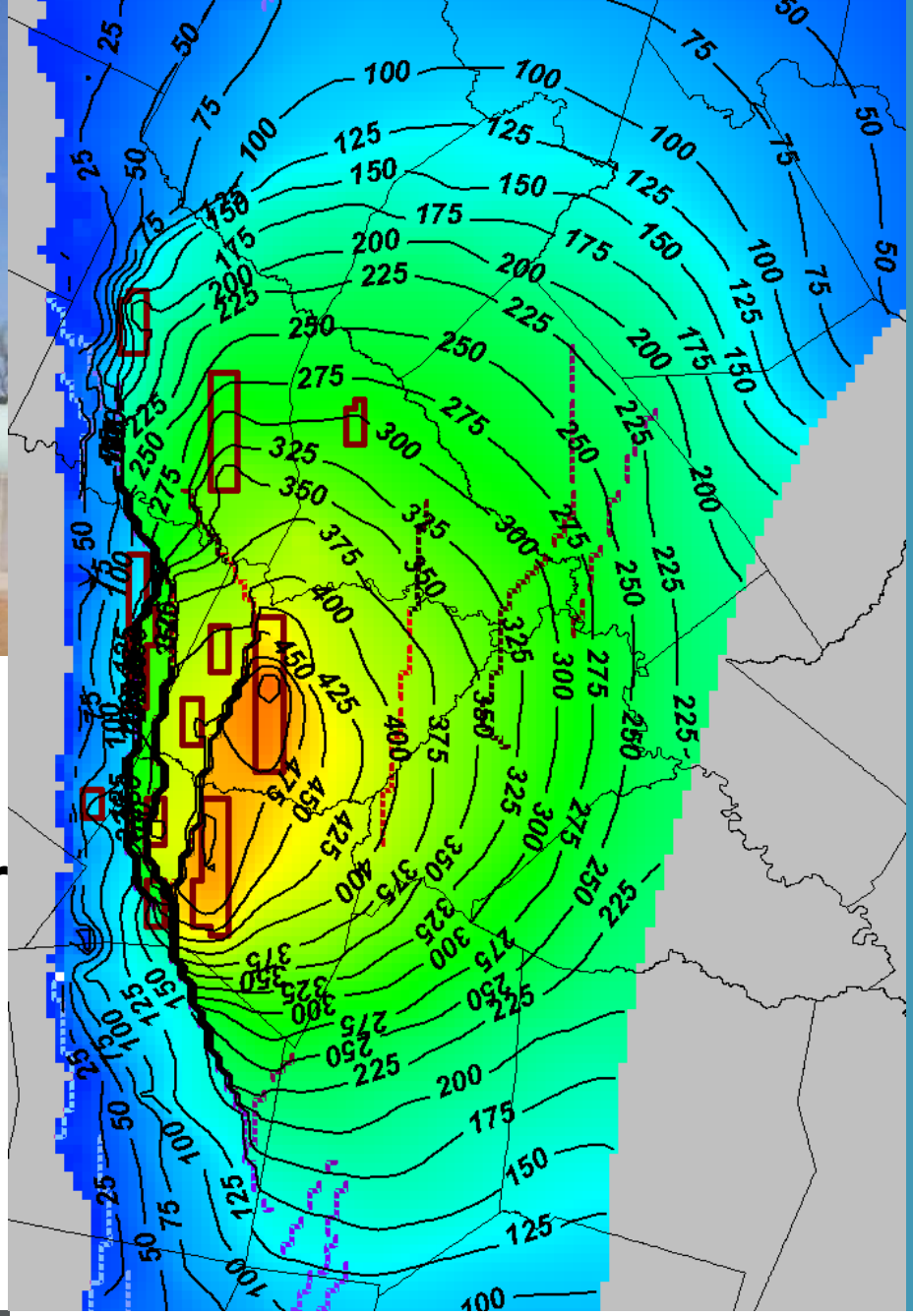


Socioeconomic Considerations when Regulating Groundwater Development

March 2016

City of College Station
City of Bryan
Brazos Valley GCD
Texas A&M University

Presentation Overview

- Purpose of evaluation (updated from 2008/2009)
- Impacts of groundwater pumping
- Hydrology and engineering
- Economic analysis
- Socioeconomic impacts of large groundwater withdrawals from Brazos and Robertson Counties
- The need for balance when establishing DFCs

Purpose of Evaluation

“Assist the GMA 12 process by providing input regarding potential economic impacts within the Brazos Valley GCD of future groundwater development and over-regulating groundwater resources.”

Impacts of Groundwater Development and Overprotection in Brazos and Robertson Counties

- Increased groundwater development can cause economic harm
  - Costs to lower and/or replace pumps
  - Costs to replace wells
  - Increased energy costs (higher lift)
- Overprotection forces communities to secure more expensive supplies
  - Reduces capability to develop nearby groundwater resources
  - Forces more expensive projects, increasing the cost of water
  - Impacts the overall economy
- Balance is required when regulating future groundwater supplies

Hydrology and Engineering

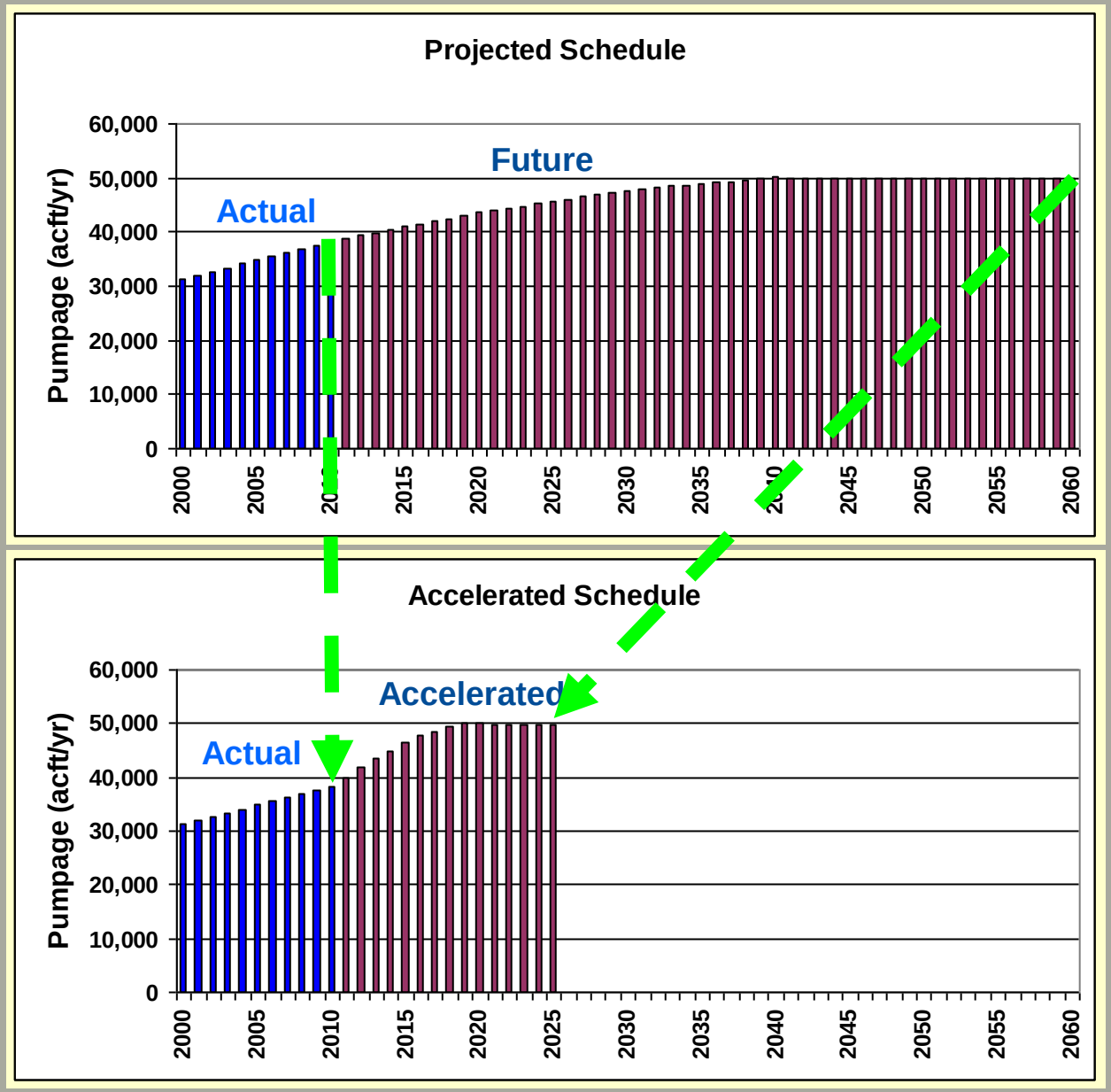
- Groundwater modeling to determine future hydrologic conditions
- Characterize existing wells
- Determine impacts of future hydrology on existing wells
- Estimate costs to existing well owners
- Evaluate costs for new supplies for Bryan and College Station

