Montecito Sanitary District & Montecito Water District
Enhanced Recycled Water Feasibility Analysis

EXECUTIVE SUMMARY

FINAL | January 2023

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Abbreviations

AACE International	Association for the Advancement of Cost Engineering
AF	acre-foot
AFY	acre-feet per year
ADWF	average dry weather flow
AOP	advanced oxidation process
AWPF	advanced water purification facility
AWTO	advanced water treatment operator
BAC	biologically active carbon
CAPP	Carpinteria Advanced Purification Project
Carollo	Carollo Engineers, Inc.
CAS	conventional activated sludge
Cater WTP	William B. Cater Water Treatment Plant
CCI	construction cost index
CEQA	California Environmental Quality Act
CIP	capital improvements plan
CSD	Carpinteria Sanitary District
DAF	dissolved air flotation
CVWD	Carpinteria Valley Water District
DPR	direct potable reuse
El Estero	El Estero Water Resource Center
ENR	*Engineering News-Record*
EQ	equalization
GSA	groundwater sustainability agency
IPR	indirect potable reuse
MBR	membrane bioreactor
MG	million gallons
mgd	million gallons per day
MSD	Montecito Sanitary District
MWD	Montecito Water District
NGO	non-governmental organization
NPDES	National Pollutant Discharge Elimination System
NPR	non-potable reuse
O&G	oil and grease
O&M	operations and maintenance
PWWF	peak wet weather flow

RO	reverse osmosis
ROC	reverse osmosis concentrate
RWA	raw water augmentation
RWQCB	Regional Water Quality Control Board
Santa Barbara	City of Santa Barbara
SSD	Summerland Sanitary District
TM	technical memorandum
TWA	treated water augmentation
UF	ultrafiltration
UV	ultraviolet
WRP	water reclamation plant
WTP	water treatment plant
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

ES.1 Introduction

The purpose of this project is to provide the Montecito Sanitary District (MSD) and the Montecito Water District (MWD) with clear direction for implementation of water reuse. Implementation of water reuse will produce a new local drought-proof water supply for the community and reduce the discharge of treated wastewater to the ocean. Previously, MWD completed a Recycled Water Facilities Plan in 2019 that identified top potential uses of recycled water along with recommended next investigative steps. This new collaborative project, contracted in partnership with MWD and MSD, builds on the previous effort by, evaluating regional partnerships and developing next steps, as well as incorporating updated information, such as the State of California's draft direct potable reuse (DPR) regulations[1].

The project also contains a "mini" master plan for the MSD wastewater treatment plant (WWTP), evaluating flows, capacity, upgrade/replacement needs, and costs. Such analysis is a crucial part of this recycled water analysis, providing valuable information on the long-term viability of the MSD WWTP.

Four distinct approaches to identify the preferred method of pursuing wastewater reuse were evaluated. The analysis considered local and regional partnerships, non-potable and potable reuse alternatives, and various treatment methods and technologies. The project concepts included in the study are as follows:

- **Montecito Non-Potable Reuse (NPR)** – local project producing tertiary quality water for irrigation of large commercial and institutional landscapes in Montecito.
- **Carpinteria Indirect Potable Reuse (IPR)** – regional project partnering with neighboring special district(s) and the use of the Carpinteria Groundwater Basin.
- **Montecito DPR** – local project in Montecito utilizing treatment at MSD and either raw water augmentation (RWA) at the MWD water treatment facility or treated water augmentation (TWA), both forms of DPR.
- **Santa Barbara DPR** – regional project partnering with the City of Santa Barbara (Santa Barbara) involving RWA at the William B. Cater Water Treatment Plant (Cater WTP).

The location of relevant regional facilities with potential for inclusion are shown in the map below. Note that Summerland Sanitary District (SSD), while shown on the map, is not part of any particular project detailed herein, but could be incorporated into a regional option.

[1] The State of California's State Water Resources Control Board is mandated by law to develop DPR regulations by the end of 2023. Current draft versions, as of August 2021, are very detailed and allow for proper evaluation of DPR for this project.

ES.2 Regional Partners

Collaboration with regional partners was essential for this project, specifically from Santa Barbara, the Carpinteria Valley Water District (CVWD), and the Carpinteria Sanitary District (CSD). At specific points in the project, representatives from these agencies met with project team staff, reviewed concepts, and provided comments. Comments from these agencies were incorporated into this document, where possible. The participation of these agencies is appreciated.

We do note that findings in this study that include these agencies do not indicate "approval" from these agencies for a particular project. Any regional project that comes out of this effort will require continued dialogue and formal agreement.

Figure ES.1 Regional Wastewater and Water Treatment Map

ES.3 Summary of Technical Memoranda

This project consisted of nine technical memoranda (TMs) (all attached as appendices to this document) that were used to conduct analysis and develop the information needed to assess the four reuse project concepts described above as well as the "mini" master plan for MSD.

- **TM 1: MSD Flow and NPDES Permit Analysis -** This TM reviewed current and anticipated wastewater flows to establish relevant flows for facility sizing. It also evaluated the minimum flow required to keep the outfall operational based on the National Pollutant Discharge Elimination System (NPDES) permit for effluent discharge. Key findings include:
  - As documented in TM 1, the average dry weather flow (ADWF) is 0.62 million gallons per day (mgd), based on data from 2017 to 2019. Flows from 2022 have been slightly lower, about 0.4 mgd, with some users offline. The future ADWF is estimated to be 0.7 mgd. It is important to note that future flows may be impacted by conservation.
    - Includes potential septic to sewer conversions within Montecito.

- Equalization (EQ) would be needed depending upon the potential project application.
  - Small EQ[2] of tertiary effluent is needed for NPR in Montecito to meet diurnal NPR demands.
  - EQ of secondary effluent for the ADWF is needed for potable reuse project options in order to provide constant flow to the membranes.
  - EQ of raw wastewater would be needed for one Santa Barbara potable reuse option and for any option that includes a new membrane bioreactor (MBR) at MSD.
  - The maximum anticipated EQ volume for future peak wet weather flow (PWWF) that would be needed is estimated to be 2.7 million gallons (MG).
  - There is available space for EQ at MSD.
- An analysis of future ocean discharge was conducted in which anticipated future discharge qualities were compared with existing NPDES[3] and Ocean Plan requirements. Based on this analysis for the reuse alternatives considered, and anticipating that future dilution credits through the outfall will increase as flows decrease, there are no anticipated significant issues with future discharge through the outfall.

- **TM 2: CSD and Santa Barbara WRP Capacity -** TM 2 reviewed historical wastewater flows for both CSD and Santa Barbara to establish available capacity to accept raw wastewater from MSD. Key findings include:
  - The CSD water reclamation plant (WRP) could accommodate 0.7 mgd of additional flow for 99 percent of hours based on data from the past year.
    - Such a potential addition of flows to CSD would essentially utilize all existing capacity and would likely trigger a WRP expansion.
    - MSD would need to buy into the CSD facility, paying for the as-built capacity of the facility proportional to the flow delivered, which would be approximately ones third of the total flow.
    - EQ of MSD flow would be needed for any CSD collaborative project, the amount depends upon the type of project.
      - For a project sending raw wastewater to CSD, all MSD flow (including PWWF) would need to be equalized.
      - For a project sending secondary effluent to CSD, only the ADWF of 0.7 mgd would need to be equalized. Flows exceeding the EQ capacity, such as wet weather flows, would be treated similar to current operation and discharged through the MSD outfall.
  - Santa Barbara's El Estero Water Resource Center (El Estero) could accommodate a range of flow from MSD, ranging from an equalized ADWF to potentially all flow

[2] "Equalization" and "storage" can be used interchangeable in this Executive Summary. Both provide the same function.
[3] The NPDES permit was renewed in 2022 with no major changes from the previous permit.

without EQ at MSD. Flows could be either raw wastewater or MSD secondary effluent.
    - If flows were not equalized at MSD, EQ would be needed at El Estero.
    - EQ of MSD flows at MSD would reduce transport pipeline capacity requirements while minimizing impact to El Estero capacity.
    - Flows from MSD, if added at the proper times, could help El Estero have a larger minimum flow for treatment while also providing more water for Santa Barbara's NPR program.
- **TM 3: Condition Assessment -** This TM presented condition assessment results from an onsite assessment at the MSD WWTP. Structural, electrical, and process engineers, working with MSD engineering and operations staff, determined the current condition of assets at the WWTP to support this project.
    - Electrical assets were the only assets that scored in very poor condition, and most of these assets are planned for replacement in an upcoming Electrical Capital Improvements Plan (CIP) project.2022-2023.
    - As noted in TM 3, there are many assets that are doing well and need only minimal repair.
    - Repairs and replacements, ranging throughout the WWTP for nearly all process areas, were categorized into Urgent (0-2 years), Priority (3-5 years), Short Term (6-10 years), Mid-Term (11-20 years), and Long Term (20+ years).
- **TM 4: Evaluation of MSD WWTP Performance and Capacity -** This TM provides a description of the existing MSD WWTP, an evaluation of the WWTP process performance, and a capacity assessment of the WWTP.
    - For each unit process, performance was assessed relative to typical anticipated performance. This evaluation provided a benchmark for assessing unit process capacity.
    - The capacity evaluation showed that all processes meet the projected ADWF of 0.7 mgd. The permitted capacity of the plant is 1.5 mgd.
- **TM 5: Cost for Rehabilitation and 30-Year Operations -** This TM used results from the condition assessment (TM 3) and the performance and capacity evaluation (TM 4) to develop a prioritized CIP and operating costs for MSD over the next 30 years.
    - MSD will need to implement an estimated $7.75 million of capital improvements over the next 30 years to maintain current treatment and operations at the plant, of which approximately $3 million will occur within the next 10 years.
- Additional studies are recommended to further evaluate several process areas (aeration basins, clarifiers, select buildings, and the ocean outfall) that could result in the need for additional capital investments.
- **TM 6: Cost for MBR Construction and 30-Year Operations -** This TM evaluates the implementation of an MBR treatment system, which is a biological wastewater treatment process that can replace conventional activated sludge (CAS) and secondary clarification in a smaller footprint and produce consistent, high-quality effluent. The TM evaluates two alternatives to replacing MSD's existing secondary treatment facilities: constructing a new MBR facility on undeveloped land, commonly referred as

"greenfield" (Alternative 1), or constructing a new MBR facility via retrofitting the existing secondary process infrastructure (Alternative 2).

- Alternative 1: A greenfield MBR facility would require several new structures that could be built in the open area on the western end of the WWTP property.
  - This facility could be constructed without disruption to existing treatment and operations and would not need to be replaced within the 30-year planning period.
  - Components of the MBR are "right sized" due to the use of all new tankage.
  - Most of the concrete infrastructure that would be abandoned for a new Greenfield MBR can be re-purposed as part of several of the recycled water project concepts.
- Alternative 2: Existing treatment structures could be retrofit to fit the new bioreactor and membrane tanks, maximizing the use of existing concrete infrastructure.
  - Components of the MBR may not be optimally sized due to the use of existing tankage.
  - Based on the condition assessment results, concrete repair would likely be required.
  - These structures would likely need to be replaced within the 30-year planning period.
  - There is significant added constructability challenges and complexity because the plant would need to continue to operate while converting existing infrastructure to an MBR.
- Estimated construction and operations and maintenance (O&M) costs are similar for the two alternatives.
- See Section ES.5.1 for key cost assumptions.

