CHAPTER 4
Feasible Alternatives

This Chapter presents additional evaluation of the feasible alternatives identified in Chapter 3. The additional evaluation includes refining of the infrastructure needs and capital costs presented in Chapter 3, preparing site layouts, and development of lifecycle costs.[1]

The Chapter is organized around the following sections:

- Alternative 1a
- Alternative 1c
- Alternative 2a
- Alternative 2b
- Alternative 3b
- Comparison of Alternatives

4.1 ALTERNATIVE 1a

Alternative 1a involves providing treatment at two local facilities. Flows from FWD, GCSD, and OCSD would be treated at a combined FWD/GCSD WWTP and recycled water system that is sized to accommodate zero surface water discharge (i.e. in lieu of making treatment improvements to meet the nitrogen effluent limitations that have been prescribed for surface discharge). Flows from the RRCSD service area would continue to be treated at the existing RRCSD WWTP. This section presents a description of the basis of design for the facility improvements, a summary of the required facility improvements, site layout, project costs, O&M costs and total lifecycle cost.

4.1.1 Basis of Design

The flows and loads of interest for design of the new treatment facilities under Alternative 1a are presented in Table 4-1.

[1] Conveyance of the OCSD flows to the GCSD collection system - common to all the alternatives - is excluded from the information presented in this TM. Where relevant, the proposed alignment for the planned OCSD to GCSD pipeline is shown on figures. The conveyance facilities are reported to have capacity for up to 0.26 mgd, and the peak day flows generated from the OCSD service area are 0.13 mgd.

Table 4-1. Alternative 1a FWD/GCSD Treatment Facilities Design Flows and Loads				
Scenario	ADWF, mgd	Relevant Peak Flow Condition	Peak Design Flow, mgd	Maximum 30-Day BOD Load, lb/day
Design Flow for the GCSD Screening System				
GCSD/OCSD	--[a]	PDF	1.5	--[a]
Design Flows and Loads to the Secondary Treatment Ponds				
GCSD Treatment Ponds	0.15	MMF	0.64	680
FWD Treatment Ponds	0.064	MMF	0.25	270
Design Flows to the Combined Tertiary Filtration and Disinfection Facilities				
Combined GCSD/OCSD/FWD Flows and Loads	0.21	MWF	1.5	--[a]

ADWF = Average Dry Weather Flow
MMF = Maximum 30-Day Flow
MWF = Maximum 7-Day Flow
PDF = Maximum Day Flow
(a) Design condition is not relevant to the facility sizing.

4.1.2 Required Facility Improvements

As discussed in Chapters 2 and 3, available RRCSD WWTP planning documents identify several condition and hydraulic capacity-related improvement projects that are necessary for continued long-term treatment at the RRCSD[2]. In addition, 5 acres of new land application area will need to be developed to accommodate approximately 8 AFY of recycled water from the RRCSD WWTP.

Significant improvements are needed for the GSCD/FWD treatment systems to accommodate the projected flows and loads. The specific improvements are as follows:

- The GCSD headworks will be upgraded with a new mechanical screening facility.
- The existing partial mix aerated ponds at GCSD will be converted to a complete mix system. This includes installation of new aerators, a floating cover on the settling pond and construction of a new blower building.
- The effluent storage pond at the FWD site will be filled in to accommodate the expansion of tertiary filtration and disinfection facilities within the existing site footprint.
- A new SAF system and cloth disk filtration system will be installed at the FWD site to accommodate the flows from GCSD and FWD.
- Two additional CCBs will be constructed at the FWD site to accommodate flows from both FWD and GCSD.
- Recycled water (effluent) storage capacity will be expanded by approximately 310 acre-feet (101 million gallons) within an existing 21-acre site north of the GCSD WWTP, resulting in a pond depth of approximately 30 feet.[3]

[2] As noted in Chapter 3, the Master Plan analysis regarding facilities required to accommodate peak flow conditions may need to be revisited based on findings from the January 2026 spill event.

[3] If additional land could be purchased, a shallower pond could likely be constructed at a lower overall cost.

- New pipelines and pump stations will be constructed to convey flows to the FWD and GCSD treatment, storage, and recycled water facilities.

Except for the upgraded pond system at the GCSD WWTP, the new treatment facilities will be sized to accommodate flows and loads defined in Table 4-1. The GCSD WWTP Pond system is assumed to be upgraded to complete mix system, which will provide the treatment capacity summarized in Table 4-2. As shown, the fully mixed treatment ponds should provide more than adequate capacity to accommodate the anticipated flows and loads to the GSCD system.

Table 4-2. GCSD WWTP Upgraded Secondary Treatment Pond Design Capacity

Facility	ADWF, mgd	MMF, mgd	Maximum 30-Day BOD Load, lb/day
GCSD WWTP Upgraded Secondary Treatment Ponds	0.52	2.2	2,390

4.1.3 Site Layouts

As previously stated, no significant site improvements are needed for RRCSD WWTP site, and the existing site layout is expected to be unchanged under this alternative.

Site layouts for GCSD and FWD showing proposed site modifications under Alternative 1a are presented on the following figures:

- Figure 4-1 shows the proposed new infrastructure and treatment systems at the FWD WWTP, along with the existing infrastructure that will be repurposed.
- Figure 4-2 shows the proposed infrastructure improvements and treatment upgrades at the GCSD WWTP.
- Figure 4-3 shows the proposed footprint for the effluent storage pond and modifications to the recycled water facilities at the GCSD WWTP.

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FWD WWTP Site Layout for Alternative 1a

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GCSD WWTP Site Layout for Alternative 1a

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Recycled Water Facilities Layout at GCSD for Alternative 1a

DRAFT **Figure 4-3**

4.1.4 Project Costs

The Opinion of Probable Capital Cost (OPCC) and Opinion of Probable Total Capital Cost (OPTCC) for Alternative 1a project elements are presented in Table 4-3, which also shows the estimated cost shares for RRCSD and for FWD/GCSD (which also includes costs for processing flows from OCSD). Additional details regarding these costs are provided in a Basis for Cost Estimating Technical Memorandum (TM) in Appendix A and detailed cost tables in Appendix B-1.

Table 4-3. OPCC and OPTCC for Alternative 1a

Facility Component	Components	Cost, $ million		
		RRCSD	FWD/GCSD	Total[a]
Treatment		**$23.6**	**$25.7**	**$49.3**
RRCSD	Condition-related improvements and hydraulic capacity improvements	23.6	--	23.6
FWD	New SAF/cloth disk filtration facility and disinfection expansion	--	15.5	15.5
GCSD	Headworks improvements	--	0.8	0.8
	Convert treatment ponds to complete mix system	--	9.4	9.4
Conveyance		**$0.0**	**$13.4**	**$13.4**
New Pump Stations	1.1 mgd pump station at the GCSD WWTP for secondary effluent transfer to FWD	--	2.5	7.6
	2.0 mgd pump station at the GCSD WWTP for tertiary effluent delivery to distribution system	--	2.7	
	1.5 mgd pump station at the FWD WWTP for tertiary effluent transfer to GCSD and delivery to customers	--	2.4	
Pipeline	Pipeline Connections Between FWD/GCSD: • 0.8 mile, 6-inch pipeline extension of existing HDPE pipe • 1.7 mile, 6-inch pipeline • Rehab existing 1.7 mile, 8-inch ductile iron pipeline	--	5.8	5.8
Recycled Water		**$0.2**	**$20.4**	**$20.6**
Land Application Area	5 acres (RRCSD)	0.2	--	0.2
Storage	310 acre-feet (GCSD)	--	20.4	20.4
	Engineer's Preliminary OPCC	**$24**	**$59**	**$83**
Engineering Design, Environmental Planning and Studies, Permitting, Construction Management, ESDC and Legal and Admin Costs, 25 percent of OPCC[b]		6	15	21
	Engineer's Preliminary OPTCC	**$30**	**$74**	**$104**

ESDC = engineering services during construction

(a) Project Phase-Level OPCC contingency of 30 percent applied to all elements.

(b) Engineering design, environmental planning and studies, permitting, construction management, ESDC and legal and administrative costs of 25 percent applied to all elements.

4.1.5 Operations and Maintenance Costs

This section provides a summary of the O&M costs, focused on the following elements:

- power costs
- labor costs
- chemical costs
- equipment repair and replacement costs

Additional details regarding these O&M costs are provided in the Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendix C-1. A 20-year project lifecycle is assumed.

4.1.5.1 Power Costs

The annual power costs for Alternative 1a are summarized in Table 4-4. These costs account for the energy demands of new treatment systems and conveyance infrastructure, as well as projected savings resulting from operational changes at the GCSD and FWD WWTPs. While an upgrade to a complete mix aeration system at the GCSD WWTP increases power demand (reflected in the treatment pond power cost), eliminating tertiary treatment at the GCSD WWTP and membrane filtration at the FWD WWTP results in power savings.

Table 4-4. Annual Power Costs for Alternative 1a

Cost Element	Annual Cost, dollars
Treatment Pond at GCSD WWTP	173,200
GCSD and FWD WWTP Operations[(a)]	-173,400
Cloth Disk Filtration at FWD WWTP	700
SAF at FWD WWTP	6,400
Conveyance Pumps	38,800
Total	**$45,700**

(a) Assuming elimination of 90 and 60 percent of GCSD and FWD current treatment power costs. A negative cost represents cost savings relative to existing costs.

4.1.5.2 Labor Costs

No change in labor costs is assumed for this alternative, although there may be potential for labor reduction costs if staff labor is consolidated between the two agencies.

4.1.5.3 Chemical Costs

Annual chemical costs for Alternative 1a are summarized in Table 4-5. The bases for these costs are provided in the footnotes to the table.

