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NBVC Irrigation Case Study: Project Development for Funding

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Possible Retrofits for Existing System

- 75 acres had automatic sprinkler systems.
  - ✓ Other than evapotranspiration controllers, probably no quick payback retrofits if system is functioning correctly.
- 83 acres of sprinkler systems with manual valves.
  - ✓ potentially replace manual valves with automatic valves and ET controllers for optimal run times.
- ~ 70% of the landscape is turf.
  - ✓ potential exists to replace turf with xeriscaping or artificial turf.

Possible Retrofits for Existing System

- 39 acres were irrigated using hose dragging:
  - Infrequent watering (once or twice a week) leads to:
    - “feast/famine” cycles that stress the plants.
    - Substantial water runoff.

✓ Installing automatic sprinkler systems with ET controllers will greatly improve water coverage and provide optimal run times.

Hose-Dragging Example

Hose-Dragging Example

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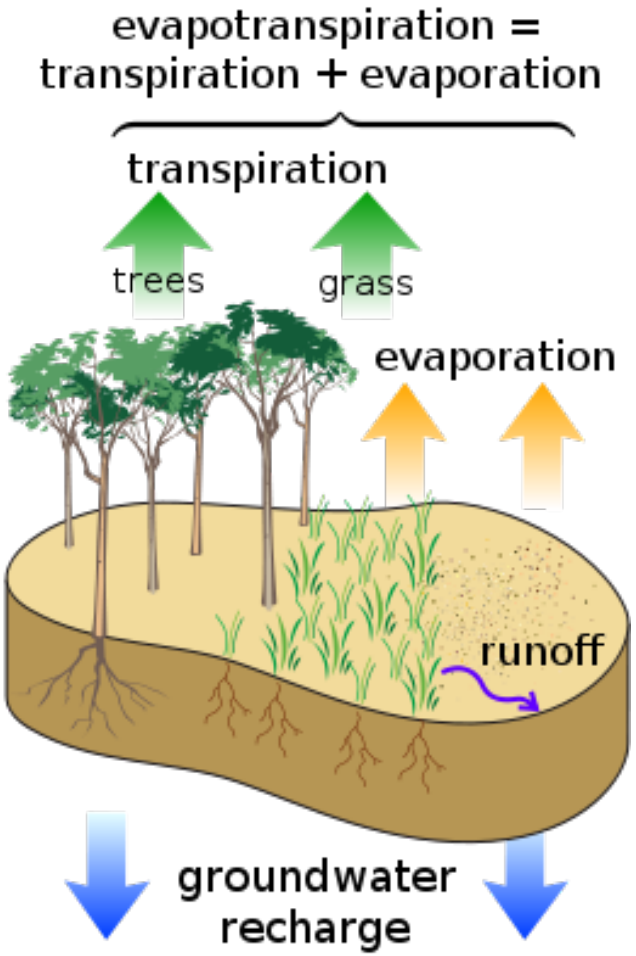
Possible Retrofits for Existing System

