

APPENDIX H: TMDL MODEL SCENARIOS

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Overall Approach

The overall approach is to model the existing BOD, DO, and NH₃ loads utilizing the New River QUAL2K Water Quality computer model, and then reduce loads of BOD and NH₃ loads until the WQO DO would be expected to be met. For BOD and NH₃ the load will be set through consideration of the observed relationships with dissolved oxygen (BOD and NH₃) as well as the simulated natural pre-developed conditions.

SUMMARY OF DISSOLVED OXYGEN MODELING RUNS FOR NEW RIVER

Modeling Scenarios:

A. Current critical conditions

Baseline Assumptions: At International Border

Flow Rate = 3.62 cm³/sec (128 cfs)

DO = 1

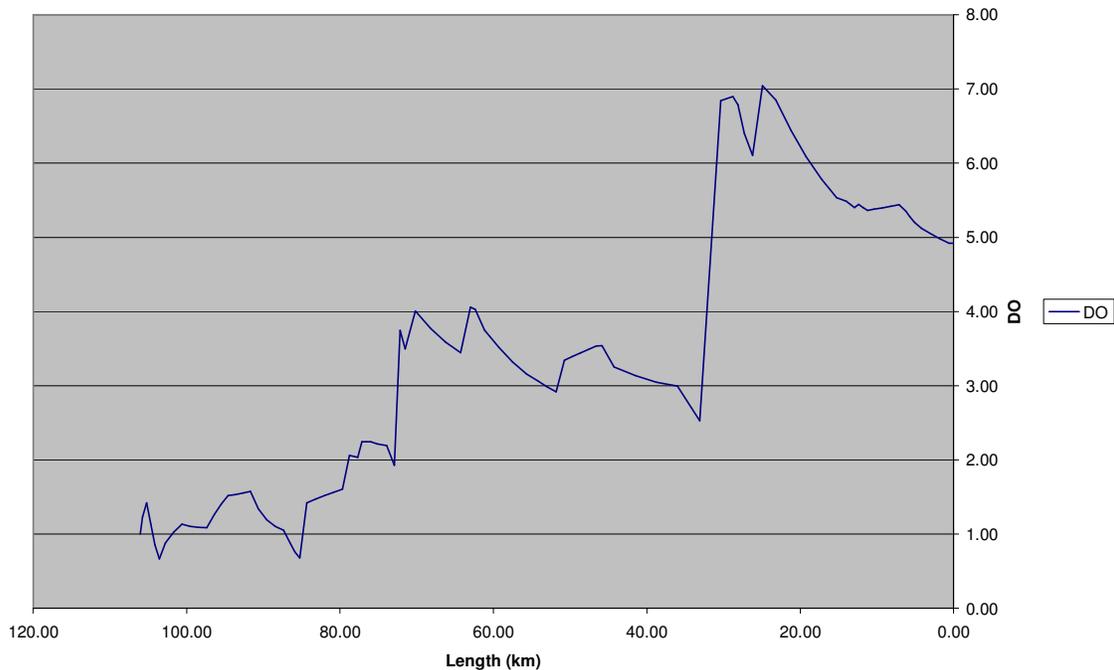
BOD = 19.5

NH₄ = 4,650 ugN/L or 4.65 mg/L

Summary of Findings: DO is generally between 1 and 2 for the first 33 km. DO increases to between 3 and 4 for the next 42 km. For the remaining 31 km to the Salton Sea, DO is above 5 and is therefore attaining the standard.

For purposes of this summary, the New River will be split into 3 segments (1st segment - approx. 30% of river, 2nd segment - approx. 40% of river, and 3rd segment - approx. 30% of river).