Table 4-5. Annual Chemical Costs for Alternative 1a

Cost Element	Annual Cost, dollars
SAF floc aid	55,700[a]
CCB: chlorine gas and sulfur dioxide gas	25,900[b]
Current GCSD WWTP Operation	-69,700[c]
Total	**$11,900**

(a) Based on chemical usage at the existing GCSD SAF facility.
(b) Additional chlorine gas and sodium bisulfite required for the expanded CCB at the FWD WWTP are estimated using FWD current design criteria and the projected increase in annual average flow from GCSD.
(c) Assuming elimination of 100 percent of GCSD WWTP chemical costs. A negative cost represents cost savings relative to existing costs.

4.1.5.4 Equipment Repair and Replacement Costs

A summary of the estimated major equipment repair and replacement costs for Alternative 1a is provided in Table 4-6. Replacement costs for equipment with replacement frequencies of more than 20 years were excluded from this analysis (e.g., pumps, which are assumed to need replacement after 25 years).

Table 4-6. Equipment Repair and Replacement Costs for Alternative 1a

Cost Element	Cost, dollars	Assumption
Filter Cloth Replacement	2,200[a]	Annual
Routine O&M[b]	7,800	Annual
Piping and Valve Maintenance and Replacement Cost	60,000	5 percent of mechanical and piping capital costs
Instrumentation Maintenance	45,000	5 percent of instrumentation and controls capital costs, Year 15
Pumps Rebuild and Major Maintenance	46,300	30 percent of pump capital costs, Every 10 Years
10-Year Parts Replacement[c]	2,100	Every 10 Years
Major Parts Replacement[d]	43,200	Every 15 Years
Average Annual Costs	**$78,800[e]**	--

(a) Filter cloth assumed to be replaced every seven years. Annual cost shown is annualized over seven years.
(b) Includes cloth disk filtration routine lubrication of backwash pumps, drive motor and gear box, SAF parts replacement, pond cleaning and pond blower filter/belt/oil changes.
(c) Includes cloth disk filtration main "V-Ring" seal replacement.
(d) Includes aeration equipment replacement.
(e) Total is lower than direct sum of the components because several cost items occur at an irregular frequency. The average annual cost is shown, based on the sum of relevant O&M present worth costs in Appendix C-1, divided by the 20-year project lifetime.

4.1.5.5 Total 20-Year Present Worth of O&M Costs

The total 20-year present worth O&M costs for Alternative 1a are shown in Table 4-7. Additional details are provided in Appendix C-1.

Table 4-7. Present Worth O&M Cost for Alternative 1a

O&M Cost Component	Total 20-Year Cost, $ million
Power	1.0
Labor	0
Chemicals	0.3
Equipment Repair and Replacement	1.7
Total 20-Year Present Worth O&M Costs	**$2.9**

4.1.6 Total Lifecycle Cost

A total lifecycle cost for Alternative 1a is calculated as shown in Table 4-8 using the OPTCC from Table 4-3 and total 20-year O&M costs from Table 4-7.

Table 4-8. Lifecycle Cost for Alternative 1a

Cost Component	Cost, $ million
Total Project Capital Cost (CapEx)	104
Total Present Worth O&M Costs (OpEx)	3
Total Lifecycle Cost	**$107**

4.2 ALTERNATIVE 1c

Alternative 1c involves treating all West County flows at new treatment facilities constructed at the existing FWD WWTP site that provides the level of treatment required to allow for seasonal discharge to the Russian River. The system would also rely on the combined FWD/GCSD recycled water system to provide for dry-season reuse.[4] This section presents a description of the basis of design for the facility improvements, a summary of the required facility improvements, site layout, project costs, O&M costs and total lifecycle cost.

4.2.1 Basis of Design

The flows and loads of interest for design of the new treatment facilities under Alternative 1c are presented in Table 4-9.

Table 4-9. Future West County Flows and Loads Relevant to Alternative 1c

Scenario	ADWF, mgd	Relevant Peak Flow Condition	Peak Flow, mgd	Maximum 30-Day BOD Load, lb/day
Projected RRCSD Flows and Loads	0.38	MWF	3.5	2,620
Projected GCSD/OCSD Flows and Loads	0.15	MMF	0.64	680
Projected FWD Flows and Loads	0.064	MMF	0.25	270
Total West County Flows and Loads	**0.59**	--	**4.4**	**3,570**

4.2.2 Required Facility Improvements

Under this alternative, the following improvements will be required:

- The GCSD headworks will be upgraded with a new mechanical screening facility.
- The existing GCSD and FWD treatment ponds and the RRCSD storage ponds would be reconfigured to provide EQ at each site. With this approach, the GCSD and FWD flows can likely be equalized to the maximum 30-day average values (0.9 mgd combined total) and RRCSD flows equalized to the lower end of the maximum 7-day average flows (i.e. 3.5 mgd). Required infrastructure for this conversion includes:
  - Influent control structures at the RRCSD, GCSD and FWD sites to allow flexible flow direction within each facility (e.g., directing flow to the ponds or pump station, or combining flows)
  - A drain pump for the FWD ponds
  - Additional internal pipelines within the facilities
- A new MBR treatment system providing biological nitrogen removal will be installed at the FWD WWTP, paired with a new UV disinfection system to meet treatment requirements.

[4] Existing recycled water use from RRCSD on the Northwood Golf Course is assumed to cease.

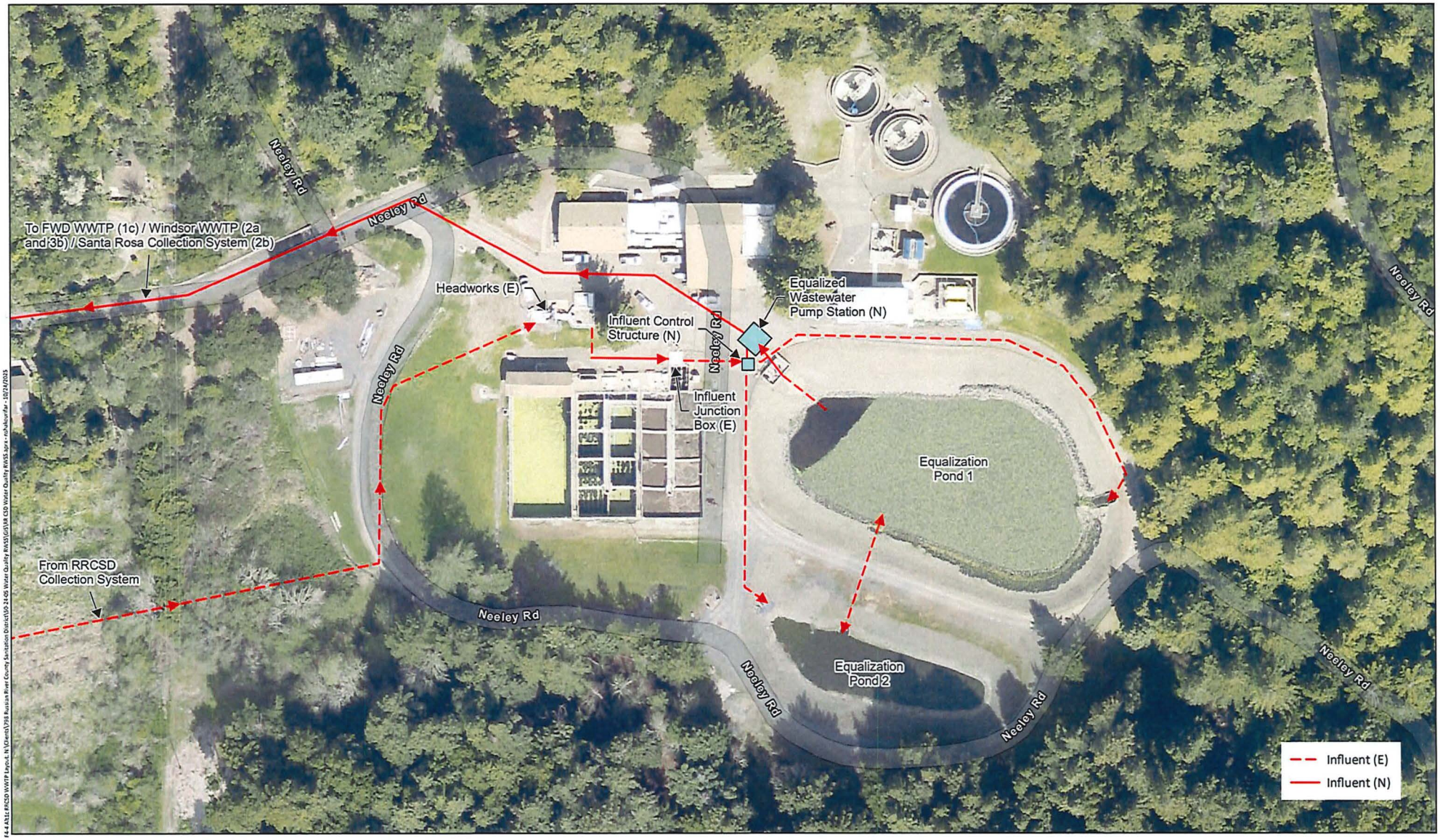
- Fine screening with 2-millimeter openings will need to be installed upstream of the MBR system, as required by membrane manufacturers to protect the membranes from damage.
- An aerobic digestion system will be constructed to treat WAS generated by the MBR process. A new solids-handling building will house mechanical equipment, such as solids thickening and dewatering systems, blowers, and a cake storage room.
- A new 24-inch, 4.1-mile-long outfall from the FWD WWTP to the Russian River.[5]
- A new 4.4 mgd pump station at the RRCSD WWTP to convey exported wastewater to the FWD WWTP site.
- A new 20-inch, 10.4-mile-long pipeline between the RRCSD and FWD WWTP sites.
- New pipelines and pump stations will be constructed between the FWD and GCSD sites to convey flows to the treatment, storage, and recycled water facilities.

