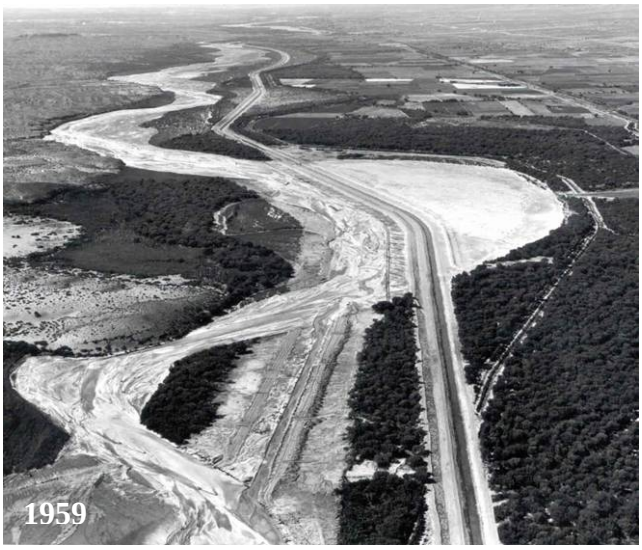
RECLAMATION

Managing Water in the West

San Acacia River Mile 114 and 113 Priority Sites

Bend Migration Estimates



U. S. Department of the Interior
Bureau of Reclamation
Albuquerque Area Office
Technical Services Division
Albuquerque, New Mexico

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MISSION STATEMENTS

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Cover Photos
Low Flow Conveyance Channel at river miles 114 and 113 in 1959 and 2004.
2004, Mike Sixta
1959, Reclamation File

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Bend Migration Estimates

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An analysis to evaluate future river bend migration is presented to estimate the anticipated project life for the levee setback alternative. This analysis is based on historical movement of six Rio Grande bends located in the study reach (see Figure 1)

Historical aerial photographs of the proposed project area were available for the years 1972, 1985, 1988, 1992, 1996, 1999, 2001, and 2002. After reviewing and comparing the photography datasets, the following decisions were made regarding the use of the 1972, 1999, and 2002 data for this evaluation:

1. For the 1972 photo, the river was essentially straight so any currently existing bends were indistinguishable. Bends later developed in the 1980's with much of the bank erosion/bed migration occurring in the late 1980's and 1990's. Therefore the 1972 data was not utilized.
2. I n comparing the 2001 coverage with the 2002, there was no measurable movement in the banklines.
3. There was only one bankline that moved measurably between 1999 and 2002.

For all river bends located in the study reach, the apex was determined by drawing a line parallel with the bankline at or near each of the upstream and downstream bend crossing. Next a line that bisected the angle formed by these two lines was created and the bend apex was plotted where the bisecting line intersected the bankline (see Figure 2).

Each bend apex location in every data set was approximated in this manner. A trend line defining the historic movement of the bend apexes was derived by connecting the apex for each successive aerial photo. The migration rate of each bend was determined using the measured change in apex position and the time interval between photos.

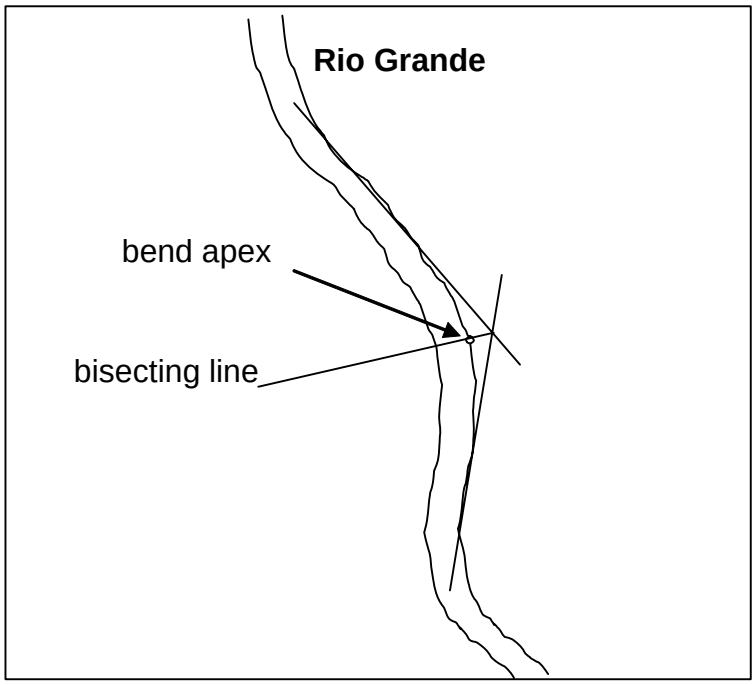


Figure 2. Bend Apex Designation Example

The historical trend of the apex migration was predominantly in the downstream direction with a small amount of lateral migration. Table 1 shows the relationship between the average percent of total movement during a time period, and the percent of the total discharge during that same time period. Based on data in table 1, it is apparent that more bend migration occurred when higher annual runoff volumes were experienced.

