recent river floods and the depth of sediment deposition. In this case recent refers to the historic period prior to the 1960s and 1970s construction of dams on the Rio Grande and its tributaries, such as the Chama River, the Jemez River and Galisteo Creek. Additionally, the new railway bed will be elevated above the existing surface, and there will only be minimal excavation for this portion of the construction. There is no possibility of impact to archaeological resources. Government- to-government letters describing the railroad track and bridge relocation and inviting consultation were sent in February 2006 to the 10 Native American Tribes on record as having concerns in Socorro County. The Tribes include the Pueblos of Acoma, Isleta, Hopi, and Ysleta del Sur; the Comanche, Fort Sill Apache, Kiowa, Mescalero Apache, Navajo, and White Mountain Apache. There are no Tribal concerns in this area. Similar letters will be sent to the Tribes concerning the entire levee reconstruction.

While there is variability in the archaeological data recorded a general discussion is possible. The number of archaeological sites recorded naturally decreases from the URGWOPS overview perspective of 5.5 km centered on the river to the actual on-the-ground survey data of the existing levee. The URGWOPS investigation recorded numbers of prehistoric sites but not historic sites; there is a total on 128 prehistoric sites in their Reach 14 which roughly coincides with the levee project location. There is an interesting difference between the east and west sides of the river in the number of prehistoric and historic sites within one-half mile (0.8 km). On the east side there are 180 prehistoric and historic sites and on the west side there are 40. There are none in the immediate project area (levee and adjacent maintenance road), and no sites will be affected during the reconstruction of the existing levee (ignoring any, as of yet, unspecified borrow or waste areas).

New Mexico SHPO Section 106 consultation will be conducted concerning the results of the new railway right-of-way survey. In the event that any new access roads, borrow or waste areas are required, they will be surveyed and reported upon. In most cases it should be possible to relocate a road or other impact areas in order to avoid any archaeological sites that may be discovered. If avoidance is not possible, the Corps in consultation with the SHPO shall develop and implement a data recovery plan prior to initiation of any ground disturbing activities.

In order to estimate potential impacts to archaeological sites within the proposed project area, several different tabulations of site data were created. For the large scale perspective the material provided in the URGWOPS area of consideration for Reach 14 (Appendix O) was used. As noted above, this data set tabulates sites within 2.5 miles of either side of the river; therefore, it includes many sites clearly outside of the area of impact but does provide a good overview of what could be expected. Unfortunately, for unstated reasons, the authors of Appendix O only tabulated prehistoric sites, and these included sites from the Paleo-Indian period, the Archaic period, and ancestral Pueblo period.

As discussed in this paragraph, the reconstruction of the levee will have no impact on any archaeological site. The expanded overview of the numbers of sites within varying distances of the project clearly indicate that any borrow or waste sites, additional access roads, or habitat restoration locations will have to be surveyed in advance of ground disturbance. Based on a December, 2007, search of the New Mexico Archaeological Records Management Section Database for the east side of the river and within one-half mile of the flood plain, there are 171 prehistoric and historic sites, including 118 prehistoric, 19 historic, 13 multi-component, and 21 temporally unknown. A comparable number would also be found on the west side. Restricting that same search to the flood plain there are 10 sites on the east side of the river and 40 sites on the west side. For the purpose of this compilation, we considered the flood plain to extend from the bases of the bluffs on either side of the river. This flood plain is not consonant with that used in the economic or hydrological studies. The 10 sites in the east-side floodplain include two multi-component, three historic and five prehistoric sites. The 40 sites in the west-side floodplain include no multi-component, 32 historic, four prehistoric, and four temporally unknown sites. Within the area that will be disturbed by levee reconstruction (the levee's existing footprint and existing maintenance road, there are no archaeological sites and nothing will be impacted (Doleman 1997). There were no tribal concerns associated with the possible bridge replacement and associated realignment of the railroad right-of-way. Additional tribal letters will be sent out concerning the levee replacement.

2 FUTURE WITHOUT PROJECT

In the event the project is not completed, approximately 40 archaeological sites on the west side of the river would be impacted in the event of a major flood, such as those that occurred 1929 (one in August and the second in September) and again in 1937. The destruction in the town of San Marcial during the 1929 floods was such that most of the people moved, and the AT&SF closed their division headquarters in San Marcial and moved further north.

3 ALTERNATIVES

A. The construction of the levees from San Acacia to Tiffany Junction. As long as no new access roads or staging areas are required, no additional material is needed, and any excess material is disposed of on or immediately adjacent to the new levee, this alternative will have no impact on cultural resources. The levees themselves can be considered historic properties, and the Albuquerque District has documented two upstream segments as a means of mitigating for the loss of the original levee structures as a result of the rehabilitation program. The Corps prepared a documentation package including an historic narrative, engineer drawings, and photographs for the New Mexico Archives and public dissemination. The public report is entitled *Historical Documentation of Middle Rio Grande Flood Protection Projects: Corrales to San Marcial* by K. Lynn Berry and Karen Lewis, 1997. While this compilation served to fully document any future work on the levees (by the terms of an MOA between the NM SHPO and the District), it was determined that an additional report further documenting the climate of the times, reasons behind the construction of the levees, and variations in the design and placement of jetty jacks and other structures, was appropriate. The second report, *Controlling the Floods, the Role of the U.S. Army Corps of Engineers in the History of the Middle Rio Grande Conservancy District*, by William A. Dodge and Abraham Santillanes documenting the Corps' proposed levee rehabilitation through Albuquerque, is due to be published in January 2008. No additional documenting of the levees is required at this time.

B. The construction of the levees from San Acacia to Tiffany Junction and the Tiffany Sediment Basin. The Tiffany Basin includes a portion of the agricultural fields of the former village of San Marcial. As discussed above the fields were abandoned by 1908 and were severely impacted by subsequent decades of flooding. Currently they are under meters of dirt. Any use of this area as a sediment basin will have no impact on cultural resources. Any important information concerning the town and its associated facilities can be gathered from archival resources. As long as no new access roads or staging areas are required, no additional material is needed, and any excess material is disposed of on or immediately adjacent to the new levee, this alternative will have no impact on cultural resources.

C. The construction of the levees from San Acacia to Tiffany Junction and relocation of the San Marcial railroad bridge. As long as no new access roads or staging areas are required, no additional material is needed, and any excess material is disposed of on or immediately adjacent to the new levee, there will be no impacts resulting from the levee work. The relocation of the San Marcial Bridge will have no effect to cultural resources because the bridge was recorded to Historic American Engineering Record (HAER) Level II standards (Van Citters 2000), and the proposed relocated right-of-way for the approaches to the replacement bridge was surveyed for cultural resources and none were found (Chapman 2006). There were no tribal concerns expressed for this portion of the project. This alternative will have no impact on cultural resources.

D. This alternative is a combination of A through C and as discussed in those paragraphs there will be no effect to cultural resources.

E. San Marcial Railroad Bridge. The relocation of the San Marcial Bridge will have no effect to cultural resources because the bridge was recorded to Historic American Engineering Record (HAER) Level II standards (Van Citters 2000), and the proposed relocated right-of-way for the approaches to the replacement bridge was surveyed for cultural resources and none were found (Chapman 2006). There were no tribal concerns expressed for this portion of the project. This alternative will have no impact on cultural resources.

F. Tiffany Sediment Basin. The Tiffany Basin includes a portion of the agricultural fields of the former villages of San Marcial, Valverde, and La Mesa. As discussed above the fields were abandoned by 1908 on the west side of the river as it was then located and were severely impacted by subsequent decades of flooding. Currently they are under meters of dirt. Any use of this area as a sediment basin may have an impact on cultural resources, as traces of the historic Valverde Ditch are still evident. Prior to conduction documentation, the ditch’s eligibility would have to be ascertained. Any important information concerning the town and its associated facilities can be gathered from archival resources.

G. This alternative is a combination of A through C with the addition of a levee segment west of the proposed Tiffany Sediment Basin. The effects of alternatives A through C are as discussed above. Due to prior flooding and other disturbance the new levee segment will have no impact on cultural resources.

H. This alternative is a combination of A, B, and G above. There will be no impacts.

I. This alternative is a combination of A, B, and G above. There will be no impacts.

J. This alternative is a combination of A and B above and a new levee to the east of the Tiffany Sediment Basin. This levee would be placed adjacent to the current location of the Rio Grande where a spoil-bank levee currently exists. This area is within the historic floodplain of the river and has been flooded countless times. Given the prior flooding, changes in the location of the river bed, and the spoil bank levee, no intact cultural resources would be found in the proposed alignment. However, the source of the material to be utilized for construction would have to identified and cleared for cultural resources and not be an area of Tribal concern before it could be excavated.

K. This alternative includes A and the new levee to the east of Tiffany (see discussion in paragraph J).

4 PREFERRED ALTERNATIVE

The preferred alternative is the reconstruction of the 43-mile long existing levee by reworking the material currently in the existing. There is sufficient material and no new borrow areas will be required. The preferred alternative will be completely within the existing levee foot print and adjacent access road. There are no cultural resources within this completely disturbed location.

Table 1 Archaeological Sites in Flood Plain but Not in Project Area; West Side of River (1 of 2)

LA Site Number	Occupation Period	Features Present?	Acres
	2009 Archaeological Site data removed – see 2012 Updated data		

Table 2 Archaeological Sites in Flood Plain but Not in Project Area; West Side of River (2 of 2)

2009 Archaeological Site data removed – see 2012 Updated data

Table 3 Features According to Time Period

Count of TYPE		TYPE		
OCCUP	Acres	Features Absent	Features Present	Grand Total
Both Historic & Prehistoric	1-5 Acres			
Both Historic & Prehistoric Total				
Historic Period	0-1 Acres 1-5 Acres 5+ Acres Unknown			
Historic Period Total				
Prehistoric Period	0-1 Acres 1-5 Acres 5+ Acres Unknown			
Prehistoric Period Total				
Unknown Affiliation	0-1 Acres 1-5 Acres			
Unknown Affiliation Total				
Grand Total				2009 Archaeological Site data removed – see 2012 Updated data

5 REFERENCES CITED

Appendix O
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GENERAL REEVALUATION REPORT AND

SUPPLEMENTAL ENVIRONMENTAL

IMPACT STATEMENT II:

RIO GRANDE FLOODWAY,

SAN ACACIA TO BOSQUE DEL APACHE UNIT,

SOCORRO COUNTY, NEW MEXICO

APPENDIX F-9

Ecological Resources

APPENDIX F-9
ECOLOGICAL RESOURCES

1. PRELIMINARY EFFECTS DETERMINATION, SCREENING OF ALTERNATIVES (January 2008)

Thirteen with-project alternatives (Alternatives A - K) were evaluated for potential beneficial or adverse effects, and requirements for mitigation. Four basic ecological resources were recognized for evaluation purposes: riverine aquatic habitat, riparian habitat, the Federally endangered Rio Grande silvery minnow (*Hybognathus amarus*), and the Federally endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus*). For convenience, this evaluation groups effects into two broad categories: those related to changes in inundation, and those related to construction and the required footprints of features.

1.01 INUNDATION

Adverse ecological affects likely to result from flood events includes the physical destruction of vegetation from high flow velocities, soil erosion, and/or sediment deposition; the temporary displacement of non-aquatic animals; and the death (primarily through drowning) of non-arboreal mammals and reptiles. Because little information exists to quantify and predict impacts to animal populations, the following discussion of ecological effects focuses on vegetation communities and areal extent of inundation as constituents of wildlife habitat quality. No attempt has been made to monetarily quantify the discussed effects. Specific habitat effects are discussed for two endangered species: the Rio Grande silvery minnow and the Southwestern Willow Flycatcher.

1.01.1 1%-chance Floodplain

Specific impacts were not quantified for this relatively rare event. Qualitatively, it is believed that this event is sufficiently severe to result in overall adverse effects to plant and animal communities.

<u>Without Project</u>

Without project, ecological damage from the 1%-chance flood event is to be expected both within the current floodway and throughout the floodplain west of the levee or railroad alignment. Affected plant communities in the floodplain include: rural and suburban yards; agricultural fields and edges; upland Chihuahuan desertscrub; and wetland and riparian communities managed at Bosque del Apache NWR.

<u>With Project (Levee Alternatives)</u>

For the with-project condition, ecological damages in the floodplain west of the levee alignment are essentially eliminated; however, adverse impacts would still occur within the riparian and aquatic communities in the floodway. Adverse effects would be extensive, yet similar to the without-project condition. Although inundation, scouring and sediment accretion are natural processes of sand-bed rivers such as the Rio Grande, the recovery of plant and animal communities from the 1%-chance flood would be slow.

Differences in effects among the various levee heights evaluated are a matter of degree, with increasing protection of floodplain communities and increasing potential damage to floodway communities. Considering the relatively rare occurrence of the 1%-chance and larger events, the economic damages that are prevented constitute a more important parameter for levee-height determination than the differential ecological damages.

1.01.2 10%-chance Floodplain

For the more probable 10%-chance event, some specific effects can be quantified. This event would most likely result from rainstorm activity; therefore inundation would be of short-duration.

<u>Without Project</u>

Generally, without the project, levee failure would result in inundation both within the current floodway and throughout the floodplain. Breached or damaged spoil bank levees would likely be quickly repaired or rebuilt along the existing alignment.

Although periodic floodplain inundation outside of the existing levee alignment has the potential for providing allocthonous material to the Rio Grande, historic and existing land uses west of the levee also present potential hazards to water quality. Following a levee breach, floodwaters would likely be of low quality and could result in the introduction of contaminants (sewage, POLs) to the river, and, therefore, would not be considered beneficial to aquatic habitat and organisms.

<u>With Project</u>

With the proposed levee replacement, the event would be contained within the current floodway. The differences in depths and velocities of the with- and without-project 10%-chance events are nominal; therefore, the extent of adverse effects would be similarly small. The magnitude of the event (approx. 10,000 cfs) is within the range of unregulated snowmelt and thunderstorm flows recorded in the Middle Rio Grande over the past 100 years, and well within the flow regime that the predominant riparian species (cottonwood, willow) have adapted.

With levee replacement, potentially adverse flooding impacts to approximately 15,000 to 20,000 acres (depending on alternative) of Chihuahuan desertscrub and agricultural habitat (and their attendant animal populations) would be prevented (Table 1).

Table 1. 10%-chance floodplain acreages for with- and without-project alternatives.

Alternative	Inundated area (ac.)	Difference from Without-project (ac.)	
10-yr Future cond., Without project	36,200	--	
10-yr Future cond., With project:			
Alts. E - F	36,200	0	
Alts. A - D (levee to Tiffany Jct.)	21,100	-15,100	Upland & undeveloped historic riparian areas removed from inundation area.
Alts. G - I (Additional levee west of Tiffany Basin)	15,400	-20,800	An additional ~5,000 acres of undeveloped historic riparian area west of LFCC is removed from inundation area.
Alts. J - K (Additional levee east of Tiffany Basin)	13,400	-22,800	A yet additional 2,000 riparian acres removed from inundation (Tiff. Basin).

Levee height alternatives: Levee height does not affect the behavior of the 10-yr event.

Rio Grande silvery minnow (RGSM) are small fish that cannot swim against high velocities for extended periods. With-levee-project depths and velocities within the 10-year floodplain were reviewed to evaluate potential effects on RGSM. Average with-project water depth in the overbank area increases by 1 to 2 feet, and extensive shallow (2 feet or less) areas still occur. Likewise, representative with-project cross-sections (e.g., Figs. 1 through 3) indicate that relatively slow-flowing (<2 ft/sec) areas are extensive enough to provide refugia for the RGSM. Summarizing, sufficient slackwater areas would remain after levee replacement to avoid flushing RGSM from the San Acacia reach.

Southwestern Willow Flycatchers (SWFLs) regularly nest in the riparian zone from Tiffany Junction downstream into the headwaters of Elephant Butte Reservoir. Upstream to San Acacia Diversion Dam, scattered, individual territories are established in some years. The slightly increased inundation area of the 10-% chance flood would benefit riparian habitat, including suitable and potentially suitable breeding habitat for the SWFL. With-project surface water elevations of the 10%-chance event would increase slightly, or decrease, in the downstream end of the study reach (Fig. 4), and would not result in the increased inundation of SWFL nests (if the event were to occur in June or July).

1.01.3 Tiffany Sediment Basin

Inundating the 2,000 acre Tiffany Basin would dramatically increase riverine aquatic habitat in the Middle Rio Grande. After sufficient sediment accumulates in the basin to reduce the possibility of mainstem headcutting, the Tiffany east spoil bank levee could be removed, opening the entire area to "run-of-the-river" flows. With sedimentation over time, the habitat would progress from aquatic habitat to a riparian plant community. Expected accumulation of sediment in the Tiffany Basin — rather than in Elephant Butte Reservoir — is on the order of 15,000 acre-feet.

The present plan proposed to introduce sediment into Tiffany Basin through a weir inlet, and evacuate water from the basin into the Low Flow Conveyance Channel through a screened outlet. Rio Grande silvery minnow would, therefore, become trapped in the Tiffany Basin in large numbers, and expire as the basin seasonally dried. Screening the inlet to prevent RGSM passage through the weir would also exclude the majority of bed material, defeating its purpose. To date, no other design solution has been formulated to resolve this issue.

Despite the potential for large ecological benefits, implementation of the Tiffany Sediment Basin also entails potentially significant adverse impacts for the RGSM which, at this time, could not be mitigated. For these reasons, the Tiffany Basin feature should not be included in the recommended plan for the San Acacia to Bosque del Apache flood damage reduction project.

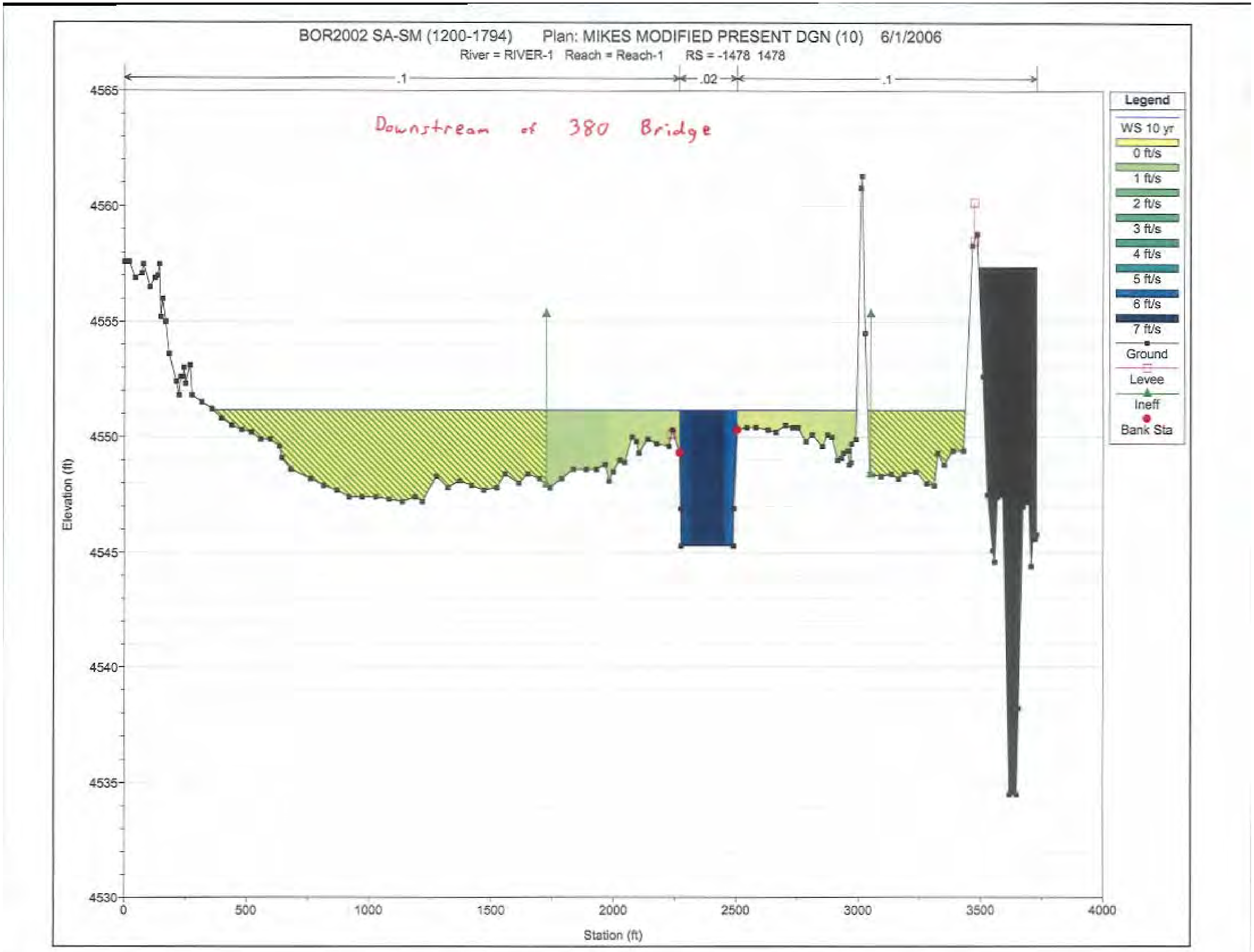


Figure 1. 10%-chance event velocities near Hwy 380 bridge.

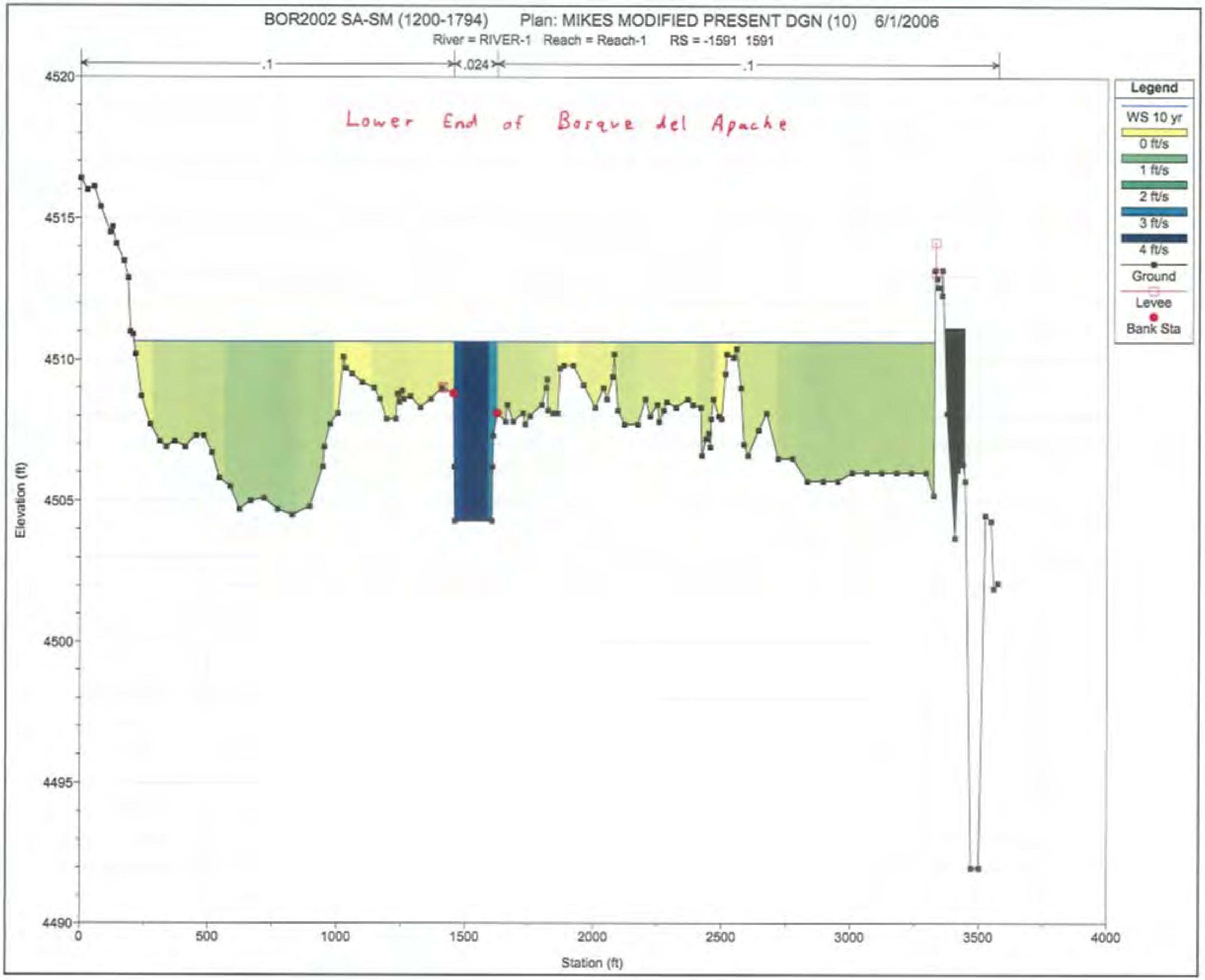


Figure 2. 10%-chance event velocities near Bosque del Apache.

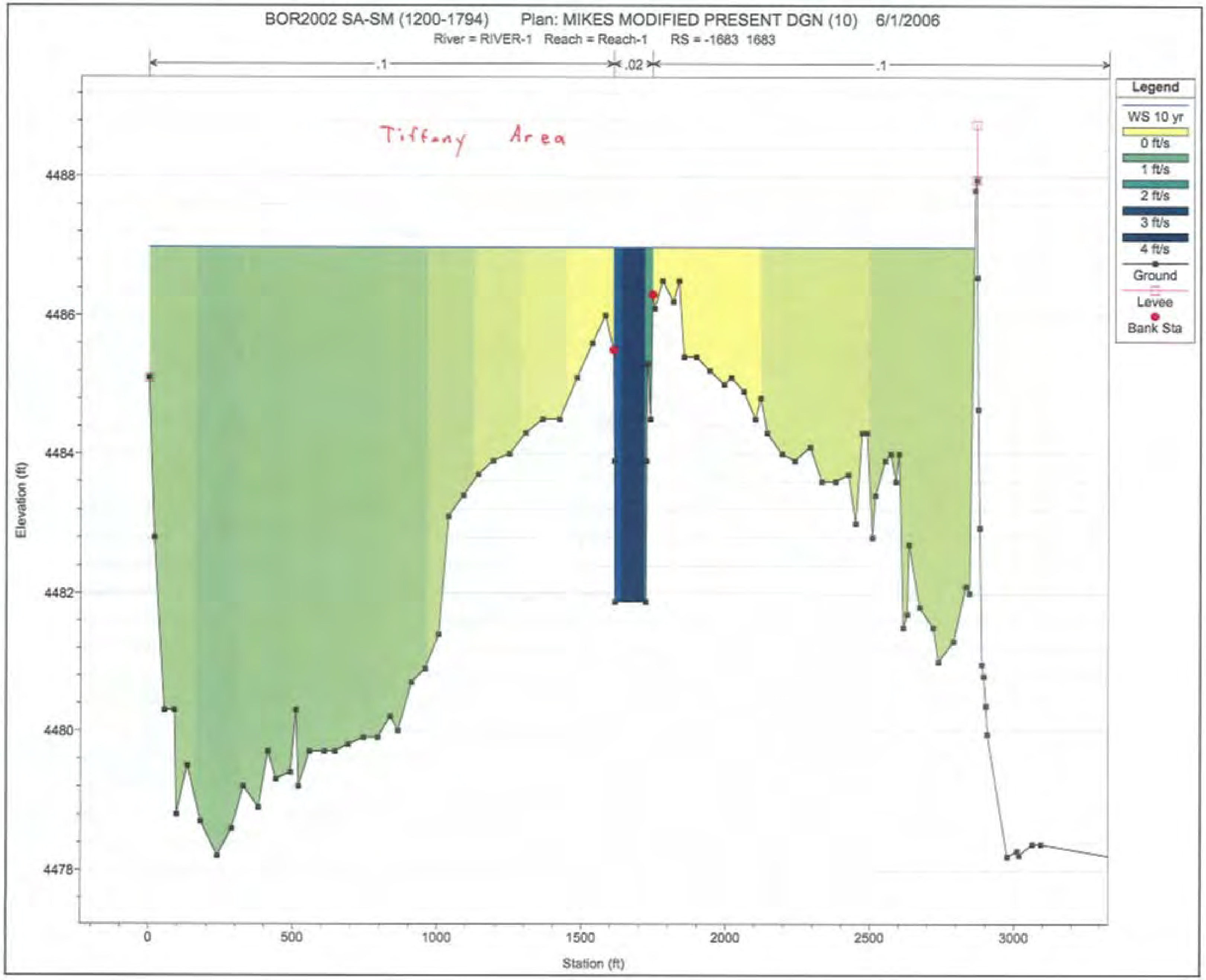


Figure 3. 10%-chance event velocities near Tiffany Basin.

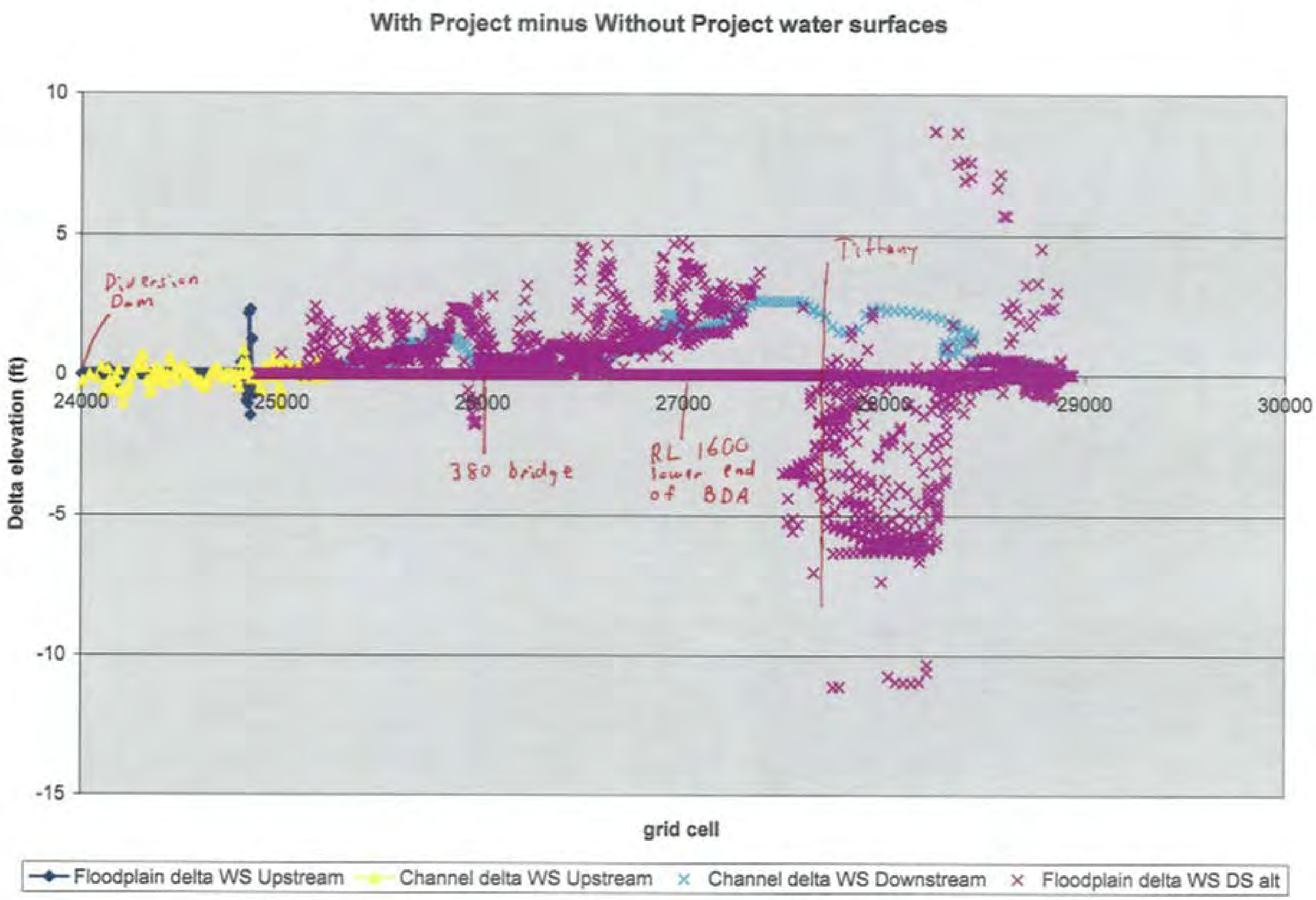


Figure 4. 10%-chance event, with-project water surface change.

1.02 FEATURE FOOTPRINTS

1.02.1 Alternative A (Primary Levee from San Acacia to Tiffany Junction)

Levee Heights and Footprints

Five levee height alternatives were included in plan formulation and NED analysis. These were based on the 100-yr water surface elevation, and increased in one-foot increments to the 100-yr + 4-feet water surface elevation.

Templates of the 100-yr and 100-yr+4ft levee cross-sections superimposed on existing topography (see examples in Figs. 5 through 7) were reviewed to estimate potential effects on riparian vegetation bordering the riverward toe of the levee. Between stations 08+00 and 1300+00, proposed levee base widths are less than the existing spoilbank width (by 50 feet or more) for all levee height alternatives. From about 1300+00 to 1900+00, the 100yr+4ft base width equals the existing width, and all other height options are less than the existing width. From about 1900+00 to 2264+00, the 100-yr base width equals the existing, and the 100yr+4ft width exceeds the existing width by approximately 30 feet.

Therefore, removal of riparian vegetation would be required in the downstream 7 to 18 miles of the proposed 46.7-mile-long primary levee. However, because the proposed levee (whatever the height) would be significantly narrower than the existing spoil bank in the upstream 30 to 40 miles, there will be a net increase to the floodway area following construction. Sufficient "newly exposed" acreage would be available for the planting of riparian trees and shrubs to offset vegetation losses at the downstream end of the levee.

Potential areas of riparian vegetation removal would not affect recent territories of breeding Southwestern Willow Flycatchers for the Alternative A segment.

Summarizing, there is no environmental preference among the 5 height alternatives analyzed for the primary levee. Although a levee with a larger cross-section would potentially require more mitigative plantings, the cost of those plantings would be more than offset by the inherent decreased cost of waste haul and disposal.

Vegetation-Free Zone

EM 1110-2-301[1] requires that no vegetation (except grasses) be allowed to grow within 15 feet of the riverward toe of new levees. Based on the discussion of levee base widths above, this would require the removal of existing riparian vegetation in the downstream 7 to 18 miles of the alignment. The respective areas of potential vegetation removal are 13 to 33 acres.

Again, the significantly narrower proposed levee (whatever its height) in the upstream 30 to 40 miles of the alignment would result in more than sufficient area (perhaps, 150 acres) for mitigative planting.

[1] When the initial screening of alternatives was performed in January 2008, EM 110-2-301, *Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, and Embankment Dams*, was the prevailing guidance. In April 2009, that document was superseded by ETL 110-2-571, *Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams and Appurtenant Structures*. The January 2008 preliminary effects determinations in this section are still valid considering the nominal changes in updated guidance document.

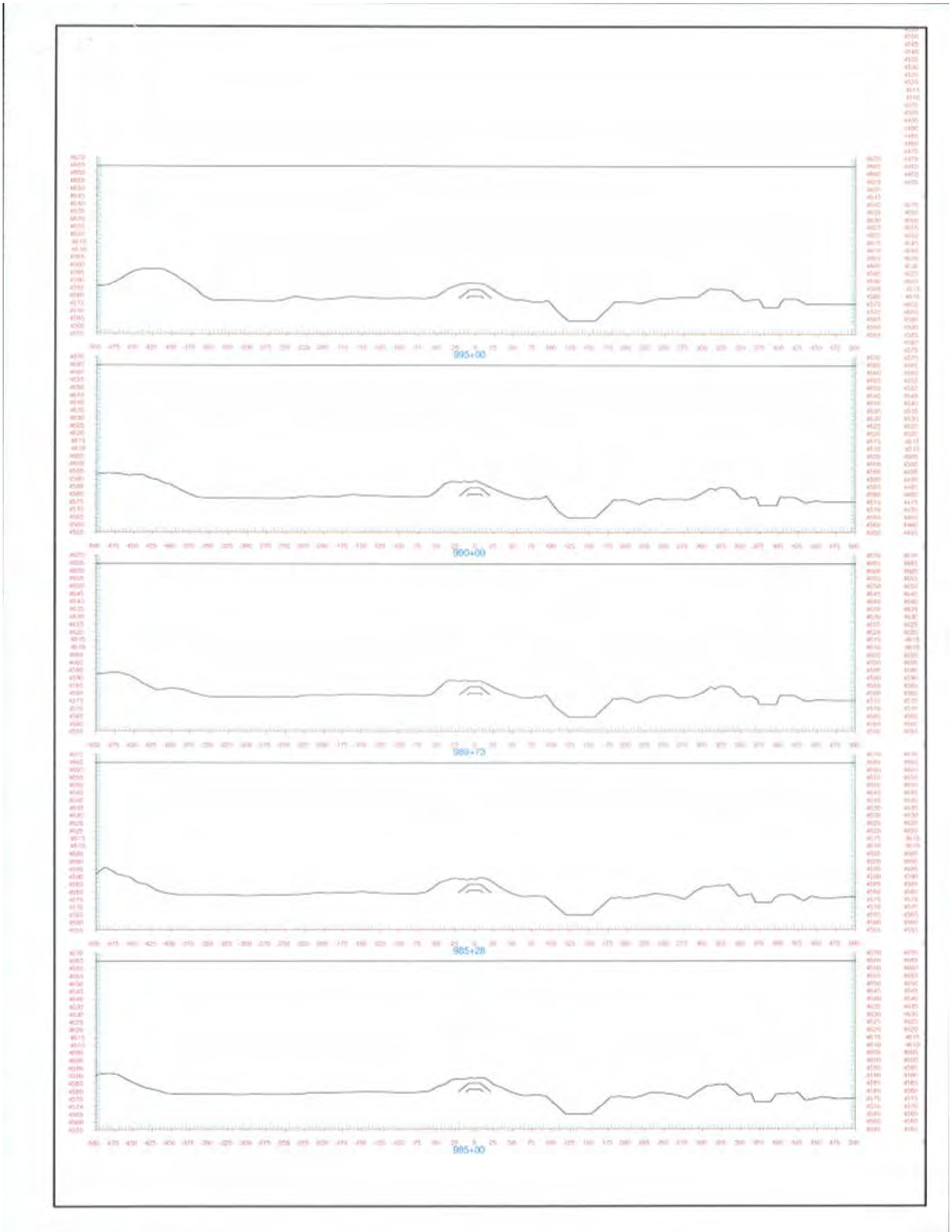


Figure 5. Example levee cross-section template.

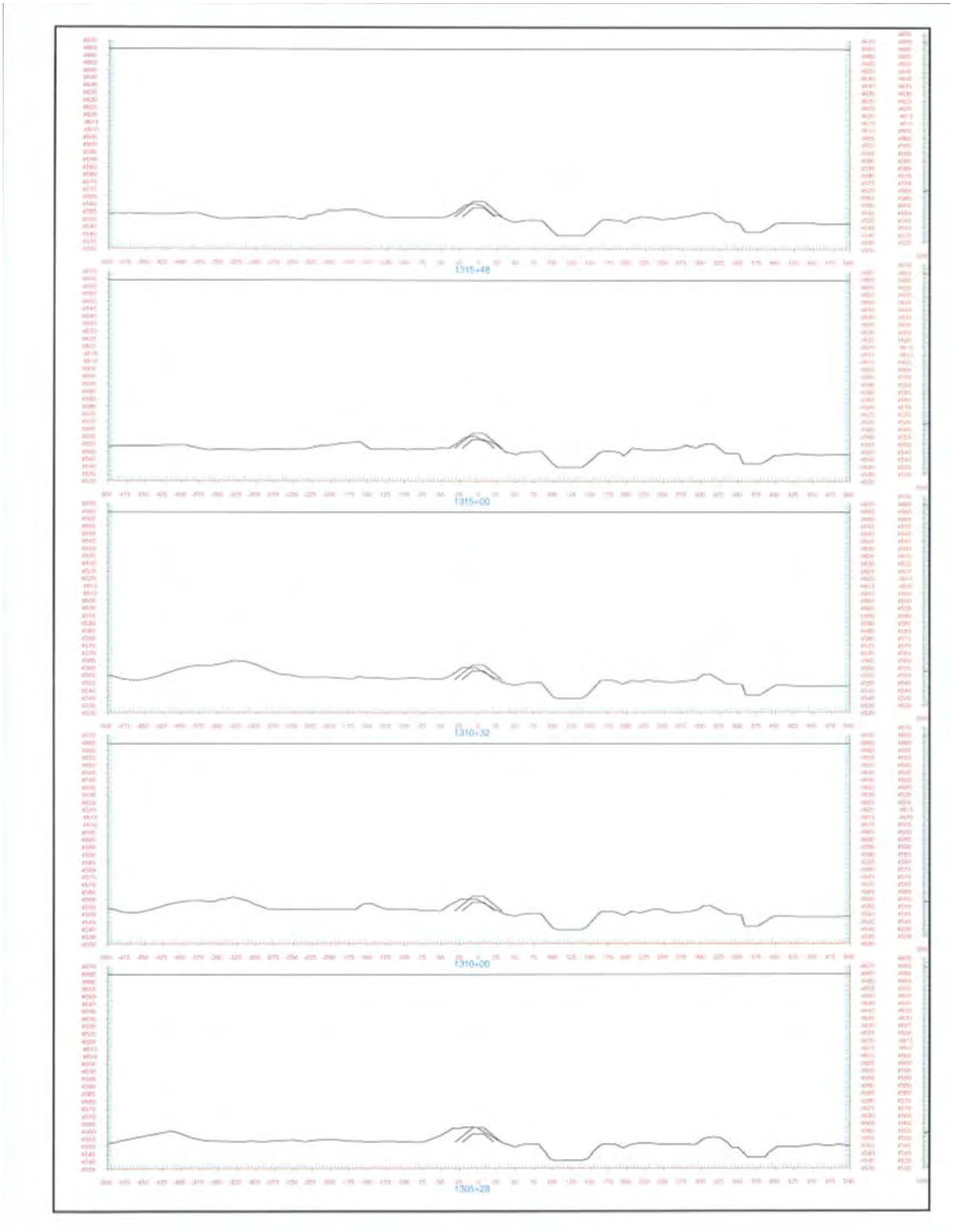


Figure 6. Example levee cross-section template.

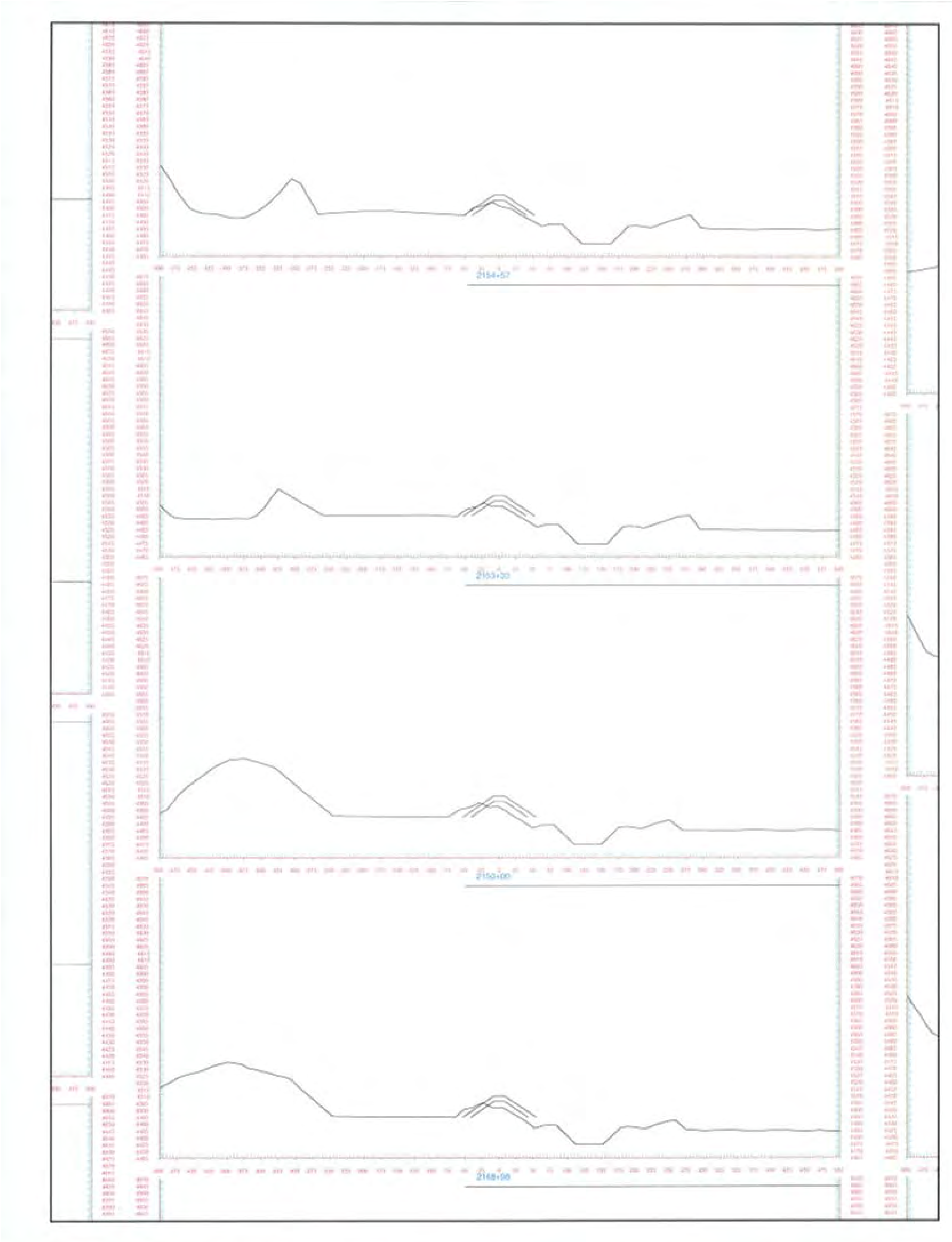


Figure 7. Example levee cross-section template.

1.02.2 **Alternatives G - I (Tiffany Levee, West Side)**

Dimensions for the alternative levee segments below Tiffany Junction and the new bridge approach were not explicitly provided, and therefore were estimated for the 1%-chance event (Table 2). These dimensions (and associated effects) may increase with increasing levee height.

A new levee abutting the existing railroad track on the west side of Tiffany Basin would displace approximately 15 acres of riparian vegetation. The required vegetation-free zone would convert about 5 acres of mixed riparian shrubs to grassland.

Table 2. Estimated dimensions of alternative features downstream from Tiffany Junction.

Features	Proposed base width (ft)	Existing base width (ft)	Difference in base width (ft)w	Length (ft)	Length (mi)	New footprint area (ac)	Vegetation-free area (ac)
Alts. G-I (Tiffany west)	45	0	45	14,942	2.83	15.44	5.15
Alts. J-K (Tiffany east)	100	60	40	21,384	4.05	19.64	14.73[a]
San Marcial bridge approach	140	0	140	7,300	1.38	23.46	3.31[b]

[a] A vegetation-free zone would be maintained on both sides of the new levee.
[b] A vegetation-free zone would be maintained on both sides of a portion of the new approach.

1.02.3 Alternatives J - K (Tiffany Levee, East Side)

An engineered levee would replace the existing spoil bank between the Tiffany Basin and the active Rio Grande floodway. Approximately 20 acres of riparian vegetation would be displaced by the proposed footprint (Table 3). A vegetation-free zone would be required on both sides of this levee segment, and would replace about 15 acres of riparian shrubs.

Suitable, and frequently occupied, Southwestern Willow Flycatcher breeding habitat borders the riverward side of this levee segment. Adverse impacts to SWFL habitat can be avoided if the new levee footprint does not extend eastward of the existing riverward toe of the spoil bank.

1.02.4 San Marcial Railroad Bridge Approach

The approach to a new San Marcial Railroad Bridge would include a realigned railroad bed and an engineered levee abutting the bed on the riverward side. The estimated areas of riparian vegetation displaced by the footprint and vegetation-free zone would be approximately 24 and 3 acres, respectively (Table 3). This includes the highest-quality riparian vegetation along the entire San Acacia levee alignment. Breeding SWFL are regularly known to occupy this area. This adverse effect may be offset by increased riparian inundation over 163 river-miles facilitated by a new bridge.

1.02.5 Tiffany Sediment Basin

The footprints of the weir and outlet structures associated with this feature are minimal. The benefit of the 2.000-acre "footprint" of the basin itself was addressed in the Inundation portion of this analysis.

1.03 RANKING OF ALTERNATIVES

Given the variety of ecological resources evaluated, there is no index of habitat value that is common to all. Therefore, overall effects to ecological resources were evaluated based on the following relative scale:

+3	Significant beneficial
+2	Moderate beneficial
+1	Minor beneficial
0	No effect, or no net effect
-1	Minor adverse
-2	Moderate adverse
-3	Significant adverse

These numeric values are relative and are not intended to be arithmetically summed when evaluating the overall effect of a specific alternative.

Table 4 summarizes the ecological resource rankings of the 13 evaluated alternatives. Generally, potential impacts related to levee features are minor to moderate, and can be mitigated through avoidance or replacement plantings. The unavoidable significant adverse effect to Rio Grande silvery minnow associated with the Tiffany Sediment Basin feature strongly influences the low ranking of all alternatives that include that feature. Conversely, the relatively large and extensive beneficial flooding effects associated with San Marcial Railroad Bridge replacement are a positive influence on the ratings of alternatives including that feature.

The three most favorable alternatives based on the least impact to ecological resources are:

Alt. I - Primary levee, Tiffany west levee, and San Marcial Railroad Bridge.

Alt. C - Primary levee and San Marcial Railroad Bridge (railroad is still susceptible to flood damage)

Alt. A - Primary levee.

Table 4. Relative ranking of alternatives.

Alterna-tive	Features in Alternatives					Ecological Resources				Overall Ecological Resource ranking
	San Acacia to Tiffany Jct. levee	Tiffany Jct. to San Marcial levee – West	Tiffany Jct. to San Marcial levee – East	San Marcial Railroad Bridge	Tiffany Sediment Basin	Aquatic Habitat	Rio Grande silvery minnow	Riparian Habitat	South-western Willow Fly-catcher	
A	X					+1 inund'n	0 inund'n	0 inund'n -1 footprint	0 inund'n 0 footprint	**+1**
B	X				X	+2 inund'n	-3 inund'n	0 inund'n -1 footprint	0 inund'n 0 footprint	-3
C	X			X		+1 inund'n	0 inund'n	+2 inund'n -1 footprint	+2 inund'n -1 footprint	**+2**
D	X			X	X	+2 inund'n	-3 inund'n	+2 inund'n -1 footprint	+2 inund'n -1 footprint	-3
E				X		0 inund'n	0 inund'n	+2 inund'n -1 footprint	+2 inund'n -1 footprint	+2 But no flood risk reduction
F					X	+2 inund'n	-3 inund'n	0 inund'n 0 footprint	0 inund'n	-3 No flood risk reduction
G	X	X		X	X	+2 inund'n	-3 inund'n	+2 inund'n -1 footprint	+2 inund'n -1 footprint	-3
H	X	X			X	+2 inund'n	-3 inund'n	-1 inund'n -1 footprint	0 inund'n 0 footprint	-3
I	X	X		X		+1 inund'n	0 inund'n	+2 inund'n -1 footprint	+2 inund'n -1 footprint	**+2**
J	X		X	X		+1 inund'n	0 inund'n	+1 inund'n -1 footprint	-1 inund'n -1 footprint	-1
K	X		X			+1 inund'n	0 inund'n	-2 inund'n -1 footprint	-1 inund'n -1 footprint	-1

2. BACKGROUND MATERIAL FOR FINAL EFFECTS DETERMINATIONS (March 2012)

Construction activities and the post-project footprint of the proposed / alternative earthen levees are primary factors of potential ecological effects. Geo-referenced basal extents of the both the 1%-chance-event and the 1%-chance-event+4-ft levees were superimposed on digital aerial photography from 2010, and on riparian vegetation coverage mapped in 2007 (Parametrix, 2008). These layers were analyzed to estimate potential changes to the floodway area and riparian vegetation bordering the riverward toe of the levee.

The position of the riverside toe of the new levee was determined relative to that of the existing soil bank at numerous locations along the 43-mile alignment. At each location, this offset (whether landward or riverward), and the ensuing affected area, determined the potential changes in floodway area and riparian vegetation.

Two levee height alternatives were analyzed: at the 1%-chance-event water surface elevation, and four feet taller than the 1%-chance-event water surface elevation (proposed plan). Due to its additional height, the 1%-chance-event+4-ft levee would be 20 to 24 feet wider than the 1%-chance-event levee, depending on whether the side slopes are 2.5:1 or 3:1, respectively.

Throughout the project area, the Rio Grande occupies a physically well-defined channel; however, flows regularly reach a magnitude to inundate portions of the overbank area adjacent to the channel. Therefore, for the purposes of this evaluation, the Ordinary High Water Mark (OHWM) was defined as the extent of the 50%-exceedance discharge. This discharge — 5,660 cfs — was determined by Tetra Tech, Inc. (described in Parametrix [2008][2]), and was based on mean daily discharge values at the San Acacia streamflow gage for the period 1974 through 2002. The Parametrix (2008) investigation also modeled and mapped these flows using the two-dimensional, FLO2-D hydraulic model. The mapped extent of inundation for the attenuated 5,660-cfs discharge at San Acacia served as the basis for determining the OHWM in the evaluation of effects.

The following tables depict the spreadsheet calculations that were used to quantify effects described in the GRR/SEIS-II.

[2] Parametrix. 2008. Restoration Analysis and Recommendations for the San Acacia Reach of the Middle Rio Grande, NM. Prepared for the U.S. Bureau of Reclamation, Albuquerque, and the Middle Rio Grande Endangered Species Collaborative Program.

Spreadsheet 1. Change in floodway area: Alt. A + 4 ft Levee.

Label or note	Station (+00)	Station as ft	Alt. A + 4ft Levee — Acres of floodway lost (-) or gained (+) due to project features: New riverward toe is x ft from old riverward toe (- = landward; + = riverward)	Acres of floodway lost (-)	Acres of floodway gained (+)	Subtotal (net) by reach	Within the gained floodway area … area suitable for woody plantings (i.e., outside of VFZ): Width (ft)	Acres	OHWM?	NWR?
Start (10+63) to 67+50				-1.99	3.08	1.09		0.00		
69+00 to Escondida Br				0.00	35.28	35.28		18.20		
Escondida Br to Hwy 380 Br				0.00	38.75	38.75		15.66		
Hwy 380 Br to BDANWR				0.00	7.19	7.19		1.30		
BDANWR				-8.71	0.57	-8.14		0.00		
BDANWR to 2213+00				0.00	0.76	0.76		0.28		
2213+00 to 2271+00				-1.36	0.12	-1.24		0.03		
NET or SUM				**-12.06**	**85.75**	**73.69**		**35.47**		
EASTSIDE:										
Channel cut		--		0.00	3.08	**3.08**			OHWM	Sevilleta
WESTSIDE:										
Start (10+63)										
soil cement	10.63	1063	0	0.00	0.00	**-1.99**				
soil cement	12.8	1280	0	0.00	0.00					Sevilleta
soil cement	27	2700	18	-0.08	0.00					Sevilleta
soil cement	29	2900	20	-0.05	0.00					Sevilleta
soil cement	30	3000	30	-0.28	0.00				-0.56 ac OW below OHWM	Sevilleta
soil cement	34	3400	30	-0.41	0.00					Sevilleta
soil cement	40	4000	20	-0.41	0.00					Sevilleta
soil cement	49	4900	30	-0.76	0.00					Sevilleta
soil cement	60	6000	0	0.00	0.00					
soil cement	67.5	6750	0	0.00	0.00					
	56.87	5687								
Earthen Levee begins										
	69	6900	-20	0.00	0.51	**35.28**	5	0.13		
	80	8000	-20	0.00	0.92		5	0.23		
	100	10000	-30	0.00	0.28		15	0.14		
San Lorenzo	104	10400	-60	0.00	5.58		45	4.18		
San Lorenzo	144.5	14450	0	0.00	0.00					
	145.5	14550	-70	0.00	0.08		55	0.06		
	146	14600	-80	0.00	7.35		65	5.97		
	186	18600	-50	0.00	0.46		35	0.32		
	190	19000	-35	0.00	0.64		20	0.37		
	198	19800	-20	0.00	0.09		5	0.02		
	200	20000	-15	0.00	0.07		0	0.00		
	202	20200	-25	0.00	1.61		10	0.64		
	230	23000	-15	0.00	0.86					
	255	25500	-30	0.00	0.34		15	0.17		
	260	26000	-60	0.00	3.44		45	2.58		
	285	28500	-50	0.00	0.11		35	0.08		
	286	28600	-30	0.00	0.62		15	0.31		
	295	29500	-20	0.00	1.61		5	0.40		
	330	33000	-25	0.00	2.30		10	0.92		
	370	37000	-20	0.00	0.23		5	0.06		
	375	37500	-20	0.00	0.46		5	0.11	OHWM	
	385	38500	-20	0.00	2.98		5	0.75	OHWM	
	450	45000	-15	0.00	1.72		0	0.00		
	500	50000	-20	0.00	3.03		5	0.76		
	566	56600								
Escondida Bridge	566	56600	-7	0.00	0.22	**2.26**	0	0.00		

Spreadsheet 1. Change in floodway area: Alt. A + 4 ft Levee. (continued)

Label or note	Station (+00)	Station as ft	Alt. A + 4ft Levee — Acres of floodway lost (-) or gained (+) due to project features: New riverward toe is x ft from old riverward toe (- = landward; + = riverward)	Acres of floodway lost (-)	Acres of floodway gained (+)	Subtotal (net) by reach	Within the gained floodway area … area suitable for woody plantings (i.e., outside of VFZ): Width (ft)	Acres	OHWM?	NWR?
	580	58000	-10	0.00	0.14		0	0.00		
	586	58600	-15	0.00	1.89		0	0.00		
	641	64100								
Socorro North Channel	647	64700	0	0.00	0.00	**22.36**	0			
	649	64900	-5	0.00	0.22		0			
	668	66800	-5	0.00	0.20		0		OHWM	
	685	68500	-23	0.00	0.26		8	0.09	OHWM	
	690	69000	-45	0.00	1.14		30	0.76	OHWM	
	701	70100	-45	0.00	2.07		30	1.38	OHWM	
	721	72100	-27	0.00	1.18		12	0.52		
	740	74000	-15	0.00	1.38		0	0.00		
	780	78000	-17	0.00	0.55		2	0.06		
	794	79400	-30	0.00	0.41		15	0.21		
	800	80000	-30	0.00	0.69		15	0.34		
	810	81000	-45	0.00	1.45		30	0.96		
	824	82400	-30	0.00	2.48		15	1.24		
	860	86000	-15	0.00	1.14		0	0.00		
	893	89300	-23	0.00	0.11		8	0.04		
	895	89500	-30	0.00	2.07		15	1.03		
	925	92500	-32	0.00	0.88		17	0.47		
	937	93700	-45	0.00	1.03		30	0.69		
	947	94700	-30	0.00	3.65		15	1.83		
	1000	100000	-27	0.00	0.31		12	0.14		
	1005	100500	-30	0.00	0.83		15	0.41		
	1017	101700	-15	0.00	0.34		0	0.00		
	1027	102700								
Brown Arroyo	1029	102900	-15	0.00	0.38	**14.13**	0	0.00		
	1040	104000	-30	0.00	2.07		15	1.03		
	1070	107000	-28	0.00	0.84		13	0.39		
	1083	108300	-15	0.00	0.59		0	0.00		
	1100	110000	-30	0.00	0.14		15	0.07		
	1102	110200	-15	0.00	1.14		0	0.00		
	1135	113500	-25	0.00	0.40		10	0.16		
	1142	114200	-30	0.00	1.10		15	0.55		
	1158	115800	-40	0.00	0.37		25	0.23		
	1162	116200	-15	0.00	0.76		0	0.00		
	1184	118400	-39	0.00	1.70		24	1.05		
	1203	120300	-35	0.00	1.37		20	0.78		
	1220	122000	-25	0.00	1.03		10	0.41		
2.5:1 slope	1238	123800	-42	0.00	0.19		27	0.12		
transitioning	**1240**	124000	-42	0.00	0.19		27	0.12		
transitioning	**1242**	124200	-42	0.00	0.29		27	0.19		
transitioning	**1245**	124500	-42	0.00	0.29		27	0.19		
3:1 slope	**1248**	124800	-42	0.00	0.19		27	0.12		
	1250	125000	-30	0.00	0.14		15	0.07		
	1252	125200	-15	0.00	0.96		0	0.00		
	1280	128000	0	0.00	0.00					
riprap	1310	131000	0	0.00	0.00					
riprap	1317.59	131759	0	0.00	0.00					
	1337.07	133707	0	0.00	0.00					
	1350	135000	0	0.00	0.00					
	1352	135200	0	0.00	0.00					
	1354	135400								

Spreadsheet 1. Change in floodway area: Alt. A + 4 ft Levee. (continued)

Label or note	Station (+00)	Station as ft	Alt. A + 4ft Levee: Acres of floodway lost (-) or gained (+) due to project features: New riverward toe is x ft from old riverward toe (- = landward; + = riverward)	Acres of floodway lost (-)	Acres of floodway gained (+)	Subtotal (net) by reach	Within the gained floodway area … area suitable for woody plantings (i.e., outside of VFZ): Width (ft)	Acres	OHWM?	NWR?
Hwy 60 Bridge	1355	135500	0	0.00	0.00	**7.19**				
	1361	136100	-10	0.00	0.07					
	1364	136400	-30	0.00	0.41		15	0.21		
riprap	1370	137000	-15	0.00	0.02		0	0.00		
riprap	1370.57	137057	-15	0.00	0.39		0	0.00		
	1381.85	138185	-15	0.00	0.25		0	0.00		
	1389	138900	-20	0.00	0.23		5	0.06		
	1394	139400	-15	0.00	1.96		0	0.00		
	1451	145100	-15	0.00	1.79		0	0.00	OHWM	
	1503	150300	-30	0.00	2.07		15	1.03	OHWM	
	1533	153300	0						OHWM	
BdA north boundary	1533	153300	0	0.00	0.00	**-8.14**			OHWM	BdA
	1600	160000	0	0.00	0.00				OHWM	BdA
	1610	161000	0	0.00	0.00				OHWM	BdA
	1620	162000	0	0.00	0.00				OHWM	BdA
	1660	166000	0	0.00	0.00				OHWM	BdA
	1692	169200	0	0.00	0.00				OHWM	BdA
	1700	170000	0	0.00	0.00				OHWM	BdA
	1710	171000	0	0.00	0.00				OHWM	BdA
riprap	1729.68	172968	0	0.00	0.00				OHWM	BdA
riprap	1733	173300	0	0.00	0.00				OHWM	BdA
riprap	1738	173800	0	0.00	0.00				OHWM	BdA
riprap	1777	177700	10	-0.56	0.00				OHWM	BdA
riprap	1801.42	180142	10	-0.36	0.00				OHWM	BdA
	1817	181700	5	-0.03	0.00				OHWM	BdA
	1820	182000	0	0.00	0.00				OHWM	BdA
	1830	183000	0	0.00	0.00				OHWM	BdA
	1840	184000	5	-0.11	0.00				OHWM	BdA
	1850	185000	0	0.00	0.00				OHWM	BdA
	1860	186000	-10	0.00	0.16				OHWM	BdA
	1867	186700	-15	0.00	0.28				OHWM	BdA
	1875	187500	-5	0.00	0.14				OHWM	BdA
	1887	188700	0	0.00	0.00				OHWM	BdA
	1907	190700	10	-0.11	0.00				OHWM	BdA
	1912	191200	15	-0.28	0.00				OHWM	BdA
	1920	192000	10	-0.16	0.00				OHWM	BdA
	1927	192700	5	-0.15	0.00				OHWM	BdA
	1940	194000	10	-0.28	0.00				OHWM	BdA
	1952	195200	15	-0.28	0.00				OHWM	BdA
	1960	196000	20	-0.09	0.00				OHWM	BdA
	1962	196200	25	-0.46	0.00				OHWM	BdA
	1970	197000	20	-0.23	0.00				OHWM	BdA
	1975	197500	25	-0.29	0.00				OHWM	BdA
	1980	198000	18	-0.21	0.00				OHWM	BdA
	1985	198500	23	-0.11	0.00				OHWM	BdA
	1987	198700	30	-0.21	0.00				OHWM	BdA
	1990	199000	40	-0.46	0.00				OHWM	BdA
	1995	199500	30	-1.72	0.00				OHWM	BdA
	2020	202000	30	-1.38	0.00				OHWM	BdA
	2040	204000	15	-0.28	0.00				OHWM	BdA
	2048	204800	20	-0.09	0.00				OHWM	BdA
	2050	205000	15	-0.28	0.00				OHWM	BdA
	2058	205800	0	0.00	0.00				OHWM	BdA

Spreadsheet 1. Change in floodway area: Alt. A + 4 ft Levee. (concluded)

Label or note	Station (+00)	Station as ft	Alt. A + 4ft Levee — Acres of floodway lost (-) or gained (+) due to project features: New riverward toe is x ft from old riverward toe (- = landward; + = riverward)	Acres of floodway lost (-)	Acres of floodway gained (+)	Subtotal (net) by reach	Within the gained floodway area … area suitable for woody plantings (i.e., outside of VFZ): Width (ft)	Acres	OHWM?	NWR?
	2060	206000	5	-0.06	0.00				OHWM	BdA
	2065	206500	10	-0.11	0.00				OHWM	BdA
	2070	207000	5	-0.06	0.00				OHWM	BdA
	2075	207500	0	0.00	0.00				OHWM	BdA
	2092	209200	0	0.00	0.00				OHWM	BdA
	2103	210300	0	0.00	0.00				OHWM	BdA
	2108	210800	0	0.00	0.00				OHWM	BdA
	2120	212000	15	-0.38	0.00				OHWM	BdA
	2131	213100							OHWM	BdA
BdA south boundary (gap here - disturbed)									OHWM	BdA
	2133	213300	0	0.00	0.00	**0.76**			OHWM	
	2170	217000	0	0.00	0.00				OHWM	
	2184	218400	-15	0.00	0.21				OHWM	
	2190	219000	-30	0.00	0.34		15	0.17	OHWM	
	2195	219500	-30	0.00	0.21		15	0.10	OHWM	
	2198	219800	0	0.00	0.00				OHWM	
	2213	221300							OHWM	
Levee curves to west; leaves floodway						The value below is the 10-yr floodplain				
10yr	2213	221300	0	0.00	0.00	**-1.24**				
10yr	2220	222000	15	-0.34	0.00					
10yr	2230	223000	0	0.00	0.00					
10yr	2240	224000	15	-0.34	0.00					
10yr	2250	225000	15	-0.34	0.00					
10yr	2260	226000	12	-0.08	0.00					
10yr	2263	226300	0	0.00	0.00					
10yr	2264	226400	-15	0.00	0.03					
10yr	2265	226500	-30	0.00	0.07		15	0.03		
10yr	2266	226600	-7	0.00	0.02					
10yr	2267	226700	15	-0.03	0.00					
10yr	2268	226800	15	-0.03	0.00					
10yr	2269	226900	30	-0.07	0.00					
10yr	2270	227000	45	-0.10	0.00					
10yr	2271	227100	0							
RR embankment (terminus)										

1%+4ft Levee: Acres (net) below OHWM --
OHWM is defined as the 2-yr flow (i.e., 5,660 cfs at San Acacia & 4,170 at San Marcial [Parametrix 2008]).
The source doc also maps these discharges.

Location or Station	Lost (ac.)	Gained (ac.)	Net (ac.)	Length ft	Length mi
East channel cut	0.00	3.08	3.08	1,950	0.37
Soil cemernt	-0.56	0.00	-0.56	1,100	0.21
375+00 - 385+00	0.00	3.44	3.44	1,000	0.19
668+00 - 701+00	0.00	3.66	3.66	3,300	0.63
1451+00 - 2213+00	-8.71	5.19	-3.53	76,000	14.39
Subtotal	-9.27	15.37	**6.10**	81,400	15.42

Spreadsheet 2. Change in floodway area: Alt. A Levee.

			Alt. A Levee							
			Acres of floodway lost (-) or gained (+) due to project features				area … area suitable for woody plantings (i.e., outside of VFZ)			
Label or note	Station (+00)	Station as ft	New riverward toe is x ft from old riverward toe (- = landward; + = riverward)	Acres of floodway lost (-)	Acres of floodway gained (+)	Subtotal (net) by reach	Width (ft)	Acres	OHWM?	NWR?
Start (10+63) to 69+00				-1.99	3.08	1.09		0.00		
69+00 to Escondida Br				0.00	58.06	58.06		40.89		
Escondida Br to Hwy 380 Br				0.00	99.29	99.29		72.43		
Hwy 60 Br to BDANWR				0.00	16.99	16.99		10.86		
BDANWR				-0.87	25.68	24.81		8.45		
BDANWR to 2213+00				0.00	5.17	5.17		2.41		
2213+00 to 2271+00				-0.06	2.02	1.96		0.00		
NET or SUM				-2.92	210.29	**207.36**		**135.05**		
EASTSIDE:										
Channel cut		--		0.00	3.08	**3.08**			OHWM	Sevilleta
WESTSIDE:										
Start (10+63) [This is the same as for the "+4-ft" levee.]										
soil cement	10.63	1063	0	0.00	0.00	**-1.99**				
soil cement	12.8	1280	0	0.00	0.00					Sevilleta
soil cement	27	2700	18	-0.08	0.00					Sevilleta
soil cement	29	2900	20	-0.05	0.00				-056 ac OW below OHWM	Sevilleta
soil cement	30	3000	30	-0.28	0.00					Sevilleta
soil cement	34	3400	30	-0.41	0.00					Sevilleta
soil cement	40	4000	20	-0.41	0.00					Sevilleta
soil cement	49	4900	30	-0.76	0.00					Sevilleta
soil cement	60	6000	0	0.00	0.00					
soil cement	67.5	6750	0							
Earthen Levee begins										
	69	6900	-40	0.00	1.01	**58.06**	25	0.63		
	80	8000	-20	0.00	0.00		5	0.00		
	80	8000	-40	0.00	1.84		25	1.15		
	100	10000	-50	0.00	0.46		35	0.32		
	104	10400	-80	0.00	7.44		65	6.04		
San Lorenzo	144.5	14450	0	0.00	0.00					
San Lorenzo	145.5	14550	-90	0.00	0.10					
	146	14600	-100	0.00	9.18		85	7.81		
	186	18600	-70	0.00	0.64		55	0.51		
	190	19000	-55	0.00	1.01		40	0.73		
	198	19800	-40	0.00	0.18		25	0.11		
	200	20000	-35	0.00	0.16		20	0.09		
	202	20200	-45	0.00	2.89		30	1.93		
	230	23000	-35	0.00	2.01		20	1.15		
	255	25500	-50	0.00	0.57		35	0.40		
	260	26000	-80	0.00	4.59		65	3.73		
	285	28500	-70	0.00	0.16		55	0.13		
	286	28600	-50	0.00	1.03		35	0.72		
	295	29500	-40	0.00	3.21		25	2.01		
	330	33000	-45	0.00	4.13		30	2.75		
	370	37000	-40	0.00	7.35		25	4.59		
	450	45000	-35	0.00	4.02		20	2.30		
	500	50000	-40	0.00	6.06		25	3.79		

Spreadsheet 2. Change in floodway area: Alt. A Levee. (continued)

Label or note	Station (+00)	Station as ft	Alt. A Levee — Acres of floodway lost (-) or gained (+) due to project features: New riverward toe is x ft from old riverward toe (- = landward; + = riverward)	Acres of floodway lost (-)	Acres of floodway gained (+)	Subtotal (net) by reach	area … area suitable for woody plantings (i.e., outside of VFZ): Width (ft)	Acres	OHWM?	NWR?
	566	56600	-20				5	-6.50		
Escondida Bridge										
	566	56600	-35	0.00	1.12	**7.99**	20	0.64		
	580	58000	-40	0.00	0.55		25	0.34		
	586	58600	-50	0.00	6.31		35	4.42		
	641	64100								
Socorro North Channel										
	647	64700	-35	0.00	0.16	**53.15**	20	0.09		
	649	64900	-45	0.00	3.72		30	2.48		
	685	68500	-60	0.00	0.69		45	0.52		
	690	69000	-80	0.00	5.69		65	4.63		
	721	72100	-62	0.00	2.70		47	2.05		
	740	74000	-65	0.00	5.97		50	4.59		
	780	78000	-62	0.00	1.99		47	1.51		
	794	79400	-50	0.00	0.69		35	0.48		
	800	80000	-65	0.00	1.49		50	1.15		
	810	81000	-80	0.00	2.57		65	2.09		
	824	82400	-65	0.00	5.37		50	4.13		
	860	86000	-50	0.00	3.79		35	2.65		
	893	89300	-60	0.00	0.28		45	0.21		
	895	89500	-65	0.00	4.48		50	3.44		
	925	92500	-72	0.00	1.98		57	1.57		
	937	93700	-80	0.00	1.84		65	1.49		
	947	94700	-50	0.00	6.08		35	4.26		
	1000	100000	-62	0.00	0.71		47	0.54		
	1005	100500	-65	0.00	1.79		50	1.38		
	1017	101700	-50	0.00	1.15		35	0.80		
	1027	102700								
Brown Arroyo										
	1029	102900	-50	0.00	1.26	**38.16**	35	0.88		
	1040	104000	-65	0.00	4.48		50	3.44		
	1070	107000	-58	0.00	1.73		43	1.28		
	1083	108300	-50	0.00	1.95		35	1.37		
	1100	110000	-65	0.00	0.30		50	0.23		
	1102	110200	-50	0.00	3.79		35	2.65		
	1135	113500	-60	0.00	0.96		45	0.72		
	1142	114200	-65	0.00	2.39		50	1.84		
	1158	115800	-75	0.00	0.69		60	0.55		
	1162	116200	-50	0.00	2.53		35	1.77		
	1184	118400	-74	0.00	3.23		59	2.57		
	1203	120300	-70	0.00	2.73		55	2.15		
	1220	122000	-50	0.00	2.07		35	1.45		
	1238	123800	-62	0.00	0.28		47	0.22		
2.5:1 slope	1240	124000	**-62**	0.00	0.28		47	0.22		
transitioning	1242	124200	**-63**	0.00	0.43		48	0.33		
transitioning	1245	124500	**-64**	0.00	0.44		49	0.34		
transitioning	1248	124800	**-65**	0.00	0.30		50	0.23		
3:1 slope	1250	125000	**-54**	0.00	0.25		39	0.18		
	1252	125200	-39	0.00	2.51		24	1.54		
	1280	128000	-24	0.00	1.65		9	0.62		
	1310	131000	-39	0.00	0.68		24	0.42		

Spreadsheet 2. Change in floodway area: Alt. A Levee. (continued)

			Alt. A Levee							
			Acres of floodway lost (-) or gained (+) due to project features				area … area suitable for woody plantings (i.e., outside of VFZ)			
Label or note	Station (+00)	Station as ft	New riverward toe is x ft from old riverward toe (- = landward; + = riverward)	Acres of floodway lost (-)	Acres of floodway gained (+)	Subtotal (net) by reach	Width (ft)	Acres	OHWM?	NWR?
riprap	1317.59	131759	-39	0.00	1.74		24	1.07		
riprap	1337.07	133707	-39	0.00	1.16		24	0.71		
	1350	135000	-47	0.00	0.22		32	0.15		
	1352	135200	-24	0.00	0.11		9	0.04		
	1354	135400								
Hwy 60 Bridge										
	1355	135500	-24	0.00	0.33	**16.99**	9	0.12		
	1361	136100	-34	0.00	0.23		19	0.13		
	1364	136400	-54	0.00	0.74		39	0.54		
	1370	137000	-39	0.00	0.05		24	0.03		
riprap	1370.57	137057	-39	0.00	1.01		24	0.62		
riprap	1381.85	138185	-39	0.00	0.64		24	0.39		
	1389	138900	-44	0.00	0.51		29	0.33		
	1394	139400	-39	0.00	5.10		24	3.14		
	1451	145100	-39	0.00	4.66		24	2.87	OHWM	
	1503	150300	-54	0.00	3.72		39	2.69	OHWM	
	1533	153300	-24						OHWM	
									OHWM	
BdA north boundary									OHWM	
	1533	153300	-24	0.00	3.69	**24.81**	9	1.38	OHWM	BdA
	1600	160000	-24	0.00	0.55		9	0.21	OHWM	BdA
	1610	161000	-24	0.00	0.55		9	0.21	OHWM	BdA
	1620	162000	-24	0.00	2.20		9	0.83	OHWM	BdA
	1660	166000	-24	0.00	1.76		9	0.66	OHWM	BdA
	1692	169200	-24	0.00	0.44		9	0.17	OHWM	BdA
	1700	170000	-24	0.00	0.55		9	0.21	OHWM	BdA
	1710	171000	-24	0.00	1.08		9	0.41	OHWM	BdA
riprap	1729.68	172968	-24	0.00	0.18		8.5	0.06	OHWM	BdA
riprap	1733	173300	-24	0.00	0.28		8.5	0.10	OHWM	BdA
riprap	1738	173800	-24	0.00	2.15		8.5	0.76	OHWM	BdA
riprap	1777	177700	-14	0.00	0.78				OHWM	BdA
riprap	1801.42	180142	-14	0.00	0.50				OHWM	BdA
	1817	181700	-19	0.00	0.13		4	0.03	OHWM	BdA
	1820	182000	-24	0.00	0.55		9	0.21	OHWM	BdA
	1830	183000	-24	0.00	0.55		9	0.21	OHWM	BdA
	1840	184000	-19	0.00	0.44		4	0.09	OHWM	BdA
	1850	185000	-24	0.00	0.55		9	0.21	OHWM	BdA
	1860	186000	-34	0.00	0.55		19	0.31	OHWM	BdA
	1867	186700	-39	0.00	0.72		24	0.44	OHWM	BdA
	1875	187500	-29	0.00	0.80		14	0.39	OHWM	BdA
	1887	188700	-24	0.00	1.10		9	0.41	OHWM	BdA
	1907	190700	-14	0.00	0.16				OHWM	BdA
	1912	191200	-9	0.00	0.17				OHWM	BdA
	1920	192000	-14	0.00	0.22				OHWM	BdA
	1927	192700	-19	0.00	0.57		4	0.12	OHWM	BdA
	1940	194000	-14	0.00	0.39				OHWM	BdA
	1952	195200	-9	0.00	0.17				OHWM	BdA
	1960	196000	-4	0.00	0.02				OHWM	BdA
	1962	196200	1	-0.02	0.00				OHWM	BdA
	1970	197000	-4	0.00	0.05				OHWM	BdA

Spreadsheet 2. Change in floodway area: Alt. A Levee. (concluded)

Label or note	Station (+00)	Station as ft	Alt. A Levee: Acres of floodway lost (-) or gained (+) due to project features: New riverward toe is x ft from old riverward toe (- = landward; + = riverward)	Acres of floodway lost (-)	Acres of floodway gained (+)	Subtotal (net) by reach	area … area suitable for woody plantings (i.e., outside of VFZ): Width (ft)	Acres	OHWM?	NWR?
	1975	197500	1	-0.01	0.00				OHWM	BdA
	1980	198000	-6	0.00	0.07				OHWM	BdA
	1985	198500	-1	0.00	0.00				OHWM	BdA
	1987	198700	6	-0.04	0.00				OHWM	BdA
	1990	199000	16	-0.18	0.00				OHWM	BdA
	1995	199500	6	-0.34	0.00				OHWM	BdA
	2020	202000	6	-0.28	0.00				OHWM	BdA
	2040	204000	-9	0.00	0.17				OHWM	BdA
	2048	204800	-4	0.00	0.02				OHWM	BdA
	2050	205000	-9	0.00	0.17				OHWM	BdA
	2058	205800	-24	0.00	0.11		9	0.04	OHWM	BdA
	2060	206000	-19	0.00	0.22		4	0.05	OHWM	BdA
	2065	206500	-14	0.00	0.16				OHWM	BdA
	2070	207000	-19	0.00	0.22		4	0.05	OHWM	BdA
	2075	207500	-24	0.00	0.94		9	0.35	OHWM	BdA
	2092	209200	-24	0.00	0.61		9	0.23	OHWM	BdA
	2103	210300	-24	0.00	0.28		9	0.10	OHWM	BdA
	2108	210800	-24	0.00	0.66		9	0.25	OHWM	BdA
	2120	212000	-9	0.00	0.23				OHWM	BdA
	2131	213100							OHWM	BdA
BdA south boundary (gap here - disturbed)									OHWM	
	2133	213300	-24	0.00	2.04	**5.17**	9	0.76	OHWM	
	2170	217000	-24	0.00	0.77		9	0.29	OHWM	
	2184	218400	-39	0.00	0.54		24	0.33	OHWM	
	2190	219000	-54	0.00	0.62		39	0.45	OHWM	
	2195	219500	-54	0.00	0.37		39	0.27	OHWM	
	2198	219800	-24	0.00	0.83		9	0.31	OHWM	
	2213	221300							OHWM	
Levee curves to west; leaves floodway										
10yr	2213	221300	-24	0.00	0.39	**1.96**	0	0.00		
10yr	2220	222000	-9	0.00	0.21		0	0.00		
10yr	2230	223000	-24	0.00	0.55		0	0.00		
10yr	2240	224000	-9	0.00	0.21		0	0.00		
10yr	2250	225000	-9	0.00	0.21		0	0.00		
10yr	2260	226000	-12	0.00	0.08		0	0.00		
10yr	2263	226300	-24	0.00	0.06		0	0.00		
10yr	2264	226400	-39	0.00	0.09		0	0.00		
10yr	2265	226500	-54	0.00	0.12		0	0.00		
10yr	2266	226600	-31	0.00	0.07		0	0.00		
10yr	2267	226700	-9	0.00	0.02		0	0.00		
10yr	2268	226800	-9	0.00	0.02		0	0.00		
10yr	2269	226900	6	-0.01	0.00		0	0.00		
10yr	2270	227000	21	-0.05	0.00		0	0.00		
10yr	2271	227100								
RR embankment (terminus)										
Net acres (gained) below OHWM:				-1.43	42.30	**40.87**		16.41		
				Filled	Exposed	Net				

Spreadsheet 3. Vegetation type change due to 15-ft-wide Vegetation-free Zone and buried riprap.