4.2.3 Site Layouts

Site layouts showing proposed site modifications under Alternative 1c are presented on the following figures:

- Figure 4-4 shows the layout of the proposed infrastructure improvements to convert the effluent storage ponds at the RRCSD WWTP to EQ ponds.
- Figure 4-5 shows the layout of the proposed infrastructure improvements to convert the existing treatment ponds at the GCSD WWTP to EQ ponds.
- Figure 4-6 shows layout of the proposed new infrastructure and treatment systems at the FWD WWTP, along with existing infrastructure that will be repurposed to provide influent equalization.
- Figure 4-7 shows the layout of the proposed modifications to the recycled water facilities at GCSD for effluent storage.

[5] Additional evaluation of the dilution available at the existing GCSD and FWD discharge locations is needed to confirm the need for a new outfall. It is also likely that the existing FWD and GCSD outfalls would be available to accommodate some of the discharge flow. A lower-cost supplemental discharge site may also be possible. Therefore, the new outfall could potentially be lower cost than what has been assumed for this study.



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RRCSD WWTP Site Layout for Alternative 1c

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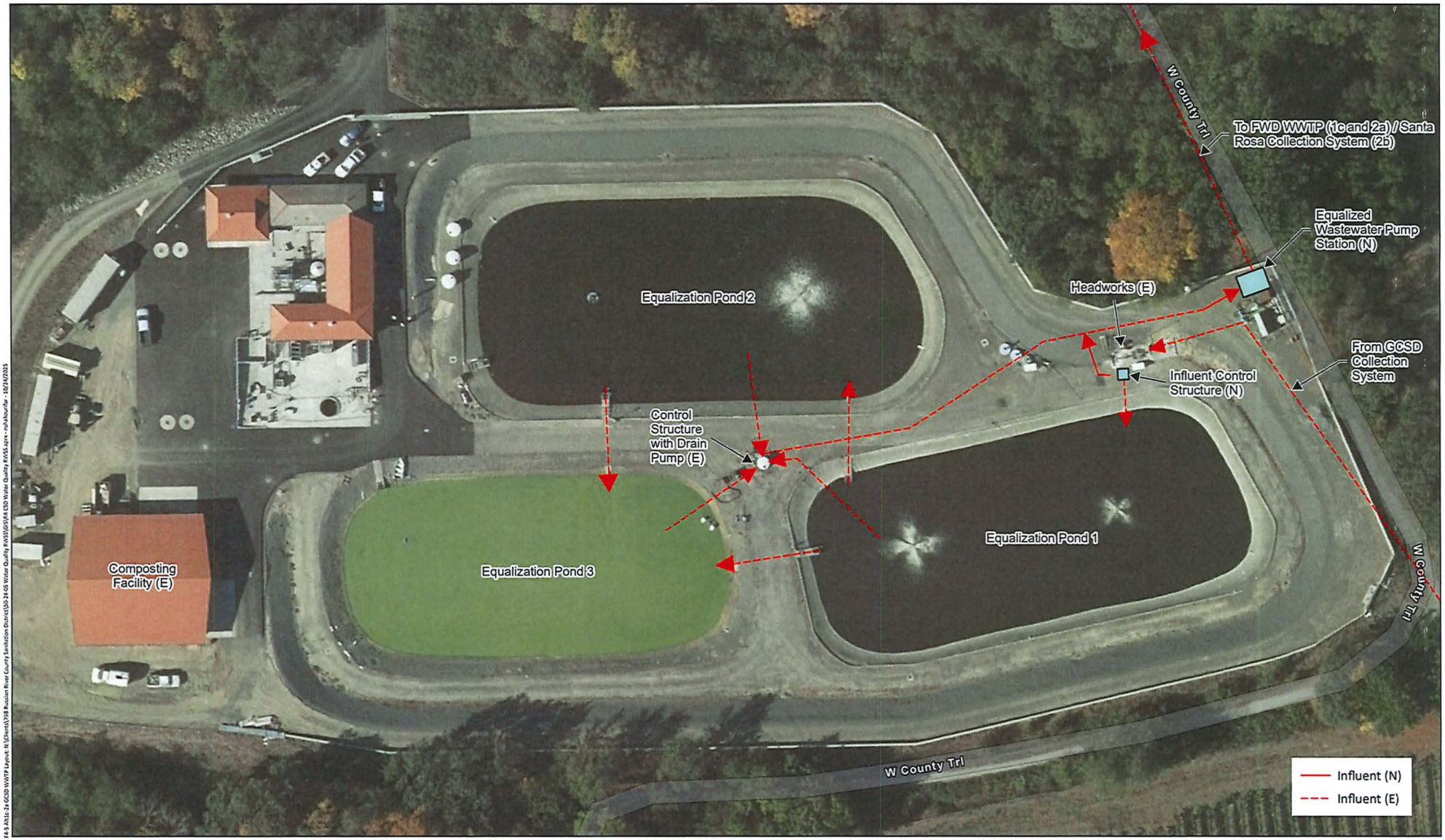

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GCSD WWTP Site Layout for Alternative 1c

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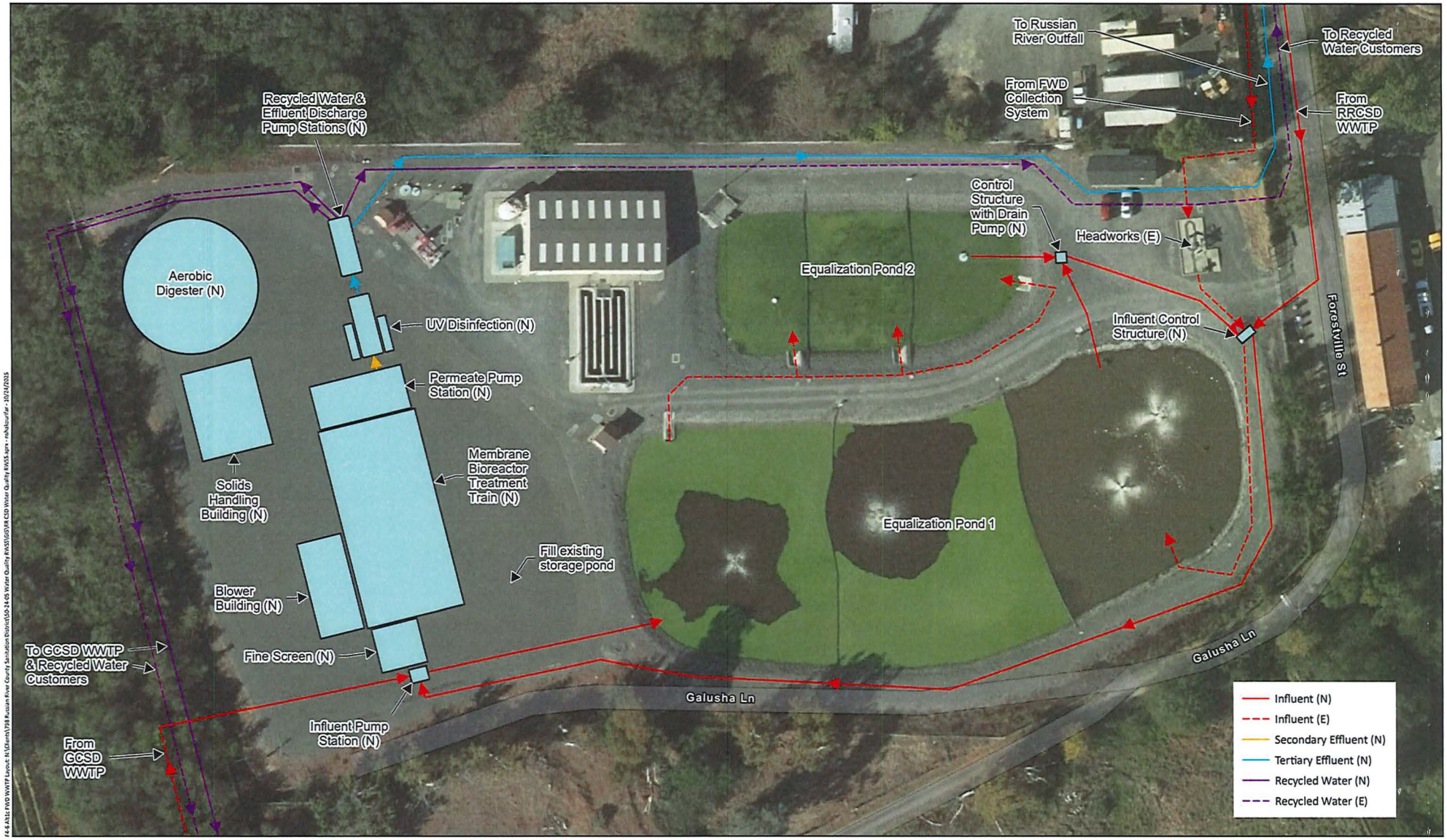

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FWD WWTP Site Layout for Alternative 1c

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GCSD WWTP Site Layout for Alternative 1c

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Figure 4-7

4.2.4 Project Cost

The OPCC and OPTCC for Alternative 1c project elements are presented in Table 4-10, with cost shares between RRCSD and the other West County agencies. Additional details regarding these costs are provided in a Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendix B-2.