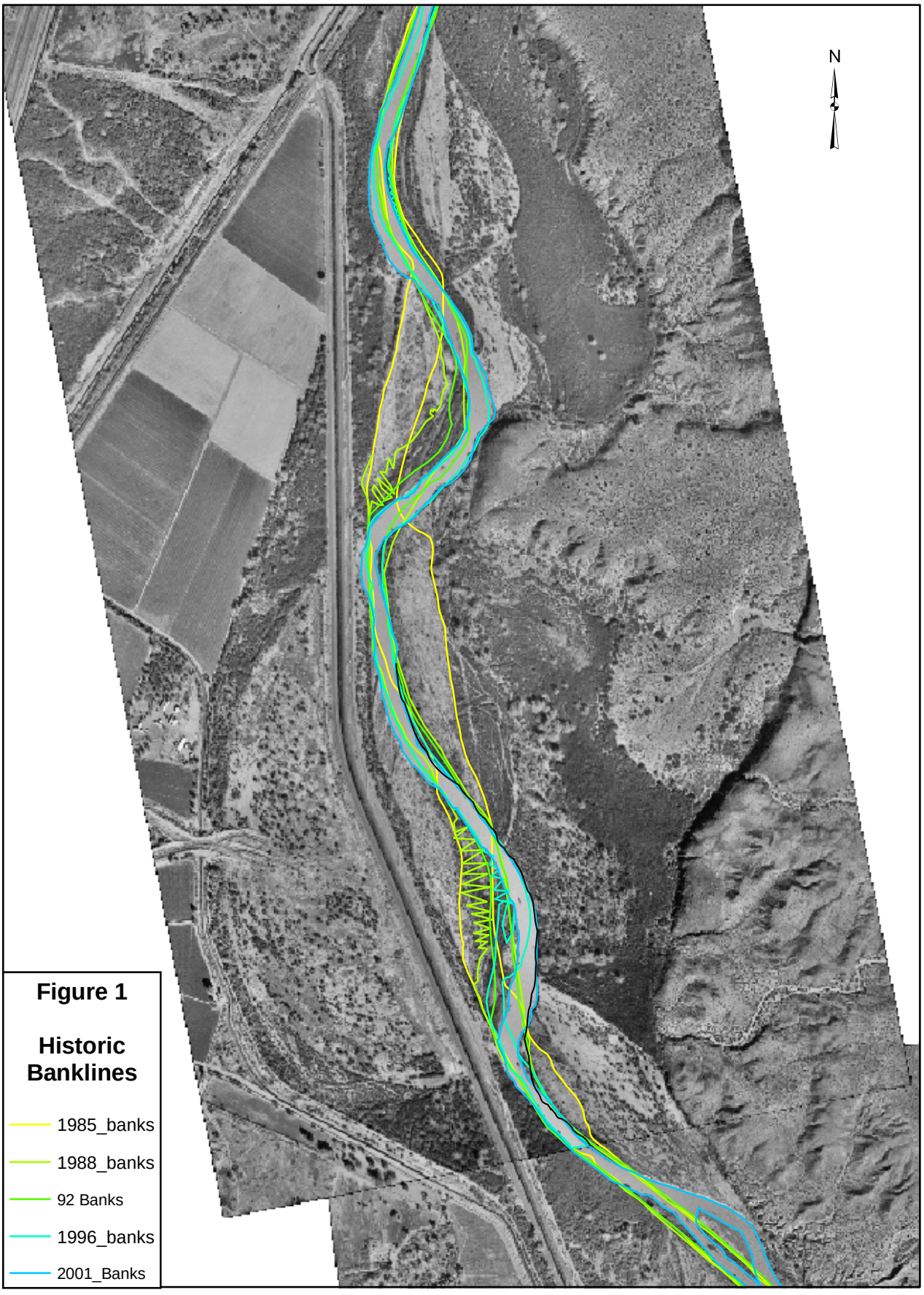
Table 1. Comparison of bend movement and River flow runoff volume (1985-2002)

Time Period (period between data sets)	Percent of total observed bend movement	*Percent of total runoff volume
1985-1988 (3)	30%	33%
1988-1992 (4)	19%	16%
1992-1996 (4)	25%	30%
1996-1999 (3)	25%	15%
1999-2002 (3)	1%	6%

*Discharge data is based on gauge records at San Acacia Gauge

To estimate the future bend apex locations, the migration rate and trajectory were analyzed. For five of the bends the rate of future movement was predicted to be the average annual change in position over the entire period (Figure 3). The migration rate at RM 113 was reduced from the entire period average to the 1992-2001 average rate. The bank erosion rate was reduced due the near future change in bank material composition at the site. At present, the bend is eroding an 8-10 foot terrace composed predominately of unconsolidated sand ('sugar sand'). In the near future as the bend migrates, it will begin eroding a 12-15 foot terrace that is composed of consolidated soil profiles, layered with slightly compacted silts and clays. For all bends, their future locations were extrapolated to 10, 25, and 50 years (Figure 3).