Current Critical Condition

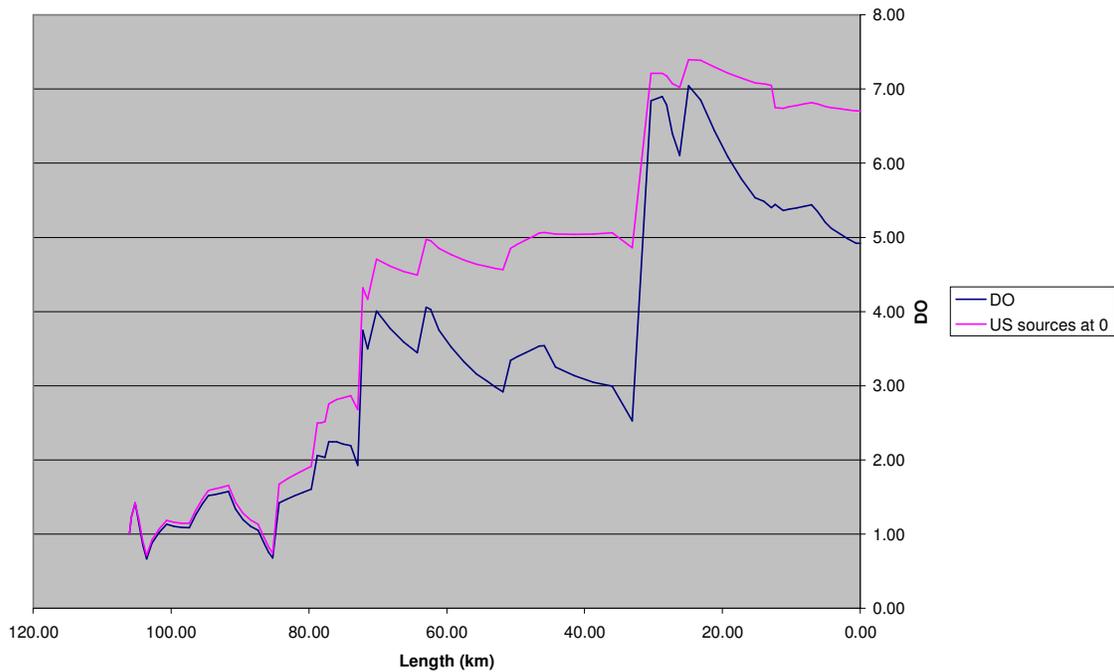


B. Maximum possible effect of US source reductions

Baseline Assumptions: - No change to Mexico's effluent
- US point sources (WWTPs and Drains) all with minimum 5 DO and zero BOD, NH4, and other nutrients

Summary of Findings: DO in the 1st segment of the river is hardly affected, showing that attainment is not possible without a change in effluent at the Int'l Border. DO in the 2nd segment is improved, however, even if US side pollutants were eliminated entirely, this would only enable an additional 14km of river to meet the standard.

Current Critical Condition vs. DO with US sources at 0

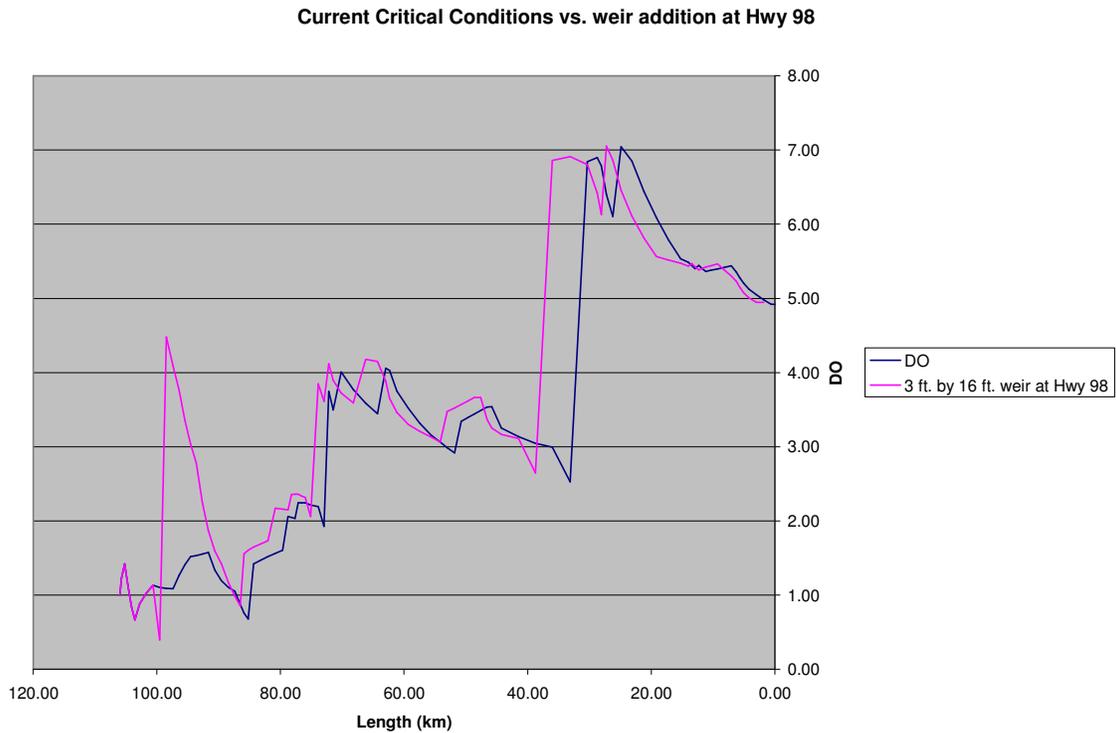


C. Effects of adding weirs on the US side

1. Weir at Hwy 98

Baseline Assumptions: - No change to Mexico's effluent
- 3 ft. high, 16 ft. wide weir added at Hwy 98 (note: modeling additional weirs alters the model's river distance assumptions – more exact estimates may require recalibration)

Summary of Findings: The weir dramatically increases DO at the 98th km of the 1st segment such that it peaks above 4, however, DO is only improved in a 10 km stretch before dropping back down to 1.

