Nonpotable and Potable Reuse: A Rough Triple Bottom Line Illustration of Respective Benefits and Costs

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Presentation Overview

- Background on Water Reuse options
- Comparison of potential advantages of Potable Reuse vs. Nonpotable Reuse
- TBL benefits and costs considered

PRELIMINARY and ILLUSTRATIVE:

- TBL values estimation and comparison

What do we mean by Water Reuse?

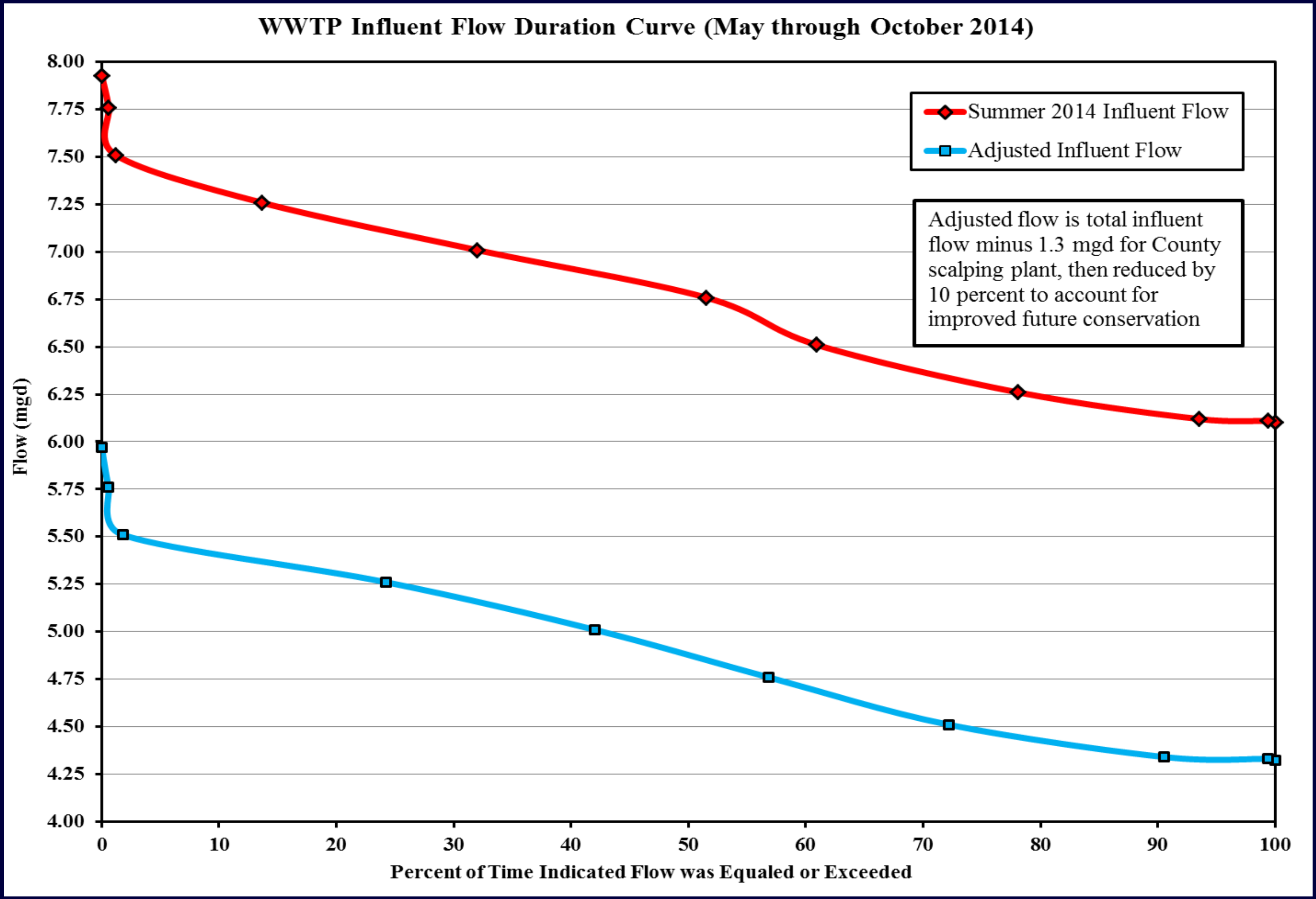
- Tapping municipal wastewater system effluent
- Purifying to very high standards (“fit for use”)
- Recycling a “waste” into a valuable resource