Because of variability in hydrology and other system wide and local geomorphic inputs, the given locations are only rough approximations. If the future is drier than the previous 18 year period, the migration could be less than predicted; if the future is wetter, the migration may be greater. However based on this analysis and baring any severe hydrologic changes or events, it is believed that the project life of the levee setback alternative is 40 to 50 years at RM 113 and over 50 years at RM 114.



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1,000 500 0 1,000 2,000 3,000 4,000 Feet

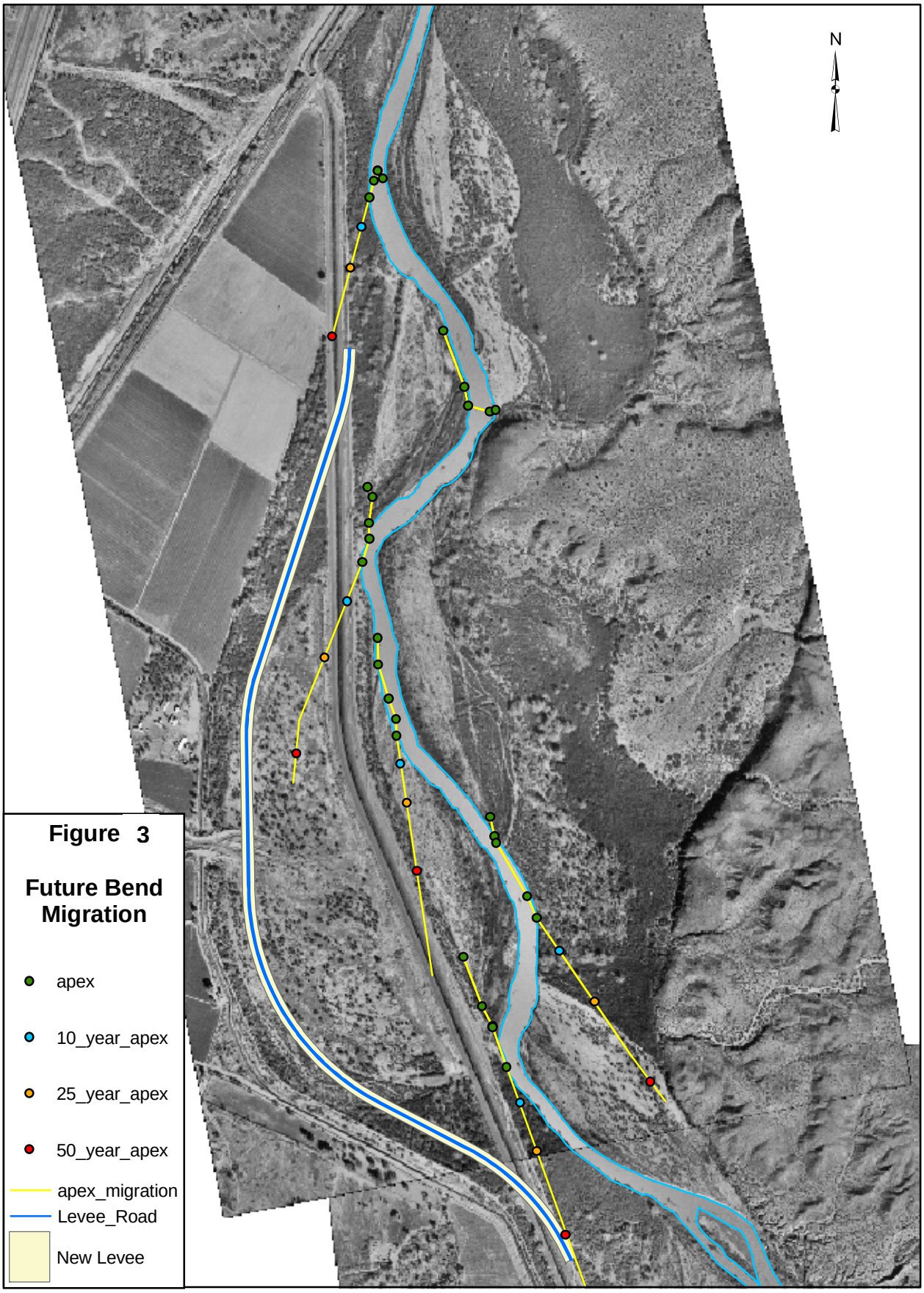
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Figure 3
Future Bend Migration
apex
10_year_apex
25_year_apex
50_year_apex
apex_migration
Levee_Road
New Levee
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1,000 500 0 1,000 2,000 3,000 4,000
Feet