			100yr+4							100yr				
			Width needed (ft)							Width needed (ft)				
	Station (+00)	Station as ft	Due to levee toe	Additional for riprap (where needed)	Length (ft)	Acres of vegetation type change	Veg. type (H&O 2007 by Px)	OHWM?	NWR?	Due to levee toe	Additional for riprap (where needed)	Length (ft)	Acres of vegetation type change	Veg. type (H&O 2007 by Px)
69+00 to Escondida Br					0	0.00						0	0.00	
Escondida Br to Hwy 380 Br					13,200	4.35						0	0.00	
Hwy 380 Br to BdA					2,028	0.58						0	0.00	
BDANWR					59,800	21.58						23,374	3.40	
BDANWR to 2213+00					6,600	2.27						0	0.00	
Subtotal (floodway)					**81,628**	**28.78**						**23,374**	**3.40**	
"Tiff Corner" to RR [10-yr-fldpln]					5,600	1.91						3,600	0.50	
SUM					**87,228**	**30.70**						**26,974**	**3.90**	
					16.52	mi.						5.11	mi.	
69+00 to Escondida Br: No veg. type change due to VFZ														
Escondida Bridge														
	566	56600	8		660	0.12	**OP**			0			0	
	572.6	57260	8		740	0.14	**SC-ATX5**			0			0	
	580	58000	5		600	0.07	**SC-ATX5**			0			0	
	586	58600	0			0				0			0	
	641	64100												
Socorro North Channel														
	647	64700	15		200	0.07	**SC5**			0			0	
	649	64900	10		1900	0.44	**SC5**			0			0	
	668	66800	10		950	0.22	**SC5**	OHWM		0			0	
	677.5	67750	10		750	0.17	**C2**	OHWM		0			0	
	685	68500	0			0		OHWM		0			0	
	690	69000	0			0		OHWM		0			0	
	721	72100	0			0				0			0	
	740	74000	0			0				0			0	
	780	78000	0			0				0			0	
	794	79400	0			0				0			0	
	800	80000	0			0				0			0	
	810	81000	0			0				0			0	
	824	82400	0			0				0			0	
	860	86000	0			0				0			0	
	893	89300	0			0				0			0	
	895	89500	0			0				0			0	
	925	92500	0			0				0			0	
	937	93700	0			0				0			0	
	947	94700	0			0				0			0	
	1000	100000	0			0				0			0	
	1005	100500	0			0				0			0	
	1017	101700	0			0				0			0	
	1027	102700								0			0	
Brown Arroyo										0			0	
	1029	102900	0			0				0			0	
	1040	104000	0			0				0			0	
	1070	107000	0			0				0			0	
	1083	108300	0			0				0			0	
	1100	110000	0			0				0			0	
	1102	110200	0			0				0			0	
	1135	113500	0			0				0			0	
	1142	114200	0			0				0			0	
	1158	115800	0			0				0			0	
	1162	116200	0			0				0			0	
	1184	118400	0			0				0			0	
	1203	120300	0			0				0			0	
	1220	122000	0			0				0			0	
	1238	123800	0			0				0			0	
2.5:1 slope	**1240**	124000	0			0				0			0	
transitioning	**1242**	124200	0			0				0			0	
transitioning	**1245**	124500	0			0				0			0	
transitioning	**1248**	124800	0			0				0			0	
3:1 slope	1250	125000	0			0				0			0	
	1252	125200	0			0				0			0	
	1280	128000	15		600	0.21	**RO-C/SC3**			0			0	
	1286	128600	15		2400	0.83	**SC5F**			0			0	
	1310	131000	15		759	0.26	**C-RO/SC3**			0			0	
riprap	1317.59	131759	15	13	1181	0.76	**SC5S**			0	0		0	
riprap	1329.4	132940	15	13	360	0.23	**SC5S**			0	0		0	
riprap	1333	133300	15	13	407	0.26	**C/SC-B-SBM-NMO1**			0	0		0	
riprap	1337.07	133707	15		1293	0.45	**C/SC-B-SBM-NMO1**			0			0	
	1350	135000	15		200	0.07	**C/SC-B-SBM-NMO1**			0			0	
	1352	135200	15		200	0.07	**C/SC-B-SBM-NMO1**			0			0	
	1354	135400												
Hwy 380 Bridge														
	1355	135500	15		100	0.03	**OP**			0			0	

Spreadsheet 3. Vegetation type change due to 15-ft-wide Vegetation-free Zone and buried riprap, (continued)

	Station (+00)	Station as ft	100yr+4: Width needed (ft): Due to levee toe	100yr+4: Width needed (ft): Additional for riprap (where needed)	100yr+4: Length (ft)	100yr+4: Acres of vegetation type change	100yr+4: Veg. type (H&O 2007 by Px)	OHWM?	NWR?	100yr: Width needed (ft): Due to levee toe	100yr: Width needed (ft): Additional for riprap (where needed)	100yr: Length (ft)	100yr: Acres of vegetation type change	100yr: Veg. type (H&O 2007 by Px)
	1356	135600	15		500	0.17	C/SC3S			0			0	
	1361	136100	5		300	0.03	C/SC3S			0			0	
	1364	136400	0			0	C/SC3S			0			0	
	1370	137000	0			0	C/SC3			0			0	
riprap	1370.57	137057	0	13	1128	0.34	C/SC3			0	0		0	
riprap	1381.85	138185	0			0				0			0	
	1389	138900	0			0				0			0	
	1394	139400	0			0				0			0	
	1451	145100	0			0		OHWM		0			0	
	1503	150300	0			0		OHWM		0			0	
	1533	153300						OHWM						
BDANWR north boundary								OHWM						
	1533	153300	15		2200	0.76	OPt	OHWM	BdA	0			0	
	1555	155500	15		1400	0.48	SC/SC3	OHWM	BdA	0			0	
	1569	156900	15		2800	0.96	SC-RO-B5	OHWM	BdA	0			0	
	1597	159700	15		300	0.10	C/SC1	OHWM	BdA	0			0	
	1600	160000	15		1000	0.34	C/SC1	OHWM	BdA	0			0	
	1610	161000	15		1000	0.34	C/SC1	OHWM	BdA	0			0	
	1620	162000	15		1300	0.45	C/SC1	OHWM	BdA	0			0	
	1633	163300	15		200	0.07	SC-B5	OHWM	BdA	0			0	
	1635	163500	15		2500	0.86	SC-TW-C/SC-B3	OHWM	BdA	0			0	
	1660	166000	15		3200	1.10	SC-TW-C/SC-B3	OHWM	BdA	0			0	
	1692	169200	15		800	0.28	SC-TW-C/SC-B3	OHWM	BdA	0			0	
	1700	170000	15		1000	0.34	SC-TW-C/SC-B3	OHWM	BdA	0			0	
	1710	171000	15		1500	0.52	SC-TW-C/SC-B3	OHWM	BdA	0			0	
	1725	172500	15		468	0.16	SC5	OHWM	BdA	0			0	
riprap	1729.68	172968	15	9.5	332	0.19	SC5	OHWM	BdA	0	0.5	332	0.004	SC5
riprap	1733	173300	15	9.5	500	0.28	SC5	OHWM	BdA	0	0.5	500	0.006	SC5
riprap	1738	173800	15	9.5	420	0.24	C/SC1	OHWM	BdA	0	0.5	420	0.005	C/SC1
riprap	1742.2	174220	15	9.5	1930	1.09	SC5	OHWM	BdA	0	0.5	1930	0.022	SC5
riprap	1761.5	176150	15	9.5	700	0.39	C/SC-RO1	OHWM	BdA	0	0.5	700	0.008	C/SC-RO1
riprap	1768.5	176850	15	9.5	850	0.48	SC5	OHWM	BdA	0	0.5	850	0.010	SC5
riprap	1777	177700	15	9.5	2300	1.29	C/SC-RO1	OHWM	BdA	0	0.5	2300	0.026	C/SC-RO1
riprap	1800	180000	15	9.5	142	0.08	SC/SC-CW3	OHWM	BdA	0	0.5	142	0.002	SC/SC-CW3
riprap	1801.42	180142	15		1558	0.54	SC/SC-CW3	OHWM	BdA	0			0	
	1817	181700	15		200	0.07	SC/SC-CW3	OHWM	BdA	0			0	
	1819	181900	15		100	0.03	C5	OHWM	BdA	0			0	
	1820	182000	15		120	0.04	C5	OHWM	BdA	0			0	
	1821.2	182120	15		880	0.30	C/SC-C3F	OHWM	BdA	0			0	
	1830	183000	15		560	0.19	C/SC-C3F	OHWM	BdA	0			0	
	1835.6	183560	15		440	0.15	SC5F	OHWM	BdA	0			0	
	1840	184000	15		1000	0.34	SC5F	OHWM	BdA	0			0	
	1850	185000	15		1000	0.34	SC5F	OHWM	BdA	0			0	
	1860	186000	5		700	0.08	SC5F	OHWM	BdA	0			0	
	1867	186700	0		800	0	SC5F	OHWM	BdA	0			0	
	1875	187500	10		1200	0.28	SC5F	OHWM	BdA	0			0	
	1887	188700	15		1650	0.57	SC5F	OHWM	BdA	0			0	
	1903.5	190350	15		130	0.04	Bare (OW)	OHWM	BdA	0			0	
	1904.8	190480	15		220	0.08	SC5F	OHWM	BdA	0			0	
	1907	190700	15		500	0.17	SC5F	OHWM	BdA	1		500	0.01	SC5F
	1912	191200	15		800	0.28	SC5F	OHWM	BdA	6		800	0.11	SC5F
	1920	192000	15		700	0.24	SC5F	OHWM	BdA	1		700	0.02	SC5F
	1927	192700	15		1300	0.45	SC5F	OHWM	BdA	0		1300	0	
	1940	194000	15		1200	0.41	SC5F	OHWM	BdA	1		1200	0.03	SC5F
	1952	195200	15		20	0.01	SC5F	OHWM	BdA	6		20	0.00	SC5F
	1952.2	195220	15		80	0.03	OP	OHWM	BdA	6		80	0.01	OP
	1953	195300	15		700	0.24	SC4	OHWM	BdA	6		700	0.10	SC4
	1960	196000	15		200	0.07	SC4	OHWM	BdA	11		200	0.05	SC4
	1962	196200	15		800	0.28	SC4	OHWM	BdA	15		800	0.28	SC4
	1970	197000	15		500	0.17	SC4	OHWM	BdA	11		500	0.13	SC4
	1975	197500	15		500	0.17	SC4	OHWM	BdA	15		500	0.17	SC4
	1980	198000	15		500	0.17	SC4	OHWM	BdA	9		500	0.10	SC4
	1985	198500	15		200	0.07	SC4	OHWM	BdA	14		200	0.06	SC4
	1987	198700	15		300	0.10	SC4	OHWM	BdA	15		300	0.10	SC4
	1990	199000	15		500	0.17	SC4	OHWM	BdA	15		500	0.17	SC4
	1995	199500	15		2500	0.86	SC4	OHWM	BdA	15		2500	0.86	SC4
	2020	202000	15		2000	0.69	SC4	OHWM	BdA	15		2000	0.69	SC4
	2040	204000	15		800	0.28	SC4	OHWM	BdA	6		800	0.11	SC4
	2048	204800	15		200	0.07	SC4	OHWM	BdA	9		200	0.04	SC4
	2050	205000	15		800	0.28	SC4	OHWM	BdA	6		800	0.11	SC4
	2058	205800	15		200	0.07	SC4	OHWM	BdA	0			0	
	2060	206000	15		500	0.17	SC4	OHWM	BdA	0			0	
	2065	206500	15		500	0.17	SC4	OHWM	BdA	1			0.01	SC4
	2070	207000	15		500	0.17	SC4	OHWM	BdA	0			0	
	2075	207500	15		400	0.14	SC4	OHWM	BdA	0			0	
	2079	207900	15		700	0.24	OP	OHWM	BdA	0			0	
	2086	208600	15		600	0.21	C-SC/C-SC3	OHWM	BdA	0			0	
	2092	209200	15		1100	0.38	C-SC/C-SC3	OHWM	BdA	0			0	
	2103	210300	15		500	0.17	C-SC/C-SC3	OHWM	BdA	0			0	

Spreadsheet 3. Vegetation type change due to 15-ft-wide Vegetation-free Zone and buried riprap, (continued)

		100yr+4							100yr				
		Width needed (ft)							Width needed (ft)				
Station (+00)	Station as ft	Due to levee toe	Additional for riprap (where needed)	Length (ft)	Acres of vegetation type change	Veg. type (H&O 2007 by Px)	OHWM?	NWR?	Due to levee toe	Additional for riprap (where needed)	Length (ft)	Acres of vegetation type change	Veg. type (H&O 2007 by Px)
2108	210800	15		1200	0.41	C-SC/C-SC3	OHWM	BdA	0			0	
2120	212000	15		140	0.05	C-SC/C-SC3	OHWM	BdA	6		140	0.02	C-SC/C-SC3
2121.4	212140	15		960	0.33	SC4	OHWM	BdA	6		960	0.13	SC4
2131	213100					SC4	OHWM	BdA					
BDANWR south boundary (gap here - disturbed)							OHWM						
2133	213300	15		250	0.09	[OP]	OHWM		0			0	
2135.5	213550	15		3450	1.19	SC4							
2170	217000	15		1400	0.48	SC4	OHWM		0			0	
2184	218400	0			0	SC4	OHWM		0			0	
2190	219000	0			0	SC4	OHWM		0			0	
2195	219500	0			0	SC4	OHWM		0			0	
2198	219800	15		1500	0.52	SC4	OHWM		0			0	
2213	221300	15					OHWM						
2213+00 (levee curves to west, leaves floodway)													
10yr-fldplain 2213	221300	15		700	0.24	SC6bt			0			0	
10yr-fldplain 2220	222000	15		1000	0.34	SC6bt			6		1000	0.14	SC6bt
10yr-fldplain 2230	223000	15		800	0.28	SC6bt			0			0	
10yr-fldplain 2238	223800	15		200	0.07	OPbt			6		200	0.03	OPbt
10yr-fldplain 2240	224000	15		1000	0.34	OPbt			6		1000	0.14	OPbt
10yr-fldplain 2250	225000	15		1000	0.34	OPbt			6		1000	0.14	OPbt
10yr-fldplain 2260	226000	15		300	0.10	OPbt			3		300	0.02	OPbt
10yr-fldplain 2263	226300	15		100	0.03	OPbt			0			0	
10yr-fldplain 2264	226400	0			0	OPbt			0			0	
10yr-fldplain 2265	226500	0			0	OPbt			0			0	
10yr-fldplain 2266	226600	8		100	0.02	OPbt			0			0	
10yr-fldplain 2267	226700	15		100	0.03	OPbt			0			0	
10yr-fldplain 2268	226800	15		100	0.03	OPbt			0			0	
10yr-fldplain 2269	226900	15		100	0.03	OPbt			15		100	0.03	OPbt
10yr-fldplain 2270	227000	15		100	0.03	OPbt			15				
10yr-fldplain 2271	227100					OPbt							
RR embankment (end)													

SUMMARY BY REACH:

	100yr+4			100yr		
Reach	Subtotal by reach	Acres of vegetation removal	Veg. type (H&O 2007 by Px)	Subtotal by reach	Acres of vegetation removal	Veg. type (H&O 2007 by Px)
69+00 to Escondida Br	0	0		0	0	
Escondida Br to Hwy 380	4.35	0.84	C/SC-B-SBM-NMO1	0.00	0	C/SC-B-SBM-NMO1
		0.17	C2		0	C2
		0.12	OP		0	OP
		0.47	RO-C/SC3		0	RO-C/SC3
		0.72	SC5		0	SC5
		1.82	SC5F		0	SC5F
		0.20	SC-ATX5		0	SC-ATX5
Hwy 380 to BDANWR	0.58	0.03	OP	0.00	0	OP
		0.54	C/SC3S		0	C/SC3S
BDANWR	21.58	0.04	Bare (OP)	3.40	0.011	(OP)
		1.48	C/SC1		0.005	C/SC1
		0.50	C/SC-C3F		0	C/SC-C3F
		1.69	C/SC-RO1		0.034	C/SC-RO1
		0.08	C5		0	C5
		1.22	C-SC/C-SC3		0.019	C-SC/C-SC3
		0.27	OP		0	OP
		0.76	OPt		0	OPt
		0.48	SC/SC3		0	SC/SC3
		0.69	SC/SC-CW3		0.002	SC/SC-CW3
		4.67	SC4		3.119	SC4
		2.19	SC5		0.041	SC5
		3.40	SC5F		0.168	SC5F
		0.07	SC-B5		0	SC-B5
		0.96	SC-RO-B5		0	SC-RO-B5
		3.10	SC-TW-C/SC-B3		0	SC-TW-C/SC-B3
BDANWR to 2213+00	2.28	0.09	[OP]	0		OW (pump channel)
		2.19	SC4			
Subtotal	28.79	28.79		3.40	3.40	
2213+00 to RR	1.91	0.86	SC6bt	0.50	0.14	SC6bt
		1.05	OPbt		0.36	OPbt
Subtotal		1.91			0.50	

Spreadsheet 3. Vegetation type change due to 15-ft-wide Vegetation-free Zone and buried riprap, (concluded)

Station (+00)	Station as ft	100yr+4: Width needed (ft): Due to levee toe	100yr+4: Width needed (ft): Additional for riprap (where needed)	100yr+4: Length (ft)	100yr+4: Acres of vegetation type change	100yr+4: Veg. type (H&O 2007 by Px)	OHWM?	NWR?	100yr: Width needed (ft): Due to levee toe	100yr: Width needed (ft): Additional for riprap (where needed)	100yr: Length (ft)	100yr: Acres of vegetation type change	100yr: Veg. type (H&O 2007 by Px)

SUMMARY (entire reach):

	100yr+4: Acres of vegetation removal	100yr+4: Veg. type (H&O 2007 by Px)	100yr+4: Native dominated	100yr+4: Mixed	100yr+4: Non-native dominated	100yr+4: OP	100yr: Acres of veg removal	100yr: Veg. type (H&O 2007 by Px)	100yr: Native dominated	100yr: Mixed	100yr: Non-native dominated	100yr: OP
Riparian (floodway):	1.32	(OP)				1.3	0.011	OP				0.011
	1.48	C/SC1		1.5			0.005	C/SC1		0.005		
	0.54	C/SC3S		0.5								
	0.84	C/SC-B-SBM-NMO1	0.8									
	0.50	C/SC-C3F	0.5									
	1.69	C/SC-RO1		1.7			0.034	C/SC-RO1		0.034		
	0.17	C2	0.2									
	0.08	C5	0.1									
	1.22	C-SC/C-SC3	1.2				0.019	C-SC/C-SC3	0.019			
	0.47	RO-C/SC3			0.5							
	0.48	SC/SC3			0.5							
	0.69	SC/SC-CW3			0.7		0.002	SC/SC-CW3			0.002	
	5.67	SC4			5.7		3.119	SC4			3.119	
	2.92	SC5			2.9		0.041	SC5			0.041	
	5.21	SC5F			5.2		0.168	SC5F			0.168	
	0.20	SC-ATX5			0.2							
	0.07	SC-B5			0.1							
	0.96	SC-RO-B5			1.0							
	3.10	SC-TW-C/SC-B3			3.1							
Sum	27.60		2.8	3.7	19.8	1.3	3.40		0.02	0.04	3.33	0.01
Percentage			10.2%	13.4%	71.6%	4.8%			0.6%	1.2%	98.0%	0.3%
10-yr floodplain (Tiffany Basin):	0.86	SC6bt			0.9		0.14	SC6bt			0.1	
	1.05	OPbt				1.1	0.36	OPbt				0.4
Sum	1.91				0.86	1.05	0.50				0.1	0.4
Percentage					45.0%	55.0%					27.8%	72.2%

Spreadsheet 4. Vegetation permanently removed due to footprint of features.

	Station (+00)	Station as ft	100yr+4 levee: New toe is x ft from old toe (- = landward; + = riverward)	100yr+4 levee: Acres of vegetation removed	100yr+4 levee: Vegetation type (H&O 2007 by Px): Black = Upland Green = Riparian	OHWM?	NWR?	100yr levee: New toe is x ft from old toe (- = landward; + = riverward)	100yr levee: Acres of vegetation removed	100yr levee: Vegetation type (H&O 2007 by Px): Black = Upland Green = Riparian
EASTSIDE:										
Channel cut				0.82	CW5	no	Sevilleta		0.82	CW5
Channel cut				2.00	SC6S	no	Sevilleta		2.00	SC6S
Channel cut				0.28	SC5	no	Sevilleta		0.28	SC5
Overbank cut				4.04	SC6S		Sevilleta		4.04	SC6S
Overbank cut				5.23	SC5		Sevilleta		5.23	SC5
WESTSIDE:										
floodwall	6.40	640	--					--		
floodwall	7.70	770	--	0.05	HMQ-ATX			--	0.05	HMS-ATX
floodwall + soil cement	10.63	1063	--	0.11	Bare OP			--	0	Bare OP
floodwall + soil cement	12.30	1230	--	0.09	C-TW2			--	0.09	C-TW2
floodwall + soil cement	12.50	1250		0.03	C/TW2				0.3	C/TW2
soil cem.	12.90	1290	--	0.02	C/TW2		Sevilleta	--	0.2	C/TW2
soil cem.	13.70	1370	--	0.67	SC5 Temp: 0.34 CW5S		Sevilleta	--	0.67	SC5 (0.67) Temp: 0.34 CW5S
soil cem.	21	2100	--	0.12	SC5 Temp: 0.11 SC5		Sevilleta	--	0.12	SC5 Temp: 0.11 SC5
soil cem.	23.5	2350	--	0.26	SC5 (0.22) CW-B5S (0.04) Temp: 0.15 SC5 Temp: 0.03 CW-B5S		Sevilleta	--	0.22	SC5 (0.22) CW-B5S (0.04) Temp: 0.15 SC5 Temp: 0.03 CW-B5S
soil cem.	29	2900	--	0.34	0.34 SC-B5 +0.56 OW	not veg; just OW	Sevilleta	--	2.01	SC-B5 +0.56 OW
soil cem.	40	4000	--	.04+	SC-B5 Temp: 0.46 SC-B5		Sevilleta	--	1.43	SC-B5
soil cem.	50	5000	--	2.28	SC4 Temp: 0.80 SC4		Sevilleta	--		
soil cem.	67.5	6750	--					--	3.08	SC4
BDANWR north boundary										
	1533	153300	0		--	OHWM	BdA			
riprap	1777	177700	10	0.17	SC5	OHWM	BdA			
riprap	1784.5	178450	10	0.36	C/SC-RO1	OHWM	BdA			
riprap	1800	180000	10	0.03	SC/SC-CW3	OHWM	BdA			
riprap	1801.42	180142	10	0.36	SC/SC-CW3	OHWM	BdA			
	1817	181700	5	0.02	SC/SC-CW3	OHWM	BdA			
	1819	181900	5	0.01	C5	OHWM	BdA			
	1820	182000	0		C5	OHWM	BdA			
	1821.2	182120	0		C/SC-C3F	OHWM	BdA			
	1830	183000	0		C/SC-C3F	OHWM	BdA			
	1835.6	183560	0		SC5F	OHWM	BdA			
	1840	184000	5	0.11	SC5F	OHWM	BdA			
	1850	185000	0		SC5F	OHWM	BdA			
	1860	186000	-10		SC5F	OHWM	BdA			
	1867	186700	-15		SC5F	OHWM	BdA			
	1875	187500	-5		SC5F	OHWM	BdA			
	1887	188700	0		SC5F	OHWM	BdA			
	1903.5	190350	0		(OP)	OHWM	BdA			
	1904.8	190480	0		SC5F	OHWM	BdA			
	1907	190700	10	0.11	SC5F	OHWM	BdA			
	1912	191200	15	0.28	SC5F	OHWM	BdA			
	1920	192000	10	0.16	SC5F	OHWM	BdA			
	1927	192700	5	0.15	SC5F	OHWM	BdA			
	1940	194000	10	0.28	SC5F	OHWM	BdA			
	1952	195200	15	0.01	SC5F	OHWM	BdA			
	1952.2	195220	15	0.03	OP	OHWM	BdA			
	1953	195300	15	0.24	SC4	OHWM	BdA			
	1960	196000	20	0.09	SC4	OHWM	BdA	-4		
	1962	196200	25	0.46	SC4	OHWM	BdA	1	0.02	SC4

Spreadsheet 4. Vegetation permanently removed due to footprint of features. (continued)

			100yr+4 levee					100yr levee		
	Station (+00)	Station as ft	New toe is x ft from old toe (- = landward; + = riverward)	Acres of vegetation removed	Vegetation type (H&O 2007 by Px): Black = Upland Green = Riparian	OHWM?	NWR?	New toe is x ft from old toe (- = landward; + = riverward)	Acres of vegetation removed	Vegetation type (H&O 2007 by Px): Black = Upland Green = Riparian
	1970	197000	20	0.23	SC4	OHWM	BdA	-4		SC4
	1975	197500	25	0.29	SC4	OHWM	BdA	1	0.01	SC4
	1980	198000	18	0.21	SC4	OHWM	BdA	-6		SC4
	1985	198500	23	0.11	SC4	OHWM	BdA	-1		SC4
	1987	198700	30	0.21	SC4	OHWM	BdA	6	0.04	SC4
	1990	199000	40	0.46	SC4	OHWM	BdA	16	0.18	SC4
	1995	199500	30	1.52	SC4	OHWM	BdA	6	0.30	SC4
	2017	201700	30	0.21	SC4	OHWM	BdA	6	0.04	SC4
	2020	202000	30	1.38	SC4	OHWM	BdA	6	0.28	SC4
	2040	204000	15	0.28	SC4	OHWM	BdA	-9		
	2048	204800	20	0.09	SC4	OHWM	BdA			
	2050	205000	15	0.28	SC4	OHWM	BdA			
	2058	205800	0		SC4	OHWM	BdA			
	2060	206000	5	0.06	SC4	OHWM	BdA			
	2065	206500	10	0.11	SC4	OHWM	BdA			
	2070	207000	5	0.06	SC4	OHWM	BdA			
	2075	207500	0		SC4	OHWM	BdA			
	2079	207900	0		OP	OHWM	BdA			
	2086	208600	0		C-SC/C-SC3	OHWM	BdA			
	2092	209200	0		C-SC/C-SC3	OHWM	BdA			
	2103	210300	0		C-SC/C-SC3	OHWM	BdA			
	2108	210800	0		C-SC/C-SC3	OHWM	BdA			
	2120	212000	15	0.05	C-SC/C-SC3	OHWM	BdA			
	2121.4	212140	15	0.30	SC4	OHWM	BdA			
	2130	213000	15	0.03	SC4	OHWM	BdA			
	2131	213100			end of BdA	OHWM	BdA			
BDANWR south boundary (gap here - disturbed)						OHWM				
	2133	213300	0		[OP]	OHWM				
	2135.5	213550	0		SC4	OHWM				
	2170	217000	0		SC4	OHWM				
	2184	218400	-15		SC4	OHWM				
	2190	219000	-30		SC4	OHWM				
	2195	219500	-30		SC4	OHWM				
	2198	219800	0		SC4	OHWM				
	2210	221000	0		C2	OHWM				
	2213	221300				OHWM				
2213+00 (levee curves to west, leaves floodway)										
10yr-fp	2213	221300	0		SC5 [BOR2010]					
10yr-fp	2220	222000	15	0.34	SC5 [BOR2010]					
10yr-fp	2230	223000	0		SC5 [BOR2010]					
10yr-fp	2235	223500	0		SC6 [BOR2010]					
10yr-fp	2237	223700	0		SC5 [BOR2010]					
10yr-fp	2238	223800	0		OPbt					
10yr-fp	2240	224000	15	0.34	OPbt					
10yr-fp	2250	225000	15	0.34	OPbt					
10yr-fp	2260	226000	12	0.08	OPbt					
10yr-fp	2263	226300	0	0.00	OPbt					
10yr-fp	2264	226400	-15		OPbt					
10yr-fp	2265	226500	-30		OPbt					
10yr-fp	2266	226600	-7		OPbt					
10yr-fp	2267	226700	15	0.03	OPbt					
10yr-fp	2268	226800	15	0.03	OPbt					
10yr-fp	2269	226900	30	0.07	OPbt					
10yr-fp	2270	227000	45	0.10	OPbt					
10yr-fp	2271	227100	0		OPbt					
RR embankment										

Spreadsheet 4. Vegetation permanently removed due to footprint of features. (concluded)

Station (+00)	Station as ft	100yr+4 levee: New toe is x ft from old toe (- = landward; + = riverward)	100yr+4 levee: Acres of vegetation removed	100yr+4 levee: Vegetation type (H&O 2007 by Px): Black = Upland Green = Riparian	OHWM?	NWR?	100yr levee: New toe is x ft from old toe (- = landward; + = riverward)	100yr levee: Acres of vegetation removed	100yr levee: Vegetation type (H&O 2007 by Px): Black = Upland Green = Riparian

Non-riparian veg'n lost to footprint

Type	Acres	Native dominated	Non-native (SC) dominated	OP
SC6S	6.04		6.04	
SC5	6.52		6.52	
SC4	2.28		2.28	
HMQ-ATX	0.05	0.05		
C-TW2	0.09	0.09		
C/TW2	0.05	0.05		
	15.03	0.19	14.84	0
		1.26%	98.74%	

Riparian (floodway) veg'n lost to footprint

Type	Acres	Native dominated	Non-native dominated	OP
North end (10+63 to 69+00):				
CW5S	0.82	0.82		
CW-B5S	0.04	0.04		
SC-B5	3.44		3.44	
Subtotal (reach)	4.30	0.86	3.44	
		20.0%	80.0%	
BDANWR:				
C/SC-RO1	0.36		0.36	
C5	0.01	0.01		
C-SC/C-SC3	0.05	0.05		
OP	0.03			0.03
SC/SC-CW3	0.41		0.41	
SC4	6.59		6.59	
SC5	0.17		0.17	
SC5F	1.10		1.10	
Subtotal (reach)	8.71	0.06	8.63	0.03
		0.7%	99.0%	0.3%
Subtotal: All riparian (floodway):				
	13.01	*0.92*	*12.07*	*0.03*
		7.07%	*92.72%*	*0.21%*

In 10-yr-floodplain (Tiffany Basin):

OPbt	1.01			1.01
SC5	0.34		0.34	
Sum	**1.36**		0.34	1.01
			25.4%	74.6%
Offsetting gain	0.12			

Temp. riparian disturbance (soil cement)

CW5S	0.34	0.34		
CW-B5S	0.07	0.07		
SC-B5	0.46		0.46	
SC5	0.15		0.15	
SC4	0.80		0.80	
Sum	**1.82**	0.41	1.41	0.00

Subtotal (floodway)	**0.87**	**SC4**

*Note: Net floodway acres = 0.87 lost & 25.68 gained = 24.81 net gain on BDANWR.

10-year floodplain (Tiffany Basin):

Corner to RR (10-yr fldpln)	0.06	**OPbt**
Offsetting gain in reach =	0.00	
Net	-0.06	

GENERAL REEVALUATION REPORT AND

SUPPLEMENTAL ENVIRONMENTAL

IMPACT STATEMENT II:

RIO GRANDE FLOODWAY,

SAN ACACIA TO BOSQUE DEL APACHE UNIT,

SOCORRO COUNTY, NEW MEXICO

APPENDIX F-10

Economics

Appendix F ECONOMIC CONSIDERATIONS

List of Tables

List of Figures

F-01 Areas of Consideration:

The study area comprises a stretch of the Rio Grande extending from the town of San Acacia south past the Bosque Del Apache Wildlife Refuge to the former village of San Marcial, which lies north of the Bureau of Reclamation's Elephant Butte Reservoir. The study area is entirely contained within Socorro County, New Mexico. The City of Socorro, NM is the largest population center within the county. The 2010 U.S. Census determined that 9,051 of the county's 17,866 people lived within that city. The two main industries of the study area are education and research. The two largest employers within Socorro County are the New Mexico Institute of Mining and Technology and the National Radio Astronomy Observatory.

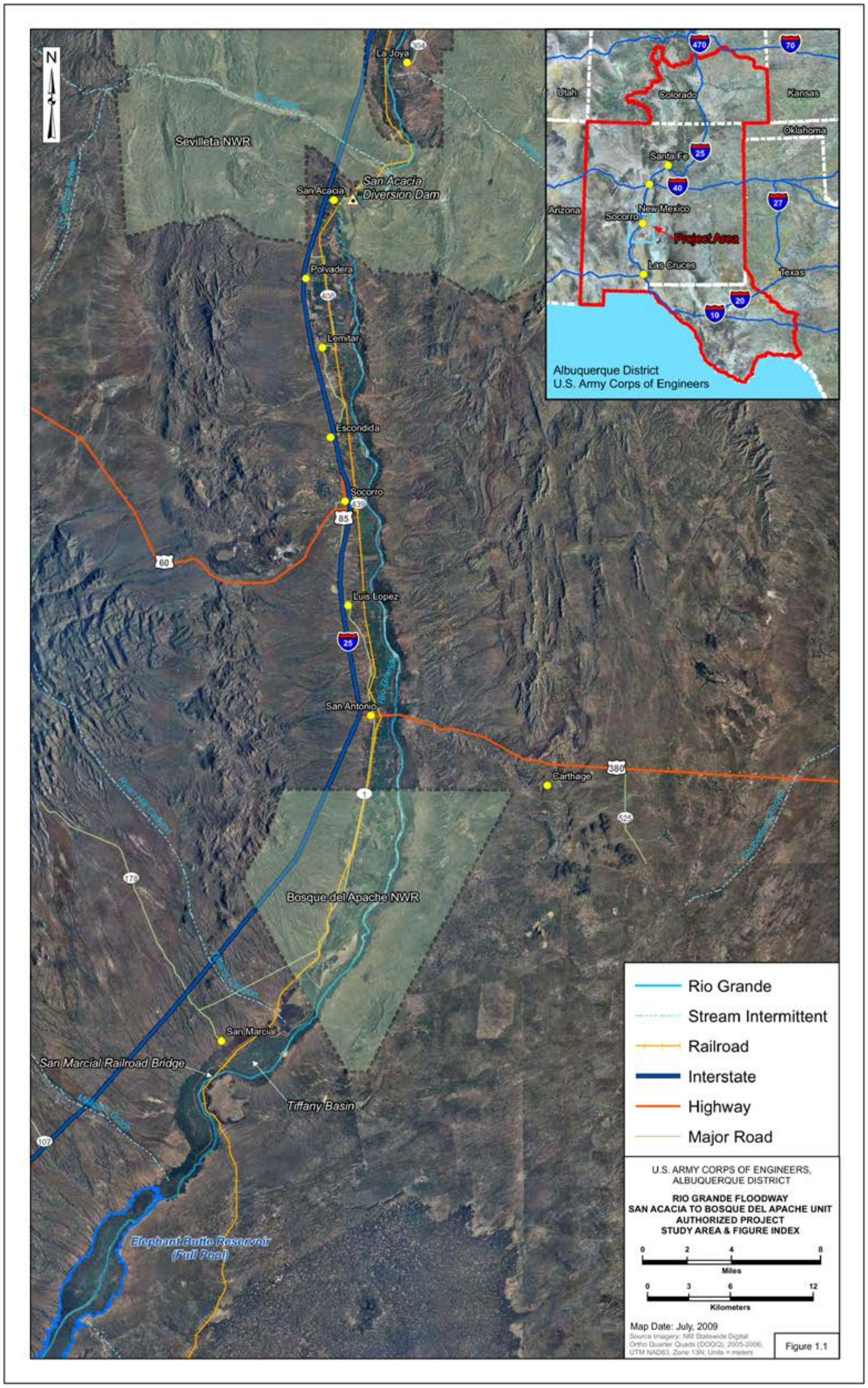


Figure F-1 – Study area

The study area is comprised of low, flat, and wide floodplains situated along both banks of the Rio Grande, which is perched. A typical perched channel cross section follows:

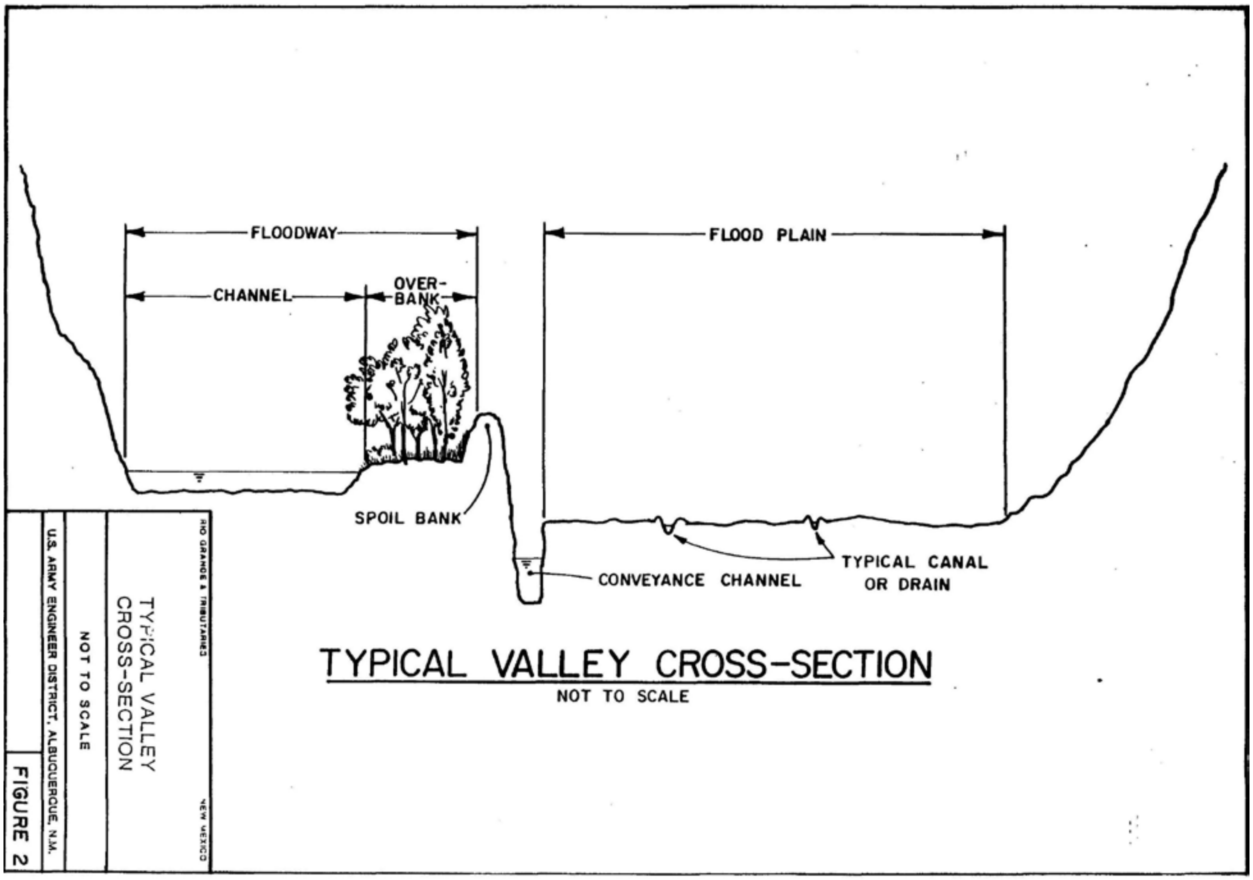


Figure F-2 - Typical perched channel cross-section

This differs from the typical cross-section of an incised river channel and the adjacent lands, diagrammed here:

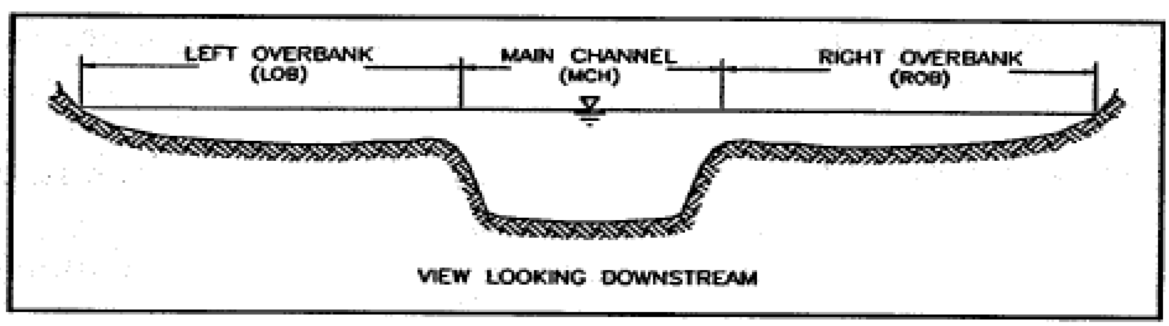


Figure F-3 - Typical incised channel cross-section

The perched channel provided additional modeling challenges to the study team. For one, the rating curves that were developed for the floodway differ from each overbank. Second, where flood waters leave the floodway and enter into the overbank, those waters may continue in the OVERBANK area for miles before reuniting with the floodway. Further discussion of modeling perched channels follows in this appendix.

The study area has an extensive history of flooding. Much of that flood threat has been mitigated with the construction of Cochiti Dam, but a substantial residual risk exists from uncontrolled drainages downstream of the dam, as well as the risk of a substantial spring snowmelt runoff. Over the past 30 years, numerous levee patrols have been conducted to monitor controlled releases from Cochiti Reservoir that threaten the spoilbank levees. Further, the Bureau of Reclamation has estimated it spends $2 million annually on levee maintenance to maintain performance in the areas proximate to the Bosque Del Apache National Wildlife Refuge. Finally, the Interstate Stream Commission has spent $11.3 million over the past 9 years to dredge and maintain a pilot channel through the main stem of the Rio Grande to mitigate sediment accumulation at the headwaters of the Elephant Butte Reservoir, at the southern extent of the study area (Albuquerque Journal, "Building a River", February 14, 2010, Page B1).

F-02 General Computational Procedures:

The assumptions and procedures used to analyze and quantify the economic variables are presented in this section. The hydro-economic model used to develop expected annual damages is based on discharge-frequency, stage-frequency, and depth-percent damage curves used to develop a damage-frequency curve. Depth-percent damage curves express dollar damages resulting from varying depths of water based on a percentage of the value of structure and contents.

Each surveyed property is assigned to a category (e.g., commercial, residential, public, apartment, transportation facilities, utilities, and vehicles) with as many subcategories (e.g., contents) as necessary, and details of ground and first floor elevations are noted. Each category has an associated depth-damage relationship expressed as a cumulative percentage of value for each foot of inundation. The depth-damage relationships were derived from historical data obtained from insurance companies, a recent commercial content survey conducted by the Albuquerque District, the Flood Insurance Administration, and prior Corps of Engineers experience. Note that the 2003 residential curves developed by the Institute of Water Resources (IWR) were used; thus, the residential content damages are a direct relationship to structure value. Table F-1 depicts the depth-damage relationships used in this study. Tables F-2A to F-2C display the without-project rating curves used in this study.

The elevation of each property (determined from GIS-based topographic maps and field investigations) is aggregated by location and structure type to compute the vertical distribution of damageable property at that location. Each property category is then tabulated in terms of the number of units, average value per unit and aggregate value, within consecutive inundation depth ranges for each location. That inventory is set into The Hydrologic Engineering Center's Flood Damage Analysis (FDA) ver. 1.2.5a to compute expected annual and Equivalent Annual Damages.

This report contains descriptive tables (number of structures subject to flooding by event, value of damageable property by property type and event, and single occurrence damages associated with specific frequency events) that were generated as a reality check of the FDA analysis. The study area's floodplain is fairly wide and flat, such that structure first floor height has a tremendous bearing on start of damages and damages attributable to specific events. To compute the number of structures in a given floodplain, the FDA_StrucDetail.out file was consulted, which computes number of structures, value of damageable property, and single occurrence damages. This computation occurs "without-risk" but serves as a consistency check on EAD and equivalent annual benefit calculations.

Tables F-3A and F-3B display the number of damageable property units by floodplain, in the present and the future hydraulic conditions. Tables F-4A and F-4B present the depreciated replacement values of those properties, by floodplain and hydraulic condition. As a quality check, these tables also display average value per structure, which is computed by dividing the number of structures in Tables F-4A to F-4B by the corresponding values in Tables F-3A to F-3B. The 2010 Census indicates the average household size in Socorro County is 2.46 persons. Multiplying this figure by the number residential and apartment structures in the 1% chance and 0.2% chance floodplains suggest that the study area has a Population at Risk (PAR) of 1,395 persons from the 1% chance flood and 1,823 persons from the 0.2% chance flood.

Section 308 of the Water Resources Development Act of 1990 states "The Secretary shall not include in the benefit base for justifying Federal flood damage reduction projects...any new or substantially improved structure...built in the 100-year flood plain with a first floor elevation less than the 100-year flood elevation after July 1,1991." To comply with that requirement, the latest Flood Insurance Rate Maps (FIRM) of the study area were consulted and compared to identified study floodplains. (http://msc.fema.gov/webapp/wcs/stores/servlet/CategoryDisplay?storeId=10001&catalogId=10001&langId=-1&categoryId=12001&parent_category_rn=12001&type=CAT_MAPPANEL&stateId=13038&countyId=14814&communityId=349932&stateName=NEW+MEXICO&countyName=SOCORRO+COUNTY&communityName=SOCORRO%2CCTY%2FSOCORRO+CO&dfirm_kit_id=&future=false&dfirmCatId=null&isCountySelected=&isCommSelected=&userType=G&urlUserType=G&sfc=0&cat_state=13038&cat_county=14814&cat_community=349932 accessed3/23/2011)

The latest applicable FIRM mapping has an effective date of 5/17/1988 and applies only to the incorporated portions of the Town of Socorro. 1446 structures were identified by comparing FIRM coverage with study floodplains. Of those structures, 1138 were elevated clear of the FIRM-identified 1% ACE water surface elevation, leaving a remainder of 308 structures subject to the Section 308 exclusion. Of those structures, only 13 were determined to be built after July 1,1991. Table F-3C presents the results of this analysis.

These 13 structures were largely comprised of single-story, detached residences and mobile homes of fairly average value. The remainder was material storage sheds and farm equipment storage buildings. The damages and benefit calculations were performed prior to this analysis, but the properties subject to exclusion by Section 308 are so few and minor in value relative to the scope of the flooding issues facing the Middle Rio Grande Valley, the study team thought it unwise to recompute damage and benefit calculations removing those properties. Sensitivity analyses indicate excluding these properties would have no material impact on EAD, project benefits, project sizing to identify the NED plan, or project cost-sharing.

For each category, the aggregate value of property at each flood depth is combined with the depth-damage relationship to compute total, single event damages for each level of flooding. Tables F-5A and F-5B display the single occurrence damages by category for the floodplain evaluated. Again, the "FDA_StrucDetail.out" file is consulted to produce these tables describing the impacts of specific frequency events such as number of structures, value of damageable property, and single occurrence damages. The value of damageable property in the HEC-FDA model is computed "with risk," and is essentially combined with the discharge-frequencies of the reference floods to produce damage-frequency relationships. Damage-frequency relationships provide probable average annual damages for each category under the conditions of each reference flood, and can then be compared to the hydrologic, hydraulic, and economic data analyzed within HEC-FDA. Tables F-6A to F-6C present the average annual damages computation from the HEC-FDA analysis.

Residual, average annual damages for each alternative, including the without project alternative, are obtained through consecutive iterations of the above computations for each alternative. The difference between damages in the without-project alternative and the residual damages for each alternative is the value of the benefits (inundation reduction) for each alternative. The following figure demonstrates the integration of hydrology, hydraulic data, and the economic information developed in this appendix is integrated to generate the Equivalent Annual Damages (EAD) computation:

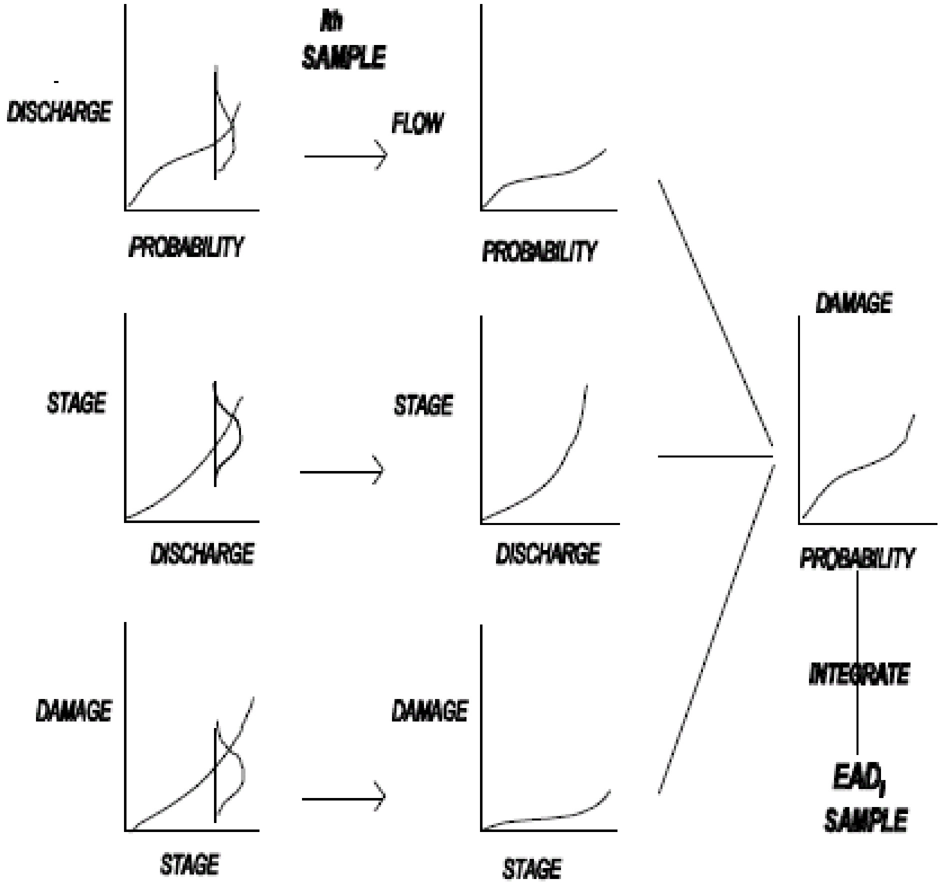


Figure F-4 - EAD Development Methodology

F-03 Value of Property:

A survey of structures within the floodplain was initially conducted in 2005, to evaluate the flood threat to the area. The property examined was categorized into residential, commercial, and public buildings, as well as, vehicles, streets and utilities, and outbuildings (sheds and detached garages). The field survey gathered primary data such as structure description (quality of construction, construction materials, number of floors, presence of basements), an estimate of effective age for depreciation purposes, occupancy type, elevation above grade, an estimate of structure size in square feet, and the number of nearby structures that share these attributes. Tables F-3A and F-4A show number of property units and value of damageable property affected by the 10-percent, 2-percent, 1-percent and 0.2 percent chance flood events, respectively. Tables F-3B and F-4B show number of property units and value of damageable property affected by the 10-percent, 2-percent, 1-percent and 0.2 percent chance flood events, respectively, in the future hydraulic condition. These tables were generated using HEC-FDA's

FDA_StrucDetail.out file for descriptive purposes only, to better understand the nature of the damages reported by HEC-FDA.

Depreciated, replacement residential structure values were computed using the factors and methods described in the Real Estate Cost Handbook, published by the Marshall and Swift Company. Corps regulations require cost-benefit evaluations use depreciated replacement costs. Replacement cost is the cost of physically replacing (reconstructing) the structure. Depreciation accounts for deterioration occurring prior to flooding, and variation in remaining useful life of structures. Depreciated replacement cost computations include factors such as construction type (wood, masonry) and quality, effective age (for depreciation purposes), and local market prices that bring the value of the structure to what we'd expect to spend on a "replacement in kind" structure in the study area. That computation was then verified in the field through interviews with local Realtors, and insurance agents to verify structure ages and replacement costs of structures in the floodplain. A windshield survey of all structures was also conducted to establish average first floor elevation above grade of structures in each damage reach. That "elevation above grade" was added to the ground surface elevation DTM data used in the hydraulic model to tie the economic inventory to the floodplain model. Commercial, public and apartment structures were inventoried in the field survey using the Marshall and Swift Valuation Service.

Content values were estimated from several sources. Residential content values were held at 50% of the structure value. Insurers contacted estimated content values are greater than 55% of structure value. (Where the IWR 2001 and 2003 structure and content depth-percent damage relationships were used, content damages are expressed as a percentage of structure value.) Commercial and public content values were computed using CCI, developed by Marshall and Swift/Boeckh, which estimated content and inventory values based upon factors like SIC code for the property, size of the property in square feet.

Vehicle estimates were determined using in-house data and published surveys. Total vehicles in the floodplain depicted are for residential structures and apartments. The typical household in Socorro County has 1.74 vehicles. It is assumed that one of these vehicles is driven out of the floodplain before any flood event. The remaining vehicles were distributed to the residential and apartment structures located within the 0.2 percent chance exceedance flood plain. It was assumed that all business-related vehicles were already evacuated from the floodplain.

Streets were measured from floodplain maps to determine quantities susceptible to flooding for each event. Streets, roads within the floodplain were elevated to a median elevation for each particular flood event for which floodplains were generated, and were "damaged" per elevation-damage relationships produced by the Galveston District (displayed in Table F-1). The resulting damages per event were then probability-adjusted per the likelihood of the event, and summed to compute equivalent annual damages. A sample of that calculation follows:

Roads Present				
freq	interval	value	single occ	total
0		36,715,390.98		
	0.002		36,715,390.98	73,430.78
0.002		36,715,390.98		
	0.008		30,868,198.44	246,945.59
0.01		25,021,005.91		
	0.01		23,370,744.67	233,707.45
0.02		21,720,483.42		
	0.08		16,093,455.23	1,287,476.42
0.1		10,466,427.03		
	0.01		5,233,213.52	52,332.14
0.11		0.00		
sum				1,893,892.37

Figure F-5 - Sample Event-Damage Calculation

Construction costs for roads were obtained from the City of Alamogordo, NM (http://ci.alamogordo.nm.us/Assets/COA+Document/City+Clerk/Minutes/04-08-2008+Regular+Minutes.pdf, accessed 10/30/2009) and the Arkansas State Highway and Transportation Department (http://www.arkansashighways.com/roadway_design_division/Cost_per_Mile_JULY_2009.pdf, accessed 10/30/2009). It was assumed that utility quantities (expressed in linear feet) were identical to paved street quantities. Utility construction costs were obtained from the Arizona and Texas Departments of Transportation. Damage estimates were calculated from published data provided by the Galveston District. Emergency costs were derived from locations that have had similar flood characteristics (Carlsbad, NM).

Agricultural acreage was measured using aerial photography of the floodplains used in this study. Agricultural valuation and damage assessment for crops within the study area was calculated using crop budgets from the NMSU Cooperative Extension Service for the study area. Using the same hydrologic data developed for recreation damage assessment, the crop budget was applied to a typical calendar year to calculate sunk costs if the flood event were to occur before the harvest. The long duration events predicted suggest a total loss of that year's crop if the event occurs before the harvest. Flood events occurring after harvest activities were conservatively assumed not to damage the value of the agricultural land, since the crop was already harvested. Officials at the Natural Resources Conservation Service provided estimates of crop composition (alfalfa hay, wheat, green chile, corn) and relative distribution.

The Bureau of Reclamation operates and maintains a Low Flow Conveyance Channel (LFCC). The channel was constructed in 1959 as a diversion running parallel to the Rio Grande that could divert water from the main channel and reduce evaporative water losses for the Rio Grande between the San Acacia diversion dam and Elephant Butte Reservoir to the south. The LFCC hasn’t actively diverted water from the Rio Grande since the 1980s, but does deliver water to the Middle Rio Grande Conservancy District’s

Socorro Diversion as well as to wetlands in the Bosque Del Apache NWR. The LFCC currently provides valley drainage, (Page 1-8 of the main report), irrigation return flows and shallow groundwater interception (Page 1-21), and water for use by Bosque Del Apache NWR and MRGCD irrigators (Page 1-9). It is the valley drainage/groundwater intercept functions alone that keep the LFCC full for much of the year. Bureau of Reclamation estimates that water is diverted from the LFCC, used, and return flows captured 4 times between the San Acacia diversion dam and the downstream end of the LFCC. Those functions are not part of the original design, but have evolved over the course of the LFCC's life. The LFCC is also recognized by the IBWC as a critical component in meeting Rio Grande Compact water delivery requirements to Texas and Mexico. The Fish and Wildlife Service also recognizes the LFCC as providing water to habitat critical to the Southwest Willow Flycatcher (an endangered species). Those functions have a value, which has not been captured in this analysis. The "Avoided Water Losses" benefit category captures the water that DIDN'T evaporate in a wider channel or pond due to intercept and delivery by the LFCC, but it's clear THAT benefit (no NED benefits claimed in this analysis) doesn't totally capture the impact of the structure. The Bureau of Reclamation has indicated they will continue to operate the LFCC without diverting flows from the Rio Grande in a Record of Decision for the Upper Rio Grande Basin Water Operations Review Final EIS (Page 1-21.). The existing channel was shortened to 58 miles, as sediment filled in the LFCC downstream of San Marcial (Page 1-9) which is the source of the "channel must be rehabilitated" statements in the report. In the event the LFCC were rendered inoperable, MRGCD irrigators would not receive their water, and neither would the Bosque Del Apache NWR. Local runoff would not return to the Rio Grande (which is perched above the floodplain) and would be impounded in the floodplain until evaporated or reabsorbed into the groundwater. New Mexico would fall further behind in Rio Grande Water Compact deliveries, and habitat critical to the Southwestern Willow Flycatcher would lose a key water source. Bureau of Reclamation representatives affirmed that the December 1993 construction cost for the LFCC was $87,620,000. Based upon the most recent expert solicitation, the Corps has estimated the LFCC's replacement cost in the study area at $125 million. Bureau of Reclamation personnel have stated as recently as 2007 in a Record of Decision that they the LFCC will continue to be operated as a passive drain with zero diversion from the Rio Grande. Savings in O&M of existing structures provided represent a benefit of the proposed project. Tables in this appendix do not reflect this savings, because it is uncertain what portion of that maintenance budget is attributed to the levee or the LFCC, or whether the Bureau of Reclamation would be able to reduce or halt its maintenance costs of the LFCC with the proposed project in place. Bureau of Reclamation personnel provided the event-%damage relationship used in this evaluation, as well as estimates of LFCC downtime following flooding and sedimentation within the diversion. The Bureau of Reclamation has indicated that they annually maintain the LFCC to protect it against underseepage from the main channel, under the existing spoilbank levee (which has no foundation) and erodes the LFCC sidewalls. An expanded discussion of the flood threats to the LFCC can be found in the Geotechnical appendix. A more detailed discussion of the flood threat to the LFCC and the benefits provided by the proposed project can be found in Paragraph F-11 of this appendix.

F-04 Sources of Uncertainty:

The major sources of economic uncertainty include many of the same variables identified above in the damage estimate analysis and others noted as follows:

1. Value of property;
2. Value of property contents;
3. Flood stage at which damage begins;
4. First floor elevations of structures;
5. Responses to flood forecasts and warnings;
6. Flood fighting efforts;
7. Cleanup costs;
8. Business losses;
9. Depth-percent damage curves;
10. Estimate of the stage associated with a given discharge;
11. Estimate of damage for a given flood stage; and
12. Estimate of future land use

Principal sources of error affecting the stage-damage relationship were examined in a risk and uncertainty framework. Those sources of error are 1) errors associated with the damageable property elevation, 2) errors associated with the values of structures in the floodplain inventory, 3) errors associated with values of structure contents in the floodplain inventory, 4) errors associated with the damage functions used against the floodplain inventory.

There are numerous factors which affect the frequency distributions as well as the rating curves for the study area's hydraulic reaches. Those factors are discussed in detail in Appendix E.

Elevation of damageable property:

A standard deviation of 0.4 feet was used to account for the uncertainty associated with the elevation of damageable property. In the study area, the flooding depths are relatively shallow and the flood plains are large and flat; therefore, an elevation difference of one foot could potentially double the damages associated with a given stage. The 0.4 feet standard deviation was used for three reasons. First, since the economic inventory was conducted by a visual windshield inspection, the first floor elevations of structures were estimated rather than measured. Second, the digital terrain model (DTM) used to develop specific frequency event floodplains introduces a source of uncertainty relative to elevation. Sensitivity analyses also indicated that the flat overbank flooding areas was overstating the impact of relatively frequent flooding, so a more conservative start of damages condition was established in HEC-FDA to minimize this impact. Para. F-05 of this appendix discusses how the start of damages condition was modeled in HEC-FDA.

Structure value:

It was assumed that the estimated structure value, which was derived from sales information and a field inventory, has a standard deviation of 15 percent of the structure value. That 15 percent standard deviation comes from prior Albuquerque District studies, and prior experience of the Ft. Worth District, which developed that estimate from interviews with various County Assessor's offices.

The structure inventory values and associated error distribution were then evaluated to compute floodplain inventory that incorporates errors concerning structure value. It was assumed that the estimated structure value (derived from field inventory and consultations with Realtors, insurance agents) could be off by 15% of the structure value. The floodplain inventory was then assessed using these assumptions, dropping all values more than three standard deviations from the reported (mean) value. The resulting distribution of structure values with error would contain 99% of possible values given the assumptions above.

Content value:

The error distribution associated with content value varied by structure type. In terms of average annual damages for residential contents the damage curves relate to the structure value rather than the content value.

The content value error distribution varied by structure type. Corps guidance stipulates residential content values should be held to no more than 50% of structure values, though local insurers note that contents are valued at 55-60% of structure value, or more. Residential and apartment content value distributions with error were fixed to the error distributions associated with residential and apartment structures. New depth-percent damage relationships published by IWR in 2001 and 2003 compute content damages as a percentage of structure value. Content valuation in this appendix is for illustrative purposes only, and content damages for residences use the IWR methods. Commercial and public contents used standard deviations that were equal to the content value to develop the content value with error. All content relationships were truncated to eliminate the possibility of negative values.

Stage-percent damage relationship:

Depth-percent damage curves are among the most important and least exact data in benefit estimation. Depth-percent damage curves express dollar damages resulting from varying depths of water based on a percentage of the value of structure and contents. Errors associated with the depth-percent damage functions were applied after the structure and content values were determined. The errors associated with the stage-percent damage relationship were evaluated for structures and contents of all occupancy types. The standard deviations used were those estimated by IWR for residential and apartment structures and contents.

The errors associated with the stage-%damage relationship were evaluated for structures and contents of commercial and public occupancy types. It was assumed that the damage value used +/- 40% of that value would contain the true damages for a given stage 95% of the time. The 40% standard deviation came from prior Albuquerque District studies, stage-%damage relationships developed by Galveston and Albuquerque Districts through post-flood surveys of property owners, and interviews with local business owners. Residential and apartment structures and contents use the IWR stage-percent damage relationships, which include errors for each stage presented. Errors associated with the depth-percent damage functions used were applied after the uncertain structure and content values were determined.

F-05 HEC-FDA Use

Consistent with the requirements set forth in EC 1105-2-412, "Assuring Quality of Planning Models" HEC-FDA version 1.2.5a was used to compute average annual and equivalent annual damages (EAD). Corps guidance stipulates that the plan which reasonably maximizes net national economic development benefits, consistent with the Federal objective, be identified. Project benefits for flood risk management measures are identified through successive iterations of existing and future without-project scenarios, changing key hydrologic and/or hydraulic variables as the measures warrant. HEC-FDA is the only model certified for formulation and evaluation of flood risk management plans using risk analysis methods, and was used in this study. Damages are computed in August, 2010 price levels using the fiscal year 2010 Federal discount rate of 4.375%. The period of analysis is 50 years.

There were special conditions in the Middle Rio Grande study area that required changes to how HEC-FDA performs its analysis. First, HEC-FDA is set up expecting an incised channel with overbank flooding areas higher than the channel. The Rio Grande River is perched in many portions of the study area, meaning the river sits higher within its banks than many of the lower spots in the overbank areas. A typical effect of perched channels is severe events can have LOWER stages than less severe, more frequent events, as the river breaks through its banks and rushes into the expansive (and lower) overbanks. A second consequence of the perched channel is different banks of the same damage reach can have different water surface elevations for the same event.

The study team developed "virtual" channels to address HEC-FDA's limitations to handle perched channels. For each damage reach, hydraulic water surface elevations were computed for the main channel, the left (east) overbank and the right (west) overbank locations. The HEC-FDA model contains three streams for purposes of analysis, identified in this appendix as the "Rio Grande", the "Rio Grande LOB" (left overbank, east of the channel), and the "Rio Grande ROB" (right overbank, west of the channel). Each stream has its own water surface profiles, exceedance-probability functions, and stage-discharge functions. The economic inventory was assigned to either the left or right overbank "stream."

A second issue created by perched channels is an exaggeration of the damages associated with frequent, though relatively not severe, events. The hydraulics appendix notes that there is considerable concern over the quality of the existing levees, such that upstream dam releases are kept to below 7,000 cfs, which corresponds to somewhere between the 20% and 10%-chance events in this study. The geotechnical appendix also notes the LFCC receives damages due to river water seeping under the existing levee (that doesn't have a foundation) and collapsing the LFCC sidewall. The HEC-RAS model showed overbank depths with the 50% and 20%-chance events, which didn't seem reasonable for this evaluation. Therefore, a beginning damage depth was applied in HEC-FDA corresponding to the present condition, 10%-chance water surface elevation. This ensures that events more frequent than the 10%-chance event doesn't damage the floodplain inventory, as the flows are expected to be contained within the banks of the Rio Grande. The PDT feels this assumption is conservative, as it assumes the existing spoil bank levees provide some degree of protection, though history shows those levees do not survive water against them. Absent the starting damage elevations, average annual damages were more than double what is presented here. Tables F-2A and F-2B display the rating curves used in this evaluation.

F-06 Potential Flood Damages:

It is currently estimated that the mean 1-percent chance exceedance flood would cause damages of about $98.4 million in the study area. Tables F-5A and F-5B presents the single occurrence damages associated with the 10%, 2%, 1%, and 0.2% chance flows in the assorted floodplains. These tables were generated using HEC-FDA results for descriptive purposes only, to better understand the nature of the damages reported by HEC-FDA. HEC-FDA does not generate point estimates of flows, stages, or damages for a specific event. The software, essentially, performs a statistical analysis of hydrology, hydraulic, and economic information using concepts of risk and uncertainty, meaning that a specific event frequency can have a range of flows, stages, and damages as a result of all the variables entered into the study. HEC-FDA was used to compute average and equivalent annual damages for structures and their contents only. Other damage categories were evaluated by identifying damages associated with the same event frequencies, as described below. This study's hydrology and hydraulic evaluations assume that flood events of a magnitude greater than the 20% chance event damage structures, contents, and vehicles in the flooding areas analyzed. It should be noted that many intangible damages (such as loss of life, disruption to community services, and increased health risks) that could occur because of flooding are not represented in these damage values.

Several damage categories (agriculture, roads, utilities, railroads, irrigation drains) were evaluated outside HEC-FDA using the following method: Within each floodplain, quantities (in acres for agriculture, in lineal feet for other categories) of each property type were measured in GIS. The 10% chance floodplain inventory represents all property falling within the 10% floodplain polygon. The 2% chance floodplain represents the entire inventory in the 10% chance floodplain, plus the measurements in the floodplain polygon between the 10% and 2% chance floodplain boundaries. The 1% floodplain represents the contents in the 10% floodplain, the floodplains between the 10% and 2% chance boundaries, plus the polygon bounded by the 2% and 1% chance floodplain boundaries. Finally, the 0.2% chance floodplain represents the sum of the 10% chance polygon, plus the polygon bounded by the 10% and 2% floodplain boundaries, plus the polygon bounded by the 2% and 1% floodplain boundaries, and finally, the polygon bounded by the 1% and 0.2% chance floodplain boundaries.

Streets, roads, utility lines, railroads, and irrigation drains within each floodplain were elevated to a median elevation for each particular flood for which floodplains were generated. Therefore, for the first floodplain a particular stretch of road is inundated, the first inundation event stage is equal to half the marginal stage between identified floodplain and the prior event or start of damages (for the 10% chance floodplain). Subsequently more severe flood stages have the effect of damaging more property, as the floodplains grow, and providing even more inundation depths for properties located within lesser floodplains.

Agricultural valuation and damage assessment for crops within the study area was calculated using crop budgets from the NMSU Cooperative Extension Service for the study area. GIS data and the floodplain boundaries were used to determine the acreage subject to flooding by specific events. Using the hydrologic data to determine the likelihood of precipitation in a given month, the crop budget was applied to a typical calendar year to calculate sunk costs if the flood event were to occur before the harvest. The long duration events predicted suggest a total loss of that year's crop if the event occurs before the harvest, therefore crop surface elevations were not necessary. Flood events occurring after harvest activities were conservatively assumed not to damage the value of the agricultural land, since the crop was already harvested. Officials at the Natural Resources Conservation Service provided estimates of crop composition (alfalfa hay, wheat, green chile, corn) and relative distribution.

Construction costs for roads and interstates were obtained from the Arkansas Department of Transportation and the City of Alamogordo, NM. Utility construction costs were obtained from the Arizona and Texas Departments of Transportation. Depth-percent damage relationships were calculated from published data provided by the Galveston District as well as prior Albuquerque District studies.

Estimated damages for the Bureau of Reclamation's Low Flow Conveyance Channel (LFCC) were developed by applying depth-percent damage relationships provided by the Bureau of Reclamation to the length of channel in each floodplain (determined by measurement of aerial floodplain photos). This was the more conservative method of assessing damages, as elevation of the LFCC on 5' contour interval aerial photos, with appurtenant uncertainty distributions, increased average annual damages using depth-damage relationships 25-40%. The stage-% damage relationship used is identified in Table 1. Paragraph F-11 of this appendix describes sensitivity studies conducted that used 5 separate depth-% damage relationships on the LFCC and their impacts.

Enumerated damages derived for the Bosque Del Apache National Wildlife Refuge represent the value of recreational opportunity lost for one year in the year that the flood event occurs. In addition to calculating values and damages to physical assets contained within the refuge, it was assumed that floods generate adverse changes to the specialized recreation values for the facility during the winter, when the site is visited by a variety of migratory waterfowl. During the summer flood events would negatively impact general recreation values for the Bosque Del Apache NWR. Hydrologic data was provided to estimate when during a typical year a significant flood event would occur, and specialized and general recreational values were developed per Economic Guidance Memorandum 10-3. A probability distribution of event occurrence in any given month was developed, and it was assumed that recreation opportunities would not be available for the remainder of the year if the Bosque Del Apache NWR were flooded, given the long duration events predicted and the loss of recreation facilities to that event. The probability distributed results for the various flood events are presented in the tables within this appendix.

The general and specialized recreation values were estimated through interviews with Corps, Bureau of Reclamation and Bosque Del Apache NWR biologists, who looked at the quality of the recreation experience, the availability of the recreation opportunity, the carrying capacity of the refuge and its facilities, the accessibility of the refuge, and the general esthetic condition. Each respondent provided a point estimate for the general recreation experience as well as the specialized recreation experience per Economic Guidance Memorandum (EGM) 07-03. Specialized recreation values were computed to cover the months when the Sandhill Crane and other migratory waterfowl visit in the winter. An arithmetic mean of the general recreation values was used to compute the value per general recreation day; the same computation was developed for specialized recreation values.

Agricultural acreage was measured using aerial photography of the floodplains used in this study. Agricultural valuation and damage assessment for crops within the study area was calculated using crop budgets from the NMSU Cooperative Extension Service for the study area. Using the same hydrologic data developed for recreation damage assessment, the crop budget was applied to a typical calendar year to calculate sunk costs if the flood event were to occur before the harvest. The long duration events predicted suggest a total loss of that year's crop if the event occurs before the harvest. Flood events occurring after harvest activities were conservatively assumed not to damage the value of the agricultural land, since the crop was already harvested. Officials at the Natural Resources Conservation Service provided estimates of crop composition (alfalfa hay, wheat, green chile, corn) and relative distribution.

Emergency costs include the costs of evacuation, reoccupation, disaster relief, cleanup and debris removal, and other similar expenses. The emergency costs incurred are dependent upon factors including number of residences damaged, evacuated, etc. Factors used in this study are based upon historical flooding in Carlsbad, NM and interviews with American Red Cross personnel.

Future flood damages resulting from basin development or growth in the floodplain have not been included, but are not expected to be significant for several reasons. 1) Local Realtors contacted noted that growth in Socorro and the surrounding area has been flat and may remain stagnant in the future. 2) Local Realtors have noted that most recent development in the study area has occurred outside the floodplain.

Future flood damages to existing properties are expected to increase in parts of the study area due to sediment aggradation within the Rio Grande. Generally, areas north of the Town of Socorro were expected to degrade, while areas south of Socorro were expected to aggrade. Any project evaluated in this light will have to account for the increased stages caused by sediment deposition in selected areas along the Rio Grande. Several tables in this appendix show existing conditions information, information for conditions 50 years hence. Tables F-6A to F-6C present Expected Annual Equivalent damages and benefits, discounting future values to present value for purposes of selecting the NED plan.

F-07 Average Annual Damages:

Risk and uncertainty analysis was used to derive average annual damages. Hydrologic and hydraulic uncertainty was combined through Monte Carlo simulations within HEC-FDA. When flooding from all sources is considered, the study area presently faces the risk of approximately $8.0 million in average annual damages to structures and contents. Sediment deposition over the proposed project's life is expected to increase those damages, which has been discounted to present value, summed, and amortized over the project life. Tables F-6A to F-6C presents the average annual damages that could occur from flooding in the study area without any flood protection, by land use category and floodplain. Table F-6C discounts the future damages to present values, and presents the Equivalent Annual Damages (EAD).

A major damage category for the study area outside of structures and their contents is damage to the Low Flow Conveyance Channel. The Water Resources Development Act of 1992 (PL 102-580) authorizes the Corps to identify the portion of project benefits attributable to Federal properties. Tables F-6A and F-6B display the Average Annual Damages for the present and future hydraulic conditions. Table F-6C discounts the future damages to present values, and presents the Equivalent Annual Damages (EAD) and EAD attributable to Federal properties.