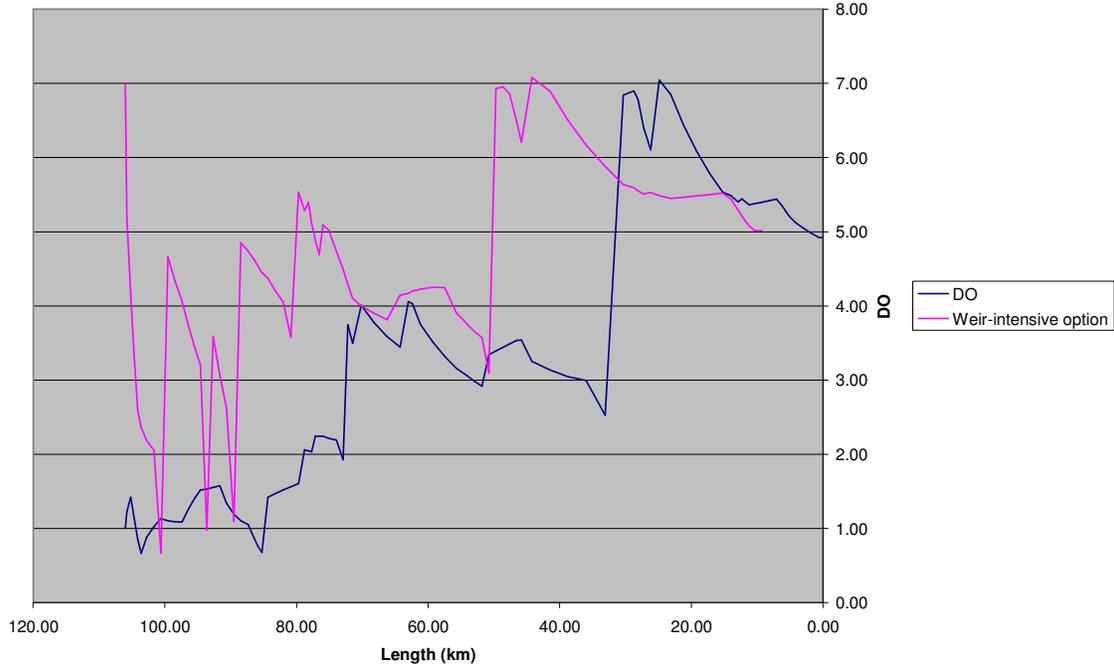


2. Weir-intensive scenario, plus oxygen pumping

Baseline Assumptions: - DO of 7 at Int'l Border resulting from an oxygen pump
- Multiple weirs added on the US side (note: this scenario does not consider engineering feasibility)

Summary of Findings: A series of peaks and dips in DO occurs. Overall, DO would be improved in the 1st segment of the river but not enough to attain the standard. Also, while oxygen-pumping could presumably increase DO at the border, it drops to 1 a short distance thereafter.

Current Critical Condition vs. multiple US weirs



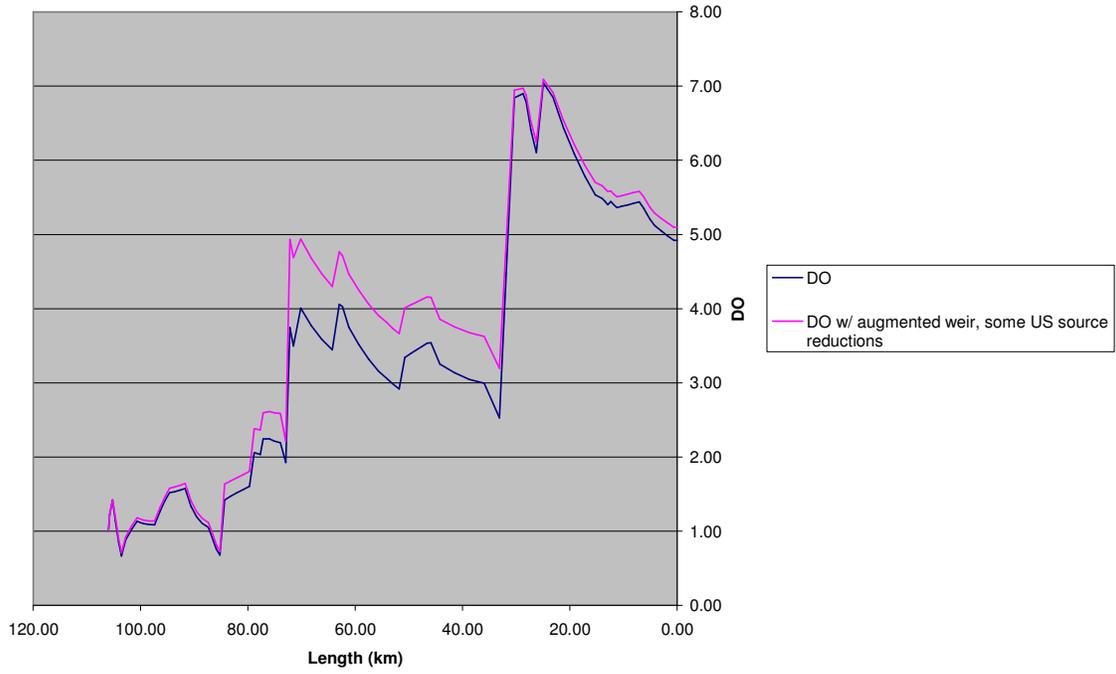
3. Weirs with a focus on the 2nd 40 km segment of New River