- **TM 7: O&G Treatment at MSD –** Oil and grease (O&G) can impact membrane treatment systems. Accordingly, a review of historical O&G data from the MSD WWTP was performed ,and it was determined that additional O&G treatment is needed for non-MBR-based potable reuse options to protect downstream membranes. Two alternatives for O&G removal were analyzed: primary and secondary dissolved air flotation (DAF).
  - The MSD historically meets the NPDES requirements for O&G, but is not designed for the robust O&G removal needed to protection the membranes that are part of many of the reuse treatment trains.
  - Cost estimates indicate that the secondary DAF alternative treating the ADWF of 0.7 mgd is significantly less expensive than a primary DAF treating 100 percent of MSD WWTP influent flow.
  - Bench and pilot testing is recommended prior to implementing a DAF for O&G removal.

- **TM 8: Recycled Water Treatment Options at MSD -** This TM looked at potential treatment trains for all four reuse project concepts. It provides treatment train design criteria, layouts, and estimated costs for each option.
  - A reuse facility at MSD (non-potable or potable) could be located in the open area at the westerly end of the plant.
  - There is room for a new MBR, a new advanced water purification facility (AWPF), and new EQ at MSD.
  - For a regional project with Santa Barbara, the AWPF would be located near the Santa Barbara El Estero, at the existing corporation yard (per Santa Barbara's existing potable reuse plans).
  - For a regional project with CSD, the AWPF could be located at MSD or located at the CSD WRP. Expanding the AWPF at CSD to accommodate the additional flows from MSD may be challenging due to space constraints.
  - Water reuse of MSD flows is maximized for any potable water reuse project, but reduced by ~75 percent for NPR due to limited number of potential customers and seasonal recycled water demand.
  - Costs are directly impacted by scale.
    - A joint project with Santa Barbara has a larger economy of scale and thus reduced costs per gallon produced.
    - A joint project with Carpinteria has a smaller economy of scale for treatment and thus higher relative costs per gallon produced than the Santa Barbara option.
    - A Montecito only project for NPR is the smallest project due to limited demand for NPR water and achieves no economy of scale and thus higher unit cost.
    - A Montecito only project for potable reuse has an improved economy of scale compared to NPR due to larger water production, but smaller economy of scale than Carpinteria or Santa Barbara options.
  - Total costs for treatment systems range from $9 million for a NPR system to $112 million for a large project at Santa Barbara. The portion of the total treatment costs that would be borne by Montecito are provided in Table ES.1.
- **TM 9: Distributed Infrastructure Analysis -** This TM developed distributed infrastructure alternatives for all reuse project concepts. Infrastructure components include pipelines, pump stations, storage, and various pipeline crossings (highway, railroad, and creek)[4]. This TM also examined the potential NPR opportunities through engagement with potential customers.
  - Multiple pipeline alignments were developed for each project concept, with a recommended alternative identified for each.
  - Costs are directly impacted by proximity of the MSD WWTP to other project partner facilities.
    - A joint project with Santa Barbara has less pipeline infrastructure compared to other options.
    - A joint project with Carpinteria has longer pipeline infrastructure, increasing project costs.

[4] The cost for injection wells for the Carpinteria IPR options is included in the treatment costs in Table ES.1 and Table ES.2.

    - A Montecito only project for NPR would require fairly extensive infrastructure to transport a relatively small amount of recycled water to various customers, increasing project costs.
    - A Montecito only project for potable reuse has options for shorter pipeline infrastructure compared to a Carpinteria option.
  - The costs for distributed infrastructure are significant, ranging from $8 million to $37 million.
  - Customer assessments were conducted for the three "anchor" customers (i.e., Birnam Wood Golf Club, Santa Barbara Cemetery, and Valley Club Montecito) to better estimate recycled water use at each site.
  - Customer usage projections for the golf courses were difficult to estimate from potable water use records due to their use of on-site groundwater wells. Also, the golf courses have implemented over the last several years conservation measures, such as turf replacement to reduce irrigation demand.
  - The previous 2019 Recycled Water Feasibility Plan assumed groundwater use from all customers could be offset by recycled water use. From the customer surveys it is now understood that recycled water would augment groundwater use. This is primarily driven by cost.
  - Lower total irrigation demand combined with only offsetting potable water use created a lower recycled water demand than previously estimated and results in a higher unit cost for NPR.

ES.4 Mini Master Plan

One goal of this project was to provide a "mini" master plan of the MSD WWTP. The mini master plan served to document the performance and necessary upgrades to maintain the wastewater treatment facility into the future to support a recycled water project. TMs 1, 3, 4, 5, and 6 summarize all aspects of the master plan analysis, including flows, treatment capacity, a condition assessment, costs for upgrades, and an evaluation of full replacement with a new MBR.

Regarding the MSD WWTP performance, condition, and rehabilitation needs:

- In terms of capital spending, it is estimated that MSD will need to implement $7.7 million of capital improvements over the next 30 years to maintain current level of treatment and operations at the plant. Approximately $3 million will occur within the first 10 years.
- The plant has sufficient capacity for the projected future 0.7 mgd ADWF.

Regarding full replacement of the MSD WWTP with a new MBR:

- The replacement of the existing MSD WWTP with an MBR is costly, in the $30 million range for either a retrofit or greenfield construction. Recent permitting of a PWWF bypass at Morro Bay for their MBR could also be applied to a Montecito project, resulting in an estimated $8 million in cost reduction for this option due to reduced EQ needs.

- Maintaining the existing MSD WWTP level of treatment as is would allow for an NPR project but would not be sufficient to support the implementation of potable reuse without modification.
- Although implementing an MBR is expensive, it provides several benefits for a potable reuse project. MBR effluent is generally consistent and high-quality, which leads to better performance of downstream advanced treatment processes. MBRs can also provide reliable treatment in a small footprint. As it takes the place of two existing treatment processes, CAS and secondary clarification; it also reduces the total number of processes to operate.

Regarding the alternative to an MBR:

- An MBR is not the only way to achieve the water quality needed for potable reuse; the alternative entails the addition of DAF and membrane filtration (ultrafiltration [UF]) following the existing MSD WWTP to attain the same water quality as an MBR. The cost of this option as compared to the MBR cost would include the full rehabilitation of the existing MSD WWTP, along with the addition of DAF and UF. These costs are less than half the costs for MBR, as follows:
  - Full Rehabilitation - $7.7 million.
  - DAF - $1.4 million.
  - UF - $4.6 million.
  - Total cost of $13.7 million.

The capital costs favor the status quo (keeping the existing facility and adding DAF and UF). The operational costs for MBR are similar to the costs of operating the existing plant plus the costs of operating the DAF and UF. In total, maintaining the existing treatment facilities and supplementing with DAF and UF is more cost-effective than converting to MBR.

ES.5 Project Comparison/Cost Analysis

The different types of recycled water projects are summarized in Table ES.1 and then further in the pages that follow, including a comparative ranking of projects. Included within Table ES.1 are important details on project components that impact cost, such as necessary pretreatment, pipelines, and use of existing assets (such as a water treatment plant [WTP]).

ES.5.1 Key Cost Assumptions

All capital cost estimates were prepared consistent with Association for the Advancement of Cost Engineering (AACE International) Class IV Estimates for feasibility and project screening. As such, the expected accuracy range could span -50 to +100 percent. The costs and assumptions used during this exercise were developed from the information available at the time the cost estimate was prepared since the upgrades have not yet been fully designed. There are numerous design related criteria, decisions, and assumptions that will need to be vetted and evaluated, including additional surveys, modeling, permit conditions, and unforeseen circumstances that could impact the cost of the project as the design progresses.

Note on construction costs: Construction costs have been rising at an unprecedented rate since May 2021. The increase in construction costs is largely attributed to workforce shortages, supply chain issues, and increases in energy (fuel) costs and inflation. *Engineering News-Record* (ENR) develops Construction Cost Index (CCI) for 20 cities across the United States and 2 in Canada. Using ENR data, national trends can be observed and analyzed. Between May 2021 and

March 2022, ENR's CCI has risen by nearly 6.7 percent. The industry is seeing an increase in projects that are bid at 20 percent over the engineer's estimate, outpacing the CCI increase. Accordingly, there are two key items to recognize when evaluating costs in this document:

1. They are conservative. Refinement of these costs require more detailed engineering analysis, preliminary design level at a minimum, to allow for reduction in safety factors.
2. They are based upon today's (September 2022) costs, as this analysis is not attempting to predict the rate of change (up or down) several years in advance.

Note on grant funding: Potential future grant funding has not been accounted for in cost estimates for this project. Receiving grant funding for a particular project would reduce the associated unit cost for Montecito.

In the sections below, this analysis highlights the approach to costing out the various treatment and delivery infrastructure necessary to implement water reuse for Montecito.

- **Reuse Treatment:** Capital costs are based on vendor quotes and similar facilities with allowances for civil, mechanical, structural, and electrical improvements, as well as engineering cost. Construction costs presented include an estimating contingency, sales tax, general conditions, and contractor's overhead and profit. The percentages assumed for these factors are provided in TM 8. Total project costs include a fee for engineering, legal, and administration, as well as an owners reserve for change orders. The percentages assumed for these factors are also provided in TM 8.
- **Reuse O&M:** These O&M costs include power consumption, chemical consumption, maintenance, and staffing. The staffing costs were developed using the results of a Carollo Engineers, Inc. (Carollo) survey of IPR operations, with extrapolation to DPR requirements. For DPR, the staffing costs assume that three Grade 5 advanced water treatment operators (AWTOs) will be needed to provide full staff for 12 hours per day and skeletal staff for 12 hours per day, with an Grade 5 AWTO on call at all times. Staffing costs for both IPR and DPR also include regulatory and compliance staff, as well as new lab staff to supplement existing lab staff, which would encompass costs associated with regulatory compliance (e.g., preparing plans, water quality sampling).
- **Montecito Portions of Reuse Treatment and O&M:** For regional projects where purification is happening at a facility not located in Montecito, it is assumed that capital and O&M costs would be shared with the regional partner. In these cases, the Montecito portion of the treatment and O&M costs were estimated to be proportional to the share of purified water that Montecito would receive versus the total project production. For example, in the case of the Carpinteria IPR project with purification in Carpinteria, Montecito's portion would be 0.56 mgd out of 1.56 mgd, or approximately 36 percent. Montecito would therefore be responsible for 36 percent of the capital and O&M costs for the facility[5].
- **EQ:** The cost for EQ is included in the cost estimates provided. The existing MSD WWTP currently does not have any EQ. Potable reuse requires EQ of the ADWF to capture and reuse as much water as possible. The maximum EQ that would be needed to equalize the PWWF at MSD is 2.7 MG. For treatment trains with an MBR, 2.1 MG of EQ is needed ahead of the MBR, reducing membrane size but also allowing a peak flow of 1.5 mgd.

[5] Costs allocated to Montecito in a regional project may be higher than what was assumed here and would depend on the outcome of negotiations with partner agencies.

Several of the options do also require storage of the treated water to meet peak demands or minimize pipeline sizes; these costs are included in the distributed infrastructure cost.