- Not considering here on-site recycling
  - Residential-level use of graywater
  - On-site business recycling (e.g., car wash)

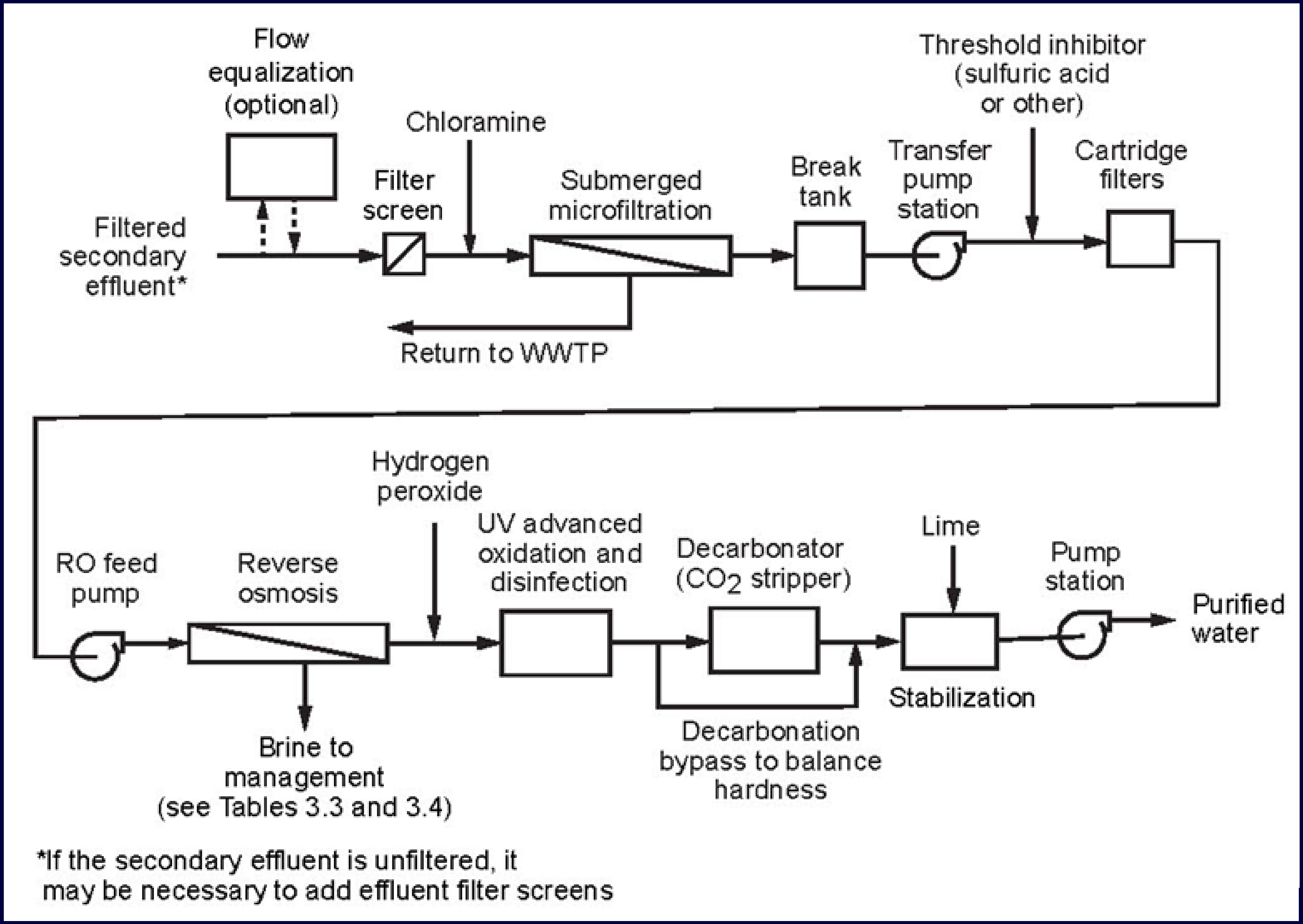
3 Main Water Reuse Options

- Nonpotable Reuse (NPR)
  - Irrigation, cooling, industrial processes, habitat
  - Tertiary treatment: Title 22 compliant
- Indirect Potable Reuse (IPR)
