CALFED Water Management Planning Workshop

CALFED PEIS/R
Modeling Approach and
Assumptions

and

CALFED PEIS/R
Technical Evaluation
for Sections 5.1, 5.2 and 5.3

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CALFED PEIS/R Modeling Approach and Assumptions

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CALFED PEIS/R Modeling Approach and Assumptions

- Uncertainties in the Assessment
- Addressing Uncertainty
- General Assessment Method for PEIS/R
- Key Assumptions

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Uncertainties in the Assessment

- Limited ability to forecast population growth
- Limited ability to forecast agricultural land use changes
- Limited ability to forecast implementation of other water management options
- Limited ability to forecast ecosystem recovery, leading to uncertainty in future environmental water requirements

Uncertainties in the Assessment

- **Primary areas of uncertainty related to CALFED modeling analysis:**
  - Environmental/M&I/Agricultural Demands
  - Delta Operation Criteria
  - New Storage
  - Delta Conveyance

Addressing Uncertainties

- Water Management Strategy
  - Conduct economic evaluation of water management alternatives (EEWMA)
  - Conduct integrated storage investigation (ISI)
  - Develop an Environmental Water Account (EWA)
  - Quantify uncertainty and risk associated with water management strategies

Addressing Uncertainty

- Environmental Water Account
  - Determine which environmental protections are provided through prescriptive standards
  - Investigate approaches for implementation
  - Develop accounting methodologies
  - Determine legal mechanisms
  - Determine water management/facility needs

Addressing Uncertainty

- CALFED PEIS/R Analytical Approach
  - Model a range of uncertainty bounded by two distinct water management criteria (Criteria A and B) for programmatic impact analysis
  - Criterion A "bookend" defines the highest environmental water requirements and lowest Delta exports
  - Criterion B "bookend" defines the lowest environmental water requirements and highest Delta exports