Groundwater Modeling

- Central Carrizo-Wilcox GAM
- Pumping scenario GMA 12-3A from first round of GMA work
- Accelerated groundwater development
  - Achieve 2060 pumping levels by 2025
  - Stresses the aquifer so a response to increased pumping is seen
  - Allows impacts to be realized within a reasonable planning window
  - Actual development could occur faster than current plans show

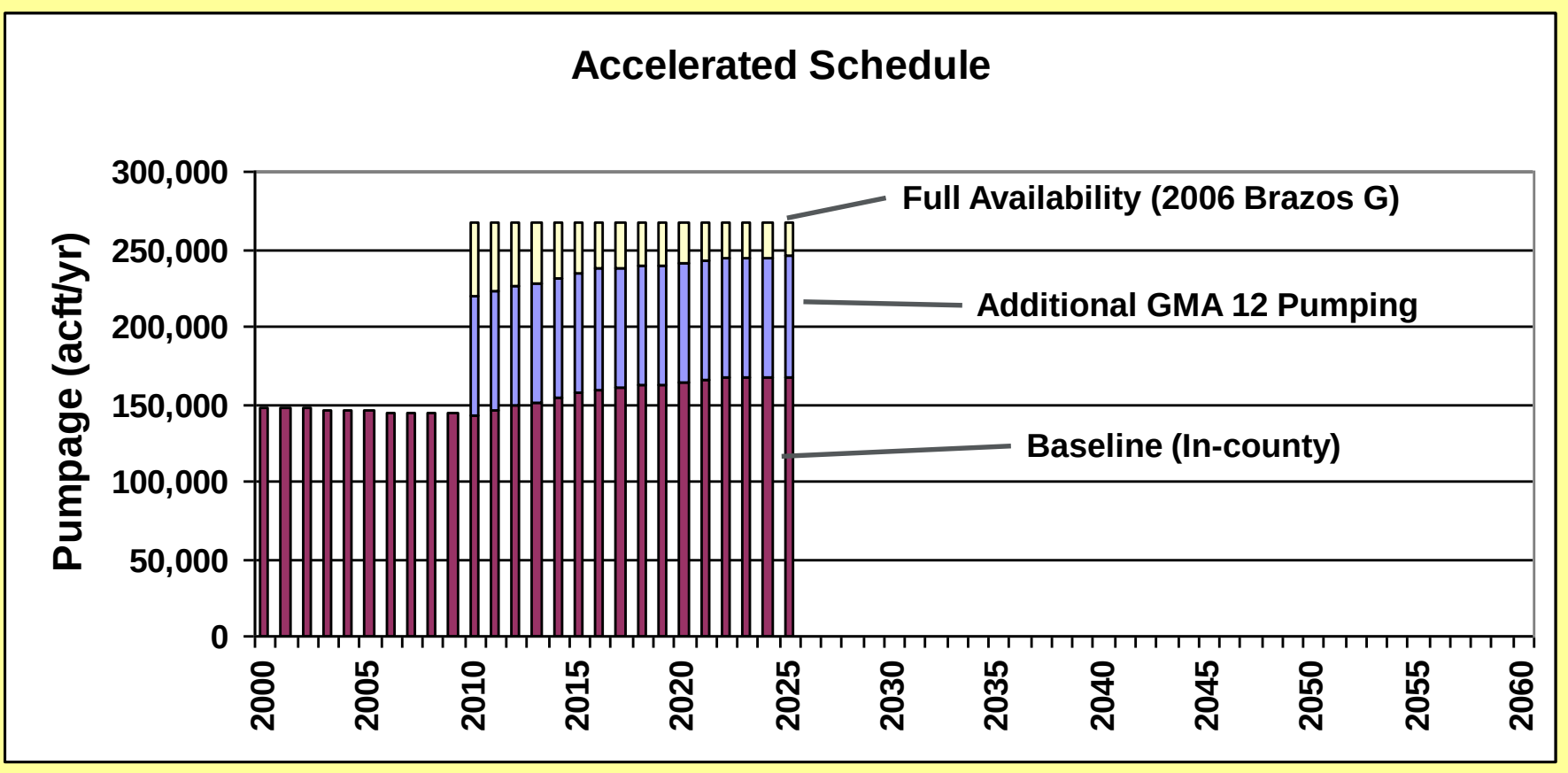
Accelerated Pumping Schedule

GMA 12-3A Pumping in Brazos County



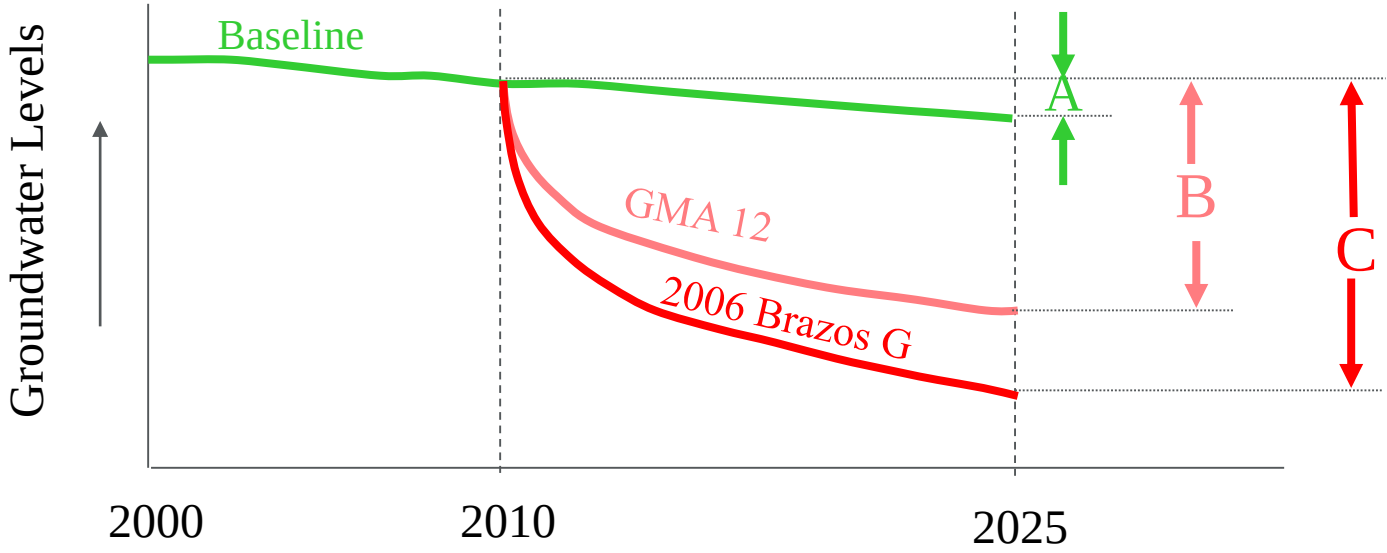
Water Demands Modeled

All GMA-12 Counties



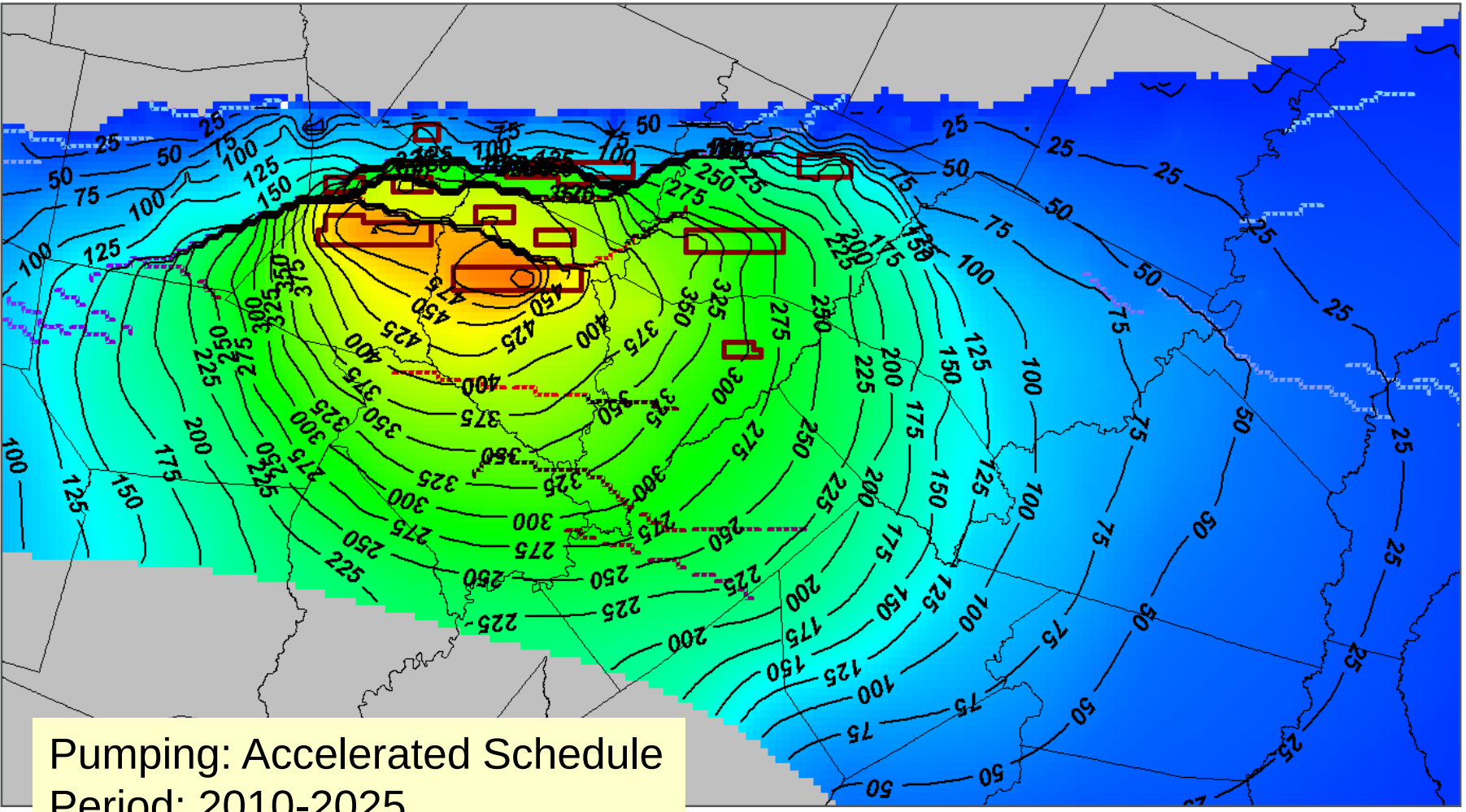
Water Demands

Impact on Groundwater Levels: Drawdown from 2010 to 2025