  - Complete Advanced Treatment (CAT)
  - Environmental buffer (reservoir, aquifer)
  - Orange County Groundwater Replenishment
- Direct Potable Reuse (DPR)
  - CAT plus “engineered buffer”
  - Not yet authorized in CA (but in practice elsewhere, and rules forthcoming for CA)

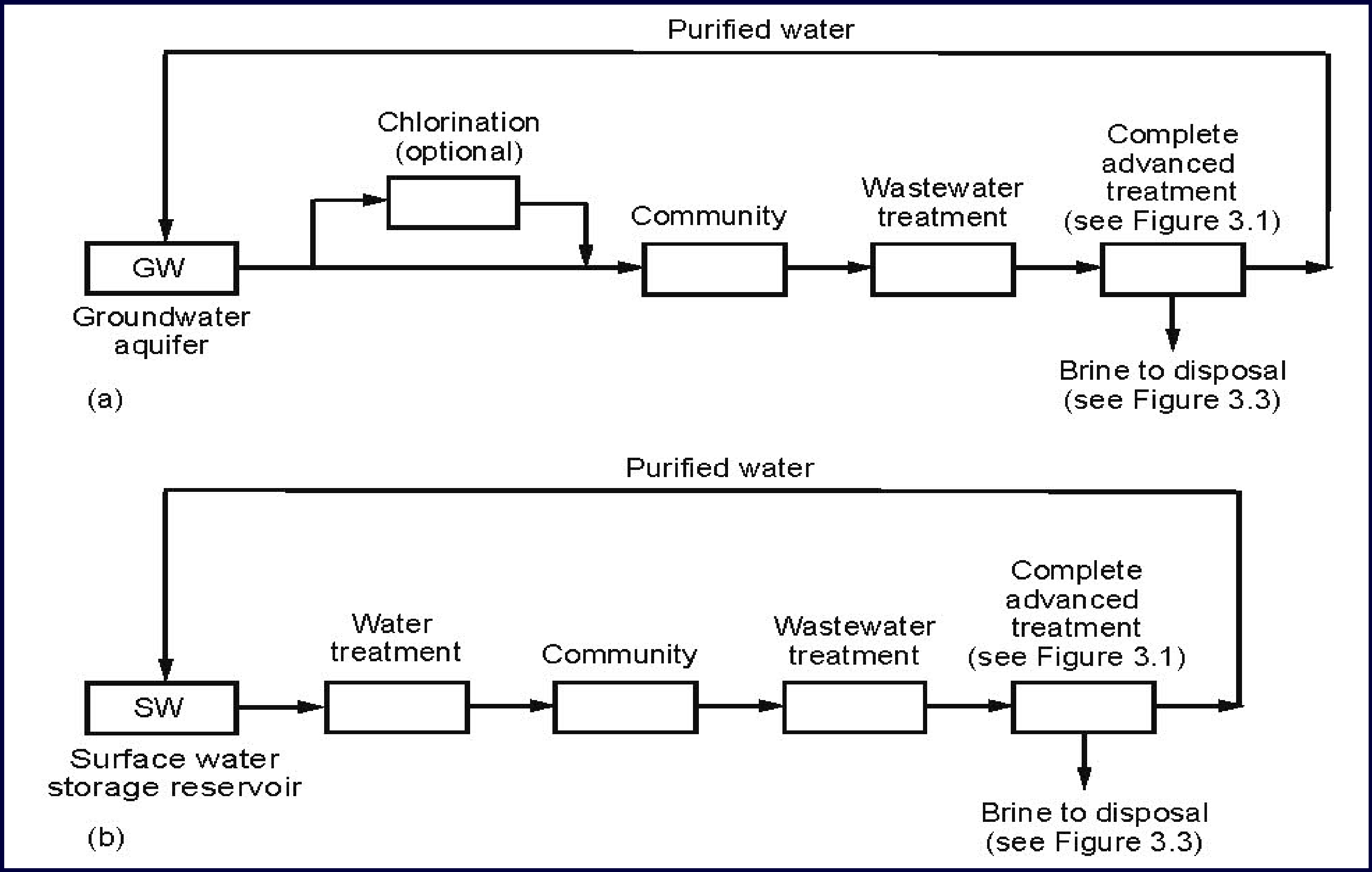
How Much Reuse Water Is Available?