Table 4-10. OPCC and OPTCC for Alternative 1c

Facility Component	Components	Cost, $ million		
		RRCSD	FWD/ GCSD	Total[a]
Treatment		**$53.5**	**$16.9**	**$70.4**
RRCSD	Convert storage ponds to EQ facility	0.3	--	0.3
FWD	Convert treatment ponds to EQ ponds	--	3.7	3.7
	Construct new BNR/MBR facility + UV disinfection + Solids Processing[b]	53.2	12.2	65.4
GCSD	Headworks improvements	--	0.8	0.8
	Convert treatment ponds to EQ facility	--	0.2	0.2
Conveyance		**$110.9**	**$16.2**	**$127.1**
New Pump Stations	3.5 mgd pump station at RRCSD for raw wastewater discharge to FWD site	3.5	--	3.5
	0.64 mgd pump stations at GCSD for raw wastewater transfer to FWD and 0.9 mgd pump station at GCSD for discharge of recycled water to customers	--	4.8	4.8
	4.4 mgd pump station at the FWD WWTP for discharge to storage/local reuse	2.5	0.7	3.2
	4.4 mgd pump station at FWD for Russian River discharge	3.0	0.8	3.8
Pipeline	10.4-mile of 20-inch conveyance pipeline between RRCSD and FWD	68.5	--	68.5
	Pipeline Connections Between FWD/GCSD: • 1.7 mile, 16-inch pipeline for tertiary effluent transfer between GCSD and FWD • 0.8 mile, 6-inch pipeline extension of existing HDPE pipe • Rehab existing 1.7 mile, 8-inch pipeline between GCSD and FWD for raw wastewater transfer	7.5	3.3	10.8
	4.1-mile, 24-inch Conveyance and Outfall to Russian River[c]	25.9	6.6	32.5
	Engineer's Preliminary OPCC	**$164**	**$33**	**$197**
Engineering Design, Environmental Planning and Studies, Permitting, Construction Management, ESDC and Legal and Admin Costs, 25 percent of OPCC[d]		45	9	54
	Engineer's Preliminary OPTCC	**$209**	**$42**	**$251**

ESDC = engineering services during construction

(a) Project Phase-Level OPCC contingency of 30 percent applied to all elements.

(b) Costs for the new FWD treatment facility are allocated proportional to BOD loading for the pond filling, MBR and solids processing; and proportional to (equalized) peak flow for the influent pumping, screens and UV disinfection system.

(c) Additional evaluation of dilution available at existing GCSD and FWD discharge locations needed to confirm new outfall requirements. A study of potential new outfall locations/alignments is also warranted. If existing FWD and GCSD outfalls are available and can reliably accommodate all planned GCSD/FWD flows, costs applied to GCSD/FWD could be eliminated (an up to $7 million reduction).

(d) Engineering design, environmental planning and studies, permitting, construction management, ESDC and legal and administrative costs of 25 percent applied to all elements, except for the outfall to Russian River, which has a 40 percent factor applied due to possible permitting challenges.

4.2.5 Operations and Maintenance Costs

This section provides a summary of the following O&M cost elements:

- power costs
- labor costs
- chemical costs
- equipment repair and replacement costs
- solids hauling

4.2.5.1 Power Cost

The annual power costs for Alternative 1c are summarized in Table 4-11. These costs account for power for the new tertiary treatment facility, solids handling facility and conveyance infrastructure, as well as anticipated savings from operational changes at the RRCSD, GCSD and FWD WWTPs.

Table 4-11. Annual Power Costs for Alternative 1c

Cost Element	Cost, dollars
Fine Screen	2,000
MBR Treatment System	181,100
Aerobic Digestion	57,600
UV	28,900
Conveyance Pumps	50,200
RRCSD, GCSD and FWD WWTPs Operation[(a)]	-576,600
Total	**-$256,800**

(a) Assuming elimination of 95, 90 and 60 percent, respectively, of RRCSD, GCSD and FWD WWTP current treatment power costs. A negative cost represents cost savings relative to existing costs.

4.2.5.2 Labor Cost

The following labor cost reductions are assumed for this alternative:

- 100 percent increase in labor and administrative costs at the FWD WWTP
- 75 percent reduction in labor costs at the RRCSD WWTP
- 90 percent reduction in labor and a 50 percent reduction in administrative costs at the GCSD WWTP

Based on these assumptions, the estimated annual labor cost savings is $2.9 million.

4.2.5.3 Chemical Cost

Annual chemical costs for Alternative 1c are summarized in Table 4-12. The bases for these costs are provided in the footnotes to the table.

Table 4-12. Annual Chemical Costs for Alternative 1c

Cost Element	Cost, dollars
MBR Treatment System	16,100[a]
Aerobic Digestion	21,900[b]
RRCSD and GCSD WWTPs Operation	-104,700[c]
Total	**-$66,700**

(a) Based on chemical doses provided by manufacturer for system cleaning after organic fouling events
(b) Based on estimated polymer usage for dewatering and thickener units
(c) Assuming elimination of 100 percent of RRCSD and GCSD WWTPs chemical costs. A negative cost represents cost savings relative to existing costs.

4.2.5.4 Equipment Repair and Replacement Cost

A summary of estimated major equipment repair and replacement costs for Alternative 1c is provided in Table 4-13. Replacement costs for equipment with replacement frequencies of more than 20 years were excluded from this analysis (e.g., pumps).

Table 4-13. Equipment Repair and Replacement Costs for Alternative 1c

Cost Element	Cost, dollars	Assumption
UV Equipment Replacement	11,900	Annual
Piping and Valve Maintenance and Replacement Cost	391,000	5 percent of mechanical and piping cost
MBR Membrane Cassette	46,000	Every 7 years, cost shown normalizes to annual cost
Instrumentation Maintenance	185,000	5 percent of instrumentation and controls cost, Year 15
Pumps Rebuild and Major Maintenance	213,000	30 percent of pump cost, Every 10 Years
15-Year MBR Replacements	243,000	Every 15 years
20-Year MBR Replacement	601,000	Every 20 years
20-Year Major Equipment Replacement (fine screens)	666,000	Every 20 years
RRCSD and GCSD Operations[a]	-948,600	Annual
Average Annual Costs	**-$399,000[b]**	--

(a) Assumes a 90 percent cost reduction for parts replacement, permitting, and testing/analysis at the RRCSD WWTP; a 50 percent reduction in SCADA-related costs at RRCSD; and an 80 percent reduction in equipment maintenance costs at the existing GCSD WWTP.
(b) Total is lower than sum of the components because several cost items occur at an irregular frequency. The average annual cost is shown, based on the sum of relevant O&M present worth costs in Appendix C-2, divided by the 20-year project lifetime.

4.2.5.5 Solids Hauling

Alternative 1c would include new solids processing equipment at the FWD WWTP, which is assumed to have associated solids hauling. A unit hauling cost of $70 per wet ton and an annual biosolids production of 1,800 wet tons are assumed. Based on these assumptions, the estimated annual solids hauling costs are $126,000.

4.2.5.6 Total 20-Year Present Worth of O&M Costs

The total 20-year present worth O&M costs for Alternative 1c are shown in Table 4-14. Additional details are provided in Appendix C-2.

Table 4-14. Present Worth O&M Cost for Alternative 1c

O&M Cost Component	Total 20-Year Cost, $ million
Power	-5.4
Labor	-62.6
Chemicals	-1.4
Equipment Repair and Replacement	-8.4
Dewatered Solids Hauling	2.7
Total 20-Year Present Worth O&M Costs	**-$75**

4.2.6 Total Lifecycle Cost

A total lifecycle cost for Alternative 1c is calculated as shown in Table 4-15 using the OPTCC from Table 4-10 and total 20-year O&M costs from Table 4-14.

Table 4-15. Lifecycle Cost for Alternative 1c

Cost Component	Cost, $ million
Total Project Capital Cost (CapEx)	251
Total Present Worth O&M Costs (OpEx)	-75
Total Lifecycle Cost	**$176**

4.3 ALTERNATIVE 2a

Alternative 2a involves conveying all untreated wastewater flows from the four West County service areas to the Windsor WWTP for treatment. No return of recycled water is assumed for use within West County under this alternative. This section presents a description of the basis of design for the facility improvements, a summary of the required facility improvements, site layout, project costs, O&M costs and total lifecycle cost.

4.3.1 Basis of Design

The flows and loads of interest for design of the new treatment facilities under Alternative 2a are the same as for Alternative 1c with the difference being ultimate conveyance to and treatment at the Windsor WWTP instead of the FWD WWTP. These flows and loads of interest were presented in Table 4-9. These flows and loads reflect contributions from 5,319 ESDs.