- **Distributed Infrastructure:** Capital costs for distributed infrastructure include construction and contractor overhead, contingency for unknown conditions and professional services (or "soft costs"). The capital cost estimates are expressed in March 2022 dollars (the corresponding 20-Cities Average ENR CCI of 12,791). Construction costs were developed using cost indexes, quotes from suppliers, recent bids for similar projects, recent engineering estimates, and known industry planning-level unit costs. Quantities were estimated using geographic information system based maps of alignments. A percentage of the construction costs is dedicated for contingency to cover as-yet-unknown aspects of the project, in accordance with AACE International recommendations. Soft costs are also estimated as a percentage of the construction costs based on typical percentages of total project costs for similar projects. Project costs were annualized and combined with reoccurring O&M costs to come up with a total annual cost. The annual cost was used to estimate the unit cost based on the annual water delivery (i.e., acre-feet per year [AFY]) for each alternative. A summary of construction, soft cost and escalation assumptions for distributed infrastructure is provided in TM 9.
- **Total Project Capital Costs:** The total project capital costs include both reuse treatment and distributed infrastructure costs.
- **Additional O&M Costs:** For some project concepts there are additional O&M costs included in the estimates. In the case of Santa Barbara DPR where Montecito sends secondary effluent to the El Estero, there is an assumed cost of wastewater retreatment of $3,000/acre-foot (AF) based on information provided by Santa Barbara. For all Santa Barbara DPR options, there is also treatment at the Cater WTP, with an assumed cost of $600/AF based on information provided by Santa Barbara.

ES.5.2 Water Supply Cost Perspective

It is prudent to consider the costs of other water supplies when comparing to the high cost of potable water reuse. Our understanding is that Montecito currently pays $3.500/AF for their desalination water. This represents the current price of desalinated water, not the future price of additional desalinated water supply. A thorough evaluation of the cost to expand desalination in Santa Barbara for additional supplies to Montecito would need to be conducted to have confidence in the unit cost.

Table ES.1 Montecito Water Reuse Project Costs Summary

Reuse Type	Wastewater Treatment	Additional Treatment for Reuse	Infrastructure Components	Total Project Size (AFY)	Annual Water Supply Benefit for Montecito (AFY)	Total Project Capital Cost ($ million)	Montecito Capital Cost	Montecito Capital Cost Components ($ million)		Total Annual O&M Cost ($ million)	Montecito Annual O&M Cost ($ million)[2]	Montecito Cost of Water ($/AF)[1] Estimate (-30 to +50 percent)	Notes
								Treatment[1]	Distributed Infrastructure				
Non-Potable	CAS + DAF (at Montecito)	Cloth filter + UV (at Montecito)	EQ of secondary effluent, tertiary recycled water treatment, pipelines to non-potable customers.	128	128	$20.6	$20.6	$5.8	$14.8	$0.5	$0.5	$12,400 ($8,300 - $16,100)	Other NPR trains evaluated in TM 8 include ones with MBR instead of CAS and side-stream RO for salt reduction. Maintaining the existing CAS is more cost effective than replacing with a new MBR, which would have higher $/AF costs. Adding sidestream RO is not necessary to allow for NPR options, though some users may prefer the desalted water. Adding RO adds cost to the $/AF shown.
Carpinteria IPR	CAS + DAF (at Montecito)	RO - UV/AOP (at Montecito)	EQ of secondary effluent, addition of DAF for O&G removal, advanced treatment, pipeline to Carpinteria, groundwater injection well.	560	504	$50.4	$50.4	$18.3	$32.1	$2.5	$2.5	$10,400 ($6,900 - $13,500)	MBR instead of CAS is a possible change to this treatment system, but it would increase the cost of purified recycled water production. Montecito supply benefit is reduced by 10 percent "leave behind" in the Carpinteria groundwater basin.
	CAS + DAF (at Montecito)	UF - RO - UV/AOP (at Carpinteria)	EQ of secondary effluent, addition of DAF for O&G removal, pipeline to Carpinteria, advanced treatment, groundwater injection well.	1,792	504	$104.2	$54.3	$21.0	$33.3	$2.9	$1.2	$8,300 ($5,500 - $10,800)	MBR at MSD is not a good option for this potential project, as the MBR effluent would blend with CAS effluent a Carpinteria and thus require UF before processing with RO (redundant processing). Montecito supply benefit is reduced by 10 percent "leave behind" in the Carpinteria groundwater basin. The concept of sending raw MSD wastewater to Carpinteria was not evaluated due to anticipated challenges with CSD capacity and cost.

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Reuse Type	Wastewater Treatment	Additional Treatment for Reuse	Infrastructure Components	Total Project Size (AFY)	Annual Water Supply Benefit for Montecito (AFY)	Total Project Capital Cost ($ million)	Montecito Capital Cost	Montecito Capital Cost Components ($ million)		Total Annual O&M Cost ($ million)	Montecito Annual O&M Cost ($ million)[2]	Montecito Cost of Water ($/AF)[1] Estimate (-30 to +50 percent	Notes
								Treatment[1]	Distributed Infrastructure				
DPR in Montecito	CAS + DAF (at Montecito)	Ozone/BAC - UF - RO - UV/AOP (at Montecito)	EQ of secondary effluent, addition of DAF for O&G removal, advanced treatment, pipeline to Bella Vista WTP.	560	560	$47.6	$47.6	$26.8	$20.8	$4.9	$4.9	$13,300 ($8,900 - $17,300)	Purified recycled water in this option would be delivered either ahead of the Bella Vista WTP or after the WTP, resulting in a blend of purified water to most customers. Options for TWA via addition of purified water into the nearest water main near the MSD was examined in TM 9 but not evaluated here.
DPR at Santa Barbara	CAS (at Montecito and again at Santa Barbara)	Ozone/BAC - UF - RO - UV/AOP (at Santa Barbara)	EQ of secondary effluent, pipeline connection to Santa Barbara sewer system, secondary treatment at El Estero, advanced treatment, pipeline to the forebay of the Cater WTP.	4,145	560	$94.4	$23.0	$10.3	$12.7	$8.1	$2.9	$7,400 ($4,900 - $9,600)	This concept keeps the MSD WWTP operational but does result in retreatment of MSD effluent at El Estero. Options exist for significantly larger EQ of raw wastewater at MSD, eliminating the "retreatment" aspect of this option but increasing costs due to EQ. Another option could involve transport of the secondary effluent direct to El Estero without blending with other raw wastewaters, resulting in increased pipeline costs but no "retreatment" costs.
	CAS at Santa Barbara	Ozone/BAC - UF - RO - UV/AOP (at Santa Barbara)	Unequalized raw wastewater from MSD to Santa Barbara via a pipeline connection to El Estero, secondary treatment at El Estero, advanced treatment, pipeline to the forebay of the Cater WTP.	4,145	560	$105.6	$34.1	$10.3	$23.8	$6.5	$1.3	$5,700 ($3,800 - $7,400)	The cost assumes no EQ, but this option could add EQ of MSD raw wastewater to reduce the size of the transport pipeline to El Estero.

Notes:
Abbreviations: AOP - advanced oxidation process; BAC - biologically active carbon, RO - reverse osmosis, UV - ultraviolet, WTP - water treatment plant.
(1) Cost of water was calculated based on total annual cost. The capital costs were annualized assuming a discount rate of 3.5 percent over a 30-year period. Annual capital and O&M costs were added together to obtain the total annual cost.

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Table ES.2 Summary of Costs Specific to Montecito for Each Project in $/AF

Project Element	Montecito NPR	Carpinteria IPR - Groundwater Storage	Carpinteria IPR - Purification in Carpinteria	Montecito DPR	Santa Barbara DPR - Secondary Effluent	Santa Barbara DPR - Raw Wastewater
Reuse Treatment at MSD	$2,500	$2,000	$0	$2,600	$0	$0
Reuse Treatment at Carpinteria	$0	$0	$2,300(1)	$0	$0	$0
Reuse Treatment at Santa Barbara	$0	$0	$0	$0	$1,000(2)	$1,000(2)
Conveyance to NPR Customers	$6,300	$0	$0	$0	$0	$0
Conveyance to Carpinteria Injection Wells	$0	$3,500(3)	$0	$0	$0	$0
Conveyance to Carpinteria AWPF	$0	$0	$3,600	$0	$0	$0
Conveyance to Bella Vista WTP	$0	$0	$0	$2,000	$0	$0
Conveyance Secondary Effluent to El Estero	$0	$0	$0	$0	$1,100	$0
Conveyance Raw Wastewater to El Estero	$0	$0	$0	$0	$0	$2,200
Conveyance El Estero to Cater WTP	$0	$0	$0	$0	$100(2)	$100(2)
O&M - Retreatment at El Estero	$0	$0	$0	$0	$3,000	$0
O&M - Treatment at Cater WTP	$0	$0	$0	$0	$600	$600
O&M - Treatment at Bella Vista WTP	$0	$0	$0	$1,000	$0	$0
O&M - Reuse Treatment at MSD	$3,600	$4,500	$500	$7,500	$0	$0
O&M - Reuse Treatment at Carpinteria	$0	$0	$1,400(2)	$0	$0	$0
O&M - Reuse Treatment in Santa Barbara	$0	$0	$0	$0	$1,400(2)	$1,400(2)
O&M - Distributed Infrastructure	$0	$500	$500	$100	$200	$300
Total ($/AF)	**$12,400**	**$10,400**	**$8,300**	**$12,300**	**$7,400**	**$5,700**

Notes:
(1) Reuse treatment for purification in Carpinteria also includes the cost for injection and monitoring wells.
(2) These items represent the Montecito portion of a shared regional cost. The costs for Montecito are proportional to the share of water received by Montecito relative to the total project size. Costs allocated to Montecito in a regional project may be higher than what was assumed here and would depend on the outcome of negotiations with partner agencies.
(3) Conveyance cost for groundwater storage option also includes the cost for injection and monitoring wells.

ES.6 Project Concept Summaries

The following sections include summaries of the five main project concepts. Each summary includes the treatment trains considered, an overview of the layouts of new infrastructure, maps of alignments for new pipelines, and a summary of project benefits and risks.

ES.6.1 Project Concept 1 - NPR in Montecito

This concept is for a local project producing water meeting Title 22 tertiary quality requirements for irrigation of large landscapes in Montecito. Some of the key information developed for this project concept is summarized here.

- Three treatment train options were evaluated, as shown in Figure ES.2. Option 1A includes sidestream RO to reduce salinity, while Options 1B and 1C are cheaper, non-RO-based systems. The use of sidestream RO increases the treatment cost, but may result in more customers using non-potable water. Treatment train 1C was used as the basis for the cost estimates provided in the previous section.
- The arrangement of infrastructure at the existing MSD WWTP is shown in Figure ES.3. As shown, there is space for a new reuse facility to house reuse treatment equipment on the west portion of the site. This facility would house the UF, RO, and UV for Option 1A, and the cloth disc filter and UV in Option 1C. Option 1B would not need a separate reuse facility because it would use the MBR and chlorine contact basin as shown in the site layout.
- The alignment for a pipeline to serve non-potable water to several customers is shown in Figure ES.4. The alignment shown is the preferred alternative because it has a preferred US 101 crossing and allows more customers to be served without additional laterals. Alternative alignments are presented in TM 9.
- A summary of the benefits and challenges for a NPR project in Montecito is shown in Table ES.3.