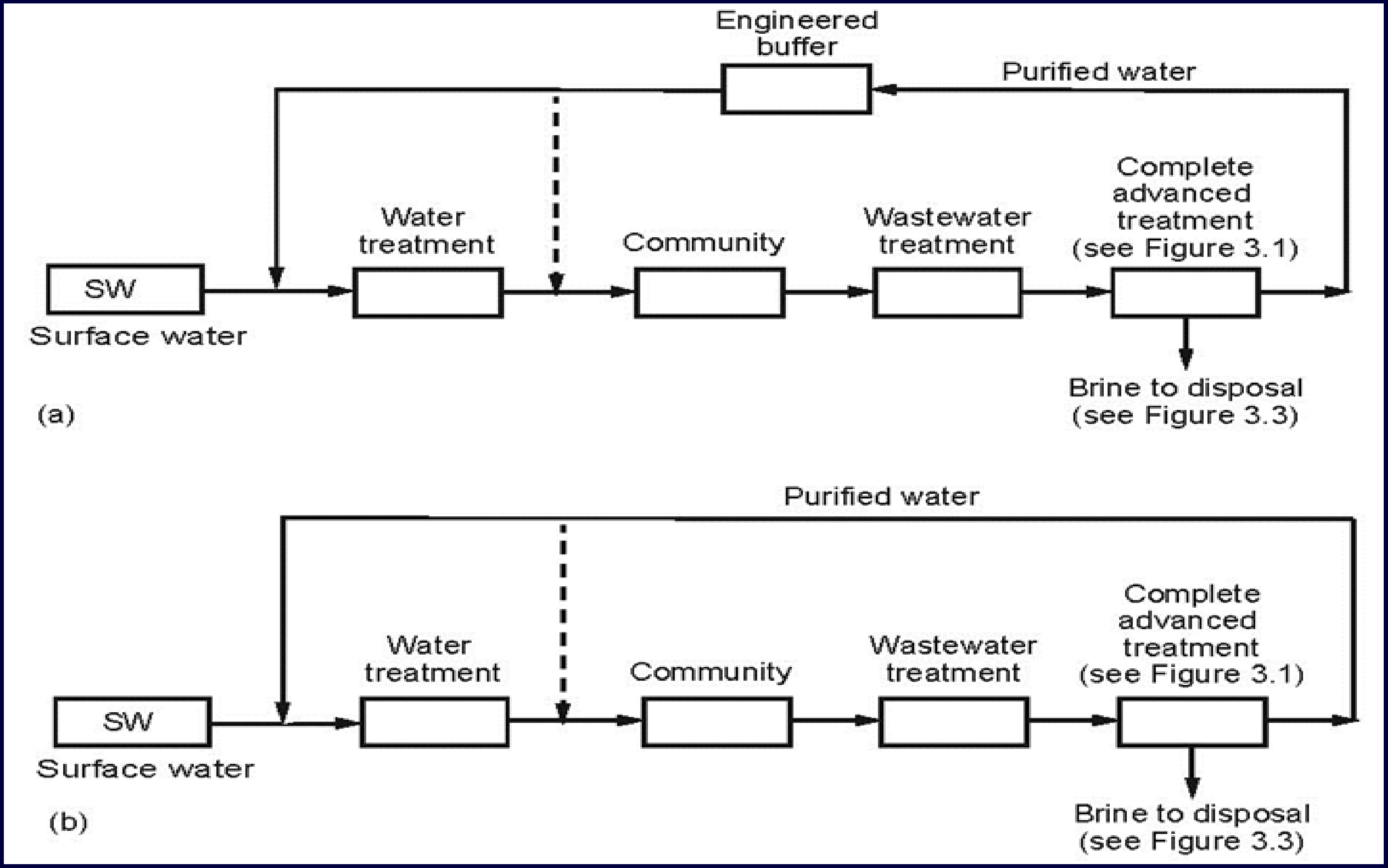
What is Complete Advanced Treatment?