A = Baseline (In-County Uses)
B = GMA 12 (Baseline plus Large Projects)
C = 2006 Brazos G (worst case)

Additional Drawdown for Simsboro (2006 Brazos G)



Pumping: Accelerated Schedule
Period: 2010-2025
Contour Interval: 25 ft

Cost Impacts to Existing Wells

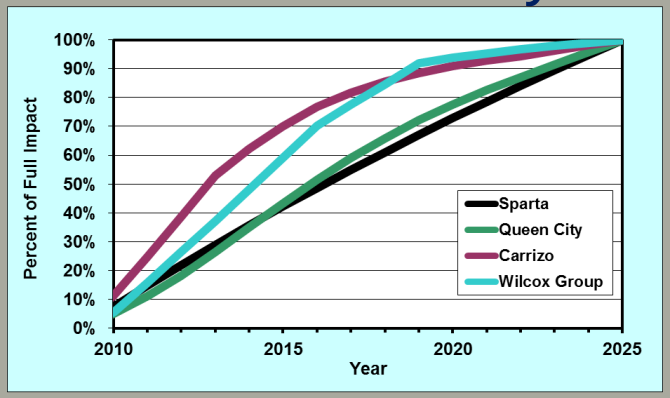
- Identify and describe existing wells
  - Location and land surface elevation
  - Well size, capacity, depth and pump setting
  - Casing and screen size and placement
  - Aquifer
  - Data from 1,151 documented wells
- Compute costs due to lowered water levels
  - Lower pump or construct new well
  - Increased energy costs (greater lift)

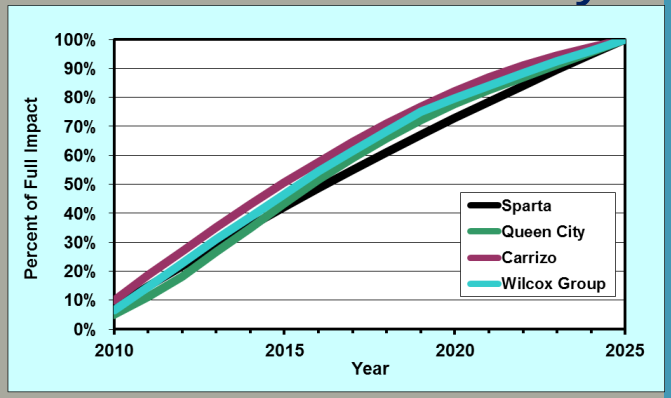
Impact Growth Curves for Accelerated Pumping