Baseline Assumptions:

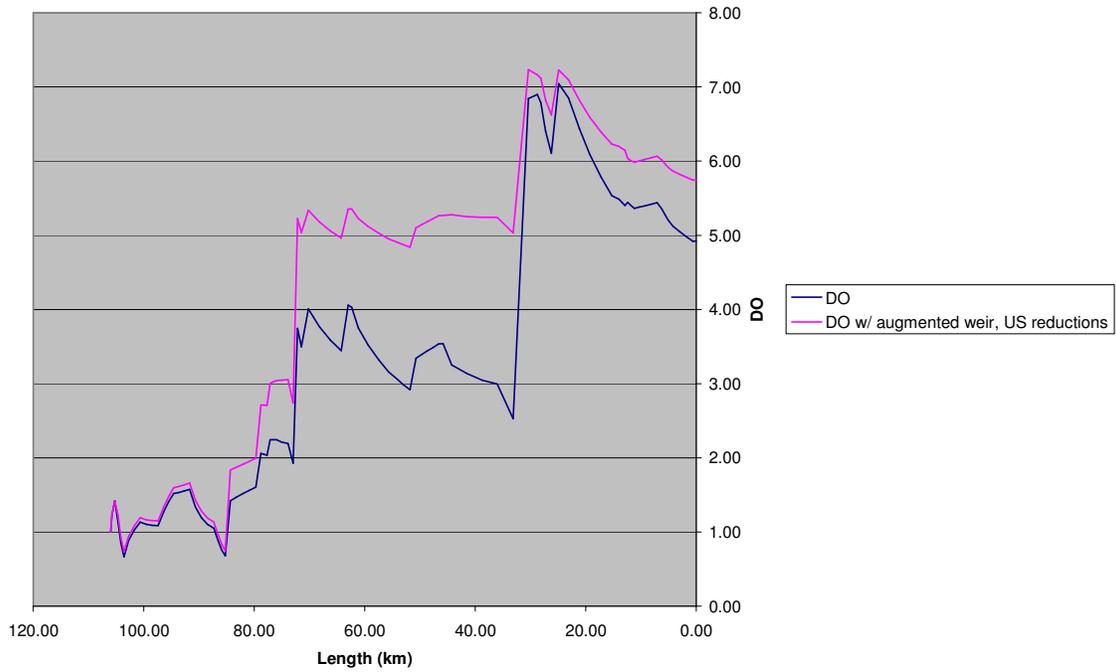
- Existing 2 ft. by 12 ft. weir at Hwy 80 (Evans Hewes) augmented to 3 ft. by 16 ft.
- Plus the following two model runs:
 1. US source reductions through N. Central Drain – improvements in DO, BOD, and NH4 at key point sources and drains
 2. US sources through N. Central Drain reduced to zero

Summary of Findings: The augmented weir raises DO to 5 at Hwy 80. Combined with US source reductions in model run 1, DO rises by about 1 in the 2nd segment of the river but the standard is not attained. In model run 2, with US sources at zero, the standard is attained throughout the 2nd segment.

Current Critical condition vs. augmented weir and some US source reductions



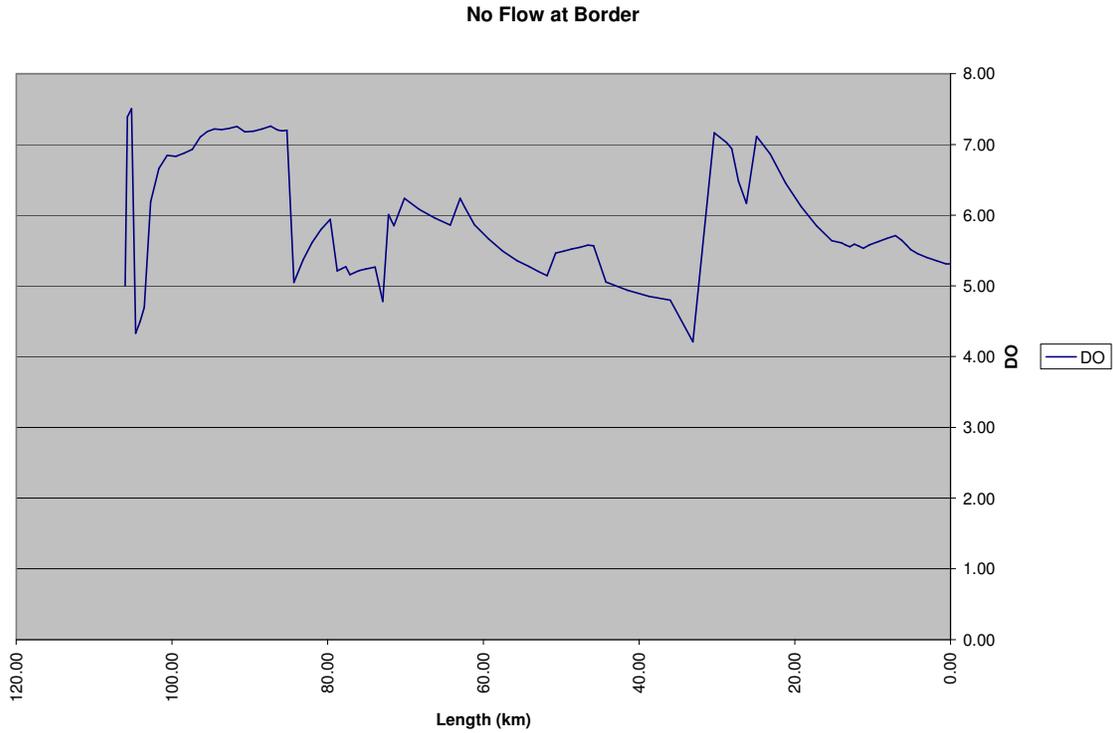
Current Critical Condition vs. Augmented weir and US reductions to zero