Indirect Potable Reuse



Direct Potable Reuse



Potential Advantages of Water Reuse

Benefits compared to Status Quo (no new water)

- Increases use of available local resource
  - Could translate into additional 3.7 MGD potable supply for Santa Cruz
- Diversifies existing supply portfolio
- Reliable, climate-independent yields
- Avoids social cost of water shortages and associated curtailments
- Decreases ocean discharge of effluent

Potential Advantages of DPR

Benefits Compared to Nonpotable Reuse (NPR):

- Produces the most valuable water
- Provides flexibility to distribute via existing potable infrastructure for any use or user
- Avoids financial, social, and environmental costs of building and operating dedicated pipe & pump networks, and on-site NPR retrofits
- Year-round uses (compared to seasonal demands and stranded assets for many NPR projects)

Key Potential Advantages of DPR (2)

Compared to Indirect Potable Reuse (IPR):

- Environmental buffer may not be locally available to enable IPR
- May reduce financial, social, and environmental costs of building and operating pipe & pump and retrieval networks (very site-specific)
- Avoids some potential water rights issues
- Precludes potential contamination and/or water loss in environmental buffer
- Avoids O&M & development costs of buffer

Value: Triple Bottom Line Analysis to Compare Alternatives

- Financial outcomes

- Social outcomes

- Environmental outcomes

El Paso Triple Bottom Line: Reuse appears Expensive, But Saves Big $s in the End

(NPR and IPR only)

Social (> $2.4M)

- Air quality related health risk reduction ($2.4M)
- Supply reliability (+)
- Climate-insensitive supply source (++)
- Sustaining agricultural communities (+)

Environmental (> $15.7M)

- Carbon footprint reduction ($15.77M)
- Energy savings 3.6M MWh
- Air quality (+)
- Groundwater quality (+)
- Surface water (+)
- Carbon footprint of piping (+)

Financial ($967M)

- 74% cost saving to supply water to all EPWU customers

(Present values over 50-year period 2010 – 2060)

Potential Savings of DPR in San Diego

- Based on comparing full scale DPR to IPR
  - Pipe to *front* of potable treatment plant
  - Yield of up to 98,500 AFY (32,000 MGY)
- DPR direct cost savings to City of San Diego
  - May be > $100 million saved in construction capital costs for pumps and piping facilities alone
  - O&M savings anticipated (but not estimated)
- Net reduction in CO_{2e} emissions: >50,000 MT CO_{2e} for pipe manufacturing footprint alone

Carbon Footprint Issues of DPR and Pipelines

- DPR can have lower GHG emissions than NPR or IPR

- Less piping (site specific)
- Less pumping (site-specific)

- Perhaps more upfront treatment
  – Tertiary (NPR): 1,600 to 2,200 kWh/MG
  – CAT (IPR or DPR): 3,200 to 3,500 kWh/MG