F-08 Analysis of Existing Levees:

A reliability assessment of the existing system of spoilbank levees was performed to determine applicable Probable Non-Failure and Probable Failure Points (PNP and PFP, respectively). The results of that evaluation are presented in the Geotechnical Appendix of this GRR. In it, the conditions under which the levees fail are limited to foundation seepage, piping, and sloughing of the land side low flow conveyance channel (LFCC), which would occur before flows break out of the river channel. This is largely due to the existing levee's lack of foundation, and occurs as often as the 50% chance event. Further discussion of the LFCC's vulnerability to flows in the Rio Grande can be found in the Geotechnical appendix, and in Paragraph F-11 of this appendix.

As a result of the subsurface investigations and interviews with Bureau of Reclamation personnel, the Probable Non-Failure Point (PNP) was determined to be some point within the Rio Grande channel. The Probable Failure Point (PFP) was determined to be the toe of the existing levee just above the point where water first breaks out of the river channel. For purposes of determining damages and benefits for this appendix, the existing spoilbank levee provides no protection from any of the flood events evaluated.

A geo-technical evaluation was performed for the existing system of spoilbank levees from San Acacia to Bosque Del Apache. The geo-technical analysis that appears in Appendix E notes that the existing levees are constructed of uncompacted materials and are not adequate to withstand water against or near the levees from the Rio Grande or the Low Flow Conveyance Channel (LFCC). Moreover, Bureau of Reclamation personnel said that extensive flood fighting had been performed in the past to prevent levee failure. Previous iterations of this report did not consider the protective value of the existing system of spoilbank levees, and no adjustment of the benefits provided by those levees is necessary.

F-09 Levee Sizes Considered:

Several alternative levee heights, with sizes corresponding to the mean 1% chance exceedance event stage to about four feet greater than the mean 1% chance exceedance event stage, were evaluated in a framework incorporating elements of risk and uncertainty in hydrology, hydraulics and economics. Any analysis of alternatives must include the no action alternative. If no action is taken, the floodplains defined by the study will continue to suffer damages described in Tables F-6A to F-6C. Each height uses the same real estate footprint and will substantially replace existing spoilbank levees so alternative alignments were not considered for this analysis.

The table which follows describes how the alternative levee sizes were selected to contain specific flood events. Given the Risk and Uncertainty framework used in plan selection, it is inappropriate to describe an alternative in terms of "level of protection." The terms ("Base levee", "Base + 1 ft. levee", etc...) describe a height that corresponds to a mean event stage. Project performance measurements (formerly known as Reliability) are discussed in paragraph F-16.

ALTERNATIVE LEVEE HEIGHTS EVALUATED

Alternative Description

Base Levee	Approximately the mean 1% chance exceedance flood stage, present conditions
Base Levee+ 1 ft	Base levee plus 1.0 foot of levee height
Base Levee+ 2 ft	Base levee plus 2.0 foot of levee height
Base Levee+ 3 ft	Base levee plus 3.0 foot of levee height
Base Levee+ 4 ft	Base levee plus 4.0 foot of levee height

The exterior-interior relationship defines a relationship between the water surface stage on the river or exterior side of the levee versus the stage in the floodplain or the interior side of the levee. This relationship is necessary if the stage in the interior will not reach the same stage that is overtopping the levee. This may be due to floods that results in stages near the top of the levee overtopping as designed in a safe, controlled manner, or a flood hydrograph volume not sufficient to fill the floodplain to the stage equal to the top of the levee. For this project, there is insufficient volume to fill the floodplain once the flows are contained within one levee. In either case, the relationship must be developed from hydrologic or hydraulic analyses external to the FDA program. If the relationship is not specified, the assumption is that the floodplain fills to the stage in the river (represented by the exterior stage-discharge function for the reach) for all events that result in stages that cause levee failure or are above the top of levee. Because the levee cuts off portions of the floodplain, the remaining water is "stacked" in a smaller cross section and areal extent. The exterior relationships are expected to be somewhat higher than the corresponding interior rating curve.

To capture the benefits of the proposed levees, the study team evaluated the beneficial effects of flood protection for the virtual "Right Overbank (ROB)" channel as an interior rating curve in the main channel. In the without-project and without-project, future conditions, the main channel and the right overbank "virtual channel" have significantly different hydrology and hydraulic properties. However, the with-project conditions have identical properties for both the main channel (which is perched several feet over the overbank areas) and the right overbank. Several attempts were made to create a proxy for main channel levee height in the right overbank, but were not successful. The economic inventory of the right overbank was relocated to the main channel to most effectively capture the effect of channel aggradation in the main channel, which was not modeled over the period of analysis in the with-project condition. The main channel and the virtual "Left Overbank (LOB)" channels used the exterior rating curves to model the impact of a levee. The main channel uses the exterior rating curve to measure the project performance and capture data like annual exceedance probability, cumulative risk of failure, and likelihood of capturing key events of specific magnitudes, such as the 1%

chance event. The left overbank uses the exterior rating curves to measure any induced damages that could be caused by putting a levee on only the right bank of the Rio Grande.

The levee heights analyzed started at the height corresponding to the mean 1% chance stage for each damage reach. Incremental heights of one foot were analyzed, up to the 1% annual chance exceedance (ACE) stage + 4' design heights. Across all reaches, that final levee height exceeds the mean 0.2% chance event stage, so the team was assured of analyzing alternatives that would include capturing almost all events. New rating curves were developed by Corps hydraulic engineers to define the with-project (exterior) relationships for the main channel and the left overbank, and are presented in Table F-2C. Since the Right Overbank's damageable property would be afforded flood protection by any proposed levee, the same rating curves developed for the without project condition in the Right Overbank were placed in HEC-FDA's levee interior-exterior relationships as the "interior" relationship in the with-project and the with-project, future condition. That relationship was used to evaluate the benefits of the levee alternatives.

F-10 Evaluation of Induced Flooding on East Bank and Downstream Areas:

Infrared aerials of the Rio Grande east bank were examined to determine the extent, if any, of induced damages that would be caused by placement of the proposed levee on the west bank. Those properties identified were then evaluated in the field for structure value and first floor elevation, using the methods described in Paragraph F-02, above. During the field inventory, attempts were made to locate any newer structures built since the time of the aerial mapping, but none were found. A lack of eastern bank growth was confirmed by the Socorro City Planner and officials at the Natural Resources Conservation Service. Forty-seven residential and commercial structures were located within the 1% annual chance exceedance (ACE) floodplain. Table F-7 describes the inventory of damageable properties on the east bank, by floodplain. The inventory on the east bank was evaluated using the methods described in Paragraphs F-03 to F-07, above, to compute EAD in the without-project and with-project condition, for both the present and future condition.

Table F-7								
NUMBER OF STRUCTURES								
WITHOUT PROJECT CONDITIONS (PRESENT)								
SAN ACACIA TO BOSQUE DEL APACHE EAST BANK FLOODPLAIN								
	EVENT							
Land Use Category	10%		2%		1%		0.20%	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Residential	13.00		17.00		19.00		21.00	
Commercial	1.00		1.00		1.00		1.00	
Public	0.00		0.00		0.00		0.00	
Apartments	0.00		0.00		0.00		0.00	
Outbuildings	27.00		27.00		27.00		34.00	
TOTAL STR.	**41.00**		**45.00**		**47.00**		**56.00**	

The east bank inventory was generally aggregated into two geographic areas. The first area on the east bank is the small community of Pueblito, immediately upstream of Socorro, which sits upon the west bank. The second area is northeast of the Village of San Antonio, consisting of residential and commercial structures along Bosquecito Road.

Different hydraulic models were used for the without-project condition (FLO-2D) and the with-project condition (HEC-RAS), making a direct, one-to-one comparison of WSEL difficult. Therefore, this discussion will center on impacts the proposed levee on the west bank of the Rio Grande has on flooding on the east bank. The additional increment of induced flooding is minor at cross sections containing damageable property (1327, 1433, and 1483), which is roughly 0.5' at the 10% chance exceedance event for properties along Bosquecito Road in the future hydraulic condition. In the present, with-project condition the levee on the west bank on the Rio Grande showed no water surface increase until the 2% chance exceedence event. The events that will produce induced flooding begin at the 10% chance exceedance event and end at the 1% chance exceedance event plus 4.0', where any proposed project's capacity is exceeded on the west bank. The following tables (Tables F-8 and F-9) describe the impact of west bank levee construction to east bank stages for specific events in the present and future conditions:

Table F-8						
10-YR WSEL CHANGES						
XSEC	10-yr WSEL, present			10-yr WSEL, future		
	w/o project	w/ project	Change	w/o project	w/ project	Change
1312	4620.76	4620.76	0	4619.59	4620.77	1.18
1327	4610.52	4610.67	0.154	4610.52	4610.674	0.154
1433	4567.66	4567.66	0	4568.435	4568.59	0.155
1483	4549.77	4549.25	-0.52	4549.77	4550.31	0.54
1491	4545.39	4546.86	1.47	4546.79	4548.32	1.53

Negative values ignored in residual EAD calculation.

Table F-9						
50-YR WSEL CHANGES						
XSEC	50-yr WSEL, present			50-yr WSEL, future		
	w/o project	w/ project	Change	w/o project	w/ project	Change
1312	4621.26	4623.36	2.1	4621.26	4622.88	1.62
1327	4613.16	4611.1	-2.06	4612.30	4612.064	-0.236
1433	4567.94	4568.39	0.45	4568.64	4569.34	0.7
1483	4549.97	4550.02	0.05	4549.97	4551.08	1.11
1491	4545.92	4547.58	1.66	4547.32	4549.04	1.72

Negative values ignored in residual EAD calculation.

Ignoring the negative values in water surface elevation changes (due to different hydraulic models) it's clear the impact of the levee is most felt in the future condition. There are two reasons for this; the general aggradation of sediment within the Rio Grande projected over the project life, and the increased error measurement, expressed in the standard deviation around the 1% chance event's water surface elevation. The standard deviation around the 1% chance event in the present condition is 1.3', and in the future condition is 2.26'. The net effect of the higher standard deviation accounts for approximately 1/3 of the increase in EAD.

Aerial photos of floodplains downstream of the downstream extent of the proposed project were examined to determine the extent of induced flooding downstream attributable to the project. No properties were found, which was verified during field investigations. Additionally, downstream flooding is more likely to occur because of change in the Elephant Butte Reservoir stage rather than the Rio Grande flood stage.

Pre- and post-project floodplains on the east bank were evaluated to determine the change in equivalent annual damages (EAD) attributable to the proposed project. The start of damages was assumed to be the 10% chance exceedance event. The proposed levee projects do not have a measurable impact to the damageable property in the present condition, but a minor impact in the future. The without project EAD for the without-project condition is $272,000 whereas with-project EAD is $275,000. The results indicate that the EAD induced by the proposed project is approximately $3,000. The damage analysis is limited to 22 existing structures.

F-11 Evaluation of the Bureau of Reclamation's Low Flow Conveyance Channel (LFCC)

1. **History and description of the LFCC**

The Bureau of Reclamation constructed, operates and maintains the Low Flow Conveyance Channel (LFCC). The earthen and rock-lined channel was constructed in 1959 as a diversion running parallel to and west of the Rio Grande that could divert water from the main channel and reduce evaporative water losses for the Rio Grande between the San Acacia Diversion Dam and Elephant Butte Reservoir to the south. The LFCC had a design carrying capacity of 2,000 cfs and extended approximately 75 miles from the San Acacia Diversion Dam to the “narrows” in Elephant Butte Reservoir.

A series of high spring runoffs and high Elephant Butte reservoir conditions from 1979 to 1987 repeatedly damaged the LFCC. Making diversions from the Rio Grande would further damage the structure, especially in the lowest 15 miles, south of the San Marcial railroad bridge crossing, where sedimentation completely filled the LFCC. The Bureau of Reclamation evaluated their options for the LFCC with various planning studies and EIS from 1996 to 2007, to include relocating the LFCC to the East bank of the Rio Grande downstream of San Marcial. Reclamation continues their operations and maintenance activities downstream of the railroad crossing, and repurposed the LFCC to serve as a passive drain to intercept and convey shallow groundwater and irrigation return flows downstream to Elephant Butte Reservoir. However, the uncertainty over the LFCC’s location and purpose downstream of the San Marcial railroad bridge has prompted the Corps to drop the segment of the LFCC downstream of the San Marcial railroad bridge from evaluation in this flood risk management study. Reclamation continues to operate and maintain the entirety of the LFCC as required. The residual length of the channel (50 miles from the San Acacia Diversion Dam to the San Marcial railroad crossing) serves as the focus of this evaluation.

The LFCC is minimally protected by a spoil bank embankment. This spoil bank, located east of the LFCC and west of the main Rio Grande channel, was built using material that was excavated to create the LFCC. Subsequent maintenance and rehabilitation activities have also provided material to create the embankment. It extends the entire length of the LFCC and varies in size, largely due to convenience and availability of material. Being a non-engineered structure, the spoil bank lacks features common in levees, such as soil compaction, appropriate side slopes, an impervious core and foundation, toe protection, etc…

2. **Uses and outputs of the LFCC**

The LFCC’s role in the study area has evolved since its construction. The LFCC hasn’t actively diverted water from the Rio Grande since the 1985, but the shorter channel length in its present configuration does deliver water to the Middle Rio Grande Conservancy District’s Socorro Diversion as well as to wetlands in the Bosque Del Apache NWR. The original intent of the LFCC was to minimize evaporative water losses by diverting Rio Grande flows into a channel with a narrower topwidth. From construction to 1985, evaporative water loss savings were between 30,000 and 40,000 acre-feet annually. That savings is not claimed in this current analysis.

The LFCC functions as a riverside drain, and provides valley drainage, (Page 1-8 of the main report), irrigation return flows and shallow groundwater interception (Page 1-21), and water for use by Bosque Del Apache NWR and MRGCD irrigators (Page 1-9). It is the valley drainage/groundwater intercept functions alone that keep the LFCC full for much of the year (The LFCC and the valley sit below the perched Rio Grande). Bureau of Reclamation estimates that water is diverted from the LFCC, used, and return flows captured 4 times between the San Acacia diversion dam and the downstream end of the LFCC. Those functions are not part of the original design, but have evolved over the course of the LFCC's life. The LFCC is also recognized by the IBWC as a critical component in meeting Rio Grande Compact water delivery requirements to Texas and Mexico. The Fish and Wildlife Service also recognizes the LFCC as providing water to habitat critical to the Southwest Willow Flycatcher (an endangered species). Those functions have value to the region and the environment, which has not been captured in this analysis.

Without the Low Flow Conveyance channel, life in the study area would be different. According to the Bureau of Reclamation, "Land use practices and their economic values for the agricultural community and BDANWR [Bosque del Apache National Wildlife Refuge] would be diminished without the LFCC drainage facility. There would be the potential for increased groundwater levels due to surface water irrigation of lands and increased alkalinity in the soils due to the groundwater rising and fluctuations near the root zones. These alkalinity problems due to lack of valley drainage would also impact fish and wildlife, vegetation, wetlands, and endangered species functions on the BDANWR." Groundwater replacement sources may be available to replace the needed water but the Bureau has indicated that groundwater levels are continually declining as it is, and further use would accelerate that depletion, potentially being an unsustainable solution. Absent the LFCC, stormwater and irrigation runoff has no means to return to the perched Rio Grande, meaning the State of New Mexico will have a harder time making water deliveries to Texas and Mexico per the Rio Grande Compact.

3. Nature of the flood threat and nature of damages

a. Spoil bank and underseepage

As previously stated, the LFCC is minimally protected from the Rio Grande by a non-engineered spoil bank levee. The most common threat to the LFCC occurs with annual channel flows. The Bureau of Reclamation has indicated that they annually maintain the LFCC to protect it against under seepage from the main channel, under the existing spoil bank levee (which has no foundation), which erodes the LFCC sidewalls. Reclamation has historically performed river and spoil bank levee maintenance during the Corps' flood control operations (above the mean annual peak flow or long duration periods at or above the mean annual peak flow) in the study area. These flows occur during the spring runoff or monsoonal thunderstorm events. Work on the river has been comprised of constructing pilot channels through sediment deposits (after flows recede) or widening, raising, and repairing the levee in the San Acacia Reach. This work occurs prior to the annual spring runoff, when the snowpack is very large, or during the spring runoff. The success rate of this preparatory work is spotty at best, as Reclamation indicates that there have been "many cases of near failure due to either overtopping or seepage/piping." Aside from the underseepage threat, the LFCC faces a threat of sedimentation closing off channel capacity. The Bureau of Reclamation spends $150,000-$700,000 annually to maintain the LFCC, which includes sediment removal, and lining vulnerable portions of the channel with rock. Small flows, to include annual flows, present a threat of under seepage. Larger flows threaten to erode the spoil bank levee, and deposit sediment and levee materials within the LFCC, which sits below the perched Rio Grande.

b. Flood fight history

The study area has an extensive history of flooding. Much of that flood threat has been mitigated with the construction of Cochiti Dam, but a substantial residual risk exists from uncontrolled drainages downstream of the dam, as well as the risk of a substantial spring snowmelt runoff. Over the past 30 years, numerous levee patrols have been conducted to monitor controlled releases from Cochiti Reservoir that threaten the spoil bank levees. Significant flood fighting efforts took place in 1966, 1969, 1973, 1984, 1989, 1991. The important thing to note about each of these events is the flows were less severe than the 10% chance event, and the more recent events (1989, 1991) were less severe than the 50% chance event. The last event in the study area that is considered more severe than the 10% chance exceedance in the study area was in 1986.

The Bureau of Reclamation has estimated it spends $150,000-$700,000 annually on LFCC maintenance to maintain performance in the areas proximate to the Bosque Del Apache National Wildlife Refuge. Even more work is done to maintain the Rio Grande main channel with the goal of managing sediment accumulation, and to maintain and repair the spoil bank levees. The Interstate Stream Commission has spent $11.3 million over the past 9 years to dredge and maintain a pilot channel through the main stem of the Rio Grande to mitigate sediment accumulation at the headwaters of the Elephant Butte Reservoir, at the southern extent of the study area (Albuquerque Journal, "Building a River", February 14, 2010, Page B1). Reclamation has also spent $2.25 million in 2009-2010 to repair 4 miles of the spoil bank levee at the northern edge of the Bosque Del Apache National Wildlife refuge. In 2005-2008, Reclamation spent $7 million for spoil bank levee repairs.

c. Benefits afforded by existing levees

A reliability assessment of the existing system of spoilbank levees was performed to determine applicable Probable Non-Failure and Probable Failure Points (PNP and PFP, respectively). The results of that evaluation are presented in the Geotechnical Appendix of this GRR. In it, the conditions under which the levees fail are limited to foundation seepage, piping, and sloughing of the land side low flow conveyance channel (LFCC), which would occur before flows break out of the river channel. This is largely due to the existing levee's lack of foundation, and occurs as often as the 50% chance event. Further discussion of the LFCC's vulnerability to flows in the Rio Grande can be found in the Geotechnical appendix.

As a result of the subsurface investigations and interviews with Bureau of Reclamation personnel, the Probable Non-Failure Point (PNP) was determined to be some point within the Rio Grande channel. The Probable Failure Point (PFP) was determined to be the toe of the existing levee just above the point where water first breaks out of the river channel. For purposes of determining damages and benefits for this appendix, the existing spoilbank levee provides no protection from any of the flood events evaluated.

A geo-technical evaluation was performed for the existing system of spoilbank levees from San Acacia to Bosque Del Apache. The geo-technical analysis that appears in Appendix E notes that the existing levees are constructed of uncompacted materials and are not adequate to withstand water against or near the levees from the Rio Grande or the Low Flow Conveyance Channel (LFCC). Moreover, Bureau of Reclamation personnel said that extensive flood fighting had been performed in the past to prevent levee failure.

Previous iterations of this report did not consider the protective value of the existing system of spoilbank levees, and no adjustment of the benefits provided by those levees is necessary.

d. Alternative means to flood fight (operate Cochiti)

Aside from flood fighting as flows threaten the spoil bank levee and the LFCC behind it, there are few other options available to the Bureau of Reclamation to mitigate the damages. Cochiti dam and reservoir is roughly 120 miles upstream of the study area, and changing operations at Cochiti does not have an impact in the study area for three days. Galisteo and Jemez dams are also upstream, but do not contribute materially to flows within the study area. The hydrology for the region indicates that events in unregulated watersheds downstream of Cochiti dam generate the most severe flows in the study hydrology. However, spring snowmelt runoff floods provide longer durations which further threatens to the fragile spoil bank levees. At the downstream end of the study area is the San Marcial railroad bridge, which is described extensively elsewhere as facing both a flood threat and a sediment accumulation threat. That bridge represents a choke point for operating Cochiti Dam releases, as the Federal government cannot cause flood damage to the structure through its operations. When the Bureau of Reclamation manages sediment accumulations in the Rio Grande, one of the results is maintained channel flows under the bridge.

4. Modeling the flood damages in HEC-FDA.

The LFCC was modeled in the Hydrologic Engineering Center's Flood Damage Analysis (HEC-FDA) package using the same information (frequency distributions, rating curves, virtual channels, interior-exterior relationships for the proposed levees, changes in H&H in the future without and with-project condition due to sediment aggradation, beginning depth-damage) that was used to model structures and their contents, described elsewhere in this GRR, except as noted here. For each hydraulic cross section, a length of the channel was assigned, keying the property elevation to the height at grade at the cross section. The Bureau of Reclamation provided a range of values for the replacement cost of the LFCC. At the low end, there is $1 million per mile, and at the high end, $1,395 per foot. This results in a replacement cost of the LFCC between $50 million and $368 million. The Corps subsequently created its own estimate to predict replacement cost of a typical length of channel ($473 per lineal foot) which puts the entire LFCC's replacement cost at roughly $125 million. For purposes of this evaluation, the low and high LFCC values, as well as the Corps' valuation was used to evaluate the impacts of LFCC replacement cost on damages and benefits.

The Bureau of Reclamation did indicate there are some reaches where the channel is in a degraded position or may have a shortened remaining life, but was unable to provide sufficient information to apply depreciation to this replacement cost. Per ER 1105-2-100, Para. E-19. k. (4) (a), depreciation, "accounts for deterioration occurring prior to flooding, and variation in remaining useful life of structures." Neither Bureau of Reclamation nor Corps personnel could identify any deterioration in the portion of the LFCC protected by the proposed levees (channel capacity remains the same as the designed capacity) nor variability in the channel's remaining useful life. Further, re-alignment and extensive repairs have been made to the LFCC by Reclamation during the last few years. Therefore, there was no depreciation factor applied to the replacement cost of the LFCC protected by the proposed project. While the Bureau of Reclamation did indicate reaches of the LFCC that were in a deteriorated condition, it's a reasonable assumption that those reaches would receive priority in the current or next year's maintenance activities. The main report refer to necessary and extensive repairs required to restore LFCC operations as an active diversion. Those repairs are to portions of the LFCC downstream of the San Marcial railroad bridge, which is downstream of the southern extent of the study area. The analysis of the flood risk and benefits of the proposed levees only deal with the Low Flow Conveyance Channel between the San Acacia Diversion Dam and the San Marcial railroad bridge.

There is a dearth of available depth-damage curves applicable to the LFCC or other irrigation channels throughout the Corps. Existing published reports frequently do not display the curves used for damage categories other than structures or contents, and studies that include "Farm" or "Crop" damages frequently ignore the irrigation infrastructure. The Bureau of Reclamation didn't have any information more recently than 1995. However, the District had several depth-% damage relationships available to model the impact of flooding on the LFCC. All five curves were applied to the three values of the LFCC to determine whether curve selection would materially impact damages and benefits, and are listed within the following table:

Table F-10

DEPTH-DAMAGE RELATIONSHIPS

(EXPRESSED AS PERCENT OF LFCC VALUE)

	Depth (ft.)															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RGMCC curve, identified in May, 1995 solicitation	0	67	100													
RGMCC curve, 1990 FIRM rate reivew	0	7	14	21	28	35	42	49	56	63	70	77	84	91	95	95
Canals, ditches depth-damage relationship	0	11	22	33	44	55	66	77	88	95	100					
Earthen feeder ditches	0	20	40	60	80	100										
Concrete feeder ditches	0	1	14	21	28	35	42	49	56	63	70	77	84	91	95	

The first curve was developed based upon a 1995 expert elicitation of local Bureau of Reclamation personnel. The second curve is based upon an earlier solicitation, although it appears that the curve was also supported by the FIA. The final three curves were developed by the Albuquerque District, Corps of Engineers, and used in other studies. The LFCC is heavily damaged on a regular basis by under seepage from the perched Rio Grande, under the existing spoil bank levee, but has yet to encounter a more traditional flood where the existing levee is breached, and flood water and sediment inundates the channel. As a means to test whether modeling existing levee performance would have an impact on LFCC damages and benefits, two scenarios were developed to model in HEC-FDA. A beginning damage depth was applied in HEC-FDA corresponding to the present condition, 20%-chance water surface elevation. This ensures that events more frequent than the 20%-chance event doesn't damage the floodplain inventory, as the flows are expected to be contained within the banks of the Rio Grande. A second beginning damage depth was applied to the LFCC corresponding to the present condition, 10%-chance water surface elevation, to evaluate the impact of the start of damages condition on LFCC damages and benefits.

5. Project benefits

The scenarios and their impact on EAD is presented within the following table:

Table F-11

WITHOUT PROJECT CONDITION, 10 YR START OF DAMAGES, LFCC EAD

LFCC replacement cost		Damage Curve selection				
		RGMCC curve, identified in May, 1995 solicitation	RGMCC curve, 1990 FIRM rate reivew	Canals, ditches depth-damage relationship	Earthen feeder ditches	Concrete feeder ditches
Low	$1 million/mile	8,660.53	2,339.88	3,690.95	6,190.58	2,346.68
Likely	$ 473/foot	21,634.33	5,843.72	9,217.91	15,464.24	5,860.69
High	$1395/foot	63,808.49	17,234.71	27,189.79	45,611.78	17,284.71

WITHOUT PROJECT CONDITION, 5 YR START OF DAMAGES, LFCC EAD

LFCC replacement cost		Damage Curve selection				
		RGMCC curve, identified in May, 1995 solicitation	RGMCC curve, 1990 FIRM rate reivew	Canals, ditches depth-damage relationship	Earthen feeder ditches	Concrete feeder ditches
Low	$1 million/mile	9,320.19	2,549.29	4,020.61	6,704.08	2,554.99
Likely	$ 473/foot	23,278.74	6,366.73	10,041.21	16,742.35	6,380.93
High	$1395/foot	68,658.27	18,777.20	29,617.47	49,381.26	18,819.04

The Water Resources Development Act of 1992 (Public Law 102-580) has a provision to adjust the non-Federal contribution to project costs to more equitably reflect the non-Federal benefits in relation to the total benefits of the project. The law requires the Corps to identify the benefits of any flood control project that are attributable to Federal properties, but also states that Federal property benefits may not exceed 50% of total project benefits. Table F-47-A-5 of the Economics appendix to the GRR contains the equivalent annual damages and benefits attributable to the NED plan, which is Alternative A at the 100-yr + 4’ levee height. That table is repeated here for convenience.

Table F-50-A-5

EQUIVALENT ANNUAL BENEFITS
BY LAND USE CATEGORY

100 yr levee + 4 ft

LAND USE CATEGORY	EAD	Residual Damages	Benefits				
			Average Annual Benefits (x $1,000 August, 2010 price level)				
Residential	2,198.80	22.72	2176.08				
Commercial	5,593.65	46.84	5546.81				
Public	119.94	12.90	107.04				
Apartments	1.49	0.04	1.45				
Outbuildings	77.40	0.87	76.53				
Subtotal - Structures and	7,991.28	83.37	7907.91				
Streets, roads	1,893.89	126.73	1767.16				
Utilities	60.73	4.06	56.66				
Railroad	193.28	12.93	180.35				
Vehicles	343.28	27.84	315.43				
Agriculture	101.00	6.15	94.86	*Federal Benefits*		*Federal Benefits*	
Irr. Drains	36.01	2.41	33.60				
LFCC	6,366.73	72.26	6294.46	*6294.46*		*7731.81*	
Avoided Water Losses	0.00	0.00	0.00	*0.00*		*0.00*	
Recreation	822.84	9.93	812.91	*812.91*		*812.91*	
East Bank	272.25	274.89	-2.64				
Emergency Costs	157.59	2.87	154.72		*Federal % of Total*		*Federal % of Total*
TOTAL	**18,238.87**	**623.45**	**17,615.42**	***7107.37***	***40.70%***	***8544.72***	***50.00%***

The table indicates the current proportion of Federal benefits to total benefits, plus identifies the maximum allowable Federal benefits under PL 102-580. This figure is important when evaluating the variables surrounding the LFCC's damage and benefit analysis. Holding the Recreation benefits to $812,910 on an equivalent annual basis, the 50% benefit cap for Federal properties is $8,545,000. Applying the 50% cap to the matrix of 30 different scenarios that handle assumptions such as replacement cost, start of damages, depth-% damage curve selection provides a useful boundary for analysis where some assumptions alone or in concert exceed the 50% benefit cap.

The following tables present the benefits of the proposed levee to the LFCC, at the 100-yr + 4' height, both in dollar values and as a percentage of total benefits, keeping in mind the benefit cap of $8,545,000.

Table F-12A

BASE+4' PROJECT CONDITION, 10 YR START OF DAMAGES

LFCC EQUIVALENT ANNUAL BENEFITS

LFCC replacement cost		Damage Curve selection				
		RGMCC curve, identified in May, 1995 solicitation	RGMCC curve, 1990 FIRM rate reivew	Canals, ditches depth-damage relationship	Earthen feeder ditches	Concrete feeder ditches
Low	$1 million/mile	8,619.34	2,330.63	3,676.70	6,166.01	2,337.42
Likely	$ 473/foot	21,531.46	5,820.61	9,182.32	15,402.89	5,837.57
High	$1395/foot	63,504.59	17,166.58	27,084.84	45,430.87	17,216.51

BASE+4' PROJECT CONDITION, 5 YR START OF DAMAGES

LFCC EQUIVALENT ANNUAL BENEFITS

LFCC replacement cost		Damage Curve selection				
		RGMCC curve, identified in May, 1995 solicitation	RGMCC curve, 1990 FIRM rate reivew	Canals, ditches depth-damage relationship	Earthen feeder ditches	Concrete feeder ditches
Low	$1 million/mile	9,195.82	2,520.36	3,976.32	6,628.91	2,526.05
Likely	$ 473/foot	22,968.12	6,294.46	9,930.61	16,554.60	6,308.64
High	$1395/foot	67,741.80	18,564.10	29,291.30	48,827.57	18,605.86

Table F-12B							
BASE+4' PROJECT CONDITION, 10 YR START OF DAMAGES							
LFCC EQUIVALENT ANNUAL BENEFITS EXPRESSED AS % OF TOTAL BENEFITS							
LFCC replacement cost			Damage Curve selection				
			RGMCC curve, identified in May, 1995 solicitation	RGMCC curve, 1990 FIRM rate reivew	Canals, ditches depth-damage relationship	Earthen feeder ditches	Concrete feeder ditches
Low	$1 million/mile		47.67%	23.29%	30.25%	40.27%	23.33%
Likely	$ 473/foot		68.34%	39.05%	49.12%	61.03%	39.11%
High	$1395/foot		86.13%	63.46%	72.93%	81.71%	63.52%

BASE+4' PROJECT CONDITION, 5 YR START OF DAMAGES							
LFCC EQUIVALENT ANNUAL BENEFITS EXPRESSED AS % OF TOTAL BENEFITS							
LFCC replacement cost			Damage Curve selection				
			RGMCC curve, identified in May, 1995 solicitation	RGMCC curve, 1990 FIRM rate reivew	Canals, ditches depth-damage relationship	Earthen feeder ditches	Concrete feeder ditches
Low	$1 million/mile		49.15%	24.35%	31.63%	41.82%	24.39%
Likely	$ 473/foot		69.67%	40.70%	50.92%	62.65%	40.75%
High	$1395/foot		86.88%	65.18%	74.41%	82.74%	65.22%

It's important to note that none of these scenarios alters the NED plan selection process. Alternative A is still the recommended alternative, and the Base + 4' levee height is the height which maximizes net benefits. The same alternative at the same levee height would be presented if there were NO Federal properties in the study area, would have a benefit/cost ratio in excess of 1.0 and would generate maximum net benefits. The purpose of the remaining portion of this examination is to determine the impact of key assumptions on the proportion of benefits attributable to Federal properties.

a. Scenarios where Federal benefits exceed 50%

From the previous tables, it's clear that some assumptions, if adopted, clearly indicate damages and benefits attributable to Federal properties in excess of the statutory limit of 50% of total project benefits. The Bureau of Reclamation presented the replacement cost of the LFCC as a range of values between $50 million and $368 million. Adopting the high value produced high damages and benefits in all scenarios, pushing Federal benefits over the 50% statutory cap. Also, using the depth-damage curve provided by the Bureau of Reclamation in 1995 generated high damages and benefits. This isn't surprising given that curve has 100% damage at 2' of inundation. Any scenario that uses either the high dollar cost or the 1995 curve pushes benefits to Federal properties over 50%.

b. Sensitivity of project damages to input variables

So what of the remaining scenarios? What can be said of the other variables and their impact on the benefits attributable to the LFCC? It would appear that the single most important variable in determining the benefits is the value of the LFCC. The Bureau of Reclamation was able to provide a range of values between $50 and $368 million, but presented that information as a minimum and maximum, with no "likely" value, nor an error distribution around that value. The PDT quick cost estimate was developed to provide a likely construction cost, which follows:

San Acacia - Estimate of LFCC Cost

Assumptions:

LFCC is a trapezoidal channel with a 40' wide earthen bottom, 2h:1v side slopes with 1' rip rap armoring and a 80' top width. Depth is approximately 10'. LFCC is excavated and the spoil material is utilized close to the excavation, spoil bank or wasted.

Costs taken from San Acacia project which involves large volume excavation and rip rap and is located in the same area as the LFCC.

Cost is for a 1000' length of LFCC

Item Description	Quantity	Unit	Unit Cost	Extended
Construction Staking	1	day	$ 1,800.00	$ 1,800.00
Clear and Grub	5.74	acre	$ 2,723.00	$ 15,630.02
Excavation	24000	cy	$ 2.81	$ 67,440.00
Fine Grading	9333	sy	$ 1.06	$ 9,892.98
Rip Rap	1630	cy	$ 45.00	$ 73,350.00
Spoil/Fill Material	26880	cy	$ 4.50	$ 120,960.00
Dust Control	24000	cy	$ 0.38	$ 9,120.00
SWPPP	1000	lf	$ 2.94	$ 2,940.00
Site Access Road	1000	lf	$ 3.78	$ 3,780.00
				$ 304,913.00
Planning, Engineering and Design @ 6%				$ 18,294.78
Construction Management @ 9%				$ 27,442.17
				$ 350,649.95
Contingency / Misc Structures @ 35%				$ 122,727.48
Grand Total 2012 dollars				**$ 473,377.43**
			per lf	**$ 473.38**

Distributed over the 50 mile length of channel in the study area, that puts the replacement cost of the LFCC at around $125 million. Cost engineering has indicated that channel REPLACEMENT involves additional activities, such as clearing sediment from damaged portions as needed, which would drive this cost up. The $368 million cost has the impact of pushing Federal benefits over 50% in all scenarios. The $50 million cost estimate was considered too low, given the Corps' own cost estimate, for serious consideration. Further discussion of the LFCC will focus on the "Likely" LFCC cost of approximately $125 million (2012 dollars).

Surprisingly, limiting the beginning damage depth in HEC-FDA had little impact on the benefit percentages. In FDA, a depth corresponding to a specific event frequency can be set for the economic inventory, such that events that produce less depth can simply be ignored. It’s a means to set a start of damages condition, and was used to model the 20% and 10% chance events, described in the hydraulics appendix. The net effect of adjusting the start of damages to a lower recurrence interval event, which would model the existing levee holding until a 10% chance event (which has no basis in historical experience or technical judgment), was to lower the benefit percentage 1-2%. The difference in water surface elevation at just about every cross section evaluated in the study area was 0.1’. There were 5 depth-% damage curves selected for this evaluation. The first curve was based upon a 1995 Bureau of Reclamation solicitation, and has the impact of placing Federal benefits over 50%, regardless of start of damages or LFCC replacement cost. That curve was considered an outlier in this analysis. At the other extreme, the Albuquerque district, Corps of Engineers has some historic, and locally developed curves that have been used in other studies. Using the “Concrete feeder ditches” curve provided the lowest damages and benefits, and was considered another outlier, as the LFCC is an earthen and rip-rap lined channel, rather than a concrete one. The remaining curves are based upon a 1990 FIRM rate review of the study area and a couple other historic curves used by the Albuquerque district, Corps of Engineers. Two of those curves, when selected, push Federal benefits over the 50% threshold. The final curve, identified as the “RGMCC curve, 1990 FIRM rate review” produces Federal benefits between 42 and 44 percent, depending on the start of damages condition modeled.

Considering all the assumptions and all the scenarios above, it would appear that Federal benefits of the proposed levee at the Base + 4’ levee height will be between 40-50% of total benefits. None of the above assumptions changed alternative selection or levee height, and excluding Federal benefits does not jeopardize the project’s benefit-cost ratio. What remains is to determine what the Federal benefits are to compute the non-Federal cost share of the project costs. There are uncaptured NED benefits which would increase Federal benefits, but were not quantified. When the proposed levee is constructed, the Bureau of Reclamation no longer has responsibility to maintain the existing spoil bank levee, and NED costs attributable to levee OMRR&R are expected to go down significantly. Because the LFCC is no longer damaged annually by under seepage, Reclamation will save LFCC OMRR&R costs (estimated in the without project condition at $150,000-$700,000), but was unable to provide a figure for the with-project condition. Another unquantified benefit of the LFCC is the riverside drain function, which ensures surface water runoff is transported downstream. Absent the LFCC, New Mexico is impounding water and has an even more difficult time meeting water delivery targets to Texas and Mexico per the Rio Grande Compact.

6. Limitations of study

There are some things that couldn’t be done in this evaluation, due to time or technological limitations. We can only answer the question, “What valuation of the LFCC coupled with the 10-year start of damages and the third depth-damage relationship would create Federal benefits over 50%?” if we agree that damages and replacement cost are proportional. The “Likely” value of the LFCC would need to be 33% greater than $125 million, or $166 million, for greater than 50% Federal benefits regardless of curve selection, with a 10% chance start of damages. For a 20% start of damages, Federal benefits exceed 50% when LFCC costs roughly $153 million (22% more than $125 million) to obviate the need to select a damage curve.

Damage curve selection becomes a greater issue only if the value of the LFCC goes down from the "Likely" $125 million replacement value. More on this point later, in the discussion of prior condition of the LFCC in any given analysis year.

One assumption that was not modeled in this analysis was the notion of a localized failure in one damage reach alleviating the flood risk in other damage reaches. The study area contains 22 damage reaches with damageable property, with the project affecting the all but the 2 damage reaches located furthest downstream. In theory, an upstream breach would lower the flood threat to the spoil bank levee, but since the LFCC represents the low point in the floodplain adjacent to the perched Rio Grande, inundation damage occurs to the LFCC in terms of channel capacity exceedance, sediment and trash deposition, and sidewall washouts. Upstream flows would eventually find their way into the LFCC and create the inundation related damages along its length, without coming in through the existing spoil bank levee. The same conditions would hold with any proposed levee project.

The HEC-FDA model assumes the LFCC is intact and functioning prior to flooding in any given year, which doesn't match the assumptions the Bureau of Reclamation gave the Corps in the most recent solicitation. The Bureau assumes that in the event the LFCC were destroyed, it could take 5 years to replace. It's HIGHLY likely that a 10% or 20% event could happen in the 5 years between the first damaging event, and the subsequent one. Without modeling the gap between the first and second damaging event, one cannot know how much of the prior event's damage was repaired. Without knowing the nature of that prior event's damage to the LFCC, which could dictate how long it would take to rebuild the damage to the LFCC, the equivalent annual flood risk could be misstated, as well as the benefits of the proposed levees. HEC-FDA assumes that modeled damages in one year are repaired by the next year, which may not hold in this case.

There are also uncaptured benefits which would increase Federal benefits. First, the Bureau of Reclamation claims that LFCC maintenance is $150,000 to $700,000 a year. The LFCC's greatest threat, and therefore use of the OMRR&R dollars, is the under seepage from the Rio Grande under the spoil bank levee, to the LFCC. A new levee would have an impervious foundation, which would result in indeterminate savings in those maintenance costs. Further, a proposed levee would have a non-Federal owner, which results in significant, and uncaptured, savings to the Bureau of Reclamation to repair the existing spoil bank. Finally, the Bureau of Reclamation has indicated that those OMRR&R funds NOT spent on the LFCC or the spoil bank levee could be applied toward channel maintenance, which may limit the sediment accumulations relative to what's modeled in this study, and making the proposed levee more effective in the future, with-project condition.

7. Conclusions

The General Reevaluation Report has identified Alternative A, at the Base + 4' levee height, as the alternative and height which maximizes net NED benefits. Excluding the benefits attributable to Federal properties does not change alternative selection nor levee height. The Water Resources Development Act of 1992 (Public Law 102-580) has a provision to adjust the non-Federal contribution to project costs to more equitably reflect the non-Federal benefits in relation to the total benefits of the project. The law requires the Corps to identify the benefits of any flood control project that are attributable to Federal properties, but also states that Federal property benefits may not exceed 50% of total project benefits. Using a reasonable "Likely" value for the replacement cost of the LFCC, the Federal property benefits are somewhere between 40 and 50% of total project benefits.

Bureau of Reclamation's response to the Corps' information request:

Reclamation Responses to
USACE Questions Regarding the Proposed San Acacia Levee Project
(February 6, 2012)

1. Historical Flooding and Flood Fighting Efforts: What historic flood events are you aware of **in the study area? Where did they occur? What was the estimated flow? Stage? Recurrence interval?**

   Reclamation is aware of multiple hydrologic and flood frequency analyses the Corps has done for their San Acacia Levee Project. Reclamation believes that this technical question is best addressed by the Corps of Engineers' Hydrology and Hydraulics experts. Reclamation understands that the scope of their investigations in the San Acacia reach is focused on flood control protection.

   Reclamation's Denver Technical Service Center has the following recent reports that review and quantify the various flood frequency values for the subject reach:

   > Dworak, F. April, 2009. Middle Rio Grande Review of Hydrology Studies. Flood Hydrology and Emergency Management Group, Bureau of Reclamation, Technical Service Center, U.S. Department of the Interior, Denver Colorado 80225
   > Wright, J.M. October 2010. The Middle Rio Grande Peak Discharge Frequency Study. Flood Hydrology and Emergency Management Group, Bureau of Reclamation, Technical Service Center, U.S. Department of the Interior, Denver Colorado 80225

   Reclamation also suggests that the Corps review the following USGS Web site for the recorded historical values for peak flows at gages in the subject reach: http://waterdata.usgs.gov/nm/nwis/nwis

2. **What actions did Reclamation take to fight the flood?**

   Given the broad and general context of this question, this question will be answered in the same context. Reclamation has historically performed river and spoil bank levee maintenance during the Corps' Flood Control Operations (above the mean annual peak flow or long duration periods at or above the mean annual peak flow) in the subject reach. These flows occur during the spring runoff or monsoonal thunderstorm events. Work on the river has been comprised of pilot channels through sediment deposits (after flows recede) or widening, raising, and repairing the levee in the San Acacia Reach. This work occurred prior to the annual spring runoff when the snowpack is very large or during the spring runoff.

3. **Was it successful?**
   Work to maintain the existing spoil levee during flood events has been successful to date with many cases of near failures due to either overtopping or seepage/piping.

4. **Any post-flood repair work to the levee or the LFCC?**
   Yes, work has been done during and after flood events in the river and LFCC as described above. Also, Reclamation constructed two LFCC setback relocation projects in the period between 2005 and 2009. These projects are located at sites where large meander bends and their migration threatened the spoil bank levee and LFCC.

5. **How much did those efforts (flood fight/flood repair) cost?**
   Please see Reclamation's response below to this question. It is unknown exactly what the percentage of work involved dealt with dealing with condition that are above flood flows and what normal (work to convey the mean annual peak flows and less) river maintenance related work.

6. **Does Reclamation perceive some stretches of the existing levee system as more susceptible to flooding than others**? Yes. In some sub-reaches, there is more susceptibility and risk to public health and safety: public and private infrastructure; homes and businesses: the local agriculture and tourism(the BDANWR is a nationally renowned bird and wildlife viewing refuge) economy; basin water delivery, and fish and wildlife including endangered species.

Channel and LFCC Operations:

7. **What activities does Reclamation participate in the Rio Grande to maintain the river channel? The LFCC?**
   [*Answer for River only*] Maintenance of the river channel includes infrastructure relocation or setback, channel modification (includes pilot channel, channel realignment, secondary channel work, floodplain work), bank protection/stabilization, habitat improvements and mitigation: and the aforementioned spoil bank levee maintenance and protection work to pass the mean annual peak flow events and less.
   [*Answer for LFCC only*] Maintenance of the LFCC consists of mowing, aquatic vegetation removal, road maintenance, sediment removal, and debris removal. Annual costs for this maintenance range from $150,000 to $700,000.

8. **How much is spent on each of these efforts?**

Annual costs have varied on the amount of work done for repair and maintenance in the subject reach. At an appraisal, feasibility grade estimated costs have varied from $0 in extremely dry drought years where no runoff has occurred to about $2.25M in 2009-10 with American Recovery and Reinvestment Act work being done on in a 4-mile reach of the northern Bosque Del Apache National Wildlife Refuge (BDANWR). The LFCC setback relocation projects at RM 114, RM 113, and RM 111 had an appraisal/feasibility grade estimated total cost of about $7M for work done in the period of 2005-2008. At the RM 114 and RM 113 locations at the crossing of the San Lorenzo arroyo, a reinforced concrete pipe siphon, and sheet-pile drop structure were also constructed as part of the costs.

Reclamation advises the Corps of Engineers to review the Calendar Year Reports submitted to the Rio Grande Compact Commission and Engineer Advisors for a detailed summary of river maintenance and water salvage related works that are done by Reclamation in the subject reach. Reclamation has been submitting these reports on its efforts in the subject reach for an extensive time period.

The above cost variability is a function of the hydrologic and the river channel conditions which are highly dynamic. In considering this response, the Corps is asked to give major consideration to the temporal nature of river maintenance work. During very wet and high flow periods, work cannot be safely performed in the active river channel and only on the spoil bank levee. During dry periods, concerning flooding and river maintenance needs, the perceived conditions by the lay person are such that no apparent maintenance issues exist with the exception of water conveyance. At this time, access to the active river channel is safer and more stable. The maintenance during the advantageous, drier periods allow for reducing maintenance work to improve river conditions during the periods when mean annual peak flow and larger events occur. Working in a fluvial environment, such as a river channel and floodplain, is difficult given the river flow's annual and seasonal variability in inundated areas.

9. **Should the proposed levee be constructed, do you foresee any changes to these activities, such as reduced spending in one activity or another?** No. Reclamation foresees that the authorized maintenance work of the river channel and LFCC will continue at existing levels given tendencies of maintenance needs to develop for both systems.

Given the non-existent current state of flood control in the reach and its limited authority for such works, Reclamation's position is that it does not have liability for any flood related damages should they occur. Reclamation does foresee a reduction in the emergency related works performed by Reclamation during the spring runoff and monsoonal flood control operational periods (above the mean annual peak flow or long duration periods at or above the mean annual peak flow) with the proposed flood control levee infrastructure and appurtenances. Reduced spending by Reclamation would be realized for these activities to protect its investment of the LFCC and continue its maintenance of the river channel elsewhere.

10. **Will shifting resources improve maintenance efficacy?** Yes. Resources and efforts would be shifted to maintenance activities that are preventative or recurring, rather than emergency in nature. Resources would also be shifted to environmental mitigation related activities.

11. **Prior iterations of this study have used an "avoided water losses" benefit category, where water diverted INTO the LFCC is saved from evaporation by running through a channel with a narrower topwidth than the Rio Grande. Does this benefit computation still make sense?** No. This would apply to surface water flows that were diverted into the LFCC at the San Acacia Diversion Dam historically between the 1950's to 1985.

12. **Surface water diversions into the LFCC are no longer occurring. What would you estimate to be the annual water SAVINGS to be?** Reclamation is not aware of any quantification of the annual amount of water salvaged of the current pre-described operation of the LFCC. Given the preceding explanation, various water supply needs are being met by the LFCC in this reach. These would be measured and quantified differently than the historic surface water deliveries by the river and the surface diversion operation of the LFCC.

    Related to water salvaged in the valley by the current operation of the LFCC, Reclamation recommends that the Corps do a water budget analysis with the URGWOM model and look at the surface and groundwater relationships and evaluate the water lost to evapotranspiration and local infiltration storage by non-permeable barriers to downstream flow. This analysis could be done for two scenarios—with and without the LFCC in place—to determine the effect of the LFCC.

    Reclamation is aware of some work done by Dr. Nabil Shafike and S.S. Papadopulos & Associates Inc. for the New Mexico Interstate Stream

Commission and New Mexico Mining and Technology in Socorro related to quantifying the surface and groundwater relationships in the subject reach. Reclamation is aware of the USGS LFCC surface water gage at San Marcial that has daily and annual volumes of surface water that goes through the subject reach. This information is quantified and located at the USGS website. Reclamation believes this would provide information on the current drainage and irrigation return flow operational water deliveries of the LFCC. Analysis could also be done to compare values with the amount of water that is delivered in the river channel and LFCC system.

13. **Since the LFCC doesn't presently divert water from the Rio Grande, do you see this savings differently?** Yes. The LFCC has and continues to serve multiple water resource related purposes that include providing effective valley drainage; being a wasteway for irrigation return flows; serving as a water source for four pumping locations to deliver water back to the river for Endangered Species flow needs; and providing irrigation diversion for the Middle Rio Grande Conservancy's Socorro Division, Bosque Del Apache National Wildlife Refuge, and the Armendaris (Turner) Ranch.

The LFCC:

14. What is your best estimate of the replacement cost of the LFCC from San Acacia diversion dam to the San Marcial railroad bridge? Do you have any uncertainties about that cost estimate, such as a contingency? Perhaps a low value, best guess, high value? We're looking to capture any uncertainties around cost estimates. How long would it take for Reclamation to replace the LFCC should it be destroyed? In the event portions of the LFCC are damaged, what would you estimate to be the annual replacement rate, such as "We could replace N miles of that channel in a year." Reclamation has not developed a comprehensive cost estimate for replacing the LFCC. For levee setback river maintenance projects encompassing one to two miles of LFCC, Reclamation uses an appraisal-level estimate of $1395.14 per foot of channel to relocate the LFCC and spoil levee. In applying this estimate to the approximately 50-mile-long reach of the LFCC between San Acacia and San Marcial, this results in a cost estimate of $368,316,960, which is obviously toward the high end of the potential cost range. A very rough estimate of the lowest replacement cost is $50,000,000, which assumes costs of $1,000,000 per mile. These cost estimates are subject to a high level of uncertainty. It is difficult, however, to imagine a scenario in which the entire LFCC would be destroyed. Furthermore, it is extremely unlikely that the LFCC would be replaced if it was somehow destroyed in its entirety. In 1995, Reclamation estimated that complete replacement of the LFCC would take about 5 years, but this estimate has not been reevaluated since then. With adequate budget and lead time to establish construction contracts, Reclamation could probably replace about 10 miles of LFCC per year. Using force account crews only, about 1 mile per year could be replaced.

15. The original project was designed and constructed to divert from San Acacia diversion dam to headwaters of Elephant Butte Reservoir. Current Corps study

recommends a levee from San Acacia diversion dam to upstream end of Tiffany Basin. Does a downstream cutoff just north of Tiffany leave a residual threat to the LFCC function? (e.g. continued maintenance of levee past Tiffany) Yes. Reclamation would continue maintenance of the levee to protect the current function of the LFCC and various infrastructure like access roads. Other non-Reclamation infrastructure such as the railroad would also be at risk. **What would the impact of extending the levees to the San Marcial railroad bridge? (e.g. avoided levee maintenance, avoided flood fighting).** Since the levee would be a flood control levee, Reclamation would not assume responsibility for its maintenance. Therefore, there would be a reduction in maintenance operations performed by Reclamation. Reclamation would provide consideration for doing reimbursable work as part of a future maintenance program.

The LFCC was designed to divert water out of the Rio Grande from the San Acacia diversion dam to the headwaters of Elephant Butte reservoir. That diversion hasn't taken place since when? Normal operation of the LFCC has not occurred since 1985. What role does the LFCC play in the region today? **Does Reclamation see the present function of the LFCC as a subset of the channel's role when authorized for construction?** The LFCC functions as a riverside drain. It is a source of water for ESA-related pumping into the Rio Grande. It also provides some water for agricultural purposes and is the primary source of water to Bosque del Apache National Wildlife Refuge. Furthermore, it supports wetlands near the upstream end of Elephant Butte Reservoir. The drainage function was a part of the original intent of the LFCC's authorization, but it was a secondary function, rather than a primary one. **Is the channel's present configuration and role cheaper than the Authorized design and role?** If the LFCC had been constructed for drainage purposes only, it would have been smaller and would have had much less riprap lining. Obviously, it would have been less expensive to construct. Operational costs are lower now than when the LFCC was in full operation because less maintenance is required. **Does the present channel maintain the same capabilities as the Authorized and constructed design?** The LFCC is currently not operable as originally intended because of extensive sediment deposition at the downstream end. Also, when parts of the LFCC were moved as part of two of Reclamation's recent levee setback projects, the riprap lining was installed only to the 500-cfs water surface, rather than to the 2000-cfs water surface. **Does the channel have the same life expectancy as it does when originally constructed?** The channel cannot currently be operated as it was originally intended. In addition to the problems caused by sediment deposition in the LFCC itself, ongoing sediment deposition in the Rio Grande floodway continues to reduce the sustainable lifespan of the floodway and LFCC system. **Are there stretches that are "worn" more than others?** The downstream portion of the LFCC has extensive sediment deposition problems that are not present in sections farther upstream. **Are there any sources of depreciation between the channel when originally constructed and what exists today?** Sediment deposition is the main source of damage to the channel. ESA-related concerns greatly reduce the probability that the LFCC would be operated according to its original intent, even if such operation was technically feasible. **Please describe how the LFCC is susceptible to flooding from the Rio Grande.** The LFCC is currently protected from the river flows by a spoil levee made from material excavated from the LFCC during its construction. Because the levee is a spoil levee any ponding (or hydraulic head of any duration) of water against the levee poses a risk to the levee**. Is the channel facing scour threats?** The main threat to the LFCC is the potential breaching of the spoil levee. **Does it risk filling with sediment?** In the event of levee breach the channel would be at risk. **How would you describe the LFCC's susceptibility (e.g. as a depth-% damage relationship, as an event-$ damage relationship)?** Again, since the levee protecting the LFCC is not an engineered levee any ponding of water against the levee would pose risk for levee failure and therefore damage to the LFCC. Since Reclamation cannot be certain of the levee makeup along the whole length of the levee, determining any type of relationship with regard to depth of water and damage would be a wild guess at this point.

16. **What would Reclamation's response be should the LFCC be damaged or destroyed?** Reclamation's current answers to this and the following related questions are conceptual/hypothetical, Since they have not been thoroughly evaluated in the context of Reclamation's management priorities. Assuming that the damage or destruction is resulting from a catastrophic flood, Reclamation would need to evaluate the situation first. There are different implications (e.g. public health and safety, economic damage, water delivery, etc.) depending upon where in the reach impacts would occur. Reclamation would most likely seek to reconstruct the LFCC facility where the damage occurs. Various efforts would be undertaken to engage with local and regional stakeholders to assisting in funding and cost sharing on this effort. Special attention would be given to those who receive the most benefits from the current operation of the facility.

17. **What is the impact to Reclamation and the region should the LFCC be damaged or destroyed?** The implications and the scope of the impact to the region if the LFCC were damaged or destroyed have been explained in preceding and subsequent answers herein.

18. **What is life like in the region without the LFCC?** Reclamation recommends that the Corps consult with the Middle Rio Grande Conservancy District, the local community farmers, residents, and BNANWR refuge staff and tourism visitors regarding this matter. Also recommend consulting with a socio-economic scientist from the area. Land use practices and their economic values for the agricultural community and BDANWR would be diminished without the LFCC drainage facility. There would be the potential for increased groundwater levels due to surface water irrigation of lands and increased alkalinity in the soils due to the groundwater rising and fluctuations near the root zones. These alkalinity problems due to lack of valley drainage would also impact fish and wildlife, vegetation, wetlands, and endangered species functions on the BDANWR. Reclamation would recommend that some work

be done to quantify the economic loss due to these conditions without the drainage function of LFCC.

19. **Are there available substitutes for water users in the region in the event the LFCC was destroyed?** At a hypothetical level, Reclamation would assume that some groundwater water pumping could be performed to meet water user needs in the subject reach. There does exist in the Middle Rio Grande area questions of the long term sustainability of this practice due to declining groundwater levels from continued pumping.

20. **Is there anything else the Corps should consider when evaluating the flood threat to the LFCC and existing levee system?**

It might be good to get the local perspective of the LFCC and its function and value to the valley. BDANWR perspective might be of use.

Reclamation understands that the potential failure modes of levee overtopping and geotechnical and piping failure will be better controlled by the flood control infrastructure and its appurtenances (i.e. seepage control and drains) with the proposed project. Reclamation through its operation and maintenance program for water and sediment delivery is aware of flood control benefits that are derived currently by the local project sponsors, community, and the Corps. Reclamation requests future, formal acknowledgement of flood control benefits of work done by Reclamation and the New Mexico Interstate Stream Commission going back to the original 1950’s river and LFCC works.

Reclamation also recommends that the Corps extend their Flood Control Levee down to the San Marcial Railroad Bridge Crossing. Reclamation considers this area at risk due to the presence of the BN&SF railroad line. In the event of a catastrophic flood, Reclamation believes there is the potential for public health and safety risks to the railroad workers and operators in the event a train is derailed due to failure of their embankment.

If a catastrophic breach of the current spoil levee occurred (causing the river to go into the western portion of the valley) in the reach below the San Marcial railroad bridge crossing, Reclamation would consider reconstructing a single channel system downstream of this location with a new LFCC outfall to the river. The new LFCC outfall would also be downstream of the railroad bridge crossing. Given the regional drought and lowered reservoir pool elevations since the early 2000’s, Reclamation and New Mexico Interstate Stream Commission have been very successful in maintaining a sustainable single channel system in the reservoir delta. Reclamation recognizes that this success can change if the reservoir pool rises dramatically or a full pool condition re-occurs at the upstream end of the reservoir in the future.

Lastly, Reclamation strongly supports the Corps position to move ahead with construction of this project with the first phase beginning in Federal Fiscal Year 2012.

NOTE: The Corps should be aware that the broad scope and hypothetical nature of these questions render Reclamation's responses as unofficial. Many of Reclamation's answers should not be regarded as definitive statements. Reclamation understands that the Corps has been planning and evaluating this flood control project as part of its mission on the Middle Rio Grande going back to the 1980's. Reclamation believes answers to a lot of the questions should be the responsibility of the Corps.

F-12 Inclusion of Additional Features to Flood Control Alternatives:

Features were evaluated with the project design to meet objectives other than flood control (sediment management, infrastructure benefits to the railroad, travel detour cost savings, Rio Grande operations improvements). These additional features can be divided into two distinct categories: the acquisition and rehabilitation of 2,053 acres within the Tiffany area and the reconstruction of a railroad bridge at San Marcial.
The following figure shows the features and their combinations that served as the basis for each of the alternatives:

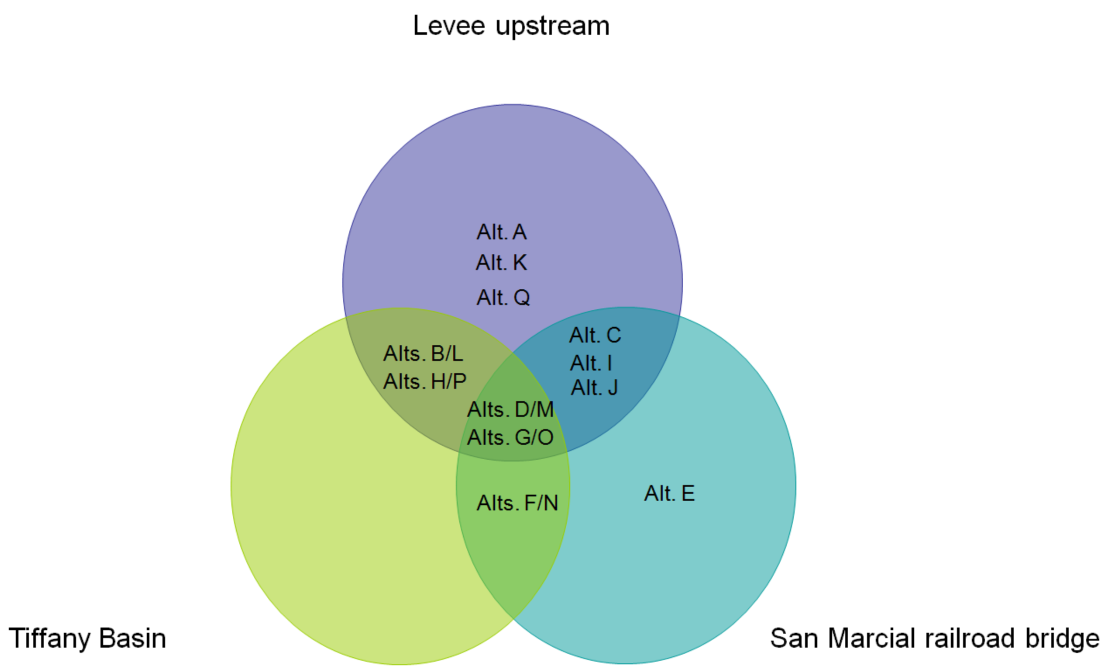


Figure F-6 - Alternatives and Their Features

The railroad bridge replacement at San Marcial is located south of the 2,053 acres comprising the Tiffany area modification, and derives much of its benefits from flood damage reduction to the railroad, and avoided train reroutes, as well as improvements in operations of the Rio Grande. Given that addition or deletion of the new bridge does not affect performance of 43 river miles of levees proposed, the railroad bridge is a separable element per ER 1105-2-100 (Para. 6-5.e.) and EC 1165-2-155. The currently designed railroad bridge modification cost $22,519,000 (August, 2010 dollars) depending upon bridge height, levee size upstream, and number of bays under the bridge. Flood control benefits for replacing the existing bridge come in avoided transportation costs to route traffic around the flooded bridge. Preliminary calculations estimating a start of damages condition, projected cost/ton-mile, detour routes and daily tonnage provided by the Burlington Northern Santa Fe railroad indicate that there may be sufficient benefits to justify bridge modifications on flood control alone. Additional benefits for bridge modification from pecuniary savings associated with a change in Rio Grande operations could be added to the flood control benefits.

The Tiffany Basin was considered during alternative formulation as a means to control sediment aggradation within the Rio Grande. Over the project life, sediment accumulations within the Tiffany Basin would elevate the basin floor even to the Rio Grande (currently perched about 10’ over the Basin floor). Sediment accumulations over the project life would mitigate the need for the Bureau of Reclamation to remove sediment from the Rio Grande. There are also benefits afforded to the environment by bringing more land into service for endangered species.

Enumeration of Railroad Bridge Benefits:

Infrastructure benefits and transportation benefits were calculated for the San Marcial railroad bridge using the following assumptions:

1) There are three critical events that need to be evaluated for the existing and proposed bridge for both the present conditions (with and without the proposed levee project) and 50 years hence (without project year 50 and with project year 50).

2) The first critical event (the “Closure Event”) occurs when floodwaters touch the low chord of the bridge. According to the BNSF railroad, the bridge will be closed for 36 hours, incurring the expense of diverting 30,000 daily estimated tonnage through a detour of 105 miles at a marginal cost of $0.025/ton-mile. On a per event basis, the closure event costs $118,125. These closure event losses cover all events equal to or greater than the closure event, but less than the damaging event, described below.

3) The second critical event (the “Damage Event”, also described by BNSF railroad personnel) occurs when flood waters rise 1' above the low chord of the bridge. The bridge is assumed to be damaged, and will cost $3,000,000 to repair the existing bridge, and will take 30 days to effect repairs. During that repair time, 30,000 daily tons is rerouted 105 miles at a marginal cost of $0.025/ton-mile, giving us a damaging event transportation detour loss of $5,362,500. These damaging event losses cover all events equal to or greater than the bridge damaging event, but less than the failure event, described below.

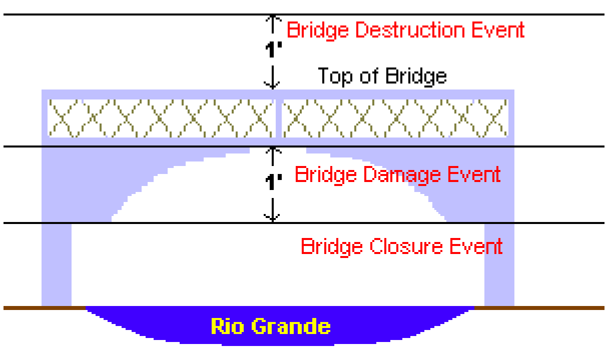


Figure F-7 - Bridge Critical Failure Points

4) The third critical event (the “Destruction Event”, described by BNSF railroad personnel) occurs when flood waters rise 1' above the top of the bridge. The bridge is assumed to be destroyed, and will cost $23 million to replace with the proposed bridge and will take one year to replace with the proposed bridge. During that repair time, 30,000 daily tons is rerouted 105 miles at a marginal cost of $0.025/ton-mile, generating failure event transportation detour losses of $45,990,000. These failure event losses cover all events equal to or greater than the bridge failure event.

5) Bureau of Reclamation officials have assured the study team that their sediment removal events will continue as long as the current railroad bridge exists. With the replacement of that bridge, those sediment removal activities may cease. Therefore, it is important to measure the replacement bridge's performance over the project life (50 years).

The replacement bridge is designed to withstand flows up to the .002 event at which point it would be destroyed. It would sustain damages at a 0.0037 flood event, such that repair costs would be approximately $3,000,000 and time out of service would be one month. A 0.0039 flood event would cause transportation reroutes for approximately 1 day. The following table describes bridge performance in the various scenarios described:

Table F-13

PROBABILITY THAT FLOOD EVENT AFFECTS CURRENT AND REPLACEMENT BRIDGE

	Scenario Evaluated					
	A	B	C	D	E	F
	Existing Bridge/ Without Project	Existing Bridge/ Without Project Year 50	Existing Bridge/ Levee Project Year 1[1]	Existing Bridge/ Levee Project Year 50[1]	Replacement Bridge/ Levee Project Year 1	Replacement Bridge/ Levee Project Year 50
Destruction Event	**0.002**	**0.99**	**0.005**	**0.99**	**0.002**	**0.01**
Damage Event	**0.76**	**0.99**	**0.76**	**0.99**	**0.0037**	**0.019**
Closure Event	**0.977**	**0.99**	**0.977**	**0.99**	**0.0039**	**0.02**

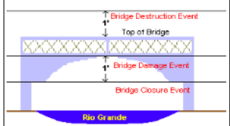
[1]Bureau of Reclamation officials will continue sediment removal efforts as long as the existing bridge remains.

Over the life of the proposed levee and bridge project there is a cumulative probability that one or more of these damaging events occurs. There is a legitimate, though small, probability that a closure or damage event could occur each year over the levee project's life, but the bridge failure event could only occur once over the project life. After the failure event, we assume the railroad replaces their lost structure with a new bridge with identical performance characteristics as the currently proposed project bridge.

The benefit and loss calculations incorporate these probabilities to monetize flood effects. The following table (Table F-14) outlines cumulative probabilities of these significant flood events for several time periods:

Table F-14

CUMULATIVE PROBABILITY THAT BRIDGE CLOSURE FLOOD EVENT AFFECTS CURRENT AND REPLACEMENT BRIDGE



		Scenario Evaluated					
		A	B	C	D	E	F
		Existing Bridge/ Without Project	Existing Bridge/ Without Project Year 50	Existing Bridge/ Levee Project Year 1[1]	Existing Bridge/ Levee Project Year 50[1]	Replacement Bridge/ Levee Project Year 1	Replacement Bridge/ Levee Project Year 50
Probability that Closure Event Occurs once in "N" years	1 Year	0.977	0.99	0.977	0.99	0.0039	0.02
	5 Years	0.999999994	1	1	1	0.019348492	0.096079
	10 Years	~1	~1	~1	~1	0.03832262	0.182927
	25 Years	~1	~1	~1	~1	0.093070555	0.396535
	30 Years	~1	~1	~1	~1	0.110618272	0.454516
	50 Years	~1	~1	~1	~1	0.177478981	0.63583
Probability that Damage Event Occurs once in "N" years	1 Year	0.76	0.99	0.76	0.99	0.0037	0.019
	5 Years	0.999203738	1	0.999203738	1	0.018363606	0.091458
	10 Years	0.999999366	~1	0.999999366	~1	0.036389989	0.174551
	25 Years	~1	~1	~1	~1	0.088507167	0.380951
	30 Years	~1	~1	~1	~1	0.105245462	0.437568
	50 Years	~1	~1	~1	~1	0.169180816	0.616778
Probability that Destruction Event Occurs once in "N" years	1 Year	0.002	0.99	0.005	0.99	0.002	0.01
	5 Years	0.00996008	1	0.024751247	1	0.00996008	0.04901
	10 Years	0.019820957	~1	0.04888987	~1	0.019820957	0.095618
	25 Years	0.048818199	~1	0.117779757	~1	0.048818199	0.222179
	30 Years	0.058292046	~1	0.139615808	~1	0.058292046	0.2603
	50 Years	0.095253182	~1	0.221687443	~1	0.095253182	0.394994

The Bureau of Reclamation will continue to remove sediment accumulations as long as the existing bridge remains at San Marcial, which is why columns A and B are identical, as well as columns C and D. When the proposed levee project is built, attenuation losses induce floodwaters to the San Marcial railroad bridge. On this table, this is represented by column C being greater for every event and every time period than column A. The same observation holds for columns D and B.

The replacement of the San Marcial railroad bridge lessens the cumulative probabilities of flooding events, which can be gleaned by noting that all values in column E are significantly smaller than corresponding values in column A. However, because the replacement bridge has improved performance over the project life, the Bureau will cease their sediment removal activities. As represented above, sediment accumulations over 50 years cause values in column F to be somewhat greater than corresponding values in column E. Therefore, the values in columns E and F are still greater than their counterparts in columns A and B. Table F-10 describes the annual risk of damaging flood events to the existing and proposed San Marcial bridge. A discussion of the source of those probabilities is in Appendix E.

The with-project condition for the existing bridge was estimated by measuring the area under the damage-frequency curve. After a closure or damaging event the bridge was assumed to be restored to its original condition. After a destruction event we assume the railroad replaces their bridge with the proposed bridge.

Under the without project condition, the damaging events occur with the same frequency. The replacement of the bridge would cause all damages from the time of replacement to be less than with than those with existing bridge. Therefore, over the life of the project (50 years), there are 51 different scenarios. Each relates to the year the bridge is destroyed. For instance, if the bridge is destroyed in year 4, during the first 3 years there are probabilities of damages costs to transportation and infrastructure based on the probabilities of the existing bridge being closed or damaged. Then from years 5 to 50, there are different sets of probabilities for each level of damage based on the new bridge. The areas under the curve were measured for each of the 51 possible scenarios. Note that the 51st scenario is one in which the existing bridge is never destroyed. The results were then combined based on probability of occurrence (the probability that the bridge had not been destroyed previously x the probability that the bridge would be destroyed in a given year).

The results of that analysis are contained within the following table (Table F-15):

Table F-15

AVERAGE ANNUAL LOSSES TO CURRENT AND REPLACEMENT BRIDGE (x $1,000 August, 2010 price level)							
		Scenario Evaluated					
		A	B	C	D	E	F
		Existing Bridge/ Without Project	Existing Bridge/ Without Project Year 50	Existing Bridge/ Levee Project Year 1[1]	Existing Bridge/ Levee Project Year 50[1]	Replacement Bridge/ Levee Project Year 1	Replacement Bridge/ Levee Project Year 50
Destruction Event		**174.14**	**174.14**	**241.51**	**241.51**	**0.00**	**0.00**
Damage Event		**3,765.77**	**3,765.77**	**4,048.69**	**4,048.69**	**9.12**	**78.14**
Closure Event		**23.75**	**23.75**	**25.63**	**25.63**	**0.02**	**0.17**
Total		**3,963.66**	**3,963.66**	**4,315.84**	**4,315.84**	**9.14**	**78.31**

To reiterate, because BuRec will continue sediment removal efforts as long as the railroad bridge remains, Columns A and B are identical, as are Columns C & D. Column F represents 50 years of sediment accumulations that occurs when those activities end with the construction of the new bridge with the proposed levee project.

The induced likelihood of flooding has already been described. Table F-16 describes what those probabilities mean in terms of dollars.

Table F-16

INDUCED AVERAGE ANNUAL LOSSES TO CURRENT BRIDGE BY PROPOSED PROJECT (x $1,000 August, 2010 price level)				
		Scenario Evaluated		
		A	C	
		Existing Bridge/ Without Project	Existing Bridge/ Levee Project Year 1[1]	Induced Damages
Destruction Event		**$174**	**$242**	**$67**
Damage Event		**$3,766**	**$4,049**	**$283**
Closure Event		**$24**	**$26**	**$2**
Total		**$3,964**	**$4,316**	**$352**

With the new levee project alone, increased likelihood of flooding is minimal will cause over $352,000 in damages on an average annual basis. Avoidance of induced damages can support over $7 million in new construction to build a bridge with the same performance characteristics as the existing bridge. Table F-17 describes the benefits of replacing the San Marcial railroad bridge.

Table F-17

AVERAGE ANNUAL BENEFITS OF REPLACEMENT BRIDGE TO CURRENT AND POST-PROJECT CONDITIONS
(x $1,000 August, 2010 price level)

	Scenario Evaluated				
	A	B	C	D	E
	Replacement Bridge/ Levee Project Year 1	Existing Bridge/ Without Project	Average Annual Benefits	Existing Bridge/ Levee Project Year 1	Average Annual Benefits + Induced Damages Prevented
Total	**$9**	**$3,964**	**$3,955**	**$4,316**	**$4,307**

Enumeration of Tiffany Area Benefits:

The benefits from including the Tiffany Basin come from decreasing sediment deposition in the upstream reaches of the Rio Grande. Alternatives containing the Tiffany Sediment Basin have lower future, with project stages than alternatives not containing this feature, but the calculations indicate those benefits are most appreciable to the smaller project sizes. At the NED plan size (Base + 4 feet), the equivalent annual benefits of including the Tiffany Basin, discounting future benefits to present values, are roughly $429,000. At the margin, the benefits do not justify the additional costs of the Tiffany Sediment feature. There is also a small unquantified benefit of rerouting sediment into the Tiffany Basin, saving Bureau of Reclamation personnel the cost of removing that sediment from the Rio Grande over the 37 years it takes to fill the basin.

At the NED plan size (Base + 4 feet), the equivalent annual benefits of including the Tiffany Basin, discounting future benefits to present values, is roughly $429,000.

F-13 Alternatives Considered:

The project features described above, such as the levee along the west bank of the Rio Grande, a replacement railroad bridge at the San Marcial river crossing, and the Tiffany Basin, were evaluated in isolation and in concert with each other to capture the effects of project features upon other project features and to evaluate the performance of the features in combination and alone in meeting the stated goals of the project. What follows is a discussion of the matrix development, and a discussion of each alternative considered, and a discussion of the effects of each project alternative.

The following diagram outlines the methods by which each alternative was evaluated. All alternatives were screened by identifying the benefit/cost ratio (BCR) but many alternatives were evaluated by examining the marginal benefits and the marginal cost of the added feature. Evaluating alternatives in this fashion would make explicit any external benefits, cost efficiencies or inefficiencies, and any potential network effects of implementing multiple project features. Where two alternatives perform the same function, this analysis identifies the least-cost alternative.