D. No flow from Mexico

Baseline Assumptions: - Flow rate at border reduced to zero

Summary of Findings: The DO standard is attained in the New River with the exception of three locations (totaling 14 km) in which DO drops below 5 but remains above 4. US source reductions would be needed to raise DO above 5 throughout New River.

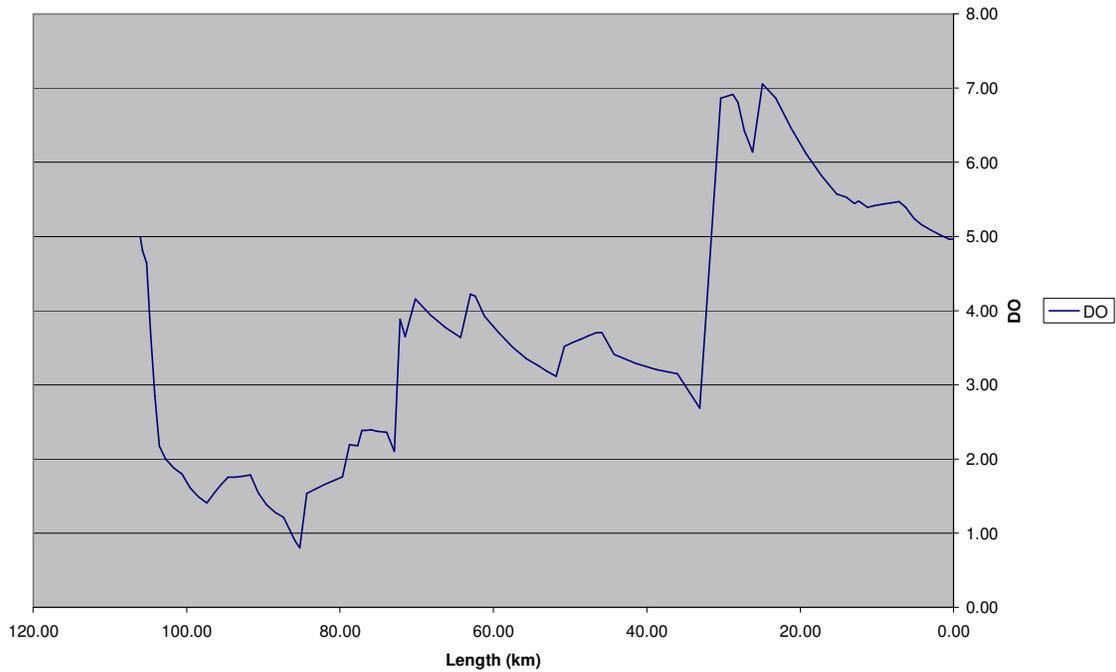


E. Dissolved oxygen alone improved at border under current Mexican-American treaty

Baseline Assumptions: - DO increased to 5 at Int'l Border

Summary of Findings: Absent reductions in BOD or nutrients from current levels, DO dips to below 2 within 4 km.

