Water and Energy Savings and Greenhouse Gas Calculations

Attachment 2 consists of the following items:

- ✓ **Water Savings Calculations**
- ✓ **Energy Intensities and Savings Calculations**
- ✓ **Greenhouse Gas Emissions Reductions**

The following information supports the water, energy and greenhouse gas emission Excel workbook calculations. This information includes assumptions, methodologies and detailed analysis for water and energy savings and GHG emissions reductions.

1. Water Savings

To establish the Project's water savings, RCWD staff calculated an existing baseline volume of water required for each of the sites being converted as part of the Project. These baseline water requirements were calculated according to the following formula:

$$WR^{mg} = ((ETo \times Kl \times IA \times 0.623) / DU\%)/1{,}000{,}000$$

where,

WR^{mg}	= Annual Water Requirement in Million Gallons
ETo^{net}	= Local Historical Reference Evapotranspiration adjusted down for estimated effective rainfall
Kl	= Landscape Coefficient (Plant Water Requirement for Turfgrass)
IA	= Irrigated Area in Square Feet
0.623	= Constant for Converting Inches to Gallons
$DU^{lq}\%$	= Low Quarter Distribution Uniformity (Irrigation Efficiency)
1,000,000	= Constant for Converting Gallons to Million Gallons

Table 2-1 shows the baseline water requirements for each of the conversion sites in addition to a total baseline water requirement for the Project.

Table 2-1. Project Baseline Water Requirements

Proposed Conversion Sites	ETo^{net*}	Kl**	IA***	Constant	DU%****	WR^{mg}
Temeku Hills Development	50.77	0.8	92,750	0.623	65%	3.61
Rancho Highlands Development	50.77	0.8	58,500	0.623	65%	2.28
Villages Development	50.77	0.8	21,925	0.623	65%	0.85

Water and Energy Savings, and GHG Calculation

Proposed Conversion Sites	ETo^{net*}	KI**	IA***	Constant	DU%****	WR^{mg}
Vintage Hills Development	50.77	0.8	16,650	0.623	65%	0.65
Campos Verdes Development	50.77	0.8	13,150	0.623	65%	0.51
Rancho California Rd Median	50.77	0.8	1,500	0.623	65%	0.06
Temecula Duck Pond	50.77	0.8	25,500	0.623	65%	0.99
Winchester Creek Park	50.77	0.8	23,800	0.623	65%	0.93
Meadows Park	50.77	0.8	17,800	0.623	65%	0.69
Paloma Del Sol Park	50.77	0.8	28,250	0.623	65%	1.10
Temeku Hills Community Park	50.77	0.8	32,750	0.623	65%	1.27
Patricia H Birdsall Sports Park	50.77	0.8	56,245	0.623	65%	2.19
					Total	**15.13**

* ETo^{net} was calculated by averaging the last 15 years of available weather data from CIMIS stations #137 and #237. For each month of the 15 year period, 66% of the month's precipitation total was subtracted from monthly reference ETo to arrive at monthly ETo^{net}. Annual ETo^{net} was calculated by adding together each monthly ETo^{net} for the respective year.
**0.8 is the university and industry accepted percentage of reference ETo required by turfgrass.
***The irrigated areas represent the number of square feet of turf proposed for removal and replacement at each of the sites.
****DU^{lq}% is the average low quarter distribution uniformity reported for each of the sites by the City of Temecula.

Following implementation of the Project, the volume of water required at the proposed conversion sites will be drastically reduced through the following:

- **Replacement of turfgrass with lower water use plant materials**
  By replacing turfgrass with lower water use shrub plantings, the Landscape Coefficient (Kl) is projected to be cut in half.
- **Net Reductions in irrigated areas**
  The overall irrigated area (IA) is projected to be reduced by 25% through the elimination of turfgrass and replacement with a shrub-based plant palette and, in some cases, drip irrigation.
- **Irrigation system efficiency improvements**
  An irrigation system retrofit will accompany the plant material replacement component of the Project, and will result in lower water requirements due to increased irrigation system efficiency (DU%).

Water and Energy Savings, and GHG Calculation

Table 2-2 shows an estimation of the volume of water that will be delivered to the sites after the Project is implemented.