Brazos County

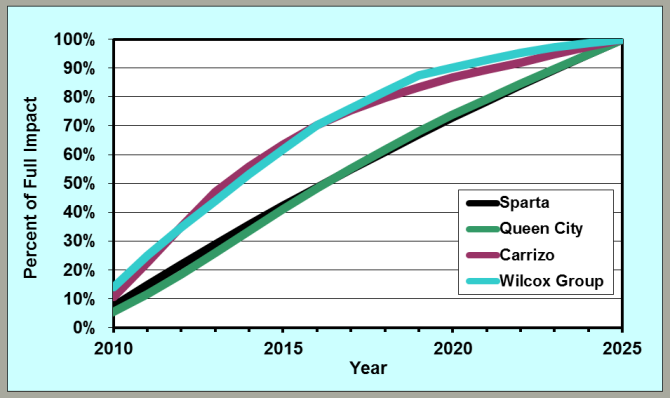
Robertson County

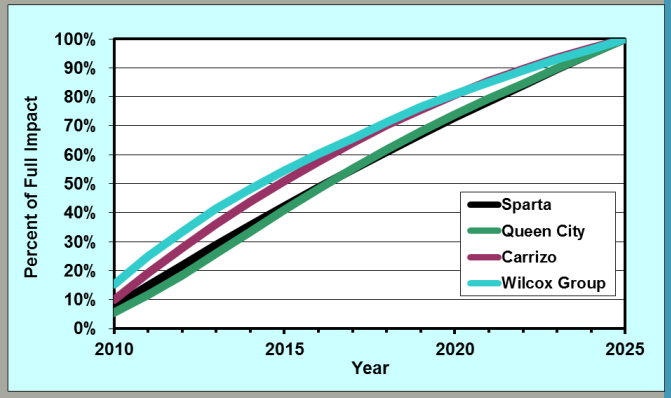
Baseline



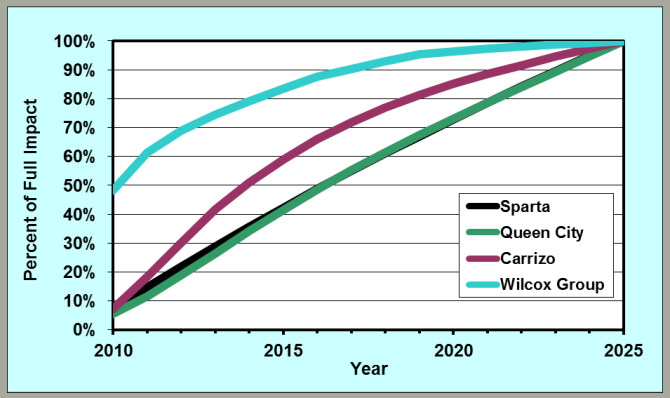


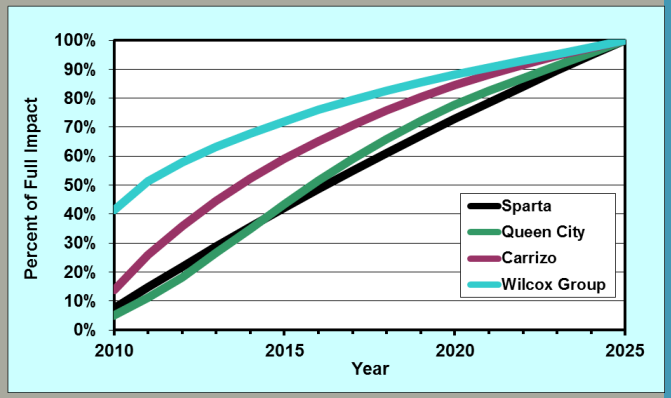
GMA 12





Brazos G

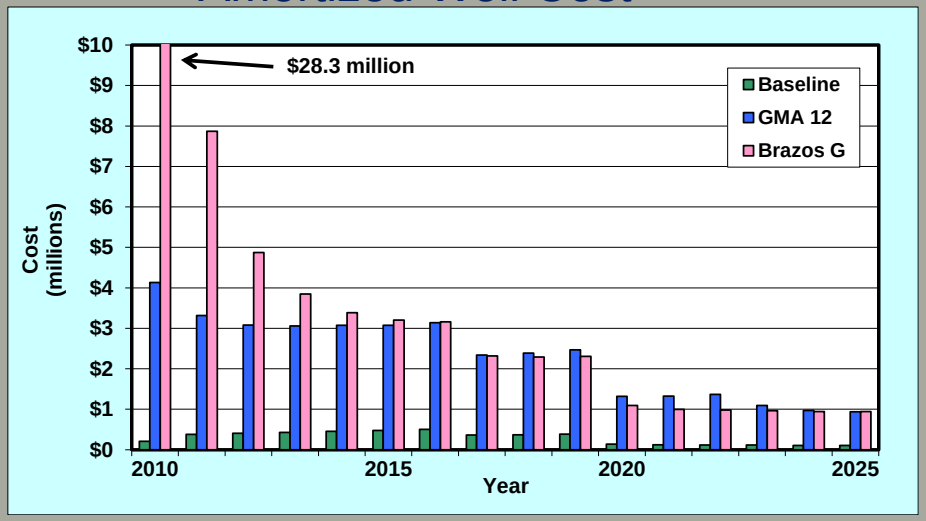




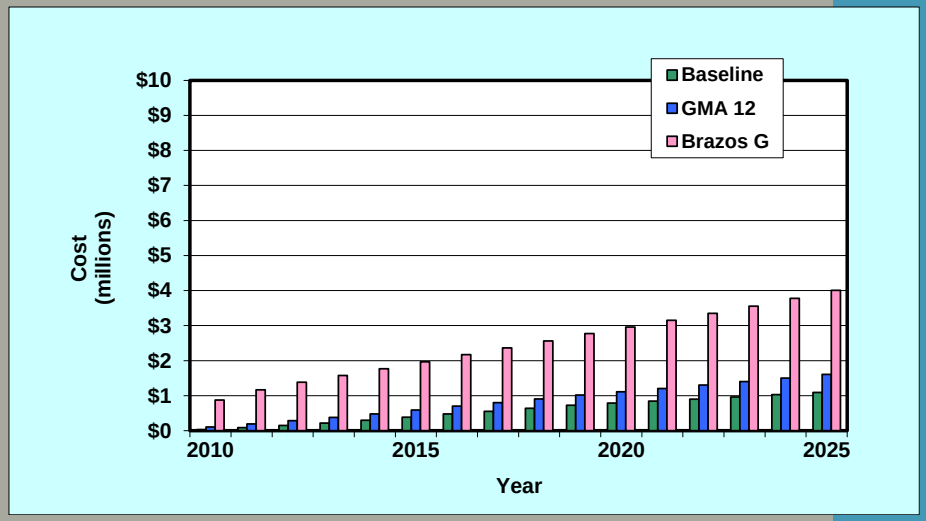
Annual Direct Well Costs

Brazos and Robertson Counties

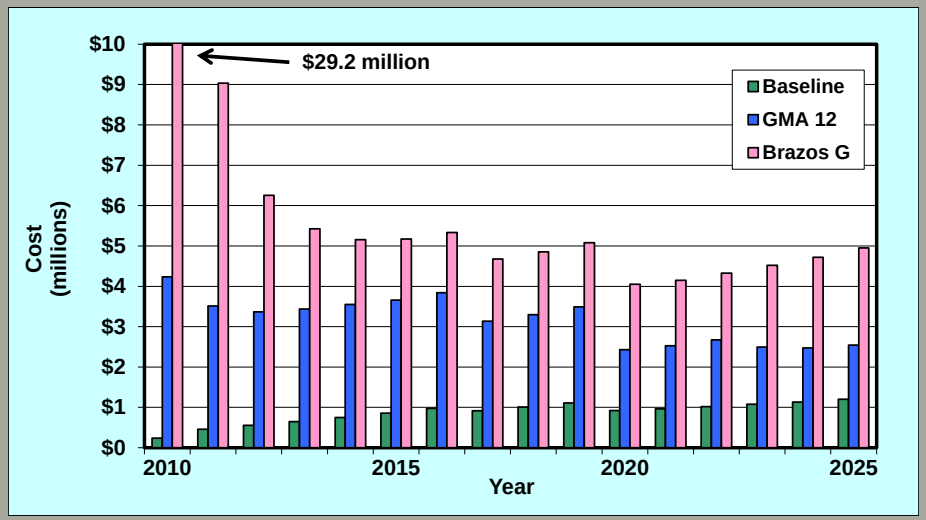
Amortized Well Cost



Power Cost



Total Annual Cost



Future Supplies for Bryan and College Station

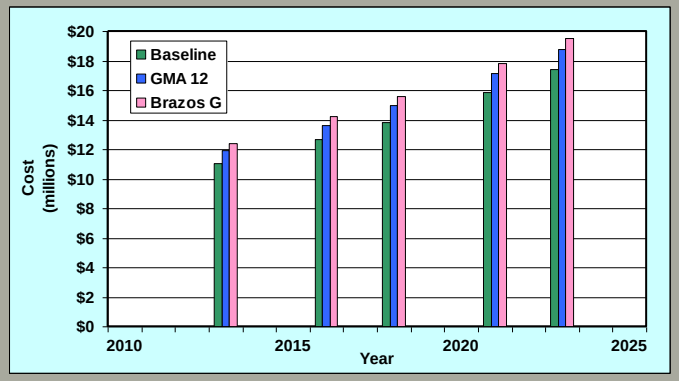
- Decreased aquifer levels will increase costs of new supplies
- Three alternatives to obtain additional 18.3 MGD peak day supply:
  - 6 new wells ($58 million)
    - Assumed Simsboro Aquifer
    - Baseline = costs to develop new wells
    - GMA 12 and Brazos G = create additional well costs
  - Brazos River diversion ($65 million)