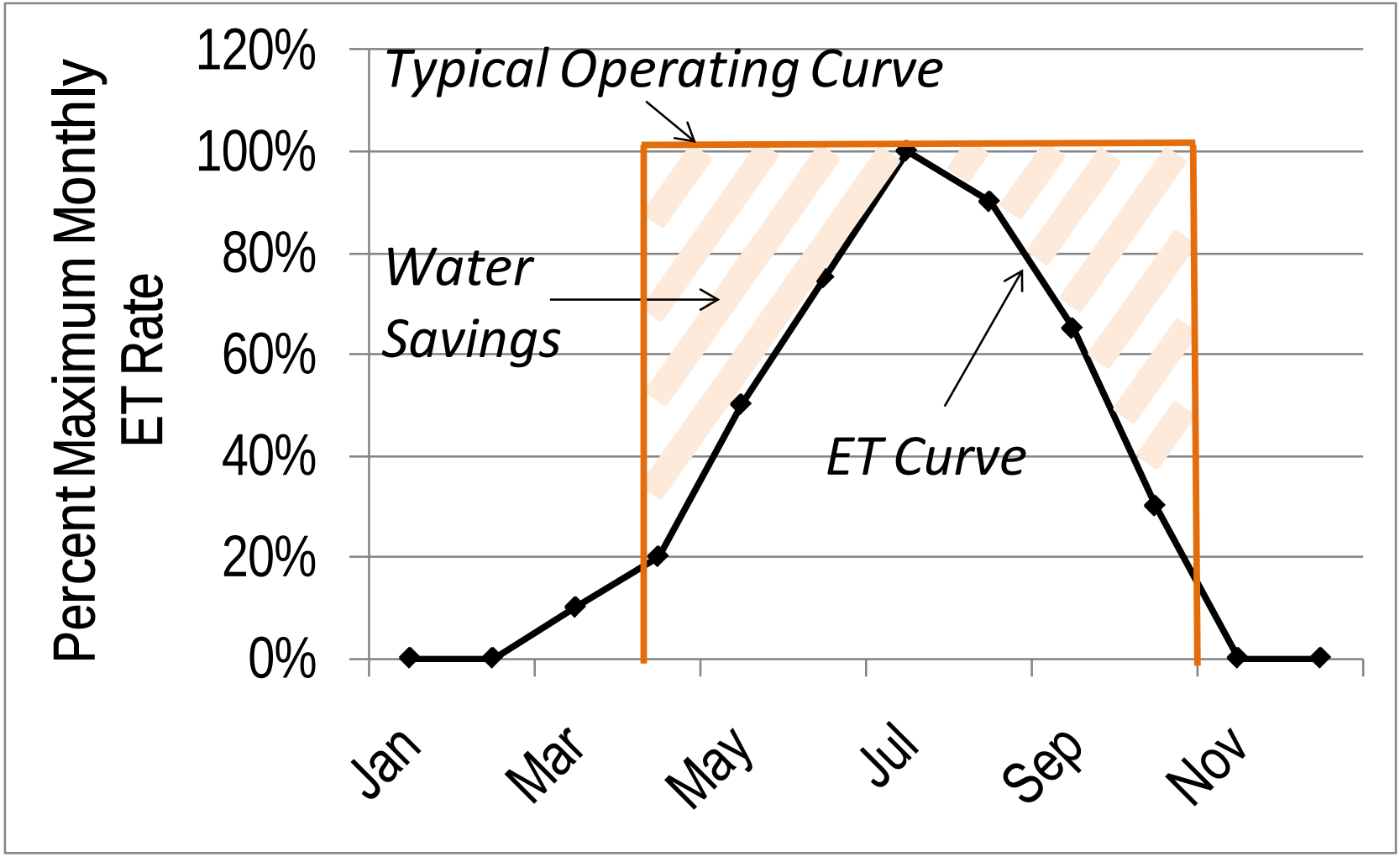
- None of the existing 133 controllers were evapo-transpiration (ET) controllers.
  - ✓ Installing ET controllers will provide the amount of water necessary for plant life to remain viable.
  - ✓ For projects with many controllers include a central computer for monitoring and control purposes.
  - ✓ Installing ET controllers is a relatively low-cost, low-payback water conservation measure.

Evapotranspiration

- Evapotranspiration is the combined water loss by evaporation from soil and transpiration from vegetation.
- Factors that affect ET:
  - type of plant
  - percentage of soil cover
  - solar radiation
  - humidity
  - temperature
  - wind



Water Savings From ET Control



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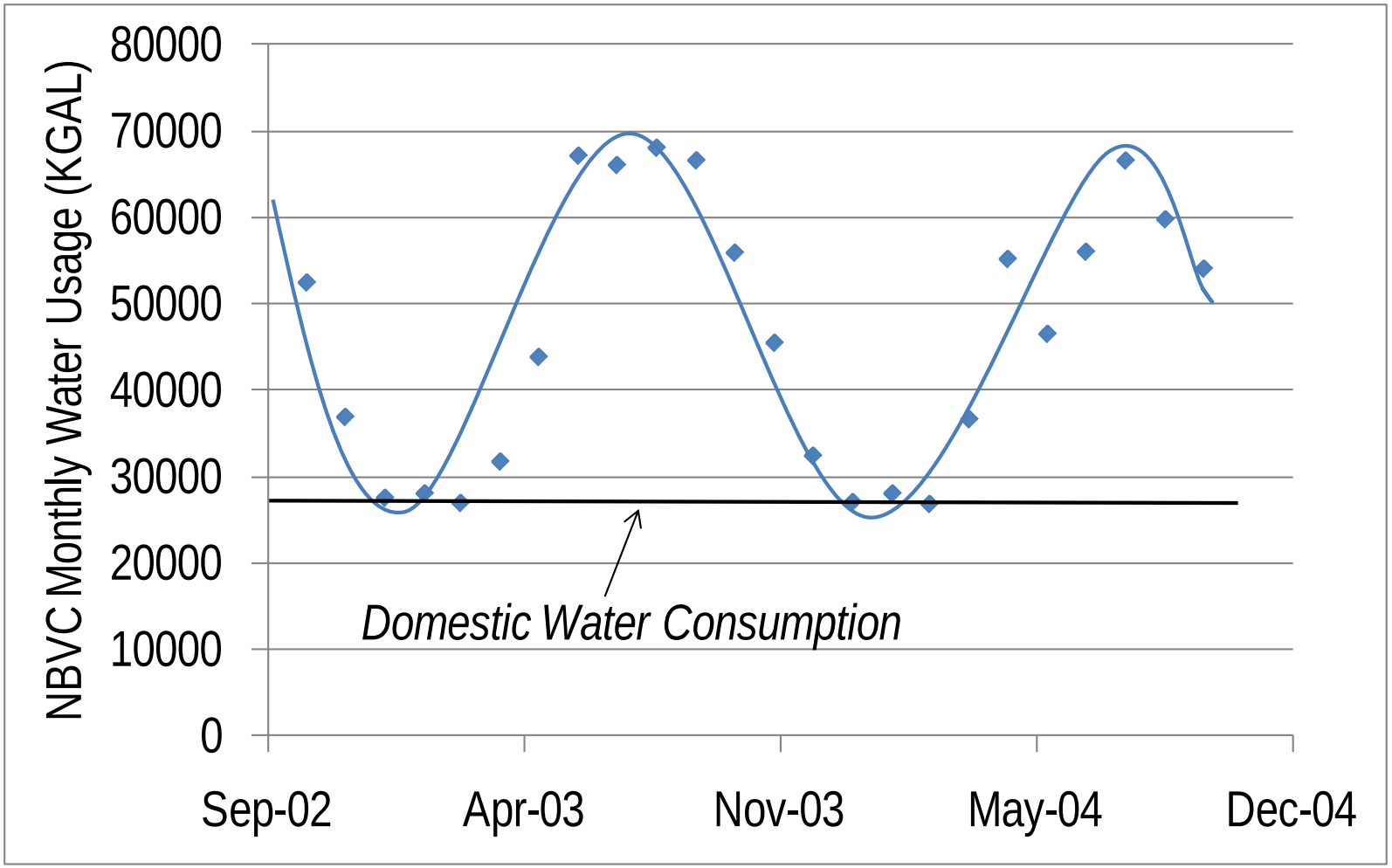
General Irrigation Retrofit Scope