Table 2-2. Post-Project Implementation Water Requirements

Proposed Conversion Sites	ETo^{net}	Kl	IA	Constant	DU%	WR^{mg}
Temeku Hills Development	50.77	0.4	69,563	0.623	80%	1.10
Rancho Highlands Development	50.77	0.4	43,875	0.623	80%	0.69
Villages Development	50.77	0.4	16,444	0.623	80%	0.26
Vintage Hills Development	50.77	0.4	12,488	0.623	80%	0.20
Campos Verdes Development	50.77	0.4	9,863	0.623	80%	0.16
Rancho California Rd Median	50.77	0.4	1,125	0.623	80%	0.02
Temecula Duck Pond	50.77	0.4	19,125	0.623	80%	0.30
Winchester Creek Park	50.77	0.4	17,850	0.623	80%	0.28
Meadows Park	50.77	0.4	13,350	0.623	80%	0.21
Paloma Del Sol Park	50.77	0.4	21,188	0.623	80%	0.34
Temeku Hills Community Park	50.77	0.4	24,563	0.623	80%	0.39
Patricia H Birdsall Sports Park	50.77	0.4	42,184	0.623	80%	0.67
					TOTAL	**4.62**

Water savings for this Project, consistent with projects of this type, will be long term. It is expected that the savings will occur each year and last indefinitely. However, for the sake of estimating the total volume of water saved over the useful life of the project, a project life of 30 years is used. Table 2-3 shows estimated annual water savings in addition to lifetime water savings.

Table 2-3. Total Water Savings

Pre Implementation WR^{mg}	Post Implementation WR^{mg}	Annual Water Savings (Million Gallons)	Project Life (Years)	Lifetime Water Savings (Million Gallons)
15.13	4.62	10.51	30	315.3

It is important to note that of the 12 sites being proposed for conversion as part of the Project, 10 use potable water for irrigation and 2 (Campos Verdes Development and Paloma Del Sol Park) use recycled water. Therefore, of the 10.51 million gallons in annual water savings, 9.40 million gallons represents conserved potable water, and 1.11 million gallons represents conserved recycled water. Table 2-4 shows the water savings by type.

Table 2-4. Water Savings Breakdown: Potable vs. Recycled

Water Type	Pre Implementation WR^{mg}	Post Implementation WR^{mg}	Annual Water Savings (Million Gallons)	Project Life (Years)	Lifetime Water Savings (Million Gallons)
Potable	13.52	4.12	9.40	30	282.0
Recycled	1.61	0.5	1.11	30	33.3
TOTAL	**15.13**	**4.62**	**10.51**	**30**	**315.3**

2. Energy Intensities & Savings

Energy savings will result through implementation of the Project as a result of the water savings. Since RCWD has a diverse water supply portfolio, which includes imported water, local groundwater, and recycled water, all of which are used to varying degrees for supplying water to the group of sites proposed for conversion, these energy savings will be realized through the following:

- State Water Project's (SWP) and Colorado River Aqueduct's (CRA) reduced energy requirements for its supply and conveyance to RCWD's system
- RCWD's reduced energy requirements for its treatment and distribution of blended imported water and local groundwater
- RCWD's reduced energy requirements for its treatment and distribution of recycled water

Energy Intensity for Supply and Conveyance

For calculating the energy intensity (EI) for the water imported to RCWD's distribution system, it is important to note that RCWD's imported water supply consists of a blend of SWP and CRA water. According to RCWD's historical water production records, 39% of water imported to RCWD's system is SWP water pumped through the Pearblossom Pumping Plant, and 61% comes from the CRA. Therefore, for this analysis, it was necessary to adjust the EIs stated in DWR's Proposal Solicitation Package (PSP) for the supply and conveyance of water imported from the SWP and the CRA according the composition of RCWD's imported water supply. Table 2-5 shows the method used for making this adjustment and calculating a weighted EI that

accurately reflects the blend of SWP and CRA water that is imported to RCWD's distribution system.