    - Assumes future development is limited by GCD
    - Only viable if BRA obtains System Operations Permit
    - Intake & pump station, pipeline, treatment
  - Millican Reservoir ($720 million)
    - Assumes future development is limited by GCD
    - Not considered viable, but indicates relative cost of a new reservoir compared to other options
    - Dam and reservoir (27%), intake & pump station, pipeline, treatment

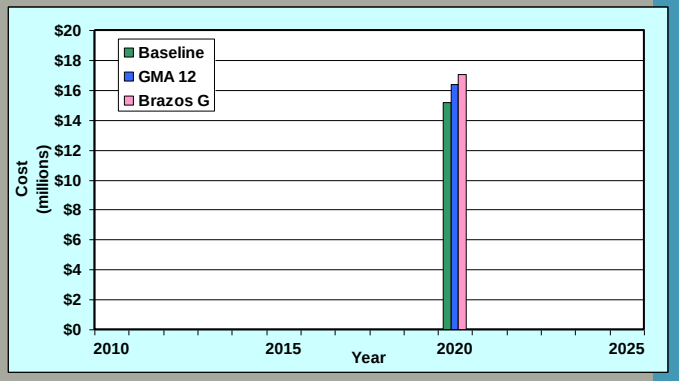
Costs of New Supplies – Wells

College Station

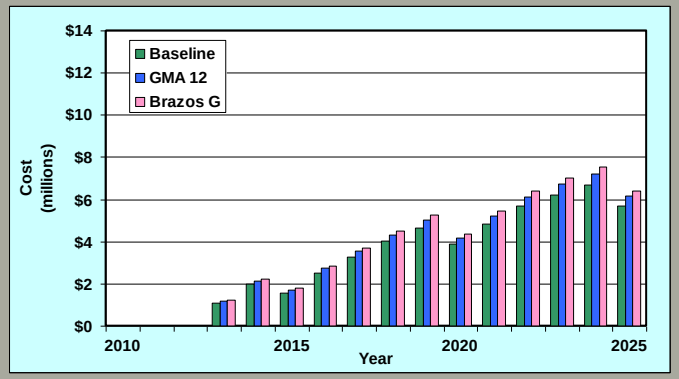
Bryan

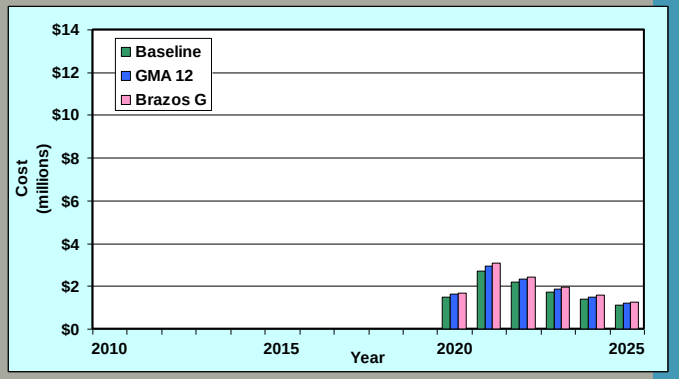
Capital Cost



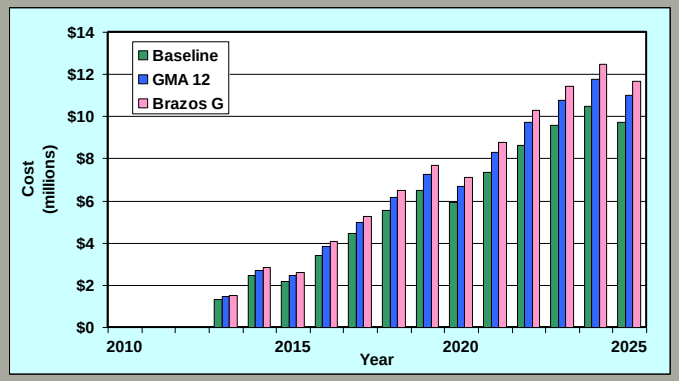


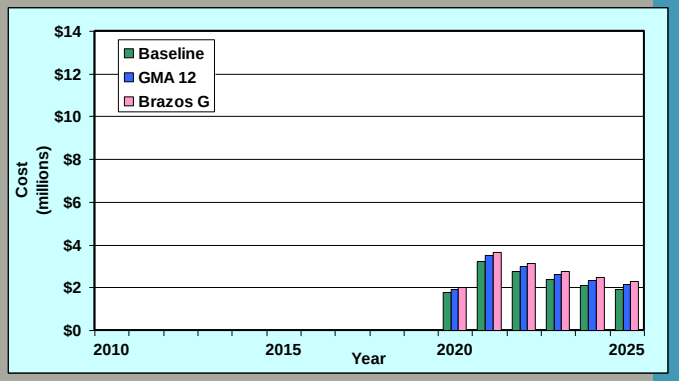
Amortized Cost





Annual Cost



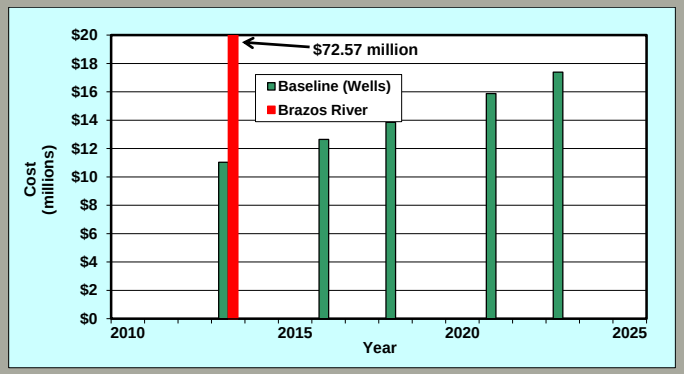


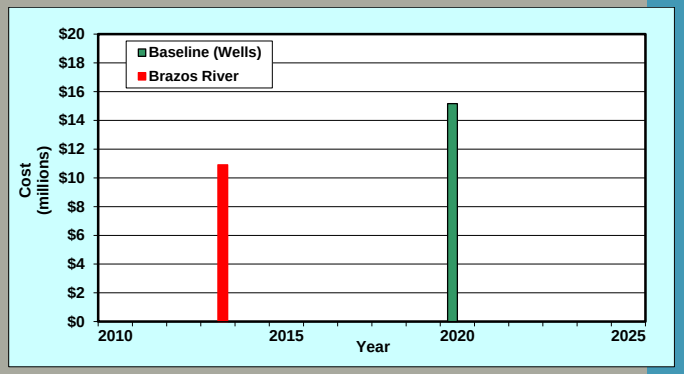
Costs of New Supplies – Brazos River Diversion