Estimated Carbon Footprint of Piping

- Lifecycle approach: manufacturing, transport to site, and installation
- Production phase accounts for 70% to 99%
  - Pipe material and diameter are key factors
- San Diego case: 36" steel-lined concrete
  - 22 miles if IPR, 10 miles if DPR
  - Save 53,280 MT carbon in production phase (may be valued at >$750 M)
- Transport, installation, pumping *not* estimated

References on Pipe GHG Emissions

- Chlana, L. 2011. Carbon Footprint Analysis of a Large Diameter Water Transmission Pipeline Installation. MS Thesis, Civil Engineering Department, U of TX Arlington, May 2011. Full text: http://dspace.uta.edu/bitstream/handle/10106/5844/Chilana_uta_2502M_11082.pdf?sequence=1. Accessed on March 5, 2013.
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Basic Comparison: DPR v. North Coast NPR

Values ***Illustrative*** Only – Not Real Estimates

DPR

- CAT Treatment (3.5 MGD)
  - 3300 kWh/MG
  - Capital cost: $17M ($1.1M/yr)
  - O&M: $1.7 M/yr
  - $2,200/MG ($700/AF)
- 1280 MGY (4000 AF)
- Pipe and pumping
  - 4 to 5 miles?
- Other Costs:
  - Public engagement