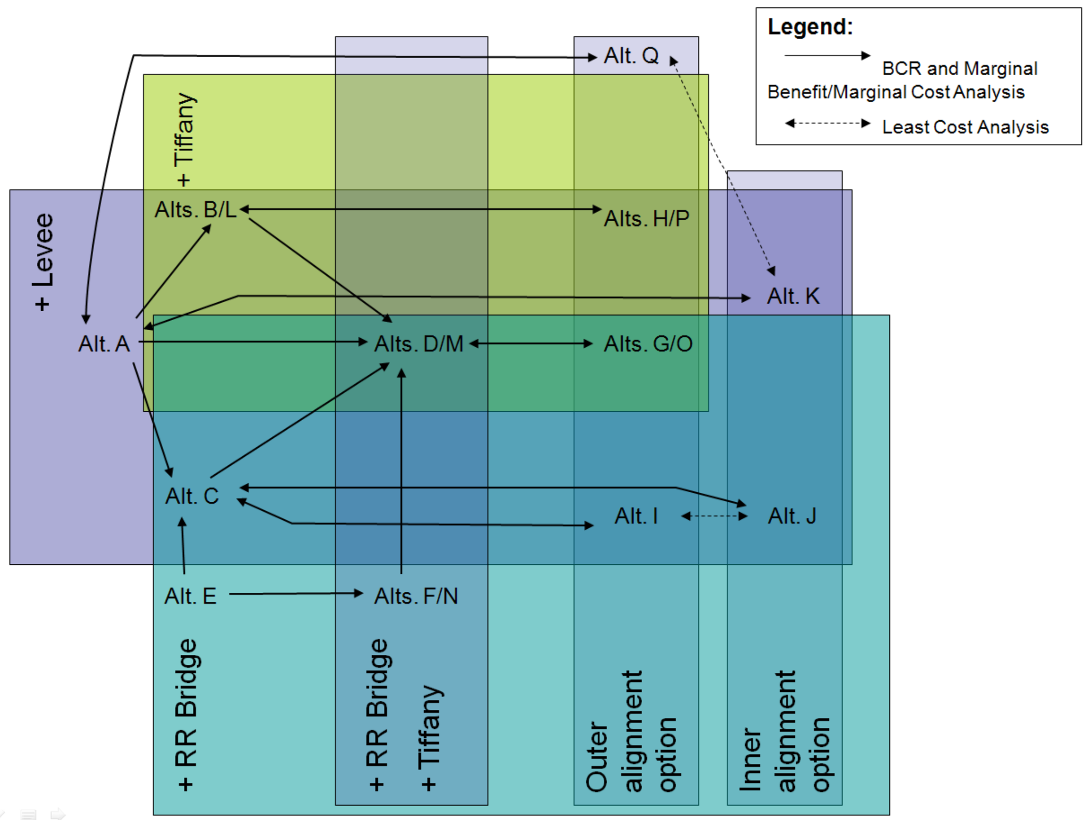


Figure F-8 - Alternatives Analysis Methods

Alternative A Evaluation

Alternative A is essentially the roughly 43 river miles of levee to the upstream extent of the Tiffany area. The NED plan, which maximizes net benefits, is the largest of the levees analyzed, at mean Base levee + 4 feet. Costs and benefits follow (Table F-18):

Table F-18

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR ALT. A

SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN

(x $1,000 August, 2010 price level)

	Base levee	Base levee + 1 ft	Base levee + 2 ft	Base levee + 3 ft	Base levee + 4 ft
Construction Costs (x $1,000)					
Levee	110,145.06	114,726.99	119,546.83	121,731.53	123,389.22
Overbank lowering/LFCC Channel Berm	4,989.60	4,989.60	4,989.60	4,989.60	4,989.60
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	4,854.00	4,854.00	4,854.00	4,854.00	4,854.00
PED	8,046.56	8,046.56	8,046.56	8,046.56	8,046.56
Construction Management	20,297.94	20,297.94	20,297.94	20,297.94	20,297.94
Mitigation	1,385.15	1,421.11	1,457.06	1,493.02	1,528.98
Total First Cost	149,718.31	154,336.19	159,191.99	161,412.65	163,106.30
IDC, Construction (168 months, 4-3/8%)*	55,367.00	57,074.73	58,870.44	59,691.66	60,317.99
Total, Interest During Construction	55,367.00	57,074.73	58,870.44	59,691.66	60,317.99
Total Investment	205,085.31	211,410.93	218,062.43	221,104.31	223,424.28
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	10,167.55	10,481.15	10,810.92	10,961.72	11,076.74
OMRR&R					
Total Avg. Ann. Cost	10,167.55	10,481.15	10,810.92	10,961.72	11,076.74
Project Benefits (x $1,000)					
Levee	11,780.59	14,643.38	16,120.77	16,990.98	17,615.42
Tiffany Basin (RR and reroutes)	379.35	379.35	379.35	379.35	379.35
RR Bridge					
Equivalent Avg. Ann. Benefits	12,159.94	15,022.72	16,500.12	17,370.32	17,994.77
Benefit/Cost Ratio	1.20	1.43	1.53	1.58	1.62
Net Benefits	1,992.39	4,541.57	5,689.20	6,408.60	6,918.03

Alternative B Evaluation

Alternative B is Alternative A plus the addition of the Tiffany sediment deposition feature. By including the Tiffany area to the project, we expect some savings to take place in project costs. First, additional toe protection to the project levee upstream may not be needed to the extent it's necessary in Alt. A, as sediment deposition over the 30+ years Tiffany is expected to fill will eliminate the risk of a headcut situation. The effects of the Tiffany Basin alone are not analyzed . Table F-19 identifies the costs and benefits of various size levees in concert with the Tiffany Sediment Basin feature. Table F-20 compares the marginal benefits and marginal costs of Alternative B to Alternative A, to highlight the impact of adding the Tiffany Sediment Basin to the upstream levees.

Alternative B Costs:
Those savings are eaten up by additional project costs. The cost of the NED levee identified in Alt. A increases by approximately $1.1 million. The Tiffany Basin feature itself costs $6.8 million. ISC officials have noted a concern that flows through the Tiffany Basin increase evaporative losses, which was a significant benefit (roughly 30,000-40,000 acre-feet/year when the diversion was active) attributable to the Low Flow Conveyance Channel. That loss would increase the costs attributable to the Tiffany Basin project feature, but as yet has been unquantified.

Alternative B Benefits:
The benefits from including the Tiffany Basin come from decreasing sediment deposition in the upstream reaches of the Rio Grande. Alt. B has lower future, with project stages than Alt. A, but the calculations indicate those benefits are most appreciable to the smaller project sizes. At the NED plan size (Base levee + 4 feet), the equivalent annual benefits of including the Tiffany Basin, discounting future benefits to present values, is roughly $429,000 ($50,000 at the margin). At the margin, the benefits do not justify the additional costs of the Tiffany Sediment feature. There is also a small unquantified benefit of rerouting sediment into the Tiffany Basin, saving Bureau of Reclamation personnel the cost of removing that sediment from the Rio Grande over the 10 years it takes to fill the basin.

At the NED plan size (Base levee + 4 feet), the equivalent annual benefits of including the Tiffany Basin, discounting future benefits to present values, is roughly $429,000. At the margin, the benefits do not justify the additional costs of the Tiffany Sediment feature.

Potential rationale for Alternative B plan selection:
It might be possible to justify the Tiffany Basin through a combination of NED and NER benefits (such as a multipurpose project or through mitigation). To do that, an incremental cost analysis showing that an expenditure of approximately $14,450,000 at Tiffany is an efficient and effective means to achieve the NER goal.

Table F-19

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR ALT. B

SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN

(x $1,000 August, 2010 price level)

	Base levee	Base levee + 1 ft	Base levee + 2 ft	Base levee + 3 ft	Base levee + 4 ft
Construction Costs (x $1,000)					
Levee	111,131.38	116,170.15	120,848.41	122,931.56	124,515.64
Overbank lowering/LFCC Channel Berm	4,989.60	4,989.60	4,989.60	4,989.60	4,989.60
Tiffany Basin	6,845.08	6,845.08	6,845.08	6,845.08	6,845.08
RR Bridge	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	4,854.00	4,854.00	4,854.00	4,854.00	4,854.00
PED	8,046.56	8,046.56	8,046.56	8,046.56	8,046.56
Construction Management	20,297.94	20,297.94	20,297.94	20,297.94	20,297.94
Total First Cost	156,164.55	161,203.32	165,881.58	167,964.73	169,548.82
IDC, Construction (168 months, 4-3/8%)*	57,750.87	59,614.25	61,344.31	62,114.67	62,700.48
Total, Interest During Construction	57,750.87	59,614.25	61,344.31	62,114.67	62,700.48
Total Investment	213,915.43	220,817.57	227,225.88	230,079.41	232,249.29
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	10,605.32	10,947.51	11,265.21	11,406.68	11,514.26
OMRR&R					
Total Avg. Ann. Cost	10,605.32	10,947.51	11,265.21	11,406.68	11,514.26
Project Benefits (x $1,000)					
Levee	11,919.14	14,639.72	16,119.75	17,007.45	17,267.09
Tiffany Basin (RR and reroutes)	429.16	429.16	429.16	429.16	429.16
RR Bridge					
Equivalent Avg. Ann. Benefits	12,348.31	15,068.88	16,548.91	17,436.61	17,696.25
Benefit/Cost Ratio	1.16	1.38	1.47	1.53	1.54
Net Benefits	1,742.99	4,121.37	5,283.70	6,029.93	6,181.99

Table F-20					
MARGINAL COSTS, COMPARING ALTERNATIVE B TO ALTERNATIVE A (X $1,000)					
Levee	986.32	1,443.16	1,301.58	1,200.03	1,126.42
Overbank lowering/LFCC Channel Berm	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	6,845.08	6,845.08	6,845.08	6,845.08	6,845.08
RR Bridge	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	0.00	0.00	0.00	0.00	0.00
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	6,446.24	6,867.13	6,689.59	6,552.08	6,442.52
IDC, Construction (168 months, 4-3/8%)*	2,383.87	2,539.52	2,473.86	2,423.01	2,382.49
Total, Interest During Construction	2,383.87	2,539.52	2,473.86	2,423.01	2,382.49
Total Investment	8,830.11	9,406.65	9,163.45	8,975.09	8,825.01
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	437.77	466.35	454.30	444.96	437.52
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	437.77	466.35	454.30	444.96	437.52
Marginal Benefits (x $1,000)					
Levee	138.55	-3.66	-1.02	16.47	-348.34
Tiffany Basin	49.82	49.82	49.82	49.82	49.82
RR Bridge	0.00	0.00	0.00	0.00	0.00
Equivalent Avg. Ann. Benefits	188.37	46.16	48.80	66.29	-298.52
Benefit/Cost Ratio	0.43	0.10	0.11	0.15	-0.68
Net Benefits	-249.41	-420.20	-405.50	-378.67	-736.04

Alternative C Evaluation

Alternative C is Alternative A plus the addition of the San Marcial railroad bridge feature. The effects of constructing the San Marcial railroad bridge alone are analyzed in Alternative E. Table F-21 identifies the costs and benefits of various size levees in concert with the replacement railroad bridge. Table F-22 compares the marginal benefits and marginal costs of Alternative C to Alternative A, to highlight the impact of adding the replacement railroad bridge to the upstream levees.

Alternative C Costs:
A major expense attributed to the upstream levees had to do with hauling material to a disposal site. By including the railroad bridge and appurtenant approaches, disposal costs for the levee (captured in Alt. A costs), and borrow costs for the railroad bridge approaches (captured in Alt. E costs) become a transfer within the project. In previous iterations of this analysis, the inclusion of the railroad bridge lowers NED levee costs by $8.3 million. The most recent cost estimate (August, 2010) does not have that savings, and borrow/fill savings appear no longer to be a factor in estimating construction costs. The railroad bridge size has been optimized for a specific horizontal alignment, a specific height, and specific features (7 bay bridge, concrete). The railroad bridge inclusion represents a $23 million additional feature to the project.

Alternative C Benefits:
As described in the economics appendix, the railroad bridge represents a service that, in the without project condition, is threatened with interruption. The benefit calculations consider the likelihood of traffic reroutes, tonnage and distance of the reroutes, and the likelihood of needing to repair or replace the existing bridge. Those benefits amount to roughly $4.3 million on an average annual basis. Those benefits come from a higher bridge deck and marginally higher railroad approaches on either side of the new river crossing. Bureau of Reclamation officials have indicated they spend roughly $2 million annually to remove sediment from nearby reaches of the Rio Grande, and altering the railroad bridge to convey more water, *ceteris paribus*, does not appear to alter that in the with project condition.

Potential rationale for Alternative C plan selection:
Alternative C, at the Base levee + 4 feet size, provides roughly $9.8 million in net average annual benefits. This is more than the NED project size identified in Alternative A ($6.8 million). Unfortunately, hydraulic analyses have indicated that constructing the levees (Alternative A) several miles upstream of the railroad bridge has no material impact on flows at the bridge. The current legal opinion is that, absent that hydraulic link between the proposed levee and the existing bridge, the Corps has no authority to reconstruct the railroad bridge.

Table F-21

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR ALT. C SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN (x $1,000 August, 2010 price level)					
	Base levee	Base levee + 1 ft	Base levee + 2 ft	Base levee + 3 ft	Base levee + 4 ft
Construction Costs (x $1,000)					
Levee	110,145.06	114,726.99	119,546.83	121,731.53	123,389.22
Overbank lowering/LFCC Channel Berm	4,989.60	4,989.60	4,989.60	4,989.60	4,989.60
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	23,000.07	23,000.07	23,000.07	23,000.07	23,000.07
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	4,854.00	4,854.00	4,854.00	4,854.00	4,854.00
PED	8,046.56	8,046.56	8,046.56	8,046.56	8,046.56
Construction Management	20,297.94	20,297.94	20,297.94	20,297.94	20,297.94
Total First Cost	171,333.23	175,915.16	180,735.00	182,919.70	184,577.39
IDC, Construction (168 months, 4-3/8%)*	63,360.37	65,054.80	66,837.22	67,645.14	68,258.17
Total, Interest During Construction	63,360.37	65,054.80	66,837.22	67,645.14	68,258.17
Total Investment	234,693.60	240,969.96	247,572.22	250,564.84	252,835.56
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	11,635.44	11,946.61	12,273.93	12,422.29	12,534.87
OMRR&R					
Total Avg. Ann. Cost	11,635.44	11,946.61	12,273.93	12,422.29	12,534.87
Project Benefits (x $1,000)					
Levee	11,780.59	14,643.38	16,120.77	16,990.98	17,615.42
Tiffany Basin (RR and reroutes)	569.09	569.09	569.09	569.09	569.09
RR Bridge	4,306.70	4,306.70	4,306.70	4,306.70	4,306.70
Equivalent Avg. Ann. Benefits	16,656.38	19,519.16	20,996.55	21,866.76	22,491.21
Benefit/Cost Ratio	1.43	1.63	1.71	1.76	1.79
Net Benefits	5,020.93	7,572.55	8,722.62	9,444.47	9,956.34

Table F-22

MARGINAL COSTS, COMPARING ALTERNATIVE C TO ALTERNATIVE A (X $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Overbank lowering/LFCC Channel Berm	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	23,000.07	23,000.07	23,000.07	23,000.07	23,000.07
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	0.00	0.00	0.00	0.00	0.00
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	21,614.92	21,578.97	21,543.01	21,507.05	21,471.10
Sediment Collection System	7,993.37	7,980.07	7,966.77	7,953.48	7,940.18
IDC, Construction (168 months, 4-3/8%)*	7,993.37	7,980.07	7,966.77	7,953.48	7,940.18
Total Investment	29,608.29	29,559.04	29,509.78	29,460.53	29,411.28
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	1,467.89	1,465.45	1,463.01	1,460.57	1,458.13
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	1,467.89	1,465.45	1,463.01	1,460.57	1,458.13
Marginal Benefits (x $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	189.74	189.74	189.74	189.74	189.74
RR Bridge	4,306.70	4,306.70	4,306.70	4,306.70	4,306.70
Equivalent Avg. Ann. Benefits	4,496.44	4,496.44	4,496.44	4,496.44	4,496.44
Benefit/Cost Ratio	3.06	3.07	3.07	3.08	3.08
Net Benefits	3,028.54	3,030.98	3,033.42	3,035.87	3,038.31

Alternative D Evaluation

Alternative D is Alternative A plus the addition of the San Marcial railroad bridge, described in Alternative C, and the Tiffany Basin feature. The Tiffany Basin was not analyzed in isolation, but its performance and cost was deemed independent of other project features, and did not need an alternative developed in isolation. Table F-23 identifies the costs and benefits of various size levees in concert with the Tiffany Sediment Basin and replacement railroad bridge features. Table F-24 compares the marginal benefits and marginal costs of Alternative D to Alternative A, to highlight the impact of adding the Tiffany Sediment Basin and the replacement railroad bridge to the upstream levees. Table F-25 compares the marginal benefits and marginal costs of Alternative D to Alternative C, to highlight the impact of adding the Tiffany Sediment Basin to Alternative A (upstream levee + railroad bridge). Table F-26 compares the marginal benefits and marginal costs of Alternative D to Alternative B, to highlight the impact of adding the replacement railroad bridge to Alternative B (upstream levee + Tiffany Sediment Basin).

Alternative D Costs:
This feature represents the combination of the upstream levee, railroad bridge, and the Tiffany basin. This feature represents the combination of the Alt. B and the Alt. C additions to Alt. A. Many of the assertions made in the discussions of Alts. B and C are still valid here. For example, the railroad bridge feature cost $23.0 million across all alternatives. The Tiffany Basin costs approximately $6.8 million across all alternatives. Minor cost changes across the alternatives come from changes to the Levee feature costs.

Comparing this Alternative to Alt. A (levee only), we note that the project incurs fixed and specific costs ($6.8 million for the Tiffany Basin, $23.0 million for the railroad), and incurred no savings in levee construction costs. Adding the basin and railroad bridge saved no money in levee construction costs for the NED plan. The NED plan size was still Base levee + 4 feet. The Tiffany Basin still serves as a drag on the project benefits, and expected cost savings on other features by including Tiffany did not materialize here.

A major expense attributed to the upstream levees had to do with hauling material to a disposal site. By including the railroad bridge and appurtenant approaches, disposal costs for the levee (captured in Alt. A costs), and borrow costs for the railroad bridge approaches (captured in Alt. E costs) become a transfer within the project. In previous analyses (September, 2007) the inclusion of the railroad bridge lowered NED levee costs by $3.4 million. That savings is not present in this analysis. Because the railroad bridge size has been optimized at a specific horizontal alignment, a specific height, and specific features (7 bay bridge, concrete) the railroad bridge inclusion represents a $23.0 million additional feature to the project.

Tables which follow show marginal cost and marginal benefit comparisons between Alt. D and previously analyzed alternatives. Some interesting relationships developed. For one, adding the Tiffany Basin feature to Alt. C (levee plus RR bridge) INCREASED levee construction costs. Adding the RR bridge to Alt. B (levee plus Tiffany) decreased levee construction costs by less than $1 million. It appears that including the Tiffany Basin increases levee construction costs, which further makes it difficult to justify the Tiffany Basin.

Alternative D Benefits:
As described in the economics appendix, the railroad bridge represents a service that, in the without project condition, is threatened with interruption. The benefit calculations consider the likelihood of traffic reroutes, tonnage and distance of the reroutes, and the likelihood of needing to repair or replace the existing bridge. Those benefits amount to roughly $4.3 million on an average annual basis. Bureau of Reclamation officials have indicated they spend roughly $2 million annually to remove sediment from nearby reaches of the Rio Grande, and altering the railroad bridge to convey more water, *ceteris paribus*, does not appear to alter that in the with project condition.

Potential rationale for Alternative D plan selection:
Alternative C, at the Base levee + 4 feet size, provides roughly $8.8 million in net average annual benefits. This is more than the NED project size identified in Alternative A ($6.8 million). Unfortunately, hydraulic analyses have indicated that constructing the levees (Alternative A) several miles upstream of the railroad bridge has no material impact on flows at the bridge. The current legal opinion is that, absent that hydraulic link between the proposed levee and the existing bridge, the Corps has no authority to reconstruct the railroad bridge.

Even if a levee and railroad bridge were justified, including the Tiffany Basin will decrease levee construction costs by roughly $617,000, comparing Alternative D to Alternative B. There are uncaptured benefits (avoidance of sediment removal costs) and uncaptured costs (increased evaporative losses of water through the Tiffany Basin). The Tiffany Basin inclusion no longer provides construction savings for other project features, and will be difficult to justify.

Table F-23

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR ALT. D SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN (x $1,000 August, 2010 price level)					
	Base levee	Base levee + 1 ft	Base levee + 2 ft	Base levee + 3 ft	Base levee + 4 ft
Construction Costs (x $1,000)					
Levee	110,959.88	115,533.27	120,211.17	122,304.66	123,899.09
Overbank lowering/LFCC Channel Berm	4,982.88	4,982.88	4,982.88	4,982.88	4,982.88
Tiffany Basin	6,842.25	6,842.25	6,842.25	6,842.25	6,842.25
RR Bridge	22,977.07	22,977.07	22,977.07	22,977.07	22,977.07
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	4,854.00	4,854.00	4,854.00	4,854.00	4,854.00
PED	8,044.43	8,044.43	8,044.43	8,044.43	8,044.43
Construction Management	20,297.94	20,297.94	20,297.94	20,297.94	20,297.94
Total First Cost	178,958.44	183,531.83	188,209.73	190,303.22	191,897.65
IDC, Construction (168 months, 4-3/8%)*	66,180.23	67,871.51	69,601.43	70,375.62	70,965.25
Total, Interest During Construction	66,180.23	67,871.51	69,601.43	70,375.62	70,965.25
Total Investment	245,138.67	251,403.34	257,811.16	260,678.84	262,862.90
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	12,153.28	12,463.86	12,781.55	12,923.72	13,032.00
OMRR&R					
Total Avg. Ann. Cost	12,153.28	12,463.86	12,781.55	12,923.72	13,032.00
Project Benefits (x $1,000)					
Levee	11,919.14	14,639.72	16,119.75	17,007.45	17,267.09
Tiffany Basin (RR and reroutes)	420.37	420.37	420.37	420.37	420.37
RR Bridge	4,306.70	4,306.70	4,306.70	4,306.70	4,306.70
Equivalent Avg. Ann. Benefits	16,646.21	19,366.79	20,846.82	21,734.52	21,994.16
Benefit/Cost Ratio	1.37	1.55	1.63	1.68	1.69
Net Benefits	4,492.93	6,902.92	8,065.27	8,810.80	8,962.16

Table F-24					
MARGINAL COSTS, COMPARING ALTERNATIVE D TO ALTERNATIVE A (X $1,000)					
Levee	814.82	806.28	664.34	573.13	509.86
Overbank lowering/LFCC Channel Berm	-6.72	-6.72	-6.72	-6.72	-6.72
Tiffany Basin	6,842.25	6,842.25	6,842.25	6,842.25	6,842.25
RR Bridge	22,977.07	22,977.07	22,977.07	22,977.07	22,977.07
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	-2.13	-2.13	-2.13	-2.13	-2.13
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	29,240.13	29,195.64	29,017.74	28,890.57	28,791.35
Sediment Collection System	10,813.23	10,796.78	10,730.99	10,683.96	10,647.27
IDC, Construction (168 months, 4-3/8%)*	10,813.23	10,796.78	10,730.99	10,683.96	10,647.27
Total Investment	40,053.36	39,992.41	39,748.73	39,574.53	39,438.62
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	1,985.73	1,982.71	1,970.63	1,961.99	1,955.25
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	1,985.73	1,982.71	1,970.63	1,961.99	1,955.25
Marginal Benefits (x $1,000)					
Levee	138.55	-3.66	-1.02	16.47	-348.34
Tiffany Basin	41.03	41.03	41.03	41.03	41.03
RR Bridge	4,306.70	4,306.70	4,306.70	4,306.70	4,306.70
Equivalent Avg. Ann. Benefits	4,486.27	4,344.06	4,346.70	4,364.19	3,999.39
Benefit/Cost Ratio	2.26	2.19	2.21	2.22	2.05
Net Benefits	2,500.54	2,361.35	2,376.07	2,402.20	2,044.13

Table F-25

MARGINAL COSTS, COMPARING ALTERNATIVE D TO ALTERNATIVE C (X $1,000)					
Levee	814.82	806.28	664.34	573.13	509.86
Overbank lowering/LFCC Channel Berm	-6.72	-6.72	-6.72	-6.72	-6.72
Tiffany Basin	6,842.25	6,842.25	6,842.25	6,842.25	6,842.25
RR Bridge	-23.01	-23.01	-23.01	-23.01	-23.01
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	-2.13	-2.13	-2.13	-2.13	-2.13
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	7,625.21	7,616.67	7,474.73	7,383.51	7,320.25
Sediment Collection System	2,819.86	2,816.71	2,764.21	2,730.48	2,707.09
IDC, Construction (168 months, 4-3/8%)*	2,819.86	2,816.71	2,764.21	2,730.48	2,707.09
Total Investment	10,445.07	10,433.38	10,238.94	10,114.00	10,027.34
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	517.84	517.26	507.62	501.42	497.13
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	517.84	517.26	507.62	501.42	497.13
Marginal Benefits (x $1,000)					
Levee	138.55	-3.66	-1.02	16.47	-348.34
Tiffany Basin	-148.71	-148.71	-148.71	-148.71	-148.71
RR Bridge	0.00	0.00	0.00	0.00	0.00
Equivalent Avg. Ann. Benefits	-10.16	-152.37	-149.73	-132.24	-497.05
Benefit/Cost Ratio	-0.02	-0.29	-0.29	-0.26	-1.00
Net Benefits	-528.00	-669.63	-657.35	-633.67	-994.18

Table F-26

MARGINAL COSTS, COMPARING ALTERNATIVE D TO ALTERNATIVE B (X $1,000)					
Levee	-171.50	-636.88	-637.24	-626.90	-616.56
Overbank lowering/LFCC Channel Berm	-6.72	-6.72	-6.72	-6.72	-6.72
Tiffany Basin	-2.83	-2.83	-2.83	-2.83	-2.83
RR Bridge	22,977.07	22,977.07	22,977.07	22,977.07	22,977.07
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	-2.13	-2.13	-2.13	-2.13	-2.13
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	22,793.88	22,328.51	22,328.15	22,338.49	22,348.83
Sediment Collection System	8,429.36	8,257.26	8,257.13	8,260.95	8,264.77
IDC, Construction (168 months, 4-3/8%)*	8,429.36	8,257.26	8,257.13	8,260.95	8,264.77
Total Investment	31,223.24	30,585.77	30,585.28	30,599.43	30,613.60
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	1,547.96	1,516.36	1,516.33	1,517.03	1,517.74
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	1,547.96	1,516.36	1,516.33	1,517.03	1,517.74
Marginal Benefits (x $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	-8.79	-8.79	-8.79	-8.79	-8.79
RR Bridge	4,306.70	4,306.70	4,306.70	4,306.70	4,306.70
Equivalent Avg. Ann. Benefits	4,297.91	4,297.91	4,297.91	4,297.91	4,297.91
Benefit/Cost Ratio	2.78	2.83	2.83	2.83	2.83
Net Benefits	2,749.95	2,781.55	2,781.57	2,780.87	2,780.17

Alternative E Evaluation

Alternative E is the San Marcial railroad bridge without the levee or the Tiffany Basin. Table F-27 identifies the costs and benefits of the railroad bridge. Previous analyses have already established the optimum characteristics of the replacement bridge and its approaches. The format of the table permits addition of the railroad bridge feature to other Alternatives.

Alternative E Costs:

This feature represents the cost of the railroad bridge in isolation. The railroad bridge feature cost $23.0 million across all alternatives. The railroad bridge and approaches are for a specified height, span (7 bay) and concrete construction, optimized in the economics appendix.

Alternative E Benefits:

As described throughout the economics appendix, the railroad bridge represents a service that, in the without project condition, is threatened with interruption. The benefit calculations consider the likelihood of traffic reroutes, tonnage and distance of the reroutes, and the likelihood of needing to repair or replace the existing bridge. Those benefits amount to roughly $4.3 million on an average annual basis. Those benefits come from a higher bridge deck and marginally higher railroad approaches on either side of the new river crossing. Bureau of Reclamation officials have indicated they spend roughly $2 million annually to remove sediment from nearby reaches of the Rio Grande, and altering the railroad bridge to convey more water, *ceteris paribus*, does not appear to alter that in the with project condition.

Potential rationale for Alternative E plan selection:

Alternative E provides roughly $3.4 million in net average annual benefits. Unfortunately, hydraulic analyses have indicated that constructing the levees (Alternative A) several miles upstream of the railroad bridge has no material impact on flows at the bridge. The current legal opinion is that, absent that hydraulic link between the proposed levee and the existing bridge, the Corps has no authority to reconstruct the railroad bridge.

Were USACE authorized to construct a railroad bridge, it would be justified through the NED analysis. The purpose of this alternative evaluation, however, concedes that there is no authority to construct the railroad bridge, and attempts to evaluate the range of alternatives on an NED basis, to identify tradeoffs, and efficiencies where possible.

Table F-27

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR ALT. E SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN (x $1,000 August, 2010 price level)					
	Base levee	Base levee + 1 ft	Base levee + 2 ft	Base levee + 3 ft	Base levee + 4 ft
Construction Costs (x $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Overbank lowering/LFCC Channel Berm	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	23,026.39	23,026.39	23,026.39	23,026.39	23,026.39
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	1,150.04	1,150.04	1,150.04	1,150.04	1,150.04
Construction Management	2,899.71	2,899.71	2,899.71	2,899.71	2,899.71
Total First Cost	27,076.14	27,076.14	27,076.14	27,076.14	27,076.14
IDC, Construction (30 months, 4-3/8%)*	1,502.41	1,502.41	1,502.41	1,502.41	1,502.41
Total, Interest During Construction	1,502.41	1,502.41	1,502.41	1,502.41	1,502.41
Total Investment	28,578.54	28,578.54	28,578.54	28,578.54	28,578.54
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	1,416.84	1,416.84	1,416.84	1,416.84	1,416.84
OMRR&R					
Total Avg. Ann. Cost	1,416.84	1,416.84	1,416.84	1,416.84	1,416.84
Project Benefits (x $1,000)					
Levee					
Tiffany Basin (RR and reroutes)	479.45	479.45	479.45	479.45	479.45
RR Bridge	4,306.70	4,306.70	4,306.70	4,306.70	4,306.70
Equivalent Avg. Ann. Benefits	4,786.15	4,786.15	4,786.15	4,786.15	4,786.15
Benefit/Cost Ratio	3.38	3.38	3.38	3.38	3.38
Net Benefits	3,369.30	3,369.30	3,369.30	3,369.30	3,369.30

Alternative F Evaluation

Alternative F is the San Marcial railroad bridge plus the Tiffany Basin without the levee. It is essentially Alternative E plus Tiffany. The Tiffany Basin was not evaluated in isolation. Table F-28 identifies the costs and benefits of the railroad bridge and the Tiffany Sediment Basin. Previous analyses have already established the optimum characteristics of the replacement bridge and its approaches. The format of the table permits addition of the railroad bridge feature to other Alternatives. Table F-29 compares the marginal benefits and marginal costs of Alternative F to Alternative E, to highlight the impact of adding the Tiffany Sediment Basin and the replacement railroad bridge to the upstream levees. Table F-30 compares the marginal benefits and marginal costs of Alternative F to Alternative D, to highlight the impact of adding the upstream levees to a combination of the Tiffany Sediment Basin and the replacement railroad bridge.

Alternative F Costs:
This feature represents the combination of the railroad bridge and the Tiffany basin. This feature represents the combination of the Tiffany Basin to Alt. E. Many of the assertions made in the discussions of Alt. E and the Tiffany Basin are still valid here. For example, the railroad bridge feature cost $23.0 million across all alternatives. The Tiffany Basin costs increased slightly to $7.2 million in this alternative. There were no cost changes across the alternatives but the absence of the levee feature appears to have impacted Tiffany in an unexpected fashion.

Tables which follow show marginal cost and marginal benefit comparisons between Alt. F and Alternative E (railroad bridge only). This alternative is somewhat different from other alternatives including the Tiffany Basin in that the Tiffany feature costs are roughly $300,000 higher here. The Tiffany Basin still represents a "drag" on the project benefit calculations. Comparing this Alternative to Alternative D, which comprises the levee plus Tiffany plus the RR bridge enables us to evaluate the LEVEE against the two other potential project features (Table 27). As expected, projects including the upstream levee provide greater net benefits than projects without the upstream levee.

Alternative F Benefits:
As described in the economics appendix, the railroad bridge represents a service that, in the without project condition, is threatened with interruption. The benefit calculations consider the likelihood of traffic reroutes, tonnage and distance of the reroutes, and the likelihood of needing to repair or replace the existing bridge. Those benefits amount to roughly $4.3 million on an average annual basis. Bureau of Reclamation officials have indicated they spend roughly $2 million annually to remove sediment from nearby reaches of the Rio Grande, and altering the railroad bridge to convey more water, *ceteris paribus*, does not appear to alter that in the with project condition.

Potential rationale for Alternative F plan selection:
It is not expected that this alternative is desirable to the Sponsors, and this alternative

serves as a basis for evaluating the impacts of other features.

Table F-28

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR ALT. F SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN (x $1,000 August, 2010 price level)					
	Base levee	Base levee + 1 ft	Base levee + 2 ft	Base levee + 3 ft	Base levee + 4 ft
Construction Costs (x $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Overbank lowering/LFCC Channel Berm	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	7,178.73	7,178.73	7,178.73	7,178.73	7,178.73
RR Bridge	23,026.39	23,026.39	23,026.39	23,026.39	23,026.39
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	1,298.28	1,298.28	1,298.28	1,298.28	1,298.28
Construction Management	3,624.86	3,624.86	3,624.86	3,624.86	3,624.86
Total First Cost	35,128.26	35,128.26	35,128.26	35,128.26	35,128.26
IDC, Construction (30 months, 4-3/8%)*	1,949.21	1,949.21	1,949.21	1,949.21	1,949.21
Total, Interest During Construction	1,949.21	1,949.21	1,949.21	1,949.21	1,949.21
Total Investment	37,077.47	37,077.47	37,077.47	37,077.47	37,077.47
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	1,838.20	1,838.20	1,838.20	1,838.20	1,838.20
OMRR&R					
Total Avg. Ann. Cost	1,838.20	1,838.20	1,838.20	1,838.20	1,838.20
Project Benefits (x $1,000)					
Levee					
Tiffany Basin (RR and reroutes)	355.40	355.40	355.40	355.40	355.40
RR Bridge	4,306.70	4,306.70	4,306.70	4,306.70	4,306.70
Equivalent Avg. Ann. Benefits	4,662.09	4,662.09	4,662.09	4,662.09	4,662.09
Benefit/Cost Ratio	2.54	2.54	2.54	2.54	2.54
Net Benefits	2,823.90	2,823.90	2,823.90	2,823.90	2,823.90

Table F-29					
MARGINAL COSTS, COMPARING ALTERNATIVE F TO ALTERNATIVE E (X $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Overbank lowering/LFCC Channel Berm	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	7,178.73	7,178.73	7,178.73	7,178.73	7,178.73
RR Bridge	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	148.24	148.24	148.24	148.24	148.24
Construction Management	725.15	725.15	725.15	725.15	725.15
Total First Cost	8,052.12	8,052.12	8,052.12	8,052.12	8,052.12
IDC, Construction (30 months, 4-3/8%)*	446.80	446.80	446.80	446.80	446.80
Total, Interest During Construction	446.80	446.80	446.80	446.80	446.80
Total Investment	8,498.92	8,498.92	8,498.92	8,498.92	8,498.92
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	421.35	421.35	421.35	421.35	421.35
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	421.35	421.35	421.35	421.35	421.35
Marginal Benefits (x $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	-124.05	-124.05	-124.05	-124.05	-124.05
RR Bridge	0.00	0.00	0.00	0.00	0.00
Equivalent Avg. Ann. Benefits	-124.05	-124.05	-124.05	-124.05	-124.05
Benefit/Cost Ratio	-0.29	-0.29	-0.29	-0.29	-0.29
Net Benefits	-545.41	-545.41	-545.41	-545.41	-545.41

Table F-30

MARGINAL COSTS, COMPARING ALTERNATIVE D TO ALTERNATIVE F (X $1,000)					
Levee	110,959.88	115,533.27	120,211.17	122,304.66	123,899.09
Overbank lowering/LFCC Channel Berm	4,982.88	4,982.88	4,982.88	4,982.88	4,982.88
Tiffany Basin	-336.49	-336.49	-336.49	-336.49	-336.49
RR Bridge	-49.33	-49.33	-49.33	-49.33	-49.33
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	4,854.00	4,854.00	4,854.00	4,854.00	4,854.00
PED	6,746.15	6,746.15	6,746.15	6,746.15	6,746.15
Construction Management	16,673.08	16,673.08	16,673.08	16,673.08	16,673.08
Total First Cost	143,830.18	148,403.57	153,081.47	155,174.96	156,769.39
IDC, Construction (30 months, 4-3/8%)*	64,231.02	65,922.30	67,652.22	68,426.41	69,016.05
Total, Interest During Construction	64,231.02	65,922.30	67,652.22	68,426.41	69,016.05
Total Investment	208,061.20	214,325.87	220,733.69	223,601.37	225,785.43
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	10,315.08	10,625.67	10,943.35	11,085.52	11,193.80
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	10,315.08	10,625.67	10,943.35	11,085.52	11,193.80
Marginal Benefits (x $1,000)					
Levee	11,919.14	14,639.72	16,119.75	17,007.45	17,267.09
Tiffany Basin	64.98	64.98	64.98	64.98	64.98
RR Bridge	0.00	0.00	0.00	0.00	0.00
Equivalent Avg. Ann. Benefits	11,984.12	14,704.69	16,184.73	17,072.42	17,332.07
Benefit/Cost Ratio	1.16	1.38	1.48	1.54	1.55
Net Benefits	1,669.04	4,079.02	5,241.38	5,986.90	6,138.26

Alternative G Evaluation

Alternative G is the San Marcial railroad bridge plus the Tiffany Basin plus the levee. It is essentially Alternative D plus the extension of the levee along the Tiffany Basin's west side. The purpose of the extension is to protect the railroad track from flooding that may occur in the Tiffany Basin. This feature serves as a trade-off to Alternative D. Table F-31 identifies the costs and benefits of the levee, the replacement railroad bridge and the Tiffany Sediment Basin. Table F-32 compares the marginal benefits and marginal costs of Alternative G to Alternative D, to highlight the impact of extending the levee protection through the Tiffany Sediment Basin.

Alternative G Costs:

This feature represents the combination of a levee extending along the west side of the Tiffany Basin, and serves as a second means of protecting the upstream levee and the railroad tracks from sedimentation and flooding originating in the Tiffany Basin. This additional length of levee would be selected over Alternative D if it achieved the same goals of the project at lower costs. As the following table (Table F-32) shows, this alternative costs roughly $19.4 million more than Alternative D.

Alternative G Benefits:

As described in the economics appendix, the railroad bridge represents a service that, in the without project condition, is threatened with interruption. Extending flood protection past the upstream limits of the Tiffany area ensures continued operations of the railroad down the west side of the Tiffany area. The benefit calculations consider the likelihood of traffic reroutes, tonnage and distance of the reroutes, and the likelihood of needing to repair or replace the existing bridge. Those benefits amount to roughly $4.3 million on an average annual basis. Bureau of Reclamation officials have indicated they spend roughly $2 million annually to remove sediment from nearby reaches of the Rio Grande, and altering the railroad bridge to convey more water, *ceteris paribus*, does not appear to alter that in the with project condition.

As previously described, the Tiffany Basin generates few NED benefits, but there are uncaptured benefits (sediment deposition not requiring Bureau of Reclamation removal, increased avoidable water losses through evaporation) that have an uncertain effect on benefits.

Alternative G would be preferable to Alternative D if it achieved the same results for less cost. As the following table indicates, Alternative G is approximately $26.7 million more than Alternative D.

Potential rationale for Alternative G plan selection:

This alternative would be preferable to Alternative D if it achieved the desired results of the project for less cost than Alternative D.

Table F-31

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR ALT. G SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN (x $1,000 August, 2010 price level)					
	Base levee	Base levee + 1 ft	Base levee + 2 ft	Base levee + 3 ft	Base levee + 4 ft
Construction Costs (x $1,000)					
Levee	125,542.47	130,741.27	137,271.02	140,482.76	143,370.51
Overbank lowering/LFCC Channel Berm	6,837.21	6,837.21	6,837.21	6,837.21	6,837.21
Tiffany Basin	4,981.58	4,981.58	4,981.58	4,981.58	4,981.58
RR Bridge	22,949.45	22,949.45	22,949.45	22,949.45	22,949.45
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	4,854.00	4,854.00	4,854.00	4,854.00	4,854.00
PED	8,050.28	8,050.28	8,050.28	8,050.28	8,050.28
Construction Management	20,297.94	20,297.94	20,297.94	20,297.94	20,297.94
Total First Cost	193,512.94	198,711.73	205,241.49	208,453.22	211,340.98
IDC, Construction (168 months, 4-3/8%)*	71,562.60	73,485.16	75,899.91	77,087.63	78,155.55
Total, Interest During Construction	71,562.60	73,485.16	75,899.91	77,087.63	78,155.55
Total Investment	265,075.54	272,196.89	281,141.39	285,540.86	289,496.52
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	13,141.69	13,494.75	13,938.19	14,156.31	14,352.42
OMRR&R					
Total Avg. Ann. Cost	13,141.69	13,494.75	13,938.19	14,156.31	14,352.42
Project Benefits (x $1,000)					
Levee	11,919.14	14,639.72	16,119.75	17,007.45	17,267.09
Tiffany Basin (RR and reroutes)	431.58	431.58	431.58	431.58	431.58
RR Bridge	4,306.70	4,306.70	4,306.70	4,306.70	4,306.70
Equivalent Avg. Ann. Benefits	16,657.42	19,377.99	20,858.03	21,745.72	22,005.37
Benefit/Cost Ratio	1.27	1.44	1.50	1.54	1.53
Net Benefits	3,515.73	5,883.24	6,919.83	7,589.42	7,652.95

Table F-32					
MARGINAL COSTS, COMPARING ALTERNATIVE G TO ALTERNATIVE D (X $1,000)					
Levee	14,582.60	15,208.00	17,059.85	18,178.10	19,471.42
Overbank lowering/LFCC Channel Berm	1,854.33	1,854.33	1,854.33	1,854.33	1,854.33
Tiffany Basin	-1,860.67	-1,860.67	-1,860.67	-1,860.67	-1,860.67
RR Bridge	-27.61	-27.61	-27.61	-27.61	-27.61
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	5.85	5.85	5.85	5.85	5.85
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	14,554.50	15,179.90	17,031.76	18,150.01	19,443.33
IDC, Construction (168 months, 4-3/8%)*	5,382.37	5,613.65	6,298.48	6,712.01	7,190.30
Total, Interest During Construction	5,382.37	5,613.65	6,298.48	6,712.01	7,190.30
Total Investment	19,936.87	20,793.55	23,330.24	24,862.02	26,633.62
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	988.41	1,030.89	1,156.65	1,232.59	1,320.42
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	988.41	1,030.89	1,156.65	1,232.59	1,320.42
Marginal Benefits (x $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	11.21	11.21	11.21	11.21	11.21
RR Bridge	0.00	0.00	0.00	0.00	0.00
Equivalent Avg. Ann. Benefits	11.21	11.21	11.21	11.21	11.21
Benefit/Cost Ratio	0.01	0.01	0.01	0.01	0.01
Net Benefits	-977.20	-1,019.68	-1,145.44	-1,221.38	-1,309.21

Alternative H Evaluation

Alternative H is the Tiffany Basin plus the levee. It is essentially Alternative B plus the extension of the levee along the Tiffany Basin's west side. The purpose of the extension is to protect the railroad track from flooding that may occur in the Tiffany Basin. This feature serves as a trade-off to Alternative B. Table F-33 identifies the costs and benefits of the levee and the Tiffany Sediment Basin. Table F-34 compares the marginal benefits and marginal costs of Alternative H to Alternative B, to highlight the impact of extending the levee protection through the Tiffany Sediment Basin. Table F-35 compares the marginal benefits and marginal costs of Alternative H to Alternative A, to highlight the impact of extending the levee protection and installing the Tiffany Sediment Basin.

Alternative H Costs:
This feature represents the combination of a levee extending along the west side of the Tiffany Basin, and serves as a second means of protecting the upstream levee and the railroad tracks from sedimentation and flooding originating in the Tiffany Basin. This alternative also incorporates restructuring the Tiffany Basin to collect sediment. This additional length of levee would be selected over Alternative B if it achieved the same goals of the project at lower costs. As the following tables show, this alternative costs roughly $25.8 million more than Alternative B.

Alternative B describes how the inclusion of the Tiffany Basin as a project feature increases project costs without increasing project benefits. However, comparing Alternative H to Alt. B indicates that, were there a justification for including the Tiffany Basin, Alt. B would be preferable to Alt. H on a least-cost basis, assuming both alternatives performed identically. Previous analyses (August, 2007) had the opposite result.

Alternative H Benefits:
The benefits from including the Tiffany Basin come from decreasing sediment deposition in the upstream reaches of the Rio Grande. Alt. H has lower future, with project stages than Alt. A, but the calculations indicate those benefits are most appreciable to the smaller project sizes. At the NED plan size (Base levee + 4 feet), the equivalent annual benefits of including the Tiffany Basin, discounting future benefits to present values, are roughly $420,800. At the margin, the benefits do not justify the additional costs of the Tiffany Sediment feature. There is also a small unquantified benefit of rerouting sediment into the Tiffany Basin, saving Bureau of Reclamation personnel the cost of removing that sediment from the Rio Grande over the 10 to 30 years it takes to fill the basin.

At the NED plan size (Base levee + 4 feet), the equivalent annual benefits of including the Tiffany Basin, discounting future benefits to present values, is roughly $41,400. At the margin, the benefits do not justify the additional costs of the Tiffany Sediment feature. Were the Tiffany Basin feature necessary to achieve the project objectives (as in a multipurpose NED/NER project or as a mitigation requirement), it would be preferable to build Alternative B over Alternative H.

As previously described, the Tiffany Basin has few identified NED benefits, but there are uncaptured benefits (sediment deposition not requiring Bureau of Reclamation removal, increased avoidable water losses through evaporation) that have an uncertain effect on benefits.

Alternative H would be preferable to Alternative B if it achieved the same results for less cost. As the following table indicates, Alternative H is approximately $25.8 million more than Alternative B, and $34.6 million more than Alternative A.

Potential rationale for Alternative H plan selection:
It might be possible to justify the Tiffany Basin through a combination of NED and NER benefits (such as a multipurpose project or through mitigation). To do that, an incremental cost analysis showing that an expenditure of approximately $25.9 million at Tiffany is an efficient and effective means to achieve the NER goal, in which case Alternative B would be the preferred alternative.

Table F-33

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR ALT. H SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN (x $1,000 August, 2010 price level)					
	Base levee	Base levee + 1 ft	Base levee + 2 ft	Base levee + 3 ft	Base levee + 4 ft
Construction Costs (x $1,000)					
Levee	125,542.48	131,003.96	137,271.03	140,482.76	143,370.52
Overbank lowering/LFCC Channel Berm	4,981.58	4,981.58	4,981.58	4,981.58	4,981.58
Tiffany Basin	6,837.24	6,837.24	6,837.24	6,837.24	6,837.24
RR Bridge	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	4,854.00	4,854.00	4,854.00	4,854.00	4,854.00
PED	8,050.28	8,050.28	8,050.28	8,050.28	8,050.28
Construction Management	20,297.94	20,297.94	20,297.94	20,297.94	20,297.94
Total First Cost	170,563.52	176,024.99	182,292.07	185,503.80	188,391.56
IDC, Construction (168 months, 4-3/8%)*	63,075.72	65,095.42	67,413.03	68,600.76	69,668.67
Total, Interest During Construction	63,075.72	65,095.42	67,413.03	68,600.76	69,668.67
Total Investment	233,639.24	241,120.42	249,705.10	254,104.56	258,060.23
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	11,583.17	11,954.07	12,379.67	12,597.78	12,793.89
OMRR&R					
Total Avg. Ann. Cost	11,583.17	11,954.07	12,379.67	12,597.78	12,793.89
Project Benefits (x $1,000)					
Levee	11,919.14	14,639.72	16,119.75	17,007.45	17,267.09
Tiffany Basin (RR and reroutes)	420.76	420.76	420.76	420.76	420.76
RR Bridge					
Equivalent Avg. Ann. Benefits	12,339.90	15,060.47	16,540.51	17,428.20	17,687.85
Benefit/Cost Ratio	1.07	1.26	1.34	1.38	1.38
Net Benefits	756.73	3,106.41	4,160.84	4,830.42	4,893.95

Table F-34					
MARGINAL COSTS, COMPARING ALTERNATIVE H TO ALTERNATIVE B (X $1,000)					
Levee	14,411.10	14,833.80	16,422.62	17,551.20	18,854.87
Overbank lowering/LFCC Channel Berm	-8.02	-8.02	-8.02	-8.02	-8.02
Tiffany Basin	-7.83	-7.83	-7.83	-7.83	-7.83
RR Bridge	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	3.72	3.72	3.72	3.72	3.72
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	14,398.97	14,821.67	16,410.49	17,539.07	18,842.74
IDC, Construction (168 months, 4-3/8%)*	5,324.85	5,481.17	6,068.73	6,486.09	6,968.19
Total, Interest During Construction	5,324.85	5,481.17	6,068.73	6,486.09	6,968.19
Total Investment	19,723.82	20,302.84	22,479.22	24,025.16	25,810.94
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	977.85	1,006.56	1,114.46	1,191.10	1,279.63
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	977.85	1,006.56	1,114.46	1,191.10	1,279.63
Marginal Benefits (x $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	-8.41	-8.41	-8.41	-8.41	-8.41
RR Bridge	0.00	0.00	0.00	0.00	0.00
Equivalent Avg. Ann. Benefits	-8.41	-8.41	-8.41	-8.41	-8.41
Benefit/Cost Ratio	-0.01	-0.01	-0.01	-0.01	-0.01
Net Benefits	-986.26	-1,014.96	-1,122.86	-1,199.51	-1,288.04

Table F-35

MARGINAL COSTS, COMPARING ALTERNATIVE H TO ALTERNATIVE A (X $1,000)					
Levee	15,397.42	16,276.97	17,724.20	18,751.23	19,981.29
Overbank lowering/LFCC Channel Berm	-8.02	-8.02	-8.02	-8.02	-8.02
Tiffany Basin	6,837.24	6,837.24	6,837.24	6,837.24	6,837.24
RR Bridge	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	3.72	3.72	3.72	3.72	3.72
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	20,845.21	21,688.80	23,100.08	24,091.15	25,285.26
IDC, Construction (168 months, 4-3/8%)*	7,708.72	8,020.69	8,542.59	8,909.10	9,350.69
Total, Interest During Construction	7,708.72	8,020.69	8,542.59	8,909.10	9,350.69
Total Investment	28,553.93	29,709.49	31,642.67	33,000.25	34,635.95
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	1,415.62	1,472.91	1,568.75	1,636.06	1,717.15
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	1,415.62	1,472.91	1,568.75	1,636.06	1,717.15
Marginal Benefits (x $1,000)					
Levee	138.55	-3.66	-1.02	16.47	-348.34
Tiffany Basin	41.41	41.41	41.41	41.41	41.41
RR Bridge	0.00	0.00	0.00	0.00	0.00
Equivalent Avg. Ann. Benefits	179.96	37.75	40.39	57.88	-306.93
Benefit/Cost Ratio	0.13	0.03	0.03	0.04	-0.18
Net Benefits	-1,235.66	-1,435.16	-1,528.36	-1,578.18	-2,024.08

Alternative I Evaluation

Alternative I is comprised of the San Marcial railroad bridge plus the levee. It is essentially Alternative C plus the extension of the levee along the Tiffany Basin's west side. The purpose of the extension is to protect the railroad track from flooding that may occur in the Tiffany Basin. This feature serves as a trade-off to Alternative C. Table F-36 identifies the costs and benefits of the levee past the Tiffany area and the replacement railroad bridge. Table F-37 compares the marginal benefits and marginal costs of Alternative I to Alternative C, to highlight the impact of extending the levee protection through the Tiffany Sediment Basin. Table F-38 compares the marginal benefits and marginal costs of Alternative H to Alternative A, to highlight the impact of extending the levee protection and installing the replacement railroad bridge.

Alternative I Costs:
This feature represents the combination of a levee extending along the west side of the Tiffany Basin, and serves as a second means of protecting the upstream levee and the railroad tracks from sedimentation and flooding originating in the Tiffany Basin. This additional length of levee would be selected over Alternative C if it achieved the same goals of the project at lower costs. As the following tables show, this alternative costs roughly $25.8 million more than Alternative C.

Alternative I describes how the inclusion of the levee extension along the west side of the Tiffany Basin increases project costs without increasing project benefits. Comparing Alt. I to Alt A, we see that the addition of the levee extension along the Tiffany Basin's west edge, even though the Tiffany sediment basin feature is not included, raises levee construction costs by $18.9 million. Alternative I does not appear to be a low-cost means of achieving flood damage reduction benefits.

Alternative I Benefits:
As described in the economics appendix, the railroad bridge represents a service that, in the without project condition, is threatened with interruption. The benefit calculations consider the likelihood of traffic reroutes, tonnage and distance of the reroutes, and the likelihood of needing to repair or replace the existing bridge. Those benefits amount to roughly $4.3 million on an average annual basis. Bureau of Reclamation officials have indicated they spend roughly $2 million annually to remove sediment from nearby reaches of the Rio Grande, and altering the railroad bridge to convey more water, *ceteris paribus*, does not appear to alter that in the with project condition.

Alternative I does not include the Tiffany Basin as a project feature.

Alternative I would be preferable to Alternative C if it achieved the same results for less cost. As the following table indicates, Alternative I is approximately $25.8 million more than Alternative C.

Potential rationale for Alternative I plan selection:

Given the increased costs for a specific output, it's highly unlikely that circumstances would align to elevate this plan, at any size, to the NED plan.

Table F-36

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR ALT. I SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN (x $1,000 August, 2010 price level)					
	Base levee	Base levee + 1 ft	Base levee + 2 ft	Base levee + 3 ft	Base levee + 4 ft
Construction Costs (x $1,000)					
Levee	124,097.97	129,832.35	135,975.23	139,288.24	142,249.39
Overbank lowering/LFCC Channel Berm	4,981.58	4,981.58	4,981.58	4,981.58	4,981.58
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	22,949.45	22,949.45	22,949.45	22,949.45	22,949.45
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	4,854.00	4,854.00	4,854.00	4,854.00	4,854.00
PED	8,050.28	8,050.28	8,050.28	8,050.28	8,050.28
Construction Management	20,297.94	20,297.94	20,297.94	20,297.94	20,297.94
Total First Cost	185,231.22	190,965.60	197,108.48	200,421.49	203,382.64
IDC, Construction (168 months, 4-3/8%)*	68,499.96	70,620.58	72,892.26	74,117.44	75,212.49
Total, Interest During Construction	68,499.96	70,620.58	72,892.26	74,117.44	75,212.49
Total Investment	253,731.18	261,586.18	270,000.74	274,538.92	278,595.13
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	12,579.27	12,968.70	13,385.87	13,610.86	13,811.96
OMRR&R					
Total Avg. Ann. Cost	12,579.27	12,968.70	13,385.87	13,610.86	13,811.96
Project Benefits (x $1,000)					
Levee	11,780.59	14,643.38	16,120.77	16,990.98	17,615.42
Tiffany Basin (RR and reroutes)	569.09	569.09	569.09	569.09	569.09
RR Bridge	4,306.70	4,306.70	4,306.70	4,306.70	4,306.70
Equivalent Avg. Ann. Benefits	16,656.38	19,519.16	20,996.55	21,866.76	22,491.21
Benefit/Cost Ratio	1.32	1.51	1.57	1.61	1.63
Net Benefits	4,077.10	6,550.46	7,610.68	8,255.90	8,679.25

Table F-37

MARGINAL COSTS, COMPARING ALTERNATIVE I TO ALTERNATIVE C (X $1,000)					
Levee	13,952.91	15,105.36	16,428.40	17,556.70	18,860.16
Overbank lowering/LFCC Channel Berm	-8.02	-8.02	-8.02	-8.02	-8.02
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	-50.62	-50.62	-50.62	-50.62	-50.62
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	3.72	3.72	3.72	3.72	3.72
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	13,897.99	15,050.44	16,373.48	17,501.78	18,805.25
IDC, Construction (168 months, 4-3/8%)*	5,139.59	5,565.77	6,055.04	6,472.30	6,954.33
Total, Interest During Construction	5,139.59	5,565.77	6,055.04	6,472.30	6,954.33
Total Investment	19,037.58	20,616.22	22,428.53	23,974.08	25,759.57
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	943.83	1,022.09	1,111.94	1,188.57	1,277.09
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	943.83	1,022.09	1,111.94	1,188.57	1,277.09
Marginal Benefits (x $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	0.00	0.00	0.00	0.00	0.00
Equivalent Avg. Ann. Benefits	0.00	0.00	0.00	0.00	0.00
Benefit/Cost Ratio	0.00	0.00	0.00	0.00	0.00
Net Benefits	-943.83	-1,022.09	-1,111.94	-1,188.57	-1,277.09

Table F-38

MARGINAL COSTS, COMPARING ALTERNATIVE I TO ALTERNATIVE A (X $1,000)					
Levee	13,952.91	15,105.36	16,428.40	17,556.70	18,860.16
Overbank lowering/LFCC Channel Berm	-8.02	-8.02	-8.02	-8.02	-8.02
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	22,949.45	22,949.45	22,949.45	22,949.45	22,949.45
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	3.72	3.72	3.72	3.72	3.72
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	35,512.91	36,629.41	37,916.49	39,008.84	40,276.34
IDC, Construction (168 months, 4-3/8%)*	13,132.95	13,545.84	14,021.82	14,425.77	14,894.51
Total, Interest During Construction	13,132.95	13,545.84	14,021.82	14,425.77	14,894.51
Total Investment	48,645.86	50,175.25	51,938.31	53,434.61	55,170.85
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	2,411.72	2,487.55	2,574.95	2,649.14	2,735.21
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	2,411.72	2,487.55	2,574.95	2,649.14	2,735.21
Marginal Benefits (x $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	189.74	189.74	189.74	189.74	189.74
RR Bridge	4,306.70	4,306.70	4,306.70	4,306.70	4,306.70
Equivalent Avg. Ann. Benefits	4,496.44	4,496.44	4,496.44	4,496.44	4,496.44
Benefit/Cost Ratio	1.86	1.81	1.75	1.70	1.64
Net Benefits	2,084.71	2,008.89	1,921.48	1,847.30	1,761.22

Alternative J Evaluation

Alternative J is the San Marcial railroad bridge plus the levee. It is essentially Alternative C plus the extension of the levee along the Tiffany Basin's east side. The purpose of the extension is to protect the railroad track from flooding that may occur in the Tiffany Basin. This feature serves as a trade-off to Alternatives C and I. Table F-39 identifies the costs and benefits of the levee along the east side of the Tiffany area and the replacement railroad bridge. Table F-40 compares the marginal benefits and marginal costs of Alternative J to Alternative C, to highlight the impact of extending the levee protection through the Tiffany Sediment Basin. Table F-41 compares the marginal benefits and marginal costs of Alternative J to Alternative I, to compare the levee extension along the west side and the east sides of the Tiffany area. Table F-42 compares the marginal benefits and marginal costs of Alternative J to Alternative A, to identify the effects of replacing the railroad bridge and providing a levee along the east side of the Tiffany area.

Alternative J Costs:
This feature represents the combination of a levee extending along the east side of the Tiffany Basin, and serves as a third means of protecting the upstream levee and the railroad tracks from sedimentation and flooding originating in the Tiffany Basin. This additional length of levee would be selected over Alternative C if it achieved the same goals of the project at lower costs. As the following tables show, this alternative costs roughly $3.1 million more than Alternative C.

Alternative J describes how the inclusion of the levee extension along the east side of the Tiffany Basin increases project costs without increasing project benefits. Comparing Alt. J to Alt A, we see that the addition of the levee extension along the Tiffany Basin's east edge, even though the Tiffany sediment basin feature is not included, raises levee construction costs by close to $2.3 million. Alternative J does not appear to be a low-cost means of achieving flood damage reduction benefits.

Alternative J Benefits:
As described in the economics appendix, the railroad bridge represents a service that, in the without project condition, is threatened with interruption. The benefit calculations consider the likelihood of traffic reroutes, tonnage and distance of the reroutes, and the likelihood of needing to repair or replace the existing bridge. Those benefits amount to roughly $4.3 million on an average annual basis. Bureau of Reclamation officials have indicated they spend roughly $2 million annually to remove sediment from nearby reaches of the Rio Grande, and altering the railroad bridge to convey more water, *ceteris paribus*, does not appear to alter that in the with project condition.

Alternative J does not include the Tiffany Basin as a project feature.

Alternative J would be preferable to Alternative C if it achieved the same results for less cost. As the following table indicates, Alternative J is approximately $3.1 million more than Alternative C.

Potential rationale for Alternative J plan selection:
Given the increased costs for a specific output, it's highly unlikely that circumstances would align to elevate this plan, at any size, to the NED plan. The only circumstance which would incorporate this alternative is where a railroad bridge were justified, authorized, and heretofore unaccounted damages to the approach tracks to the railroad bridge justified the incremental levee extension. This alternative is cheaper than Alternative I.

Table F-39

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR ALT. J SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN (x $1,000 August, 2010 price level)					
	Base levee	Base levee + 1 ft	Base levee + 2 ft	Base levee + 3 ft	Base levee + 4 ft
Construction Costs (x $1,000)					
Levee	111,279.11	116,029.51	121,169.66	123,605.98	125,678.91
Overbank lowering/LFCC Channel Berm	4,981.58	4,981.58	4,981.58	4,981.58	4,981.58
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	22,949.54	22,949.54	22,949.54	22,949.54	22,949.54
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	4,854.00	4,854.00	4,854.00	4,854.00	4,854.00
PED	8,050.28	8,050.28	8,050.28	8,050.28	8,050.28
Construction Management	20,297.94	20,297.94	20,297.94	20,297.94	20,297.94
Total First Cost	172,412.44	177,162.85	182,302.99	184,739.32	186,812.24
IDC, Construction (168 months, 4-3/8%)*	63,759.47	65,516.21	67,417.07	68,318.05	69,084.63
Total, Interest During Construction	63,759.47	65,516.21	67,417.07	68,318.05	69,084.63
Total Investment	236,171.92	242,679.06	249,720.06	253,057.37	255,896.87
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	11,708.73	12,031.34	12,380.41	12,545.87	12,686.64
OMRR&R					
Total Avg. Ann. Cost	11,708.73	12,031.34	12,380.41	12,545.87	12,686.64
Project Benefits (x $1,000)					
Levee	11,780.59	14,643.38	16,120.77	16,990.98	17,615.42
Tiffany Basin (RR and reroutes)	568.20	568.20	568.20	568.20	568.20
RR Bridge	4,306.70	4,306.70	4,306.70	4,306.70	4,306.70
Equivalent Avg. Ann. Benefits	16,655.49	19,518.27	20,995.66	21,865.87	22,490.32
Benefit/Cost Ratio	1.42	1.62	1.70	1.74	1.77
Net Benefits	4,946.76	7,486.93	8,615.25	9,320.00	9,803.68

Table F-40					
MARGINAL COSTS, COMPARING ALTERNATIVE J TO ALTERNATIVE C (X $1,000)					
Levee	1,134.05	1,302.53	1,622.83	1,874.45	2,289.68
Overbank lowering/LFCC Channel Berm	-8.02	-8.02	-8.02	-8.02	-8.02
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	-50.54	-50.54	-50.54	-50.54	-50.54
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	3.72	3.72	3.72	3.72	3.72
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	1,079.21	1,247.69	1,567.99	1,819.61	2,234.85
IDC, Construction (168 months, 4-3/8%)*	399.10	461.41	579.86	672.91	826.46
Total, Interest During Construction	399.10	461.41	579.86	672.91	826.46
Total Investment	1,478.32	1,709.09	2,147.85	2,492.52	3,061.31
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	73.29	84.73	106.48	123.57	151.77
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	73.29	84.73	106.48	123.57	151.77
Marginal Benefits (x $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	-0.89	-0.89	-0.89	-0.89	-0.89
RR Bridge	0.00	0.00	0.00	0.00	0.00
Equivalent Avg. Ann. Benefits	-0.89	-0.89	-0.89	-0.89	-0.89
Benefit/Cost Ratio	-0.01	-0.01	-0.01	-0.01	-0.01
Net Benefits	-74.18	-85.62	-107.37	-124.46	-152.66

Table F-41

MARGINAL COSTS, COMPARING ALTERNATIVE J TO ALTERNATIVE I (X $1,000)					
Levee	-12,818.86	-13,802.84	-14,805.57	-15,682.25	-16,570.48
Overbank lowering/LFCC Channel Berm	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	0.08	0.08	0.08	0.08	0.08
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	0.00	0.00	0.00	0.00	0.00
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	-12,818.78	-13,802.75	-14,805.49	-15,682.17	-16,570.40
IDC, Construction (168 months, 4-3/8%)*	-4,740.48	-5,104.37	-5,475.19	-5,799.39	-6,127.86
Total, Interest During Construction	-4,740.48	-5,104.37	-5,475.19	-5,799.39	-6,127.86
Total Investment	-17,559.26	-18,907.12	-20,280.68	-21,481.56	-22,698.26
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	-870.54	-937.36	-1,005.46	-1,064.99	-1,125.32
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	-870.54	-937.36	-1,005.46	-1,064.99	-1,125.32
Marginal Benefits (x $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	-0.89	-0.89	-0.89	-0.89	-0.89
RR Bridge	0.00	0.00	0.00	0.00	0.00
Equivalent Avg. Ann. Benefits	-0.89	-0.89	-0.89	-0.89	-0.89
Benefit/Cost Ratio	0.00	0.00	0.00	0.00	0.00
Net Benefits	869.65	936.47	1,004.57	1,064.11	1,124.43

Table F-42

MARGINAL COSTS, COMPARING ALTERNATIVE J TO ALTERNATIVE A (X $1,000)					
Levee	1,134.05	1,302.53	1,622.83	1,874.45	2,289.68
Overbank lowering/LFCC Channel Berm	-8.02	-8.02	-8.02	-8.02	-8.02
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	22,949.54	22,949.54	22,949.54	22,949.54	22,949.54
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	3.72	3.72	3.72	3.72	3.72
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	22,694.14	22,826.65	23,111.00	23,326.67	23,705.94
IDC, Construction (168 months, 4-3/8%)*	8,392.47	8,441.48	8,546.63	8,626.38	8,766.64
Total, Interest During Construction	8,392.47	8,441.48	8,546.63	8,626.38	8,766.64
Total Investment	31,086.60	31,268.13	31,657.63	31,953.05	32,472.59
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	1,541.19	1,550.19	1,569.50	1,584.14	1,609.90
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	1,541.19	1,550.19	1,569.50	1,584.14	1,609.90
Marginal Benefits (x $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	188.85	188.85	188.85	188.85	188.85
RR Bridge	4,306.70	4,306.70	4,306.70	4,306.70	4,306.70
Equivalent Avg. Ann. Benefits	4,495.55	4,495.55	4,495.55	4,495.55	4,495.55
Benefit/Cost Ratio	2.92	2.90	2.86	2.84	2.79
Net Benefits	2,954.36	2,945.36	2,926.05	2,911.41	2,885.65

Alternative K Evaluation

Alternative K is the upstream levee plus the extension of the levee along the Tiffany Basin's east side. The purpose of the extension is to protect the railroad track from flooding that may occur in the Tiffany Basin. This feature serves as a trade-off to Alternatives A. Table F-43 identifies the costs and benefits of the levee past the Tiffany area. Table F-44 compares the marginal benefits and marginal costs of Alternative K to Alternative A, to highlight the impact of extending the levee protection along the east side of the Tiffany area. An alternative extending the levee along the west side of the Tiffany Basin without reconfiguring the Tiffany Basin to collect sediment, is not technically feasible, and introduces an uncontrolled headcut into the Rio Grande as water flows in an uncontrolled fashion into the basin.

Table F-44 does indicate that extending the levee along the Tiffany Basin produces small net benefits. This would suggest that extending the levee, at a lower crest elevation, through Tiffany would be cost justified. However, according to Table F-57, the hydraulic reaches by Tiffany represent the locations of the most severe sediment accumulations in the study area. The likelihood of the Base levee + 1' levee containing the 1% chance exceedance event starts at 76.8% in the present, with-project condition, and drops to less than 4.3% in the future, with-project condition. Any levee through the Tiffany reach isn't expected to last as long as the upstream levees.

Alternative K Costs:
This feature represents the combination of a levee extending along the east side of the Tiffany Basin, and serves as a third means of protecting the upstream levee and the railroad tracks from sedimentation and flooding originating in the Tiffany Basin. This additional length of levee would be selected over Alternative A if it achieved the same goals of the project at lower costs. As the following tables show, this alternative costs roughly $1.7 million more than Alternative A.

Alternative K describes how the inclusion of the levee extension along the east side of the Tiffany Basin increases project costs without increasing project benefits. Comparing Alt. K to Alt A, we see that the addition of the levee extension along the Tiffany Basin's east edge, even though the Tiffany sediment basin feature is not included, raises levee construction costs by $1.7 million. Alternative K does appear to be a low-cost means of achieving flood damage reduction benefits.

Alternative K Benefits:
Alternative K represents the upstream levees described in Alternative A plus the extension of the levee along the Tiffany Basin's east edge, between it and the river. The Tiffany Basin has no damageable properties outside of a length of railroad track that forms the western border of the Tiffany Basin. As previously stated, the Tiffany Basin sits roughly 10' lower than the adjacent Rio Grande. Alternative K does not include the Tiffany Basin as a project feature.

Alternative K would be preferable to Alternative A if it achieved the same results for less cost. As the following table indicates, Alternative K is approximately $1.7 million more than Alternative A.

Potential rationale for Alternative K plan selection:
Alternative K, at the Base levee + 4 foot levee height, provides similar net benefits to the equivalent levee in Alternative A. It would appear that, in some cases, Alternative K provides even more net benefits and could be the plan which maximizes net benefits consistent with the flood risk management goals of this project. However, it is not desirable to cut the Tiffany Basin off from the Rio Grande floodway without substantial mitigation costs. Cutting Tiffany off from the Rio Grande perpetually would require extensive mitigation of over 2000 acres of land that once received river flows (albeit sporadically). Prior experience on other projects indicates mitigation would require 4 acres for every one impacted. The current Real Estate appendix indicates that an acre of land in the study area goes from $460 to $13,000 per acre, meaning that 8000 acre mitigation LAND ACQUISITION COSTS start at $3.7 million. If the unit cost of mitigation land (that's acquisition plus any modifications needed to accomplish the mitigation goal) exceeds $2,338.18 per acre then Alternative K gets too expensive, and Alternative A rises as the plan with the highest net benefits.

The net equivalent annual benefits for Alternative A at Base levee +4' is $7.0 million (August, 2010 dollars). The net equivalent annual benefits of the equivalent configuration of Alternative K is practically identical at $6.9 million (project benefits differ by only about $116,000 on an equivalent annual basis). Prior evaluations indicated Alternative K produced greater average annual net benefits difference is $259,000 which is a fairly thin margin. That figure could justify roughly $5.2 million in construction to support any mitigation efforts. That number goes down really quickly once marginal O&M costs is figured in, as one dollar in O&M is worth about $20 in first costs.

It is unlikely that one can mitigate over 2000 acres for less than $5.2 million. The land acquisition costs start at $3.7 million and will rise with plantings and any other mitigation efforts. Extending the levee down the west side of the Tiffany area is $21.8 million MORE (With an average annual cost of $1.1 million MORE) than doing the extension down the east side of the Tiffany area. This “Alternative Q” is discussed in detail later in this appendix. Consequently, it appears that Alternative A, the 43 mile levee, at Base levee + 4' is the plan which maximizes net benefits.

Present analysis indicates that Alternative K produces slightly fewer net benefits than Alternative A. Alternative A was updated to include $3.0 million in mitigation costs across the various levee heights, which was not available at the time of the alternative screening.

Table F-43

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR ALT. K SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN (x $1,000 August, 2010 price level)					
	Base levee	Base levee + 1 ft	Base levee + 2 ft	Base levee + 3 ft	Base levee + 4 ft
Construction Costs (x $1,000)					
Levee	110,641.20	115,389.70	120,508.24	122,972.57	125,053.52
Overbank lowering/LFCC Channel Berm	4,974.86	4,974.86	4,974.86	4,974.86	4,974.86
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	4,854.00	4,854.00	4,854.00	4,854.00	4,854.00
PED	8,048.15	8,048.15	8,048.15	8,048.15	8,048.15
Construction Management	20,297.94	20,297.94	20,297.94	20,297.94	20,297.94
Total First Cost	148,816.15	153,564.65	158,683.19	161,147.52	163,228.47
IDC, Construction (168 months, 4-3/8%)*	55,033.38	56,789.41	58,682.29	59,593.62	60,363.17
Total, Interest During Construction	55,033.38	56,789.41	58,682.29	59,593.62	60,363.17
Total Investment	203,849.53	210,354.06	217,365.47	220,741.14	223,591.64
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	10,106.28	10,428.76	10,776.36	10,943.72	11,085.04
OMRR&R					
Total Avg. Ann. Cost	10,106.28	10,428.76	10,776.36	10,943.72	11,085.04
Project Benefits (x $1,000)					
Levee	11,780.59	14,643.38	16,120.77	16,990.98	17,615.42
Tiffany Basin (RR and reroutes)	374.74	374.74	374.74	374.74	374.74
RR Bridge					
Equivalent Avg. Ann. Benefits	12,155.34	15,018.12	16,495.51	17,365.72	17,990.17
Benefit/Cost Ratio	1.20	1.44	1.53	1.59	1.62
Net Benefits	2,049.06	4,589.36	5,719.15	6,422.00	6,905.13

Table F-44					
MARGINAL COSTS, COMPARING ALTERNATIVE K TO ALTERNATIVE A (X $1,000)					
Levee	496.15	662.71	961.41	1,241.04	1,664.30
Overbank lowering/LFCC Channel Berm	-14.74	-14.74	-14.74	-14.74	-14.74
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	1.59	1.59	1.59	1.59	1.59
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	-902.16	-771.54	-508.80	-265.13	122.17
IDC, Construction (168 months, 4-3/8%)*	-333.62	-285.32	-188.16	-98.05	45.18
Total, Interest During Construction	-333.62	-285.32	-188.16	-98.05	45.18
Total Investment	-1,235.78	-1,056.87	-696.96	-363.17	167.35
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	-61.27	-52.40	-34.55	-18.01	8.30
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	-61.27	-52.40	-34.55	-18.01	8.30
Marginal Benefits (x $1,000)					
Levee	0.00	0.00	0.00	0.00	0.00
Tiffany Basin	-4.60	-4.60	-4.60	-4.60	-4.60
RR Bridge	0.00	0.00	0.00	0.00	0.00
Equivalent Avg. Ann. Benefits	-4.60	-4.60	-4.60	-4.60	-4.60
Benefit/Cost Ratio	0.08	0.09	0.13	0.26	-0.55
Net Benefits	56.66	47.79	29.95	13.40	-12.90

Alternate configuration of the Tiffany Sediment Basin (Alternatives L, M, N, O and P)

An alternative configuration for the Tiffany Basin was developed on the concern that the recommended configuration, which contains weirs, would entrap the Rio Grande Silvery Minnow (a Federally-listed Endangered species) within the Basin. Minnows trapped within the Basin would be cut off from the Rio Grande. The alternative configuration contained in Alternatives L-P uses Streamside Systems' sediment collectors to collect and remove sediment from the Rio Grande and then distributes that sediment throughout the Tiffany Basin. Five alternatives were created as substitutes for alternatives using the Tiffany Basin weir structures, as follows:

Alternative B = Alternative L.

Alternative D = Alternative M.
Alternative F = Alternative N.
Alternative G = Alternative O.
Alternative H = Alternative P.

These alternatives generally have a lower installation cost (about $900,000 to $1.5 million less, August, 2010 prices) but extraordinarily high operations and maintenance costs (over $16 million). Those costs are attributed to dispersing the equivalent of four dump trucks worth of sediment DAILY. Alternatives L-P have the same performance characteristics, and the same benefits identified for Alternatives B, D, F, G, H were used for L-P. The higher costs associated with Alternatives L-P are attributed solely to the alternative configuration using the sediment collector and manually distributing the accumulated sediment. Table F-45 identifies the Alternatives that include Tiffany, and the alternatives that include the alternative Tiffany configuration.

Table F-45

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR ALTS. B, D, F, G, H
AND ALTS. L, M, N, O, P
SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN
(x $1,000 August, 2010 price level)

	Alternative B	Alternative L	Alternative D	Alternative M	Alternative F	Alternative N	Alternative G	Alternative O	Alternative H	Alternative P
	Base levee + 4 ft.	Base levee + 4 ft.	Base levee + 4 ft.	Base levee + 4 ft.	Base levee + 4 ft.	Base levee + 4 ft.	Base levee + 4 ft.	Base levee + 4 ft.	Base levee + 4 ft.	Base levee + 4 ft.
Construction Costs (x $1,000)										
Levee	124,515.64	123,001.48	123,899.09	123,001.48	0.00	0.00	143,370.51	142,249.39	143,370.52	142,249.39
Overbank lowering/LFCC Channel Berm	4,989.60	4,981.58	4,982.88	4,981.58	0.00	0.00	6,837.21	4,981.58	4,981.58	4,981.58
Tiffany Basin	6,845.08	0.00	6,842.25	0.00	7,178.73	0.00	4,981.58	0.00	6,837.24	0.00
RR Bridge	0.00	0.00	22,977.07	22,949.45	23,026.39	23,026.39	22,949.45	22,949.45	0.00	0.00
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LERRD	4,854.00	4,854.00	4,854.00	4,854.00	0.00	0.00	4,854.00	4,854.00	4,854.00	4,854.00
PED	8,046.56	8,050.28	8,044.43	8,050.28	1,298.28	1,298.28	8,050.28	8,050.28	8,050.28	8,050.28
Construction Management	20,297.94	20,297.94	20,297.94	20,297.94	3,624.86	3,624.86	20,297.94	20,297.94	20,297.94	20,297.94
Total First Cost	169,548.82	161,185.28	191,897.65	184,134.73	35,128.26	27,949.53	211,340.98	203,382.64	188,391.56	180,433.18
Sediment Collection System	62,700.48	24,262.06	70,965.25	24,262.06	1,949.21	24,343.40	78,155.55	24,262.06	69,668.67	24,262.06
IDC, Construction (168 months, 4-3/8%)*	62,700.48	68,579.88	70,965.25	77,066.77	1,949.21	2,901.65	78,155.55	84,184.79	69,668.67	75,697.90
Total Investment	232,249.29	229,765.15	262,862.90	285,463.56	37,077.47	55,194.57	289,496.52	311,829.49	258,060.23	280,393.15
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	11,514.26	11,391.10	13,032.00	14,152.47	1,838.20	2,736.39	14,352.42	15,459.62	12,793.89	13,901.10
OMRR&R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	11,514.26	11,391.10	13,032.00	14,152.47	1,838.20	2,736.39	14,352.42	15,459.62	12,793.89	13,901.10
Project Benefits (x $1,000)										
Levee	17,267.09	17,267.09	17,267.09	17,267.09	0.00	0.00	17,267.09	17,267.09	17,267.09	17,267.09
Tiffany Basin (RR and reroutes)	429.16	429.16	420.37	420.37	355.40	355.40	431.58	431.58	420.76	420.76
RR Bridge	0.00	0.00	4,306.70	4,306.70	4,306.70	4,306.70	4,306.70	4,306.70	0.00	0.00
Equivalent Avg. Ann. Benefits	17,696.25	17,696.25	21,994.16	21,994.16	4,662.09	4,662.09	22,005.37	22,005.37	17,687.85	17,687.85
Benefit/Cost Ratio	1.54	1.55	1.69	1.55	2.54	1.70	1.53	1.42	1.38	1.27
Net Benefits	6,181.99	6,305.15	8,962.16	7,841.68	2,823.90	1,925.70	7,652.95	6,545.74	4,893.95	3,786.75

Alternative Q Evaluation

Alternative Q is the upstream levee plus the extension of the levee along the Tiffany Basin's west side. The purpose of the extension is to protect the railroad track from flooding that may occur in the Tiffany Basin. This feature serves as a trade-off to Alternatives K. Alternative K was identified previously as the plan which maximizes net NED benefits consistent with the objectives of the project, but has the undesirable side effect of isolating the Tiffany Area from the Rio Grande floodway. This Alternative serves as a comparison to Alternative K by running the extended levee down the west side of the Tiffany Area instead of the east side. For purposes of this analysis, Alternative Q is identical in performance and cost to Alternative H, less the Tiffany Basin feature. Table F-46 identifies the costs and benefits of the levee past the Tiffany area. Table F-47 compares the marginal benefits and marginal costs of Alternative Q to Alternative A, to highlight the impact of extending the levee protection along the west side of the Tiffany area. An alternative extending the levee along the west side of the Tiffany Basin without reconfiguring the Tiffany Basin to collect sediment, is not technically feasible, and introduces an uncontrolled headcut into the Rio Grande as water flows in an uncontrolled fashion into the basin. Alternative Q is presented here as a means to identify the cost of relocating the extended levee versus mitigating for the Tiffany Area's separation from the floodway. Table F-45 makes that comparison explicitly.