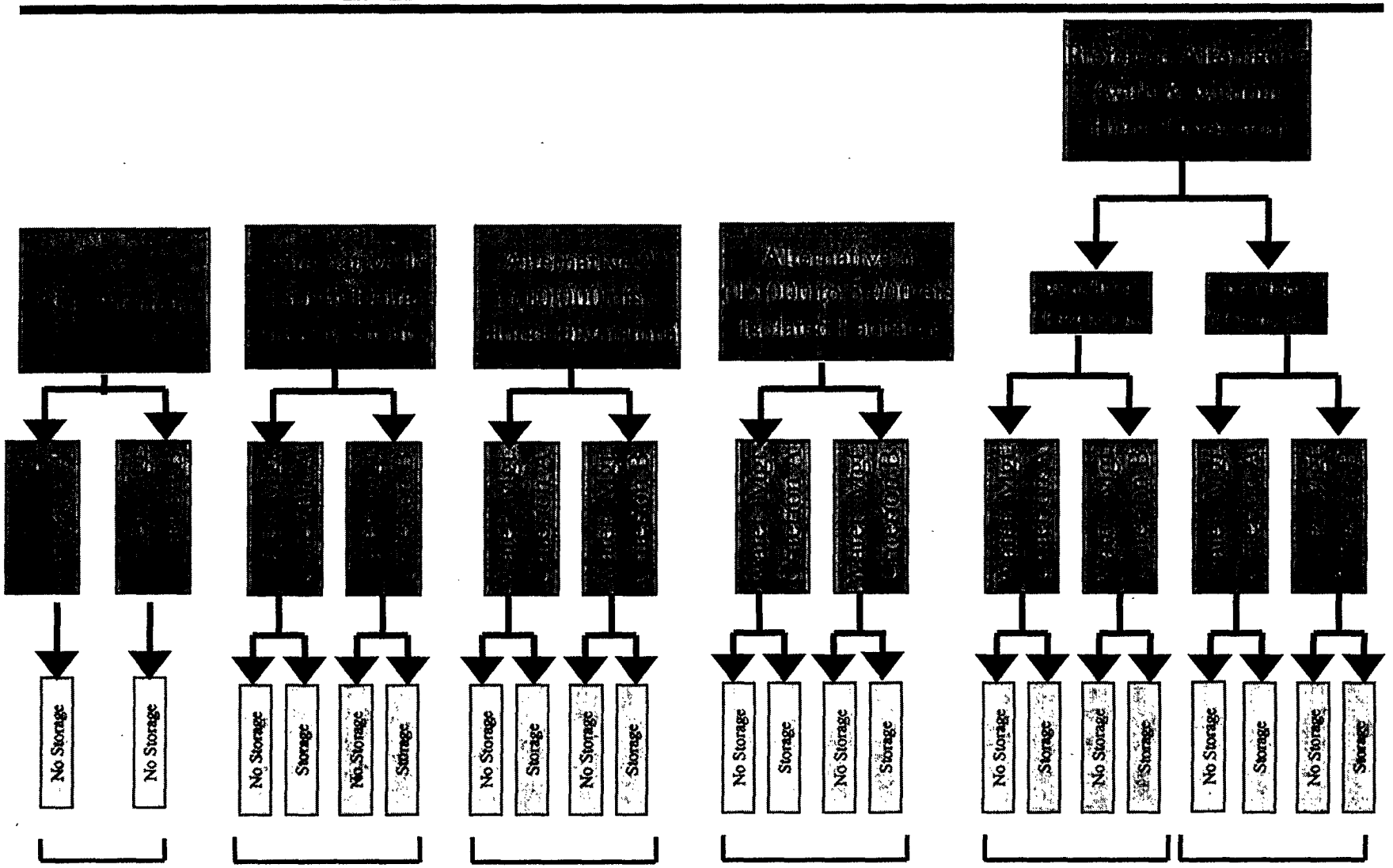
General Assessment Method

- Water Management Criterion A
  - Demand - 1995 LOD, Trinity, American, ERP
  - Delta Criteria - WQCP, Delta (b)(2), Additional Prescriptive Standards, Alternative Criterion
  - Storage - With and Without (4.75 MAF Ag/Urban & 1.25 MAF Env.)

General Assessment Method

- Water Management Criterion B
  - Demand - 2020 LOD, ERP
  - Delta Criteria - WQCP, Delta (b)(2), Alternative Criterion
  - Storage - With and Without (4.75 MAF Ag/Urban & 1.25 MAF Env.)

CALFED PEIS/R Assessment Approach Diagram



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Existing Conditions Assumptions

- 1995-Level Hydrology
- 2.6-3.5 MAF Variable SWP Demand
- 3.5 MAF w/ Level II Refuge CVP Demand
- Delta Standards
  - May 1995 WQCP
  - CVPIA (b)(2)
- 340 TAF Trinity Instream Requirement

No Action - Criterion A Assumptions

- 2020 -Level Hydrology
- 2.6-3.5 MAF Variable SWP Demand
- 3.4 MAF w/ Level II Refuge CVP Demand
- Delta Standards
  - May 1995 WQCP
  - CVPIA (b)(2) Delta Actions
  - Additional Prescriptive Delta Actions
- 390-750 TAF Trinity Instream Requirement
- 115 TAF Max. EBMUD American Diversion