Table 2-5. Energy Intensity for Supply & Conveyance of Imported Water

Water Source	% Imports	EI (kWh/MG)	Weighted EI (kWh/MG)
CRA	61%	6,066	3,700.26
SWP	39%	13,606	5,306.34
		Total Weighted EI	**9,006.60**

**The formula used to derive the weighted EI is: (13,606 kWh/MG x 39%) + (6,066 kWh/MG x 61%) = 9,006.6 kWh/MG

Energy Intensity for RCWD's Potable Distribution System

RCWDs collective potable water supply consists of a blend of the imported water described in the previous section and locally produced groundwater. Although the same amount of energy is required for pumping water from both of these sources through RCWD's potable distribution system, additional energy is required for producing local water before it enters the system (i.e., it needs to be pumped from wells and treated). Because each of these blend constituents has a different EI, the same method used to calculate the weighted EI for imported water supply and conveyance was used to calculate a weighted EI for RCWD's potable distribution system. Table 2-6 shows the EIs that were provided by RCWD's Operations staff for each of these water sources, and shows the calculation used for deriving a weighted EI that accurately reflects the blend.

Table 2-6. Energy Intensity for RCWD's Potable Distribution System

Water Source	% Potable Supply	EI Well Production	EI Treatment & Distribution	Total EI (kWh/MG)	Weighted EI (kWh/MG)
Import	61%	0	1,366	1,366	833.26
Local	39%	2,137	1,366	3,503	1,366.17
				Total Weighted EI	**2,199.43**

**The formula used to derive the adjusted EI is: (3,503 kWh/MG x 39%) + (1,366 kWh/MG x 61%) = 2,199 kWh/MG

Energy Intensity for RCWD's Recycled Distribution System

Two of the twelve sites proposed for conversion currently receive water from RCWD's recycled water distribution system. The energy required for producing this water consists of collection, treatment, and pumping. Table 2-7 shows the EI of RCWD's recycled water system as reported by RCWD's Operations staff.

Table 2-7. Energy Intensity for RCWD's Recycled Water Distribution System

Water Source	EI Treatment & Distribution (kWh/MG)
Recycled Water	2,839.00
Total EI	**2,839.00**

Summary of Energy Intensities

Table 2-8 summarizes the EIs associated with the proposed Project.

Table 2-8. Summary of Energy Intensities

Water System	EI
Combined SWP/CRA Systems	9,006.60
RCWD Potable System	2,199.43
RCWD Recycled Water System	2,839.00

Energy Savings

As required by the PSP, the Attachment 2 Excel workbook provided by DWR was used to calculate energy savings. The worksheet required data to be entered including:

- Water savings calculations
- Life of project estimates
- Water supply composition data (i.e., % imported vs. local water)
- EI data for the Supply & Conveyance of imported water
- EI data for RCWD's distribution systems

Because Project implementation will create water and energy savings for two different RCWD distribution systems with separate EIs, RCWD elected to divide the proposed Project into two separate Projects within the Attachment 2 Excel workbook: one consisting of the 10 conversion sites currently drawing from RCWD's potable water distribution system and the other consisting the remaining two sites that draw from the recycled water system. While the details of the energy savings calculation can be found in the Attachment 2 workbook, the Table 2-9 summarizes the Project's energy savings.

Table 2-9. Summary of Energy Savings

Project Name	Annual Energy Savings (kWh)	Project Life (years)	Lifetime Energy Savings (kWh)
Potable Water Sites	72,318	30	2,169,555
Recycled Water Sites	3,151	30	94,539
TOTAL	**75,470**	**30**	**2,264,093**

3. Greenhouse Gas Emissions Reductions

The aforementioned water and energy savings also translate to reductions in Greenhouse Gas (GHG) emissions. Because total GHG output emission rates are not available for the specific Project location, the annual total-output statewide emission rate of 0.278 kg CO2e/kWh provided by DWR is used for calculating these reductions. Estimated GHG emissions reductions that will result from implementation of the proposed Project are summarized in Table 2.10.

Table 2.10. Summary of Greenhouse Gas Emissions Reductions

Project Name	Annual GHG Emissions Reductions (kg CO2e)	Project Life (years)	Lifetime GHG Emission Reductions (kg CO2e)
Potable Water Sites	20,105	30	603,136
Recycled Water Sites	876	30	26,282
TOTAL	**20,981**	**30**	**629,418**