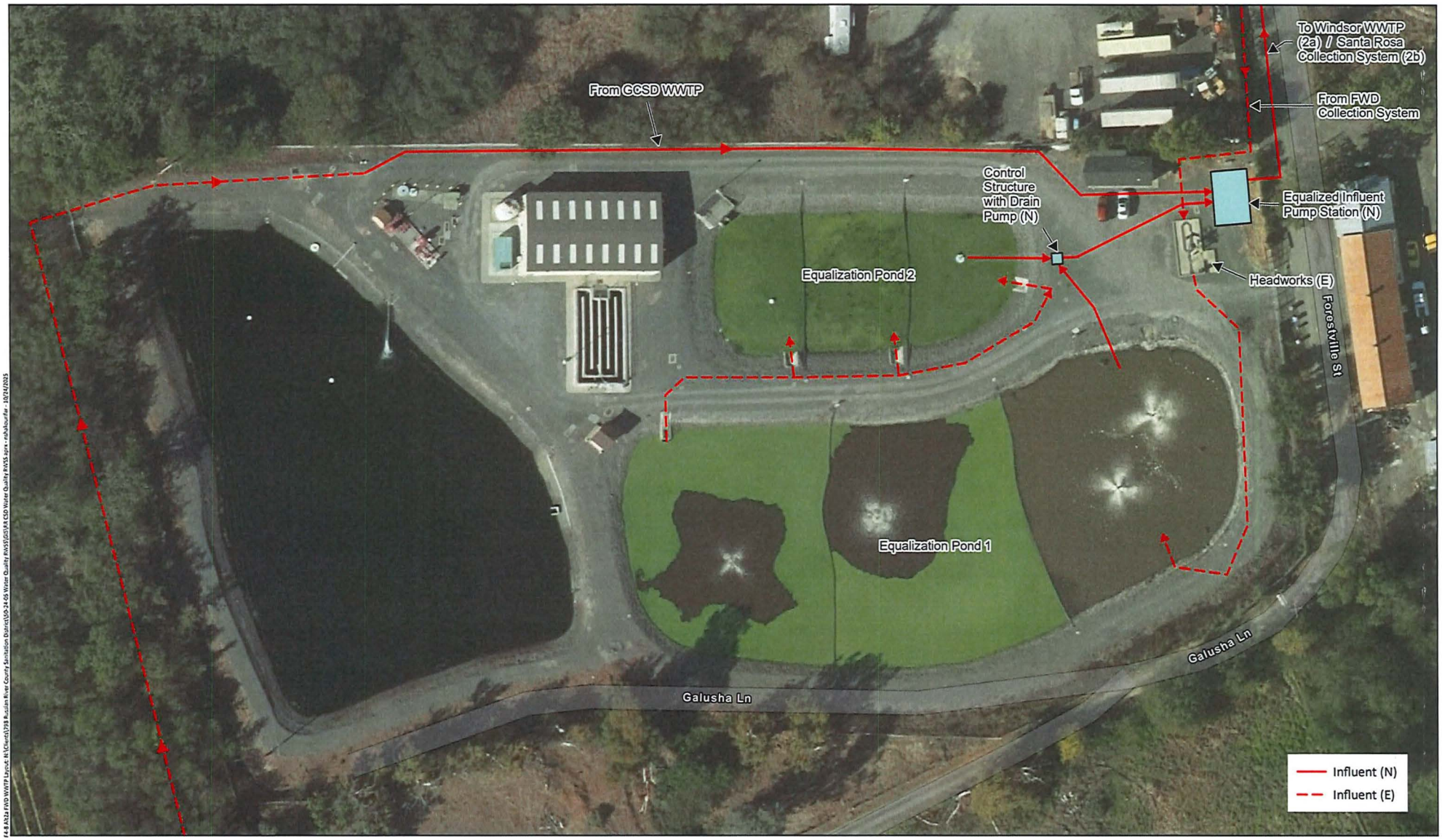
4.3.2 Required Facility Improvements

The major capital cost components for Alternative 2a are the following:

- The GCSD headworks will be upgraded with a new mechanical screening facility.
- The existing GCSD and FWD treatment ponds and the RRCSD storage ponds would be reconfigured to provide EQ at each site. With this approach, the GCSD and FWD flows can likely be equalized to the maximum 30-day average values (0.9 mgd combined total) and RRCSD flows equalized to the lower end of the maximum 7-day average flows (i.e. 3.5 mgd). Required infrastructure for this conversion includes:
  - New influent control structures at both the RRCSD and GCSD sites
  - A new drain pump for the FWD ponds
  - A new flow control structure at the FWD site to allow flexible flow direction within the facility (e.g., directing flow to the ponds or pump station, or combining flows)
  - Additional internal pipelines within the facilities
- New 4.3 mgd , 0.9 mgd and 1.4 mgd discharge pump stations would be constructed at the RRCSD, GCSD and FWD facilities, respectively, for raw wastewater export.
- A new 20- to 24-inch diameter, 8-mile pipeline would be constructed between the RRCSD and FWD/GCSD junction point to the Windsor WWTP. The cost of this conveyance pipeline would be shared between RRCSD and FWD/GCSD facilities, based on the proportion of flow each contributes to the combined conveyance system beyond the junction.
- Construction of new pipelines for RRCSD/FWD/GCSD for conveyance of raw wastewater, as well as rehabilitation of the existing 8-inch ductile iron pipeline between the GCSD and FWD WWTPs for the same.
- An estimated connection/capacity fee of $69.6 million will need to be paid to increase the capacity in the Windsor WWTP. These costs would be split between RRCSD and FWD/GCSD in proportion to their ADWF values.

4.3.3 Site Layouts

The infrastructure required to convert the existing ponds at the RRCSD and GCSD WWTPs into EQ ponds is similar to Alternative 1c and is illustrated on Figure 4-4 and Figure 4-5 in the previous sections. The proposed infrastructure improvements to convert the existing treatment ponds at the FWD WWTP to EQ ponds are shown on Figure 4-8. RRCSD raw wastewater is pumped to the export pipeline junction near the intersection of River Road and Trenton Road (as was shown on Figure 3-7). At the junction, the RRCSD wastewater combines with FWD and GCSD wastewater from FWD before flowing to the Windsor WWTP.



Prepared by:

WEST YOST

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Prepared for:

Russian River County Sanitation District
Water Quality and Recycled Water Supply Feasibility Study

Sonoma Water

FWD WWTP Site Layout for Alternative 2a

DRAFT **Figure 4-8**

4.3.4 Project Costs

The OPCC and OPTCC for Alternative 2a is provided in **Error! Reference source not found.**, with cost shares b etween RRCSD and the other West County agencies. Additional details regarding these costs are provided in a Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendix B-3.

Table 4-16. OPCC and OPTCC for Alternative 2a

Facility Component	Components	Cost, $ million		
		RRCSD	FWD/GCSD	Total[a]
Treatment		**$44.8**	**$29.5**	**$74.3**
RRCSD	Convert storage ponds to EQ facility	0.3	--	0.3
FWD	Convert treatment ponds to EQ facility	--	3.4	3.4
GCSD	Headworks improvements	--	0.8	0.8
	Convert treatment ponds to EQ facility	--	0.2	0.2
Windsor Connection Fee[b]		44.5	25.1	69.6
Conveyance		**$135.8**	**$27.3**	**$163.1**
New Pump Stations	0.64 mgd pump station at GCSD for secondary effluent transfer to FWD	--	2.4	8.5
	0.9 mgd pump station at FWD for wastewater transfer to Windsor	--	2.7	
	3.5 mgd pump station at RRCSD for wastewater transfer to Windsor	3.5	--	
Pipeline	18.9 miles of 20 to 24-inch conveyance pipeline	132.3	20.5	152.8
	Rehab existing 1.7 mile, 8-inch pipeline between GCSD and FWD	--	1.8	1.8
	Engineer's Preliminary OPCC	**$181**	**$57**	**$237**
Engineering Design, Environmental Planning and Studies, Permitting, Construction Management, ESDC and Legal and Admin Costs, 25 percent of OPCC[c]		45	14	59
	Engineer's Preliminary OPTCC	**$226**	**$71**	**$297**

ESDC = engineering services during construction

(a) Project Phase-Level OPCC contingency of 30 percent applied to all elements.

(b) Connection fee for Windsor based on discussion with Town of Windsor staff, as discussed in Chapter 3.

(c) Engineering design, environmental planning and studies, permitting, construction management, ESDC and legal and administrative costs of 25 percent applied to all elements.

4.3.5 Operations and Maintenance Costs

This section provides a summary of the following O&M cost elements:

- power costs
- labor costs
- chemical costs
- equipment repair and replacement costs
- Windsor O&M rate costs

4.3.5.1 Power Cost

The annual power costs for Alternative 2a are summarized in Table 4-17. These cost account for power for the new raw wastewater pump stations, as well as anticipated savings from operational changes at the RRCSD, GCSD and FWD WWTPs.

Table 4-17. Annual Power Costs for Alternative 2a

Cost Element	Cost, dollars
Conveyance Pumps	29,300
RRCSD, GCSD and FWD WWTPs Operation[(a)]	-614,800
Total	**-$585,500**

(a) Assuming 95 percent of the current treatment power costs at RRCSD and 90 percent at FWD/GCSD would be eliminated.

4.3.5.2 Labor Cost

Under this alternative, similar to Alternative 1c, the following labor reductions are assumed:

- 75 percent reduction at RRCSD WWTP
- 90 percent reduction in operations labor and 50 percent reduction in administrative costs at the GCSD WWTP
- 80 percent reduction at the FWD WWTP

Based on these assumptions, the estimated annual labor cost savings is $3.6 million.

4.3.5.3 Chemical Cost

As shown in Table 4-18, since treatment processes are eliminated at the facilities, all existing chemical costs would be entirely saved for Alternative 2a.

Table 4-18. Annual Chemical Costs for Alternative 2a

Cost Element	Cost, dollars
RRCSD, GCSD and FWD WWTPs Operation[(a)]	-154,700

(a) Assuming elimination of 100 percent of chemical costs at RRCSD, GCSD and FWD WWTPs

4.3.5.4 Equipment Repair and Replacement Cost

A summary of the major equipment repair and replacement costs for Alternative 2a is provided in Table 4-19. Replacement costs for equipment with replacement frequencies of more than 20 years were excluded from this analysis (e.g., pumps).

Table 4-19. Equipment Repair and Replacement Costs for Alternative 2a

Cost Element	Cost, dollars	Assumption
Piping and Valve Maintenance and Replacement Cost	297,000	5 percent of mechanical and piping cost
Pumps Rebuild and Major Maintenance	79,000	30 percent of pump cost, Every 10 Years
RRCSD, GCSD and FWD WWTPs Operation[a]	-996,000	Annual
Total Annual Costs[b]	**-$691,000**	--

(a) Assumes a 90 percent cost reduction for parts replacement, permitting, and testing/analysis at the RRCSD WWTP, a 50 percent reduction in SCADA-related costs at RRCSD, 80 percent reduction in equipment maintenance costs at the existing GCSD WWTP, and 60 percent reduction in existing equipment maintenance costs at the FWD WWTP.

(b) Total is lower than sum of the components because several cost items occur at an irregular frequency. The average annual cost is shown.

4.3.5.5 Windsor O&M Rate Costs

The estimated annual rates for 0.96 mgd average annual flow equal to $4.2 million, based on the rate currently paid for Sonoma Water discharges from the Airport area. These rates are expected to increase significantly over the next several years, likely to support the construction of new treatment facilities. However, the current analysis accounts for new facility capital costs within the connection fee.

4.3.5.6 Total 20-Year Present Worth of O&M Costs

The total 20-year present worth O&M costs for Alternative 2a are shown in Table 4-20. Additional details are provided in Appendix C-3.