- ✓ Install sprinkler systems with automatic valves and ET controllers to replace hose dragging.
- ✓ Replace manual valves on existing sprinkler systems with automatic valves and ET controllers.
- ✓ Replace existing controllers with ET controllers.
- ✗ Artificial turf was deemed too expensive.
- ✗ Xeriscaping was deemed too expensive except for demonstration purposes.

Estimate Baseline Water Usage

- At NBVC irrigation water is not metered separately from domestic water.
- Annual domestic water consumption was assumed to be the average monthly water consumption, during months when irrigation is shut off, multiplied by 12.
- Irrigation water consumption is estimated as the difference between total water consumption and domestic consumption.

Estimate Baseline Water Usage



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Estimate Post-Retrofit Water Usage

- Irrigation rate is estimated from the following:

  $I.R. = ET_o \times K_c/D.U.$

  Where I.R. is the irrigation rate, ET_o is the reference ET rate, K_c is the plant coefficient (0.65 for Bermuda grass) and D.U. is the distribution uniformity. Summed monthly ET_o for April thru October was used.

  I.R. = 31.5 x 0.65/0.8 = 25.6 gal/sq.ft. per year

- Add a 10% safety factor to the irrigation rate.

- Calculated target irrigation rate = 28.2 gal/(sq.ft.-yr)

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Estimate Installation Costs

- Installation costs for the purpose of obtaining funding (not design) were estimated as follows:
  - In Phase 1 new sprinkler systems were estimated at $1.00/sq.ft.
  - In Phase I manual valve costs were estimated from vendor quotes and estimated installation costs.
  - In Phase 2 swap-outs with ET controllers were estimated from vendor quotes and estimated installation costs.
- Subsequent phases used actual costs from Phase 1.

Life-Cycle Cost Analysis

- LCCA Cost savings include:
  - Water cost savings.
  - Labor cost savings, i.e reductions in the landscape maintenance contract.
- Note: there are generally no sewer cost savings.
  - However, if sewer charges are based on total water consumption, contact water utility to have irrigation consumption removed from sewer charges.

Funding Mechanism

- Energy Conservation Investment Program (ECIP)
  - Awarded three phases funded by ECIP.
- Utility Energy Services Contract
  - Awarded one phase under a UESC contract.
- Projects were bundled to include irrigation upgrades, lighting upgrades and mechanical system upgrades.

Energy Project Irrigation Financials

ENERGY PROJECT PHASE	FY AWARDED	PROJECT COST	ANNUAL COST SAVINGS	ANNUAL KGAL SAVINGS	SIMPLE PAYBACK
I	2005	$1,103,971	$101,530	35,500	10.9
II	2006	$1,125,743	$138,267	49,200	8.1
III	2008	$1,328,065	$105,512	34,300	12.6
V	2011	$537,115	$37,671	12,557	14.3

The Phase IV Energy Project did not include irrigation upgrades.
Average unit cost of water was $2.20/KGAL.
Annual Cost Savings include O&M savings.

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Some Lessons Learned

- Expect higher costs or additional scope. Most of the existing irrigation system cannot be readily inspected while developing the project.
- Check if the existing maintenance contract has a “keep the grass green” clause. If it does, get it changed to require water conservation.
- Once funded, continually make it clear to the project team that funding is based on water savings not purely on aesthetics.