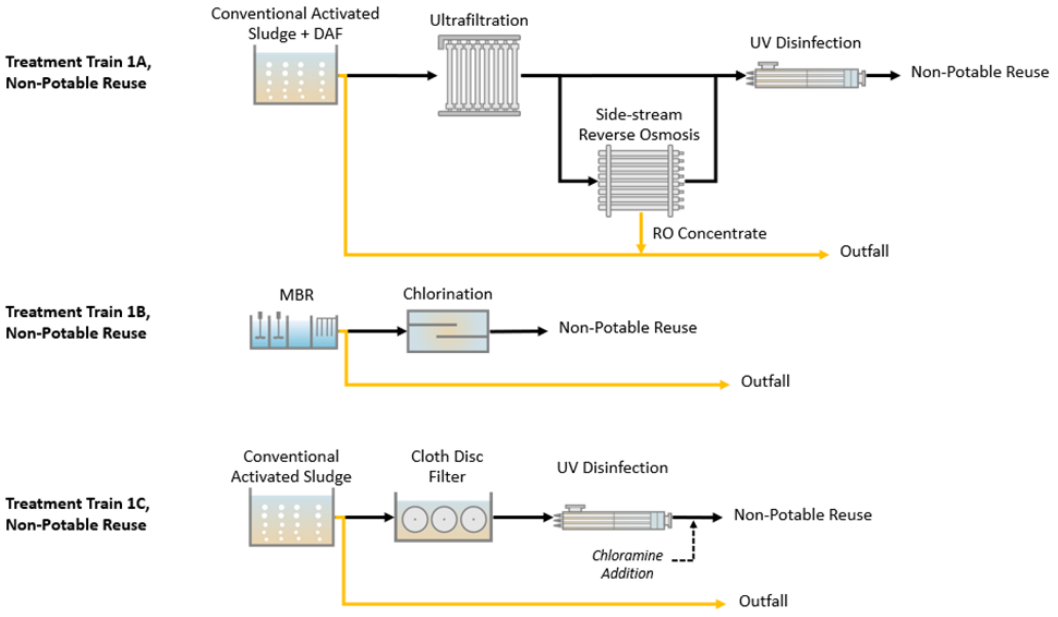


Figure ES.2 Treatment Trains Evaluated for NPR at Montecito

Note: MBR infrastructure assumes the retrofit alternative.

Figure ES.3 Layout of Potential Infrastructure Needed for NPR in Montecito

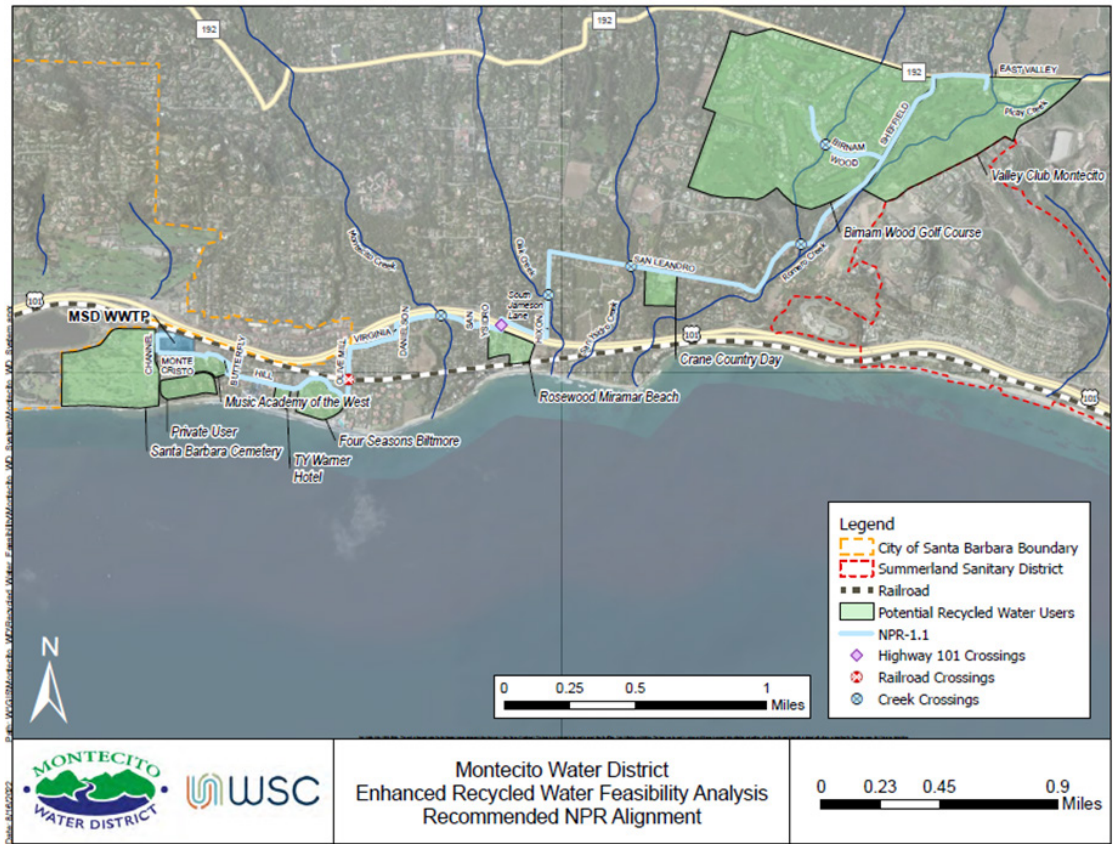


Figure ES.4 Recommended Alignment for Serving Non-Potable Customers From an NPR Project in Montecito

Table ES.3 Summary of Benefits and Challenges for an NPR Project in Montecito

Project Benefits	Challenges and Risks
• Agency controlled, drought-resistant water supply • Lower capital cost than potable reuse alternatives • Operationally less complex than potable reuse • Near term implementation • Some distributed infrastructure could be repurposed for a future Montecito DPR project	• Limited users • Minimal demand, thus minimal reuse • Need for larger irrigation customers to accept recycled water • Requires significant conveyance infrastructure • Some smaller users may want lower salt concentrations and thus may require sidestream RO • High unit cost

ES.6.2 Project Concept 2 - IPR in Carpinteria: Groundwater Storage in Carpinteria

This project concept is a regional project in which Montecito produces purified wastewater and sends it to Carpinteria for injection into the Carpinteria groundwater basin. This project entails a partnership with neighboring special district(s). Some key elements that were evaluated for this project are summarized below.

- Two potential treatment trains were evaluated, as shown in Figure ES.5. The main difference between the two trains is whether or not an MBR is used, or the existing CAS process with a new secondary DAF.
- The arrangement of infrastructure at the existing MSD WWTP is shown in Figure ES.6. Like in the NPR concept, there is space for a new reuse facility to house reuse treatment equipment on the west portion of the site. This facility would house the UF (if needed), RO, and UV/AOP.
- The proposed alignment for a pipeline to send purified water for injection in Carpinteria is shown in Figure ES.7. Note that the distributed infrastructure did not include a pipeline to return water from Carpinteria to Montecito, because it was assumed that the primary mechanism for Montecito to obtain the water supply benefit would be through a water exchange via the South Coast Conduit. However, further definition of this project may result in the addition of a return pipeline, which would increase the distributed infrastructure cost.
- A summary of the benefits and challenges for a groundwater storage IPR project in Carpinteria is shown in Table ES.4.

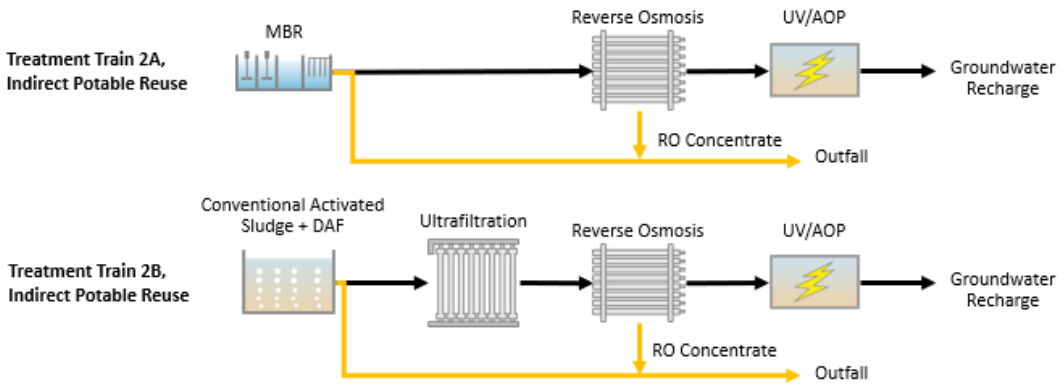
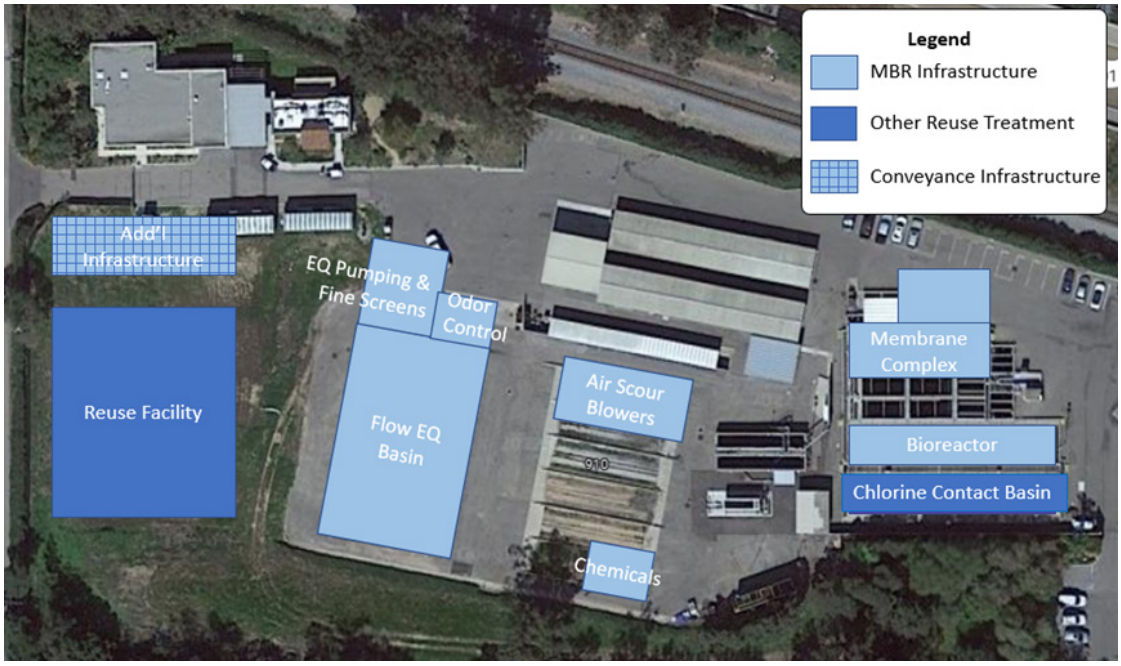
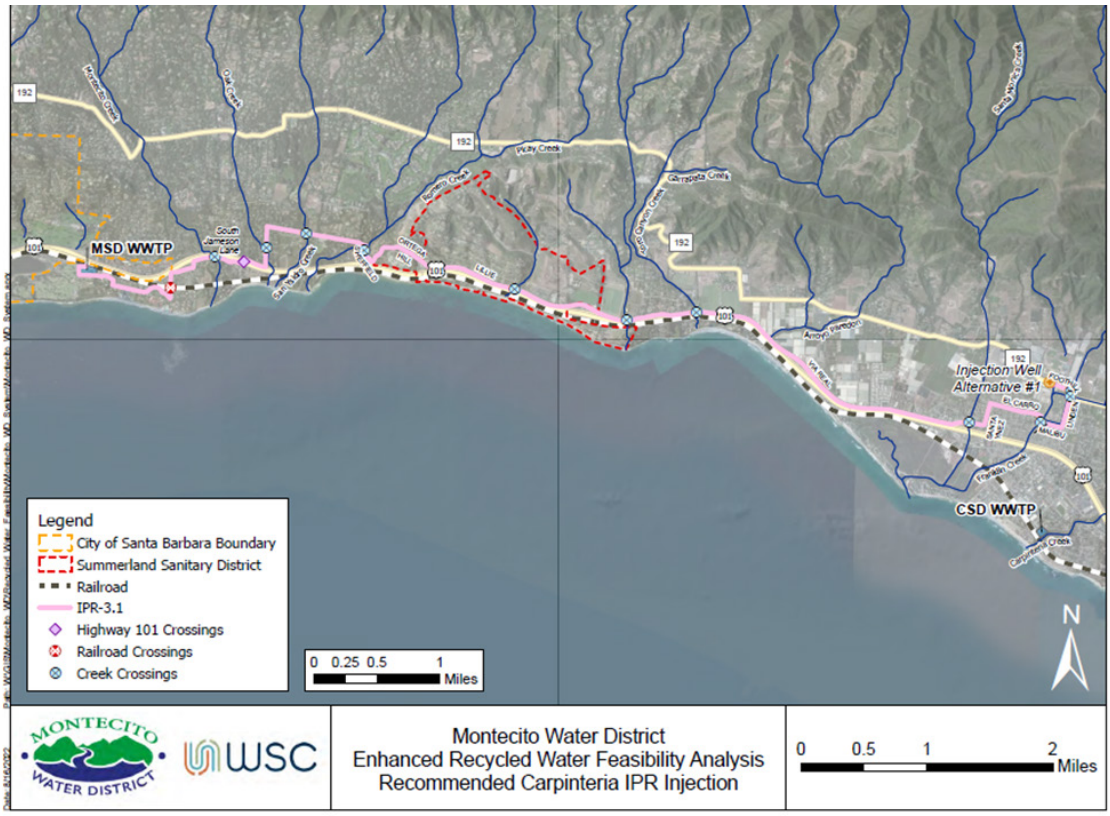