Alternative Q Costs:

This Alternative represents the combination of the original 43 mile levee (identified in Alternative A) plus a levee extending along the west side of the Tiffany Basin. This additional length of levee would be selected over Alternative A if it achieved the same goals of the project at lower costs. As the following tables show, this alternative costs roughly $25.3 million more than Alternative A. There are unidentified costs that would be associated with protecting the proposed levees from an uncontrolled flow into the Tiffany Area and the resultant headcut that would work its way up the Rio Grande. The existing Tiffany Area sits approximately 10' below the elevation of the Rio Grande channel.

Alternative Q Benefits:

Alternative Q represents the upstream levees described in Alternative A plus the extension of the levee along the Tiffany Basin's west edge. The Tiffany Basin has no damageable properties outside of a length of railroad track that forms the western border of the Tiffany Basin. As previously stated, the Tiffany Basin sits roughly 10' lower than the adjacent Rio Grande. Alternative Q does not include the Tiffany Basin as a project feature.

Alternative Q provides an additional $244,300 (August, 2010 prices) in equivalent annual benefits due to the extended length of the levee along the west side of the Tiffany Basin.

Potential rationale for Alternative Q plan selection:

Alternative Q, at the Base levee + 4 foot levee height, provides the greatest net benefits among all the levee sizes evaluated. However, Alternative K is cheaper at every levee height than Q, and would be preferential when selecting the plan which maximizes net NED benefits.

Unfortunately, the extensive mitigation costs associated with Alternative K would drive down the net NED benefits to the point where Alternative A (where the levee terminates just upstream of the Tiffany Area) becomes the plan which maximizes net NED benefits. It is highly unlikely that any extension of the levee around either side of the Tiffany Area would make sense when viewed with the NED account.

Table F-46

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR ALT. Q SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN (x $1,000 August, 2010 price level)					
	Base levee	Base levee + 1 ft	Base levee + 2 ft	Base levee + 3 ft	Base levee + 4 ft
Construction Costs (x $1,000)					
Levee	125,542.48	131,003.96	137,271.03	140,482.76	143,370.52
Overbank lowering/LFCC Channel Berm	4,981.58	4,981.58	4,981.58	4,981.58	4,981.58
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	4,854.00	4,854.00	4,854.00	4,854.00	4,854.00
PED	8,050.28	8,050.28	8,050.28	8,050.28	8,050.28
Construction Management	20,297.94	20,297.94	20,297.94	20,297.94	20,297.94
Total First Cost	163,726.28	169,187.75	175,454.82	178,666.56	181,554.31
IDC, Construction (168 months, 4-3/8%)*	60,547.26	62,566.96	64,884.57	66,072.29	67,140.21
Total, Interest During Construction	60,547.26	62,566.96	64,884.57	66,072.29	67,140.21
Total Investment	224,273.53	231,754.71	240,339.39	244,738.85	248,694.52
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	11,118.85	11,489.74	11,915.35	12,133.46	12,329.57
OMRR&R					
Total Avg. Ann. Cost	11,118.85	11,489.74	11,915.35	12,133.46	12,329.57
Project Benefits (x $1,000)					
Levee	11,919.14	14,639.72	16,119.75	17,007.45	17,267.09
Tiffany Basin (RR and reroutes)	420.76	420.76	420.76	420.76	420.76
RR Bridge					
Equivalent Avg. Ann. Benefits	12,339.90	15,060.47	16,540.51	17,428.20	17,687.85
Benefit/Cost Ratio	1.11	1.31	1.39	1.44	1.43
Net Benefits	12,339.90	15,060.47	16,540.51	17,428.20	17,687.85

Table F-47

MARGINAL COSTS, COMPARING ALTERNATIVE Q TO ALTERNATIVE A (X $1,000)					
Levee	15,397.42	16,276.97	17,724.20	18,751.23	19,981.29
Overbank lowering/LFCC Channel Berm	-8.02	-8.02	-8.02	-8.02	-8.02
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	3.72	3.72	3.72	3.72	3.72
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	14,007.97	14,851.56	16,262.84	17,253.91	18,448.02
IDC, Construction (168 months, 4-3/8%)*	5,180.26	5,492.22	6,014.12	6,380.63	6,822.22
Total, Interest During Construction	5,180.26	5,492.22	6,014.12	6,380.63	6,822.22
Total Investment	19,188.22	20,343.78	22,276.96	23,634.54	25,270.24
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	951.30	1,008.59	1,104.43	1,171.73	1,252.83
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	951.30	1,008.59	1,104.43	1,171.73	1,252.83
Marginal Benefits (x $1,000)					
Levee	138.55	-3.66	-1.02	16.47	-348.34
Tiffany Basin	41.41	41.41	41.41	41.41	41.41
RR Bridge	0.00	0.00	0.00	0.00	0.00
Equivalent Avg. Ann. Benefits	179.96	37.75	40.39	57.88	-306.93
Benefit/Cost Ratio	0.19	0.04	0.04	0.05	-0.24
Net Benefits	-771.34	-970.84	-1,064.04	-1,113.85	-1,559.75

Table F-48

MARGINAL COSTS, COMPARING ALTERNATIVE Q TO ALTERNATIVE K (X $1,000)					
Levee	14,901.27	15,614.25	16,762.79	17,510.19	18,317.00
Overbank lowering/LFCC Channel Berm	6.72	6.72	6.72	6.72	6.72
Tiffany Basin	0.00	0.00	0.00	0.00	0.00
RR Bridge	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Inner Alignment	0.00	0.00	0.00	0.00	0.00
Levee to Bridge Outer Alignment	0.00	0.00	0.00	0.00	0.00
LERRD	0.00	0.00	0.00	0.00	0.00
PED	2.13	2.13	2.13	2.13	2.13
Construction Management	0.00	0.00	0.00	0.00	0.00
Total First Cost	14,910.12	15,623.10	16,771.63	17,519.04	18,325.84
IDC, Construction (168 months, 4-3/8%)*	5,513.88	5,777.55	6,202.28	6,478.68	6,777.04
Total, Interest During Construction	5,513.88	5,777.55	6,202.28	6,478.68	6,777.04
Total Investment	20,424.00	21,400.65	22,973.92	23,997.72	25,102.88
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	1,012.56	1,060.98	1,138.98	1,189.74	1,244.53
OMRR&R	0.00	0.00	0.00	0.00	0.00
Total Avg. Ann. Cost	1,012.56	1,060.98	1,138.98	1,189.74	1,244.53
Marginal Benefits (x $1,000)					
Levee	138.55	-3.66	-1.02	16.47	-348.34
Tiffany Basin	46.01	46.01	46.01	46.01	46.01
RR Bridge	0.00	0.00	0.00	0.00	0.00
Equivalent Avg. Ann. Benefits	184.56	42.35	44.99	62.48	-302.32
Benefit/Cost Ratio	0.18	0.04	0.04	0.05	-0.24
Net Benefits	-828.00	-1,018.63	-1,093.99	-1,127.26	-1,546.85

Evaluation of Alternatives, Conclusions:

Alternative K, which is comprised of a levee along the west bank of the Rio Grande plus an extension of that levee downstream, past the east border of the Tiffany Area, is the plan which maximizes NED benefits in previous evaluations. The height of the levee corresponds to approximately the elevation of the 1% chance event water surface elevation plus four feet, referred throughout this appendix as the "Base levee + 4' levee." This levee would extend past the Tiffany Basin, and include features to prevent an uncontrolled spill from the perched river channel into that basin, and a subsequent headcut situation up the Rio Grande. However, uncaptured mitigation costs associated with replacing over 2,000 acres that was once part of the Rio Grande floodway will select Alternative K out of further consideration. Alternative A, which is a levee which terminates just north of the Tiffany Area, is the remaining plan which maximizes net benefit, at the Base levee + 4' levee height. Because of the uncaptured costs to implement Alternative K, plus the undesirable impact to the environment, there is no further reason to consider Alternative K.

The San Marcial railroad bridge replacement is justified using the most recent cost estimates, but is not authorized. The west approach to the existing San Marcial bridge isn't threatened by flooding. BNSF railroad officials have commented they do not perceive damages from waters against the existing embankment. The existing railroad embankment does not meet USACE levee safety standards, but absent a second opinion that the railroad approaches are threatened by Rio Grande flooding at water surface elevations below the trackbed, damages to the railroad approaches remain at zero for the floods described. While there are positive net NED benefits associated with Alternatives including a replacement railroad bridge, statutory authority limits Corps involvement in replacing this bridge only to situations where the proposed project induces flooding in severity or frequency. Hydraulic analyses indicates the proposed project will not impact the existing railroad bridge beneficially or adversely. Therefore, Alternatives containing the railroad bridge are beyond this study's authority, and were dropped from further consideration.

The Tiffany Basin has some attributable benefits and represents an additional cost to the flood damage reduction plans described here. Including the Tiffany Basin as a project feature limits the aggradation of the upstream Rio Grande, as well as ameliorates the sedimentation and aggradation enhancements to the flood risk to the railroad track (inundation damages, service interruption) and LFCC adjacent to the Tiffany Basin. Including the Tiffany Basin as a project feature limits the Rio Grande's aggradation over the project life, but at the NED plan's size, that benefit is roughly $429,000 on an equivalent average annual basis. There are unquantified benefits (sedimentation occurring in the basin over 10 to 30 years that BuRec would not have to remove) and costs (increased evaporative water losses due to the larger surface area). Net effect of these two forces on NED plan selection is indeterminate. This analysis also examined trade-off conditions where the inclusion of the Tiffany Basin lowers levee costs upstream. That didn't pan out as expected, but it did identify costs applicable to NER project purposes (such as restoration or mitigation). Any inclusion of the Tiffany Basin for NER purposes or mitigation would then have to be justified as an efficient and effective means to achieve the desired output.

The levee extensions along the eastern and western edge of the Tiffany Basin were developed as a means of limiting any headcut situation to the upstream levees, protecting the existing railroad approaches, and preserving the Tiffany Basin from Rio Grande flooding. As described above, extending the levee along the east side of the Tiffany Area (but without creating the Tiffany Basin sediment management feature) would produce positive net NED benefits, but would incur substantial mitigation costs due to replacing 2,000 acres that were removed from the Rio Grande floodway. Those costs price levee extension alternatives out of consideration.

Considering all the issues presented here, the alternative feature which maximizes net NED benefits, is the 43 mile levee system described in Alternative A, at the Base levee + 4 foot levee height.

F-14 Average Annual Cost:

Table F-18 shows, for each alternative and the aggraded channel future situation considered, construction cost, interest during construction, total investment cost, interest and amortization costs, and total average annual costs. The period of construction is assumed to be 240 months with equal mid-monthly payments and no project benefits until the project phase is complete. The August, 2010 Federal interest rate of 4.375% was used in the calculations to further refine the cost of the tentatively selected plan.

Following internal reviews, and as the NED plan's design was clarified, and more accurate pricing data was developed, a revised project cost estimate was developed (March, 2012 prices and 4% interest rate for discounting purposes). Many assumptions have changed since the alternative screening.

F-15 Average Annual Benefits:

Tables F-50-A and F-50-B show benefits for the analyzed levee heights in the present and future conditions. Equivalent annual benefit computations for the flood control alternatives considered are depicted in Tables F-50-A-1 to F-50-A-5. Average annual residual damages calculations for those alternatives considered are presented in Tables F-50-B-1 to F-50-B-5 and F-50-C-1 to F-50-C-5. Tables F-50-A-1 to F-50-A-5 discount the benefit stream of future damages and benefits to present value to present an Equivalent Annual Damage figure to serve as the basis of project benefits. Tables F-51-A and F-51-B show the expected net benefits of structures and contents in the baseline year and the project year 50 condition. Benefit determination for the post project condition was computed by changing the proposed levee height to remove damageable property from lesser magnitude events. Tables F-52-A and F-52-B show the expected B/C ratio for structures and contents in the baseline year and the project year 50 condition. It was not possible to show the distribution of residual damages, net benefits, or the benefit/cost ratio in Tables F-49(A and B), F-50(all 15 instances), F-51(A and B), and F-52(A and B).

Administrative costs of flood insurance policies represent an NED loss. Those administrative costs are approximately $192 per flood insurance policy (fiscal year 2006). Those administrative costs have not been updated since fiscal year 2006. FEMA has reported that while Socorro County does not participate in the Flood Insurance Program, property owners within the City of Socorro have purchased 123 policies. A benefit of the structural alternatives considered is the savings of those administrative costs. If a levee or floodwall captures the 1% chance exceedance event less than 95% of the time, those administrative costs cannot be claimed as benefits, unless the project is built to the mean 1% ACE water surface elevation + 3'. Those losses are roughly $23,600/year and do not appear in any tables in this appendix. The plan which maximizes net benefits is the Base levee + 4' height levee, and savings in flood insurance policies are a claimable benefit, but were not claimed in this evaluation.

Benefits attributable to the Bureau of Reclamation's Low Flow Conveyance Channel (LFCC) as well as benefits attributable to the Bosque Del Apache National Wildlife Refuge (NWR) serve as benefits to other Federal properties. Tables F-50-A-1 to F-50-A-5 outline the benefits attributable to Federal properties, which is roughly 31.6% of the total benefits of the project. As the size of the project increases and its performance against the flood events improves, there is a small decrease in the proportion of benefits to the Federal properties. The LFCC and the NWR are immediately adjacent to the Rio Grande, so the percentage decrease simply demonstrates that non-Federal properties within the floodplain further away from the Rio Grande receive benefits from flood protection. Sensitivity studies indicate that excluding benefits to Federal properties does not affect plan selection nor size of plan which maximizes net benefits.

F-16 Benefit-Cost Comparisons and Plan Selection:

Table F-18 displays annualized equivalent annual benefit and cost information, discounting future benefits of flood control (which increases due to sediment aggradation along most reaches) and amortizing those benefits over the project life. Figure F-9 displays the optimization curve for the recommended Alternative and all sizes considered.

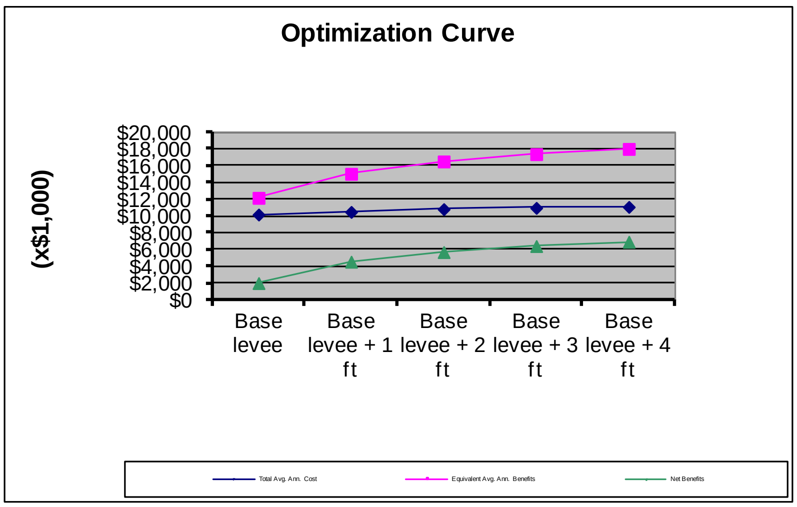


Figure F-9 - Optimization Curve

Tables F-51-A and F-51-B show the average annual benefits, average annual costs, net average annual benefits, for levee alternatives considered for project baseline year and project baseline +50 years. Tables F-52-A and F-52-B display the benefit/cost ratio for alternatives considered as applied to the floodplain inventory structures and contents.

Sensitivity studies indicate that neither alternative selection nor alternative sizing is impacted by the inclusion or deletion of Federal properties such as the Low Flow Conveyance Channel or the Bosque Del Apache National Wildlife Refuge.

As noted in Paragraph F-12 of this appendix, the cost estimates for the levees, the Tiffany basin, and the San Marcial railroad bridge replacement are entwined in some unusual fashions which makes plan selection challenging. As stated in Paragraph F-08, the existing levee on the west bank of the Rio Grande is uncompacted and provides no protection to the floodplain. The construction plan calls for removal of the existing embankment followed by placement of the same material with additional features and the compaction necessary to enable the project to withstand flood stages up against it. The new levee will be a lower height than the existing spoilbank structures, meaning that there are excess material disposal costs for several levee heights evaluated. Disposal costs decrease as the levee height increases.

The study team was proceeding on the assumption that the bridge needed to be built before the levees upstream, but the benefits of replacing the bridge do not support the costs to borrow soil plus the other features necessary to install the replacement bridge. Earlier studies, assuming the bridge were built prior to the levee, show that costs increased to the point of threatening the Benefit-Cost Ratio (BCR). Alternatives analyzed that included the replacement railroad bridge assumed that borrow materials for the approaches come from levee waste materials.

It is inefficient to borrow dirt to construct the approaches to a bridge while subsequently wasting dirt when constructing the levee. Corps structural engineers have indicated that the waste material from the existing spoilbank levee is suitable to build the necessary railroad embankments.

When the levees are constructed prior to the railroad bridge, the waste costs identified for the levee are eliminated, and the borrow quantities for the railroad embankments are reduced by the waste quantities. The savings are fairly substantial, and in concert with providing minimum approach lengths to minimize the need for embankments, provide for a cost-effective means to replace the San Marcial railroad bridge. Cost estimates for Alternatives including the railroad bridge are generated using these assumptions, and have a positive BCR (above 1.0) in some circumstances.

If the mean Base levee +4' levee were to be constructed, there are minimal waste costs, and the railroad bridge costs revert to those values expressed in Table F-27, above. Currently, all railroad bridges, regardless of width (expressed by number of bays) or height perform the same, and generate the same equivalent annual benefits. Therefore, plan selection for the railroad bridge appears to be limited to picking the cheapest bridge design.

Several alternatives evaluated included the replacement railroad bridge, and were the railroad bridge authorized, Alternative C, which would be comprised of the levee at the Base levee + 4' elevation plus the replacement railroad bridge at San Marcial, would be the plan which maximizes net benefits.

The plan that maximizes net benefits has a height approximating the mean 1% ACE event's water surface elevation plus 4.0 feet, with a benefit/cost ratio of 1.6:1 and net benefits equal to $7,000,000. It's unlikely that a larger levee would generate even more net for several reasons. First, levee costs for most levees use the existing spoilbank levee along the west bank of the Rio Grande as source material for new levee construction. Above the Base levee + 4' levee height, the project incurs substantial (and presently uncaptured) borrow costs for material, real estate costs to accommodate the wider footprint, and potentially higher mitigation costs. Second, the levee captures over 97% of EAD, and additional costs are expected to substantially offset, and even overshadow, the benefits remaining. Remaining benefits are from the severe and rare events, which would be capturable only through levee height increases, which would increase construction costs at increasing rates as the required volume of materials necessary to support a trapezoidal levee of specific side slopes increases.

F-17 Benefits and Costs of the Proposed Project Prior to the Base Year:

Generally, benefits are only anticipated after plan implementation, but for some projects, benefits can occur during the construction period. The problem is to convert the varying benefit and cost streams to the equivalent and comparable average annual measures over a common time period that is the period of analysis. The present value, in terms of the base year, is determined for benefits derived prior to the base year.

Benefits accruing prior to the base year should be documented and included in the benefit evaluation. These benefits should be brought forward from the time the benefits begin to the beginning of the period of analysis, using the project interest rate. All benefits and costs are stated in present worth terms as of the period of analysis.

Due to the time length required for construction of all alternatives for the study, benefits that accrue prior to the base year are substantial. Several elements of each project start to provide some limited flood control benefit prior to the 2032 base year. The following will estimate the benefits during construction for the alternatives being considered.

Some elements of the proposed project will be completed and provide some protection prior to the 2032 base year. The current construction schedule calls for completion of the levees adjacent to the Town of Socorro first, followed by construction of the levees, upstream to downstream. The Socorro reaches of the proposed levee tie into geographic features, such that benefits accrue when the phase is completed. For the rest of the study area, the threat of backwater flows downstream of the protected reaches delay project benefits until the subsequent phase is completed. Backwater flows are a significant threat to the study area, especially considering the perched nature of the Rio Grande. Each project phase is one year in duration and approximately 1.5-3 river miles in length.

All benefits that accrue prior to the base year of 2032 must be brought forward in the same manner as all costs prior to the base year. Those benefits are then amortized over the period of analysis. The following tables display this process.

Table F-53
INCREMENTAL BENEFITS PRIOR TO BASE YEAR
(x $1,000, Oct, 2013 Prices)

period in years =	50
interest rate =	0.035
capital recovery factor	0.0426337

		Benefits prior to 2032				Benefits brought foward to Base Year			
Phase	Year	West Bank		East Bank	Total Benefits TB=	Interest Rate Factor 1+r=	Period to 2032 n=	Factor r^n	Benefit in 2032 value TB*r^n
1	2013	0.00		0.00	0.00	1.035	19.5	1.955856	0.00
2	2014	7,864.87		-0.37	7,864.50	1.035	18.5	1.889716	14,861.67
3	2015	7,864.87		-0.37	7,864.50	1.035	17.5	1.825812	14,359.10
4	2016	7,864.87		-0.37	7,864.50	1.035	16.5	1.76407	13,873.53
5	2017	7,864.87		-0.37	7,864.50	1.035	15.5	1.704415	13,404.37
6	2018	8,728.07		-0.37	8,727.70	1.035	14.5	1.646778	14,372.59
7	2019	11,027.99		-0.37	11,027.62	1.035	13.5	1.59109	17,545.93
8	2020	12,593.33		-2.08	12,591.25	1.035	12.5	1.537285	19,356.34
9	2021	13,441.86		-2.08	13,439.78	1.035	11.5	1.485299	19,962.10
10	2022	13,729.34		-2.08	13,727.26	1.035	10.5	1.435072	19,699.61
11	2023	15,290.62		1.30	15,291.92	1.035	9.5	1.386543	21,202.90
12	2024	15,290.62		1.30	15,291.92	1.035	8.5	1.339655	20,485.90
13	2025	15,393.52		1.30	15,394.82	1.035	7.5	1.294353	19,926.33
14	2026	15,619.14		-2.65	15,616.49	1.035	6.5	1.250582	19,529.71
15	2027	15,662.15		-2.65	15,659.50	1.035	5.5	1.208292	18,921.25
16	2028	16,769.24		-2.65	16,766.59	1.035	4.5	1.167432	19,573.85
17	2029	16,769.24		-2.65	16,766.59	1.035	3.5	1.127954	18,911.93
18	2030	17,618.08		-2.65	17,615.43	1.035	2.5	1.08981	19,197.48
19	2031	17,618.08		-2.65	17,615.43	1.035	1.5	1.052957	18,548.29
20	2032	17,618.08		-2.65	17,615.43	1.035	0.5	1.017349	17,921.05
	2032 TO 2082	17,618.08		-2.65	17,615.43				
	Total								**341,653.93**

The value of all benefits prior to the base year are equal to $341.7 million when brought forward to the year 2032. When these benefits are amortized over the 50 year period of analysis, they provide an additional $16.6 million in average annual benefits.

The proposed levee will be constructed in 20, 1-year phases. The “Program Year” project cost estimate was used to develop costs for each of the phases of construction. Interest during construction was computed for each phase using equal, mid-monthly payments at the FY 2014 interest rate (3.5%).

Table F-54
CONSTRUCTION COSTS (PROGRAM YEAR FY 2014)
1 Oct 2013 Price Level
Base + 4' levee

	9/25/2013	9/25/2014	9/25/2015	9/25/2016	9/25/2017	9/25/2018	9/25/2019	9/25/2020	9/25/2021	9/25/2022
Project Cost	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8	Phase 9	Phase 10
Levee	11,533.00	10,567.00	12,752.00	10,035.00	9,687.00	9,638.00	9,316.00	17,888.00	8,948.00	8,430.00
Channels & Canals								5,123.00		
Lands and Damages	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
PED	496.00	494.00	494.00	494.00	494.00	494.00	494.00	494.00	494.00	494.00
Construction Management	803.00	803.00	803.00	803.00	803.00	803.00	803.00	803.00	803.00	803.00
Mitigation	28.32	28.32	64.04	64.04	64.04	64.04	73.92	127.00	64.04	119.26
Total First Cost	12,910.32	11,942.32	14,163.04	11,446.04	11,098.04	11,049.04	10,736.92	24,485.00	10,359.04	9,896.26
IDC, Construction (12 months, 3.5%)*	224.64	207.80	246.44	199.17	193.11	192.26	186.83	426.05	180.25	206.64
Total, Interest During Construction	224.64	207.80	246.44	199.17	193.11	192.26	186.83	426.05	180.25	206.64
Study Sunk Costs	12,422.00									
Total Investment	25,556.96	12,150.12	14,409.48	11,645.20	11,291.15	11,241.29	10,923.74	24,911.04	10,539.29	10,102.89

	9/25/2023	9/25/2024	9/25/2025	9/25/2026	9/25/2027	9/25/2028	9/25/2029	9/25/2030	9/25/2031	9/25/2032
Project Cost	Phase 11	Phase 12	Phase 13	Phase 14	Phase 15	Phase 16	Phase 17	Phase 18	Phase 19	Phase 20
Levee	8,295.00	5,239.00	8,228.00	7,938.00	7,905.00	13,338.00	7,415.00	7,200.00	7,100.00	11,545.00
Channels & Canals										
Lands and Damages	50.00	50.00	50.00	49.00	49.00	49.00	49.00	49.00	49.00	49.00
PED	494.00	494.00	494.00	494.00	494.00	494.00	494.00	494.00	494.00	494.00
Construction Management	803.00	803.00	803.00	803.00	803.00	803.00	803.00	803.00	803.00	803.00
Mitigation	118.85	83.13	83.13	83.13	108.97	99.09	71.64	71.64	26.42	25.84
Total First Cost	9,760.85	6,669.13	9,658.13	9,367.13	9,359.97	14,783.09	8,832.64	8,617.64	8,472.42	12,916.84
IDC, Construction (12 months, 3.5%)*	169.84	116.05	168.05	162.99	162.87	257.23	153.69	149.95	147.42	224.76
Total, Interest During Construction	169.84	116.05	168.05	162.99	162.87	257.23	153.69	149.95	147.42	224.76
Study Sunk Costs										
Total Investment	9,930.69	6,785.17	9,826.18	9,530.12	9,522.83	15,040.32	8,986.33	8,767.59	8,619.84	13,141.60

Table F-55
INCREMENTAL COSTS PRIOR TO BASE YEAR
(x $1,000, Oct, 2013 Prices)

period in years =	50
interest rate =	0.035
capital recovery factor =	0.0426337

		Costs prior to 2032				Costss brought foward to Base Year			
Phase	Year				Total Costs TC=	Interest Rate Factc 1+r=	Period to 2032 n=	Factor r^n	Cost in 2032 value TB*r^n
1	2013				25,556.96	1.035	19.5	1.955856	49,985.73
2	2014				12,150.12	1.035	18.5	1.889716	22,960.27
3	2015				14,409.48	1.035	17.5	1.825812	26,309.00
4	2016				11,645.20	1.035	16.5	1.76407	20,542.95
5	2017				11,291.15	1.035	15.5	1.704415	19,244.80
6	2018				11,241.29	1.035	14.5	1.646778	18,511.92
7	2019				10,923.74	1.035	13.5	1.59109	17,380.66
8	2020				24,911.04	1.035	12.5	1.537285	38,295.37
9	2021				10,539.29	1.035	11.5	1.485299	15,654.00
10	2022				10,102.89	1.035	10.5	1.435072	14,498.38
11	2023				9,930.69	1.035	9.5	1.386543	13,769.33
12	2024				6,785.17	1.035	8.5	1.339655	9,089.79
13	2025				9,826.18	1.035	7.5	1.294353	12,718.54
14	2026				9,530.12	1.035	6.5	1.250582	11,918.20
15	2027				9,522.83	1.035	5.5	1.208292	11,506.36
16	2028				15,040.32	1.035	4.5	1.167432	17,558.55
17	2029				8,986.33	1.035	3.5	1.127954	10,136.16
18	2030				8,767.59	1.035	2.5	1.08981	9,555.01
19	2031				8,619.84	1.035	1.5	1.052957	9,076.32
20	2032				13,141.60	1.035	0.5	1.017349	13,369.60
	2032 TO 2082				0.00				
	Total				**242,921.84**				**362,080.93**

The following table presents project costs (to include interest during construction computed in Table F-55) and benefits (to include benefits during construction computed in Table F-53) computed prior to the base year (2032) and during the period of analysis.

Table F-56

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR BASE + 4' LEVEE SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN (x $1,000 Oct 2013 price level)	
Construction Costs (x $1,000)	
Total Investment	362,080.93
Avg. Ann. Cost (3.5%, 50 yr. project life)	15,436.85
OMRR&R	618.02
Total Avg. Ann. Cost	16,054.87
Project Benefits (x $1,000)	
Levee	32,181.41
Tiffany Basin (RR and reroutes)	0.00
RR Bridge	0.00
Equivalent Avg. Ann. Benefits	32,181.41
Benefit/Cost Ratio	2.00
Net Benefits	16,126.54

F-18 Impact of Addressing Flood Risk in Four Accounts (NED, NER, OSE, RED):

The Principles and Guidelines establish four accounts to facilitate the evaluation and display of effects of alternative plans. They are described in ER 1105-2-100, para. 2-3. The evaluation of the tentatively selected plan against those accounts follows:

- The National Economic Development (NED) Account displays changes in the economic value of the national output of goods and services. The damages and benefits described in this appendix describe NED impacts of flooding in the study area and the effects of alternatives designed to address the flood threat.
- The Environmental Quality (EQ) account displays non-monetary effects on ecological, cultural, and aesthetic resources including the positive and adverse effects of ecosystem restoration plans. The array of plans described in this appendix have flood risk management as their stated goals. EQ benefits or impacts are identified within the Environmental appendix to this report. Implementing the levee system identified in Alternative A (at the Base levee + 4’ height) is expected to add 60 acres to the Rio Grande floodway. The levee also has the impact of protecting the Bureau of Reclamation’s Low Flow Conveyance Channel (LFCC) which provides water to critical habitat of the Threatened and Endangered species found within the study area.
- The Regional Economic Development (RED) account displays changes in the distribution

of regional economic activity (e.g., income and employment). This account is typically used to capture the regional impacts of a large capital infusion of project implementation dollars on income and employment throughout the study area through the use of income and employment multipliers. A recent study for the Nuclear Watch of New Mexico suggests that public sector multipliers tend to be below 1.5, while the Department of Energy claimed multipliers of 2.4 to 3.5 in fiscal year 1998. (Dumas, L.J., Economic Multipliers and the Economic Impact of DOE Spending in New Mexico, March 2003) The important point to be made here is that a large infrastructure project in the Middle Rio Grande Valley will have a positive impact on local income and employment.

- The Other Social Effects (OSE) account displays plan effects on social aspects such as community impacts, health and safety, displacement, energy conservation and others. In most cases, impacts of proposed projects not covered in other accounts are described and evaluated here. Generally, the plans described here meet USACE criteria for project adequacy (completeness, effectiveness, efficiency, and acceptability). Residual risk of implementing levees of various heights is described in Para. F-17 of this appendix. In the unfortunate circumstance that the proposed levees were exceeded, the resultant flood magnitude, timing, and duration is not expected to become even more severe than the without-project and without-project, future condition.

The Bosque Del Apache National Wildlife Refuge represents a significant recreation opportunity in the study area that is important to both the region and the Nation. Providing flood protection to the Refuge (in the form of levees) preserves this recreation opportunity for continued enjoyment by visitors. Alternatives that excluded the levees provided no means to preserve this recreation opportunity.

The floodplain is roughly 1.5 to 2 miles wide, and sits below the perched Rio Grande. In the event of a flood, warning times may prevent evacuation, but flood velocities are not expected to be sufficient to dislodge vehicles using local roads, however, the field inventory did not identify any high water marks as the floodplain is generally flat, and does not include low water crossings, although there may be unexpected areas with more flood depth due to local topography. Most flood fatalities occur in vehicles moving through the floodplain (http://www.nws.noaa.gov/oh/hic/flood_stats/recent_individual_deaths.shtml, accessed 4/5/12).

The flood hydrograph described in the H&H appendix outlines two flood scenarios. Floods generated by local thunderstorms have short warning, rapid onset, relatively short duration (3-4 days) with the flood peak passing within hours. Floods generated by snowmelt in uncontrolled drainages downstream of Cochiti dam have considerably more warning time, but the volume and duration suggests a 90-100 day inundation duration. Only a small portion of the urbanized areas of the Town of Socorro will be impacted, as most of the Town sits above the floodplain. Public services are not expected to be disrupted outside of the floodplain. The flood impacts will fall mostly upon the rural areas outside of the Town. Evacuations will be necessary, and reoccupation and cleanup time and costs from New Orleans and Mississippi River floods (longer duration, though much deeper than projected for this study) suggest that the emergency costs used in this report (from Carlsbad, NM) are fairly conservative.

F-19 Project Performance:

Besides a strict benefit/cost comparison, another measure of the effectiveness of flood protection is its ability to contain damaging floods where there was limited protection before. Limitations of the analysis package preclude a rigorous analysis of project performance, but inspection of the available data could provide decision makers a glimpse of the nature of the flood problem and how the project will act to contain it. Table F-61 presents the likelihood of flood stages being exceeded by specific flood events at each cross section used within the study in the without and with-project, future conditions. One scenario was developed to describe the effectiveness of the various alternatives considered.

Vulnerable location identified –

A reference point was selected in the without project scenario where the flood flow would exceed the start of damages first, or most often. Project performance was evaluated at that reference point for all project sizes that effect that location. For each alternative and project size, that reference point was selected in the protected area where residual flows for the events analyzed would exceed the start of damages most often, wherever that reference point may be. For purposes of this analysis, this reference point is important in that start of damages flows occur most frequently, thus the term "vulnerable location" is applied. The vulnerable location does not move to other reference points as various project sizes are applied to the floodplain. With that in mind, project performance tables indicate only where the preproject condition is worst, as there are several other reference points where levee protection is much improved. describe project performance within the most vulnerable location within the study area as a set of probabilities of structural alternatives containing various damaging flood events.

Table F-57 presents the probability that the recommended alternative, and various sizes of that alternative, would contain the specified events, for the specified scenarios. Table F-58 presents the probability that each evaluated alternative would be exceeded on an annual basis damaging flood events. Tables F-59-A presents the long term risk of exceedance (likelihood that project will be exceeded over an extended time frame) for indicated time frames.

Worst case scenario –

Given that each flood protection project could affect several of the reference points that collectively describe the flooding problem, a single reference point was selected where the flood flow would exceed the start of damages first, or most often. For each alternative and project size, a new reference point was selected in the protected area where residual flows for the events analyzed would exceed the start of damages most often, wherever that reference point might be. This scenario tends to discount expected performance of structural alternatives more than the vulnerable location scenario.

Table F-60 presents the probability that the alternative, and various sizes of that alternative, would contain the specified events, for the specified scenarios. Table F-58 present the probability that each evaluated alternative would be exceeded on an annual basis damaging flood events. Table F-59-B presents the long term risk of exceedance (likelihood that project will be exceeded over an extended time frame) for indicated time frames.

Table F-61 displays, for the future hydraulic condition, the probability of non-damaging stages occurring, by cross-section, for the without project and all levee heights considered. This table serves as the basis for the analyses described in Paragraph F-19.

F-20 Evaluation of Non-Structural Alternatives:

A variety of non-structural flood damage reduction measures were identified, which could be used to meet the planning objectives. The initial evaluation of these measures is discussed below.

Floodplain Management Regulations

Socorro County does not participate in the National Flood Insurance Program (NFIP), which is administered through the Federal Emergency Management Agency (FEMA). FEMA has published Flood Insurance Rate Maps (FIRMs) for both jurisdictions that identify Special Flood Hazard Areas for the Rio Grande River and tributaries. For local jurisdictions to maintain eligibility in the NFIP, minimum levels of floodplain management regulations must be adopted and enforced. Floodplain management regulations and enforcement would have the effect of mitigating flood damages in tne future due to new development, but does nothing for the exiting flood problem, nor the future flooding condition. Floodplain management is considered a reasonable and prudent measure with or without a constructed flood risk management feature, but this measure was not carried forward for alternative evaluation in this appendix. The future conditions in this economic evaluation does not include any future development in the floodplain for reasons described in Para. F-06.

Flood Warning Systems

A flood warning and preparedness system is often the most cost effective flood mitigation measure comprised of computer hardware, software, technical activities and/or organizational arrangements aimed at decreasing flood hazards. Advanced warning is not generally effective in reducing structural damages (outside of sandbagging efforts given early warning); the primary benefits of such a system are credited for providing early evacuation of residents and reduction in damages to vehicles and structure contents.

The evaluation presented in the Economics Appendix assumes that 1.0 of the 1.74 vehicles per capita in Socorro County residences have been evacuated, and that all operable commercial and public vehicles have already been evacuated prior to any flooding. A flood warning system would present benefits by reducing the amount of residential contents subject to flooding. Assuming that residential contents were half the Residential EAD presented in Table F-6C, that would indicate an effective and understood flood warning system would decrease EAD by at most 7.8%. The high residual damages, and the flood threat to Federal properties (the Low Flow Conveyance Channel and the Bosque Del Apache National Wildlife Refuge) as well as the other infrastructure (roads, agriculture, utilities, public and commercial properties) suggests that a flood warning system is ineffective and incomplete on its own. Further, relative to the structural alternative presented (Alternative A, with a levee height corresponding to Base levee +4' elevation and net benefits of over $23.0 million), it's impossible for a flood warning system to provide greater net benefits.

Flood Proofing

Flood proofing offers the opportunity to provide flood protection on an individual structure-by-structure basis or a group of structures. Flood proofing techniques typically include buyouts, relocation, elevation, floodwalls or levees, and dry flood proofing. Elevation, buyout, and relocation are the most dependable of these flood proofing methods. Flood proofing costs can vary substantially depending on the type of flood proofing method being considered and the type, size, age, and location of the structure(s). Flood proofing techniques considered for alternative development are:

1) Relocation of Existing Structures: Relocation is perhaps the most dependable flood proofing technique since it totally eliminates flood damages, minimizes the need for flood insurance and allows for the restoration/reclamation of the floodplain. This technique requires the physical relocation of flood prone structures outside of the identified flood hazard area. This also requires purchase of the flood prone property; selecting and purchasing a new site; and lifting/moving the structure to the new site.

   Corps experience has indicated that relocations and buyouts only work when the land left behind is repurposed to some other public good, such as a public park or reuniting the acquired land with the floodway. The Federal Emergency Management Agency estimates relocation costs at between $99 and $116 per square foot (1999 dollars), which exceeds the depreciated replacement costs of just about every structure in the floodplain. (FEMA, <u>Homeowner's Guide to Retrofitting</u>, December 2009, page 3-28, Table 3-9).The study area floodplain extends for over 43 river miles, and represents a wide and flat area next to the perched Rio Grande main channel. Reuniting the overbank with the channel, which sits higher than the overbank, exacerbates the flooding problem, and this measure is considered impractical. Relocations also do nothing for the flood risk to public properties and Federal properties (the Low Flow Conveyance Channel and the Bosque Del Apache National Wildlife Refuge), and is therefore an incomplete solution to the flood problem.

2) Buyout or Acquisition: This technique requires the purchase of the flood prone property and structure; demolition of the structure; relocation assistance; and applicable compensation required under Federal and State law. This alternative typically requires voluntary relocation by the property owners and/or eminent domain rights exercised by the non-federal sponsor.

As stated previously with relocations, acquiring properties in a floodplain next to a perched channel has limited utility. The acquired land cannot be returned to the floodway without exacerbating the flood problem. Further, the study area's floodplains extend over 43 river miles, and is over 1 mile wide in parts. Repurposing land for a public good like a park is also infeasible, as it would represent an incomplete solution to the flood problem.

3) Retrofitting or Dry Flood Proofing: Dry flood proofing of existing structures is a common flood proofing technique applicable for flood depths of three (3) feet or less on buildings that are structurally sound. Installation of temporary closures or flood shields is a commonly used flood proofing technique. A flood shield is a watertight barrier designed to prevent the passage of floodwater though doors, windows, ventilating shafts, and other openings of the structure exposed to flooding. Such shields are typically made of steel or aluminum and are installed on structures only prior to expected flooding. However, flood shields can only be used on structures with walls that are strong enough to resist the flood-induced forces and loadings. Exterior walls must be made watertight in addition to the use of flood shields. This technique is not applicable areas subject to flash flooding (less than one hour) or where flow velocities are greater than three (3) feet per second. It would also not be applicable to mobile homes, due to the type of construction and typical lack of anchoring to a foundation.

   Aside from the cost, dry flood proofed homes and businesses can still suffer flood damages due to the potentially incomplete nature of the solution. Enclosures for windows and doors require human intervention in order to fully implement the solution and, this action would have to occur in a relatively short time frame. Tables F-2A and F-2B in the economics appendix display the water surface elevations associated with various events. In many locations, flood stages are expected to exceed 3', rendering the flood proofing measures ineffective. Due to the incomplete nature and limited applicability of this flood proofing method, it was not carried forward for alternative evaluation.

4) Localized Levees or Floodwalls: Ring levees or floodwalls can be built around individual structures to protect single or small groups of structures. Ring levees are earthen embankments with stable or protected side slopes and a wide top. Floodwalls are generally constructed of masonry or concrete and are designed to withstand varying heights of floodwaters and hydrostatic pressure. Closures (e.g., for driveway access) are typically manually operated based on flood forecasting and prediction that would alert the operator. Disadvantages of levees or berms are: 1) can impede or divert flow of water in a floodplain; 2) can block natural drainage; 3) susceptible to scour and erosion; 4) give a false sense of security; and 5) take up valuable property space. Disadvantages of floodwalls are: 1) high cost; 2) closures for openings required, and 3) give a false sense of security.

   In this evaluation, the Town of Socorro represents a relatively concentrated location receiving flood damages. The study team used the methods described in the Economics appendix to identify, locate, elevate, and compute equivalent annual damages, and residual damages to only the hydraulic cross sections proximate to the town. Table F-55 presents the equivalent annual damages applicable only to the town. Table F-56 presents the residual damages attributable to a levee with a height corresponding to the 1% chance event (present condition). Alternative levee heights were computed for benefit computation, but are not presented in this appendix.

A ring levee surrounding the Town of Socorro was not designed, but some simplifying assumptions were made to estimate a project cost. It's assumed that the "Socorro ring levee" would have a northern tieback of 1 mile, and a southern tieback of 1.5 miles. The cross sections identified in the hydraulic analysis applicable to the Town stretch for 3.25 river miles. Assuming a ring levee costs 13% of the cost of an equivalent levee extending 43 river miles, and shortening the construction period to 30 months (down from the 168 months for the longer levees computed in 2010), Table F-64 presents an estimate of benefits and costs of the hypothetical ring levees.

The cost for the ring levee is considered to be very conservative on a few points. First, the upstream and downstream tie backs would require real estate acquisitions, which were not estimated for this analysis. Second, additional project features would have to be included in the ring levee, such as closure structures to prevent flood waters from entering the LFCC portion protected by the levee. Alternately, moving the ring levee landward of the LFCC would require even more real estate to acquire the footprint in the most urbanized area of Socorro County. Pump mechanisms would have to be installed to get water from the inside of the levee to the Rio Grande or to the LFCC outside of the ring levee, to maintain water delivery requirements consistent with New Mexico's 96 hour rule, an element of various water compact treaties in the region by which water cannot be detained for more than 96 hours. Finally, the levee would require a substantial redesign, as the proposed levee balances cut and fill,such that borrow costs are minimized. A new levee around Socorro itself would require substantial borrow materials (at a cost not yet identified) to implement.

The ring levee is not suitable for further consideration on several grounds. First, the benefits to the Town of Socorro are approximately 35% of the benefits of a longer levee to the entire study area. Second, localized protection does little to nothing to protect the Federal properties (the Low Flow Conveyance Channel and the Bosque Del Apache National Wildlife Refuge) impacted by flooding in the study area. Lastly, while a ring levee would meet USACE benefit/cost criteria, the plan that would be recommended for implementation is the one with the greatest net benefits, consistent with environmental protection goals. The 43 mile levees produce greater net benefits than equivalent levees only surrounding the Town of Socorro.

Alternative levee lengths were also considered, such as cutting off the Bosque Del Apache National Wildlife Refuge. This would have the impact of removing from project benefits structures and contents south of NM highway 380, and losing the recreation benefits attributable to the refuge. Analysis of shorter levee lengths, considering the longer tie back to high ground upstream of the current tie back, suggests the Refuge has sufficient benefits to “carry” the levee past the refuge, before tying back the levee to high ground.

5) Elevation of Structures: Existing structures can be elevated or raised above the potential flood elevation. Structures can be raided on concrete columns, metal posts, piles, compacted earth fill, or extended foundation walls. Elevated structures must be designed and constructed to withstand anticipated hydrostatic and hydrodynamic forces and debris impact resulting from flooding. The access and utility systems of the structures to be raised would need to be modified to ensure they are safe from flooding.

   FEMA has estimated that elevation in place for slab-on-grade homes (the most common foundation type in the study area) can cost $80-88 per square foot (2009 dollars) for a frame home, and $88-96 per square foot for a masonry home (FEMA, Homeowner’s Guide to Retrofitting, December 2009, page 3-20, Table 3-3). That value exceeds the per square foot depreciated replacement cost of most of the improvements in the floodplain, which makes this alternative infeasible.

   Alternatives which considered replacing the San Marcial railroad bridge with a replacement bridge (and a higher water crossing) could be considered a nonstructural alternative in the sense that the action alters the property’s susceptibility to flooding, rather than impact the nature of the flood threat (flow, stage, etc…) As previously discussed, a replacement railroad bridge would only be authorized for Corps involvement if it could be demonstrated that the proposed project impacted the flood threat facing the bridge, which is not the case in this analysis.

F-21 Comparison of the Tentatively Selected Plan to the Authorized Plan:

The authorized plan was last presented in a 1993 Decision Document, which describes a 58 mile levee which would reduce risk of flooding from a 0.5% chance exceedance flood event starting from the San Acacia Diversion Dam down the west bank of the Rio Grande down to Elephant Butte Reservoir. Table F-65 compares the benefits and costs of the tentatively selected plan to the Authorized Project. Table F-59 identifies the changes in cost apportionment between the authorized project and this tentatively selected plan.

There have been several changes in the damages and benefit computations between the Authorized Plan (1993) and the tentatively selected plan (2010). Table F-66 outlines, by damage category, the equivalent annual damages by property type for both the 1993 and the present analysis. Table F-68 describes the benefits attributable to the authorized plan (1993) and the tentatively selected plan (2010).

1993

The economic analysis performed for the 1993 Appendix to Update Project Decision Document was done in a non-risk and uncertainty based model called LA Damages, which was consistent with guidance at the time, but is no longer used by the Army Corps of Engineers. The 1993 analysis used floodplain data from 4 events (10%, 2%, 1%, and 0.5% chance exceedance) to compute equivalent annual damages.

2010

As described in this economics appendix, the 2010 economic analysis was performed using the Corps' certified risk and uncertainty tool, HEC-FDA version 1.2.4. The 2010 analysis uses 8 events for the without-project condition, and 5 events for the with-project condition. Several other factors in this present evaluation differ from the evaluation supporting the Authorized Plan, which are highlighted below:

New hydraulics and hydrology – The 2010 analysis includes factors that weren't evaluated in 1993, such as the perched channel, and significant sediment accumulations over the study time period, which substantially alters the future without- and future with-project conditions. Sediment accumulations have the effect of increasing future damages for a given flow, and attenuating any project's performance in the future, with-project condition. There was also significant evaluation of the impact of a proposed levee on the east bank of the Rio Grande, and downstream properties, such as the San Marcial railroad bridge.

New economic evaluation guidance – The Corps' shift from a deterministic, point-estimate of damages and benefits attributable to specific-frequency events to an evaluation incorporating concepts of risk and uncertainty has had the impact of increasing damages and benefits attributable to projects. Experience with prior Albuquerque District studies in the mid-1990s suggested that merely shifting from a deterministic model to a risk and uncertainty-based model increased EAD and benefits by 25%. The biggest boost to EAD came from the variability surrounding the probability economic damages began (the "start of damages" condition).

Another factor serving to increase EAD and claimable benefits came from Economic Guidance Memorandum (EGM) 04-01, which provided generic depth-damage relationships for residential structures and contents. Studies conducted prior to the memo used FIA claims data to populate depth-damage relationships, where the newer curves used research conducted by the Corps' Institute for Water Resources (IWR) evaluation of factors such as warning time, inundation duration, etc... The curves were developed for nation-wide applicability, and per the EGM, site-specific depth-damage relationships, content valuations, and content-to-structure ratios are not required to be developed when using these newer curves. This saves study dollars. The newer curves also differ from prior studies in that non-zero damages start at -2' for a one-story, no basement structure, which is the predominant residential structure type in the study area. A direct comparison of the IWR curves, which contain a mean and standard deviation of damages for each inundation depth, to the curves used in the 1993 analysis demonstrated slightly higher damages for each inundation depth. Curve selection served to increase EAD about 60% for residential structures and contents, holding other factors constant.

New floodplain inventory of damageable properties and NED benefits – Since the 1993 evaluation, several changes to the nature of the economic evaluation took place. The 1993 evaluation contains a pair of property types (Transportation Facilities and Rural Improvements) that weren't directly correlated to the present evaluation. In the 2010 evaluation, significant lengths of railroad track were in the study area floodplain, which doesn't seem to be the case with the 1993 analysis. The 1993 "Rural improvements" damage category seems to most directly align with the 2010 "Outbuildings" property type, but there's room for interpretation there. Several structures (97) were hay storage shelters, and were coded as "Commercial." Those structures had content values up to 10 times structure value, and were located close to the river and LFCC. Further, those contents (bales of hay) use depth-% damage curves that show 85% damage with three feet of inundation. In the present evaluation, outbuildings referred to material storage sheds, shelters for vehicles or covered storage, like hay storage buildings. In some cases, a storage shed on a residential property would merely be coded "Residential" during the field inventory. The outbuildings category served as a catch-all to identify structures and contents, where ownership and use (public or commercial) was not easily identifiable.

There was a significant change in the recreation damages and benefits, largely due to new visitation data, and the inclusion of specialized recreation values during the winter, when visitation is significantly higher, due to the Bosque Del Apache National Wildlife Refuge's unique role as winter home for migratory waterfowl.

Since the 1993 evaluation, the Sediment benefit category was dropped, as the most recent sediment studies indicate the Rio Grande is aggrading south of the Town of Socorro. No sediment management features are proposed in the tentatively selected plan, although sediment management was evaluated as a potential benefit category in the alternative formulation.

The 1993 evaluation did not include an evaluation of potential induced damages on the east bank of the Rio Grande as a result of installing a levee on the west bank, which was included in the 2010 analysis.

The agricultural damages and benefits changed slightly from 1993 to 2010, which is largely attributable to new crop budget data showing increased input costs, and relatively flat revenues per acre relative to 17 years ago. Subsequently, there appears to be less acreage in production.

F-22 Plan for Updating Project Benefits in the Future:

At the time that a project update is required, the significant assumptions regarding hydrology and hydraulics will be reviewed. All pertinent economic assumptions shall be reviewed. After determining whether there have been changes in the basic assumptions, the following shall be analyzed:

Residential neighborhoods shall be sampled to determine current values. Real estate agents, appraisers and the Marshall and Swift Valuation Service will be used in updating residential values.

Discussions with local realtors and businessmen combined with field sampling will be made to determine if major changes have occurred to businesses existing at the time of the initial inventory. Important changes affecting structure or content values will be included in the update. As is the case of residential values, the Marshall and Swift Valuation Service and local appraisers and realtors will be contacted regarding commercial values.

After consultation with city planners and examining city building permits; residential, public and commercial growth since the inventory was taken shall be sampled as needed within the flood plain. The growth shall be included, as appropriate, in the updated benefit computations.

The results of the reanalysis shall be documented in a "Special Evaluation Report" (SER).

Tables

Table F-1

DEPTH-DAMAGE RELATIONSHIPS

(expressed as proportion of property value)

	Stage (ft.)									
	1	2	3	4	5	6	7	8	9	10
Structures										
1 story no bsmt., Residential (mean/SD)	0.233/.016	0.321/.016	0.401/.018	0.471/.019	0.532/.02	0.586/.021	0.632/.022	0.672/.023	0.705/.024	0.732/.027
1 story no bsmt. (comm./public)	0.14	0.21	0.26	0.29	0.30	0.41	0.43	0.44	0.45	0.46
1 story w/ bsmt., Residential (mean/SD)	0.32/.01	0.387/.011	0.455/.014	0.522.016	0.586/.019	0.645/.021	0.698/.024	0.742/.025	0.777/.027	0.801/.028
2 story no bsmt., Residential (mean/SD)	0.152/.03	0.209/.028	0.263/.029	0.314/.032	0.36/.034	0.407/.037	0.449/.039	0.488/.04	0.524/.041	0.557/.042
2 story no bsmt. (comm./public)	0.16	0.28	0.37	0.43	0.47	0.49	0.50	0.51	0.55	0.58
2 story w/ bsmt., Residential (mean/SD)	0.223/.014	0.27.015	0.319/.018	0.369/.02	0.419/.023	0.469.026	0.518/.029	0.564.031	0.608.034	0.648/.037
Mobile home	0.44	0.64	0.73	0.78	0.80	0.81	0.82	0.84	0.86	0.88
Metal	0.07	0.10	0.15	0.18	0.20	0.23	0.28	0.33	0.37	0.40
Outbuilding	0.25	0.35	0.41	0.46	0.54	0.65	0.71	0.80	0.85	0.90
Contents										
1 story no bsmt. (Residential, Mean/SD)*	0.133/.012	0.179/.012	0.22/.014	0.257/.015	0.288/.016	0.315/.016	0.338/.017	0.357/.018	0.372/.019	0.384/.021
2 story no bsmt. (Residential, Mean/SD)*	0.087/.026	0.122/.025	0.155/.025	0.185/.027	0.213/.03	0.239/.032	0.263/.033	0.284/.034	0.303/.035	0.32/.035
1 story w/ bsmt. (Residential, Mean/SD)*	0.189/.008	0.218/.01	0.247/.012	0.274/.014	0.3/.016	0.324/.018	0.345/.02	0.363/.021	0.377/.023	0.386/.024
2 story w/ bsmt. (Residential, mean/SD)*	0.138/.011	0.157/.012	0.177/.014	0.198/.016	0.22/.018	0.243/.02	0.267/.021	0.291/.023	0.317/.024	0.344/.024
Mobile home (Residential)**	0.27	0.50	0.64	0.70	0.76	0.78	0.79	0.81	0.83	0.92
Motel, Office, Church (1 story)**	0.35	0.50	0.60	0.68	0.74	0.78	0.81	0.83	0.85	0.87
Motel, Office, Church (2 story)**	0.26	0.39	0.48	0.55	0.61	0.67	0.73	0.78	0.83	0.87
Food Related**	0.55	0.70	0.85	0.90	0.95	0.95	0.95	0.95	0.95	0.95
Gas Station, Car Service**	0.22	0.43	0.70	0.92	0.95	0.95	0.95	0.95	0.95	0.95
Retail (1 story)**	0.18	0.30	0.59	0.70	0.90	0.95	0.95	0.95	0.95	0.95
Retail (2 story)**	0.12	0.22	0.34	0.54	0.74	0.83	0.87	0.91	0.93	0.95
Clothing Store**	0.35	0.45	0.67	0.83	0.95	0.95	0.95	0.95	0.95	0.95
Car Dealership**	0.10	0.72	0.80	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Furniture Store**	0.75	0.85	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Outbuilding Contents**	0.30	0.51	0.62	0.67	0.69	0.71	0.80	0.85	0.90	0.95
Roads	0.11	0.22	0.35	0.50	0.66	0.76	0.76	0.76	0.76	0.76
Utilities	0.06	0.13	0.22	0.32	0.42	0.52	0.63	0.76	0.88	0.92
Railroad	0.03	0.04	0.12	0.15	0.18	0.21	0.31	0.64	0.76	0.82
(Low Flow Conveyance Channel)	0.07	0.14	0.21	0.28	0.35	0.42	0.49	0.56	0.63	0.70
Vehicles	0.05	0.17	0.20	0.75	0.80	0.85	0.90	0.95	0.95	0.95

* Content stage-damage function expressed as a percentage of structure value.

** Content stage-damage function expressed as a percentage of content value.

Table F-2A

RATING CURVES BY REACH
WITHOUT PROJECT CONDITIONS (PRESENT)
SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN

LEFT (EAST) OVERBANK AND CHANNEL	EVENT							
Station	2-yr	5-yr	10-yr	20-yr	50-yr	100-yr	200-yr	500-yr
1218	4,661.53	4,661.53	4,661.53	4,661.53	4,664.01	4,665.02	4,665.81	4,667.02
1256	4,644.57	4,644.57	4,644.57	4,644.57	4,644.66	4,645.27	4,645.71	4,646.23
1268	4,634.38	4,634.38	4,635.11	4,635.72	4,636.57	4,637.02	4,637.47	4,637.92
1299	4,622.51	4,622.51	4,624.17	4,625.24	4,625.88	4,626.44	4,626.96	4,627.44
1312	4,617.07	4,617.07	4,619.59	4,620.68	4,621.26	4,621.71	4,622.23	4,622.34
1327	4,607.79	4,607.79	4,612.38	4,612.91	4,613.16	4,613.39	4,614.37	4,614.66
1339	4,604.35	4,604.35	4,605.46	4,605.69	4,605.78	4,606.02	4,606.85	4,607.31
1346	4,597.83	4,597.83	4,602.15	4,602.33	4,602.42	4,602.61	4,602.94	4,603.21
1360	4,594.75	4,595.65	4,595.78	4,595.93	4,596.03	4,596.13	4,596.23	4,596.28
1394	4,581.19	4,582.53	4,583.07	4,583.17	4,583.28	4,583.37	4,583.48	4,583.62
1400	4,581.70	4,581.70	4,581.70	4,581.77	4,581.87	4,581.97	4,582.07	4,582.17
1414	4,573.09	4,574.64	4,574.70	4,574.80	4,574.87	4,575.00	4,575.13	4,575.29
1433	4,567.57	4,567.73	4,567.74	4,567.84	4,567.94	4,568.04	4,568.25	4,568.51
1483	4,549.32	4,549.67	4,549.77	4,549.87	4,549.97	4,550.26	4,550.58	4,550.99
1491	4,541.92	4,545.29	4,545.39	4,545.49	4,545.92	4,546.24	4,546.44	4,546.70
1517	4,533.46	4,535.57	4,535.67	4,535.77	4,535.87	4,535.97	4,536.07	4,536.17
1550	4,520.68	4,522.00	4,522.10	4,522.20	4,522.30	4,522.40	4,522.50	4,522.63
1603	4,503.74	4,504.06	4,504.16	4,504.26	4,504.69	4,504.94	4,505.01	4,505.09
1641	4,495.04	4,495.04	4,495.42	4,495.58	4,495.73	4,495.80	4,495.87	4,495.98

RIGHT (WEST) OVERBANK	EVENT							
Station	2-yr	5-yr	10-yr	20-yr	50-yr	100-yr	200-yr	500-yr
1218	4,661.96	4,661.96	4,661.96	4,661.96	4,661.96	4,662.83	0.00	4,663.73
1256	4,641.40	4,641.40	4,641.40	4,641.40	4,641.40	4,641.40	4,641.40	4,644.27
1268	4,635.80	4,635.80	4,635.80	4,635.80	4,635.80	4,635.80	4,635.80	4,637.07
1299	4,618.00	4,618.00	4,618.26	4,618.54	4,620.44	4,621.49	4,622.08	4,623.58
1312	4,615.74	4,615.74	4,615.97	4,616.65	4,619.37	4,620.38	4,620.57	4,622.25
1327	4,600.01	4,600.01	4,600.01	4,600.79	4,611.00	4,613.43	4,614.98	4,615.44
1339	4,598.04	4,599.00	4,599.10	4,599.20	4,600.58	4,601.19	4,601.77	4,602.29
1346	4,593.49	4,594.47	4,594.57	4,594.67	4,595.55	4,596.22	4,596.88	4,597.54
1360	4,591.18	4,591.99	4,592.09	4,592.13	4,592.82	4,593.58	4,594.28	4,594.88
1394	4,575.16	4,577.63	4,577.73	4,577.83	4,577.93	4,577.96	4,579.29	4,580.96
1400	4,575.11	4,577.55	4,577.65	4,577.75	4,577.85	4,577.88	4,579.15	4,580.79
1414	4,570.48	4,571.19	4,571.29	4,571.39	4,571.48	4,571.56	4,572.14	4,572.92
1433	4,564.43	4,565.50	4,565.60	4,565.70	4,565.80	4,565.90	4,566.00	4,566.50
1483	4,541.68	4,541.99	4,542.09	4,542.19	4,542.29	4,542.44	4,542.80	4,543.35
1491	4,538.55	4,538.90	4,539.00	4,539.10	4,539.23	4,540.04	4,540.41	4,540.93
1517	4,524.32	4,524.42	4,524.52	4,524.62	4,524.67	4,524.97	4,525.21	4,525.19
1550	4,512.61	4,513.18	4,513.28	4,513.38	4,513.48	4,513.58	4,513.68	4,513.78
1603	4,499.22	4,499.97	4,500.07	4,500.17	4,500.27	4,500.37	4,500.47	4,500.56
1641	4,485.66	4,486.43	4,486.53	4,486.63	4,486.73	4,486.83	4,486.93	4,487.03

Table F-2B

RATING CURVES BY REACH
WITHOUT PROJECT CONDITIONS (FUTURE)
SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN

LEFT (EAST) OVERBANK AND CHANNEL	EVENT							
Station	2-yr	5-yr	10-yr	20-yr	50-yr	100-yr	200-yr	500-yr
1218	4,661.53	4,661.53	4,661.53	4,661.53	4,664.01	4,665.02	4,665.81	4,667.02
1256	4,644.57	4,644.57	4,644.57	4,644.57	4,644.66	4,645.27	4,645.71	4,646.23
1268	4,634.38	4,634.38	4,635.11	4,635.72	4,636.57	4,637.02	4,637.47	4,637.92
1299	4,622.51	4,622.51	4,624.17	4,625.24	4,625.88	4,626.44	4,626.96	4,627.44
1312	4,617.07	4,617.07	4,619.59	4,620.68	4,621.26	4,621.71	4,622.23	4,622.34
1327	4,607.79	4,607.79	4,612.38	4,612.91	4,613.16	4,613.39	4,614.37	4,614.66
1339	4,604.35	4,604.35	4,605.46	4,605.69	4,605.78	4,606.02	4,606.85	4,607.31
1346	4,597.83	4,597.83	4,602.15	4,602.33	4,602.42	4,602.61	4,602.94	4,603.21
1360	4,594.75	4,595.65	4,595.78	4,595.93	4,596.03	4,596.13	4,596.23	4,596.28
1394	4,581.19	4,582.53	4,583.07	4,583.17	4,583.28	4,583.37	4,583.48	4,583.62
1400	4,581.70	4,581.70	4,581.70	4,581.77	4,581.87	4,581.97	4,582.07	4,582.17
1414	4,573.69	4,575.24	4,575.30	4,575.40	4,575.47	4,575.60	4,575.73	4,575.89
1433	4,568.27	4,568.43	4,568.44	4,568.54	4,568.64	4,568.74	4,568.95	4,569.21
1483	4,550.62	4,550.97	4,551.07	4,551.17	4,551.27	4,551.56	4,551.88	4,552.29
1491	4,543.32	4,546.69	4,546.79	4,546.89	4,547.32	4,547.64	4,547.84	4,548.10
1517	4,535.26	4,537.37	4,537.47	4,537.57	4,537.67	4,537.77	4,537.87	4,537.97
1550	4,523.28	4,524.60	4,524.70	4,524.80	4,524.90	4,525.00	4,525.10	4,525.23
1603	4,508.14	4,508.46	4,508.56	4,508.66	4,509.09	4,509.34	4,509.41	4,509.49
1641	4,501.24	4,501.24	4,501.62	4,501.78	4,501.93	4,502.00	4,502.07	4,502.18

RIGHT (WEST) OVERBANK	EVENT							
Station	2-yr	5-yr	10-yr	20-yr	50-yr	100-yr	200-yr	500-yr
1218	4,661.96	4,661.96	4,661.96	4,661.96	4,661.96	4,662.83	0.00	4,663.73
1256	4,641.40	4,641.40	4,641.40	4,641.40	4,641.40	4,641.40	4,641.40	4,644.27
1268	4,635.80	4,635.80	4,635.80	4,635.80	4,635.80	4,635.80	4,635.80	4,637.07
1299	4,618.00	4,618.00	4,618.26	4,618.54	4,620.44	4,621.49	4,622.08	4,623.58
1312	4,615.74	4,615.74	4,615.97	4,616.65	4,619.37	4,620.38	4,620.57	4,622.25
1327	4,600.01	4,600.01	4,600.01	4,600.79	4,611.00	4,613.43	4,614.98	4,615.44
1339	4,598.04	4,599.00	4,599.10	4,599.20	4,600.58	4,601.19	4,601.77	4,602.29
1346	4,593.49	4,594.47	4,594.57	4,594.67	4,595.55	4,596.22	4,596.88	4,597.54
1360	4,591.18	4,591.99	4,592.09	4,592.13	4,592.82	4,593.58	4,594.28	4,594.88
1394	4,575.16	4,577.63	4,577.73	4,577.83	4,577.93	4,577.96	4,579.29	4,580.96
1400	4,575.11	4,577.55	4,577.65	4,577.75	4,577.85	4,577.88	4,579.15	4,580.79
1414	4,570.48	4,571.19	4,571.29	4,571.39	4,571.48	4,571.56	4,572.14	4,572.92
1433	4,564.43	4,565.50	4,565.60	4,565.70	4,565.80	4,565.90	4,566.00	4,566.50
1483	4,541.68	4,541.99	4,542.09	4,542.19	4,542.29	4,542.44	4,542.80	4,543.35
1491	4,538.55	4,538.90	4,539.00	4,539.10	4,539.23	4,540.04	4,540.41	4,540.93
1517	4,524.32	4,524.42	4,524.52	4,524.62	4,524.67	4,524.97	4,525.21	4,525.19
1550	4,512.61	4,513.18	4,513.28	4,513.38	4,513.48	4,513.58	4,513.68	4,513.78
1603	4,499.22	4,499.97	4,500.07	4,500.17	4,500.27	4,500.37	4,500.47	4,500.56
1641	4,485.66	4,486.43	4,486.53	4,486.63	4,486.73	4,486.83	4,486.93	4,487.03

Table F-2C

RATING CURVES BY REACH
WITH PROJECT CONDITIONS (PRESENT)
SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN

LEFT (EAST) OVERBANK AND CHANNEL	EVENT							
Station	2-yr	5-yr	10-yr	20-yr	50-yr	100-yr	200-yr	500-yr
1218	4,656.97		4,660.10		4,662.90	4,664.19	4,665.54	4,667.94
1256	4,640.68		4,643.32		4,645.66	4,647.17	4,648.42	4,648.77
1268	4,635.10		4,636.50		4,637.74	4,638.56	4,639.24	4,639.53
1299	4,622.29		4,625.24		4,627.38	4,628.45	4,629.57	4,630.57
1312	4,618.31		4,620.76		4,623.36	4,623.65	4,624.90	4,626.32
1327	4,609.17		4,610.67		4,612.06	4,612.54	4,612.76	4,613.59
1339	4,605.69		4,606.48		4,607.68	4,608.25	4,608.97	4,609.68
1346	4,602.03		4,602.94		4,603.96	4,604.60	4,605.49	4,606.48
1360	4,595.56		4,596.02		4,596.88	4,598.00	4,598.59	4,599.51
1394	4,581.91		4,582.91		4,584.82	4,585.88	4,587.11	4,588.44
1400	4,581.91		4,582.91		4,584.82	4,585.88	4,587.11	4,588.44
1414	4,574.90		4,574.98		4,576.10	4,576.78	4,577.57	4,578.45
1433	4,567.11		4,567.66		4,568.39	4,568.98	4,569.64	4,570.39
1483	4,548.64		4,549.25		4,550.02	4,550.79	4,551.54	4,552.40
1491	4,545.98		4,546.86		4,547.58	4,548.32	4,549.05	4,549.89
1517	4,536.58		4,537.18		4,537.84	4,538.54	4,539.21	4,540.00
1550	4,522.43		4,523.08		4,523.69	4,524.34	4,524.99	4,525.75
1603	4,505.77		4,506.62		4,507.28	4,508.53	4,509.47	4,510.44
1641	4,497.48		4,498.25		4,498.81	4,499.87	4,500.66	4,501.42

Table F-3A

NUMBER OF STRUCTURES
WITHOUT PROJECT CONDITIONS (PRESENT)
FLOODPLAIN

Land Use Category	EVENT							
	10%		2%		1%		0.20%	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Residential	372.00		532.00		564.00		735.00	
Commercial	109.00		178.00		189.00		213.00	
Public	6.00		14.00		14.00		15.00	
Apartment	2.00		3.00		3.00		6.00	
Outbuildings	249.00		409.00		424.00		455.00	
Agriculture (acres)	5160.4		8062.5		8860.8		10942.3	
TOTAL STR.	**738.00**		**1136.00**		**1194.00**		**1424.00**	

Table F-3B

NUMBER OF STRUCTURES
WITHOUT PROJECT CONDITIONS (FUTURE)
SAN ACACIA TO BOSQUE DEL APACHE

Land Use Category	EVENT							
	10%		2%		1%		0.20%	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Residential	371.00		531.00		563.00		734.00	
Commercial	109.00		178.00		189.00		213.00	
Public	6.00		14.00		14.00		15.00	
Apartment	2.00		3.00		3.00		6.00	
Outbuildings	247.00		407.00		422.00		453.00	
Agriculture (acres)	5160.4		8062.5		8860.8		10942.3	
TOTAL STR.	**735.00**		**1133.00**		**1191.00**		**1421.00**	

Table F-3C

PROPERTIES EXCLUDED FROM BENEFIT CALCULATIONS

	Identified within 5/17/1988 FIRM	Elevated clear of 1% chance WSEL	Remainder	Structures excluded from benefit calculations
Number of Structures	1446	1138	308	13

Table F-4A

VALUE OF DAMAGEABLE PROPERTY
WITHOUT PROJECT CONDITIONS (PRESENT)
SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN

(x $1,000 August, 2010 price level)

Land Use Category	EVENT							
	10%		2%		1%		0.20%	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
$/str	$33.55		$36.29		$35.62		$31.17	
Residential	12,481		19,305		20,092		22,911	
Res. Content	6,138		9,519		9,908		11,272	
$/str	$106.70		$119.14		$113.51		$111.04	
Commercial	11,630		21,208		21,454		23,652	
Comm. Content	22,922		33,242		33,503		37,164	
$/str	$190.81		$106.50		$106.50		$105.26	
Public	1,145		1,491		1,491		1,579	
Pub. Content	283		565		565		574	
$/str	$21.87		$46.72		$46.72		$40.90	
Apartment	44		140		140		245	
Apt. Contents	22		70		70		123	
$/str	$2.25		$2.28		$2.26		$2.37	
Outbuilding	560		934		959		1,078	
Out.. Contents	279		478		491		550	
Total	**55,504**		**86,951**		**88,673**		**99,146**	

Table F-4B

VALUE OF DAMAGEABLE PROPERTY
WITHOUT PROJECT CONDITIONS (FUTURE)
SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN

(x $1,000 August, 2010 price level)

Land Use Category	EVENT 10%		2%		1%		0.20%	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
$/str	$33.60		$36.33		$35.66		$31.19	
Residential	12,467		19,291		20,078		22,896	
Res. Content	6,131		9,511		9,901		11,265	
$/str	$106.70		$119.14		$113.51		$111.04	
Commercial	11,630		21,208		21,454		23,652	
Comm. Content	22,922		33,242		33,503		37,164	
$/str	$190.81		$106.50		$106.50		$105.26	
Public	1,145		1,491		1,491		1,579	
Pub. Content	283		565		565		574	
$/str	$21.87		$46.72		$46.72		$40.90	
Apartment	44		140		140		245	
Apt. Contents	22		70		70		123	
$/str	$2.24		$2.28		$2.26		$2.37	
Outbuilding	554		929		954		1,073	
Out.. Contents	273		472		485		544	

Table F-5A

SINGLE OCCURRENCE DAMAGES
WITHOUT PROJECT CONDITIONS (PRESENT)
FLOODPLAIN

(x $1,000 August, 2010 price level)

Land Use Category	EVENT							
	10%		2%		1%		0.20%	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Residential	4,584		7,025		7,874		9,956	
Res. Content	1,457		2,235		2,539		3,193	
Commercial	1,962		3,924		4,685		6,005	
Comm. Content	15,792		21,256		23,998		29,017	
Public	152		203		240		281	
Pub. Content	133		183		248		356	
Apartments	1		1		3		16	
Apt. Contents	0		1		1		5	
Outbuildings	108		174		199		259	
Out. Contents	73		108		124		162	
Subtotal - Structures	**6,806**		**11,328**		**13,000**		**16,518**	
Subtotal - Contents	**17,455**		**23,783**		**26,909**		**32,734**	
Subtotal - Structures and Contents	**24,261**		**35,110**		**39,910**		**49,252**	
Streets, roads	10,466		21,720		25,021		36,715	
Utilities	232		762		898		1,317	
Railroad	1,693.65		1,838.59		1,927.93		2,829.59	
Vehicles	2,705		3,430		4,086		5,075	
Agriculture	704		1,100		1,209		1,493	
Irr. Drains	210		396		440		798	
LFCC	14,386.06		18,960.99		20,746.66		27,275.17	
Avoided Water Losses	0.00		0.00		0.00		0.00	
Recreation	2,837.38		2,837.38		2,837.38		2,837.38	
East Bank	285.57		372.63		401.21		482.24	
Emergency Costs	599.83		957.80		1093.90		1447.79	
Total	**58,380**		**87,486**		**98,570**		**129,522**	

Table F-5B

SINGLE OCCURRENCE DAMAGES
WITHOUT PROJECT CONDITIONS (FUTURE)
SAN ACACIA TO BOSQUE DEL APACHE

(x $1,000 August, 2010 price level)

Land Use	EVENT 10%		2%		1%		0.20%	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Residential	4,572		7,014		7,863		9,945	
Res. Content	1,451		2,229		2,533		3,187	
Commercial	1,962		3,924		4,685		6,005	
Comm. Content	15,792		21,256		23,998		29,017	
Public	152		203		240		281	
Pub. Content	133		183		248		356	
Apartments	1		1		3		16	
Apt. Contents	0		1		1		5	
Outbuildings	105		170		195		256	
Out. Contents	71		106		122		160	
Subtotal -	**6,791**		**11,313**		**12,985**		**16,503**	
Subtotal -	**17,447**		**23,775**		**26,901**		**32,726**	
Subtotal -	**24,238**		**35,087**		**39,887**		**49,228**	
Streets, roads	10,466		21,720		25,021		36,715	
Utilities	232		762		898		1,317	
Railroad	1,693.65		1,838.59		1,927.93		2,829.59	
Vehicles	2,705		3,430		4,086		5,075	
Agriculture	704		1,100		1,209		1,493	
Irr. Drains	210		396		440		798	
LFCC	14,392.51		18,967.44		20,753.11		27,275.17	
Avoided Water Losses	0.00		0.00		0.00		0.00	
Recreation	2,837.38		2,837.38		2,837.38		2,837.38	
East Bank	285.57		372.63		401.21		482.24	
Emergency Costs	599.53		957.49		1093.58		1447.47	

Table F-6A

AVERAGE ANNUAL DAMAGES (PRESENT) BY LAND USE CATEGORY

(x $1,000 August, 2010 price level)

LAND USE CATEGORY	Average Annual Damages (x $1,000 August, 2010 price level)					
Residential	2196.44					
Commercial	5591.67					
Public	119.94					
Apartments	1.49					
Outbuildings	77.31					
Subtotal - Structures and Contents	**7,986.85**					
Streets, roads	1893.89					
Utilities	60.73					
Railroad	193.28					
Vehicles	343.28					
Agriculture	101.00					
Irr. Drains	36.01					
LFCC	6366.42					
Avoided Water Losses	0.00					
Recreation	822.84					
East Bank	237.53					
Emergency Costs	158.69					
TOTAL	**18,200.51**					

Table F-6B

AVERAGE ANNUAL DAMAGES (FUTURE)
BY LAND USE CATEGORY

(x $1,000 August, 2010 price level)

LAND USE	Average Annual Damages (x $1,000 August, 2010 price level)	Probability Avg. Ann. Damages Exceed Indicated Amount				
		0.95	0.75	0.5	0.25	0.05
Residential	2200.30					
Commercial	5594.91					
Public	119.94					
Apartments	1.49					
Outbuildings	77.45					
Subtotal - Structures and Contents	**7,994.09**					
Streets, roads	1893.89					
Utilities	60.73					
Railroad	193.28					
Vehicles	343.28					
Agriculture	101.00					
Irr. Drains	36.01					
LFCC	6386.84					
Avoided Water Losses	0.00					
Recreation	822.84					
East Bank	294.28					
Emergency Costs	158.79					
TOTAL	**18,285.03**					

Table F-6C

EQUIVALENT ANNUAL DAMAGES BY LAND USE CATEGORY

(x $1,000 August, 2010 price level)