College Station

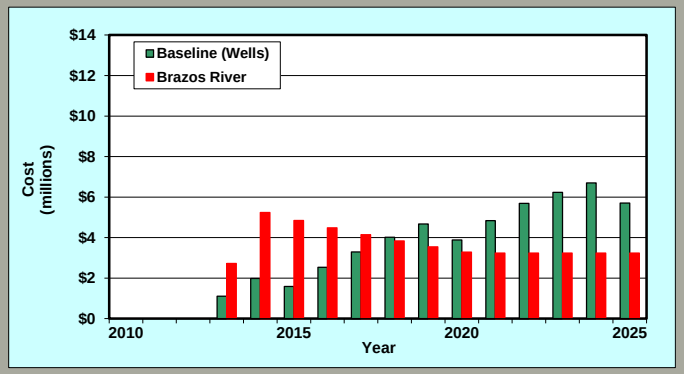
Bryan

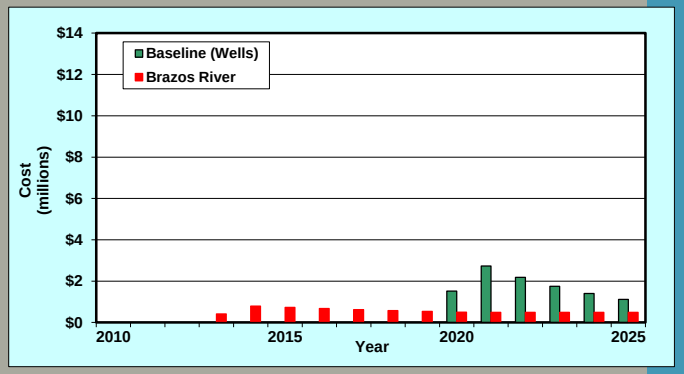
Capital Cost



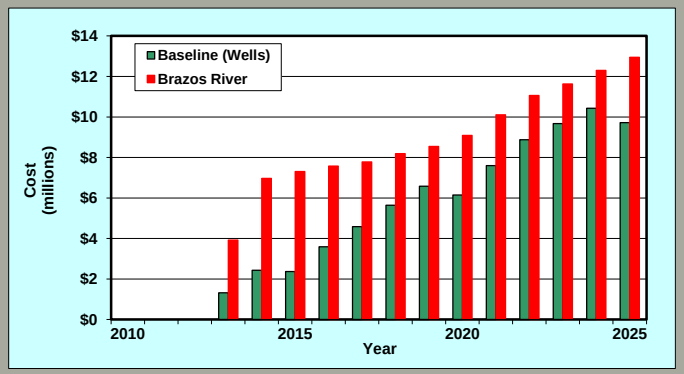


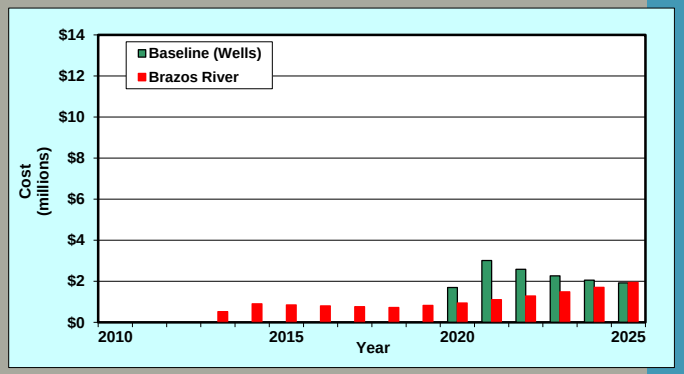
Amortized Cost





Annual Cost



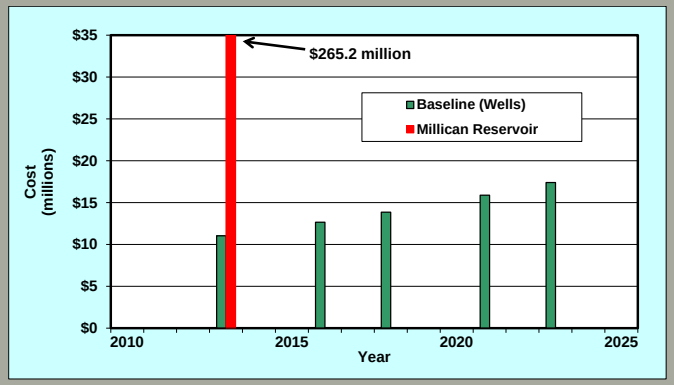


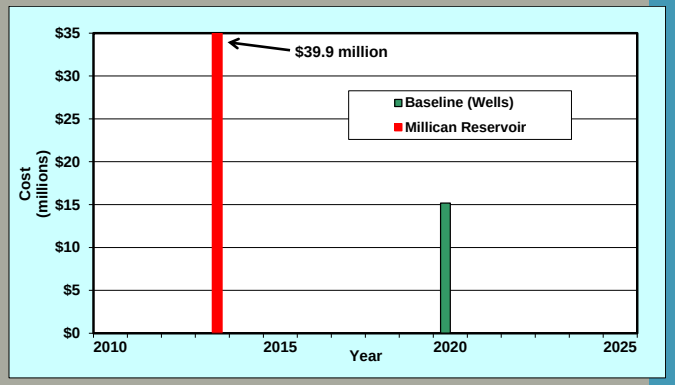
Costs of New Supplies – New Reservoir

College Station

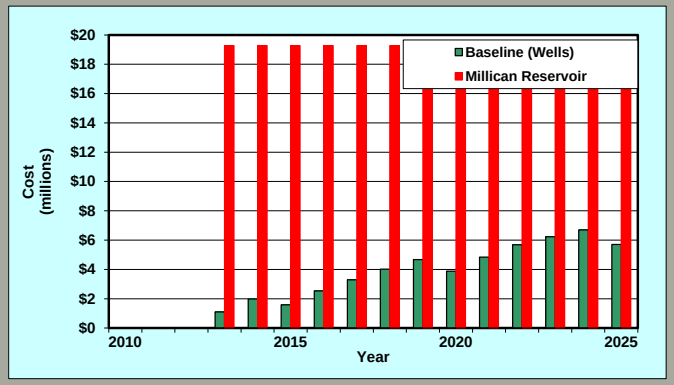
Bryan

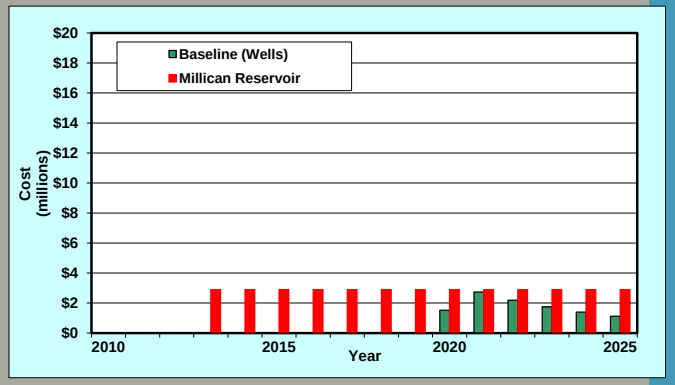
Capital Cost



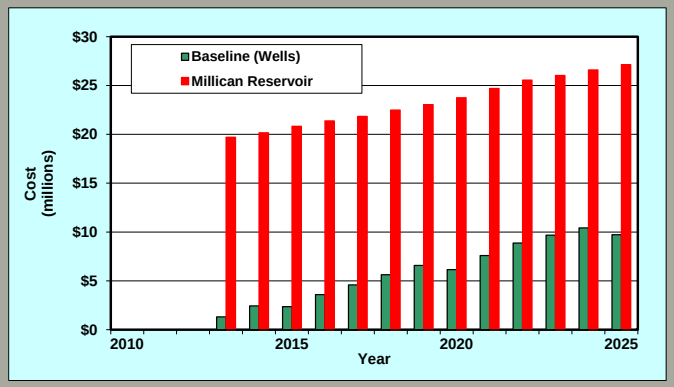


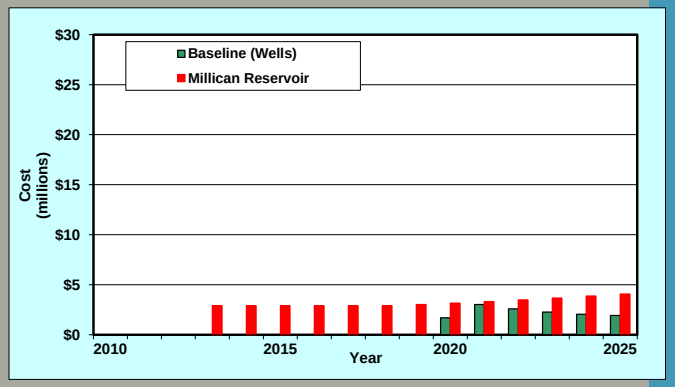
Amortized Cost





Annual Cost



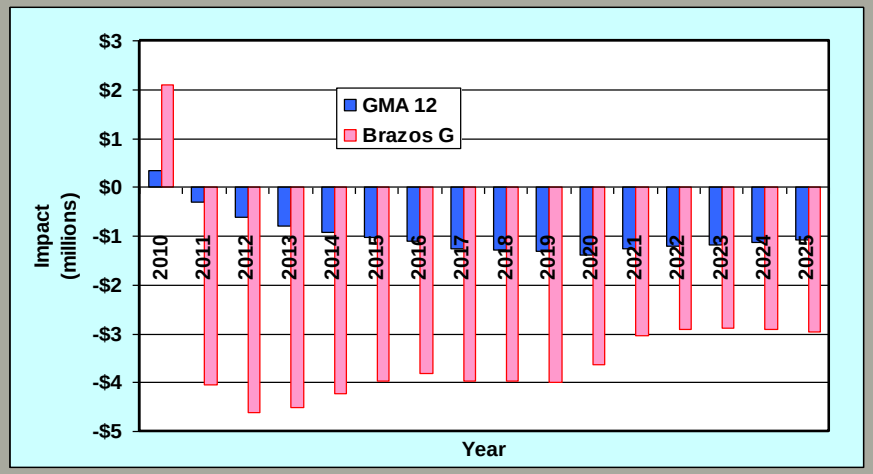


Economic Analysis

- IMPLAN model background
  - Developed by U.S. Forest Service in 1972 – impacts of alternative uses of U.S. public forest resources
  - Privatized – Minnesota IMPLAN Group (MIG)
- IMPLAN analysis
  - Spreadsheet analogy – columns represent different industries/economic sectors; rows represent the same. Value in a cell represents the economic "link" between the economic sectors.
  - Input/Output model computes Direct, Indirect, Induced costs
    - Direct costs: increase in cost of water changes industry output
    - Indirect costs: changes in money transfers between sectors as a result of more expensive water
    - Induced costs: changes in local spending resulting from income changes in directly and indirectly affected economic sectors
- Input direct costs to IMPLAN
  - Cost for water input as a commodity, through "analysis by parts"