Figure ES.5 Treatment Trains Evaluated for IPR in Carpinteria Where Advanced Treatment Takes Place in Montecito and Purified Water is Sent to Carpinteria for Injection in Their Groundwater Basin



Note: MBR infrastructure assumes the retrofit alternative.

Figure ES.6 Layout of Potential Infrastructure Needed for IPR With Carpinteria When Advanced Treatment Takes Place in Montecito



Note: Injection well location shown is estimated; ultimate location would be determined during future project definition.

Figure ES.7 Recommended Alignment for Sending Purified Water to Injection Wells in Carpinteria

Table ES.4 Summary of Benefits and Challenges for IPR in Carpinteria Where Purified Water is Sent by Montecito for Injection in Carpinteria's Groundwater Basin

Project Benefits	Challenges and Risks
• Maximizes reuse of available MSD wastewater • Minimizes ocean discharge • Utilizes the potable distribution system for delivery • Provides drought-resistant supply of drinking water • Provides seasonal storage(1); potential for longer term shortage • Storage avoids potential loss due to an inability to use water in real time during low demand periods (as with DPR) • Potential low-cost water recovery option through water exchange	• Requires interagency coordination with CVWD and GSA • Requires significant transmission infrastructure • Requires further groundwater modeling to confirm storage capability in confined and unconfined zones • Involves more complex operations of an AWPF • Basin injection could be infeasible during future wet periods due to lack of storage capacity • Compensation for use of Carpinteria Basin assumed to be 10 percent leave behind; negotiations required

Notes:
Abbreviation: GSA - groundwater sustainability agency.
(1) Potentially provides seasonal storage but may be an annual "put and take" operation depending on future groundwater modeling results.

ES.6.3 Project Concept 3 - IPR in Carpinteria: Purification in Carpinteria

This project concept is a regional project in which Montecito sends secondary effluent to Carpinteria for treatment at a new AWPF and injection into the Carpinteria groundwater basin. This project builds on the existing Carpinteria IPR project, which is currently in design, to create a larger regional project.

- The treatment train evaluated is shown in Figure ES.8. The only change required in Montecito is the addition of secondary DAF for O&G removal to protect downstream membranes. No additional reuse treatment would be needed in Montecito. Alternatively, the use of an MBR could also replace the existing wastewater treatment; this alternative was not specifically evaluated.
- No site layout is provided here because the only additional infrastructure needed is the new secondary DAF.
- The proposed alignment for a pipeline to send purified water for injection in Carpinteria is shown in Figure ES.7.
- A summary of the benefits and challenges for a groundwater storage IPR project in Carpinteria is shown in Table ES.5.

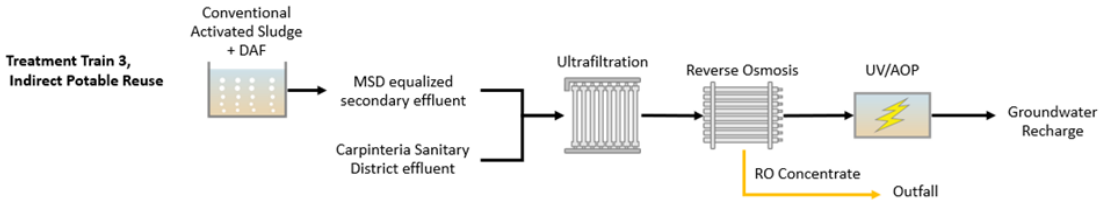


Figure ES.8 Treatment Train Evaluated for IPR in Carpinteria Where Montecito Sends Secondary Effluent to Carpinteria for Treatment at Their AWPF

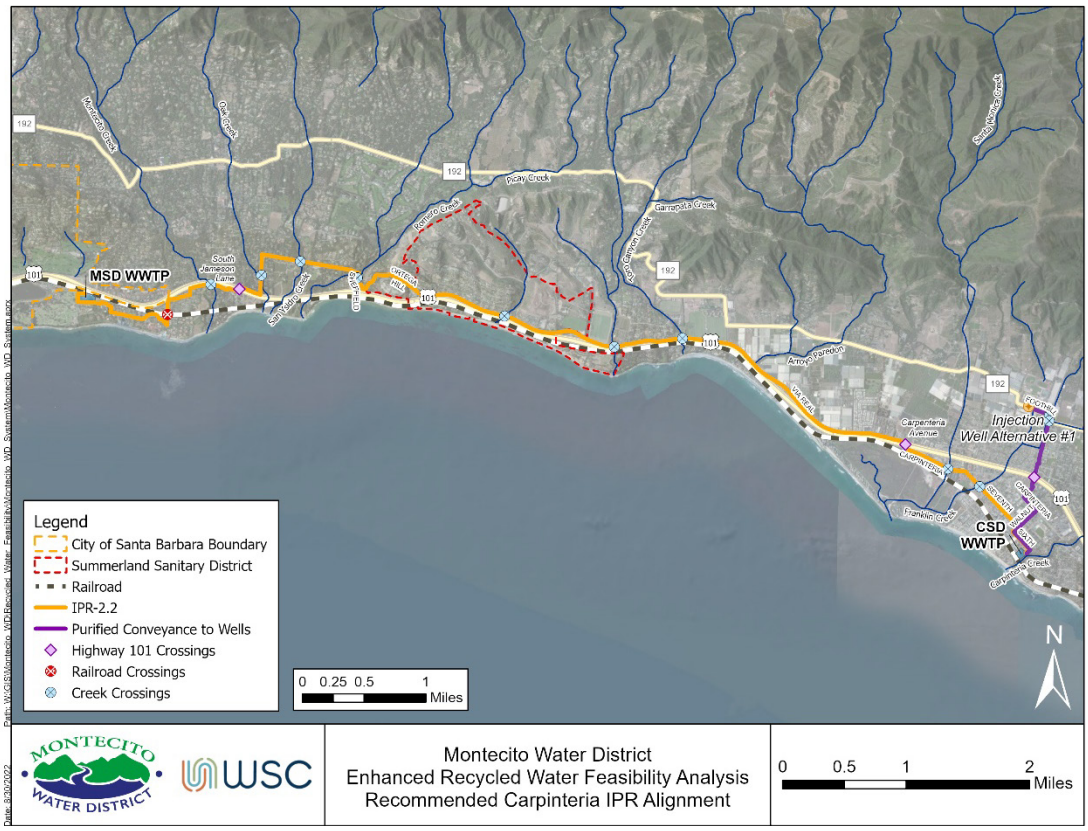


Figure ES.9 Recommended Alignment to Send Secondary Effluent to Carpinteria for Treatment at the CSD AWPF and Alignment for Sending Purified Water to Injection Wells in Carpinteria Groundwater Basin

Table ES.5 Summary of Benefits and Challenges for an IPR Project With Purification in Carpinteria

Project Benefits	Challenges and Risks
• Achieves some economy of scale • Does not impact CSD WRP capacity • Removes responsibility for AWPF operations from MSD • Maximizes reuse of available MSD wastewater • Minimizes ocean discharge • Utilizes the potable distribution system for delivery • Provides drought-resistant supply of drinking water • Storage avoids potential loss due to an inability to use water in real time during low demand periods (as with DPR) • Provides seasonal storage; potential for longer term shortage	• Likely resistance to the CAPP delay to allow for incorporation of Montecito • Requires interagency coordination with CVWD and GSA • Requires significant transmission infrastructure • Potential public concern with Montecito's wastewater going to Carpinteria (via ROC) • Potential public concern over Montecito's use of Carpinteria groundwater basin • Basin injection could be infeasible during future wet periods due to lack of storage capacity • Requires further groundwater modeling to confirm storage capability in confined and unconfined zones • Cost uncertainty; negotiations likely to result in a cost benefit to Carpinteria for Montecito's participation, above proportional participation in capital and O&M costs

Abbreviations: CAPP - Carpinteria Advanced Purification Project, ROC - reverse osmosis concentrate.

ES.6.4 Project Concept 4 - DPR in Montecito

This project concept is a local project in Montecito producing purified water and utilizing either RWA or TWA for use within the existing distribution system.in Montecito. Some of the key elements evaluated for this project concept are as follows:

- The treatment trains evaluated are shown in Figure ES.10. Extensive advanced treatment is required for DPR - ozone and biologically activated carbon have been added to the treatment trains per the state of California's draft DPR regulations. The use of the Bella Vista WTP is necessary in treatment train 4B in order to achieve the required pathogen log removal targets. For treatment train 4A, the targets can be met without the use of a WTP, and purified water from the AWPF could be placed directly into the distribution system.
- A site layout of potential infrastructure needed for DPR in Montecito is shown in Figure ES.11.
- Potential alignments for DPR in Montecito are shown in Figure ES.12. There is not a preferred alignment identified because the alignments shown represent different approaches to DPR. Alignment 4.3 would involve sending the water to Bella Vista reservoir for additional treatment at the WTP, while the other alignments would involve sending purified water directly to the distribution system for TWA.
- A summary of the benefits and challenges for a DPR project in Montecito is provided in Table E.S6.