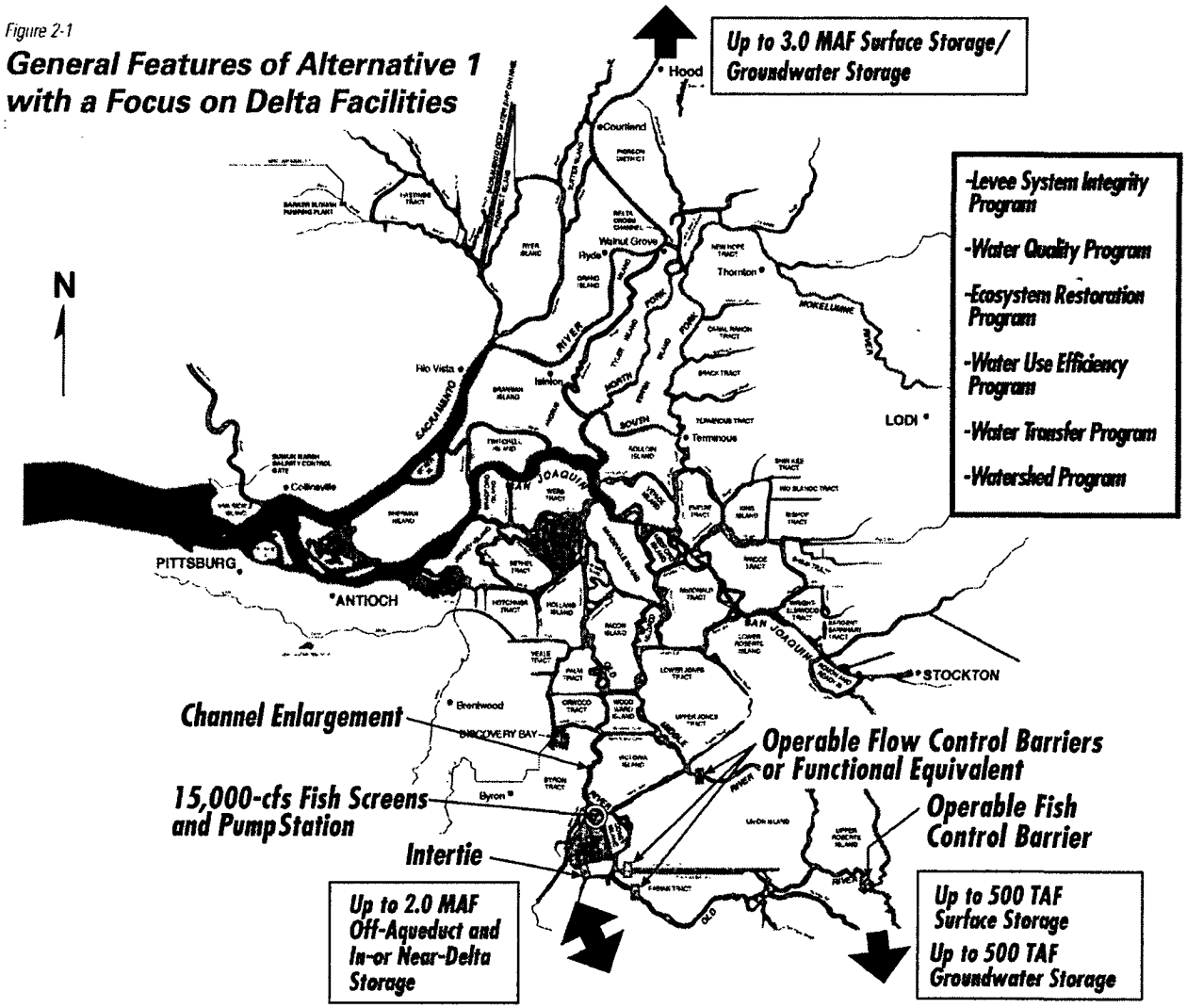
No Action - Criterion B Assumptions

- 2020 -Level Hydrology
- 3.6-4.2 MAF Variable SWP Demand
- 3.5 MAF w/ Level II Refuge CVP Demand
- Delta Standards
  - May 1995 WQCP
  - CVPIA (b)(2) Delta Actions
- 340 TAF Trinity Instream Requirement

Alternative 1

Figure 2-1

General Features of Alternative 1 with a Focus on Delta Facilities



Alternative 1 Assumptions - Criteria A

- No Action Water Management Criterion A
- South Delta Criterion A
  - Full and Unlimited Joint Point of Diversion
  - 10,300 cfs Banks Pumping Plant Capacity
  - Pumping Constrained by 1981 Corps Criteria