LAND USE CATEGORY	Equivalent Annual Damages (x $1,000 August, 2010 price level)		
	Total	Federal	
Residential	2,198.80		
Commercial	5,593.65		
Public	119.94		
Apartment	1.49		
Outbuildings	77.40		
East Bank			
Subtotal - Structures and Contents	**7,991.28**		
Streets, roads	1,893.89		
Utilities	60.73		
Railroad	193.28		
Vehicles	343.28		
Agriculture	101.00		
Irrigation Drains	36.01		
LFCC	6,366.73	6,366.73	
Avoided Water Losses	0.00	0.00	
Recreation	822.84	822.84	
East Bank	272.25		
Emergency Costs	157.59		
			Federal % of Total
TOTAL	**18,161.47**	**7,189.57**	**39.59%**

Table F-49-A EXPECTED VALUE AND PROBABILISTIC VALUES OF EAD AND EAD REDUCED FOR PROPOSED PROJECTS

PRESENT CONDITIONS

Plan	Expected Annual Damage (x $1,000)			Probability Residual Damages Exceeds Indicated Amount (x $1,000)				
	Without Plan*	With Plan**	Benefits	0.05	0.25	0.5	0.75	0.95
No Action	7,986.85	7,986.85	0.00		0.00	0.00	0.00	
Base levee	7,986.85	1,426.73	6,560.12		406.74	516.84	1,048.98	
Base levee + 1 ft	7,986.85	420.58	7,566.27		330.10	406.14	511.15	
Base levee + 2 ft	7,986.85	131.51	7,855.34		85.46	104.60	140.90	
Base levee + 3 ft	7,986.85	34.62	7,952.23		38.85	47.46	56.39	
Base levee + 4 ft	7,986.85	6.45	7,980.40		20.30	24.79	29.29	
Alternative 1 doesn't include flood insurance savings of					$19.01	for	1191	structures

* From Subtotal - Structures and Contents in Table F-6A

** Residual damages for Structures and Contents.

Table F-49-B EXPECTED VALUE AND PROBABILISTIC VALUES OF EAD AND EAD REDUCED FOR PROPOSED PROJECTS

FUTURE CONDITIONS

Plan	Expected Annual Damage (x $1,000)			Probability Residual Damages Exceeds Indicated Amount (x $1,000)				
	Without Plan*	With Plan**	Benefits	0.05	0.25	0.5	0.75	0.95
No Action	7,994.09	7,994.09	0.00		0.00	0.00	0.00	
Base levee	7,994.09	4,668.41	3,325.68		526.99	864.24	3,844.34	
Base levee + 1 ft	7,994.09	2,089.91	5,904.18		443.11	572.43	1,257.12	
Base levee + 2 ft	7,994.09	871.47	7,122.62		359.71	497.30	656.56	
Base levee + 3 ft	7,994.09	342.38	7,651.71		308.31	389.84	525.30	
Base levee + 4 ft	7,994.09	132.15	7,861.94		178.06	218.64	295.70	
Alternative 1 doesn't include flood insurance savings of					$19.01	for	1191	structures

* From Subtotal - Structures and Contents in Table F-6B

** Residual damages for Structures and Contents.

Table F-50-A-1

EQUIVALENT ANNUAL BENEFITS
BY LAND USE CATEGORY

Base levee

LAND USE CATEGORY	EAD	Residual Damages	Benefits	Average Annual Benefits (x $1,000 August, 2010 price level)				
				Probability Avg. Ann. Damages Exceed Indicated Amount				
				0.95	0.75	0.5	0.25	0.05
Residential	2,198.80	1,059.49	1139.31					
Commercial	5,593.65	2,233.81	3359.84					
Public	119.94	79.27	40.67					
Apartments	1.49	1.90	-0.41					
Outbuildings	77.40	35.78	41.62					
Subtotal - Structures and Contents	7,991.28	3,410.25	4581.03					
Streets, roads	1,893.89	599.59	1294.31					
Utilities	60.73	20.05	40.68					
Railroad	193.28	55.79	137.49					
Vehicles	343.28	101.21	242.07					
Agriculture	101.00	14.40	86.61	*Federal Benefits*				
Irr. Drains	36.01	11.69	24.32					
LFCC	6,366.73	1,927.02	4439.71	*4439.71*				
Avoided Water Losses	0.00	0.00	0.00	*0.00*				
Recreation	822.84	29.79	793.05	*793.05*				
East Bank	272.25	274.89	-2.64					
Emergency Costs	157.59	13.62	143.97		*Federal % of Total*			
TOTAL	**18,238.87**	**6458.28**	**11,780.59**	***5232.76***	***44.97%***			

Table F-50-A-2

EQUIVALENT ANNUAL BENEFITS
BY LAND USE CATEGORY

Base levee + 1 ft

LAND USE CATEGORY	EAD	Residual Damages	Benefits	Average Annual Benefits (x $1,000 August, 2010 price level) Probability Avg. Ann. Damages Exceed Indicated Amount 0.95	0.75	0.5	0.25	0.05
Residential	2198.80	444.42	1754.38					
Commercial	5593.65	933.19	4660.46					
Public	119.94	49.19	70.75					
Apartments	1.49	0.70	0.79					
Outbuildings	77.40	14.51	62.89					
Subtotal - Structures and Contents	7991.28	1,442.01	6549.27					
Streets, roads	1893.89	413.70	1480.20					
Utilities	60.73	13.81	46.92					
Railroad	193.28	41.46	151.82					
Vehicles	343.28	68.83	274.45					
Agriculture	101.00	8.96	92.05	*Federal Benefits*				
Irr. Drains	36.01	8.26	27.75					
LFCC	6366.73	1,297.40	5069.33	*5069.33*				
Avoided Water Losses	0.00	0.00	0.00	*0.00*				
Recreation	822.84	17.02	805.82	*805.82*				
East Bank	272.25	274.89	-2.64					
Emergency Costs	157.59	9.17	148.42		*Federal % of Total*			
TOTAL	**18238.87**	**3595.50**	**14643.38**	***5875.14***	***40.53%***			

Table F-50-A-3

EQUIVALENT ANNUAL BENEFITS
BY LAND USE CATEGORY

Base levee + 2 ft

LAND USE CATEGORY			Average Annual Benefits (x $1,000 August, 2010 price level)					
				Probability Avg. Ann. Damages Exceed Indicated Amount				
	EAD	Residual Damages	Benefits	0.95	0.75	0.5	0.25	0.05
Residential	2,198.80	176.29	2022.51					
Commercial	5,593.65	367.43	5226.22					
Public	119.94	34.39	85.55					
Apartments	1.49	0.26	1.23					
Outbuildings	77.40	5.90	71.50					
Subtotal - Structures and Contents	7,991.28	584.27	7407.01					
Streets, roads	1,893.89	260.33	1633.56					
Utilities	60.73	8.35	52.38					
Railroad	193.28	26.57	166.71					
Vehicles	343.28	54.67	288.60					
Agriculture	101.00	11.43	89.57	*Federal Benefits*				
Irr. Drains	36.01	4.95	31.06					
LFCC	6,366.73	876.68	5490.05	*5490.05*				
Avoided Water Losses	0.00	0.00	0.00	*0.00*				
Recreation	822.84	9.93	812.91	*812.91*				
East Bank	272.25	274.89	-2.64					
Emergency Costs	157.59	6.03	151.56		*Federal % of Total*			
TOTAL	**18,238.87**	**2118.11**	**16,120.77**	***6302.96***	***39.47%***			

Table F-50-A-4

EQUIVALENT ANNUAL BENEFITS BY LAND USE CATEGORY

Base levee + 3 ft

LAND USE CATEGORY			Average Annual Benefits (x $1,000 August, 2010 price level)					
				Probability Avg. Ann. Damages Exceed Indicated Amount				
	EAD	Residual Damages	Benefits	0.95	0.75	0.5	0.25	0.05
Residential	2,198.80	64.78	2134.02					
Commercial	5,593.65	133.82	5459.83					
Public	119.94	21.91	98.03					
Apartments	1.49	0.09	1.40					
Outbuildings	77.40	2.32	75.08					
Subtotal - Structures and Contents	7,991.28	222.92	7768.36					
Streets, roads	1,893.89	154.02	1739.87					
Utilities	60.73	4.94	55.79					
Railroad	193.28	15.72	177.56					
Vehicles	343.28	33.00	310.27					
Agriculture	101.00	7.34	93.66	*Federal Benefits*				
Irr. Drains	36.01	2.93	33.08					
LFCC	6,366.73	518.62	5848.10	*5848.10*				
Avoided Water Losses	0.00	0.00	0.00	*0.00*				
Recreation	822.84	9.93	812.91	*812.91*				
East Bank	272.25	274.89	-2.64					
Emergency Costs	157.59	3.59	154.00		*Federal % of Total*			
TOTAL	**18,238.87**	**1247.90**	**16,990.98**	***6661.01***	***39.56%***			

Table F-50-A-5

EQUIVALENT ANNUAL BENEFITS BY LAND USE CATEGORY

Base levee + 4 ft

LAND USE CATEGORY			Average Annual Benefits (x $1,000 August, 2010 price level)					
				Probability Avg. Ann. Damages Exceed Indicated Amount				
	EAD	Residual Damages	Benefits	0.95	0.75	0.5	0.25	0.05
Residential	2,198.80	22.72	2176.08					
Commercial	5,593.65	46.84	5546.81					
Public	119.94	12.90	107.04					
Apartments	1.49	0.04	1.45					
Outbuildings	77.40	0.87	76.53					
Subtotal - Structures and Contents	7,991.28	83.37	7907.91					
Streets, roads	1,893.89	126.73	1767.16					
Utilities	60.73	4.06	56.66					
Railroad	193.28	12.93	180.35					
Vehicles	343.28	27.84	315.43					
Agriculture	101.00	6.15	94.86	*Federal Benefits*				
Irr. Drains	36.01	2.41	33.60					
LFCC	6,366.73	72.26	6294.46	*6294.46*				
Avoided Water Losses	0.00	0.00	0.00	*0.00*				
Recreation	822.84	9.93	812.91	*812.91*				
East Bank	272.25	274.89	-2.64					
Emergency Costs	157.59	2.87	154.72		*Federal % of Total*			
TOTAL	**18,238.87**	**623.45**	**17,615.42**	***7107.37***	***40.70%***			

Table F-50-B-1

AVERAGE ANNUAL BENEFITS (PRESENT)
BY LAND USE CATEGORY

Base levee

LAND USE CATEGORY	Avg. Ann. Damages	Residual Damages	Benefits	0.95	0.75	0.5	0.25	0.05
			Average Annual Benefits (x $1,000 August, 2010 price level)	Probability Residual Avg. Ann. Damages Exceed Indicated Amount				
Residential	2,196.44	428.17	1,768.27					
Commercial	5,591.67	966.41	4,625.26					
Public	119.94	21.58	98.36					
Apartments	1.49	0.61	0.88					
Outbuildings	77.31	9.96	67.35					
Subtotal - Structures and Contents	7,986.85	1,426.73	6,560.12					
Streets, roads	1,893.89	332.89	1,561.01					
Utilities	60.73	11.94	48.79					
Railroad	193.28	25.65	167.63					
Vehicles	343.28	48.84	294.44					
Agriculture	101.00	14.40	86.61					
Irr. Drains	36.01	6.77	29.24					
LFCC	6,366.42	976.35	5,390.07					
Avoided Water Losses	0.00	0.00	0.00					
Recreation	822.84	29.79	793.05					
East Bank	237.53	221.68	15.85					
Emergency Costs	158.69	6.99	151.70					
TOTAL	**18,200.51**	**3,102.03**	**15,098.49**					

Table F-50-B-2

AVERAGE ANNUAL BENEFITS (PRESENT)
BY LAND USE CATEGORY

Base levee + 1 ft

LAND USE CATEGORY	EAD	Residual Damages	Benefits	Average Annual Benefits (x $1,000 August, 2010 price level) Probability Avg. Ann. Damages Exceed Indicated Amount 0.95	0.75	0.5	0.25	0.05
Residential	2,196.44	129.52	2,066.92					
Commercial	5,591.67	281.81	5,309.86					
Public	119.94	6.07	113.87					
Apartments	1.49	0.19	1.30					
Outbuildings	77.31	2.99	74.32					
Subtotal - Structures and Contents	7,986.85	420.58	7,566.27					
Streets, roads	1,893.89	220.29	1,673.60					
Utilities	60.73	7.90	52.82					
Railroad	193.28	21.32	171.96					
Vehicles	343.28	30.45	312.82					
Agriculture	101.00	8.96	92.05					
Irr. Drains	36.01	4.79	31.22					
LFCC	6,366.42	592.44	5,773.98					
Avoided Water Losses	0.00	0.00	0.00					
Recreation	822.84	17.02	805.82					
East Bank	237.53	221.68	15.85					
Emergency Costs	158.69	4.47	154.21					
TOTAL	**18,200.51**	**1,549.90**	**16,650.61**					

Table F-50-B-3

AVERAGE ANNUAL BENEFITS (PRESENT)
BY LAND USE CATEGORY

Base levee + 2 ft

LAND USE CATEGORY	EAD	Residual Damages	Benefits	Average Annual Benefits (x $1,000 August, 2010 price level) Probability Avg. Ann. Damages Exceed Indicated Amount 0.95	0.75	0.5	0.25	0.05
Residential	2,196.44	41.04	2,155.40					
Commercial	5,591.67	87.48	5,504.19					
Public	119.94	1.99	117.95					
Apartments	1.49	0.06	1.43					
Outbuildings	77.31	0.94	76.37					
Subtotal - Structures and Contents	7,986.85	131.51	7,855.34					
Streets, roads	1,893.89	178.60	1,715.29					
Utilities	60.73	5.73	55.00					
Railroad	193.28	18.23	175.05					
Vehicles	343.28	43.90	299.37					
Agriculture	101.00	9.53	89.57					
Irr. Drains	36.01	3.40	32.61					
LFCC	6,366.42	600.38	5,766.04					
Avoided Water Losses	0.00	0.00	0.00					
Recreation	822.84	9.93	812.91					
East Bank	237.53	221.68	15.85					
Emergency Costs	158.69	3.88	154.80					
TOTAL	**18,200.51**	**1,226.77**	**16,971.84**					

Table F-50-B-4

AVERAGE ANNUAL BENEFITS (PRESENT)
BY LAND USE CATEGORY

Base levee + 3 ft

LAND USE CATEGORY	EAD	Residual Damages	Benefits	Average Annual Benefits (x $1,000 August, 2010 price level) Probability Avg. Ann. Damages Exceed Indicated Amount 0.95	0.75	0.5	0.25	0.05
Residential	2,196.44	10.90	2,185.54					
Commercial	5,591.67	22.92	5,568.75					
Public	119.94	0.54	119.40					
Apartments	1.49	0.01	1.48					
Outbuildings	77.31	0.25	77.06					
Subtotal - Structures and Contents	7,986.85	34.62	7,952.23					
Streets, roads	1,893.89	111.35	1,782.54					
Utilities	60.73	3.57	57.16					
Railroad	193.28	11.36	181.92					
Vehicles	343.28	28.01	315.26					
Agriculture	101.00	5.94	93.66					
Irr. Drains	36.01	2.12	33.89					
LFCC	6,366.42	374.31	5,992.11					
Avoided Water Losses	0.00	0.00	0.00					
Recreation	822.84	9.93	812.91					
East Bank	237.53	221.68	15.85					
Emergency Costs	158.69	2.42	156.27					
TOTAL	**18,200.51**	**805.30**	**17,393.81**					

Table F-50-B-5

AVERAGE ANNUAL BENEFITS (PRESENT)
BY LAND USE CATEGORY

Base levee + 4 ft

LAND USE CATEGORY	EAD	Residual Damages	Benefits	Average Annual Benefits (x $1,000 August, 2010 price level) Probability Avg. Ann. Damages Exceed Indicated Amount 0.95	0.75	0.5	0.25	0.05
Residential	2,196.44	2.06	2,194.38					
Commercial	5,591.67	4.24	5,587.43					
Public	119.94	0.10	119.84					
Apartments	1.49	0.00	1.49					
Outbuildings	77.31	0.05	77.26					
Subtotal - Structures and Contents	7,986.85	6.45	7,980.40					
Streets, roads	1,893.89	92.03	1,801.87					
Utilities	60.73	2.95	57.77					
Railroad	193.28	9.39	183.89					
Vehicles	343.28	28.01	315.26					
Agriculture	101.00	4.91	94.86					
Irr. Drains	36.01	1.75	34.26					
LFCC	6,366.42	10.54	6,355.88					
Avoided Water Losses	0.00	0.00	0.00					
Recreation	822.84	9.93	812.91					
East Bank	237.53	221.68	15.85					
Emergency Costs	158.69	2.06	156.62					
TOTAL	**18,200.51**	**389.70**	**17,809.57**					

Table F-50-C-1

AVERAGE ANNUAL BENEFITS (FUTURE, NO TIFFANY)
BY LAND USE CATEGORY

Base levee

LAND USE CATEGORY	Avg. Ann. Damages	Residual Damages	Benefits	Average Annual Benefits (x $1,000 August, 2010 price level) Probability Residual Avg. Ann. Damages Exceed Indicated Amount 0.95	0.75	0.50	0.25	0.05
Residential	2,200.30	1,459.94	740.36					
Commercial	5,594.91	3,037.74	2,557.17					
Public	119.94	115.86	4.08					
Apartments	1.49	2.71	-1.22					
Outbuildings	77.45	52.16	25.29					
Subtotal - Structures and Contents	7,994.09	4,668.41	3,325.68					
Streets, roads	1,893.89	1,093.74	800.15					
Utilities	60.73	35.07	25.66					
Railroad	193.28	111.62	81.66					
Vehicles	343.28	198.24	145.03					
Agriculture	101.00	14.40	1,561.01					
Irr. Drains	36.01	20.80	15.21					
LFCC	6,386.84	3,688.45	2,698.39					
Avoided Water Losses	0.00	0.00	0.00					
Recreation	822.84	29.79	793.05					
East Bank	294.28	308.64	-14.36					
Emergency Costs	158.79	24.36	134.44					
TOTAL	**18,285.03**	**10,193.51**	**9,565.92**					

Table F-50-C-2

AVERAGE ANNUAL BENEFITS (FUTURE, NO TIFFANY) BY LAND USE CATEGORY

Base levee + 1 ft

LAND USE CATEGORY	EAD	Residual Damages	Benefits	Average Annual Benefits (x $1,000 August, 2010 price level) Probability Avg. Ann. Damages Exceed Indicated Amount 0.95	0.75	0.50	0.25	0.05
Residential	2,200.30	644.16	1,556.14					
Commercial	5,594.91	1,346.37	4,248.54					
Public	119.94	76.54	43.40					
Apartments	1.49	1.03	0.46					
Outbuildings	77.45	21.81	55.64					
Subtotal - Structures and Contents	7,994.09	2,089.91	5,904.18					
	0.00							
Streets, roads	1,893.89	772.04	1,121.85					
Utilities	60.73	24.75	35.97					
Railroad	193.28	78.79	114.49					
Vehicles	343.28	139.94	203.34					
Agriculture	101.00	8.96	1,673.60					
Irr. Drains	36.01	14.68	21.33					
LFCC	6,386.84	2,603.58	3,783.26					
Avoided Water Losses	0.00	0.00	0.00					
Recreation	822.84	17.02	805.82					
East Bank	294.28	308.64	-14.36					
Emergency Costs	158.79	16.86	141.94					
TOTAL	**18,285.03**	**6,075.17**	**13,791.41**					

Table F-50-C-3

AVERAGE ANNUAL BENEFITS (FUTURE, NO TIFFANY) BY LAND USE CATEGORY

Base levee + 2 ft

LAND USE CATEGORY	EAD	Residual Damages	Benefits	Average Annual Benefits (x $1,000 August, 2010 price level) Probability Avg. Ann. Damages Exceed Indicated Amount 0.95	0.75	0.50	0.25	0.05
Residential	2,200.30	262.08	1,938.22					
Commercial	5,594.91	545.01	5,049.90					
Public	119.94	54.95	64.99					
Apartments	1.49	0.38	1.11					
Outbuildings	77.45	9.05	68.40					
Subtotal - Structures and Contents	7,994.09	871.47	7,122.62					
	0.00							
Streets, roads	1,893.89	411.77	1,482.13					
Utilities	60.73	13.20	47.52					
Railroad	193.28	42.02	151.26					
Vehicles	343.28	74.63	268.64					
Agriculture	101.00	14.97	1,715.29					
Irr. Drains	36.01	7.83	28.18					
LFCC	6,386.84	1,388.62	4,998.22					
Avoided Water Losses	0.00	0.00	0.00					
Recreation	822.84	9.93	812.91					
East Bank	294.28	308.64	-14.36					
Emergency Costs	158.79	9.31	149.48					
TOTAL	**18,285.03**	**3,152.40**	**16,761.89**					

Table F-50-C-4

AVERAGE ANNUAL BENEFITS (FUTURE, NO TIFFANY) BY LAND USE CATEGORY

Base levee + 3 ft

LAND USE CATEGORY	EAD	Residual Damages	Benefits	Average Annual Benefits (x $1,000 August, 2010 price level) Probability Avg. Ann. Damages Exceed Indicated Amount 0.95	0.75	0.50	0.25	0.05
Residential	2,200.30	98.96	2,101.34					
Commercial	5,594.91	204.16	5,390.75					
Public	119.94	35.47	84.47					
Apartments	1.49	0.15	1.34					
Outbuildings	77.45	3.64	73.81					
Subtotal - Structures and Contents	7,994.09	342.38	7,651.71					
	0.00							
Streets, roads	1,893.89	233.08	1,660.81					
Utilities	60.73	7.47	53.25					
Railroad	193.28	23.79	169.49					
Vehicles	343.28	42.25	301.03					
Agriculture	101.00	9.94	1,782.54					
Irr. Drains	36.01	4.43	31.58					
LFCC	6,386.84	786.02	5,600.82					
Avoided Water Losses	0.00	0.00	0.00					
Recreation	822.84	9.93	812.91					
East Bank	294.28	308.64	-14.36					
Emergency Costs	158.79	5.34	153.46					
TOTAL	**18,285.03**	**1,773.26**	**18,203.25**					

Table F-50-C-5

AVERAGE ANNUAL BENEFITS (FUTURE, NO TIFFANY)
BY LAND USE CATEGORY

Base levee + 4 ft

LAND USE CATEGORY	EAD	Residual Damages	Benefits	Average Annual Benefits (x $1,000 August, 2010 price level) Probability Avg. Ann. Damages Exceed Indicated Amount 0.95	0.75	0.50	0.25	0.05
Residential	2,200.30	35.82	2,164.48					
Commercial	5,594.91	73.86	5,521.05					
Public	119.94	21.02	98.92					
Apartments	1.49	0.05	1.44					
Outbuildings	77.45	1.40	76.05					
Structures and Contents	7,994.09	132.15	7,861.94					
	0.00							
Streets, roads	1,893.89	191.03	1,702.87					
Utilities	60.73	6.13	54.60					
Railroad	193.28	19.50	173.78					
Vehicles	343.28	34.62	308.65					
Agriculture	101.00	8.44	1,801.87					
Irr. Drains	36.01	3.63	32.38					
LFCC	6,386.84	186.62	6,200.22					
Avoided Water Losses	0.00	0.00	0.00					
Recreation	822.84	9.93	812.91					
East Bank	294.28	308.64	-14.36					
Emergency Costs	158.79	4.23	154.56					
TOTAL	**18,285.03**	**904.92**	**19,089.42**					

Table F-51-A EXPECTED VALUE AND PROBABILISTIC VALUES OF NET BENEFITS FOR PROPOSED PROJECTS

PRESENT CONDITIONS

Plan	Expected Annual NED Benefit and NED Cost (x $1,000)			Probability Net Benefit Exceeds Indicated Amount (x $1,000)				
	Benefits*	Cost	Net Benefits	0.05	0.25	0.5	0.75	0.95
No Action	0.00	0.00	0.00					
Base levee	6,560.12	10,167.55	-3,607.43					
Base levee + 1 ft	7,566.27	10,481.15	-2,914.88					
Base levee + 2 ft	7,855.34	10,810.92	-2,955.58					
Base levee + 3 ft	7,952.23	10,961.72	-3,009.49					
Base levee + 4 ft	7,980.40	11,076.74	-3,096.34					

* From Benefits in Table F-11-A.

Table F-51-B EXPECTED VALUE AND PROBABILISTIC VALUES OF NET BENEFITS FOR PROPOSED PROJECTS

FUTURE CONDITIONS

Plan	Expected Annual NED Benefit and NED Cost (x $1,000)			Probability Net Benefit Exceeds Indicated Amount (x $1,000)				
	Benefits*	Cost	Net Benefits	0.05	0.25	0.5	0.75	0.95
No Action	0.00	0.00	0.00					
Base levee	3,325.68	10,167.55	-6,841.87					
Base levee + 1 ft	5,904.18	10,481.15	-4,576.97					
Base levee + 2 ft	7,122.62	10,810.92	-3,688.30					
Base levee + 3 ft	7,651.71	10,961.72	-3,310.01					
Base levee + 4 ft	7,861.94	11,076.74	-3,214.80					

* From Benefits in Table F-11-B.

Table F-52-A EXPECTED VALUE AND PROBABILISTIC VALUES OF BENEFIT/COST RATIOS FOR PROPOSED PROJECTS

PRESENT CONDITIONS

Plan	Expected Benefit/Cost Ratio	Probability Benefit/Cost Ratio Exceeds Indicated Value				
		0.05	0.25	0.5	0.75	0.95
No Action						
Base levee	1.20					
Base levee + 1 ft	1.43					
Base levee + 2 ft	1.53					
Base levee + 3 ft	1.58					
Base levee + 4 ft	1.62					

Table F-52-B EXPECTED VALUE AND PROBABILISTIC VALUES OF BENEFIT/COST RATIOS FOR PROPOSED PROJECTS

FUTURE CONDITIONS

Plan	Expected Benefit/Cost Ratio	Probability Benefit/Cost Ratio Exceeds Indicated Value				
		0.05	0.25	0.5	0.75	0.95
No Action						
Base levee	0.33					
Base levee + 1 ft	0.56					
Base levee + 2 ft	0.66					
Base levee + 3 ft	0.70					
Base levee + 4 ft	0.71					

Table F-57	CONDITIONAL PROBABILITY OF DESIGN NON-EXCEEDANCE			
FLOODPLAIN				
FUTURE CONDITIONS				
	Conditional Probability of Design			
	Containing Indicated Event			
	(vulnerable location identified)			
Plan	10%	2%	1%	0.20%
XSEC 1394				
No Action	0.000	0.000	0.000	0.000
Base levee	0.943	0.685	0.501	0.206
Base levee + 1 ft	0.982	0.822	0.661	0.339
Base levee + 2 ft	0.995	0.912	0.795	0.500
Base levee + 3 ft	0.999	0.962	0.890	0.662
Base levee + 4 ft	1.000	0.986	0.949	0.797

Table F-58	CONDITIONAL PROBABILITY OF DESIGN NON-EXCEEDANCE	
SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN		
FUTURE CONDITIONS		
Plan	Annual Performance (Expected Annual Probability of Design Being Exceeded - vulnerable location)	Annual Performance (Expected Annual Probability of Design Being Exceeded - worst case scenario)*
	XSEC 1394	
No Action	0.999	0.999
Base levee	0.032	0.430
Base levee + 1 ft	0.015	0.178
Base levee + 2 ft	0.007	0.170
Base levee + 3 ft	0.003	0.098
Base levee + 4 ft	0.002	0.005
* Includes unpopulated areas.		

Table F-59-A	ANNUAL PERFORMANCE AND EQUIVALENT LONG-TERM RISK					
SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN						
	Annual Performance	Equivalent Long-term Risk				
Plan	(Expected Annual Probability of Design being Exceeded - vulnerable location identified)	(Probability of Exceedance Over Indicated Time Period)				
		10 years	20 years	25 years	30 years	50 years
	XSEC 1394					
No Action	0.999	1.000	1.000	1.000	1.000	1.000
Base levee	0.032	0.277	0.477	0.555	0.622	0.802
Base levee + 1 ft	0.015	0.140	0.261	0.315	0.365	0.530
Base levee + 2 ft	0.007	0.071	0.136	0.167	0.197	0.307
Base levee + 3 ft	0.003	0.033	0.066	0.082	0.097	0.157
Base levee + 4 ft	0.002	0.019	0.037	0.046	0.055	0.091

Table F-59-B	ANNUAL PERFORMANCE AND EQUIVALENT LONG-TERM RISK					
SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN						
Plan	Annual Performance (Expected Annual Probability of Design being Exceeded - worst case scenario)*	Equivalent Long-term Risk (Probability of Exceedance Over Indicated Time Period)				
		10 years	20 years	25 years	30 years	50 years
No Action	0.999	1.000	1.000	1.000	1.000	1.000
Base levee	0.430	0.996	1.000	1.000	1.000	1.000
Base levee + 1 ft	0.178	0.858	0.980	0.992	0.997	1.000
Base levee + 2 ft	0.170	0.846	0.976	0.991	0.996	1.000
Base levee + 3 ft	0.098	0.643	0.873	0.924	0.955	0.994
Base levee + 4 ft	0.005	0.048	0.094	0.116	0.137	0.218

* Includes unpopulated areas

Table F-60	CONDITIONAL PROBABILITY OF DESIGN NON-EXCEEDANCE			
FLOODPLAIN				
FUTURE CONDITIONS				
	Conditional Probability of Design Containing Indicated Event (worst case scenario)*			
Plan	10%	2%	1%	0.20%
No Action	0.000	0.000	0.000	0.000
Base levee	0.088	0.053	0.014	0.001
Base levee + 1 ft	0.182	0.123	0.043	0.005
Base levee + 2 ft	0.330	0.234	0.101	0.021
Base levee + 3 ft	0.508	0.388	0.197	0.055
Base levee + 4 ft	0.678	0.563	0.336	0.126

* Includes unpopulated areas.

Table F-61
CONDITIONAL PROBABILITY OF DESIGN NON-EXCEEDANCE BY EVENT AND DAMAGE CENTER
SAN ACACIA TO BOSQUE DEL APACHE FLOODPLAIN

		Preproject		Base, no Tiffany		Base + 1', no Tiffany		Base + 2', no Tiffany		Base + 3', no Tiffany		Base + 4', no Tiffany	
Damage Center	Event	**Start of Damages (stage)**	Non-Exceedance Probability (decimal)	**Start of Damages (stage)**	Non-Exceedance Probability (decimal)	**Start of Damages (stage)**	Non-Exceedance Probability (decimal)	**Start of Damages (stage)**	Non-Exceedance Probability (decimal)	**Start of Damages (stage)**	Non-Exceedance Probability (decimal)	**Start of Damages (stage)**	Non-Exceedance Probability (decimal)
XSEC 1190	10%	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
future	4%		0		0		0		0		0		0
	1%		0		0		0		0		0		0
	0.20%		0		0		0		0		0		0
XSEC 1218	10%	**4661.9**	0	**4661.96**	0.9977	**4661.96**	0.9997	**4661.96**	1	**4661.96**	1	**4661.96**	1
future	4%		0		0.7284		0.8407		0.9147		0.9576		0.9803
	1%		0		0.5081		0.6473		0.7654		0.8557		0.9195
	0.20%		0		0.1629		0.2624		0.3876		0.5339		0.6796
XSEC 1256	10%	**4641.4**	0	**4641.4**	0.9946	**4641.4**	0.999	**4641.4**	0.9998	**4641.4**	1	**4641.4**	1
future	4%		0		0.7664		0.8772		0.9412		0.9748		0.9904
	1%		0		0.5168		0.6716		0.7981		0.8905		0.9479
	0.20%		0		0.3337		0.4913		0.6539		0.7921		0.8926
XSEC 1268	10%	**4635.8**	0	**4635.8**	0.8646	**4635.8**	0.9497	**4635.8**	0.9848	**4635.8**	0.9964	**4635.8**	0.9993
future	4%		0		0.6482		0.7993		0.9014		0.9585		0.9849
	1%		0		0.5051		0.6715		0.8085		0.9032		0.9592
	0.20%		0		0.3927		0.5652		0.7248		0.8485		0.9297
XSEC 1299	10%	**4620.57**	0	**4618.26**	0.9791	**4619.28**	0.9953	**4620.31**	0.9991	**4621.34**	0.9998	**4622.37**	1
future	4%		0		0.7099		0.8421		0.9245		0.9679		0.9883
	1%		0		0.4865		0.6455		0.7802		0.8779		0.9396
	0.20%		0		0.2921		0.4417		0.6031		0.7486		0.8602
XSEC 1312/1316	10%	**4616.03**	0	**4615.97**	0.9427	**4617.17**	0.9806	**4618.38**	0.9953	**4619.58**	0.9987	**4620.78**	0.9998
future	4%		0		0.6539		0.7809		0.8839		0.9467		0.9783
	1%		0		0.5057		0.6623		0.7956		0.8907		0.9396
	0.20%		0		0.1798		0.3053		0.4624		0.6218		0.8602
XSEC 1327	10%	**4604.12**	0	**4600.01**	0.8229	**4606.44**	0.9272	**4612.87**	0.9759	**4619.29**	0.9937	**4625.72**	0.9985
future	4%		0		0.6126		0.7702		0.881		0.9468		0.9793
	1%		0		0.5127		0.6791		0.8131		0.9053		0.9602
	0.20%		0		0.2749		0.4324		0.6038		0.7565		0.8707
XSEC 1339	10%	**4598.85**	0	**4599.1**	0.8129	**4600.14**	0.9213	**4601.18**	0.9727	**4602.22**	0.9924	**4603.26**	0.998
future	4%		0		0.6113		0.7696		0.8829		0.9491		0.9808
	1%		0		0.5018		0.6713		0.8102		0.9056		0.9607
	0.20%		0		0.3092		0.4739		0.6446		0.7898		0.8933
XSEC 1346	10%	**4594.19**	0	**4594.57**	0.8311	**4595.09**	0.9284	**4595.61**	0.9749	**4596.13**	0.9929	**4596.65**	0.9983
future	4%		0		0.67		0.8154		0.9106		0.963		0.9869
	1%		0		0.5331		0.6972		0.8282		0.9161		0.9651
	0.20%		0		0.3057		0.4696		0.6408		0.7865		0.8908
XSEC 1360	10%	**4591.6**	0	**4592.09**	0.9649	**4592.57**	0.9913	**4593.06**	0.9983	**4593.54**	0.9998	**4594.03**	0.9999
future	4%		0		0.6947		0.8318		0.9191		0.9657		0.9873
	1%		0		0.5032		0.6643		0.7978		0.8924		0.9495
	0.20%		0		0.2065		0.3386		0.4997		0.6624		0.7961
XSEC 1394	10%	**4576.95**	0	**4577.73**	0.7162	**4577.81**	0.8641	**4577.89**	0.9463	**4577.97**	0.9834	**4578.04**	0.9955
future	4%		0		0.5154		0.69		0.828		0.9183		0.9674
	1%		0		0.3942		0.5691		0.7273		0.8493		0.9281
	0.20%		0		0.2098		0.3502		0.5182		0.6836		0.8165
XSEC 1400	10%	**4577.03**	0	**4577.65**	0.6208	**4577.69**	0.8508	**4577.73**	0.9594	**4577.77**	0.9921	**4577.81**	0.9987
future	4%		0		0.4293		0.6283		0.7929		0.9023		0.9616
	1%		0		0.3313		0.5069		0.6776		0.8164		0.9099
	0.20%		0		0.1888		0.3239		0.4921		0.6614		0.8004
XSEC 1414	10%	**4570.7**	0	**4571.29**	0.5412	**4571.41**	0.7285	**4571.54**	0.8651	**4571.66**	0.9449	**4571.78**	0.9816
future	4%		0		0.3985		0.5837		0.747		0.8693		0.9446
	1%		0		0.2787		0.4396		0.6137		0.7663		0.8761
	0.20%		0		0.1222		0.2274		0.3787		0.5502		0.7106
XSEC 1433/1450	10%	**4564.82**	0	**4565.6**	0.5055	**4565.79**	0.6903	**4565.98**	0.8335	**4566.17**	0.925	**4566.36**	0.9718
future	4%		0		0.3722		0.5519		0.719		0.8483		0.9307
	1%		0		0.2612		0.4188		0.593		0.7493		0.8633
	0.20%		0		0.1152		0.2166		0.3643		0.5358		0.6978
XSEC 1473/1477/1	10%	**4541.42**	0	**4542.19**	0.4086	**4542.2**	0.598	**4542.21**	0.761	**4542.22**	0.8791	**4542.23**	0.95
future	4%		0		0.3023		0.473		0.6478		0.7949		0.8973
	1%		0		0.209		0.3524		0.5231		0.6901		0.8203
	0.20%		0		0.0904		0.1774		0.3115		0.4793		0.648
XSEC 1491	10%	**4538.4**	0	**4539**	0.2585	**4539.18**	0.9998	**4539.36**	0.6117	**4539.53**	0.7702	**4539.71**	0.8834
future	4%		0		0.181		0.9998		0.4909		0.6627		0.8013
	1%		0		0.1194		0.9999		0.3731		0.5456		0.7055
	0.20%		0		0.0423		0.9998		0.1961		0.3361		0.5047
XSEC 1517.2	10%	**4523.84**	0	**4524.52**	0.0883	**4524.65**	0.1824	**4524.78**	0.3302	**4524.91**	0.5075	**4525.04**	0.6782
future	4%		0		0.0527		0.1234		0.2339		0.3884		0.56332
	1%		0		0.0143		0.0425		0.1008		0.1968		0.3357
	0.20%		0		0.0013		0.0053		0.0209		0.0553		0.126
XSEC 1550	10%	**4512.6**	0	**4513.28**	0	**4613.49**	0	**4513.71**	0	**4513.92**	0	**4514.14**	0
future	4%		0		0		0		0		0		0
	1%		0		0		0		0		0		0
	0.20%		0		0		0		0		0		0
XSEC 1603.7	10%	**4499.22**	0	**4500.07**	0	**4500.29**	0	**4500.52**	0	**4500.74**	0	**4500.97**	0
future	4%		0		0		0		0		0		0
	1%		0		0		0		0		0		0
	0.20%		0		0		0		0		0		0
XSEC 1641	10%	**0**	1	**0**	1	**0**	1	**0**	1	**0**	1	**0**	1
future	4%		1		1		1		1		1		1
	1%		1		1		1		1		1		1
	0.20%		1		1		1		1		1		1

Non-exceedance probability is the likelihood of events being less than or equal to the start of damages volume.
is15 Alt. 1 project is less effective at containing the 0.2% event, but is more effective than smaller projects at containing more frequent events.

Table F-62

EQUIVALENT ANNUAL DAMAGES BY LAND USE CATEGORY

TOWN OF SOCORRO ONLY

LAND USE CATEGORY	Average Annual Damages (x $1,000 August, 2010 price level)					
		XSEC 6	XSEC 7	XSEC 8	XSEC 9	
	Total	1327	1339	1346	1360	
Residential	1,426.64	16.69	9.39	18.06	1,382.50	
Commercial	4,696.06	8.55	2.02	5.11	4,680.38	
Public	76.13	0.00	0.00	0.00	76.13	
Apartments	0.34	0.00	0.28	0.00	0.06	
Outbuildings	21.80	0.07	0.06	0.08	21.59	
East Bank						
Subtotal - Structures and	**6,220.97**	**25.31**	**11.75**	**23.25**	**6,160.66**	
Streets, roads	427.42					
Utilities	29.72					
Railroad	11.64					
Vehicles	253.80					
Agriculture	0.00					
Irr. Drains	4.42					
LFCC	538.41	167.39	3.43	163.59	204	
Avoided Water Losses	0.00					
Recreation	0.00					
East Bank	0.00					
Emergency Costs	104.15					
TOTAL	**7,590.52**					

Table F-63

EQUIVALENT ANNUAL BENEFITS
BY LAND USE CATEGORY

TOWN OF SOCORRO ONLY

Base levee

LAND USE CATEGORY			Average Annual Benefits (x $1,000 August, 2010 price level)					
	EAD	Residual Damages	Benefits	XSEC 6 1327	XSEC 7 1339	XSEC 8 1346	XSEC 9 1360	
Residential	1,426.64	350.96	1075.68	5.10	6.18	15.54	324.14	
Commercial	4,696.06	871.28	3824.78	1.97	1.29	7.03	860.99	
Public	76.13	16.92	59.21	0.00	0.00	0.00	16.92	
Apartments	0.34	0.33	0.01	0.00	0.28	0.00	0.05	
Outbuildings	21.80	3.54	18.26	0.01	0.06	0.05	3.42	
Subtotal - Structures and Contents	6,220.97	**1,243.03**	4977.94	**7.08**	**7.81**	**22.62**	**1,205.52**	
Streets, roads	427.42	100.91	326.50					
Utilities	29.72	6.81	22.91					
Railroad	11.64	2.52	9.12					
Vehicles	253.80	35.69	218.10					
Agriculture	0.00	0.00	0.00					
Irr. Drains	4.42	1.11	3.31					
LFCC	538.41	0.97	537.44	0.54	0.01	0.24	0.18	
Avoided Water Losses	0.00	0.00	0.00					
Recreation	0.00	0.00	0.00					
East Bank	0.00	0.00	0.00					
Emergency Costs	104.15	2.50	101.65					
TOTAL	**7,590.52**	**1393.54**	**6,196.98**					

Table F-64

COMPARISON OF COSTS AND EQUIVALENT ANNUAL BENEFITS FOR RING LEVEE

TOWN OF SOCORRO ONLY

(x $1,000 August, 2010 price level)

	100 yr levee	100 yr levee + 1 ft	100 yr levee + 2 ft	100 yr levee + 3 ft	100 yr levee + 4 ft
Construction Cost	14,232.23	14,824.27	15,447.06	15,729.36	15,943.55
Tiffany Basin					
LFCC reroute					
PED (9%)	1,280.90	1,334.18	1,390.24	1,415.64	1,434.92
Total First Cost	15,513.13	16,158.46	16,837.30	17,145.00	17,378.47
IDC, Construction (30 months, 4-3/8%)*	692.37	729.20	767.99	787.39	802.25
Total, Interest During Construction	692.37	729.20	767.99	787.39	802.25
Total Investment	16,205.50	16,887.66	17,605.29	17,932.39	18,180.72
Avg. Ann. Cost (4-3/8%, 50 yr. project life)	803.42	837.24	872.82	889.04	901.35
OMRR&R					
Total Avg. Ann. Cost	803.42	837.24	872.82	889.04	901.35
Equivalent Avg. Ann. Benefits	6,196.98	6,343.95	7,015.73	7,292.38	7,391.63
Benefit/Cost Ratio	7.71	7.58	8.04	8.20	8.20
Net Benefits	5,393.56	5,506.70	6,142.91	6,403.35	6,490.28

Table F-65

COMPARISON OF RECOMMENDED PLAN TO AUTHORIZED PLAN - BENEFITS AND COSTS

Category	Authorized Project			LRR/SEIS (August 2010)
	1988 Decision Document	**1993 Decision Document**	**Values in Current Prices[3]**	**Preliminary Preferred Plan**
Structures or Parcels in 0.2% probability floodplain	Not available	Not available	Not available	1,828
Structures or Parcels in 1% probability floodplain	884	Not available	884	1,522
Total Value of Damageable Property	216.3 million	Not available	363.95	231.8 million[5]
Damages 1% Probability Event	150.5 million	Not available	253.24	238.4 million
Damage 0.5% Probability Event	Not available	Not available	Not available	282.4 million
Price Level	Feb-87	Oct-93	Aug-10	Aug-10
Interest Rate	$8^5/_8$%	$8^1/_4$%	4-$^3/_8$%	4-$^3/_8$%
Period of Analysis	100 years	50 years	50 years	50 years
Risk-Based	No	No	No	Yes
EAD – Without-Project (existing)	Not available	12.996 million	Not available	18.2 million4
EAD – With-Project	Not available	967 thousand	Not available	0.2 million4
Benefits	10.98 million[1]	12,029 thousand	18.48	18 million4
Annual Costs	3.31 million[1]	5.11 million	5.57	11.1 million4
Net Benefits	7.67 million[1]	6.92 million[1]	12.91	6.9 million4
B/C	3.3	2.3	3.3	1.62

[1] October 1988 Price Level, $8^5/_8$%

[2] October 1993 Price Level, $8^1/_4$%

[3] Will incorporate information in subsequent submittals.

[4] Based on the NED Levee Plan – 100-Year Levee + 4 feet.

[5] Structures and contents only

Table F-66

COMPARISON OF RECOMMENDED PLAN TO AUTHORIZED PLAN - COST APPORTIONMENT

Item	Authorized Project (October 1993 Prices)		Authorized Project (August 2010 Prices)		Preliminary Preferred Plan (Program Year, 1 Oct 2013 Prices)	
	Federal	Non-Federal	Federal	Non-Federal	Federal	Non-Federal
Construction[a] (Flood Risk Management)	$54,499,000		$91,702,000		243,183.74	
LERRDs		0		0	-c	993.00
Total First Cost (Flood Risk Management)	**$54,499,000**	**$0**	**$91,702,000**		**$243,184**	**$993**
Mandatory 5% Cash	($1,697,050)	$2,725,000	($4,585,100)	$4,585,100	($12,200)	$12,200
Subtotals	$52,801,950	$2,725,000	$87,116,900	$4,585,100	$230,984	$13,193
Percentage of Total Cost-Shared Amount	*95%*	*5%*	*95%*	*5%*	*95%*	*5%*
Additional Cash to Provide Minimum Non-Federal Share of Total Project Costs	($10,899,800)	$10,899,800	($18,340,400)	$18,340,400	($48,600)	$48,600
Subtotals	$25,455,750	$8,485,250	$68,776,500	$22,925,500	$182,384	$61,793
Percentage of Total Cost-Shared Amount	*75%*	*25%*	*75%*	*25%*	*75%*	*25%*
Adjustment due to Benefits to Federal Properties	$5,091,150[d]	($5,091,150)	$8,566,600	($8,566,600)	$25,200	($25,200)
TOTALS	**$30,546,900**	**$3,394,100**	**$77,343,100**	**$14,358,900**	**$207,584**	**$36,593**
Percentage of Total Cost-Shared Amount	*90%*	*10%*	*84%*	*16%*	*85.01%*	*14.99%*

[a] Does not include OMRR&R, which is a 100% non-Federal cost. $35,600

[b] Total construction costs includes construction management.

[c] LERRDs costs were not incorporated to match information as presented in the Economic Appendix.

[d] Provisions of PL 99-662 as identified in 1988 Decision Document.

Table F-67

COMPARISON OF RECOMMENDED PLAN TO AUTHORIZED PLAN - EAD

	Authorized Project (x$1,000)					LRR/SEIS (August 2010)		
Category	1988 Decision Document	1993 Decision Document	Price Level Update Factor	Values in Current Prices3	Basis of Price Level update	Preliminary Preferred Plan	Difference	Basis of Difference
Residential Structure		429	1.69	725.3229483	ENR Construction Cost Index	2,200	1033	Additional structures evaluated, perched channel evaluation, new structure and content curves, risk based analysis, new H&H data, price level update of structures, content damages a function of structure value
Residential Content		293	1.51	442.43	CPI-U (annual average)			
Commercial Structure		84	1.69	142.0212766	ENR Construction Cost Index	5,593.65	5151	Additional structures evaluated, perched channel evaluation, new structure, risk based analysis, new H&H data, price level update of structures and contents
Commercial Content		199	1.51	300.49	CPI-U (annual average)			
Public Structure		45	1.69	76.08282675	ENR Construction Cost Index	119.94	-128	Additional structures evaluated, perched channel evaluation, new structure, risk based analysis, new H&H data, price level update of structures and contents
Public Content		114	1.51	172.14	CPI-U (annual average)			
Vehicles		179	1.05	188.6166738	CPI (New and Used Motor Vehicles, US City Average, Not seasonally adjusted)	343.28	155	Price level update of vehicles, risk based analysis, vehicles a function of additional structures in floodplain, perched channel evaluation
Transportation Facilities		676	1.69	1142.933131	ENR Construction Cost Index	2,087.17	944	Railroad track length included in floodplain
Utilities		253	1.69	427.7545593	ENR Construction Cost Index	60.73	-367	
Crops		128	1.42	182.2955854	PPI (Farm Products, US Average, Not seasonally adjusted)	101.00	-81	Updated crop budgets yield lower revenues on per acre basis. Less acreage in production as a result.
Irrigation Facilities		378	1.69	639.0957447	ENR Construction Cost Index	36.01	-603	
RG LFCC		7,760	1.69	13120.06079	ENR Construction Cost Index	6,366.73	-6753	Perched channel evaluation
Avoided Water Losses		696	1.42	991.2322457	PPI (Farm Products, US Average, Not seasonally adjusted)	0.00	-991	Value of water in Middle Rio Grande basin increased, new volume of water saved.
Rural Improvements		326	1.69	551.1778116	ENR Construction Cost Index	77.40	-474	Potential damage category mismatch,. Present evaluation put "Outbuildings" in this category.
Recreation (Bosque Del Apache)		37	1.51	55.87	CPI-U (annual average)	822.84	767	Price level changes. Also inclusion of specialized recreation values for winter visitation.
Sediment		1,198	1.69	2025.493921	ENR Construction Cost Index	0.00	-2025	Current recommended plan does not include sediment management features.
Emergency Costs		201	1.51	303.51	CPI-U (annual average)	157.59	-146	
East Bank		Not evaluated				272.25	272	Prior studies did not examine potential for induced damages.
TOTAL		12,996		21486.52751		18,238.87	-3248	

Table F-68

COMPARISON OF RECOMMENDED PLAN TO AUTHORIZED PLAN - AVERAGE ANNUAL BENEFITS

Category	Authorized Project (x$1,000)					LRR/SEIS (August 2010)	
	1988 Decision Document	**1993 Decision Document**	**Price Level Update Factor**	**Values in Current Prices3**	**Basis of Price Level update**	**Preliminary Preferred Plan**	**Difference**
Residential Structure		352	1.69	595.1367781	ENR Construction Cost Index	2,178	1225
Residential Content		237	1.51	357.87	CPI-U (annual average)		
Commercial Structure		65	1.69	109.8974164	ENR Construction Cost Index	5546.81	5207
Commercial Content		152	1.51	229.52	CPI-U (annual average)		
Public Structure		36	1.69	60.8662614	ENR Construction Cost Index	107.04	-106
Public Content		101	1.51	152.51	CPI-U (annual average)		
Vehicles		147	1.05	154.8974919	CPI (New and Used Motor Vehicles, US City Average, Not seasonally adjusted)	315.43	161
Transportation Facilities		560	1.69	946.8085106	ENR Construction Cost Index	1,947.51	1001
Utilities		213	1.69	360.1253799	ENR Construction Cost Index	56.66	-303
Crops		114	1.42	162.3570058	PPI (Farm Products, US Average, Not seasonally adjusted)	94.86	-68
Irrigation Facilities		317	1.69	535.9612462	ENR Construction Cost Index	33.60	-502
RG LFCC		7,440	1.69	12579.02736	ENR Construction Cost Index	6,294.46	-6285
Avoided Water Losses		667	1.42	949.9309021	PPI (Farm Products, US Average, Not seasonally adjusted)	0.00	-950
Rural Improvements		280	1.69	473.4042553	ENR Construction Cost Index	76.53	-397
Recreation (Bosque Del Apache)		34	1.51	51.34	CPI-U (annual average)	812.91	762
Sediment		1,149	1.69	1942.648176	ENR Construction Cost Index		-1943
Emergency Costs		165	1.51	249.15	CPI-U (annual average)	154.72	-94
East Bank		Not evaluated				-2.64	-3
TOTAL		12,029		19911.45078		17,615.42	-2296

NOTE: The August 2010 analysis combines structure and content information into the applicable Structure category.

GENERAL REEVALUATION REPORT AND

SUPPLEMENTAL ENVIRONMENTAL

IMPACT STATEMENT II:

RIO GRANDE FLOODWAY,

SAN ACACIA TO BOSQUE DEL APACHE UNIT,

SOCORRO COUNTY, NEW MEXICO

APPENDIX F-11

Real Estate

RIO GRANDE FLOODWAY

SAN ACACIA TO BOSQUE DEL APACHE

UNIT PROJECT

SOCORRO COUNTY, NEW MEXICO

REAL ESTATE PLAN

JULY 2013

US Army Corps
of Engineers
Albuquerque District
South Pacific Division

TABLE OF CONTENTS

RIO GRANDE RIVER FLOODWAY FLOOD RISK MANAGEMENT PLAN
REAL ESTATE PLAN ANALYSIS

1. INTRODUCTION:

This report is tentative in nature, focuses on the Recommended Plan , and is to be used for planning purposes only. There may be modifications to the plans that occur as implementation documents for each phase are developed, thus changing items such as the final acquisition area(s) and/or administrative and land cost. The Albuquerque District's integrated General Reevaluation Report (GRR) and Supplemental Environmental Impact Statement II (SEIS-II) addresses alternative plans to provide higher levels of flood risk management to floodplain communities along the Rio Grande River from the San Acacia Diversion Dam (SADD) downstream to Elephant Butte Lake, New Mexico, within the San Acacia to Bosque del Apache Unit of the Rio Grande River Floodway. This reach of the Rio Grande River was included in a comprehensive plan for flood risk management in the Rio Grande basin, originally authorized in 1948.

This GRR/SEIS-II is the final response to determine (1) whether the authorized project is still implementable; (2) if any changes are necessary for implementation; and (3) if the changes are within the approval authority delegated to the Division Commander, the Chief of Engineers, or if they require additional Congressional authorization. This GRR/SEIS-II presents recommendations on future actions to best meet the flood risk management needs within the study area. This Real Estate Plan (REP) is prepared under the general guidelines of ER 405-1-12, Chapter 2 and Chapter 12.

Measures and alternatives evaluated in the current and previous analysis efforts can be found in detail in the GRR Report at Table 4.1. A Reevaluation Report was completed in 1989and a Supplemental EIS was completed in 1992.

The Recommended Plan is the National Economic Development (NED) Plan. This Real Estate Plan focuses on the recommended plan or National Economic Development (NED) Plan.

The recommended plans consists of an earthen levee extending approximately 43 miles along the west bank of the Rio Grande, from the San Acacia Diversion Dam to Tiffany Junction, which is approximately 3 miles north of the Railroad Bridge at San Marcial and ancillary features to the engineered levee. See Section 3 of the REP for further description of recommended plan.

a. INTERESTED PARTIES AND STAKEHOLDERS:

The principal land and facility managers in the Middle Rio Grande Valley include the Middle Rio Grande Conservancy District (MRGCD), Bureau of Reclamation (BOR) and the US Fish and Wildlife Service (FWS). The State of New Mexico (State Engineer and Interstate Stream Commission and Department of Game and Fish and Environmental Department) also has management roles and responsibilities in the project area.

This Proposed Project is being prepared in partnership with MRGCD and the New Mexico Interstate Stream Commission (NMISC), who are the interested non-federal cost sharing partners and would be the signatories to a Project Partnership Agreement. The Middle Rio Grande Conservancy District (MRGCD) and the State of New Mexico Interstate Stream Commission (NMISC) support the Recommended Plan (TSP). Partnership interests follow:

MRGCD: Local sponsor responsible for obtaining and granting access and easements for all phases of levee construction which fall under their jurisdiction, consisting of approximately 444.36 acres in project Segments 1 through 4 and a portion of Segment 5, provides input to USACE and non-federal cost share. MRGCD will assume operation and maintenance of levees which fall under their jurisdiction after construction and have done so historically using their cooperative agreement with BOR.

NMISC: Local Sponsor responsible for obtaining and granting access and easements for all phases of levee construction which fall under their jurisdiction, consisting of approximately 363.41 acres in a portion of project Segment 5 and Segment 6, provides input to USACE, non-federal cost share and review of overall project design and to ensure the project does not have implications to New Mexico obligations to the Rio Grande Compact. NMISC will assume responsibility for levee operation and maintenance in areas which fall under their jurisdiction after construction and have done so historically using their cooperative agreement with BOR.

BOR: The Bureau is a federal stakeholder for the project and is the managing federal agency of the lands of the Rio Grande channel and Low Flow Conveyance Channel (LFCC) for a large portion of the project consisting of approximately 608.95 acres in Segments 1 through 5 and a portion of Segment 6. The lands ownership is currently in dispute with the local sponsor, MRGCD, as explained in Section 5, paragraph 6 of this plan. As the ownership dispute is not resolved, the Bureau’s approval for the project is necessary. Additionally, the Bureau constructed and maintains the low flow conveyance channel (LFCC) which exists throughout the entire project area and accounts for all of the federal benefits on the project.

DOI, U.S. Fish and Wildlife Service: The Service is an interested party for the portions of the project, consisting of approximately 196.34 acres that will be constructed and maintained within the Sevilleta and Bosque del Apache National Wildlife Refuges (NWR) located in Segments 3 and portions of Segments 5 and 6. NWR cooperation for the project is necessary. Additionally, there are a few NWR facilities that will be protected by the project.

The U.S. Army Corps of Engineers will be responsible for all engineering design, analysis, permitting and compliance, NEPA and ESA compliance, and construction and oversight.

b. BACKGROUND:

The study area has a long history of flood damage. Recorded flood history in the study area dates back to the 1920s. Before that time, newspaper accounts identify major floods that occurred in July 1895 and September 1904. Recorded major floods, which would have exceeded the methods for accomplishing flood risk management in the study area have been evaluated for compliance with Corps planning policy as well as the National Environmental Policy Act (NEPA), both of which were established after 1948.

MRGCD was formed in 1925, primarily because of concerns over a decrease in irrigated areas in the Middle Rio Grande Valley resulting from water shortages, poor drainage, inadequate irrigation facilities, and periodic flooding. From 1925 to 1935 the MRGCD constructed El Vado Dam, a storage reservoir on the Rio Chama, four major irrigation diversion dams on the Rio Grande one of which is San Acacia, two canal headings, 345 miles of main irrigation canals, and rehabilitated old irrigation ditches. The San Acacia Diversion Dam (SADD) diverts water from the Rio Grande to provide irrigation water to fields in the Socorro area. MRGCD operates and maintains irrigation and flood control management facilities in the Middle Rio Grande Valley.

Endangered or Threatened Species of the project area are the Rio Grande Silvery Minnow, the Southwestern Willow Flycatcher, the Interior Least Tern, and the Pecos Sunflower.

2. PROJECT AUTHORITY:

The Rio Grande Floodway, San Acacia to Bosque del Apache Unit flood control project was authorized for construction by section 203 of the Flood Control Act of 1948, as amended by section 204 of the Flood Control Act of 1950, and in accordance with the Chief of Engineers Report dated April 5, 1948, as found in House Document No. 243, 81st Congress, 1st Session.

The Flood Control Act of 1948 concluded the flood problems of the Rio Grande Basin were severe and could be addressed under the Corps' flood risk management program in conjunction with the BOR which would strive to provide a stable channel having a lower river bed so that controlled releases of 5,000 cfs could be efficiently carried and also provide a lower river bed so that the channel effectively drains the river valley lands and results in a lower water table. Due to changes within the basin over the years, including budgetary requirements, real estate constraints, flood risk management features implemented in the upper watershed, and environmental concerns the features of the project have changed several times.

The recommended levee plan has been divided into 20 phases and 6 segments (see Exhibit C) for funding and manageable construction purposes and construction contracts will be issued and sequenced from segment 1 to segment 6 with multiple contracts needed to build each segment, with the exception of segment 3 which is recommend as one contract. Local sponsors, MRGCD and NMISC, have requested that construction begin at the Socorro diversion channel and proceed south to Brown Arroyo. Three activities relating to the proposed work below the ordinary high water mark OHWM are planned and include 1) earthen levee construction; 2) placement of riprap along the riverward slope and toe of the levee and; 3) a temporary river crossing to access the east side of the river to excavate a terrace above the OHWM. Material from the spoil bank will be used to build the proposed engineered levee, with some exceptions. The new levee cross section is narrower in the northern portion and gets larger as you proceed South than the existing spoil bank. The new levee design height is equivalent to the water surface elevation corresponding to the mean 1% chance flow, plus an additional 4 feet (base levee +4 ft).

In 1956 the United States Senate directed a review of the authorized plan (in addition to other elements contained in the Rio Grande Floodway) to determine whether any additions or modifications should be made. In response to this review an interim report was prepared, resulting in Cochiti and Galisteo Dams being authorized for construction by the Flood Control Act of 1960. In accordance with the recommendation of the Chief of Engineers, as found in House Document No. 243, 81st Congress, 1st Session, dated 5 April 1948, which reads as follows:

"The comprehensive plan for the Rio Grande Basin as set forth in the report of the Chief of Engineers, dated April 5, 1948, and in the report of the Bureau of Reclamation (BOR), dated November 21, 1947, all in substantial accord with the agreement approved by the Secretary of the Army and the Acting Secretary of the Interior on November 21, 1947, is hereby approved except insofar as the recommendations in those reports are inconsistent with the provision of this Act and subject to authorization and limitations set forth herein."

The approval granted above shall be subject to the following conditions and limitations:

a. Construction of the spillway gate at Chamita Dam, later relocated and renamed Abiquiu Dam and Reservoir shall be deferred so long as New Mexico shall have accrued debits as defined by the Rio Grande Compact and until New Mexico shall consistently accrue credits pursuant to the Rio Grande Compact;

b. Chiflo Dam and Reservoir later relocated and renamed Cochiti Dam and Lake Project on the Rio Grande shall be excluded from the Middle Rio Grande Project authorized herein without prejudice to subsequent consideration of Chiflo Dam and Reservoir by the Congress:

c. The BOR, in conjunction with other interested federal agencies, is directed to make studies to determine feasible ways and means of reducing non-beneficial consumption of water by native vegetation in the floodplain of the Rio Grande and its principle tributaries above Caballo Reservoir; and

d. At all times when New Mexico shall have accrued debits as defined by the Rio Grande Compact all reservoirs constructed as part of the project shall be operated solely for flood control except as otherwise required by the Rio Grande Compact, and at all times all project works shall be operated in conformity with the Rio Grande Compact as it is administered by the Rio Grande Compact Commission.

A 1961 Senate Resolution directed further review of the 1948 Chief of Engineers Report to include the Rio Puerco and the Rio Salado.

Title 1 of the Water Resources Development Act (WRDA) of 1992 (Public Law 102-580) revised the project cost sharing as follows: "Notwithstanding any other provision of law, the project for flood control, Rio Grande Floodway, San Acacia to Bosque del Apache Unit, New Mexico, authorized by Section 203 of the Flood Control Act of 1948 (Public Law 80-858) and amended by Section 204 of the Flood Control Act of 1950 (Public Law 81-516), is modified to more equitably reflect the non-federal benefits from the project by reducing the non-federal contribution for the project by that percentage of benefits which is attributable to the federal properties; except that, for purposes of this subsection, Federal property benefits may not exceed 50 percent of the total project benefits" as directed by CECW policy guidance dated 22 February 1993. The cost-sharing for this project reduces the non-Federal share by the percentage of benefits attributed to federal properties.

3. PROJECT LOCATION:

The project area comprises a stretch of the Rio Grande extending from the San Acacia diversion dam (SADD), near the historic community of San Acacia and located 12 miles north of Socorro, south through the Bosque del Apache National Wildlife Refuge to the headwaters of BOR's Elephant Butte Reservoir, south of the former village of San Marcial at Tiffany Junction. The San Acacia to Bosque del Apache Unit is the southern-most section of the Middle Rio Grande Valley, comprising 58 miles between the SADD and the northern end of Elephant Butte Reservoir just below the San Marcial Railroad Bridge. The principal city in this reach is Socorro with a 2010 census population of 9,051. In addition, six small agricultural villages occur on the flood plain: Polvadera, Lemitar, Escondida, Luis Lopez, San Antonio, and San Marcial. The project area is entirely contained within Socorro County, New Mexico.

4. PROJECT DESCRIPTION:

The San Acacia to Bosque del Apache Unit Project is a single-purpose flood control management project including mitigation of adverse effects. The Recommended Plan consists of replacement of the existing spoil banks to form a structurally sound levee paralleling the BOR Low Flow Conveyance Channel (LFCC).

The proposed project would remove approximately 43 miles of non-engineered spoil banks adjacent to the Rio Grande Floodway and replace them with engineered levees along the west bank of the Rio Grande capable of containing at least the mean 1%-chance flood event. The spoil banks were constructed with excess material removed while excavating the adjacent low flow conveyance channel (LFCC).

San Acacia Reach

The San Acacia Division has a markedly different floodway configuration than the two reaches directly to the north. The river here is unconstrained by a levee on its east side. The floodway can be over 2,000 feet wide in places and the river channel quite variable in width (from 100 to over 1,000 feet). Several small discontinuous drains on the east side of the river serve to drain water from relatively small farmed areas back to the river. The LFCC currently serves as the riverside drain on the west side of the floodway. The LFCC is larger and deeper than most other riverside drains in the middle valley. South of Escondida, the LFCC does not return water to the river. Because of aggradation of the river bed, water in the LFCC is conveyed directly to Elephant Butte Reservoir. Significant bosque flooding can and does occur south of Escondida. Most irrigation, including that on the Bosque del Apache, occurs west of the floodway and is served by the Socorro Main Canal and the LFCC. In sharp contrast to the reaches to the north, sediment is being deposited by the river, and the river bed has aggraded in the reach from just north of NM–380 south. In some places near San Marcial the bed of the river is 5–10 feet higher than the valley floor to the west and 2–3 feet higher than the valley floor to the west, creating a significant flood risk. Levee sloughing, overtopping, and bank erosion of the levee are potential flood threats. Significant amounts of money are spent each year by the BOR and the ISC to keep the river channel open and reduce the risk of a levee failure. However, the existing flood risks significantly constrain upstream releases from the Corps of Engineers flood control reservoirs, which limits the potential for flooding of the bosque in upstream reaches.

Low Flow Conveyance Channel

The Middle Rio Grande LFCC is an artificial riprap lined channel that parallels the Rio Grande on the west side and extends the length of a 54-mile reach of the Rio Grande from San Acacia to San Marcial. The LFCC collects river seepage and irrigation surface and subsurface return flows, thus reducing evaporation.   It is part of the 1948 Rio Grande Basin authorization for the purpose of reducing consumption of water, providing more effective sediment transport, improving valley drainage, and to aid delivery of Rio Grande compact waters. The LFCC has not actively diverted water from the Rio Grande since the 1980's but does deliver water to the MRGCD's Socorro diversion and to wetlands in the Bosque del Apache NWR. The LFCC is owned, operated, and maintained by the BOR. Construction began in 1951 and was completed in 1959. BOR estimates it spends $2M annually on levee maintenance and the Interstate Stream Commission has spent $11.3M over the past 9 years to dredge and maintain a pilot channel through the main stem of the Rio Grande to mitigate sediment accumulation at the headwaters of the Elephant Butte Reservoir, at the southern extent of the study area.

The usefulness of the LFCC is dependent upon the water level of Elephant Butte Reservoir. Depending upon the condition of the outfall, a maximum of 2,000 cfs can be diverted into the LFCC at San Acacia. Diversions from the river into the LFCC began in 1953, and diversions at San Acacia began in 1960. With above average water years the reservoir was relatively full through the 1980s. During this time the lowest reaches of the LFCC, which were inundated by the reservoir, became filled with sediment. This made the outfall of the LFCC difficult to maintain, and therefore diversions ceased in 1985. Since that time the LFCC has carried only drainage and irrigation return flows, with minor exceptions. Currently the spoil dike that protects the LFCC (and surrounding lands such as the Bosque del Apache National Wildlife Refuge) from Rio Grande flooding is threatened by overtopping downstream of the Bosque del Apache Wildlife Refuge because of sediment deposition in the river channel. Environmental groups have also raised concerns about the impacts of future LFCC operations on the bosque, wildlife resources, and endangered species in the river below San Acacia Diversion Dam. The states of Colorado, New Mexico, and Texas, and farmers in the lower Rio Grande have raised concerns that compact deliveries will be impaired if the LFCC is not operated. Due to these factors and the condition of the channel outlet, operations of the LFCC as originally intended are not currently possible.

In order to meet needs of the endangered Rio Grande silvery minnow, the BOR began pumping from the LFCC into the Rio Grande at four locations in 2000. These pump sites begin approximately 20 miles downstream of San Acacia Diversion Dam at the Neil Cupp pump site are located at the northern and southern boundaries of the Bosque del Apache National Wildlife Refuge, approximately 6 and 16 miles downstream respectively from the Neil Cupp location. Finally pumping occurs at the Fort Craig site approximately 10 miles downstream from the southern boundary of the Bosque del Apache National Wildlife Refuge. Fifteen pumps are currently available to supplement Rio Grande flows and manage river recessions consistent with the current Biological Opinion.

Low Flow Conveyance Channel Near Socorro NM

Current Land Uses

The Rio Grande corridor in Socorro County contains the largest contiguous undeveloped tracts of farmland in the Middle Rio Grande valley. The river and adjacent farmland function as a linked hydrologic and ecologic system, providing habitat to the endangered silvery minnow and southwestern willow flycatcher and some of the most significant remaining cottonwood–willow forest or “bosque” in the Rio Grande basin (in fact in the entire southwestern U.S.). The farmland in this reach, together with the managed field crops and wetland habitat at Bosque del Apache National Wildlife Refuge, provides winter habitat to more than 100,000 migratory waterfowl of the Rio Grande flyway. Farmland in the Middle Rio Grande valley is managed as small (less than 50 acres), medium (50 to 500 acres), and large (500 to 1,000 or more acres) farms. Socorro County operates more medium and large farms than the more populated counties of Valencia, Bernalillo, and Sandoval and cultivates more than 20,000 irrigated acres. The productive bottom lands of the Rio Grande produce some of New Mexico’s most delicious green chile and melons, and most nutritious alfalfa hay. The San Acacia reach stretches from the San Acacia Diversion Dam near the village of San Acacia southward to the Bosque del Apache National Wildlife Refuge and is contiguous with the Socorro Division of the Middle Rio Grande Conservancy District.

Recommended Plan

The San Acacia to Bosque del Apache Unit Project is a single-purpose flood control management project that includes mitigation of adverse effects. The Recommended Plan consists of replacement of the existing spoil banks to form a structurally sound levee paralleling the BOR Low Flow Conveyance Channel (LFCC). Adverse environmental impacts will be mitigated by revegetation in the floodplain and riparian zone of available areas reclaimed into the active floodplain.

The engineered levees will run approximately 43 miles along the west bank of the Rio Grande, from the San Acacia Diversion Dam (SADD) to Tiffany Junction, which is approximately 3 miles north of the Railroad Bridge at San Marcial. The Recommended Plan is located along the same alignment as the existing spoil bank system and parallels the LFCC.

The Recommend Plan is the National Economic Development (NED) Plan, which maximizes net economic benefits according to the GRR consistent with protecting the Nation's environment, as follows:

- The proposed levee embankment would have a crest width of 15 feet with 1V:2.5H and 1V:3H depending on the height of the levee. The levee height corresponds to 4 feet above the water surface elevation of the 1% chance mean exceedance event and levee height ranges from 1 foot at the northern end to 15.5 feet at the southern end.
- Material for the project would be obtained from existing spoil banks.
- For levee heights greater than 5 feet, 6-inch perforated pipe toe drain, discharge pipes into the LFCC, and risers as well as an 8-foot-wide by 4-foot-high inspection trench with 1V:1H side slopes would be required. In addition, a 2-foot-wide bentonite slurry trench would extend from 2-feet below the levee embankment crest to 5 feet into the foundation material.
- Ancillary features to the engineered levee in the project are 655 linear feet (LF) of concrete floodwall, approximately 3300 LF of overbank excavation, 2300 LF of channel excavation, approximately 6000 LF of soil cement bank armoring, approximately 395 LF roller compacted concrete, and rip-rap for erosion control at locations vulnerable to erosion from high stream velocities.

Earthen Levee Construction: The existing spoil bank will be removed, approximately one mile at a time, with bulldozers, scrapers, or excavators and the materials for the proposed levee will be stockpiled and mixed within the footprint of the levee alignment.

Riprap would be used for erosion protection along a total of 6.4 miles in various locations as determined by scour analysis of the riverward slope and toe for the proposed levee. Riprap would be installed in the areas most susceptible to scour during flood events and would be buried at depths of between 1 and 12 feet. It would be placed during levee construction when the area is dry.

Infrared aerials of the Rio Grande east bank were examined to determine the extent, if any, of induced damages which may be caused by placement of the proposed levee on the west bank. Those properties identified were then evaluated in the field for structure value and first floor elevation. Fifty (50) residential and commercial structures were located within the 100 year floodplain. The east bank inventory was generally limited to the small community of Pueblito, immediately upstream of Socorro, which sits on the west bank. The second area is northeast of the Village of San Antonio, consisting of residential and commercial structures along Bosquecito Road.

Aerial photos of floodplains downstream of the downstream extent of the proposed project were examined to determine the extent of induced flooding downstream attributable to the project. No properties were found. Any downstream flooding is more likely to occur because of changes in the Elephant Butte Reservoir stage rather than the Rio Grande flood stage.

5. REAL ESTATE REQUIREMENTS:

The current levee plan has been divided into 20 phases and 6 segments (see Exhibit C) for funding and manageable construction purposes. Construction contracts will be issued and sequenced from segment 1 to segment 6 with multiple contracts needed to build each segment, with the exception of segment 3 which is recommend to be completed under a single contract. Local sponsors have requested that construction begin at the Socorro diversion channel and proceed south to Brown Arroyo. As a result, the project's initial construction location will be known as phase 1, located in segment 1, beginning at the Socorro diversion channel with construction proceeding southward as funds allow for the funded fiscal year. As funds for the fiscal year are depleted, construction will cease until funding is in place for the project to proceed within the segment starting the next phase of construction. The project's phased construction will begin and end within a segment, by phases, as funding permits in the years ahead.

The requirements for lands, easements, rights-of-way and relocations (LERs/LERRDs) include permanent easements for construction of the engineered levee, an existing levee maintenance road, the levee footprint including a riverside 15' wide vegetation free zone, and ancillary features including a floodwall; temporary easements for access, staging areas, construction areas, and disposal areas; and fee interests required for environmental mitigation, totaling 1,147.9163 acres as outlined in the table below.

Most of the land needed for the construction, operation and maintenance of the proposed 43-mile engineered levee is currently owned in fee by either the Federal government or the NFSs. To the extent that neither the Federal Government nor either of the NFSs own the required LER, the NFSs will be responsible to provide the required LER as noted in the table below. Where the Federal Government owns the fee or otherwise asserts fee ownership, the Corps will work with the cognizant Federal agency to obtain, on behalf of the NFSs, all necessary rights to use such land for the purposes of the project.

The following acreage requirements were provided Albuquerque District Engineering Division. Maps are attached as exhibits.

Project Area	Project Feature	Acreage	Current Interest held by USA/ NFS	Standard Estate	Owner
Segments 1, 2, 3, 4, & 5 North of BDANWR	Levee	568.88	Fee	Flood Protection Levee Easement (FPLE)	[1]USA (BOR/BLM)
Segments 3, 5 & 6 of BDANWR & SNWR	Levee	196.34	Fee	FPLE	USA (USFW)
Segment 6	Levee	51.1902	None	FPLE	Private
Segment 3	Levee	9.5	None	FPLE	ATSF/BNSF Railroad
Segment 1	Levee	8.0861	None	FPLE	City of Socorro
Segment 6 in Tiffany Basin	Spoil Disposal Sites	307.220	None	TWAE	Private
Segment 6	Temp Staging Areas	2.0	[3]Fee	[2]TWAE	NMISC/TBD
Segment 6	Temp Construction Areas	2.0	[3]Fee	[2]TWAE	NMISC/TBD
Segment 3 San Acacia Diversion Dam	Ancillary features: Temp Construction Area	1.2	Fee	TWAE	MRGCD
Segment 3 San Acacia Diversion Dam	Ancillary features: Floodwall	1.5	None	FPLE	BNSF Railroad
	Total	1147.9163			

Table 1.

[1] There is ongoing dispute between the BOR and the MRGCD regarding title to certain land in segments 1 through 4 and a portion of segment 5 of the project. The Federal position is that the land is owned in fee by the Government. This position is disputed by the MRGCD; however, for the purposes of project planning it **i**s assumed that title is in the United States of America as discussed below.

[2]The precise location Temporary Work Area Easement will be determined at a later date in coordination with the construction contractor.

[3]The underlying estates are assumed to be held in fee by NMISC. A final determination of ownership will be made by the NFS prior to issuance of the certification of availability.

Lands required for mitigation are not noted separately. Mitigation consists of revegetation of areas disturbed during construction and will be completely within the project footprint. The lands required for mitigation are presently owned in fee by the Federal government or the NFS.

The MRGCD maintains and operates the project area from the SADD to an area north of the Bosque del Apache National Wildlife Refuge (NWR) as part of its contractual obligations outlined in a 1951 Agreement between BOR and the MRGCD for the Middle Rio Grande (MRG) Project. MRGCD will confirm its interest in the lands from Brown Arroyo to the northern boundary of the Bosque del Apache NWR. There is on-going dispute between BOR and the MRGCD regarding ownership of the land in (segments 1 through 4 and a portion of segment 5) of the project. Therefore, the Corps will enter into an agreement with the Bureau to allow the use of the land for project purposes in the event that the Bureau prevails in the dispute.

MRGCD acknowledges that it will not receive a credit for the disputed lands. BOR does not object to the use of its lands for this project. A Special Use Permit for use of the disputed lands will be obtained through the Corps. The disputed lands comprise 568.88 acres.

Approximately 9.5 acres at San Lorenzo Arroyo, located approximately 3 miles south of the SADD, required for a levee tie back at the San Lorenzo drainage basin are owned in fee by MRGCD. MRGCD will receive credit for these lands as they were acquired subsequent to the 1951 MRG project are not among the disputed lands.

It is noted that lands in the BDANWR and SNWR are in Federal ownership administered by the United States Fish and Wildlife Service (USFWS); BOR currently utilizes lands under an agreement with USFS. A Special Use Permit for use of USFWS lands will be obtained through the Corps.