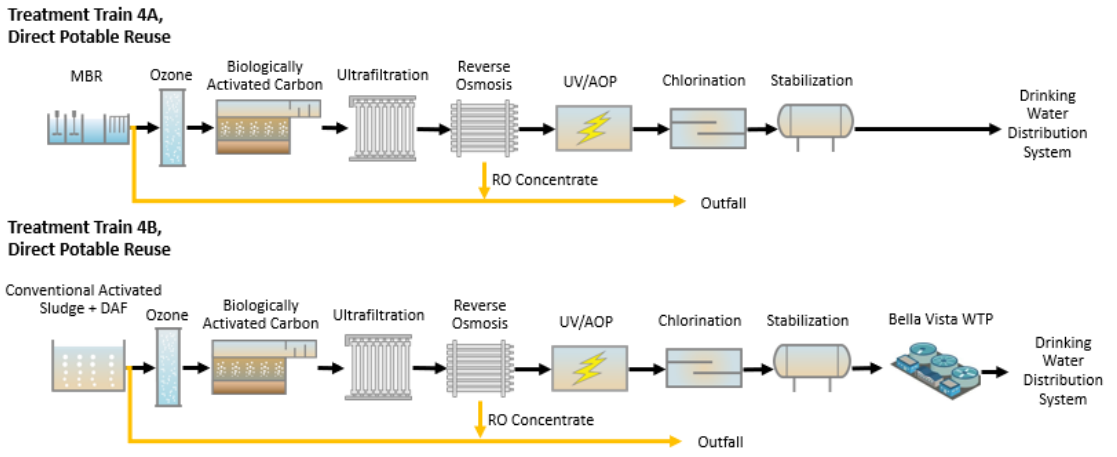


Figure ES.10 Treatment Trains Evaluated for DPR in Montecito

Figure ES.11 Site Layout of Infrastructure Needed for DPR in Montecito

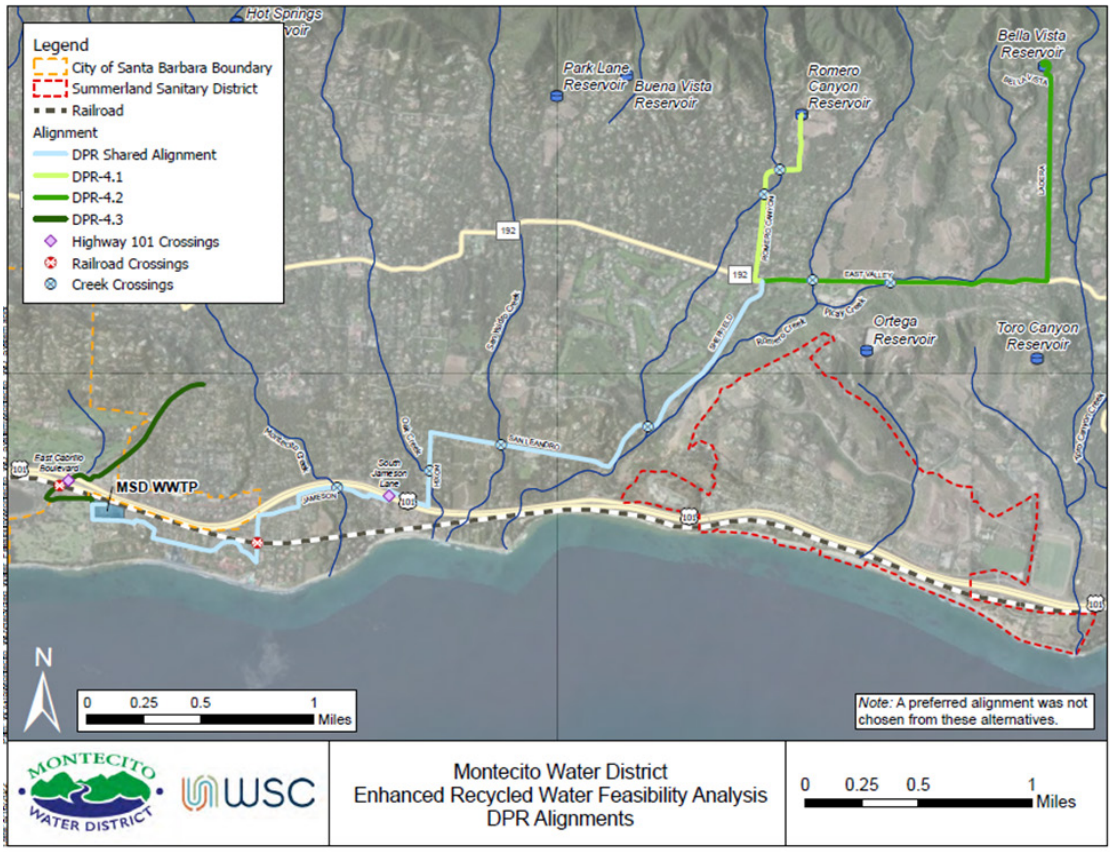


Figure ES.12 Potential Alignments for Purified Water Distribution in Montecito

Table ES.6 Summary of Benefits and Challenges for DPR in Montecito

Project Benefits	Challenges and Risks
• Provides agency controlled, drought-resistant supply of drinking water • Regional cooperation and collaboration with neighboring agencies are not required • Maximizes reuse of available MSD wastewater • Minimizes ocean discharge • Utilizes the potable distribution system for delivery	• Significantly more complex operation of AWPF • Requires real-time use • Potential water loss during periods when desal and DPR combined flow exceed demand • Must meet extensive regulatory requirements, including technical and managerial capacity • Public engagement and acceptance • DPR regulations have not been finalized, so there is uncertainty about final requirements

ES.6.5 Project Concept 5 - DPR in Santa Barbara

This project concept is a regional project in which Montecito sends either raw or secondary effluent to Santa Barbara for treatment at the El Estero and subsequently a new AWPF. Purified water would then be used for RWA at the Cater WTP. Some of the key elements evaluated for this project concept are as follows:

- The treatment train evaluated is shown in Figure ES.13. The treatment train is the same as shown above for DPR in Montecito, although in this case the AWPF would be located in Santa Barbara, not in Montecito.
- A site layout for a new AWPF in Santa Barbara is shown in Figure ES.14. For this alternative, new infrastructure is not needed at Montecito's wastewater treatment plant.
- Potential alignments for DPR in Santa Barbara are shown in Figure ES.15. There is not a preferred alignment identified because the alignments shown represent different approaches to DPR. Alignments 5.1 and 5.2 would convey dry weather secondary effluent flows from Montecito to Santa Barbara, while Alignment 5.3 would convey PWWFs[6]. Alignment 5.1 would leverage the existing Santa Barbara collection system, with upsizing required for some segments. The other two alignments involve construction of new gravity sewers.
- A summary of the benefits and challenges for a DPR project in Santa Barbara is provided in Table ES.7.

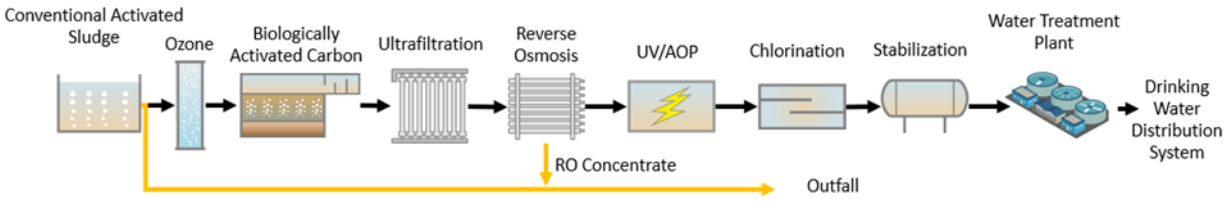


Figure ES.13 Treatment train Evaluation for DPR in Santa Barbara

[6] Alignment 5.2 was used for the cost estimate for a project sending secondary effluent to Santa Barbara for DPR; Alignment 5.3 was used for the project sending raw wastewater to Santa Barbara.

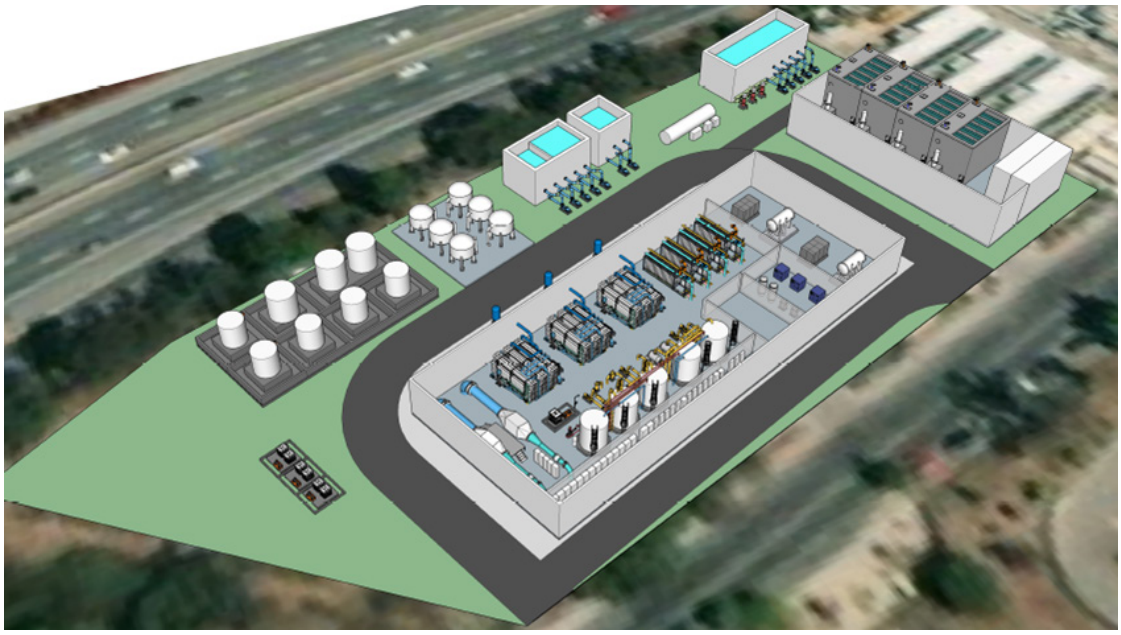
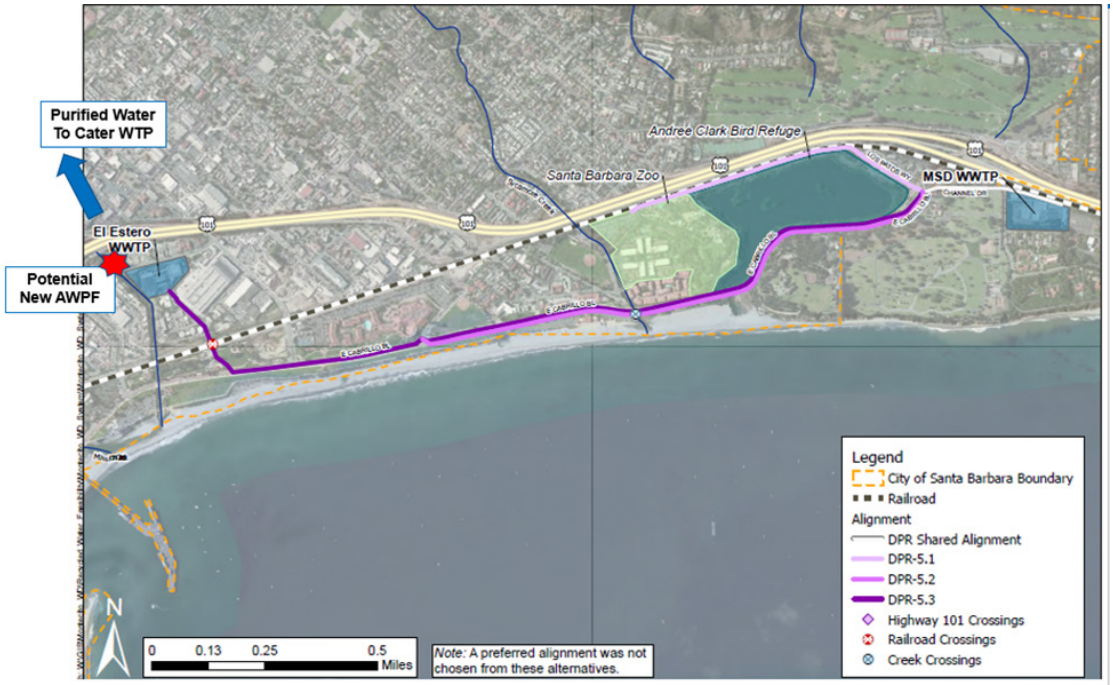