DO of 5 at Border



F. Improvements in BOD and NH4 from Mexico's effluent

1. Nutrient Removal + Filtration plus US source reductions

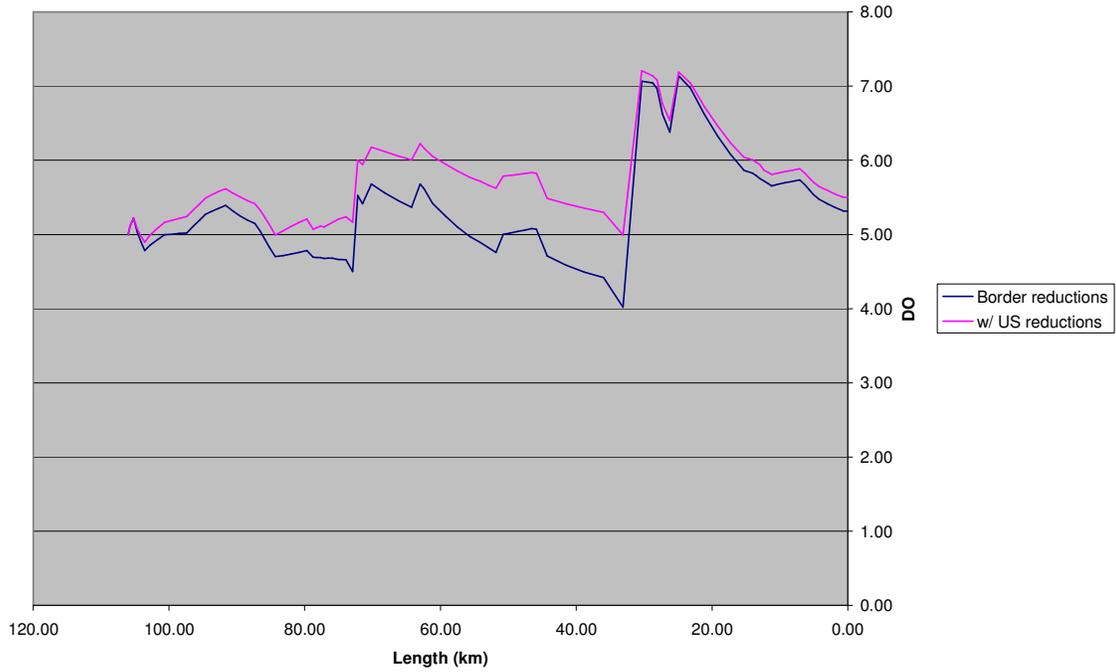
Baseline Assumptions:

Two model runs:

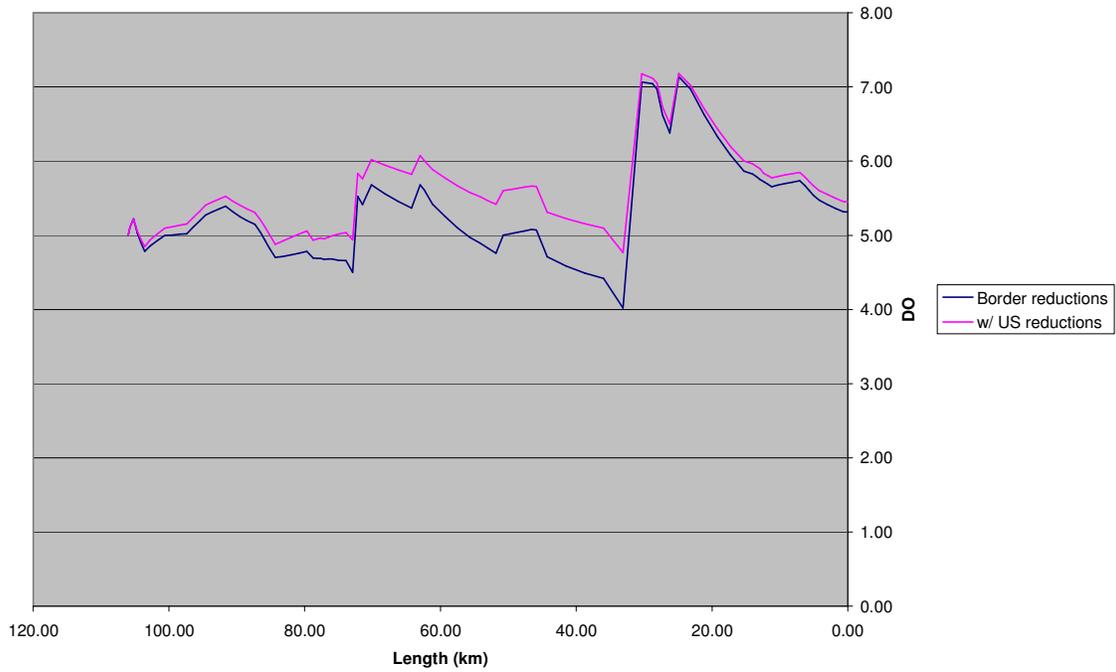
1. At Int'l Border DO=5, **BOD=5, NH4=0.5** mg/l and no US source reductions
2. In addition to the above assumptions, US source reductions through N. Central Drain – 8 BOD at WWTPs and maximum 0.5 mg/L NH4 at WWTPs and drains

Summary of Findings: Reductions in BOD and NH4 from Mexico's effluent go a long way towards improving DO, raising it to above 4 throughout the 1st and 2nd segments of New River. However, this is not sufficient to attain the DO standard. Reducing BOD to a maximum of 8 and NH4 to a maximum of 0.5 from US sources through the N. Central Drain demonstrates attainment.