In addition to lands currently owned by the Federal government and the NFSs, the following additional lands are required for the project:

a. Approximately 307 acres are required in temporary construction easement at Tiffany Sedimentation Basin to support disposal activities during construction. These privately-owned lands will be used for disposal of any waste soil not appropriate for reuse in the engineered levee. The local sponsor will receive credit for acquisition of the 307 acre easement at Tiffany Sedimentation Basin.

b. Approximately 1.5 acres in permanent flood protection levee easement at the SADD will be needed north of the SADD for construction of ancillary features to the engineered levee consisting of a flood wall to be located within the railroad right of way. The local sponsor will receive credit for acquisition of the 1.5 acre permanent easement.

c. Approximately 8.0861 acres owned by the City of Socorro in permanent flood protection levee easement at North Socorro Diversion/Arroyo, located in vicinity of Socorro, NM are required for a levee tie back.

d. Approximately 51.19 acres of privately owned land south of the Bosque del Apache Refuge in permanent flood protection levee easement for levee construction. The local sponsor will receive credit for acquisition of the permanent easement

Real Estate requirements for the levee construction and temporary work areas include approximately 1,147.9163 acres. Approximately 15 feet in width, would be required along the entire length of the 43 miles of the levee project next to the riverside toe for a vegetation-free zone width, which is the maximum width required under existing vegetation on levee regulations. Additionally, an area of approximately 22 feet in width and 25 feet riverward of the LFCC, the existing maintenance road, is required for the approximately 43 miles of the project. Exact locations for construction staging areas have not yet been determined; however, the areas will be within the existing MRGCD/BOR area of the LFCC. The existing haul road adjacent to and between the existing spoil-banks will be used for levee construction purposes. Turn-around areas will be located on the levee; therefore, no additional road easements and no new roads will be required.

The Sevilleta National Wildlife Refuge and Bosque del Apache NWR, managed by U.S. Fish and Wildlife Service, are a part of the National Wildlife Refuge System and subject to the provisions of the National Wildlife Refuge System Administration Act of 1966 (PL 89-669), which provides guidelines for administrations of lands and resources within the National Wildlife Refuge System. This Act authorizes the Secretary of the Interior to "permit the use of, or grant easements in, over, across, upon, through, or under any areas within the System for purposes such as, but not necessarily limited to, power lines, telephone lines, canals, ditches, pipelines, and roads, including the construction, operation, and maintenance thereof, whenever he determines that such uses are compatible with the purposes for which these areas are established." A compatibility determination has previously been received from the Fish and Wildlife Service reflecting a finding of project interrelationship with refuge purposes and goals. Approximately 30.34 acres of the Sevilleta NWR, located just south of the SADD, on the east side of the river, will be needed for overbank and channel excavation purposes. The Non-Federal sponsors (NFS) will acquire, through the Corps, any rights from the USFWS necessary to use these federal lands in the Sevilleta NWR to include a temporary construction use agreement or permit for this purpose. In the south-central reach of the project, the project cuts through the length of the Bosque del Apache NWR. The refuge would be temporarily affected by all construction activities, including dust, noise, personnel, and the movement of large construction equipment. NMISC will acquire, through the Corps, any real property interest necessary to use these federal lands for this purpose.

The project has been divided into 6 segments and within each segment there are multiple phases. Currently, the phases are defined into 20 geographical areas due to the nature of the construction project and the federal appropriations mechanism. Each phase ends as funding is depleted in the fiscal year and each subsequent phase begins in the new fiscal year as funding is authorized. Exhibit C is a map of the proposed segments. Real Estate certification of sufficient real property interests to support construction will be accomplished adequately in advance of the project's sequential phased progress and solicitations for construction contracts.

6. LERRDS OWNED BY THE NFS AND CREDITING:

The project's 43 mile length crosses Federal, Private, Non-Federal Sponsor (MRGCD and NMISC) lands for the construction of an engineered levee, mitigation and spoil sites, and flood wall utilizing existing access roads for maintenance and operation purposes.

As discussed above, approximately 9.5 acres at San Lorenzo Arroyo, located approximately 3 miles south of the SADD, required for a levee tie back at the San Lorenzo drainage basin are owned in fee by MRGCD. MRGCD will receive credit for these lands as they were acquired subsequent to the 1951 Middle Rio Grande Project.

As noted above, there is an ongoing dispute between the BOR and the MRGCD regarding title to 568.88 acres of land in segments 1 through 4 and a portion of segment 5 of the project. The dispute is in over with lands purchased in connection with the Middle Rio Grande Project constructed under the Flood Control Acts of 1948 and 1950. Besides improving and stabilizing the economy of the Middle Rio Grande Valley, the proposal sought to rescue and rehabilitate the Middle Rio Grande Conservancy District (MRGCD), organized with private capital in 1925 as a political subdivision of the State, but floundering by the late 1940s. To that end, the United States agreed to acquire the MRGCD's obligations and cancel all indebtedness in exchange for MRGCD's conveying and assigning "all of its property rights, including reservoirs, canals, dams, and flood-control works, together with its water rights, and including title and ownership thereto … such property so conveyed to the United States shall be so held until Congress otherwise directs."

In September, 1951 United States and the MRGCD, entered into a contract pursuant to the Reclamation Acts of 1902, 1948, and 1950 (1951 Repayment Contract). Central to its terms was the transfer of title to all MRGCD works, defined as:

> those structures, reservoirs, ditches and canals now constructed and operated by the District and those to be constructed or rehabilitated under the terms of this contract for the storage, diversion and distribution of water for use in the District, and the drainage of lands, together with rights of way therefor and for operation thereof.

The 1951 Repayment Contract provided that "title to all works constructed by the United States under this contract is vested in …the United States until otherwise provided for by Congress, notwithstanding the transfer hereafter of any such works to the District for operation and maintenance."

The Federal position is disputed by the MRGCD however, for the purposes of project planning – the Federal position is: The 1951 Repayment Contract assigned all of the MRGCD's water filings to the United States. Not simply full repayment but also approval by Congress must predicate the reversion of title to the MRGCD under the MRG Project Act and the 1951 Repayment Contract. Unless and until a Federal Court of competent jurisdiction decides otherwise, or Congress acts to revert or revest ownership in the MRGCD, we presume title to the MRG Project works remains in the United States.

For the purposes of project planning it is assumed that title is in the United States of America. Therefore, no credit will be provided for any disputed lands as part of MRGCD's local cost share.

7. STANDARD FEDERAL ESTATES AND NON-STANDARD ESTATES:

Estates that may be required for this project are as follows: Fee Estate for diversion dam structure, Temporary Easements for levee, spoil/mitigation/disposal areas, construction and staging areas, and road easements for road access. There are no non-standard estates. The following estates are listed for reference at this time and may be required for the project and will be populated later.

FEE

The fee simple title to (the land described in Acquisition Schedule) (Tract Nos. ___, and ___), subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

FLOOD PROTECTION LEVEE EASEMENT

A perpetual and assignable right and easement in (the land described in Schedule A) (Tracts Nos. __, __ and __) to construct, maintain, repair, operate, patrol and replace a flood protection levee, including all appurtenances thereto; reserving, however, to the owners, their heirs and assigns, all such rights and privileges in the land as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

TEMPORARY WORK AREA EASEMENT

A temporary easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos. __, __ and __), for a period not to exceed _____, beginning with date possession of the land is granted to the United States, for use by the United States, its representatives, agents, and contractors as a (borrow area) (work area), including the right to borrow and/or deposit fill, spoil and waste material thereon) (move, store and remove equipment and supplies, and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the ___________________Project, together with the right to trim, cut, fell and remove there from all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

BORROW EASEMENT

A perpetual and assignable right and easement to clear, borrow, excavate and remove soil, dirt, and other materials from (the land described in Schedule A) (Tracts Nos. __, __ and __); subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges in said land as may be used without interfering with or abridging the rights and easement hereby acquired.

MEMORANDUM OF AGREEMENT

A long term agreement between BOR and Corps of Engineers identifying the manner in which the project will be constructed, operated, repaired, and maintained for the anticipated duration of the project's beneficial existence and operation.

LICENSE/SPECIAL USE PERMIT

An agreement between BOR and Corps of Engineers identifying the manner, requirements, restrictions, and guidelines for construction work during each phase of the project.

There are no non-standard estates proposed or anticipated for the project.

8. DESCRIPTION OF ANY EXISTING FEDERAL PROJECTS IN OR PARTIALLY IN THE PROPOSED PROJECT:

The LFCC was constructed by BOR in the 1950's to aid the State of New Mexico in delivery of water obligated to Texas under the Rio Grande Compact (Compact). Prior to LFCC construction, the channel into Elephant Butte Reservoir was obstructed with sediment and vegetation such that no surface flows entered the reservoir, resulting in an estimated water loss of 140,000 acre-feet per year.

The Sevilleta NWR abuts the project area in the San Acacia vicinity and would be temporarily affected by all construction activities associated with the use of a 30.34-acre overbank area located just south of the SADD. In the south-central reach of the project, the project cuts through the length of the Bosque del Apache NWR. The refuge would be temporarily affected by all construction activities, including dust, noise, personnel, and the movement of large construction equipment. The LFCC is a valuable source of water for the Bosque del Apache NWR, which operates extensive water distribution systems throughout the refuge for waterfowl.

9. DESCRIPTION OF ANY FEDERALLY OWNED LAND NEEDED FOR THE PROJECT:

In addition to the disputed lands discussed in Section 6, the project will utilize lands within two U.S. Fish and Wildlife Service refuges; project requirements include 30.3 acres in the Sevilleta NWR and 196.3444 acres in Bosque del Apache NWR. The proposed project areas associated with these refuges contained acres are maintained and operated by BOR under the authorization of an existing Memorandums of Agreement/Understanding with USFWS.

Although the Project Partnership Agreement for this cost shared project will require that the NFS certify that sufficient property rights are owned by the NFS, to the extent land required for the project is owned or claimed by a Federal agency, the Corps will acquire from the Federal agency any federal interest necessary for the project. The Corps will acquire from the Department of Interior a license or special use permit for each parcel and for each phase of construction as well as a Memorandum of Agreement (MOA) for the entire project.

10. APPLICATION OF NAVIGATIONAL SERVITUDE TO THE LERRDS REQUIREMENT:

Not applicable.

11. PROJECT MAP:

Exhibit A depicts maps of the project area, Exhibit B is the associated land tract register and Exhibit C is the Segment Definition Map of the project area.

12. ANTICIPATED INCREASED FLOODING AND IMPACTS:

Hydraulic analyses performed by the Albuquerque District have indicated that implementation of the Recommended Plan, the engineered levee plan upstream of the San Marcial Railroad Bridge, has little to no effect on the likelihood of flooding to private and public lands.

Pre- and post-project floodplains on the East bank were evaluated to determine the change in equivalent annual damages (EAD) attributable to the proposed project. The start of damages was assumed to be the 10% chance exceedance event. The proposed levee projects do not have a measurable impact to the damageable property in the present condition, but a minor impact in the future. Therefore damage is di minimus.

13. COST ESTIMATE:

The cost estimate is based on November 30, 2012, Real Estate Cost Estimate prepared by Roger Jennings and Thurman Schweitzer, staff appraisers with the Fort Worth District, U.S. Army Corps of Engineers. The estimated land acquisition and administrative cost for the entire project is **$ 998,620** as indicated in Table 2 below**.** The date of valuation for Lands and Easements is October 29, 2012.

LERRDS	ACRES	COST
Lands and Easements ((Includes Borrow Sites) (01 Account)	1147.9163	**$ 416,900**
Incremental RE Costs (30% contingency) (01 Account)		**$ 125,070**
Facility/Utility Relocations Costs (Includes 23% contingency) (02 Account)		**$ 0**
Relocation Assistance Program P.L. 91-646 (Includes 23% contingency) (01 Account)		**$ 0**
Subtotal LERRDs		**$ 541,970**
*Non Federal Administrative Costs (including crediting) (01 Account)		**$ 174,150**
Total Non-Federal LERRDs		**$ 716,120**
**Federal Administrative Costs (01 Account)		**$ 282,500**
Total Real Estate Costs		**$ 998,620**

Table 2 – LERRDs and Cost

***Provided by Sponsor(s) **Provided by Albuquerque District**

A contingency for price changes through negotiations, undervaluation due to unknown conditions, court valuation differences, and unknown ownerships. No contingency is included for the Federally Owned Lands.

Typical Federal Real Estate costs include preparation of all Real Estate Reports, acquisition and review of all ownerships materials, review, coordination and planning meetings, review of documents, costs of legal reviews, mapping costs, and general administrative costs associated with the project, including monitoring activities. Here, the Federal Real Estate costs also include negotiation of use permits with BOR, BLM and USFS as necessary for each phase of construction.

14. PUBLIC LAW 91-646, RELOCATION ASSISTANCE BENEFITS:

Public Law 91-646, Uniform Relocation Assistance provides entitlement for various payments associated with federal participation in acquisition of real property. Title II makes provision for relocation expenses for displaced persons, and Title Ill provides for reimbursement of certain expenses incidental to transfer of property. There are no residential, tenant, business, or farm operations impacted by this project, i.e., no relocations are required.

15. MINERAL/TIMBER ACTIVITY:

Primary mineral resources that are present in the vicinity consist of sand and gravel. Commercial excavation and developed borrow pits exist in the Region, but not within the project area. Other mineral resources occurring in the area include barite, fluorite, calcite, uranium, silver, iron, perlite, and coal. The existing spoil-bank contains an appreciable quantity of excavated sand and gravel. There are no Oil and Gas activities/ownership within the project area. There are other mineral resources in the area, but not within the footprint of the project.

16. HAZARDOUS, TOXIC, AND RADIOLOGICAL WASTE IMPACTS:

According to the Hazardous, Toxic, and Radioactive Waste (HTRW) portion of Chapter 2, Section 2.3, of the Draft General Reevaluation Report and Supplemental Environmental Impact Statement (GRR/SEIS), Echota Technologies Corporation completed a Phase 1 Environmental Site Assessment on July 20 and August 8, 2005, of the project corridor in and around the Tiffany area which, includes the site of a former railroad maintenance facility roundhouse in the former town of San Marcial. Although the site is over 2,000 feet from the proposed levee alignment, the report states “if construction activities are anticipated near the former railroad facility, then a Phase II Environmental Site Investigation is recommended to verify the degradation of petroleum products”.

In addition, BOR operates two maintenance and storage facilities within the project area. The first maintenance facility is located 0.15 miles west of the SADD near the perimeter of the project limits, and the other is located 0.49 miles north-northwest of the LFCC near the Tiffany area. In the past, these two sites were identified as having some underground petroleum storage tanks leaks. BOR reported that the tanks were removed in 1991. The two sites are not expected to pose an HTRW risk unless construction activities are anticipated near either site. If construction activities are anticipated, a Phase II Environmental Site Investigation is recommended. None of these areas will be used for borrow areas, if borrow areas are needed.

17. NON-FEDERAL SPONSOR'S ABILITY TO ACQUIRE:

Assessments of the NMISC's and MRGCD's experience and capability to acquire real estate interest for the project are attached as Exhibit D and Exhibit E, respectively.

18. ZONING ANTICIPATED IN LIEU OF ACQUISITION:

There is no zoning modification proposed or anticipated at this time.

19. ACQUISITION SCHEDULE:

The following table is shown with Real Estate activities, projected for Phase 1 Fiscal Year 2013. Real Estate activities are planned to continue through the year 2026 to support the fourteen phases of construction that are planned. Schedules for future phases will be developed as funding is made available for this project. The detailed acquisition schedules will be developed for each Phase when the PPA has been executed and the final plans and specs developed for each Phase; and that Sponsors, PM and Real Estate Technical manager will formulate milestone schedule to meet dates for advertisement and award of construction contracts for each Phase.

Acquisition Tasks for Phase 1, Segment 3	**Due**
Real Estate Personnel meet with Non-Federal Sponsor (MRGCD)	After the Project Delivery Team has identified a Tentatively Selected Plan (completed)
Real Estate Plan (120 days) (actual <500)	28 Jun 2013
Prepare Acquisition Maps/Legal Descriptions for Phase 1 Construction	19 Oct 2012
Prepare Real Estate Cost Estimate	30 Nov 2012
Send Take Letter to NFS for Proof of LERRDs Ownership	03 May 2013
Real Estate Certificate of Sufficiency for Phase 1 Construction	28 Jul 2013
Obtain Right-of-Entry & License for Phase 1 Construction (MRGCD & BOR)	30Aug 2013
Prepare and Submit Credit Requests	14 Oct 2013
Review/Approve or Deny Credit Requests	14 Oct 2014
Establish Value for Creditable LERRDs	30 Nov 2014

Table 3.

The plans and specifications for phase 1 are being developed concurrently with the final review and approval of the General Reevaluation Report (GRR) and Environmental Impact Statement Report II. Phase 1 construction will begin 1000 feet west into the Socorro Diversion Channel to tie in the engineered levee to the Socorro Diversion then will proceed south along the existing spoil bank alignment south for approximately 3 miles.

Certification for construction of phase 1 is anticipated to be Aug 2013. All the necessary real estate interests for the entire project will be acquired or certification received in phases. The current estimate is that total project will require 20 phases to construct based on an assumed federal funding level of $10,000,000 per year. The Non-Federal Sponsors will be required to acquire the required real estate interests to support the construction of the project, one phase at a time and prior to advertisement of each phase of construction.

20. DESCRIPTION OF FACILITY AND UTILITY RELOCATIONS:

The term "relocation" shall mean providing a functionally equivalent facility to the owner of an existing utility, cemetery, highway or other public facility or town when such action is authorized in accordance with applicable legal principles of just compensation or as otherwise provided by Federal statute or any project report or House or Senate document referenced therein. Providing a functionally equivalent facility may take the form of adjusting, altering, lowering, raising, or replacement and attendant removal of the affected facility or part thereof. It is important to note that relocation assistance under Public Law 91-646 relates specifically to displaced persons, and should be distinguished from the separate concept of facility or utility relocations. Utilities and Facilities identified by District General Engineering Section and confirmed by Real Estate and described below. No facility or utility relocations are required for the project.

a. Facility Relocations: It is proposed to construct Project features consisting of a levee and a flood wall within the Railroad Right of way at the northern limits of the project adjacent to the San Acacia Diversion Dam in Segment 3. It has been determined that the features will not adversely impact the railroad facility and will not require adjusting, altering, or replacing the railroad facility.

b. Utility Relocations: Fiber optic communication lines, owned by CenturyLink (formerly Qwest), are known to exist within the spoil bank in Segments 5 and 6 and will be physically impacted as a result of construction of the engineered levee. If phases are funded as assumed, Segment 5 (phase 12) construction would begin at the earliest in federal fiscal year 2024 The Preliminary Attorney's Opinion of Compensability has determined that CenturyLink does not have a compensable interest in real property. A final attorney's opinion of compensability will be prepared. Neither the Government nor the Non-Federal Sponsor, MRGCD, has a legal obligation to relocate the communication line. As a result, any modification of the line or its location within the levee is not classified as relocation and any associated costs are not included as a LERRDs credit. A final opinion of compensability will be prepared as required by ER 405-1-12, 12-22. Total Project Cost (TPC) will be revisited in FY14 and adjusted as necessary.

21. ATTITUDE OF LANDOWNERS:

There is no known opposition to the project.

22. RISK LETTERS

Risk letters were sent to the two prospective non federal sponsors on 22 April 2013.

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

April 22, 2013

CESPL-AM-AB
Albuquerque Real Estate Branch

Mr. Subhas K. Shah
Chief Engineer
Middle Rio Grande Conservancy District
P.O. Box 581
Albuquerque, NM 87103-0581

Subject: Middle Rio Grande Floodway San Acacia to Bosque del Apache Project

Dear Mr. Shah:

During the planning and feasibility phase of civil projects, the U. S. Army Corps of Engineers identifies the estimated need and extent of real estate interests required for the proposed project. My staff and I have been working on the Middle Rio Grande Floodway San Acacia to Bosque del Apache Project real estate requirements and have come up with some initial estimates.

When real estate requirements are determined, Government regulations require us to send a letter advising the sponsor of the risks involved in acquiring necessary real estate interests prior to execution of the Project Partnership Agreement ("PPA").

This letter constitutes official notice of the risks involved with acquiring property rights for the proposed protection of the Middle Rio Grande Floodway for the flood control project located in the in the Middle Rio Grande Floodway from San Acacia Diversion Dam to Bosque del Apache Refuge, prior to the signing of the PPA. As the non-Federal sponsor, the Middle Rio Grande Conservancy District assumes full and sole responsibility for any and all costs, responsibility, or liability arising out of the acquisition effort. Generally, these risks include, but are not limited to, the following:

1. Congress may not appropriate funds to construct the proposed project;

2. The proposed project may otherwise not be funded or approved for construction.

3. A PPA, mutually agreeable to the non-Federal sponsor and the Government, may not be executed and implemented;

4. The non-Federal sponsor may incur liability and expense by virtue of its ownership of contaminated lands, or interests therein, whether such liability should arise out of local, state, or Federal laws or regulations including liability arising out of CERCLA as mentioned;

5. The non-Federal sponsor may acquire interests or estates that are later determined by the Government to be inappropriate, insufficient, or otherwise not required for the project;

6. The non-Federal sponsor may incur costs or expenses in connection with its decision to acquire or perform LERRD (lands, easements, rights-of-way, relocations, disposal areas) activities in advance of the executed PPA and the Government's notice to proceed which might not be creditable under the provisions of Public Law 99-662 or the PPA; and The non-Federal sponsor may initially acquire insufficient or excessive real property acreage which may result in additional negotiations and/or benefit payments under P.L. 91-646 as well as the payment of additional fair market value to affected landowners which could have been avoided by delaying acquisition until after PPA execution and the Government's notice to commence acquisition and performance of LERRD.

If you have any questions please contact Mr. Mark Turkovich, at 505-342-3256/343-6270 or Mark.Turkovich@uasce.army.mil or feel free to contact me at 505-342-3225 or Richard.W.Rodier@usace.army.mil.

Sincerely,

Richard W. Rodier
Branch Chief, Albuquerque Branch
Asset Management Division
Los Angeles District
U.S. Army Corps of Engineers

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

April 22, 2013

CESPL-AM-AB
Albuquerque Real Estate Branch

Mr. Estevan López
Director
New Mexico Interstate Stream Commission
P.O. Box 25102
Santa Fe, NM 87504-5102

Subject: Middle Rio Grande Floodway San Acacia to Bosque del Apache Project

Dear Mr. López:

During the planning and feasibility phase of civil projects, the U. S. Army Corps of Engineers identifies the estimated need and extent of real estate interests required for the proposed project. My staff and I have been working on the Middle Rio Grande Floodway San Acacia to Bosque del Apache Project real estate requirements and have come up with some initial estimates.

When real estate requirements are determined, Government regulations require us to send a letter advising the sponsor of the risks involved in acquiring necessary real estate interests prior to execution of the Project Partnership Agreement ("PPA").

This letter constitutes official notice of the risks involved with acquiring property rights for the proposed protection of the Middle Rio Grande Floodway for the flood control project located in the in the Middle Rio Grande Floodway from Bosque del Apache Refuge to Tiffany Basin, prior to the signing of the PPA. As the non-Federal sponsor, the Middle Rio Grande Conservancy District assumes full and sole responsibility for any and all costs, responsibility, or liability arising out of the acquisition effort. Generally, these risks include, but are not limited to, the following:

1. Congress may not appropriate funds to construct the proposed project;

2. The proposed project may otherwise not be funded or approved for construction.

3. A PPA, mutually agreeable to the non-Federal sponsor and the Government, may not be executed and implemented;

4. The non-Federal sponsor may incur liability and expense by virtue of its ownership of contaminated lands, or interests therein, whether such liability should arise out of local, state, or Federal laws or regulations including liability arising out of CERCLA as mentioned;

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6. The non-Federal sponsor may incur costs or expenses in connection with its decision to acquire or perform LERRD (lands, easements, rights-of-way, relocations, disposal areas) activities in advance of the executed PPA and the Government's notice to proceed which might not be creditable under the provisions of Public Law 99-662 or the PPA; and The non-Federal sponsor may initially acquire insufficient or excessive real property acreage which may result in additional negotiations and/or benefit payments under P.L. 91-646 as well as the payment of additional fair market value to affected landowners which could have been avoided by delaying acquisition until after PPA execution and the Government's notice to commence acquisition and performance of LERRD.

If you have any questions please contact Mr. Mark Turkovich, at 505-342-3256/343-6270 or Mark.Turkovich@uasce.army.mil or feel free to contact me at 505-342-3225 or Richard.W.Rodier@usace.army.mil.

Sincerely,

Richard W. Rodier
Branch Chief, Albuquerque Branch
Asset Management Division
Los Angeles District
U.S. Army Corps of Engineers

Real Estate Plan

Exhibit A

Project Maps

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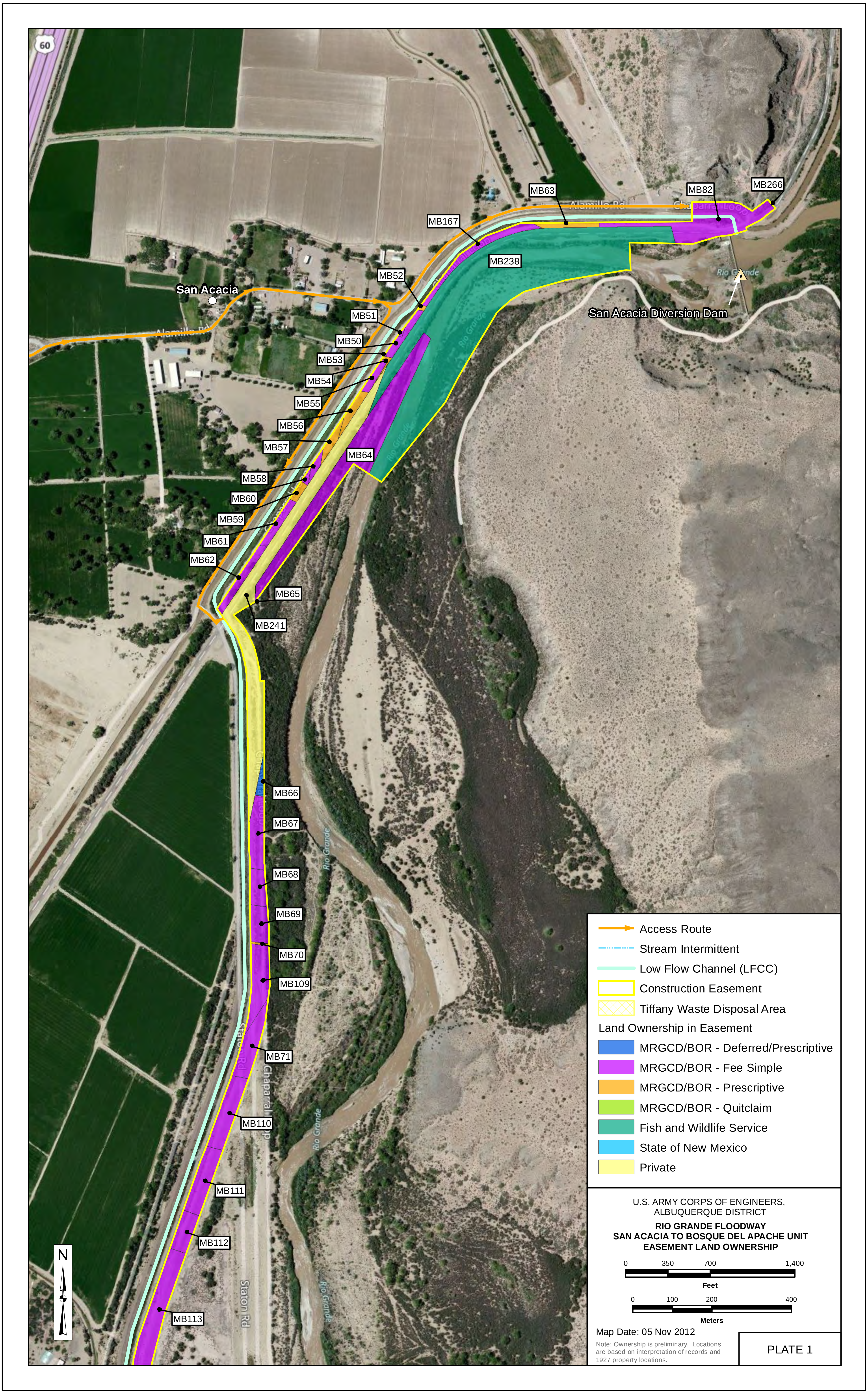
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San Acacia Diversion Dam
Rio Grande
Staton Rd
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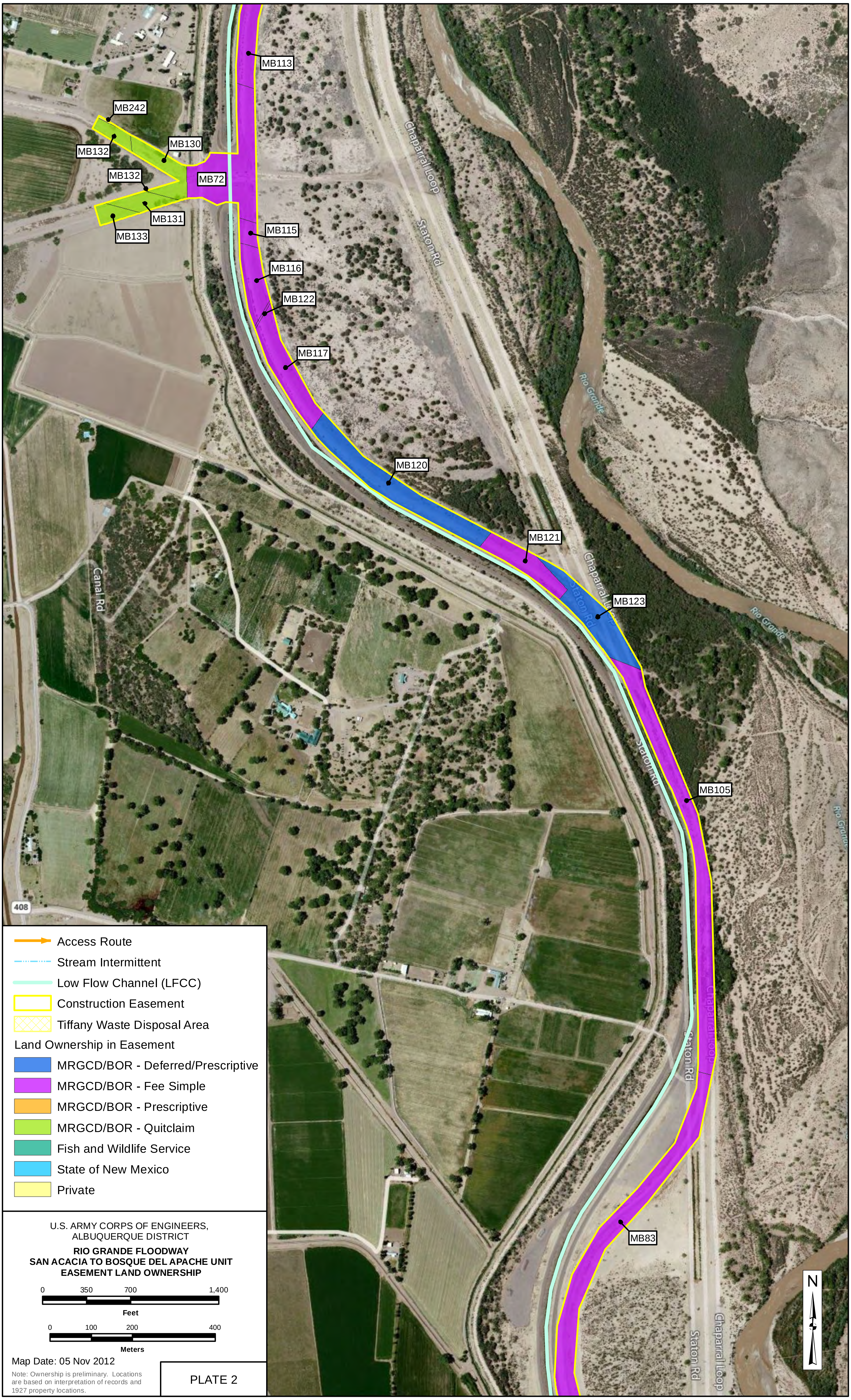
N
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 1

EXHIBIT A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Chaparral Loop
Staton Rd
Rio Grande
Canal Rd
408
N
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
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Feet
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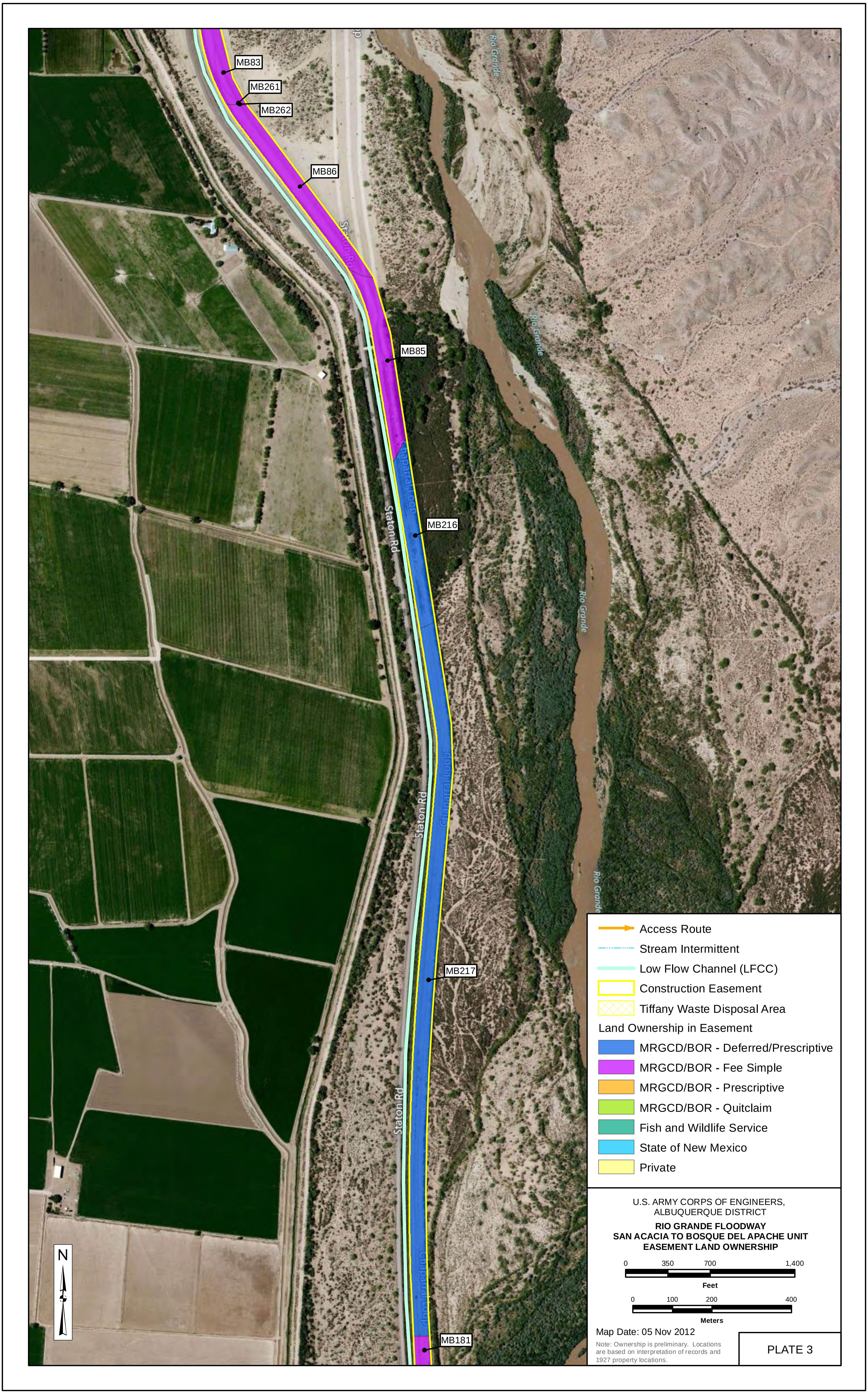
PLATE 2

EXHIBIT A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Chaparral Loop
Rio Grande
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
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EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
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Meters
Map Date: 05 Nov 2012
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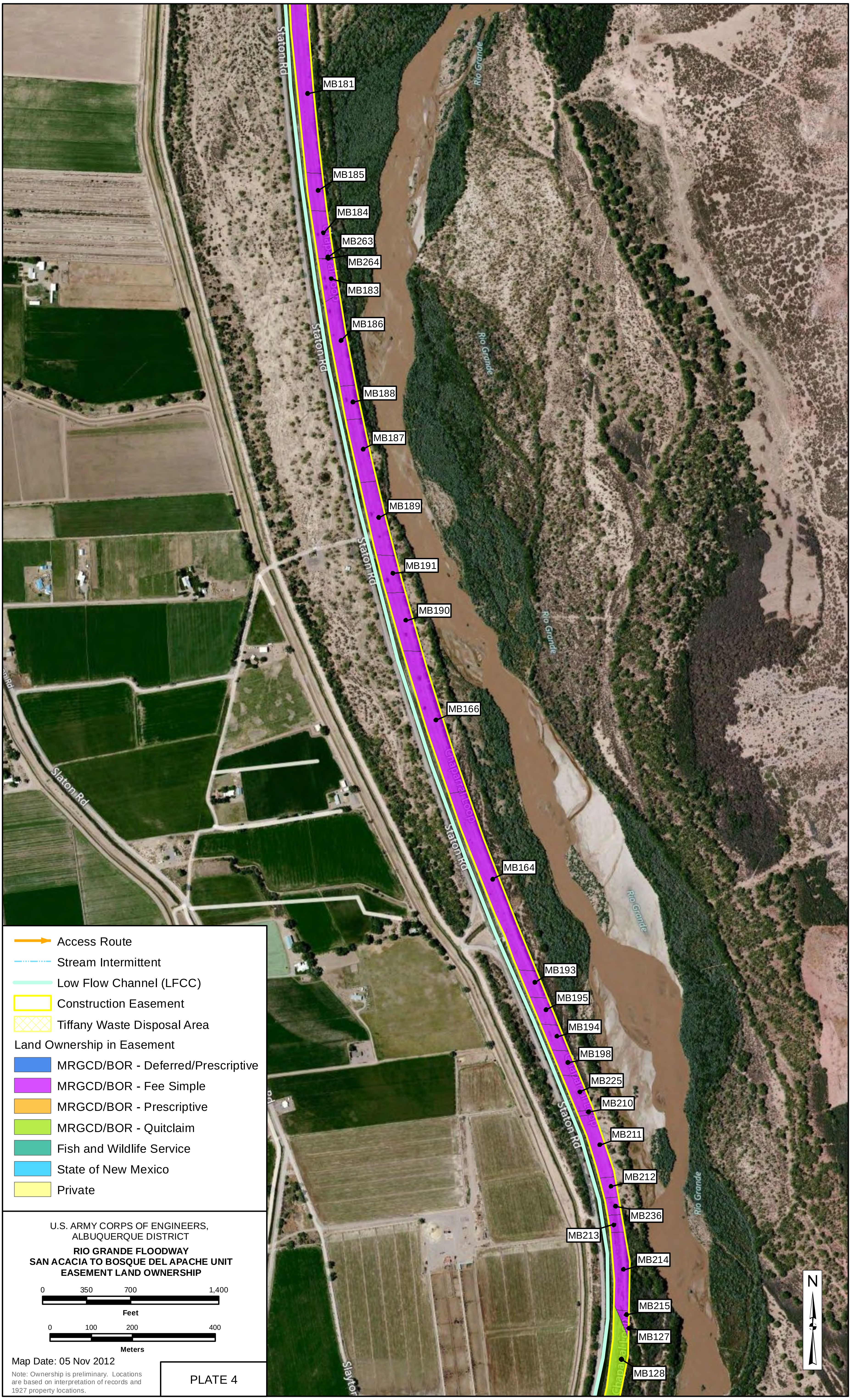
PLATE 3
N

EXHIBIT A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0 100 200 400
Meters
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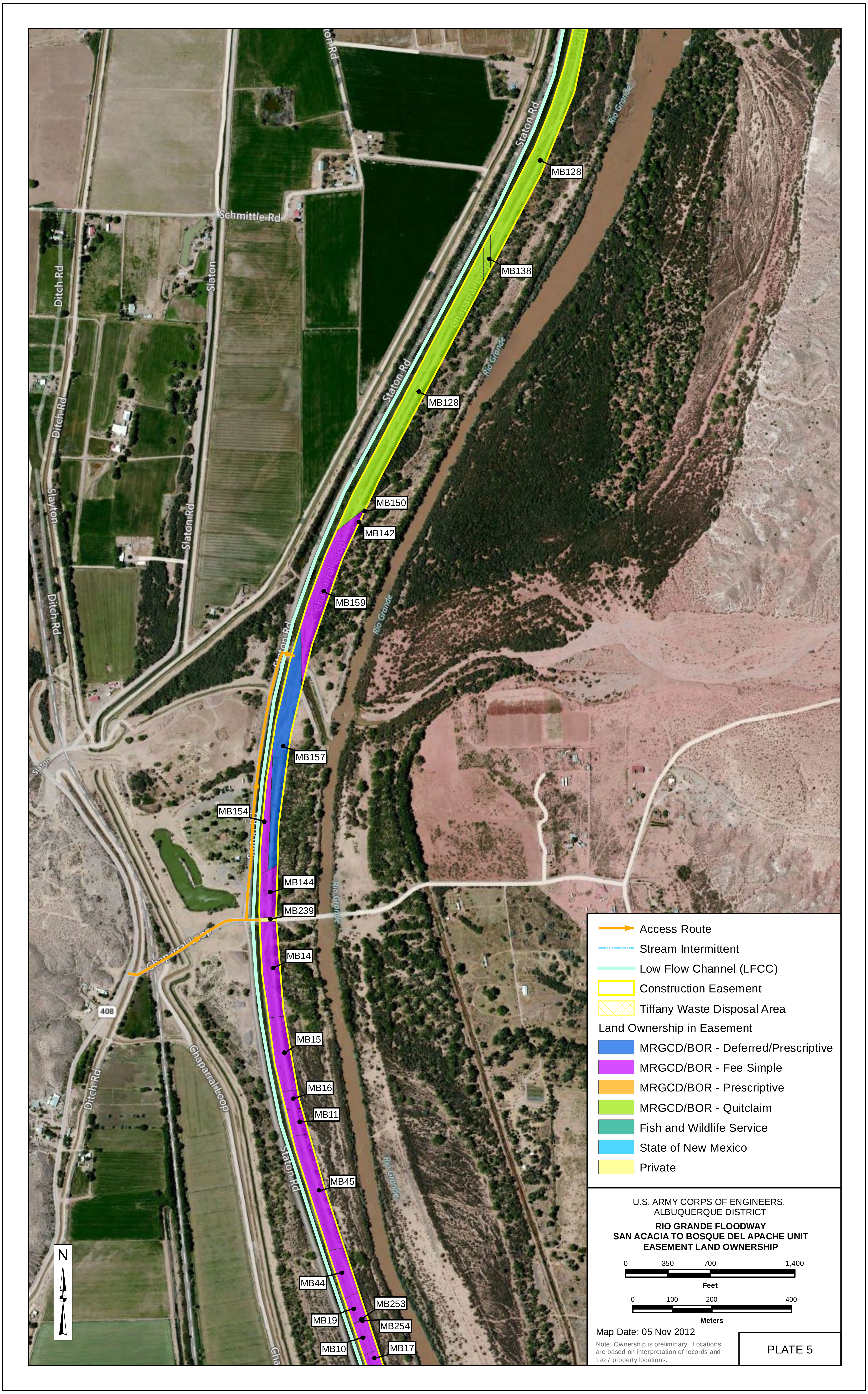
PLATE 4
N

EXHIBIT A



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Schmittle Rd
Slaton
Ditch Rd
Slayton
Slaton Rd
Chaparral Loop
Rio Grande
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Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 5

EXHIBIT A

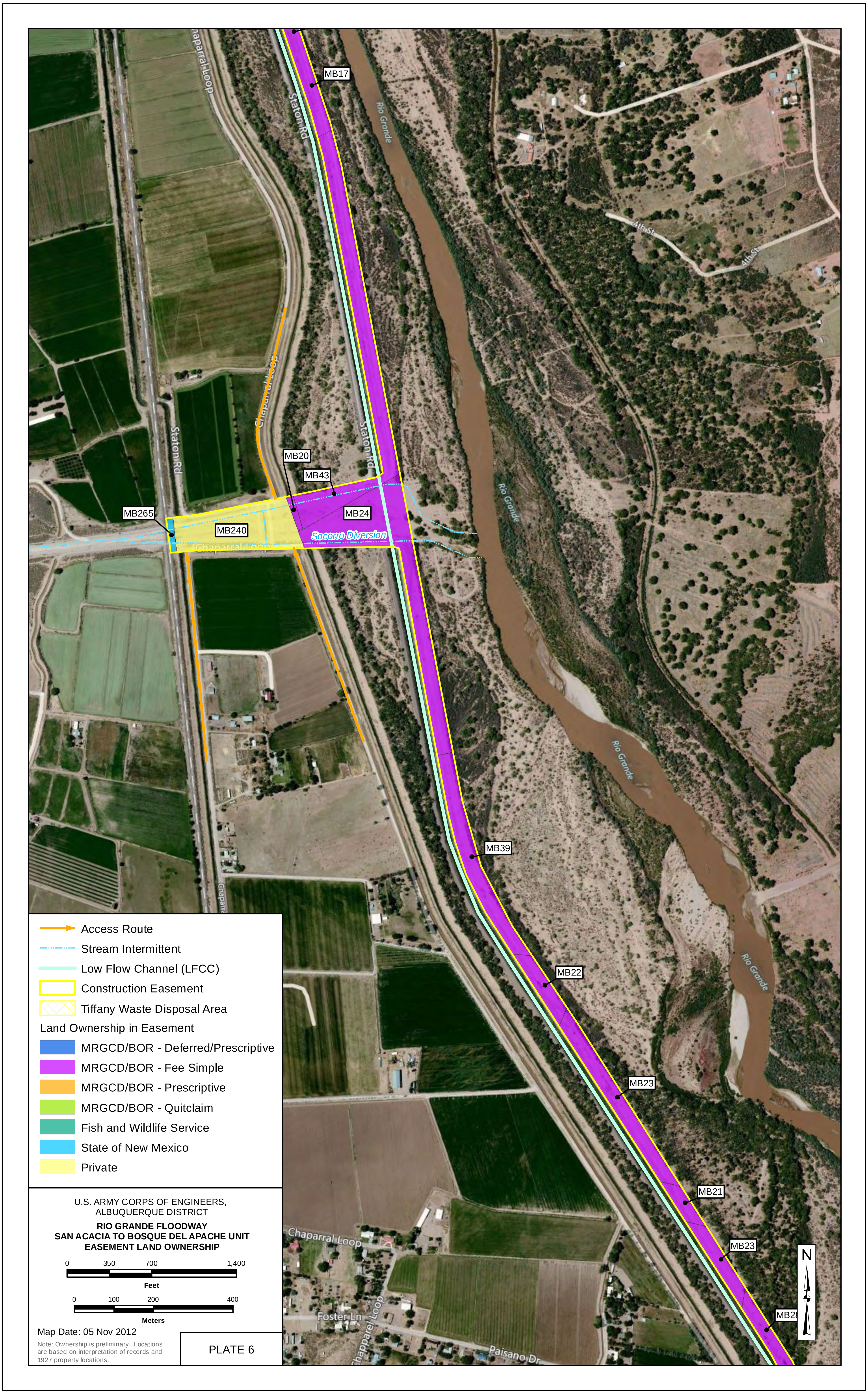

MB17
Staton Rd
Rio Grande
Chaparral Loop
4th St
Staton Rd
MB20
MB43
MB24
MB265
MB240
Socorro Diversion
Chaparral Loop
MB39
MB22
MB23
MB21
MB23
MB28
Foster Ln
Paisano Dr
N
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 6

EXHIBIT A

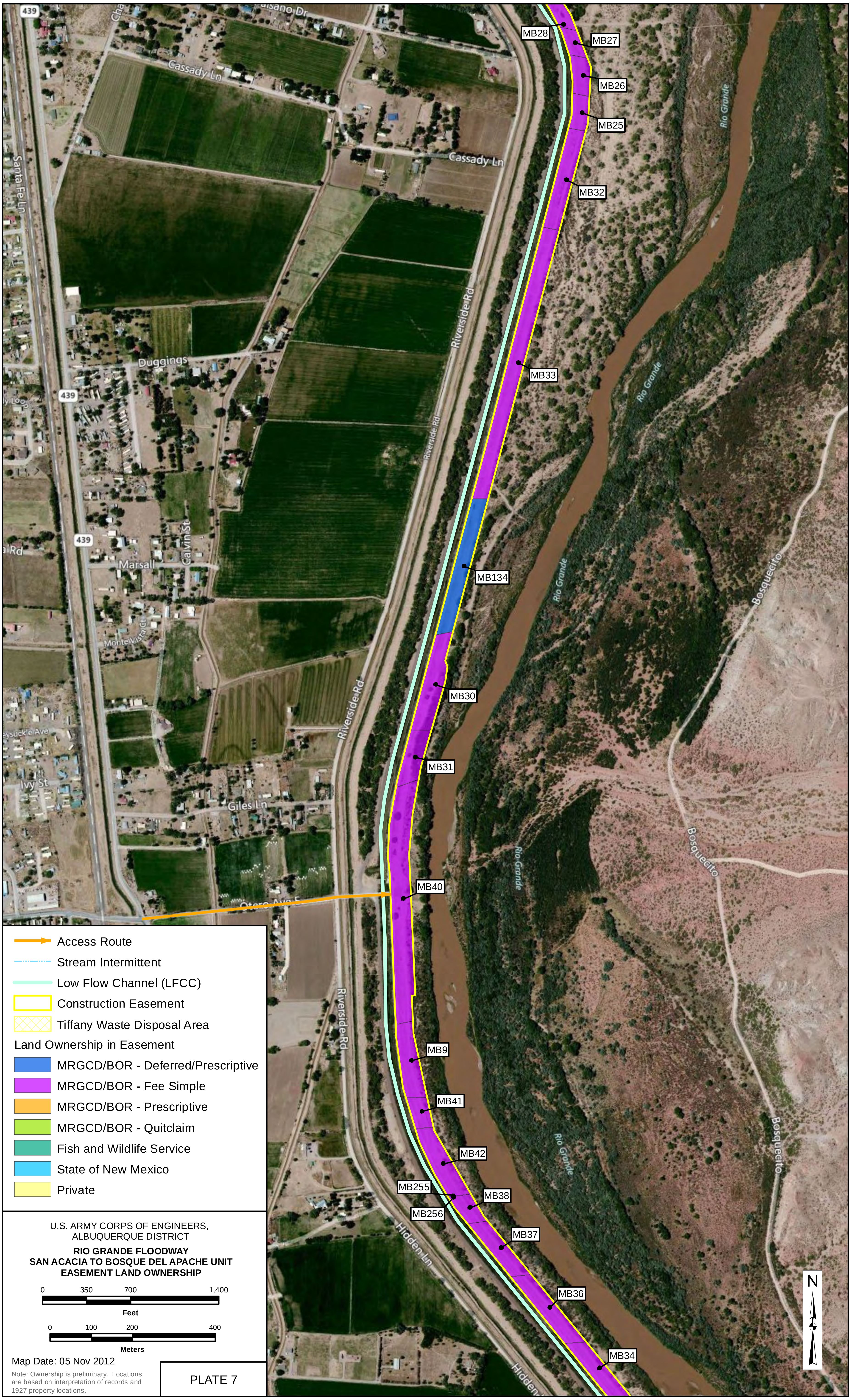

MB28
MB27
MB26
MB25
MB32
MB33
MB134
MB30
MB31
MB40
MB9
MB41
MB42
MB255
MB256
MB38
MB37
MB36
MB34
439
Cassady Ln
Santa Fe Ln
Duggings
Marsall
Calvin St
Monte Vista
Riverside Rd
Ivy St
Giles Ln
Otero Ave E
Hidden Ln
Rio Grande
Bosquecito
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 7
N

EXHIBIT A

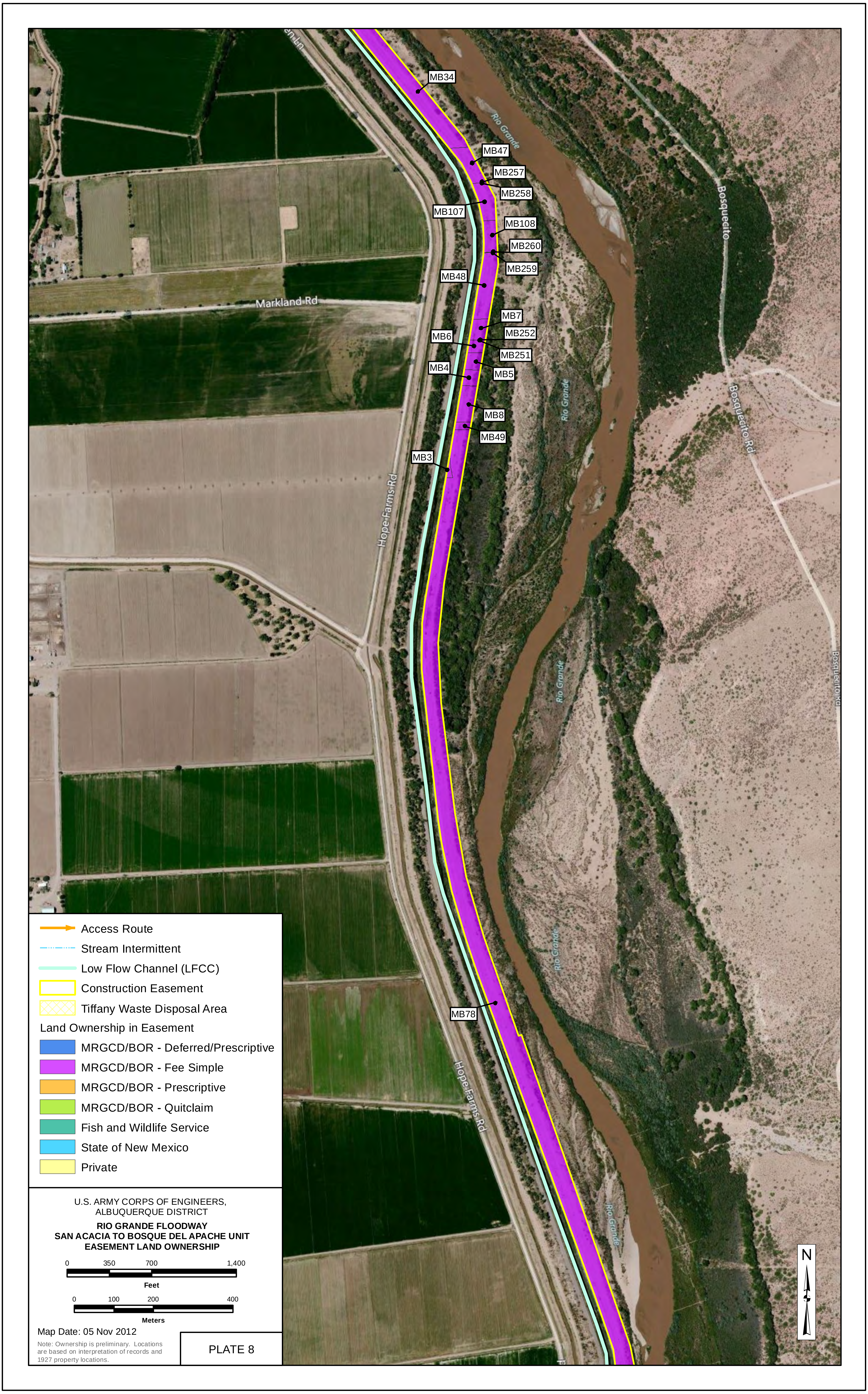

Markland Rd
Hope Farms Rd
Bosquecito
Bosquecito Rd
Rio Grande
MB34
MB47
MB257
MB258
MB107
MB108
MB260
MB259
MB48
MB7
MB252
MB6
MB251
MB4
MB5
MB8
MB49
MB3
MB78
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 8
N

EXHIBIT A

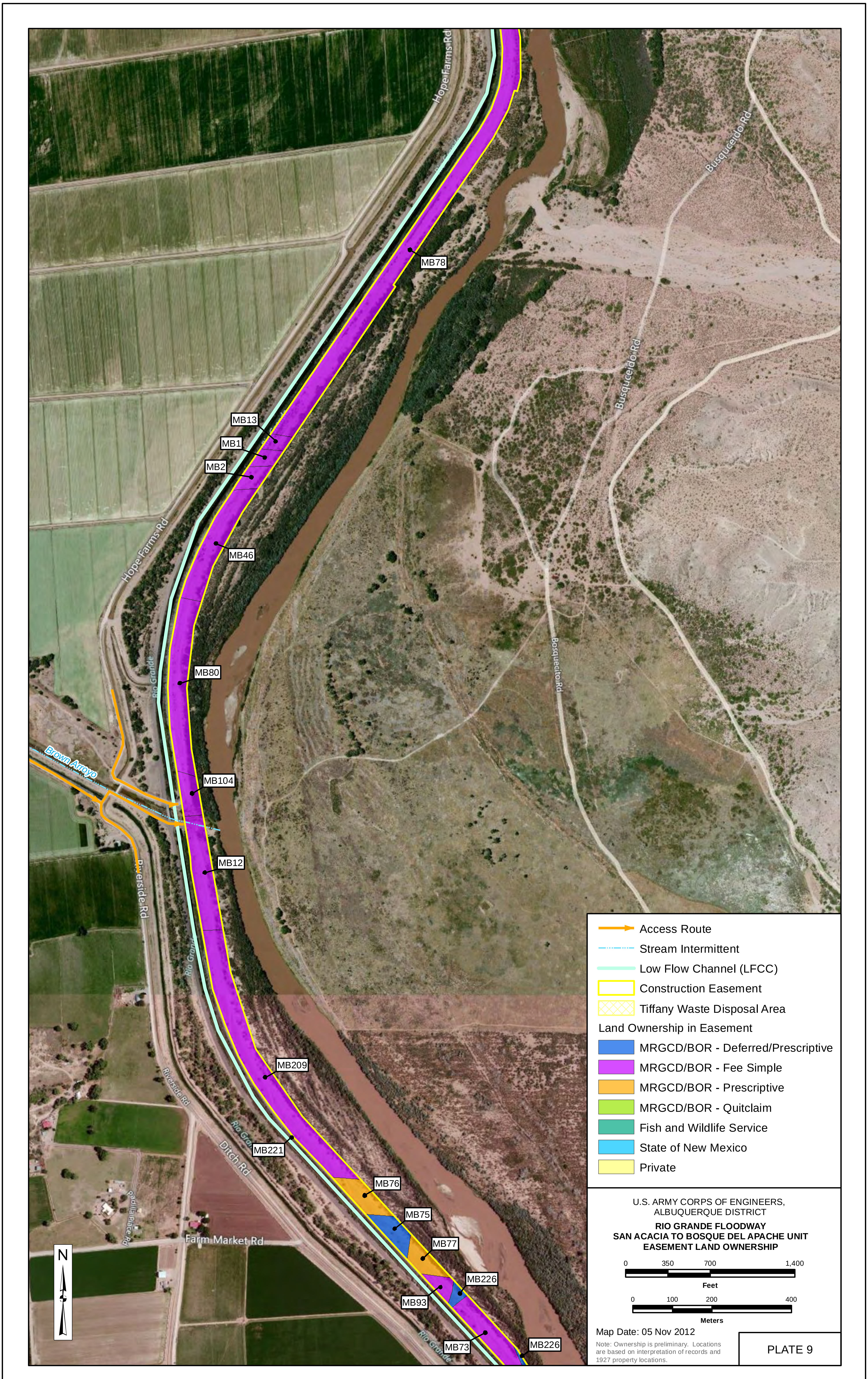
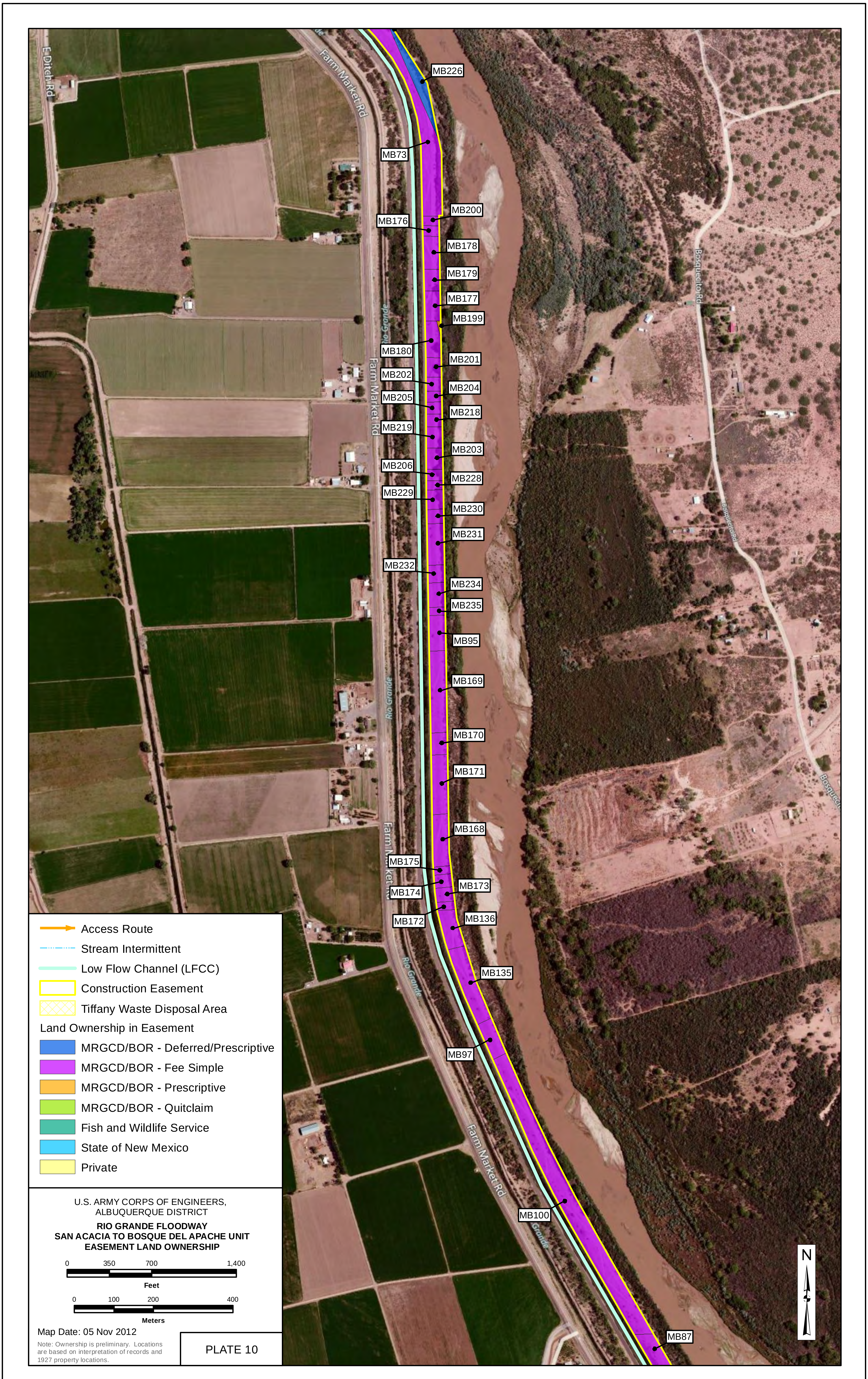

Hope Farms Rd
Busquceido Rd
MB78
MB13
MB1
MB2
MB46
Hope Farms Rd
MB80
Rio Grande
Brown Arroyo
MB104
MB12
Riverside Rd
Rio Grande
MB209
Riverside Rd
Rio Grande
Ditch Rd
MB221
MB76
MB75
MB77
MB226
MB93
MB73
MB226
Farm Market Rd
Padilla Place Rd
N
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 9

EXHIBIT A



E Ditch Rd
Farm Market Rd
Rio Grande
Bosquecito Rd
MB226
MB73
MB200
MB176
MB178
MB179
MB177
MB199
MB180
MB201
MB202
MB204
MB205
MB218
MB219
MB203
MB206
MB228
MB229
MB230
MB231
MB232
MB234
MB235
MB95
MB169
MB170
MB171
MB168
MB175
MB173
MB174
MB172
MB136
MB135
MB97
MB100
MB87
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 10
N

EXHIBIT A

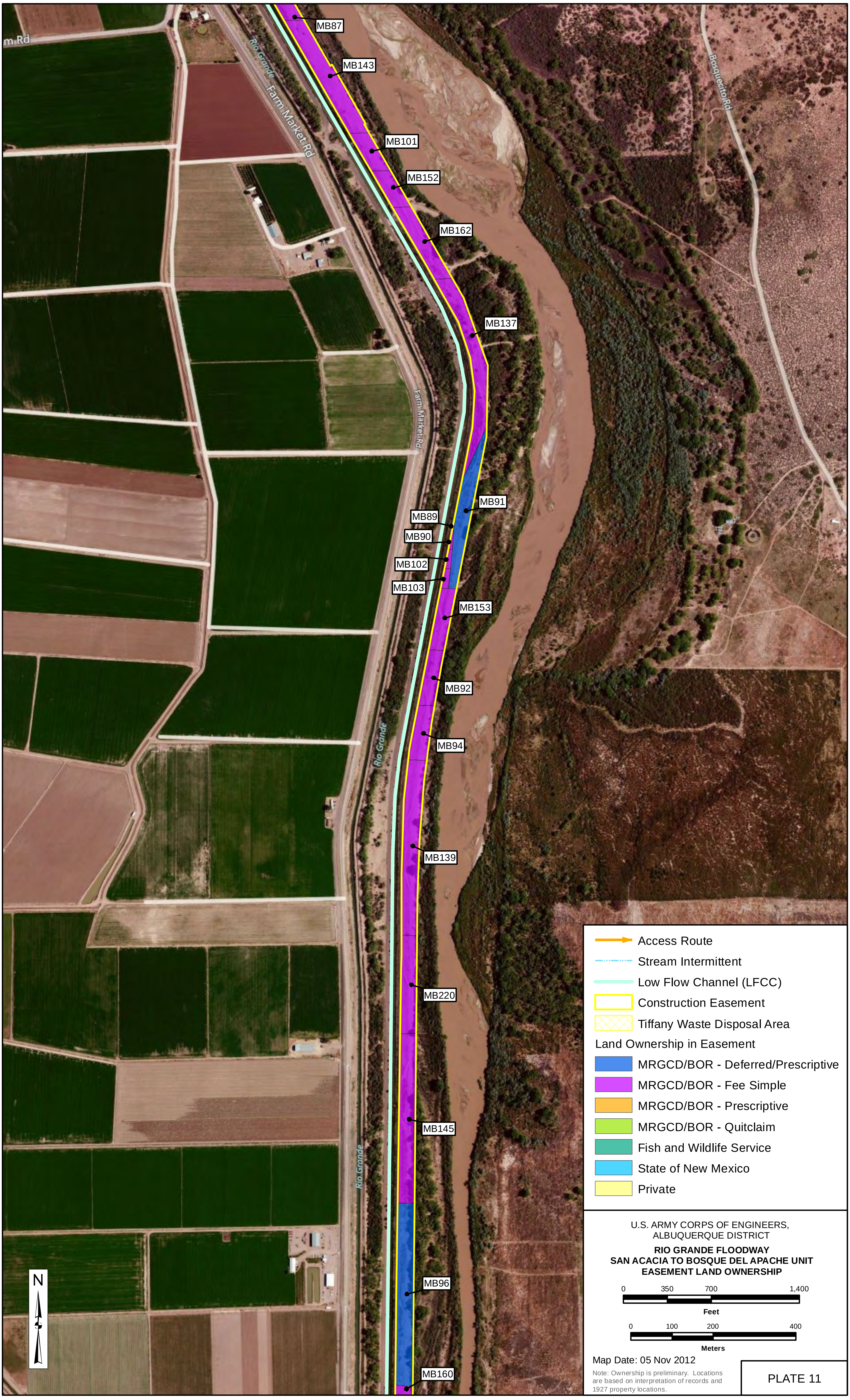
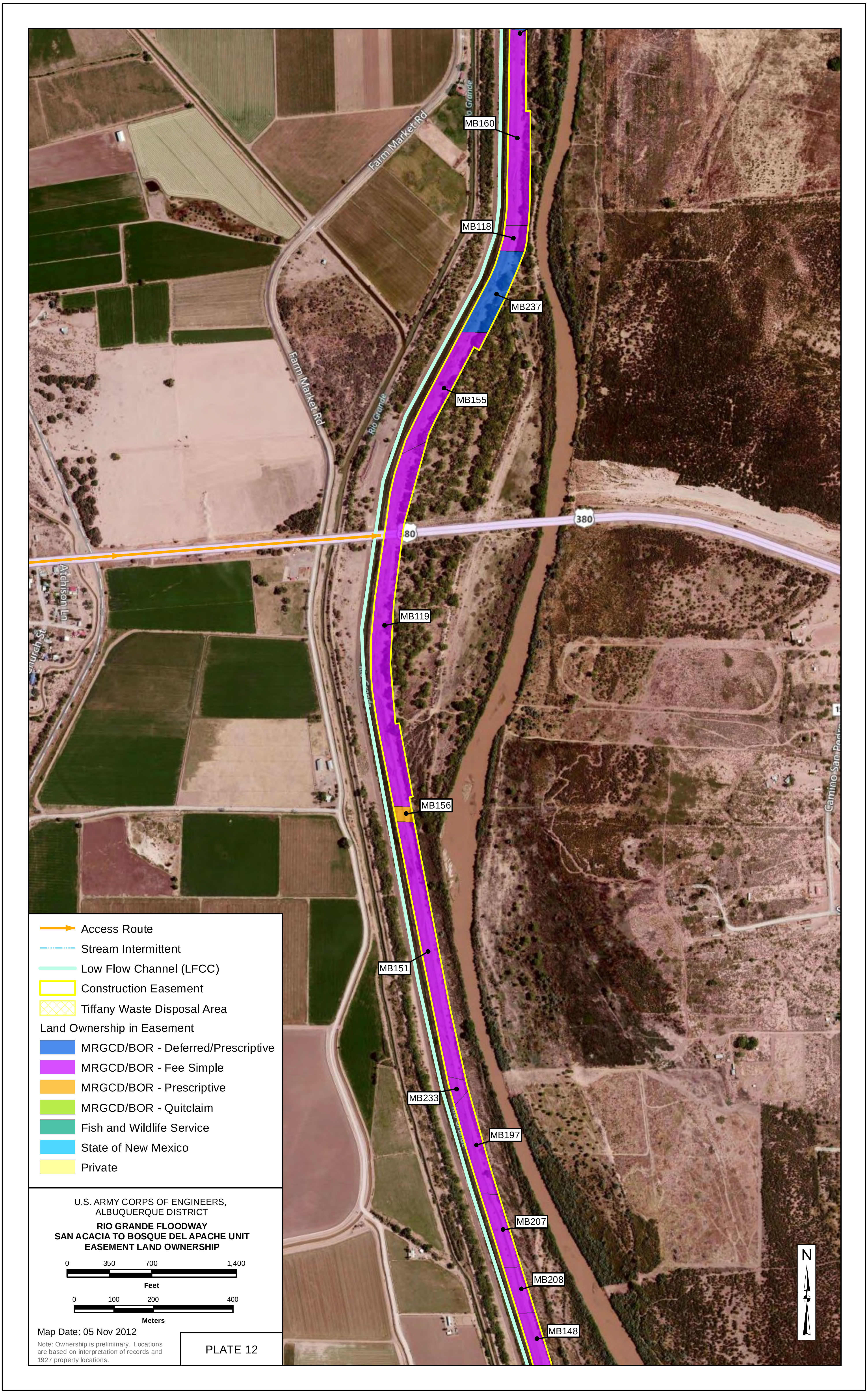
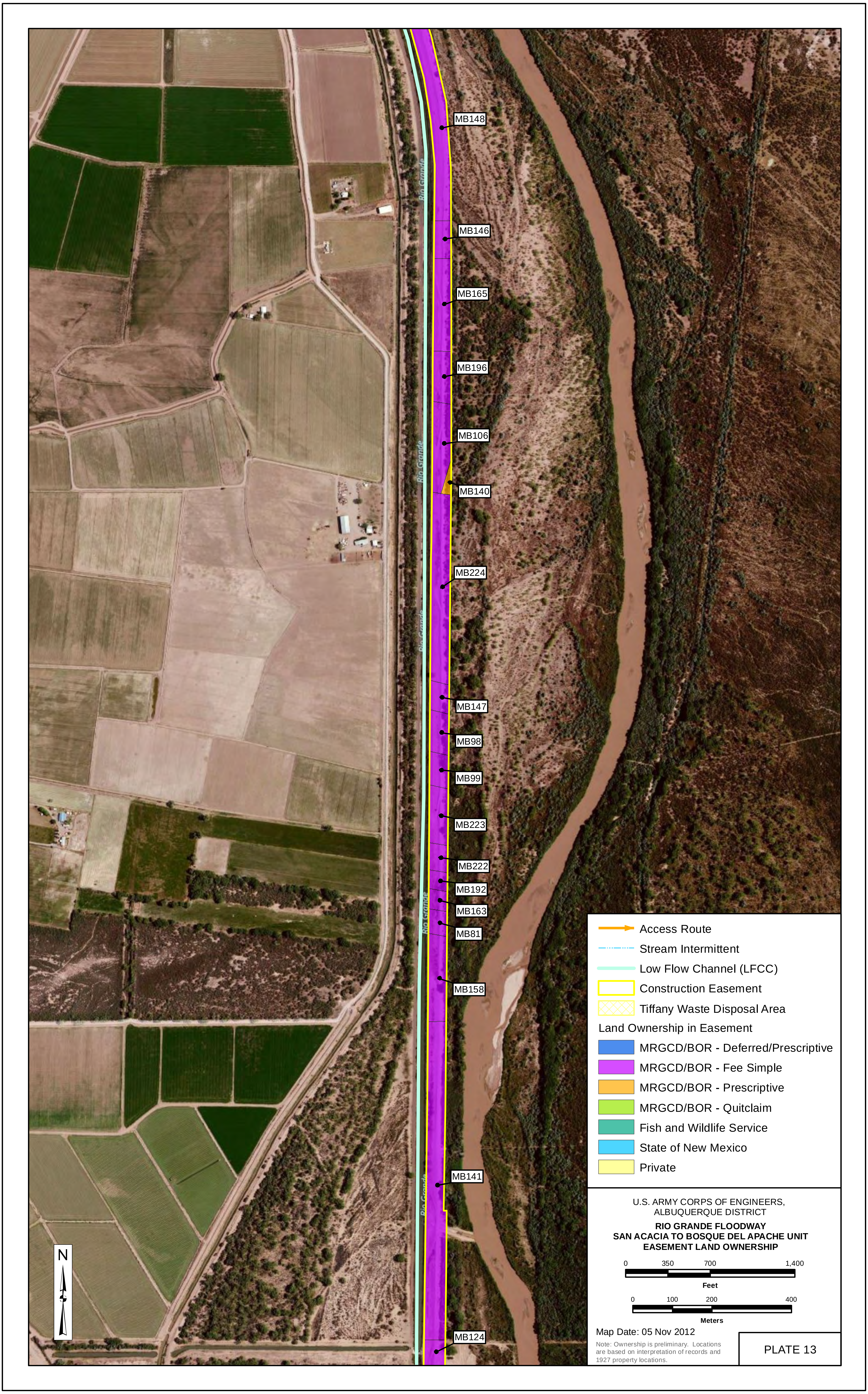

m Rd
Rio Grande
Farm Market Rd
Bosquecito Rd
MB87
MB143
MB101
MB152
MB162
MB137
MB91
MB89
MB90
MB102
MB103
MB153
MB92
MB94
MB139
MB220
MB145
MB96
MB160
N
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS, ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 11

EXHIBIT A



MB160
MB118
MB237
MB155
Farm Market Rd
Rio Grande
380
MB119
Atchison Ln
Church St
MB156
Camino San Pedro
MB151
MB233
MB197
MB207
MB208
MB148
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 12
N

EXHIBIT A



MB148
MB146
MB165
MB196
MB106
MB140
MB224
MB147
MB98
MB99
MB223
MB222
MB192
MB163
MB81
MB158
MB141
MB124
Rio Grande
N
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 13