Figure ES.14 Potential Layout for New AWPF in Santa Barbara



Note: Figure also shows the location of a potential new AWPF.

Figure ES.15 Potential Alignments for Sending Raw Wastewater or Secondary Effluent to Santa Barbara's Wastewater Treatment Plant

Table ES.7 Summary of Benefits and Challenges for a DPR Project in Santa Barbara

Project Benefits	Challenges and Risks
• Provides drought-resistant supply of drinking water • Maximizes reuse of available MSD wastewater • Minimizes ocean discharge • Removes responsibility for AWPF operations from MSD • Larger project leverages economies of scale and may be more likely to receive grant funding • Utilizes existing potable water delivery systems • Potentially ends need for ocean discharge at MSD	• Requires interagency collaboration with Santa Barbara • Not anticipated to provide new water supply until at least 2035 • Public engagement and acceptance • Final DPR regulation not known • Uncertain costs and project timing 10 to 15 years in the future • Future changes in City Council and staff could impact Santa Barbara's long term plans for reuse. • Santa Barbara's control over multiple water supplies for Montecito. • Requires real-time use • Potential water loss during periods when desalination and DPR combined flow exceed demand

ES.7 Project Evaluation and Scoring

ES.7.1 Project Evaluation Criteria

The following evaluation criteria were developed to capture the priorities and interests of MSD and MWD, and to aid in the selection of a preferred project concept.

- **Cost of Water -** All in cost-per-unit of water based on capital cost for reuse treatment systems, infrastructure needed to move water and/or wastewater, annual O&M costs, and retreatment (if required).
- **Annual Water Supply Benefit -** Total amount of water produced by a project and made available annually to MWD.
- **Implementation Timeline -** Timing of when recycled water would become available for use.
- **Political Support -** Likelihood of support from elected officials; considering political impacts and challenges associated with projects (e.g., local vs. regional).
- **Public and Non-Governmental Organization (NGO) Support -** Likelihood of support from public and NGOs; considering factors like sustainability, customer benefits, rate impacts, and challenges like ocean discharge.
- **Technical and Managerial Capacity -** Complexity of staffing (particularly O&M, and laboratory); this increases significantly going from NPR to IPR to DPR.
- **Grant Funding Potential -** Likelihood to receive grant funding, which may be higher for regional projects and for potable reuse projects as compared with non-potable projects.

- **Local Control -** Ownership of project within Montecito. Projects in Montecito minimize challenges and effort related to interagency cooperation and collaboration.
- **Permitting Complexity -** Anticipated complexity of permitting process, including the number of agencies involved, and Regional Water Quality Control Board (RWQCB), the Division of Drinking Water, California Environmental Quality Act (CEQA), and Caltrans permitting.

ES.7.2 Pairwise Comparison for Criteria Ranking

A pairwise comparison is a process of comparing criteria in pairs to determine a relative preference for each criterion. The process is illustrated in Figure ES.16 in an example with four criteria: A, B, C, and D.

In the first step, the criteria are compared in pairs and in each pair a preferred criterion is identified. In the second step, the relative preference for each criterion is calculated based on the number of times each one was favored. Criterion A was favored two times out of six; therefore, its relative preference is 33 percent.

The relative preference for each criterion, also called the weighting factor, is used later in the project scoring process to develop a total project score that reflects MSD and MWD priorities.

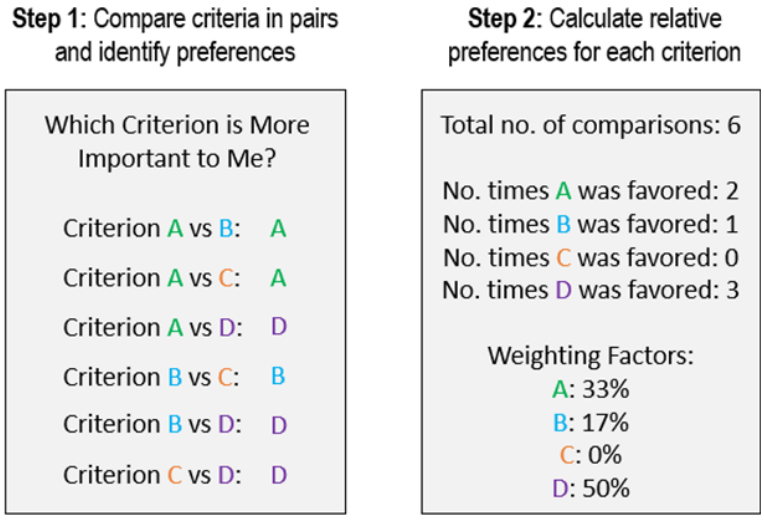


Figure ES.16 Example Illustrating the Process of Pairwise Comparison

ES.7.3 Evaluation Criteria Ranking Results

Staff from MSD and MWD were guided through the process of pairwise comparison for the 10 project evaluation criteria for water reuse projects. The results of the relative preferences for each criterion are summarized in Figure ES.17. Note that all criteria are important, even criteria with low or no relative ranking.

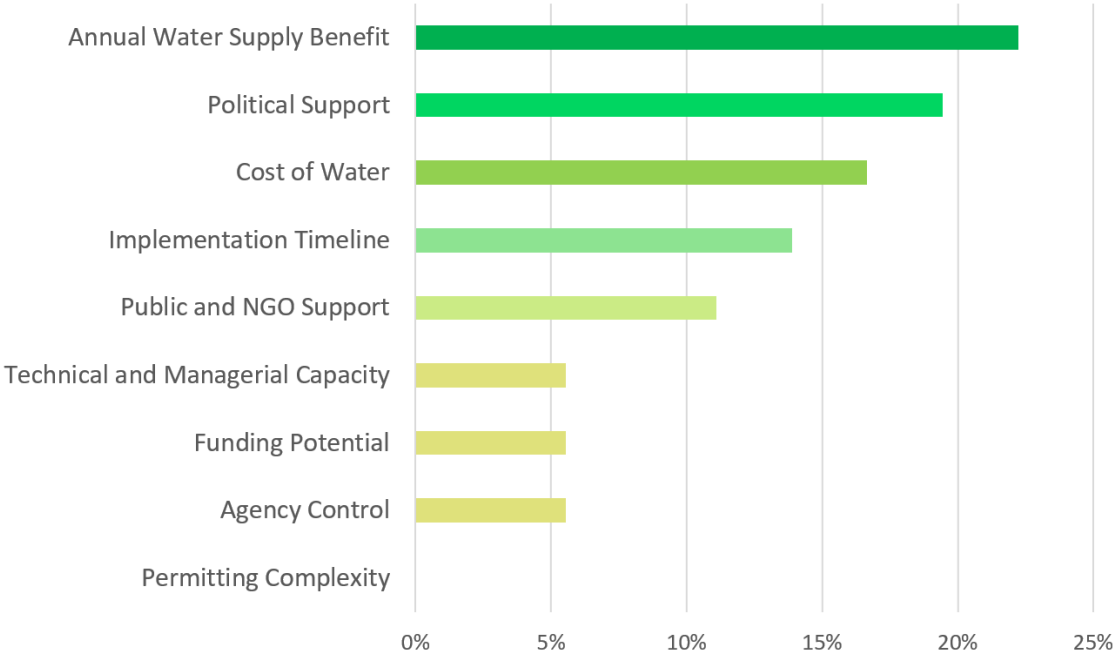


Figure ES.17 Weighting of Project Evaluation Criteria as a Result of Pairwise Comparison

ES.7.4 Project Scoring Results

Projects were scored in a collaborative process incorporating feedback from MWD and MSD representatives. Some of the key points underpinning the project scoring are as follows:

- For the quantitative categories of annual water supply benefit and cost of water, the project scores are normalized to the 'best' project, i.e., more water and lowest cost per unit. The best projects were scored as a 5.
- Political support: this criterion is intended to capture the likely future support of the MWD and MSD boards, as well as other elected officials. The highest score for DPR in Montecito reflects the support for agency control and maximizing the water supply benefit. The lower score for an NPR project reflects the general preference for potable reuse projects, while the lower score for IPR in Carpinteria via purification in Carpinteria reflects potential anticipated challenges related to the cost and schedule impacts of expanding the existing CAPP. The delivery of purified water from Montecito to Carpinteria scores higher because it will not impact the CAPP implementation.
- Implementation timeline: NPR in Montecito would be the least complex project to implement and therefore could likely be implemented within a few years. IPR projects could be implemented sooner than DPR projects and thus are scored higher. Santa Barbara has indicated that they will not pursue DPR before 2035, which is why that is the lowest scoring project in this category.

- Public and NGO support: several factors play into this category, including public confidence in water quality and safety of new supplies, trust in utility staff, and protection of the environment. There was an acknowledgement that DPR projects can be more challenging for the public to accept, therefore these projects were scored lower. In addition, a project in which Montecito's secondary effluent is sent to Carpinteria was also scored lower based on potential concerns about Montecito's waste going to Carpinteria for treatment and discharge into the ocean.
- Grant funding potential: factors that were assumed to increase the likelihood of receiving grant funding include larger project size, inclusion of regional partners, and implementing potable reuse (as opposed to NPR).
- Agency control: projects under the complete control of Montecito agencies were scored higher in this category. Project 2, IPR in Carpinteria via groundwater storage, also scored higher because Montecito would be in full control of the advanced water treatment portion of the project.
- Technical and managerial capacity: this category applies to the capacity needed in Montecito specifically (not for the project overall). The more advanced treatment Montecito is responsible for, the lower a project scored in this metric. If Montecito is operating an AWPF, there would be significant new needs regarding operational capacity (e.g., new AWTOs, additional lab staff), reporting, and other technical aspects.
- Permitting complexity: the score for this metric is highest for NPR, which is anticipated to be the easiest project to permit, and low for DPR, which is significantly more difficult to permit given the novelty of these types of projects.