Table 4-20. Present Worth O&M Cost for Alternative 2a

O&M Cost Component	Total 20-Year Cost, $ million
Power	-12.3
Labor	-74.8
Chemicals	-3.3
Equipment Repair and Replacement	-14.5
Windsor O&M Rates	88.2
Total 20-Year Present Worth O&M Costs	**-$17**

4.3.6 Total Lifecycle Cost

The lifecycle cost for Alternative 2a was calculated and shown in Table 4-21 using the present worth of the capital cost and annualized O&M costs over the planning period.

Table 4-21. Lifecycle Cost for Alternative 2a

Cost Component	Cost, $ million
Total Project Capital Cost (CapEx)	297
Total Present Worth O&M Costs (OpEx)	-17
Total Lifecycle Cost	**$280**

4.4 ALTERNATIVE 2b

Alternative 2b involves conveying all untreated wastewater flows from the four West County service areas to the Laguna WWTP for treatment. For the current evaluation, no return of recycled water is assumed for use within West County under this alternative. This section presents a description of the basis of design for the facility improvements, a summary of the required facility improvements, site layout, project costs, O&M costs and total lifecycle cost.

4.4.1 Basis of Design

The flows and loads of interest for design of the new treatment facilities under Alternative 2b are the same as for Alternative 1c with the difference being ultimate conveyance to and treatment at the Laguna WWTP instead of the FWD WWTP. These flows and loads of interest were presented in Table 4-9. These flows and loads reflect contributions from 5,319 ESDs.

4.4.2 Required Facility Improvements

The major capital cost components for Alternative 2b are the following:

- The GCSD headworks will be upgraded with a new mechanical screening facility.
- The existing GCSD and FWD treatment ponds and storage ponds will be repurposed as EQ at each site, similar to Alternative 2a. Required infrastructure for this conversion includes:
  - New influent control structures at both the RRCSD and GCSD sites
  - A new drain pump for the FWD ponds
  - A new flow control structure at the FWD site to allow flexible flow direction within the facility (e.g., directing flow to the ponds or pump station, or combining flows)
  - Additional internal pipelines within the facilities
- New 3.5 mgd, 0.64 mgd and 3.8 mgd discharge pump stations would be constructed at the RRCSD, GCSD and FWD facilities, respectively. for raw wastewater export.
- A new 24-inch diameter, 7.6-mile pipeline would be constructed between the RRCSD and FWD/GCSD junction point to the Santra Rosa collection system near the intersection of Hall and Fulton Roads. The cost of this conveyance is shared between RRCSD and FWD/GCSD facilities, based on the proportion of flow each contributes to the combined conveyance system beyond the junction.

- An estimated connection/capacity fee of $68.8 million will need to be paid to buy capacity in the Laguna WWTP, and a $5 million nominal cost for expansion of Santa Rosa recycled water storage is assumed. These costs would be split between RRCSD and FWD/GCSD in proportion to their ADWF values.
- Construction of new pipelines for RRCSD/FWD/GCSD for conveyance of raw wastewater.

4.4.3 Site Layouts

The proposed infrastructure upgrades needed to convert the facilities into EQ facilities are similar to those described under Alternative 2a and are illustrated in the site layouts shown on Figure 4-4, Figure 4-5 and Figure 4-8 in the previous sections. GCSD raw wastewater is pumped to the export pipeline junction near the intersection of Highway 116 and Guerneville Road east of the GCSD WWTP (as was shown on Figure 3-8). At the junction, the GCSD wastewater combines with RRCSD and FWD wastewater from FWD before flowing to the Santa Rosa collection system.

4.4.4 Project Costs

The OPCC and OPTCC for Alternative 2b is provided in Table 4-22, with the estimated cost shares between RRCSD and the other West County agencies. Additional details regarding these costs are provided in a Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendix B-4.

Table 4-22. OPCC and OPTCC for Alternative 2b

Facility Component	Components	Cost, $ million		
		RRCSD	FWD/GCSD	Total[a]
Treatment		**$44.3**	**$29.2**	**$73.5**
RRCSD	Convert storage ponds to EQ facility	0.3	--	0.3
FWD	Convert treatment ponds to EQ facility	--	3.4	3.4
GCSD	Headworks improvements	--	0.8	0.8
	Convert treatment ponds to EQ facility	--	0.2	0.2
Santa Rosa Connection Fee[b]		44.0	24.8	68.8
Conveyance		**$130.8**	**$18.7**	**$149.5**
New Pump Stations	0.64 mgd pump station at GCSD for wastewater transfer to Santa Rosa collection system	--	2.6	9.7
	3.8 mgd pump station at FWD for wastewater transfer to Santa Rosa collection system	2.9	0.7	
	3.5 mgd pump station at RRCSD for wastewater transfer to FWD	3.5	--	
Pipeline	18.0 miles of 16 to 24-inch conveyance pipeline	124.4	15.4	139.8
Recycled Water		**$3.2**	**$1.8**	**$5.0**
Storage	*Nominal cost assumed for Santa Rosa*	3.2	1.8	5.0
	Engineer's Preliminary OPCC	**$178**	**$50**	**$228**
Engineering Design, Environmental Planning and Studies, Permitting, Construction Management, ESDC and Legal and Admin Costs, 25 percent of OPCC[c]		45	12	57
	Engineer's Preliminary OPTCC	**$223**	**$62**	**$285**

ESDC = engineering services during construction
(a) Project Phase-Level OPCC contingency of 30 percent applied to all elements.
(b) Connection fee for Santa Rosa based on discussion with Santa Rosa staff, as discussed in Chapter 3.
(c) Engineering design, environmental planning and studies, permitting, construction management, ESDC and legal and administrative costs of 25 percent applied to all elements.

4.4.5 Operations and Maintenance Costs

This section provides a summary of the following O&M cost elements:

- power costs
- labor costs
- chemical costs
- equipment repair and replacement costs
- Laguna WWTP O&M rate costs

4.4.5.1 Power Cost

The annual power costs for Alternative 2b are summarized in Table 4-23. As with Alternative 2a, these costs account for power requirements for the new raw wastewater pump stations, as well as anticipated savings from operational changes at the RRCSD, GCSD and FWD WWTPs.

Table 4-23. Annual Power Costs for Alternative 2b

Cost Element	Cost, dollars
Conveyance Pumps	52,600
RRCSD, GCSD and FWD WWTPs Operation[(a)]	-614,800
Total	**-$562,200**

(a) Assuming 95 percent of the current treatment power costs at RRCSD and 90 percent at FWD/GCSD would be eliminated.

4.4.5.2 Labor Cost

The same labor cost reductions are assumed as under Alternative 2a, with the same estimated annual labor cost savings of $3.6 million.

4.4.5.3 Chemical Cost

The same reduction in chemical costs is assumed as under Alternative 2a ($154,700 a year savings).

4.4.5.4 Equipment Repair and Replacement Cost

A summary of the major equipment repair and replacement costs for Alternative 2b is provided in Table 4-24. As with other alternatives, replacement costs for equipment with replacement frequencies of more than 20 years were excluded from this analysis (e.g., pumps). The reduction in equipment repair and replacement costs is notably less than under Alternative 2a ($663,000 annual savings). The lower savings is a function of slightly longer pipelines and larger total pumping capacity, resulting in higher piping maintenance and pump rebuild/major maintenance costs, respectively.

Table 4-24. Equipment Repair and Replacement Costs for Alternative 2b		
Cost Element	Cost, dollars	Assumption
Piping and Valve Maintenance and Replacement Cost	308,000	5 percent of mechanical and piping cost
Pumps Rebuild and Major Maintenance	103,000	30 percent of pump cost, Every 10 Years
RRCSD, GCSD and FWD WWTPs Operation[a]	-996,000	Annual
Total Annual Costs[b]	**-$678,000**	--

(a) Assumes a 90 percent cost reduction for parts replacement, permitting, and testing/analysis at the RRCSD WWTP, a 50 percent reduction in SCADA-related costs at RRCSD, 80 percent reduction in equipment maintenance costs at the existing GCSD WWTP, and 60 percent reduction in existing equipment maintenance costs at the FWD WWTP.

(b) Total is lower than sum of the components because several cost items occur at an irregular frequency. The average annual cost is shown.

4.4.5.5 Laguna WWTP O&M Rate Costs

The estimated annual rates for 0.59 mgd average dry weather flow equal to $5.6 million, based on a review of published wastewater rates and discussions with Santa Rosa staff.

4.4.5.6 Total 20-Year Present Worth of O&M Costs

The total 20-year present worth O&M costs for Alternative 2a are shown in Table 4-25. Additional details are provided in Appendix C-4.

Table 4-25. Present Worth O&M Cost for Alternative 2b	
O&M Cost Component	Total 20-Year Cost, $ million
Power	-11.8
Labor	-74.8
Chemicals	-3.3
Equipment Repair and Replacement	-14.2
Santa Rosa Rate	117.6
Total 20-Year Present Worth O&M Costs	**$14**

4.4.6 Total Lifecycle Cost

The lifecycle cost for Alternative 2b was calculated as shown in Table 4-26 using the OPTCC from Table 4-22 and annualized O&M costs over the planning period from Table 4-25.

Table 4-26. Lifecycle Cost for Alternative 2b	
Cost Component	Cost, $ million
Total Project Capital Cost (CapEx)	285
Total Present Worth O&M Costs (OpEx)	14
Total Lifecycle Cost	**$299**

4.5 ALTERNATIVE 3b

Alternative 3b involves conveying all untreated wastewater flows from the RRCSD service areas to the Windsor WWTP for treatment. Flows from FWD, GCSD, and OCSD would be treated at a combined FWD/GCSD WWTP and recycled water system that is sized to accommodate zero surface water discharge (i.e. in lieu of making treatment improvements to meet the nitrogen effluent limitations that have been prescribed for surface discharge). This section presents a description of the basis of design for the facility improvements, a summary of the required facility improvements, site layout, project costs, O&M costs and total lifecycle cost.