F.1. BOD and NH4 reductions at Border vs. On both sides of Border

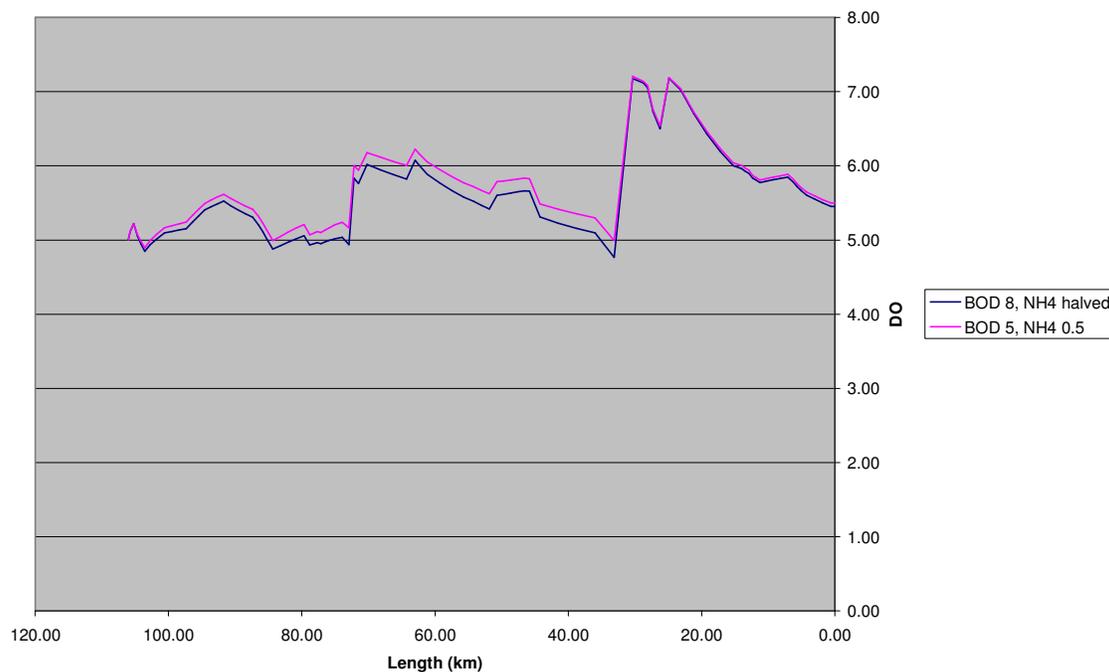


F.1.a. BOD and NH4 reductions at Border vs. On both sides of Border



The chart titled “Model Run F.1_Sensitivity of DO to US Reductions” shows the incremental difference in DO with more modest US source reductions of 15 BOD at WWTPs and NH4 reduced 50% below current levels at WWTPs and drains.

Model Run F.1_Sensitivity of DO to US Reductions



2. Nutrient Removal + High Lime + Filtration plus US source reductions

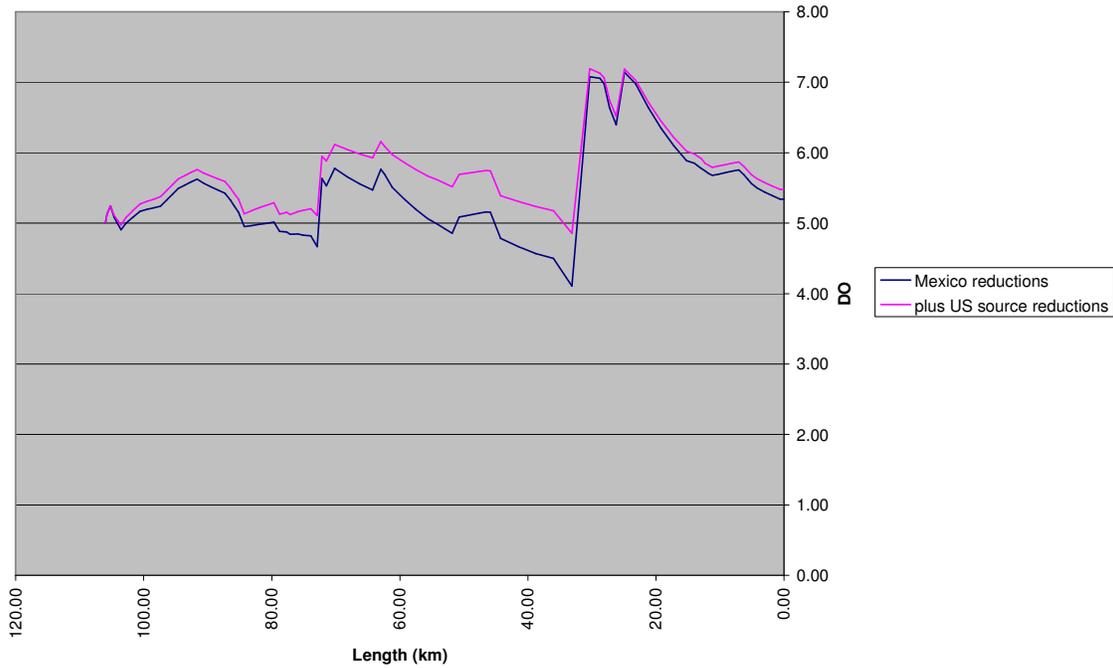
Baseline Assumptions:

Two model runs:

1. At Int'l Border DO=5, **BOD=3**, **NH4=0.4** mg/l and no US source reductions
2. In addition to the above assumptions, US source reductions through N. Central Drain – 15 BOD at WWTPs and NH4 reduced 50% below current levels at WWTPs and drains

Summary of Findings: The incremental difference of further reducing BOD and NH4 from Mexico's effluent results in slightly higher DO relative to option F.1. This alone is not sufficient to demonstrate attainment, however, attainment can be reached with fewer reductions from US sources relative to option F.1.

Mexico effluent at 3 BOD and 0.4 NH4, US sources at 15 max. BOD and NH4 halved



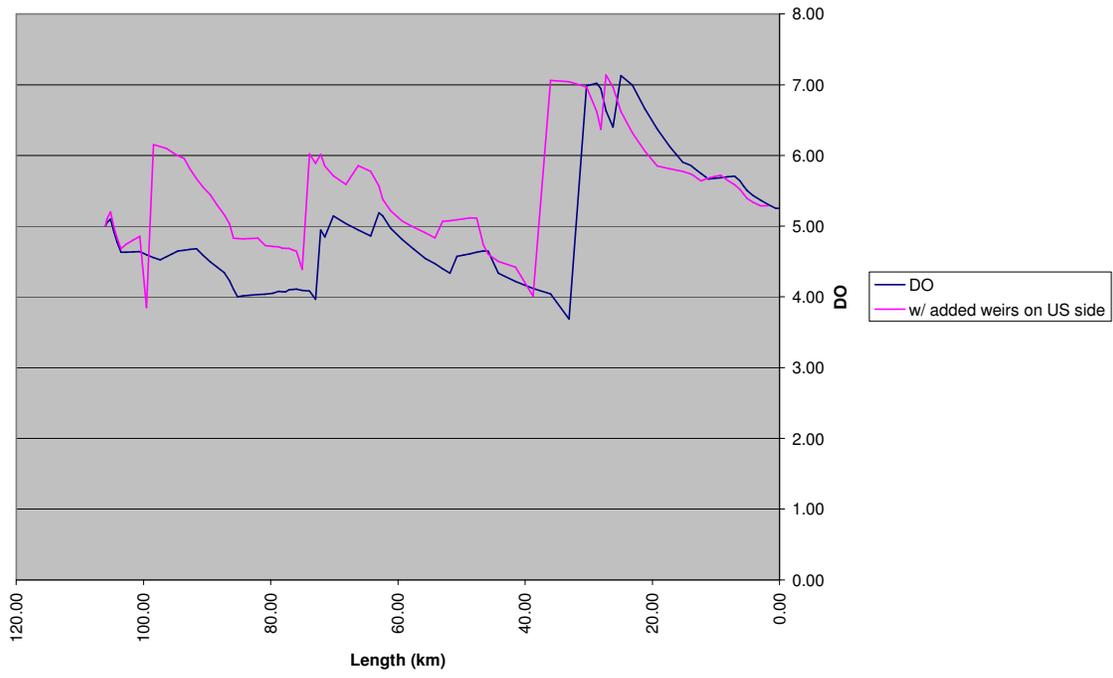
3. Nutrient Removal to achieve 8 BOD and 0.5 NH4 plus US weirs

Baseline Assumptions:

- At Int'l Border DO=5, BOD=8, NH4=0.5
- 3 ft. by 16 ft. weir added at Hwy 98
- Augmented weir at Hwy 80 (Evans Hewes) to 3 ft. by 16 ft.

Summary of Findings: The combined effect of improvements to Mexico's effluent and US-side weirs raises DO above 5 for approximately 40 km, cumulatively, in the 1st and 2nd segments. However, DO dips to 4 so attainment is not achieved.

Border effluent at 8 BOD, 0.5 NH4 plus weirs on US side



4. Scenario F.3 plus US source reductions

Baseline Assumptions:

- At Int'l Border, DO=5, BOD=8, NH4=0.5
- 3 ft. by 16 ft. weir added at Hwy 98
- Augmented weir at Hwy 80 (Evans Hewes) to 3 ft. by 16 ft.
- US source reductions at WWTPs and drains such that DO is no lower than 5, BOD no higher than 8, and NH4 no higher than 0.5 mg/L

Summary of Findings: The combined effect of improvements in Mexico's effluent, US-side weirs, and US-side reductions is sufficient to achieve attainment in all but the first 8 km of the 1st segment where DO dips below 5 in some locations but still remains above 4.

Results from model scenarios that reduce BOD and NH4 from Mexico's effluent reveal that incremental source reductions on the US side are needed to attain the DO standard throughout New River.

Border effluent at 8 BOD, 0.5 NH4 plus equal US side reductions plus weirs