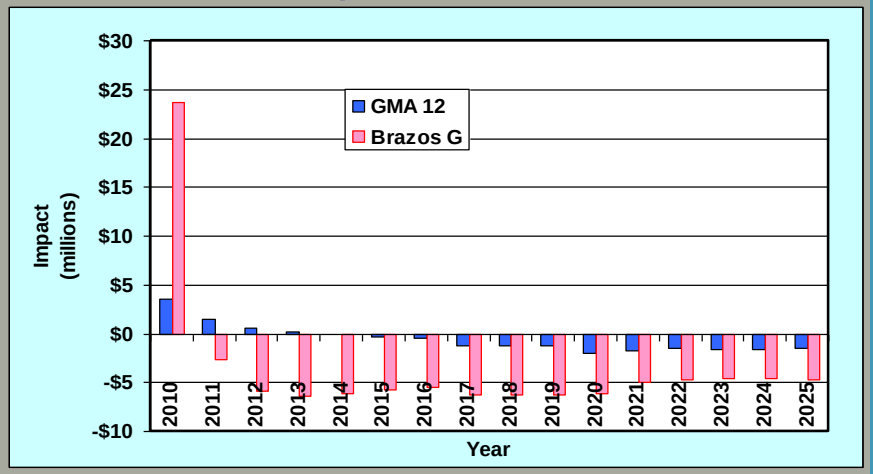
Economic Impacts – Existing Uses

Value Added



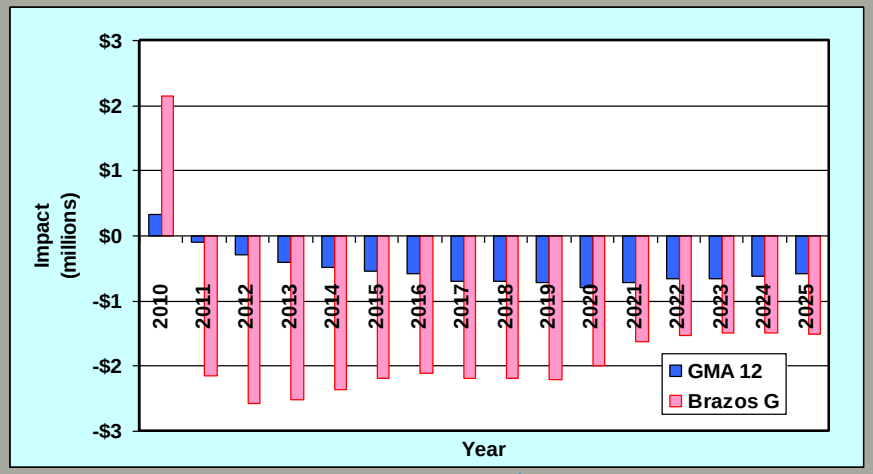
Est. 2008 VA = $6.56 billion

Economic Output



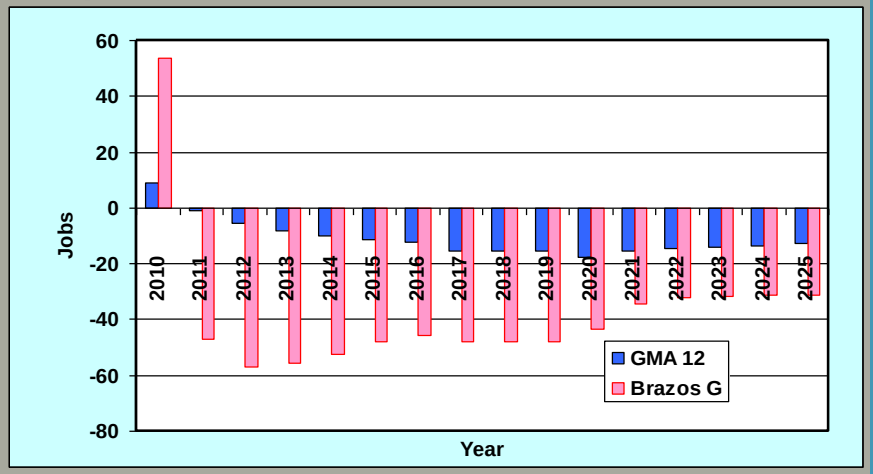
Est. 2008 Output = $10.7 billion

Labor Income



Est. 2008 Income = $4.34 billion

Employment



Est. 2008 Employment = 112,589

Single-Year Impacts (2015) – Existing Uses

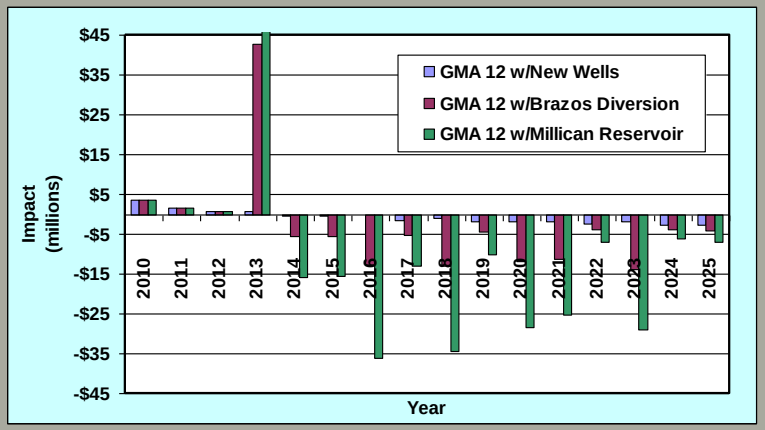
	GMA 12	Brazos G
Value Added (out of $6.6 billion)	-$1.1 million (-0.017%)	-$3.96 million (-0.060%)
Output (out of $10.7 billion)	-$287,000 (-0.003%)	-$5.72 million (-0.054%)
Labor Income (out of $4.3 billion)	-$534,000 (-0.012%)	-$2.19 million (-0.051%)
Jobs (out of 112,589)	12 lost	49 lost

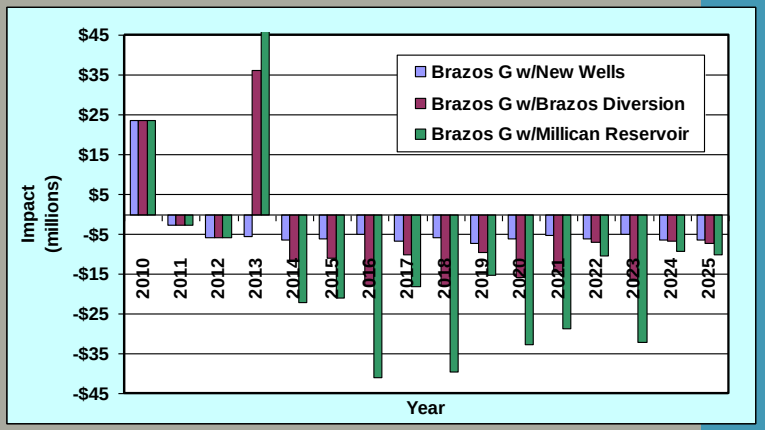
Economic Impacts – Future Supplies

GMA 12

Brazos G

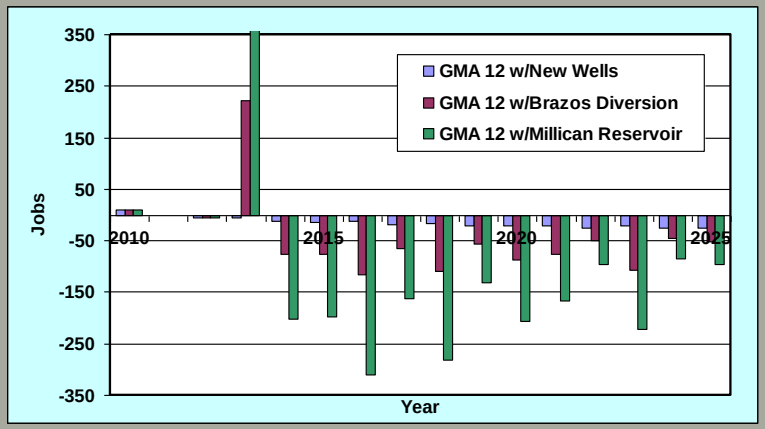
Economic Output

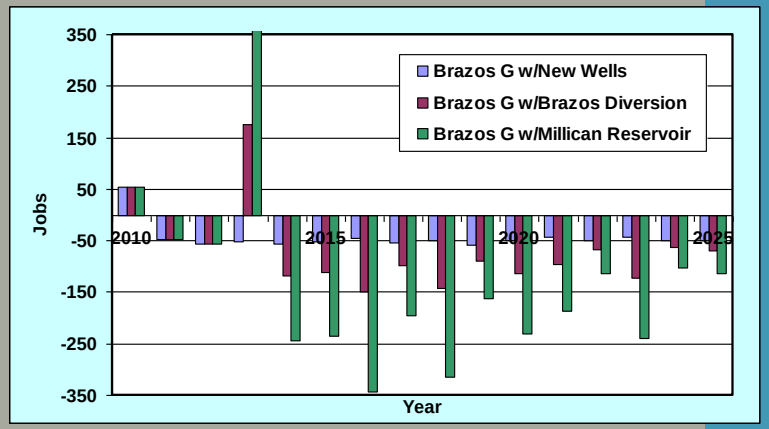




Est. 2008 Output = $10.7 billion

Employment





Est. 2008 Employment = 112,589

Economic Impacts of Future Supplies

- Impacts applied to existing, not future uses
- Annual economic output decreases
  - $287 thousand decrease when future supplies not considered
  - $532 thousand decrease if additional wells provide future supplies
    - Likely offset by economic benefits of growth
  - $5.58 million decrease if Brazos River diversion project is necessary
  - $15.67 million decrease if new reservoir is necessary
- Economic impact depends on relative timing of capital construction between scenarios

Summary

- Additional large groundwater withdrawals will increase costs to existing uses
  - Modest negative impact to existing economy
    - Output will slow, income will decrease, jobs could be lost
- High economic impact to develop new water supplies if aquifers are overpumped
  - Economic impacts will increase 10-fold if cities are forced to develop an expensive surface water source rather than rely on proximate groundwater
- Need to find the “sweet spot” for pumping limits
  - Overpumping
    - Impacts existing uses
    - Increases costs of future GW supplies
  - Overprotecting
    - Will force reliance on more expensive (surface water) supplies