4.5.1 Basis of Design

The relevant design flows and loads for Alternative 3b are presented in Table 4-27 for the respective components to the Windsor and FWD WWTPs.

Table 4-27. Future West County Flows and Loads Relevant to Alternative 3b

Scenario	ADWF, mgd	Relevant Peak Flow Condition	Peak Flow, mgd	Maximum 30-Day BOD Load, lb/day
Flows and Loads to Windsor WWTP				
Projected RRCSD Flows and Loads	0.38	PDF	3.5	2,620
Flows and Loads to FWD/GCSD WWTPs				
Projected GCSD/OCSD Flows and Loads	0.15	MMF/MWF	0.64/1.1	680
Projected FWD Flows and Loads	0.064	MMF/MWF	0.25/0.39	270
Combined GCSD/OCSD/FWD Flows and Loads	**0.21**	**MWF**	**1.49**	**80[a]**

(a) The combined GCSD/OCSD/FWD BOD load represents the load to the FWD tertiary system following secondary treatment, which is the relevant design criteria for the proposed system.

4.5.2 Required Facility Improvements

The required facility improvements for the RRCSD entail the following:

- The existing RRCSD storage ponds would be reconfigured to provide EQ. With this approach, the RRCSD flows will be equalized to the lower end of the maximum 7-day average flows (i.e. 3.5 mgd). Required infrastructure for this conversion includes:
  - New influent control structures
  - Additional internal pipelines
- A new 3.5 mgd discharge pump station would be constructed at the RRCSD for raw wastewater export.
- A new, 20-inch diameter, 18.9-mile pipeline would be constructed between the RRCSD site and Windsor WWTP.
- A $44.8 million connection/capacity fee will be paid to Windsor to increase the capacity in the Windsor WWTP. These costs would be incurred by RRCSD.

The major infrastructure required for the FWD and GCSD sites under Alternative 3b is the same as for these sites under Alternative 1a, detailed in Section 4.1.2.

4.5.3 Site Layouts

The proposed infrastructure improvements for the RRCSD WWTP were presented on Figure 4-4. The only distinctions are that conveyance would be to the Windsor WWTP instead of the FWD WWTP, and the wastewater pump station at the RRCSD site would be designed accordingly.

The proposed new treatment systems and infrastructure improvements for the FWD and GCSD WWTPs are to the same as those already described under Alternative 1a, with site layouts as presented on Figure 4-1 and Figure 4-2 for the respective sites.

4.5.4 Project Costs

Capital costs for Alternative 3b are summarized in Table 4-28, with cost shares between RRCSD and the other agencies. Additional details regarding these costs are provided in a Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendix B-5.

Table 4-28. OPCC and OPTCC for Alternative 3b

Facility Component	Components	Cost, $ million		
		RRCSD	FWD/GCSD	Total[a]
Treatment		**$45.1**	**$25.7**	**$70.8**
RRCSD	Convert storage ponds to EQ facility	0.3	--	0.3
	Windsor connection fee[b]	44.8	--	44.8
FWD	Expansion of tertiary filtration and disinfection	--	15.5	15.5
GCSD	Headworks improvements	--	0.8	0.8
	Convert treatment ponds to complete mix system	--	9.4	9.4
Conveyance		**$149.6**	**$13.2**	**$162.8**
New Pump Stations	1.1 mgd pump station at GCSD for secondary effluent transfer to FWD	--	2.5	10.9
	1.5 mgd pump station at GCSD for tertiary effluent delivery to distribution system	--	2.5	
	1.5 mgd pump station at FWD for tertiary effluent transfer GCSD and delivery to customers	--	2.4	
	3.5 mgd pump station at RRCSD for wastewater transfer to Windsor	3.5	--	
Pipeline	• 0.8 mile, 6-inch pipeline; 1.7 mile, 6-inch pipeline • Rehab existing 1.7 mile, 8-inch pipeline between GCSD and FWD	--	5.8	151.9
	18.9 miles of 20-inch conveyance from RRCSD to Windsor WWTP	146.1	--	
Recycled Water		**$0.0**	**$20.4**	**$20.4**
Storage	310 acre-feet (GCSD)	--	20.4	20.4
	Engineer's Preliminary OPCC	**$195**	**$59**	**$254**
Engineering Design, Environmental Planning and Studies, Permitting, Construction Management, ESDC and Legal and Admin Costs, 25 percent of OPCC[c]		49	15	64
	Engineer's Preliminary OPTCC	**$243**	**$74**	**$318**

ESDC = engineering services during construction
(a) Project Phase-Level OPCC contingency of 30 percent applied to all elements.
(b) Connection fee for Windsor based on discussion with Town of Windsor staff.
(c) Engineering design, environmental planning and studies, permitting, construction management, ESDC and legal and administrative costs of 25 percent applied to all elements.

4.5.5 Operations and Maintenance Costs

This section provides a summary of the following O&M cost elements:

- power costs
- labor costs
- chemical costs
- equipment repair and replacement costs
- Windsor O&M rate costs

4.5.5.1 Power Costs

The annual power costs for Alternative 3b are summarized in Table 4-29. These costs account for the energy demands of new treatment systems and conveyance infrastructure, as well as projected savings resulting from operational changes at the GCSD and RRCSD WWTPs.

Table 4-29. Annual Power Costs for Alternative 3b

Cost Element	Annual Cost, dollars
Treatment Pond at GCSD WWTP	173,200
RRCSD, GCSD and FWD WWTPs Operation[a]	-565,800
Cloth Disk Filtration	700
SAF	6,400
Conveyance Pumps	106,900
Total	**-$278,600**

(a) Assuming elimination of 90 percent of GCSD and 95 percent of RRCSD current treatment power costs.

4.5.5.2 Labor Costs

As with Alternative 1a, no additional labor costs are included. A 75 percent reduction in labor costs at the RRCSD WWTP is assumed, resulting in an estimated annual savings of $3.0 million.

4.5.5.3 Chemical Costs

The chemical costs for the new treatment systems at FWD, as well as the savings at GCSD, are similar to those presented for Alternative 1a in Section 0. Additionally, further chemical cost savings will occur at RRCSD due to the elimination of treatment at that facility. A summary of estimated annual chemical cost Is provided in Table 4-30.

Table 4-30. Annual Chemical Costs for Alternative 3b

Cost Element	Annual Cost, dollars
SAF	55,700[a]
CCB	25,900[b]
RRCSD and GCSD WWTPs Operation	-104,700[c]
Total	**-$23,100**

(a) Based on chemical usage at the existing GCSD SAF facility.
(b) Additional chlorine gas and sodium bisulfite required for the expanded CCB at the FWD WWTP are estimated using FWD current design criteria and the projected increase in annual average flow from GCSD.
(c) Assuming elimination of 100 percent of GCSD and RRCSD chemical costs.

4.5.5.4 Equipment Repair and Replacement Costs

A summary of the equipment repair and replacement costs for Alternative 3b is shown in Table 4-31.

Table 4-31. Equipment Repair and Replacement Costs for Alternative 3b

Cost Element	Cost, dollars	Assumption
Filter Cloth Replacement	2,200	Annual
Routine O&M[a]	7,800	Annual
Piping and Valve Maintenance and Replacement Cost	72,000	5 percent of mechanical and piping cost
Instrumentation Maintenance	54,000	5 percent of instrumentation and controls cost, Year 15
Pumps Rebuild and Major Maintenance	49,000	30 percent of pump cost, Every 10 Years
10-Year Equipment Replacement[b]	2,100	Every 10 years
Major Equipment Replacement	43,200	Every 15 Years
RRCSD WWTP Operation[c]	-853,600	Annual
Total Annual Costs[d]	**-$762,000**	--

(a) Includes cloth disk filtration routine lubrication of backwash pumps, drive motor and gear box, SAF parts replacement, pond cleaning, pond blower filter/belt/ oil changes.

(b) Includes cloth disk filtration main "V-Ring" seal replacement.

(c) Assumes a 90 percent cost reduction for parts replacement, permitting, and testing/analysis at the RRCSD WWTP and a 50 percent reduction in SCADA-related costs at RRCSD.

(d) Total is lower than sum of the components because several cost items occur at an irregular frequency. The average annual cost is shown.

4.5.5.5 Windsor O&M Rate Costs

The annual rates for 0.66 mgd from the RRCSD WWTP to the Windsor WWTP are estimated to be $2.7 million, based on the rate currently paid for discharges from the Airport area, with an adjustment to reflect the smaller flow for RRCSD. As noted with discussion of these rates with Alternative 2a, the Airport rates are expected to increase significantly in the coming years, likely to support the construction of new treatment facilities, but the current analysis accounts for new facility capital costs within the connection fees.

4.5.5.6 Total 20-Year Present Worth of O&M Costs

The total 20-year present worth O&M costs for Alternative 3b are shown in Table 4-32. Additional details are provided in Appendix C-5.

Table 4-32. Present Worth O&M Cost for Alternative 3b

O&M Cost Component	Total 20-Year Cost, $ million
Power	-5.9
Labor	-62.2
Chemicals	-0.5
Equipment Repair and Replacement	-16.0
Windsor Rate	54.0
Total 20-Year Present Worth O&M Costs	**-$31**

4.5.6 Total Lifecycle Cost

A total lifecycle cost for Alternative 3b is calculated as shown in Table 4-33 using the OPTCC from Table 4-28 and present worth annualized O&M costs over the 20-year planning period from Table 4-32.