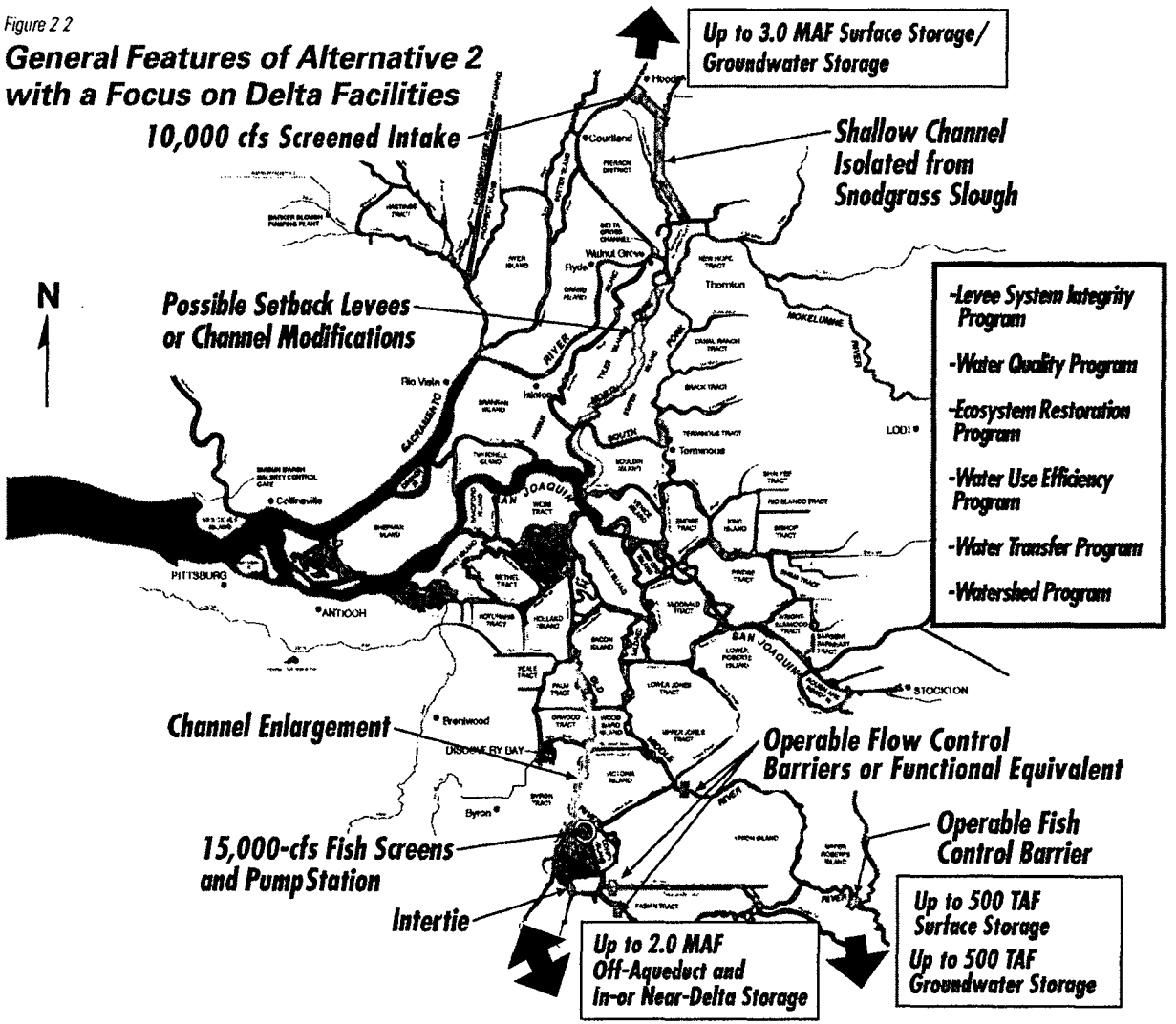
Alternative 1 Assumptions - Criterion B

- No Action Water Management Criterion B
- South Delta Criterion B
  - Full and Unlimited Joint Point of Diversion
  - 10,300 cfs Banks Pumping Plant Capacity
  - No Additional Pumping Constraints

Alternative 2

Figure 2 2

General Features of Alternative 2 with a Focus on Delta Facilities



Alternative 2 Assumptions - Criterion A

- No Action & South Delta Criterion A
- North Delta Criterion A (10,000 cfs Hood Facility)
  - Hood Diversion is limited to:
    - 50% of South Delta exports
    - 5,000 cfs in May
    - 35% of Sacramento flow in March & June
    - 15% of Sacramento flow in April & May
  - Minimum 3,000 cfs Rio Vista flow maintained
  - Delta Cross Channel gates closed for all months, except June (Dry, Critical, and Below Normal WY)