As shown in Table ES.8, the project that received the highest score from the scoring process is IPR in Carpinteria via groundwater storage, followed by DPR in Santa Barbara. Both of these projects benefit from having regional partners while providing the highest water supply benefits for Montecito.

Table ES.8 Summary of Project Scoring

Criterion	Weight[1]	Project 1: NPR in Montecito	Project 2: IPR in Carpinteria (Groundwater Storage)	Project 3: IPR in Carpinteria (Purification in Carpinteria)	Project 4: DPR in Montecito	Project 5: DPR in Santa Barbara
Annual Water Supply Benefit	22%	2	5	5	5	5
Political Support	19%	3	3.5	2	5	3
Cost of Water	17%	1.5	2	2	1	4.5
Implementation Timeline	14%	5	3	3.5	1.5	1
Public and NGO Support	11%	4	4.5	3	3	3
Grant Funding Potential	6%	1	3	4	3	5
Agency Control	6%	5	4	2	5	1
Technical and Managerial Capacity	6%	5	3	4	1	4
Permitting Complexity	0%	5	3	3	2	1.5
WEIGHTED SCORE		**3.0**	**3.6**	**3.2**	**3.3**	**3.5**

Notes:
(1) Weighted scores were rounded for this table.

ES.8 Project "Loose Ends"

Throughout the documentation of this work, suggestions from internal stakeholders were captured and, in some cases, incorporated into the overall effort, such as the change to NPR treatment that does not include salt removal or the parallel examination of greenfield and retrofit MBR options. Other suggestions were not incorporated, either due to having a perceived fatal flaw or due to being outside the scope of work for this project. Such suggestions are chronicled below, allowing for them to be re-evaluated at a future date. These suggestions are categorized based upon the end use of the recycled water and the project partners for that end use.

- **NPR in Montecito:**
  - Salt removal:
    - As documented in TM 9 and illustrated previously, the expectation for NPR in Montecito is 128 AFY, of which about 100 AFY would go to larger customers that can blend with groundwater and thus reduce TDS levels in the tertiary recycled water.
    - For the remaining smaller potential users and the 28 AFY, more detailed discussions are needed to gain support, with a focus on salt-tolerant landscaping.
    - Should salt removal be perceived as a necessity for some of the NPR customers, the addition of sidestream RO can be implemented, though at high cost, or decentralized at the point of use and customer's responsibility.
  - Santa Barbara Collaboration:
    - Santa Barbara recently completed an updated recycled water master plan, evaluating non-potable and potable water reuse (September 2022).
    - Within Santa Barbara's analysis is the potential for sending tertiary recycled water to the Montecito cemetery (30 AFY) and the Ty Warner Estate (5 AFY), at an approximate cost of $3,400/AF.
- **IPR in Carpinteria:**
  - Secondary Treated Water in Carpinteria:
    - Having Carpinteria treat a combined MSD and CSD flow for purification means increased ROC into the CSD outfall.
    - While analysis across California indicates that ROC discharge can be managed to minimize (or avoid) NPDES impacts, detailed analysis would be required prior to proceeding with this option.
  - Raw Wastewater to Carpinteria:
    - As documented in TM 8, two concepts for potable reuse involving Carpinteria were evaluated and costed, one sending secondary effluent to Carpinteria for purification as part of the CAPP, and then groundwater injection and a second sending of purified water to Carpinteria for groundwater injection.
    - The concept of transferring raw wastewater to Carpinteria for treatment at the CSD WRP was discussed. Incorporation of all MSD flows at CSD may be feasible, but will significantly impact available capacity at CSD while also coming at a high cost to "buy in" to the CSD facility at about 30 percent of total capacity.

  - Further discussions could be had on this concept, which would require a detailed CSD capacity review, potential analysis for expansion, and cost sharing agreements.
  - For this work, the concept of sending raw wastewater to CSD from MSD was not included in the final evaluations.
- Secondary Effluent to Carpinteria via Alternative Transport:
  - Within TM 9, pipeline infrastructure alignment and costs to transport equalized secondary effluent from MSD to Carpinteria for purification and later groundwater injection.
  - Project stakeholders suggested that the project team consider ways to transport secondary effluent from MSD to Carpinteria via a pipeline in the ocean, under the assumption that costs would be reduced compared to land-based construction.
  - The project team discussed the challenges of a pipeline in the ocean to transport secondary effluent from Montecito to Carpinteria, and concluded that it was not feasible from a cost or regulatory perspective. Example challenges include:
    - High construction cost via barge that requires significant anchoring to resist tidal energy.
    - Sensitive ocean habitats that would prohibit pipelines in areas that are to be determined.
    - Robust engineering to address fault lines.
    - Leakage into the pipeline which would add salt to the feed water to purification.
    - Permitting requirements with the RWQCB, California Coastal Commission, Coast Guard, State Lands Commission, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, U.S. Fish and Wildlife Service, Army Corps of Engineers, and CEQA.
    - Navigation impacts.
    - Public concern.
- Groundwater Modeling in the Carpinteria Basin:
  - Prior to implementing a regional partnership with Carpinteria, new groundwater modeling is needed.
    - Modeling would determine (a) where additional injection of purified water could occur, (b) how much water can be injected, and (c) how long can water be stored.
    - New modeling should consider the inland confined and unconfined groundwater basins as well as a seawater intrusion barrier located closer to the coast.
    - Modeling would inform the need, or lack thereof, for additional injection wells, extraction wells, and monitoring wells.
  - Negotiations, coupled with the groundwater modeling, would also be required to determine several items:
    - The necessity of "put and take" into the groundwater basin, where the volume of purified water injected into the basin would need to be extracted within a short timeframe to avoid raising the pressure in the basin. If a put

and take operational mode is required, it would limit the benefit of storage provided by the groundwater basin. However, even a put and take operation could provide benefit to Montecito by allowing for storage of water during low demand periods.
        - Water transfer agreements, such as the injected water would be kept and used in Carpinteria and the equivalent volume would be recovered by Montecito through transfers from the South Coast Conduit. Interagency agreements would be needed to define these terms.
    - Regional Partnership with SSD:
        - SSD could become a third partner in a collaboration between Montecito and Carpinteria, providing their raw wastewater or secondary effluent for treatment and purification.
        - In one example, SSD could send equalized raw wastewater to MSD for secondary treatment, adding new supply to subsequent purification and groundwater recharge in the region.
    - Distributed Infrastructure:
        - A more favorable alignment may exist within Caltrans right-of-way. Attempts were made to reach out to Caltrans but further engagement will be required during preliminary design. The more favorable alignment would bypass the Ortega Hill Road area through a bike path parallel to Highway 101. The alternative alignment would reduce pipeline lengths, pump sizing and operating costs, and reduce risk of conflicts in the utility dense area of Ortega Hill Road.
- **DPR in Montecito:**
    - TM 8 and TM 9 evaluated methods to implement DPR in Montecito.
    - The evaluated option highlighted in this document utilizes a pipeline to the head of the Bella Vista WTP, which provides important pathogen credits while also mixing the purified recycled water with other water to Montecito customers.
        - Implementation of this option should also consider the capacity of the Bella Vista WTP and any need for future expansion due to the added flow of purified water.
        - Testing would also be required to determine if there were any significant impact to WTP operation based upon the change in feed water quality.
    - Other options for DPR exist in Montecito without the use of Bella Vista, with specific benefits and challenges.
        - Benefits:
            - Reduced pipeline length to connect directly into the potable water distribution system.
            - No impact to Bella Vista capacity or operations.
        - Challenges:
            - Reduced pathogen credits, potentially requiring additional treatment prior to use.
            - Uneven distribution of purified recycled water within Montecito.

- **DPR in Santa Barbara:**
  - TM 9 evaluated different options for moving MSD wastewater to Santa Barbara, including:
    - Equalized secondary effluent using new gravity sewers to connect into the Santa Barbara wastewater collection system.
    - Unequalized raw wastewater using new gravity sewers to connect directly to the El Estero.
  - Other options not investigated for sending wastewater to Santa Barbara could include:
    - Installation of a force main to transfer either secondary effluent or raw wastewater.
    - Full EQ of raw wastewater at Montecito followed by connection to the existing Santa Barbara wastewater collection system.
    - Transfer of MSD secondary effluent directly to the effluent of the El Estero.
  - Impacts of climate change, such as sea level rise and permitting concerns, were not included in Carollo's scope of work. The alternatives for DPR in Santa Barbara pose the most risk based on conveyance path and topographic issues in terms of sea level rise, and, therefore, future analyses during the design phase would need to incorporate potential California Coastal Commission and RWQCB input.

ES.9 Preferred Project and Next Steps

For Montecito to move forward with a reuse project, the next step is to identify the preferred project. The analysis above showed the highest ranking for Project 2 - IPR in Carpinteria (Groundwater Storage), which at this time is the preferred project.

For each of the project options, some high-level next steps have been identified and are presented in Table ES.9.

Moving ahead with Project 2, then, dictates pursuit of grant funding, predesign and 30 percent design, and initiating the CEQA process. Moving through predesign and 30 percent design provides much more accurate cost estimates, which, coupled with grant funding, will refine the economic viability of Project 2. Once completed, Montecito can revisit all project options to determine whether the preferred project should continue moving forward. It is possible that further analysis and other future unknown considerations may lead to the desire to pivot to a different project option.

Table ES.9 Potential Next Steps for Each Reuse Project Alternative

	Next Steps
Project 1: NPR in Montecito	• Confirm recycled water customers and verify water quality expectations to determine whether RO is needed • Secure access to freeway undercrossing(s) • Initiate CEQA and predesign/30 percent design
Project 2: IPR in Carpinteria (Groundwater Storage)	• Develop a memorandum of understanding or other documentation that defines terms of partnership between participating agencies • Coordinate with CVWD on additional groundwater basin modeling to confirm capacity • Secure access to freeway undercrossing • Pilot test secondary DAF if MBR is not the selected wastewater treatment process • Initiate CEQA and predesign/30 percent design • Position for and submit for grant funding
Project 3: IPR in Carpinteria (Purification in Carpinteria)	• Develop a memorandum of understanding or other documentation that defines terms of partnership between participating agencies • Coordinate with CVWD on additional groundwater basin modeling to confirm capacity • Pilot test secondary DAF if MBR is not the selected wastewater treatment process • Initiate CEQA, predesign/30 percent design, and design to minimize schedule impact to the CAPP • Position for and submit for grant funding
Project 4: DPR in Montecito	• Move forward with design and implementation of a demonstration facility • Begin developing public outreach plan • Monitor DPR regulations due by end of 2023
Project 5: DPR in Santa Barbara	• Develop a memorandum of understanding or other documentation that defines terms of partnership between participating agencies • Based on project timing and selected alternative, determine what investments are needed at MSD WWTP if plant will be decommissioned in the 15-year horizon

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