RAYMONDVILLE DRAIN PROJECT
ECONOMICS APPENDIX A-5

ATTACHMENT B

ECONOMICS DESIGN TASK PROTOCOL

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ECONOMICS

1. Overview of Plan Formulation and Economic Evaluation

a) Formulating Alternatives was done during the hydrology and hydraulics phase of this study to reduce flooding in the downstream areas of North Main Drain and Raymondville drain. (This is described in detail in Appendix A1 – Engineering)
b) Evaluating the national economic development (NED) benefits for the alternatives.
c) Comparing the NED benefits for each alternative.

2. Complete alternative cost estimate

Cost estimates were done for each alternative. These estimates allow comparison of alternatives on an equal footing to enable plan selection. The cost estimates were based on present construction costs using the Texas Department of Transportation statewide unit price averages. In addition to the project construction costs additional expenses were included. The following fees and expenses were added to calculate a total project cost:

- Administrative and legal expenses
- Land, structure, right-of-way, appraisals
- Relocation expenses and payments
- Architectural and engineering fees
- Other Architectural and engineering fees
- Additional services (Geotechnical and survey)
- Project inspections

Contingency allowances were also included:

- 15% of the project construction total
- 5% of the fees and expenses total

3. Compute annual O&M Costs

The annual Operating and Maintenance (O&M) costs were based on 1% of the project construction cost. This will be used to determine the annual money needed to keep the project operating properly from year to year during its service life.

4. Determine the B_{IR}

The inundation-reduction benefit (B_{IR}) is the difference between the equivalent annual damage (EAD) of the without-project and with-project plan. The EAD is generated in the Flood Damage Assessment

portion of this report (See DTP FDA for details). The EAD is the annualized flood damage based on the duration of the service life. For this study the service life is 50 years.

5. Increasing the B_{IR} to account for other Non-Structural Benefits

The inundation-reduction benefit was increased by a factor of 1.39 (39%) in order to account for non-structural damages which will occur during a flood event. According to the US Army Corps of Engineers' "*Appendix C – Economic Analysis, Dredged material Management Plan and Environmental Impact Statement, McNary Reservoir and Lower Snake River Reservoirs* ", the 39% is determined by the following:

- Emergency Costs – 13.4%
- Transportation Costs – 5%
- Utility Costs – 0.6%
- Non-Physical Damages – 20%
- Total of Other Costs – 39%

Emergency costs include five areas and these areas make up the 13.4% of the structural and content damage total:

- Protection of life, health, and property
- Evacuation, transition, and reoccupation
- Emergency and mass care
- Emergency preparedness
- Administrative cost of emergency

Non-Physical damages were determined from problems such as lost wages, additional living expenses, lost income, temporary opening and closing costs for businesses, alternate routes for traffic, public infrastructure, etc.

The initial value of 39% extracted from the McNary sample project has been further validated by the paper titled "*Estimating the Costs of Emergency Services During Flood Events*", presented at the 4th International Symposium on Flood Defense in Ontario, CA in May 2008. (https://www.researchgate.net/publication/259479521_Estimating_the_costs_of_emergency_services_during_flood_events). Based on an analysis of approximately 65 flooding events, the average cost of emergency services was 37% of flood damages (NED costs, not RED). This closely aligns and validates the 39% initially used by the PDT. The slight increase from the average cost (from 37% to 39%) is justified due to the rural nature of the majority of the Raymondville Drain study area, which results in longer travel response times than many of the analyzed events.

Agricultural damages generally occur in more remote and less inhabited areas of the study area. The PDT determined that the 1.39 factor would increase benefits more than appropriate for agricultural damages. Emergency costs and non-physical damages are expected to be significantly less than in more inhabited areas. Therefore, benefits in agricultural areas were increased by a more conservative factor of 1.15 (15% increase).

6. Determine B_L (NOT USED IN BENEFITS NUMBER)

Location Benefit is the increase in land value of land removed from the existing floodplain due to the decrease of floodplain width from project improvements. The total without-project 100-year 24-hour flood envelope minus the total with-project 100-year 24-hour flood envelope multiplied by $1,000 increase in value is the used.

7. Determine B_I (NOT USED IN BENEFITS NUMBER)

Intensification Benefit is the increase in land value adjacent to new ditches. Since the new ditches will be designed for the 100-year storm flooding will be minimal so the land adjacent to the ditches would increase in value. For this study a 1000-foot section on both sides of the new ditch multiplied by the length of the new ditch was increased in value by $1,500 per acre.

8. Calculate Net Benefit

After all the alternatives have been defined and a flood damage assessment has been completed to show improvements from the without project conditions, the net benefit needs to be calculated to determine which alternative's benefit cost ratio (BCR) will recommend the best alternative to be implemented. The net benefit is the combination of several factors. The total of the location benefit, intensification benefit, and the inundation-reduction benefit is calculated then the difference between this total and the total cost of implementing, operating, maintaining, repairing, replacing, and rehabilitating (OMRR&R) will generate the net benefit.

$$NB = (B_L + B_I + B_{IR}) - C$$

B_L - the location benefit which is the value of making existing floodplain land available for new economic uses (not included in this analysis)
B_I - intensification benefit which is the value of intensifying the future use of the land such as increasing the land value (not included in this analysis)
B_{IR} - inundation-reduction benefit which is the value of reducing or modifying the flood losses to economic activity already using the floodplain land in absence of any further action or plan
C - the total cost of implementing, operating, maintaining, repairing, replacing, and rehabilitating (OMRR&R)
NB – net benefit

In order to calculate the B_L, the with- and without-project floodplains need to be determined. Once determined the acreage recovered by the with project floodplain is

9. Calculate present value of NB for service life (applying interest rate)

The present value net benefit is taken in whole dollars and multiplied by the current federal interest rates for Corps of Engineers projects for the service life duration. The interest rate applicable to interest during construction, investment cost repayment, and capitalized O&M cost for 2024 is 2.75 %. This number is from the Economic Guidance Memorandum 24-01, Federal Interest Rate for Corps of Engineers Projects for Fiscal Year 2024. The service life as mentioned before is 50 years. This will

give the future value of the net benefit. The Annual present value (A_{PV}) is calculated to determine the total NED benefits equally distributed per year. This value is used to determine the benefit to cost ratio

10. Calculate annual value of construction costs based on service life (applying interest rate)

The present value construction cost is taken in whole dollars and multiplied by the current federal interest rates for Corps of Engineers projects for the service life duration. The interest rate applicable to interest during construction, investment cost repayment, and capitalized O&M cost for 2024 is 2.75%. The service life as mentioned before is 50 years. This will give the future value of the construction costs. The Annual present value (A_{PV}) is calculated to determine the total construction costs equally distributed per year. This value is used to determine the benefit to cost ratio.

11. Calculate benefit to cost ratio (BCR)

The Benefit to Cost Ratio (BCR) is simply the annualized NED benefit divided by the annualized construction costs. The BCR is calculated to determine the value of the investment, and is considered as a factor for Federal participation for the project. The additional costs such as engineering, right-of-way acquisition, surveying, etc. are not included in this funding.