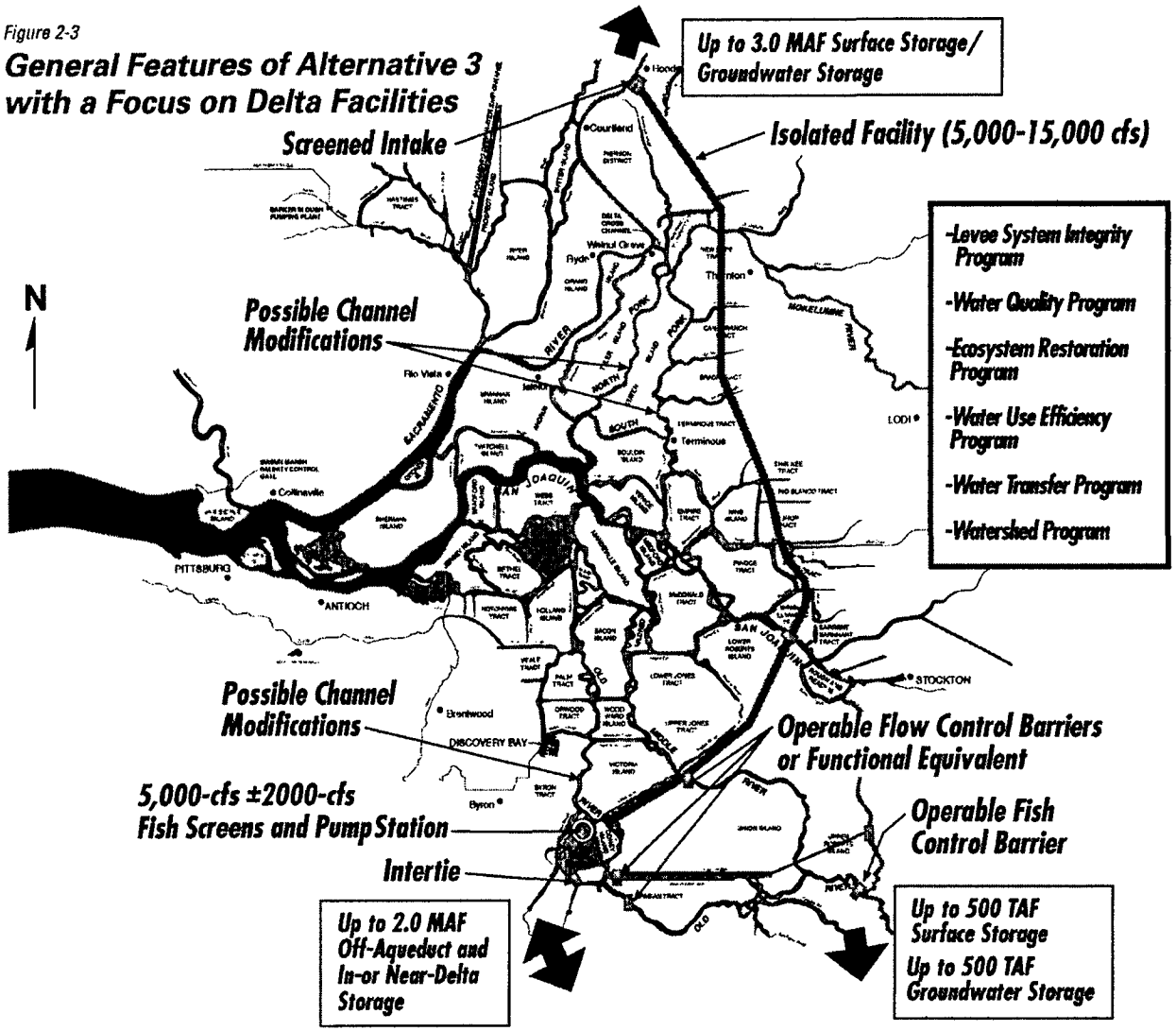
Alternative 2 Assumptions - Criterion B

- No Action & South Delta Criterion B
- North Delta Criterion B (10,000 cfs Hood Facility)
  - Hood Diversion is limited to:
    - 100% of South Delta exports
    - 5,000 cfs in May
  - Minimum 3,000 cfs Rio Vista flow maintained
  - Delta Cross Channel gates closed for all months, except July and August