EXHIBIT A

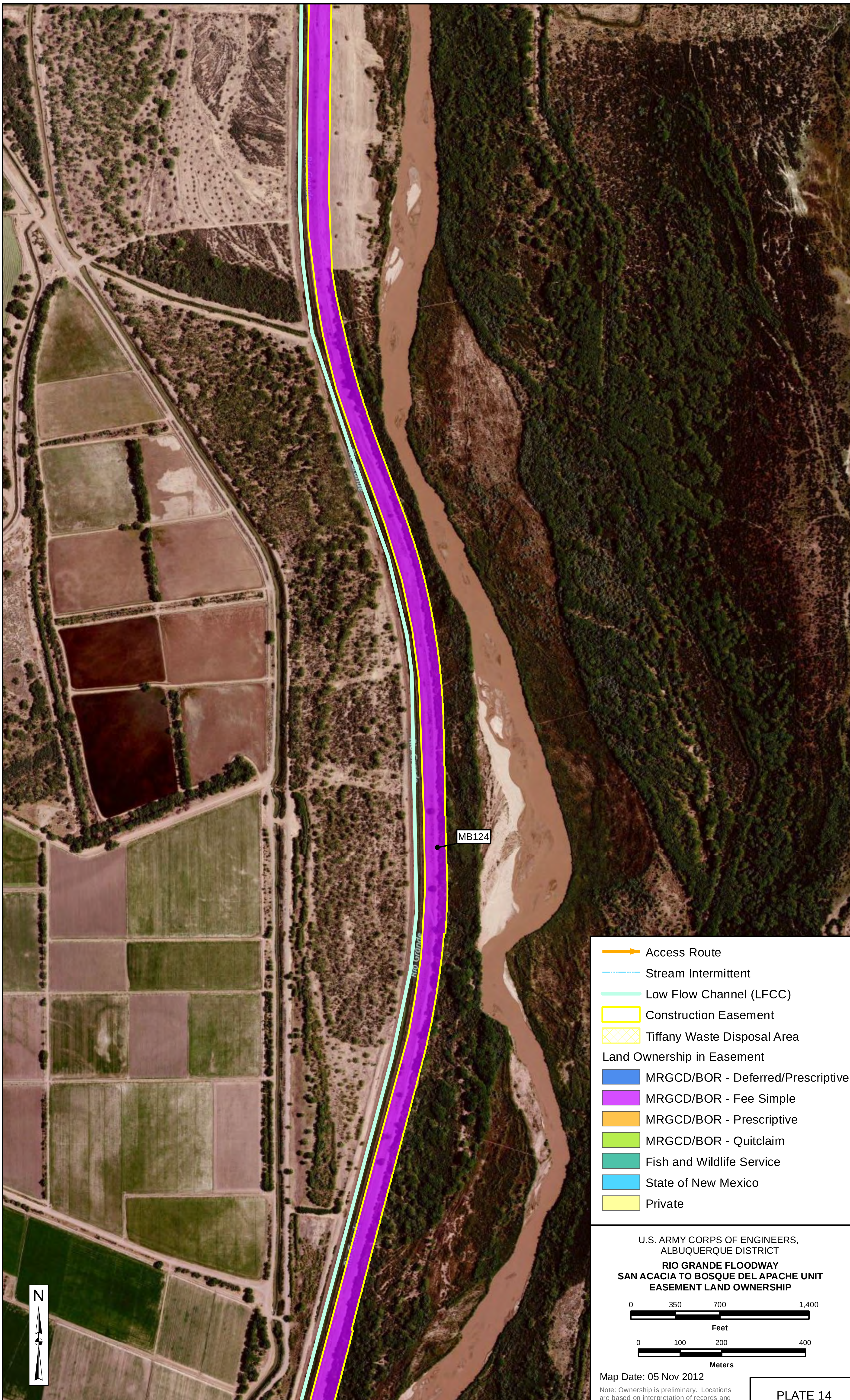

MB124
Rio Grande
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 14
N

EXHIBIT A

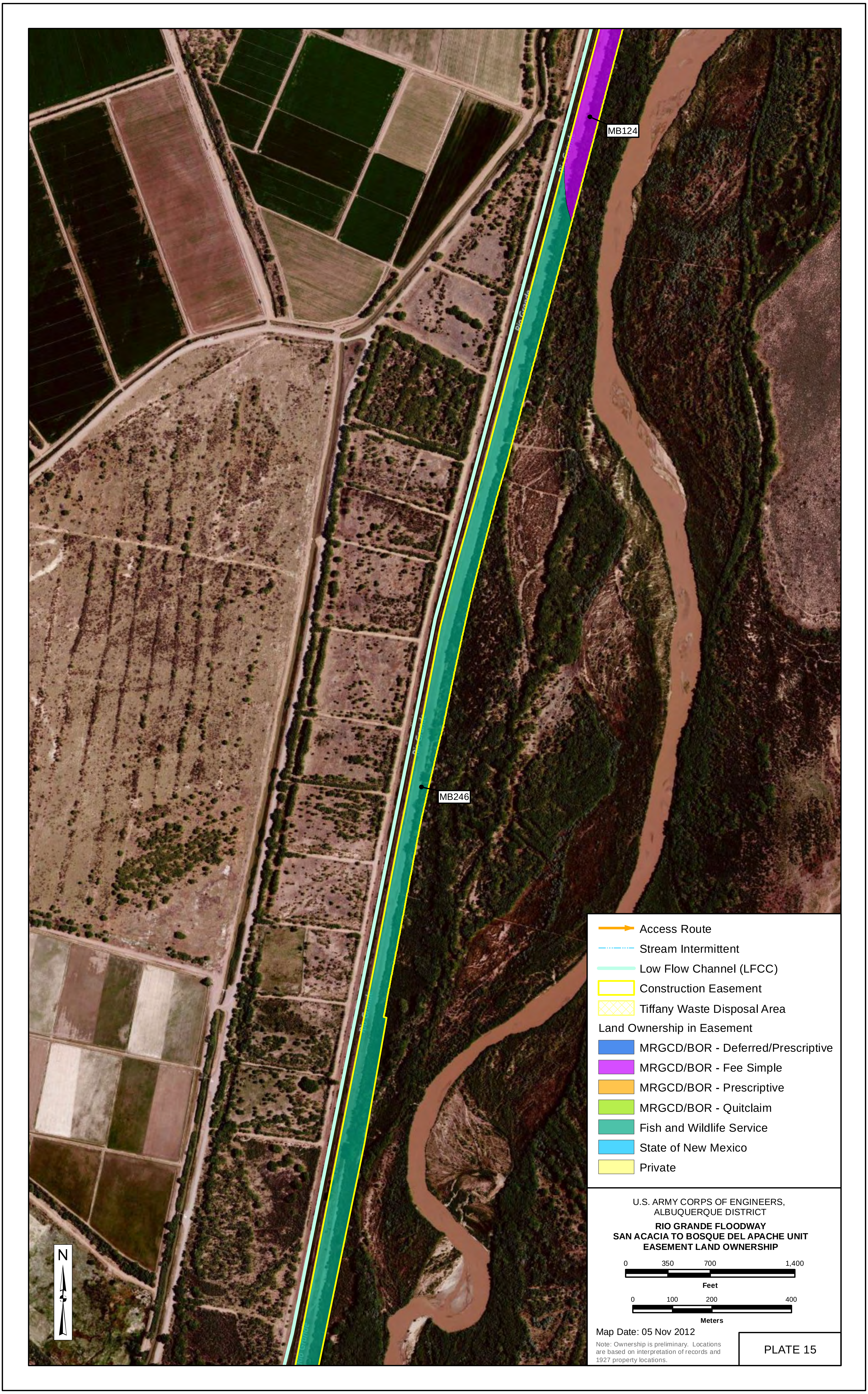

MB124
MB246
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 15
N

EXHIBIT A

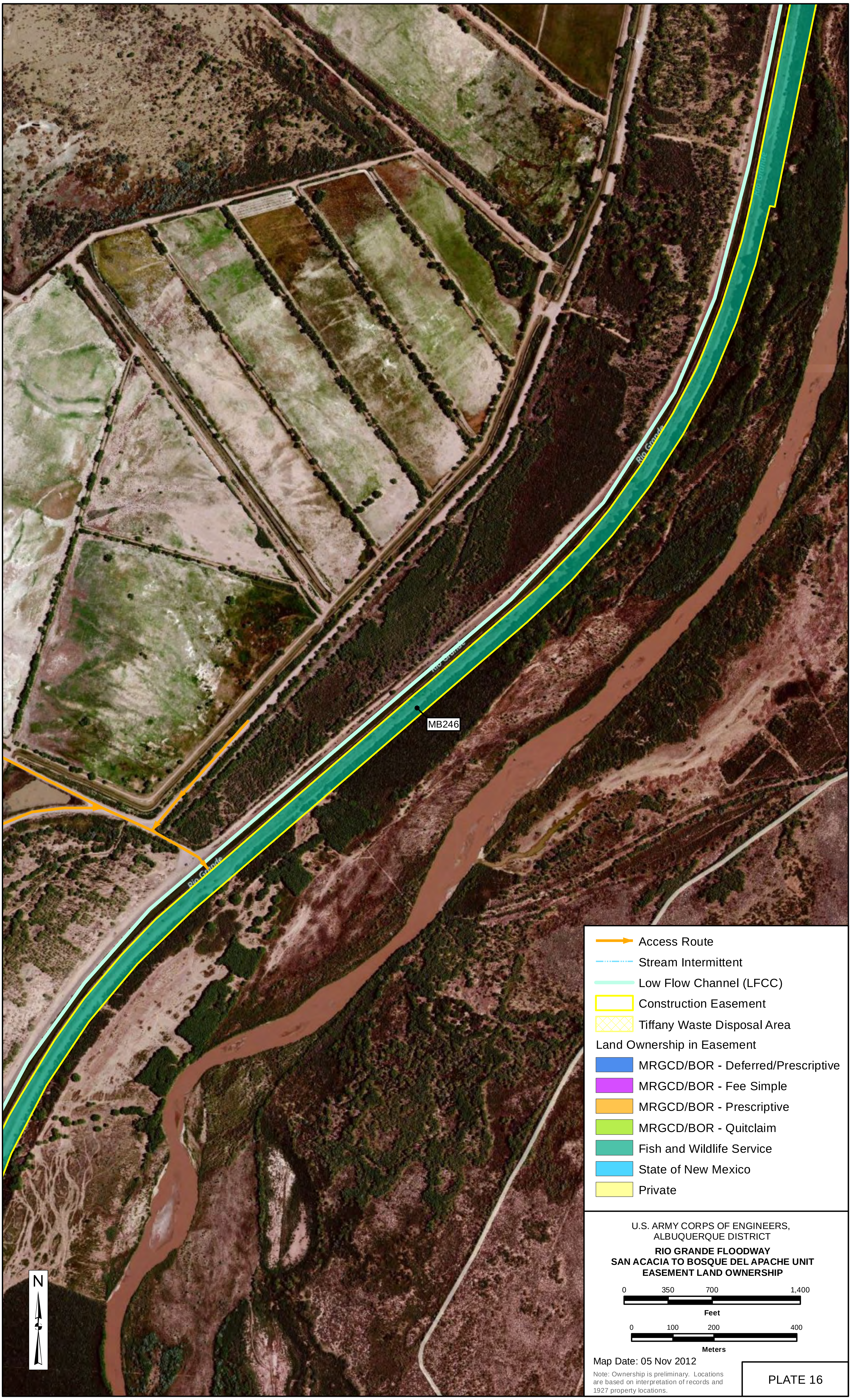

Rio Grande
Rio Grande
MB246
Rio Grande
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 16
N

EXHIBIT A

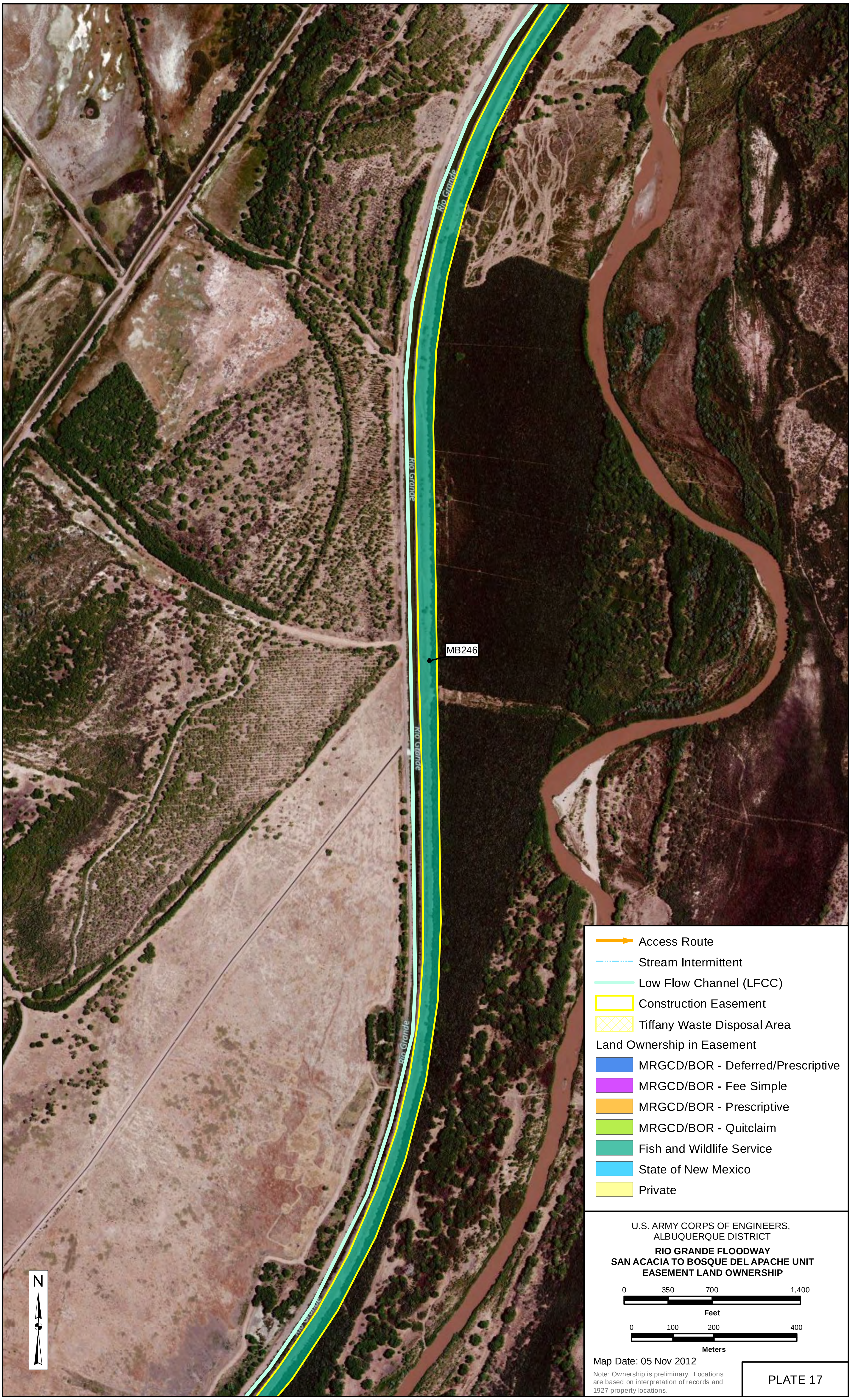
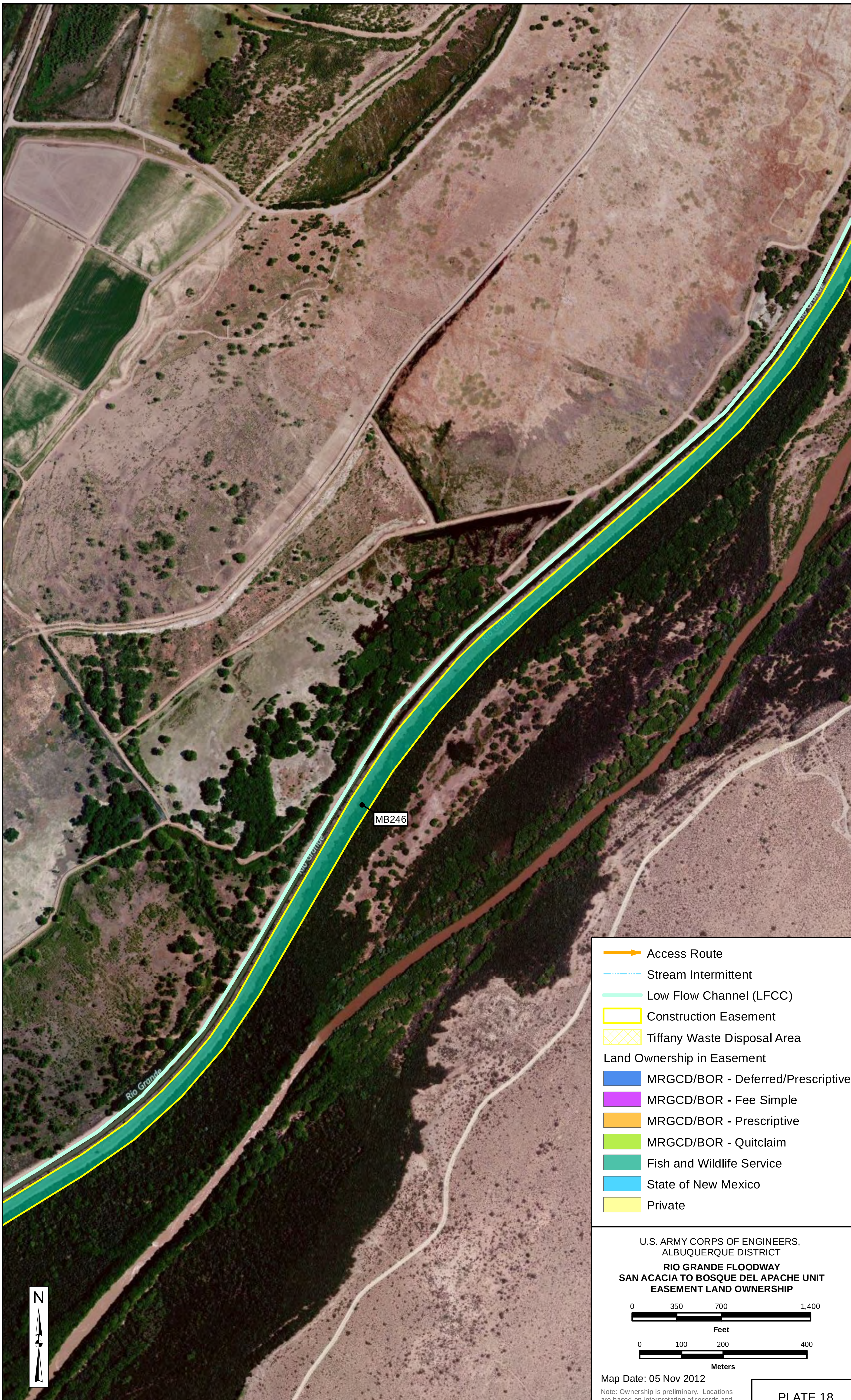

Rio Grande
Rio Grande
MB246
Rio Grande
Rio Grande
N
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 17

EXHIBIT A



Rio Grande
MB246
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS, ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 18
N

EXHIBIT A

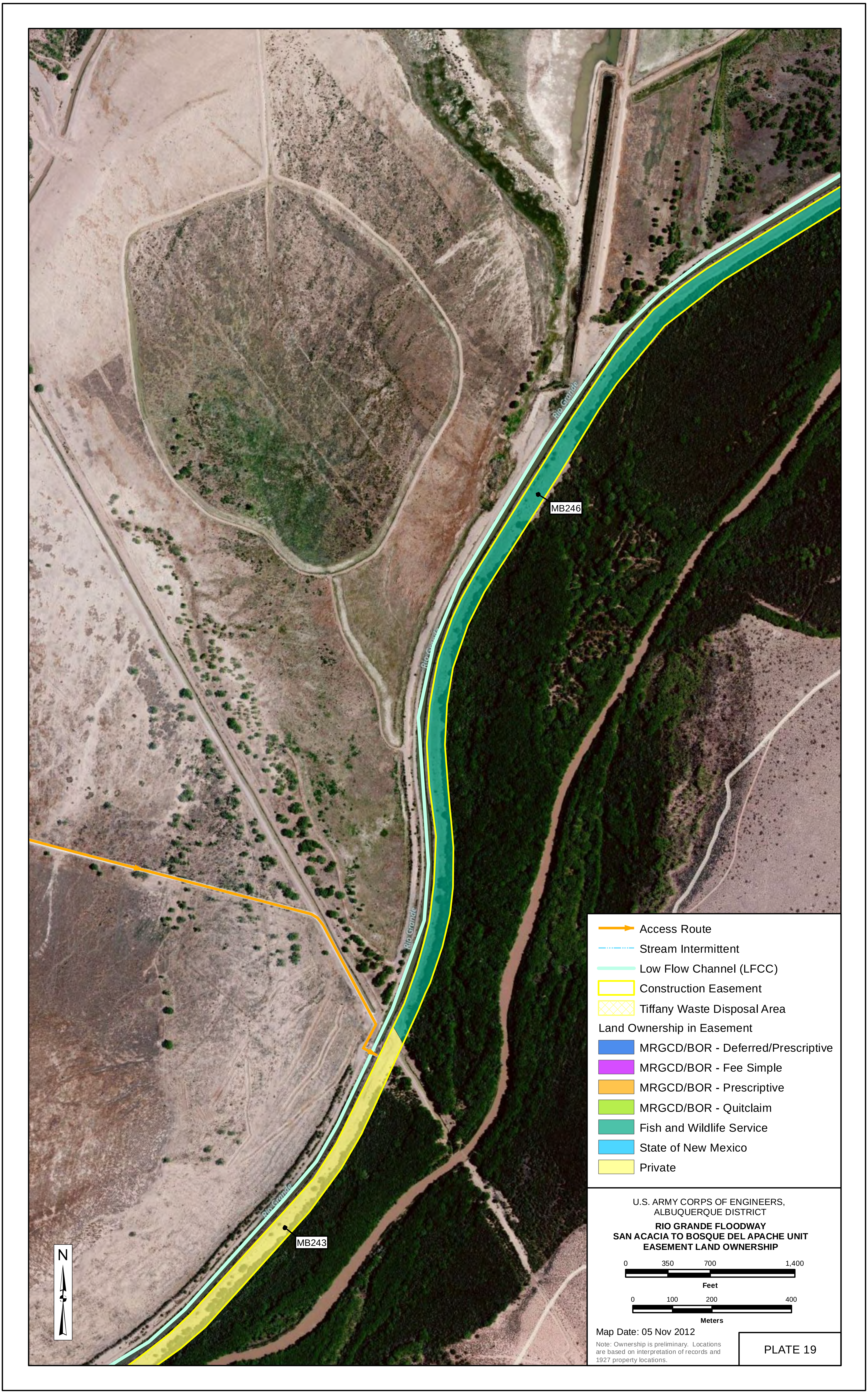

Rio Grande
Rio Grande
Rio Grande
Rio Grande
MB246
MB243
N
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 19

EXHIBIT A

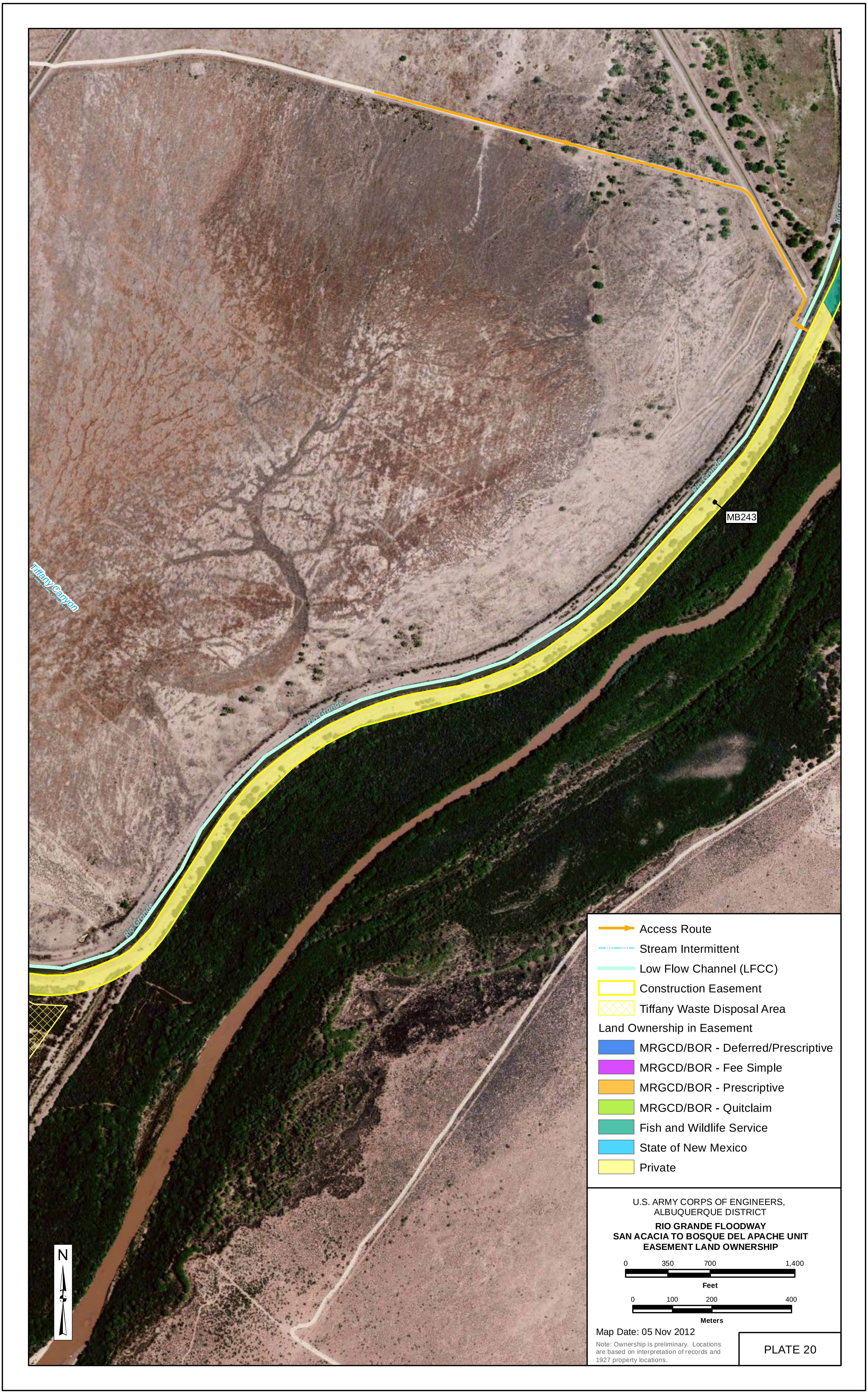
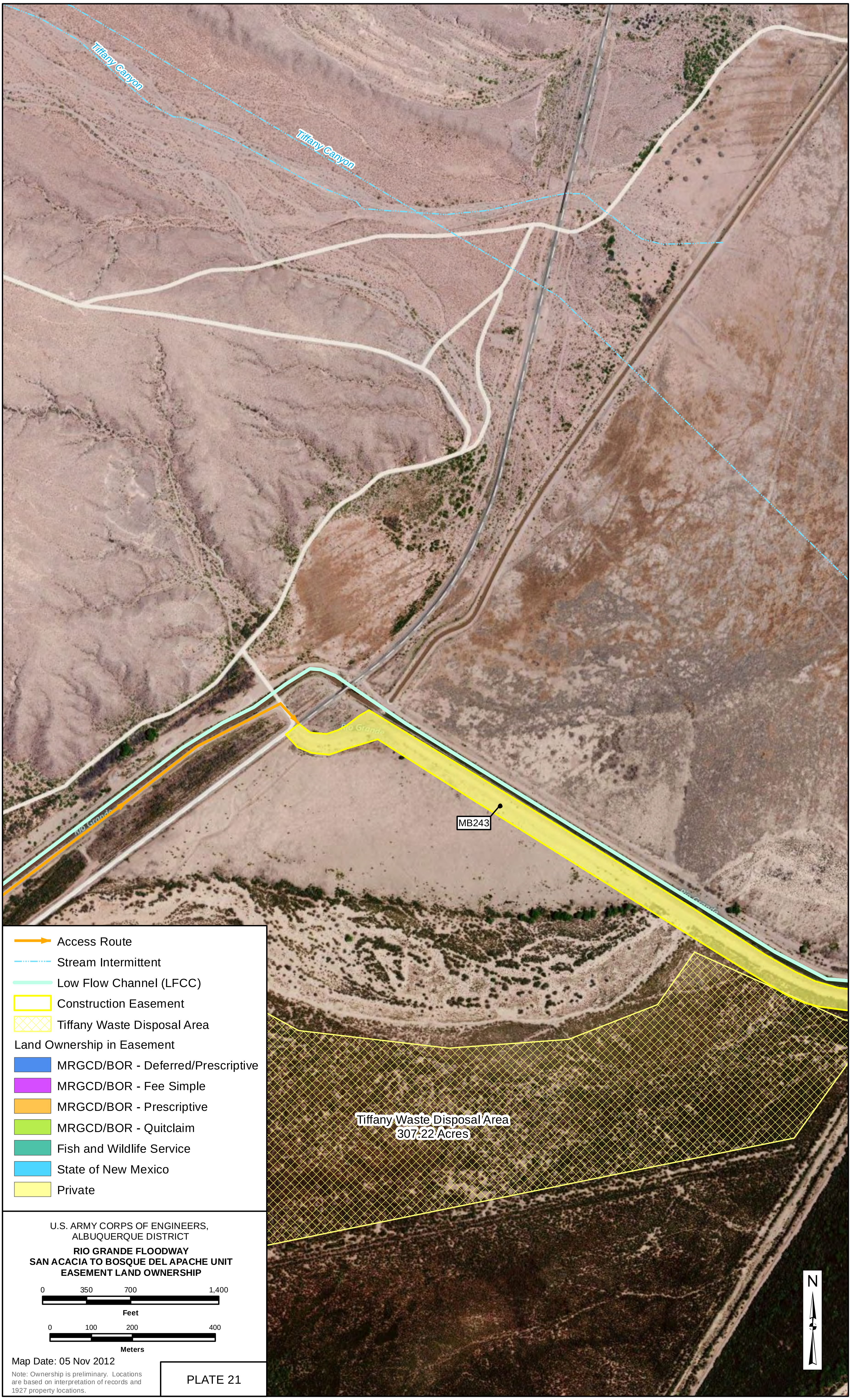

Tiffany Canyon
Rio Grande
MB243
Access Route
Stream Intermittent
Low Flow Channel (LFCC)
Construction Easement
Tiffany Waste Disposal Area
Land Ownership in Easement
MRGCD/BOR - Deferred/Prescriptive
MRGCD/BOR - Fee Simple
MRGCD/BOR - Prescriptive
MRGCD/BOR - Quitclaim
Fish and Wildlife Service
State of New Mexico
Private
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP
0 350 700 1,400
Feet
0 100 200 400
Meters
Map Date: 05 Nov 2012
Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.
PLATE 20
N

EXHIBIT A



U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT

RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
EASEMENT LAND OWNERSHIP

Map Date: 05 Nov 2012

Note: Ownership is preliminary. Locations are based on interpretation of records and 1927 property locations.

PLATE 21

EXHIBIT A

Real Estate Plan

Exhibit B

Tract Register and Plate Definition Map

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FACILITY NAME	MRGCD PROPERTY MAP ATLAS 2008 OWNERSHIP DESCRIPTION	OWNER TYPE	OWNER	U.S. ARMY CORPS OF ENGINEERS MAP BOOK PLATE	U.S. ARMY CORPS OF ENGINEERS MAP BOOK ID	ACRES
SOCORRO MAIN CANAL (NORTH)	PT OF MAP 147 UNPLATTED LD ADJ TO TRS 20 AND 31	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB50	0.58
SOCORRO MAIN CANAL (NORTH)	PT OF MAP 147 TR 20	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB51	0.05
SOCORRO MAIN CANAL (NORTH)	PT OF MAP 147 PUBLIC RD ADJ TO TR 3 AND TR 20	PRESCRIPTIVE	MRGCD/BOR	PLATE 1	MB52	0.05
SOCORRO MAIN CANAL (NORTH)	PT OF MAP 147 TR 31	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB53	0.01
SOCORRO MAIN CANAL (NORTH)	PT OF MAP 147 PUBLIC RD ADJ TO TRS 31, 35 & 36	PRESCRIPTIVE	MRGCD/BOR	PLATE 1	MB54	0.12
SOCORRO MAIN CANAL (NORTH)	ALL OF MAP 147 TR 35	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB55	0.40
SOCORRO MAIN CANAL (NORTH)	PT OF MAP 147 A T & S F RR LDS	PRESCRIPTIVE	MRGCD/BOR	PLATE 1	MB56	0.51
SOCORRO MAIN CANAL (NORTH)	ALL OF MAP 147 TR 36	PRESCRIPTIVE	MRGCD/BOR	PLATE 1	MB57	0.42
SOCORRO MAIN CANAL (NORTH)	PT OF MAP 147 TR 38	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB58	0.26
SOCORRO MAIN CANAL (NORTH)	ALL OF MAP 147 TR 39	PRESCRIPTIVE	MRGCD/BOR	PLATE 1	MB59	0.24
SOCORRO MAIN CANAL (NORTH)	PT OF MAP 147 TR 40	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB60	0.11
SOCORRO MAIN CANAL (NORTH)	PT OF MAP 147 TR 102	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB61	0.62
SOCORRO MAIN CANAL (NORTH)	PT OF MAP 147 TR 101	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB62	0.89
SOCORRO MAIN CANAL (NORTH)	PT OF MAP 147 UNPLATTED LDS	PRESCRIPTIVE	MRGCD/BOR	PLATE 1	MB63	0.47
LEMITAR RIVERSIDE DRAIN	ALL OF MAP 147 TRS 107 AND 108	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB64	7.88
LEMITAR RIVERSIDE DRAIN	PT OF MAP 147 TR 109	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB65	0.00
LEMITAR RIVERSIDE DRAIN	PT OF MAP 148 TR 5	DEFERRED/PRESCRIPTIVE	MRGCD/BOR	PLATE 1	MB66	0.35
LEMITAR RIVERSIDE DRAIN	PT OF MAP 148 TR 7	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB67	1.62
LEMITAR RIVERSIDE DRAIN	PT OF MAP 148 TR 8	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB68	0.93
LEMITAR RIVERSIDE DRAIN	PT OF MAP 148 TR 9	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB69	1.05
LEMITAR RIVERSIDE DRAIN	PT OF MAP 148 PUBLIC RD ADJ TO TRS 9 AND 62	PRESCRIPTIVE	MRGCD/BOR	PLATE 1	MB70	0.06
LEMITAR RIVERSIDE DRAIN	ALL OF MAP 148 TRS 63C, 63D & 63E AND PT OF TR 63B	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB71	1.73
SAN ACACIA DIVERSION DAM	PT OF MAP 147 SEVILETTA GRANT, T 1 S, R 1 W & R 1 E, SECS 1 AND 6 NMPM	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB82	4.74
LEMITAR RIVERSIDE DRAIN	PT OF MAP 148 TR 62	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB109	2.02
LEMITAR RIVERSIDE DRAIN	PT OF MAP 148 TR 65	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB110	2.05
LEMITAR RIVERSIDE DRAIN	PT OF MAP 148 TR 66	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB111	1.90
LEMITAR RIVERSIDE DRAIN	PT OF MAP 148 TR 67	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB112	1.10
SOCORRO MAIN CANAL (NORTH)	PTS OF MAP 146 TR 21 AND MAP 147 TR 3	FEE SIMPLE	MRGCD/BOR	PLATE 1	MB167	1.42
LEMITAR RIVERSIDE DRAIN	PT OF MAP 149 TR 2	FEE SIMPLE	MRGCD/BOR	PLATE 1, 2	MB113	5.16
LEMITAR RIVERSIDE DRAIN	ALL OF MAP 149 TR 2B	FEE SIMPLE	MRGCD/BOR	PLATE 2	MB72	6.82
LEMITAR RIVERSIDE DRAIN	PT OF MAP 150 TR 1	FEE SIMPLE	MRGCD/BOR	PLATE 2	MB105	9.99
LEMITAR RIVERSIDE DRAIN	PT OF MAP 149 TR 9	FEE SIMPLE	MRGCD/BOR	PLATE 2	MB115	0.67
LEMITAR RIVERSIDE DRAIN	PT OF MAP 149 TR 13	FEE SIMPLE	MRGCD/BOR	PLATE 2	MB116	2.19
LEMITAR RIVERSIDE DRAIN	PT OF MAP 149 TR 60A	FEE SIMPLE	MRGCD/BOR	PLATE 2	MB117	3.77
LEMITAR RIVERSIDE DRAIN	PT OF MAP 149 TR 60B	DEFERRED/PRESCRIPTIVE	MRGCD/BOR	PLATE 2	MB120	6.26
LEMITAR RIVERSIDE DRAIN	PT OF MAP 149 TR 60C	FEE SIMPLE	MRGCD/BOR	PLATE 2	MB121	2.60
LEMITAR RIVERSIDE DRAIN	PT OF MAP 149 TR 60	FEE SIMPLE	MRGCD/BOR	PLATE 2	MB122	0.09
LEMITAR RIVERSIDE DRAIN	ALL OF MAP 149 TR 60D	DEFERRED/PRESCRIPTIVE	MRGCD/BOR	PLATE 2	MB123	4.02
SAN LORENZO ARROYO	MAP 149 TR 2A2	QUITCLAIM	MRGCD/BOR	PLATE 2	MB130	2.12
SAN LORENZO ARROYO	MAP 149 TR 9B2	QUITCLAIM	MRGCD/BOR	PLATE 2	MB131	1.18
SAN LORENZO ARROYO	MAP 149 TR 7A	QUITCLAIM	MRGCD/BOR	PLATE 2	MB132	0.88
SAN LORENZO ARROYO	MAP 149 TR 13A2	QUITCLAIM	MRGCD/BOR	PLATE 2	MB133	0.79
LEMITAR RIVERSIDE DRAIN	PT OF MAP 150 TR 36	FEE SIMPLE	MRGCD/BOR	PLATE 2, 3	MB83	11.55

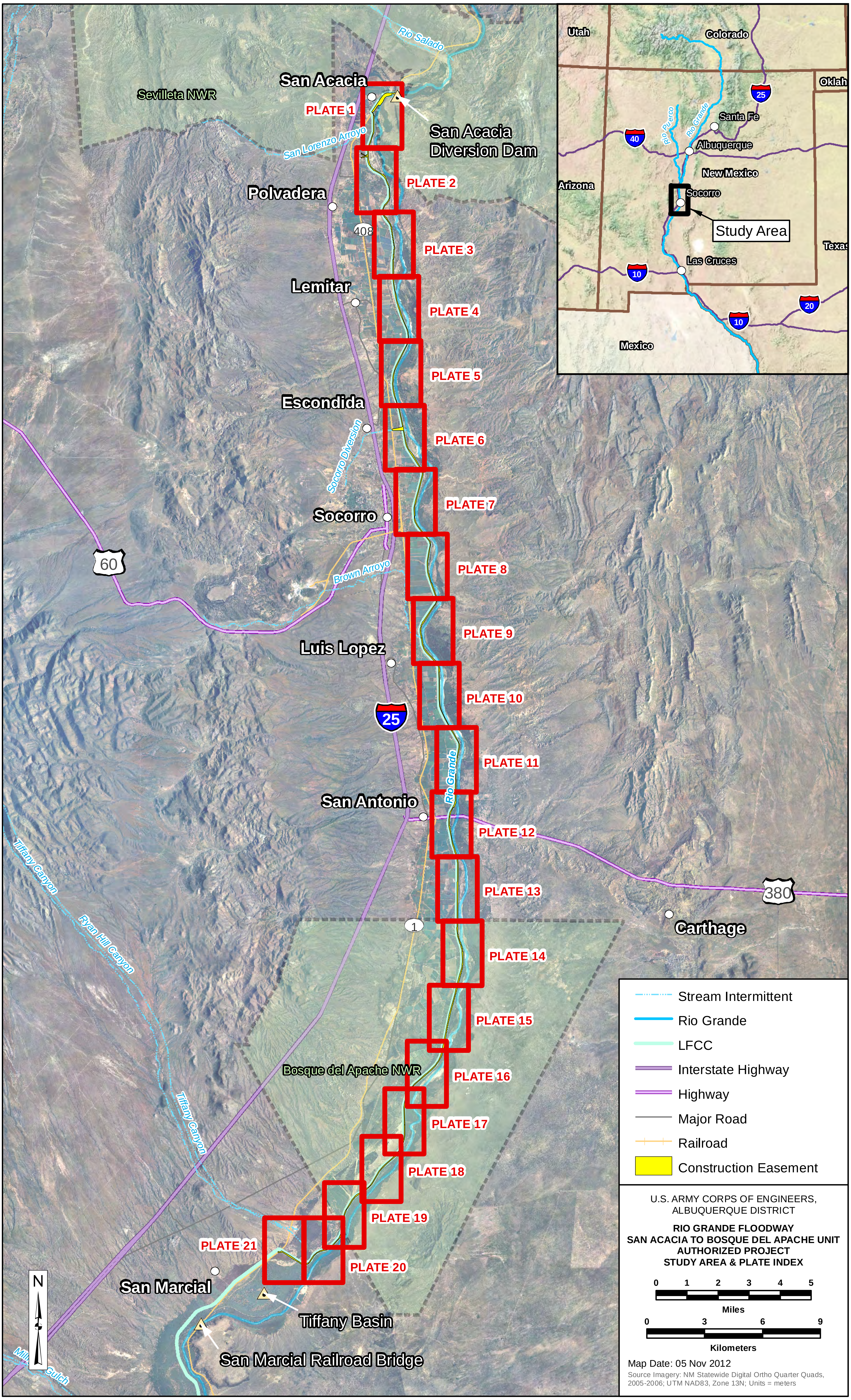
FACILITY NAME	MRGCD PROPERTY MAP ATLAS 2008 OWNERSHIP DESCRIPTION	OWNER TYPE	OWNER	U.S. ARMY CORPS OF ENGINEERS MAP BOOK PLATE	U.S. ARMY CORPS OF ENGINEERS MAP BOOK ID	ACRES
LEMITAR RIVERSIDE DRAIN	PT OF MAP 151 TR 12	FEE SIMPLE	MRGCD/BOR	PLATE 3	MB85	5.12
LEMITAR RIVERSIDE DRAIN	PT OF MAP 151 TR 12	FEE SIMPLE	MRGCD/BOR	PLATE 3	MB86	5.99
LEMITAR RIVERSIDE DRAIN	PT OF MAP 151 TR 51	DEFERRED/PRESCRIPTIVE	MRGCD/BOR	PLATE 3	MB216	4.83
LEMITAR RIVERSIDE DRAIN	PT OF MAP 152 TR 1	DEFERRED/PRESCRIPTIVE	MRGCD/BOR	PLATE 3	MB217	18.74
LEMITAR RIVERSIDE DRAIN	PT OF MAP 150 TR 36	FEE SIMPLE	MRGCD/BOR	PLATE 3	MB261	0.00
LEMITAR RIVERSIDE DRAIN	PT OF MAP 151 TR 12	FEE SIMPLE	MRGCD/BOR	PLATE 3	MB262	0.00
LEMITAR RIVERSIDE DRAIN	ALL OF MAP 153 TR 1	FEE SIMPLE	MRGCD/BOR	PLATE 3, 4	MB181	4.52
LEMITAR RIVERSIDE DRAIN	PT OF MAP 156 TR 4	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB127	0.10
LEMITAR RIVERSIDE DRAIN	PT OF MAP 155 TR 1A	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB164	4.81
LEMITAR RIVERSIDE DRAIN	PT OF MAP 155 TR 1	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB166	3.93
LEMITAR RIVERSIDE DRAIN	ALL OF MAP 153 TR 2	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB183	0.91
LEMITAR RIVERSIDE DRAIN	PT OF MAP 153 TR 5	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB184	1.14
LEMITAR RIVERSIDE DRAIN	PT OF MAP 153 TR 6	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB185	0.93
LEMITAR RIVERSIDE DRAIN	PT OF MAP 153 TR 167	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB186	2.15
LEMITAR RIVERSIDE DRAIN	PT OF MAP 153 TR 169	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB187	1.59
LEMITAR RIVERSIDE DRAIN	PT OF MAP 153 TR 170	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB188	0.83
LEMITAR RIVERSIDE DRAIN	PT OF MAP 153 TR 171	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB189	1.96
LEMITAR RIVERSIDE DRAIN	PT OF MAP 154 TR 1	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB190	1.66
LEMITAR RIVERSIDE DRAIN	PT OF MAP 154 TR 15A	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB191	1.04
LEMITAR RIVERSIDE DRAIN	PT OF MAP 155 TR 17	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB193	0.71
LEMITAR RIVERSIDE DRAIN	PT OF MAP 155 TR 5	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB194	0.67
LEMITAR RIVERSIDE DRAIN	PT OF MAP 155 TR 4	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB195	0.72
LEMITAR RIVERSIDE DRAIN	PT OF MAP 155 TR 6	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB198	0.65
LEMITAR RIVERSIDE DRAIN	PT OF MAP 155 TR 11	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB210	0.12
LEMITAR RIVERSIDE DRAIN	PT OF MAP 155 TR 12	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB211	1.45
LEMITAR RIVERSIDE DRAIN	PT OF MAP 155 TR 13	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB212	0.45
LEMITAR RIVERSIDE DRAIN	PT OF MAP 155 TR 15	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB213	0.35
LEMITAR RIVERSIDE DRAIN	PT OF MAP 156 TR 1	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB214	1.74
LEMITAR RIVERSIDE DRAIN	PT OF MAP 156 TR 2	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB215	0.16
LEMITAR RIVERSIDE DRAIN	PT OF MAP 155 TR 7	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB225	0.90
LEMITAR RIVERSIDE DRAIN	PT OF MAP 155 TR 14	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB236	0.36
LEMITAR RIVERSIDE DRAIN	ALL OF MAP 153 TR 2	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB263	0.00
LEMITAR RIVERSIDE DRAIN	PT OF MAP 153 TR 5	FEE SIMPLE	MRGCD/BOR	PLATE 4	MB264	0.00
LEMITAR RIVERSIDE DRAIN AND LFCC	PTS OF MAP 156 TRS 1 THRU 15 AND 77 THRU 84	QUITCLAIM	MRGCD/BOR	PLATE 4, 5	MB128	15.22
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 158 TR 36	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB10	0.83
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 157 TR 28	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB11	0.70
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 157 TR 25	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB14	2.58
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 157 TR 26	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB15	2.00
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 157 TR 27	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB16	0.47
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 158 TR 35	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB19	0.69
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 158 TR 33A	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB44	1.25
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 158 TR 33	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB45	3.17
LEMITAR RIVERSIDE DRAIN AND LFCC	ALL OF MAP 156 TR 76	QUITCLAIM	MRGCD/BOR	PLATE 5	MB138	0.37
LEMITAR RIVERSIDE DRAIN	PT OF MAP 156 TR 69	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB142	0.14
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 157 TR 18	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB144	1.31
LEMITAR RIVERSIDE DRAIN	PT OF MAP 156 TR 70	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB150	0.03
LEMITAR RIVERSIDE DRAIN	PT OF MAP 156 TR 66	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB154	1.22
LEMITAR RIVERSIDE DRAIN	PT OF MAP 156 TR 67	DEFERRED/PRESCRIPTIVE	MRGCD/BOR	PLATE 5	MB157	4.74
LEMITAR RIVERSIDE DRAIN	PT OF MAP 156 TR 68	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB159	3.82

FACILITY NAME	MRGCD PROPERTY MAP ATLAS 2008 OWNERSHIP DESCRIPTION	OWNER TYPE	OWNER	U.S. ARMY CORPS OF ENGINEERS MAP BOOK PLATE	U.S. ARMY CORPS OF ENGINEERS MAP BOOK ID	ACRES
SOCORRO RIVERSIDE DRAIN "B"	PRIVATE	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB239	0.10
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 158 TR 36	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB253	0.00
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 158 TR 35	FEE SIMPLE	MRGCD/BOR	PLATE 5	MB254	0.00
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 158 TR 37	FEE SIMPLE	MRGCD/BOR	PLATE 5, 6	MB17	2.78
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 158 TR 42	FEE SIMPLE	MRGCD/BOR	PLATE 6	MB20	0.35
SOCORRO RIVERSIDE DRAIN "B"	ALL OF MAP 160 TR 4	FEE SIMPLE	MRGCD/BOR	PLATE 6	MB21	1.15
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 159 TR 11	FEE SIMPLE	MRGCD/BOR	PLATE 6	MB22	1.92
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 161 TR 1	FEE SIMPLE	MRGCD/BOR	PLATE 6	MB23	7.25
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 159 TR 7	FEE SIMPLE	MRGCD/BOR	PLATE 6	MB24	13.09
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 159 TR 10	FEE SIMPLE	MRGCD/BOR	PLATE 6	MB39	5.69
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 158 TR 39	FEE SIMPLE	MRGCD/BOR	PLATE 6	MB43	12.13
SOCORRO RIVERSIDE DRAIN "B"	ALL OF MAP 160 TR 5	FEE SIMPLE	MRGCD/BOR	PLATE 6, 7	MB28	2.09
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 162 TR 46	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB9	2.15
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 160 TR 8	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB25	0.89
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 160 TR 7	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB26	1.02
SOCORRO RIVERSIDE DRAIN "B"	ALL OF MAP 160 TR 6	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB27	0.66
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 162 TR 18	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB30	2.78
SOCORRO MAIN CANAL AND SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 162 TR 32D	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB31	1.60
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 160 TR 9	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB32	2.60
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 160 TR 10	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB33	6.68
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 14	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB36	2.24
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 15	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB37	1.75
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 12	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB38	0.94
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 162 TR 44	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB40	7.11
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 1	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB41	0.88
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 2	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB42	2.24
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 162 TR 48	DEFERRED/PRESCRIPTIVE	MRGCD/BOR	PLATE 7	MB134	3.21
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 12	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB255	0.00
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 2	FEE SIMPLE	MRGCD/BOR	PLATE 7	MB256	0.00
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 28	FEE SIMPLE	MRGCD/BOR	PLATE 7, 8	MB34	5.75
SOCORRO RIVERSIDE DRAIN	PORTION OF MAP 164 TRACT 4	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB3	0.10
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 59	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB4	0.41
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 56	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB5	0.44
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 58	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB6	0.32
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 57	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB7	0.53
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 60	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB8	0.92
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 42	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB47	0.94
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 53	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB48	1.68
SOCORRO RIVERSIDE DRAIN "B"	PORTION OF MAP 164 TRACT 1	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB49	0.19
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 43	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB107	0.95
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 44	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB108	0.67
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 58	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB251	0.00
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 57	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB252	0.00
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 42	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB257	0.00
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 43	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB258	0.00
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 53	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB259	0.01
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 163 TR 44	FEE SIMPLE	MRGCD/BOR	PLATE 8	MB260	0.01
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 165 TR 1	FEE SIMPLE	MRGCD/BOR	PLATE 8, 9	MB78	40.01
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 166 TR 4	FEE SIMPLE	MRGCD/BOR	PLATE 9	MB1	0.64
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 166 TR 5	FEE SIMPLE	MRGCD/BOR	PLATE 9	MB2	0.91

FACILITY NAME	MRGCD PROPERTY MAP ATLAS 2008 OWNERSHIP DESCRIPTION	OWNER TYPE	OWNER	U.S. ARMY CORPS OF ENGINEERS MAP BOOK PLATE	U.S. ARMY CORPS OF ENGINEERS MAP BOOK ID	ACRES
SOCORRO RIVERSIDE DRAIN "A"	ALL OF MAP 166 TR 16	FEE SIMPLE	MRGCD/BOR	PLATE 9	MB12	3.71
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 166 TR 3	FEE SIMPLE	MRGCD/BOR	PLATE 9	MB13	0.57
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 166 TR 10	FEE SIMPLE	MRGCD/BOR	PLATE 9	MB46	4.10
SOCORRO RIVERSIDE DRAIN "A"	PT OF MAP 167 TR 62	DEFERRED/PRESCRIPTIVE	MRGCD/BOR	PLATE 9	MB75	1.36
SOCORRO RIVERSIDE DRAIN	ALL OF MAP 167 TR 46	PRESCRIPTIVE	MRGCD/BOR	PLATE 9	MB76	1.59
SOCORRO RIVERSIDE DRAIN	ALL OF MAP 167 TR 61	PRESCRIPTIVE	MRGCD/BOR	PLATE 9	MB77	1.24
SOCORRO RIVERSIDE DRAIN "B"	PT OF MAP 166 TR 9	FEE SIMPLE	MRGCD/BOR	PLATE 9	MB80	5.48
SOCORRO RIVERSIDE DRAIN	PT OF MAP 167 TR 63	FEE SIMPLE	MRGCD/BOR	PLATE 9	MB93	0.74
SAN ANTONITO LATERAL AND LEVEE AND FLOODWAY	PT OF MAP 166 TR 9-A	FEE SIMPLE	MRGCD/BOR	PLATE 9	MB104	1.26
SOCORRO RIVERSIDE DRAIN "A"	PT OF MAP 167 TR 3	FEE SIMPLE	MRGCD/BOR	PLATE 9	MB209	9.28
SOCORRO RIVERSIDE DRAIN "A"	PT OF MAP 167 TR 45	DEFERRED/PRESCRIPTIVE	MRGCD/BOR	PLATE 9	MB221	0.02
SOCORRO RIVERSIDE DRAIN	PT OF MAP 167 TR 88	FEE SIMPLE	MRGCD/BOR	PLATE 9, 10	MB73	6.76
SOCORRO RIVERSIDE DRAIN	ALL OF MAP 167 TR 89	DEFERRED/PRESCRIPTIVE	MRGCD/BOR	PLATE 9, 10	MB226	1.80
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 61	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB95	0.93
SOCORRO RIVERSIDE DRAIN	PT OF MAP 169 TR 4	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB97	0.94
SOCORRO RIVERSIDE DRAIN	PT OF MAP 169 TR 12	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB100	8.38
SOCORRO RIVERSIDE DRAIN	PT OF MAP 169 TR 5	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB135	2.08
SOCORRO RIVERSIDE DRAIN	PT OF MAP 169 TR 6	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB136	1.09
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 93	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB168	1.38
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 62	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB169	2.14
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 87	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB170	0.57
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 88	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB171	1.55
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 97	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB172	0.24
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 96	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB173	0.41
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 95	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB174	0.38
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 94	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB175	0.22
SOCORRO RIVERSIDE DRAIN	PT OF MAP 167 TR 126	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB176	0.27
SOCORRO RIVERSIDE DRAIN	PT OF MAP 167 TR 124	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB177	0.74
SOCORRO RIVERSIDE DRAIN	PT OF MAP 167 TR 127	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB178	0.85
SOCORRO RIVERSIDE DRAIN	PT OF MAP 167 TR 123	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB179	0.53
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 3	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB180	0.83
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 UNPLATTED GOVERNMENT LDS	PRESCRIPTIVE	MRGCD/BOR	PLATE 10	MB199	0.06
SOCORRO RIVERSIDE DRAIN	PT OF MAP 167 TR 125	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB200	0.25
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 23	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB201	0.47
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 24	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB202	0.34
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 29	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB203	0.54
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 25	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB204	0.26
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 26	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB205	0.30
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 30	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB206	0.30
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 27	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB218	0.32
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 28	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB219	0.53
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 31	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB228	0.24
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 32	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB229	0.52
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 33	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB230	0.37
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 52	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB231	1.09
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 53	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB232	0.46
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 54	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB234	0.66
SOCORRO RIVERSIDE DRAIN	PT OF MAP 168 TR 55	FEE SIMPLE	MRGCD/BOR	PLATE 10	MB235	0.21
SOCORRO RIVERSIDE DRAIN	PT OF MAP 169 TR 13	FEE SIMPLE	MRGCD/BOR	PLATE 10, 11	MB87	1.13

FACILITY NAME	MRGCD PROPERTY MAP ATLAS 2008 OWNERSHIP DESCRIPTION	OWNER TYPE	OWNER	U.S. ARMY CORPS OF ENGINEERS MAP BOOK PLATE	U.S. ARMY CORPS OF ENGINEERS MAP BOOK ID	ACRES
SOCORRO RIVERSIDE DRAIN	PT OF MAP 170 TR 22B	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB89	0.02
SOCORRO RIVERSIDE DRAIN	PT OF MAP 170 TR 22C	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB90	0.07
SOCORRO RIVERSIDE DRAIN	PT OF MAP 170 TR 50	DEFERRED/PRESCRIPTIVE	MRGCD/BOR	PLATE 11	MB91	2.82
SOCORRO RIVERSIDE DRAIN	PT OF MAP 170 TR 33	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB92	1.31
SOCORRO RIVERSIDE DRAIN	PT OF MAP 170 TR 34	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB94	1.41
SOCORRO RIVERSIDE DRAIN	PT OF MAP 172 TR 13	DEFERRED/PRESCRIPTIVE	MRGCD/BOR	PLATE 11	MB96	4.65
SOCORRO RIVERSIDE DRAIN	PT OF MAP 169 TR 21	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB101	1.10
SOCORRO RIVERSIDE DRAIN	PT OF MAP 170 TR 22D	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB102	0.13
SOCORRO RIVERSIDE DRAIN	PT OF MAP 170 TR 22E	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB103	0.19
SOCORRO RIVERSIDE DRAIN	PT OF MAP 170 TR 2	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB137	3.80
SOCORRO RIVERSIDE DRAIN	PT OF MAP 170 TR 35	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB139	4.38
SOCORRO RIVERSIDE DRAIN	PT OF MAP 169 TR 20	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB143	3.51
SOCORRO RIVERSIDE DRAIN	PT OF MAP 172 TR 8	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB145	4.06
SOCORRO RIVERSIDE DRAIN	PT OF MAP 169 TR 22	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB152	1.03
SOCORRO RIVERSIDE DRAIN	PT OF MAP 170 TR 22	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB153	1.44
SOCORRO RIVERSIDE DRAIN	PT OF MAP 169 TR 23	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB162	1.97
SOCORRO RIVERSIDE DRAIN	PT OF MAP 172 TR 2	FEE SIMPLE	MRGCD/BOR	PLATE 11	MB220	2.24
SOCORRO RIVERSIDE DRAIN (NKA SAN ANTONIO RIVERSIDE DRAIN)	PT OF MAP 172 TR 21	FEE SIMPLE	MRGCD/BOR	PLATE 11, 12	MB160	6.23
SOCORRO RIVERSIDE DRAIN (NKA SAN ANTONIO RIVERSIDE DRAIN)	PT OF MAP 173 TR 26	FEE SIMPLE	MRGCD/BOR	PLATE 12	MB118	0.97
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 173 TR 16	FEE SIMPLE	MRGCD/BOR	PLATE 12	MB119	11.47
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 175 TR 4	FEE SIMPLE	MRGCD/BOR	PLATE 12	MB151	7.09
SOCORRO RIVERSIDE DRAIN (NKA SAN ANTONIO RIVERSIDE DRAIN)	PT OF MAP 173 TR 25	FEE SIMPLE	MRGCD/BOR	PLATE 12	MB155	3.98
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 173 PUBLIC RD AND R. R. R/W	PRESCRIPTIVE	MRGCD/BOR	PLATE 12	MB156	0.43
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 175 TR 8	FEE SIMPLE	MRGCD/BOR	PLATE 12	MB197	2.83
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 175 TR 6	FEE SIMPLE	MRGCD/BOR	PLATE 12	MB207	2.09
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 175 TR 6A	FEE SIMPLE	MRGCD/BOR	PLATE 12	MB208	1.32
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 175 TR 7	FEE SIMPLE	MRGCD/BOR	PLATE 12	MB233	0.56
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 173 TRS 7 & 8	DEFERRED/PRESCRIPTIVE	MRGCD/BOR	PLATE 12	MB237	3.28
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 175 TR 78	FEE SIMPLE	MRGCD/BOR	PLATE 12, 13	MB148	6.36
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 179 TR 3	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB81	0.73
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 176 TR 72	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB98	1.26
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 176 TR 73	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB99	1.01
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 177 TR 2B	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB106	2.40
SAN ANTONIO RIVERSIDE DRAIN	ALL OF MAP 177 TR 11	PRESCRIPTIVE	MRGCD/BOR	PLATE 13	MB140	0.31
SAN ANTONIO RIVERSIDE DRAIN "B"	PT OF MAP 179 TR 31	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB141	9.75
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 177 TR 2	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB146	1.02
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 176 TR 71	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB147	0.88
SAN ANTONIO RIVERSIDE DRAIN "B"	PT OF MAP 179 TR 30	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB158	2.54
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 179 TR 2A	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB163	0.59
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 177 TR 3	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB165	2.63
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 179 TR 2B	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB192	0.56
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 177 TR 2A	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB196	1.50
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 179 TR 1	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB222	0.81
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 176 TR 48	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB223	1.71
SAN ANTONIO RIVERSIDE DRAIN	PT OF MAP 177 TR 4	FEE SIMPLE	MRGCD/BOR	PLATE 13	MB224	5.75
SAN ANTONIO RIVERSIDE DRAIN & ELMENDORF DRAIN	PT OF BOSQUE DEL APACHE GRANT	FEE SIMPLE	MRGCD/BOR	PLATE 13, 14, 15	MB124	50.71

FACILITY NAME	MRGCD PROPERTY MAP ATLAS 2008 OWNERSHIP DESCRIPTION	OWNER TYPE	OWNER	U.S. ARMY CORPS OF ENGINEERS MAP BOOK PLATE	U.S. ARMY CORPS OF ENGINEERS MAP BOOK ID	ACRES
				TOTAL ACRES IN MRGCD/BOR		568.88
SEVILLETA NATIONAL WILDLIFE REFUGE	FISH AND WILDLIFE SERVICE	FEDERAL	FISH AND WILDLIFE SERVICE	PLATE 1	MB238	30.34
BOSQUE DEL APACHE NATIONAL WILDLIFE REFUGE	FISH AND WILDLIFE SERVICE	FEDERAL	FISH AND WILDLIFE SERVICE	PLATE 15, 16, 17, 18, 19	MB246	166.00
				TOTAL ACRES IN FEDERAL		196.34
STATE OF NEW MEXICO	STATE OF NEW MEXICO	STATE OF NEW MEXICO	STATE OF NEW MEXICO	PLATE 6	MB265	0.35
				TOTAL ACRES IN STATE GOVERNMENT		0.35
CITY OF SOCORRO	PRIVATE	LOCAL	CITY OF SOCORRO	PLATE 6	MB240	8.09
				TOTAL ACRES IN LOCAL GOVERNMENT		8.09
PRIVATE	PRIVATE	PRIVATE	AT&SF c/o BNSF	PLATE 1	MB241	9.50
PRIVATE	PRIVATE	PRIVATE	PRIVATE	PLATE 19, 20, 21	MB243	51.19
				TOTAL ACRES IN PRIVATE		60.69
				TOTAL ACRES ALL OWNERS		834.35
Tiffany Waste Disposal Area	PRIVATE	PRIVATE	PRIVATE	ACRES IN WASTE DISPOSAL AREA		307.22
Acres column represents the land area necessary for construction by the Corps and for the non-federal sponsor to perform OMRR&R.						
Acres in Tiffany Waste Displosal Area not included in TOTAL ACRES ALL OWNERS						



San Acacia
Sevilleta NWR
Rio Salado
PLATE 1
San Acacia Diversion Dam
San Lorenzo Arroyo
PLATE 2
Polvadera
408
PLATE 3
Lemitar
PLATE 4
PLATE 5
Escondida
Socorro Diversion
PLATE 6
PLATE 7
Socorro
60
PLATE 8
Brown Arroyo
PLATE 9
Luis Lopez
PLATE 10
25
PLATE 11
Rio Grande
San Antonio
PLATE 12
PLATE 13
380
1
Carthage
PLATE 14
Tiffany Canyon
Ryan Hill Canyon
PLATE 15
Bosque del Apache NWR
PLATE 16
PLATE 17
PLATE 18
PLATE 19
PLATE 21
PLATE 20
San Marcial
Tiffany Basin
San Marcial Railroad Bridge
Milligan Gulch
N
Utah
Colorado
Oklah
25
Santa Fe
Rio Puerco
Rio Grande
40
Albuquerque
New Mexico
Arizona
Socorro
Study Area
Texas
10
Las Cruces
20
10
Mexico
Stream Intermittent
Rio Grande
LFCC
Interstate Highway
Highway
Major Road
Railroad
Construction Easement
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
AUTHORIZED PROJECT
STUDY AREA & PLATE INDEX
0 1 2 3 4 5
Miles
0 3 6 9
Kilometers
Map Date: 05 Nov 2012
Source Imagery: NM Statewide Digital Ortho Quarter Quads, 2005-2006; UTM NAD83, Zone 13N; Units = meters

EXHIBIT C

Real Estate Plan

Exhibit C

Segment Map

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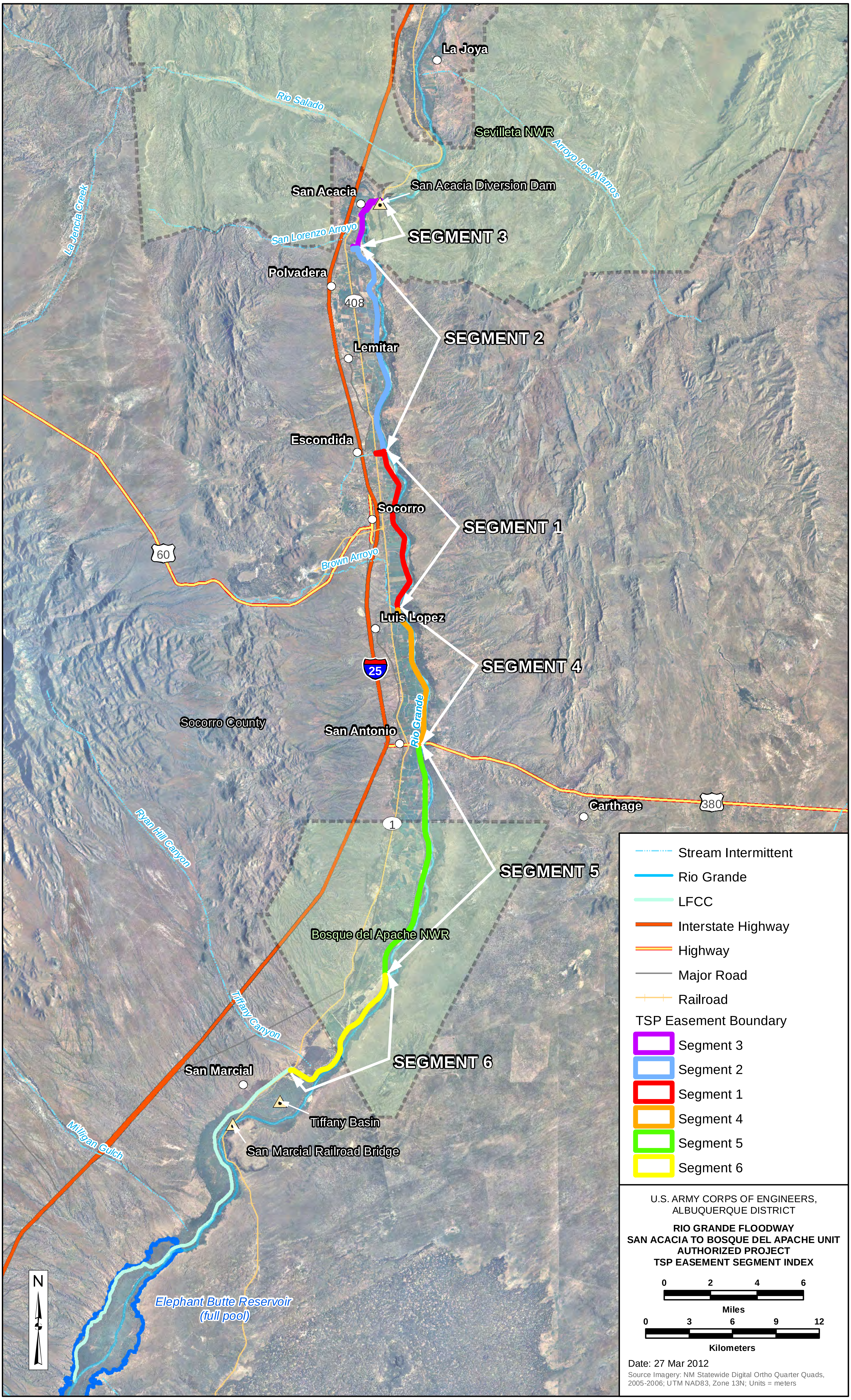

La Joya
Rio Salado
Sevilleta NWR
Arroyo Los Alamos
San Acacia
San Acacia Diversion Dam
La Jencia Creek
San Lorenzo Arroyo
SEGMENT 3
Polvadera
408
SEGMENT 2
Lemitar
Escondida
Socorro
SEGMENT 1
60
Brown Arroyo
Luis Lopez
SEGMENT 4
25
Rio Grande
Socorro County
San Antonio
Carthage
380
1
Ryan Hill Canyon
SEGMENT 5
Bosque del Apache NWR
Tiffany Canyon
SEGMENT 6
San Marcial
Tiffany Basin
San Marcial Railroad Bridge
Milligan Gulch
Elephant Butte Reservoir
(full pool)
N
Stream Intermittent
Rio Grande
LFCC
Interstate Highway
Highway
Major Road
Railroad
TSP Easement Boundary
Segment 3
Segment 2
Segment 1
Segment 4
Segment 5
Segment 6
U.S. ARMY CORPS OF ENGINEERS,
ALBUQUERQUE DISTRICT
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
AUTHORIZED PROJECT
TSP EASEMENT SEGMENT INDEX
0 2 4 6
Miles
0 3 6 9 12
Kilometers
Date: 27 Mar 2012
Source Imagery: NM Statewide Digital Ortho Quarter Quads, 2005-2006; UTM NAD83, Zone 13N; Units = meters

Exhibit C

Real Estate Plan

Exhibit D

Assessment of Non-Federal Partners Real Estate Acquisition Capability

(MRGCD)

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EXHIBIT D

ASSESSMENT OF NON-FEDERAL PARTNERS
REAL ESTATE ACQUISITION CAPABILITY

General Reevaluation Report
Rio Grande Floodway
San Acacia to Bosque Del Apache Unit Project
Socorro County, New Mexico

I. LEGAL AUTHORITY

a. Does the Non-Federal Cost-Sharing Partner have legal authority to acquire and hold title to real property for project purposes?

Yes. The Middle Rio Grande Conservancy District's (MRGCD's) Board's power and authority is clearly established by the Conservancy Act of New Mexico at New Mexico State Statutes Annotated (NMSA) 1978 § 73-14-39 (1927). This Act authorizes and empowers the MRGCD to protect life and property within the district from flooding by constructing the necessary works either within or outside of the district. The Board was given authority through the Conservancy Act to acquire real or personal property, public or private, either within or outside of the district, through donation, purchase, or condemnation.

Pursuant to New Mexico State Statute 73-14-39, General Powers: "... a Conservancy District has the authority and power to acquire by purchase or condemnation .., own, use and sell, hold ... any real property."

b. Does the Cost-Sharing Partner have the power of eminent domain for this project?

Yes. Please refer to I.a., above.

c. Does the Cost-Sharing Partner have quick-take authority for this project?

Yes. The New Mexico State Statutes Annotated 42A-I-22, Condemnation Proceedings, " ... court may make an order within 30 days of the condemnation filing authorizing the condemner to take immediate possession of the property ... ", and 42-2-6, Special Alternative Condemnation Procedure, Preliminary Order of Entry, " ... petitioner may obtain a preliminary order permitting the political subdivision to immediately enter and occupy the premises sought to be condemned pending the action and to do such work thereon as may be required."

d. Are any of the lands/interests in land required for the project located outside of the Cost-Sharing Partners political boundary?

Yes. Lands that may be required for excavation near the San Acacia Diversion Dam and potential lands for borrow; disposal, storage and staging areas are privately or federally held. Parts of the project area are located on and adjacent to the Sevilleta National Wildlife Refuge (the Sevilleta de la Joya Land Grant), the Town of Socorro Land Grant, the Bosque del Apache National Wildlife Refuge (NWR) and the Pedro Armendaris Land Grant.

e. Are any of the lands/interests in land required for the project owned by an entity whose property the Cost-Sharing Partner cannot condemn?

Yes. The Cost-Sharing Partner would probably not be successful in condemning property of the Sevilleta and Bosque del Apache NWRs, nor any property owned by Reclamation or U.S. Department of the Interior, Bureau of Land Management. and Burlington Northern and Santa Fe Railroad. lands would be permitted to the cost sharing partner by the corresponding federal agency and the railroad.

II. HUMAN RESOURCE REQUIREMENTS

a. Will the Cost-Sharing Partner's in-house staff require training to become familiar with the real estate requirements of federal projects including P.L.91-646, as amended?

No, the NFS proposes to contract for necessary real estate services familiar with the real estate requirements of federal projects including P.L.91-646, as amended, to fulfill its obligation to provide the LERRDs identified by the government.

b. If the answer to II.a. is "yes" has a reasonable plan been developed to provide such training?

No training plan has been developed, nor is the need anticipated.

c. Does the Cost-Sharing Partner's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project?

Yes, the NFS proposes to contract for necessary real estate services to fulfill its obligation to provide the LERRDs identified by the government.

d. Is the Cost-Sharing Partner's project in-house staffing level sufficient considering its other work load, if any, and the project schedule?

Yes, the NFS proposes to contract for necessary real estate services to fulfill its obligation to provide the LERRDs identified by the government.

e. Can the Cost-Sharing Partner obtain contractor support, if required, in a timely fashion?

Yes. The Corps will facilitate MRGCD in obtaining Acquisition services for the project. Acquisition services are readily available within the New Mexico area.

f. Will the Partner likely request U.S. Army Corps of Engineers (Corps) assistance in acquiring real estate?

No. The partner will utilize contracted real estate services as necessary for acquiring real estate.

III. OTHER PROJECT VARIABLES

a. Will the Cost-Sharing Partner's staff be located within a reasonable proximity to the project site?

Yes, The Corps has staff within 90 miles of the project.

b. Has the Cost-Sharing Partner approved the project real estate schedule/milestones?

The Cost-Sharing Partner is aware of the status of the project and continues to support project development. MRGCD has reviewed and approved phase one of the project.

IV. OVERALL ASSESSMENT

a. Has the Cost-Sharing Partner performed satisfactorily on other Corps projects?

Yes. Most recently this partner worked with the Corps on the Albuquerque West Levee project. The Cost-Sharing Partner is a well-established, long-standing state service provider to the inhabitants of the area and is empowered under the Conservancy Act of New Mexico at NMSA 1978 § 73-14-39 (1927), New Mexico State Statutes Annotated, which states in part:

"...the board is authorized and empowered . . . in or out of said district . . . to construct and maintain main and lateral ditches, . . . canals, . . . levees, . . . retarding basins, floodways, . . . and any other works and improvements deemed necessary to construct, preserve, operate or maintain the works in or out of said district; to construct, reconstruct or enlarge or cause to be constructed, reconstructed or enlarged, any and all bridges that may be needed in or out of said district; . . . to construct, reconstruct any and all of said works and improvements in or out of said district; . . . and shall have the right to acquire by donation, purchase or condemnation to construct, own, lease, use and sell, to hold, encumber, control and maintain any easement, water right, acequias, well, railroad right-of-way, canal, sluice, flume, reservoir site, reservoir or retarding basin, mill dam, water power, franchise, park, cemetery or any other public way or place or any real or personal property, public or private in or out of said district, for rights-of-way and such other things, or for materials of construction or for any other use not inconsistent with the purposes of this act; . . ."

Additionally, the New Mexico Interstate Stream Commission has provided statements of financial support to the MRGCD and continues to show interest and support for this project.

b. With regard to this project, is the Cost-Sharing Partner anticipated to be highly capable?

Yes.

V. COORDINATION

a. Has this assessment been coordinated with the Cost-Sharing Partner?

Yes, additionally the Corps will coordinate with the Cost-Sharing Partner during the upcoming conduct of the Engineering Technical Appendix prepared for the General Reevaluation Report, which occurs after the F4A Alternative Formulations Briefing.

b. Does the Cost-Sharing Partner concur with this assessment?

Yes, the Cost-Sharing Partner has previously stated their support of the project. The Cost-Sharing will provide a certification as to their financial capabilities as a part the Project Partnership Agreement.

Prepared by:

Mark K. Turkovich
Realty Specialist
13Jan12

Reviewed and approved by:

Acting For

Karen Kennedy
Chief, Real Estate Division
13Jan12

EXHIBIT D

Real Estate Plan

Exhibit E

Assessment of Non-Federal Partners Real Estate Acquisition Capability

(NMISC)

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EXHIBIT E

ASSESSMENT OF NON-FEDERAL PARTNERS'S
REAL ESTATE ACQUISITION CAPABILITY

General Reevaluation Report
Rio Grande Floodway
San Acacia to Bosque Del Apache Unit Project
Socorro County, New Mexico

I. LEGAL AUTHORITY

a. Does the Non-Federal (Cost-Sharing) Partner have legal authority to acquire and hold title to real property for project purposes?

Yes. Pursuant to NMSA 1978 § 72-14-10, et seq., the New Mexico Interstate Stream Commission (NMISC) has authority to acquire and hold title to real property taken in the name of the Commission.

b. Does the Cost-Sharing Partner have the power of eminent domain for this project?

Yes, Pursuant to NMSA 1978 § 72-14-10 et seq., the NMISC has authority to condemn real property for public use.

c. Does the Cost-Sharing Partner have quick-take authority for this project?

Yes. Pursuant to NMSA 1978 § 42-2-1 et seq., the NMISC has the authority to use special alternative condemnation procedures to enter into possession at the inception of the proceeding and take possession of real property that is necessary for the immediate preservation of the public peace, health, safety, the promotion of the general welfare.

d. Are any of the lands/interests in land required for the project located outside of the Cost-Sharing Partners political boundary?

No, Pursuant to NMSA 1978 § 72-14-3 the NMISC has authority throughout the State of New Mexico.

e. Are any of the lands/interests in land required for the project owned by an entity whose property the Cost-Sharing Partner cannot condemn?

Yes. Some lands are in federal ownership.

II. HUMAN RESOURCE REQUIREMENTS

a. Will the Cost-Sharing Partner's in-house staff require training to become familiar with the real estate requirements of federal projects including P.L.91-646, as amended?

The ISC is willing to have staff trained as indicated above.

b. If the answer to II.a. is "yes" has a reasonable plan been developed to provide such training?

The ISC will develop a plan for the training and coordinate with USACE on such.

c. Does the Cost-Sharing Partner's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project?

With the completion of the above-mentioned training, the NMISC as cost-share sponsor will have sufficient real estate acquisition experience for the project.

d. Is the Cost-Sharing Partner's project in-house staffing level sufficient considering its other work load, if any, and the project schedule?

The planned phasing of the construction of this project assures sufficient in-house staffing levels.

e. Can the Cost-Sharing Partner obtain contractor support, if required, in a timely fashion?

Yes, if required the ISC can obtain contractor support.

f. Will the Partner likely request U.S. Army Corps of Engineers (Corps) assistance in acquiring real estate?

ISC does not plan to ask assistance from USACE for acquiring real estate.

III. OTHER PROJECT VARIABLES

a. Will the Cost-Sharing Partner's staff be located within a reasonable proximity to the project site?

Yes

b. Has the Cost-Sharing Partner approved the project real estate schedule/milestones?

The ISC concurs with the schedule prepared by the Corps and submitted by MRGCD on October 27, 2011 as part of their application for assistance to the New Mexico Water Trust Board.

IV. OVERALL ASSESSMENT

a. Has the Cost-Sharing Partner performed satisfactorily on other Corps projects?

Yes. Most recently this partner worked with the Corps and performed outstandingly on the salinity studies on the Pecos River and Rio Grande River.

b. With regard to this project, is the Cost-Sharing Partner anticipated to be highly capable?

The Cost-Sharing Partner is anticipated to be capable.

V. COORDINATION

a. Has this assessment been coordinated with the Cost-Sharing Partner?

Yes, additionally the Corps will coordinate with the Cost-Sharing Partner during the upcoming conduct of the Technical Appendix prepared for the Limited Reevaluation Report, which occurs between the F4 Alternative Review Conference and the F4 Alternative Formulations Briefing.

b. Does the Cost-Sharing Partner concur with this assessment?

Yes, the Cost-Sharing Partner has previously stated their support of the project. The Cost-Sharing Partner will provide a certification as to their financial capabilities as part of the Project Partnership Agreement.

Prepared by:

Marvin L. Urban
Realty Specialist
13Jan12

Reviewed and approved by:

Karen Kennedy
Chief, Real Estate Division
13Jan12

EXHIBIT E