Table 4-33. Lifecycle Cost for Alternative 3b

Cost Component	Cost, $ million
Total Project Capital Cost (CapEx)	318
Total Present Worth O&M Costs (OpEx)	-31
Total	**$287**

4.6 COMPARISON OF ALTERNATIVES

4.6.1 Summary of Estimated Project Lifecycle Costs

The estimated project lifecycle costs for all five feasible alternatives are summarized in Table 4-34, which shows capital costs, 20-year present worth O&M costs, and total 20-year lifecycle costs. The capital cost share between RRCSD and FWD/GCSD is also shown.

Table 4-34. Summary of Estimated Lifecycle Costs, $ million

Estimated Cost Component	Alternative 1a	Alternative 1c	Alternative 2a	Alternative 2b	Alternative 3b
Capital Cost (CapEx)	104	251	297	285	318
RRCSD Share	*30*	*209*	*226*	*223*	*243*
FWD/GCSD Share	*74*	*42*	*71*	*62*	*74*
20-Year Present Worth O&M (OpEx)	3	-75[a]	-17[a]	14	-31[a]
Estimated Total 20-Year Lifecyle Cost	**107**	**176**	**280**	**299**	**287**

(a) A negative cost represents cost savings relative to existing costs.

The project costs presented in Table 4-34 reveal Alternative 1a as the least cost alternative. Although Alternative 1a has the second highest operating costs, the significantly lower capital costs nevertheless results in a significantly lower total 20-year project cost. In contrast, Alternative 2b represents the highest-cost scenario, driven by (1) a relatively high capital cost and (2) the highest operating costs. Alternative 3b is slightly lower, driven by (1) the highest capital cost and (2) operating savings in the middle of other alternatives.

4.6.2 Screening Criteria Scoring

Chapter 3 includes discussion of seven qualitative screening criteria that were used to evaluate the alternatives. A summary of the previously defined screening scores is provided in Table 4-35.[6]

Table 4-35. Summary of Screening Criteria Scoring

Criteria	Alternative 1a	Alternative 1c	Alternative 2a	Alternative 2b	Alternative 3b
Reliability/ Ease of Operation	1.0	3.0	5.0	5.0	2.5
Long-Term Regulatory Compliance	2.5	3.0	5.0	5.0	4.0
Flexibility for Adding Critical Unsewered Communities	1.0	3.0	5.0	3.0	5.0
Local Recycled Water Benefits	4.5	4.0	1.0	1.0	3.5
Environmental	5.0	2.0	2.0	3.0	2.5
Resiliency	2.0	3.0	4.0	5.0	3.0
Ease of Implementation	5.0	3.0	1.5	1.0	2.5
Average Score	**3.0**	**3.0**	**3.4**	**3.3**	**3.3**
Total Score	**21.0**	**21.0**	**23.5**	**23.0**	**23.0**

To compare alternatives in terms of both costs and qualitative criteria scores, a plot of the average (or total) screening scores against the estimated lifecycle costs was prepared, shown on Figure 4-9.

[6] The criteria scores were found to be adequate with the refined analysis, so no changes were made.

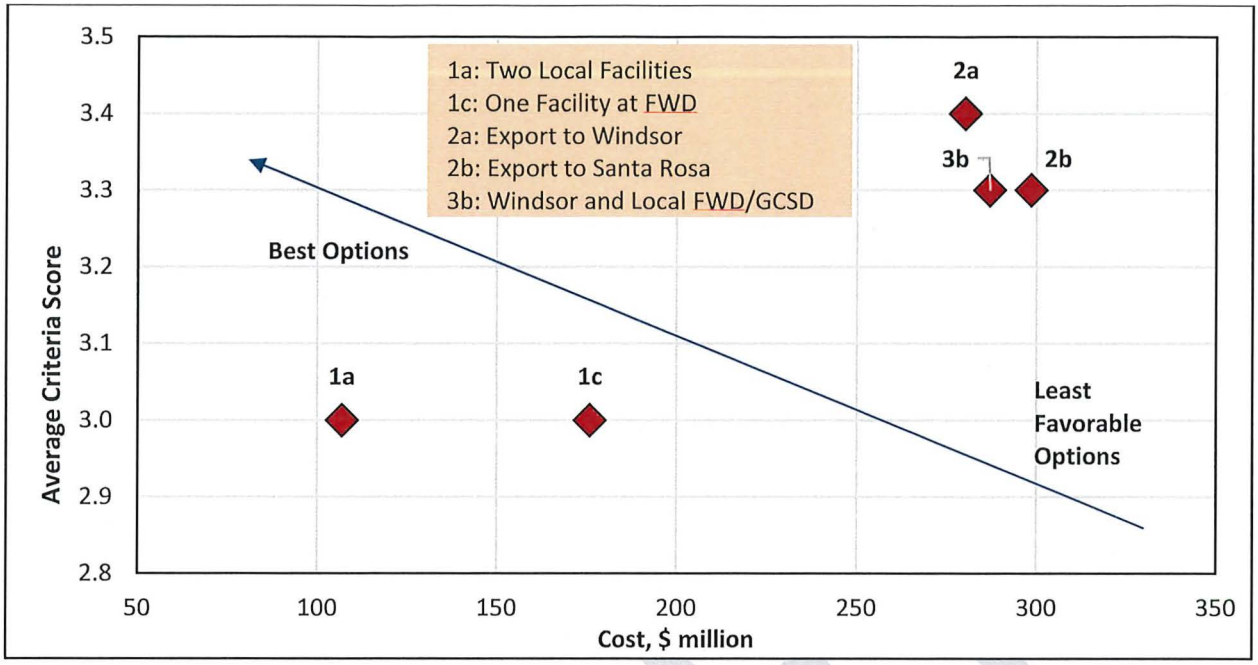

Figure 4-9. Comparison of Alternatives based on Average Criteria Score vs. 20-Year Lifecycle Cost

The results on Figure 4-9 do not reveal an obvious best alternative. While Alternative 1a has the lowest estimated lifecycle cost, it is also tied for the lowest average criteria score with Alternative 1c. The alternatives with export components (2a, 2b and 3b) have notably higher criteria scores but also significantly higher lifecycle costs.

Stakeholders were asked to rank the screening criteria in order of importance during a stakeholder meeting on May 14, 2025. Average stakeholder rankings have been calculated from these results as presented in Table 4-36 (where a ranking of 1 represents a higher importance).

Table 4-36. Weighting of Screening Criteria Scores

Screening Criteria	Average Stakeholder Ranking	Weighting,[(a)] percent
Reliability/ Ease of Operation	3.43	13.2
Long-Term Regulatory Compliance	3.57	12.7
Flexibility for Adding Critical Unsewered Communities	2.43	18.7
Local Recycled Water Benefits	3.43	13.2
Environmental	3.00	15.1
Resiliency	3.29	13.8
Ease of Implementation	3.43	13.2

(a) Weighting calculated from ratio of inverted average ranking value to sum of all inverted average rankings

The weighted scores are plotted on Figure 4-10 against the same estimated lifecycle costs to reflect stakeholder input on the screening criteria importance. The scores for Alternatives 1a and 3b have changed slightly after applying the weightings, with Alternative 1a decreasing slightly, and Alternative 3b increasing slightly. Even with the revised weighting, however, an obvious best alternative does not emerge. Based on this analysis, all five alternatives were selected to be included in the next phase of the evaluation.

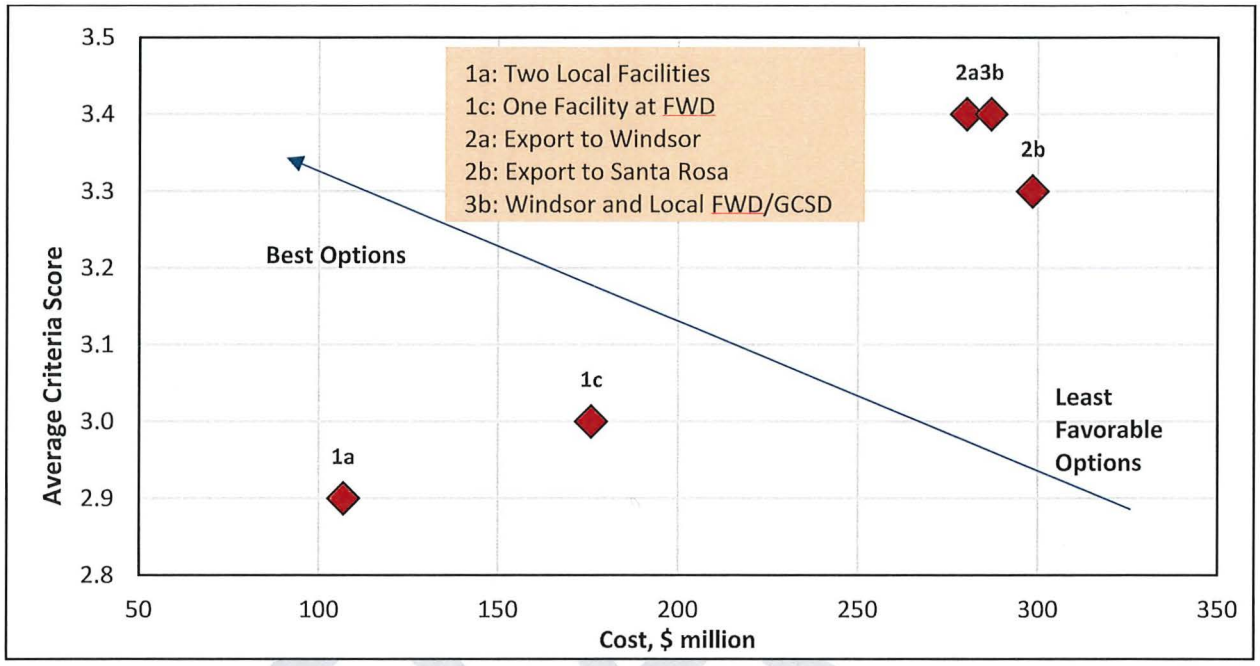

Figure 4-10. Comparison of Alternatives based on Weighted Average Criteria Score vs. 20-Year Lifecycle Cost