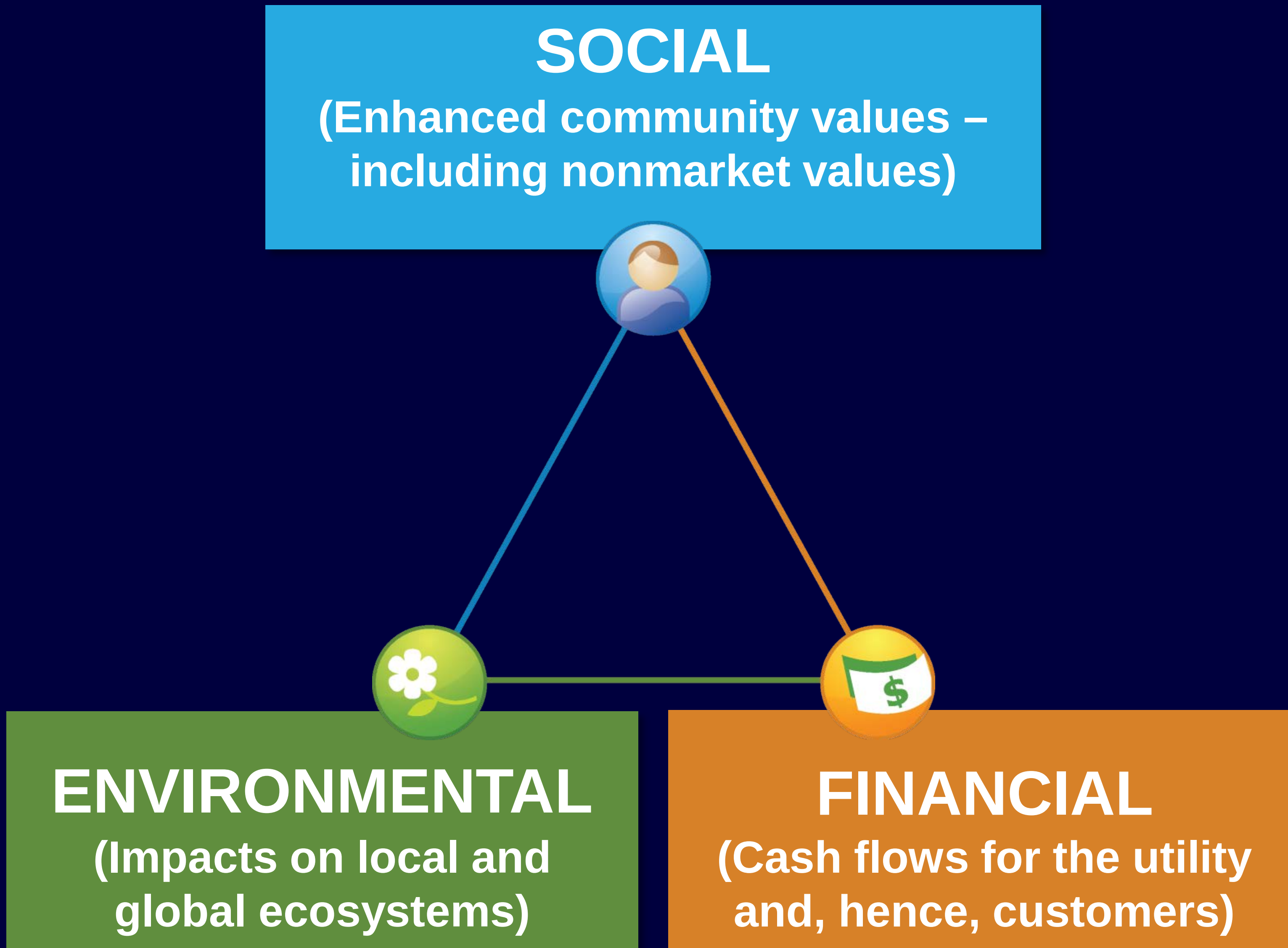
NPR

- Tertiary Treatment (4.5 MGD)
  - 1900 kWh/MG
  - Capital cost: ??
  - O&M: ??
  - $??/MG
- 700 MGY exchange to City
- Pipe and pumping
  - 8.5 to 11.5 miles?
- Other Costs:
  - Well development and pumping

Energy Use and Carbon Footprint

- Pipeline: if NPR requires ~ 5 miles more
  - – 20,000 MT CO_{2e} embedded in added pipe?
  - – Additional CO_{2e} from added pumping
- Treatment - NPR
  - – NPR: 1,900 kWh/MG * 4.5 MGD* 180 days = 1.54 M kWh per year
  - – Yield to City: 700 MGY => 2,200 kWh/MG
- Treatment – CAT for DPR at 3,300 kWh/MG
  - – Yield: 3.5 MGD * 365 days = 1,280 MGY
  - – Energy per Yr: 4.2 M kWh/yr

TBL Components for Direct Potable Reuse (DPR)



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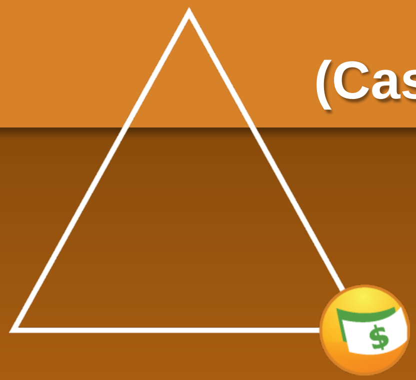

FINANCIAL

(Cash flows for the utility and, hence, customers)

- May avoid potable treatment plant expansion/upgrade costs
- Avoid financial costs of dedicated pipe and pump networks (vs. NPR)
- Avoid costs of on-site retrofits (vs. NPR)
- Avoid costs of environmental buffer (vs. IRP)

TBL Components for Direct Potable Reuse (DPR)

SOCIAL

(Enhanced community values – including nonmarket values)

- Adds reliability, climate independence
- Avoid cost of water shortages and associated curtailments
- Produces most valuable, all-use water
- Avoids disruption of adding dedicated reuse pipelines
- Precludes potential contamination in environmental buffer
- Avoids potential water rights issues
- Public health concerns need to be carefully and fully addressed!!

TBL Components for Direct Potable Reuse (DPR)

ENVIRONMENTAL

(Impacts on local and global ecosystems)

- May reduce carbon footprint
  - ❖ Potential use of less pipe
  - ❖ Potentially less pumping
  - ❖ Potentially less overall, redundant treatment
- Makes use of an untapped “waste” resource
- Reduces effluent discharge
- May enable higher instream flows and groundwater levels
- Improves water quality

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Thank you!

Questions?

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