Alternative 3

Figure 2-3

General Features of Alternative 3 with a Focus on Delta Facilities



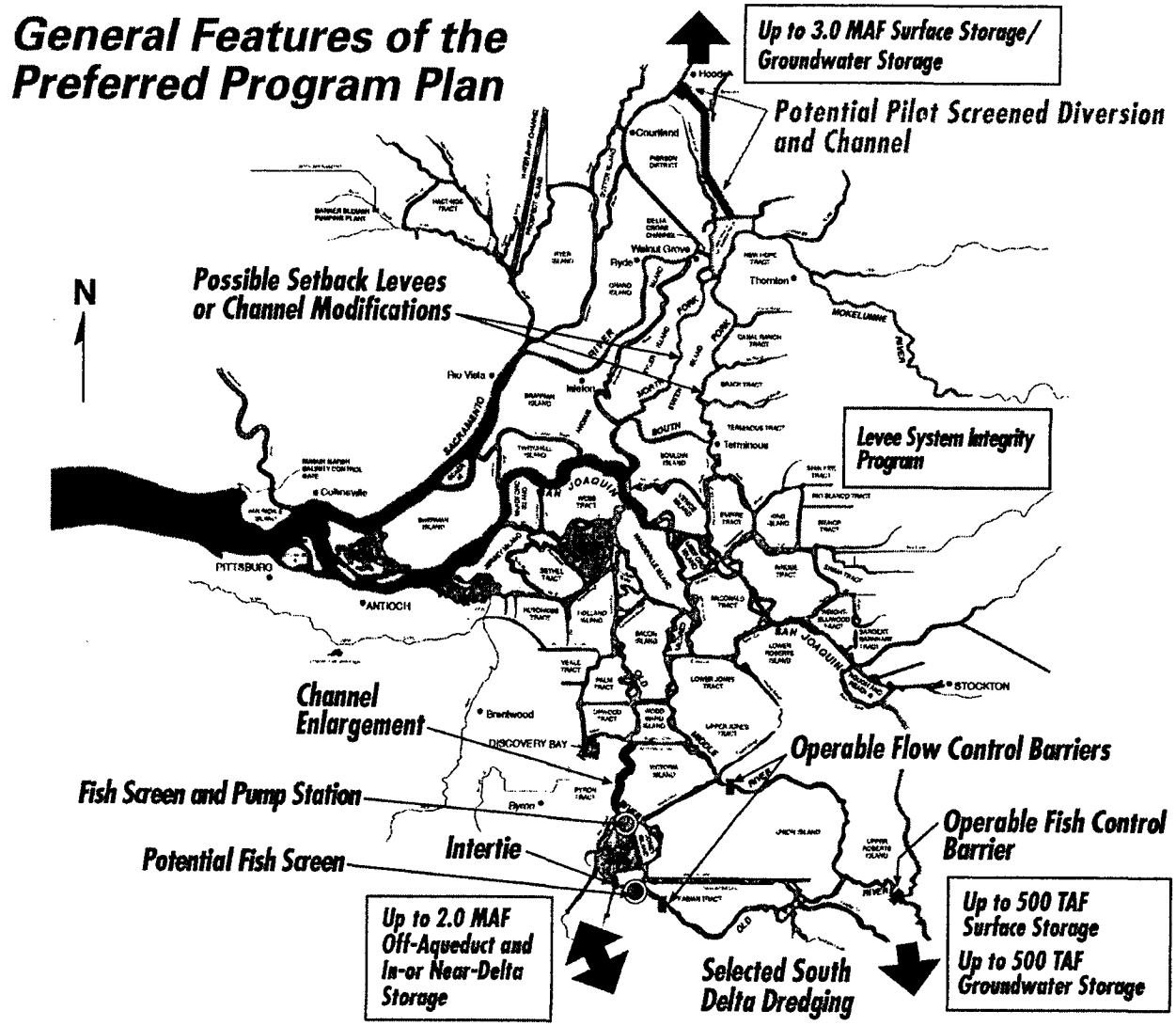
Alternative 3 Assumptions - Criterion A

- No Action & South Delta Criteria A
- Isolated Facility 5,000-15,000 cfs Criterion A
  - Isolated Facility Diversions limited to 5,000 cfs in May
  - 1,000 cfs Min. through-Delta conveyance from October-March and July-September
  - Minimum 3,000 cfs Rio Vista flow maintained
  - Delta Cross Channel gates closed for all months, except June (Dry, Critical, and Below Normal WY)
  - IF diversions included in export restrictions
  - Level II Delta Ag. Diversion from IF (15,000 cfs IF only)

Alternative 3 Assumptions - Criterion B

- No Action & South Delta Criterion B
- Isolated Facility (5,000-15,000 cfs) Criterion B
  - Isolated Facility Diversions are limited to:
    - 5,000 cfs in May, 35% of Sacramento flow in March and June and 15% of Sacramento flow in April and May
  - 1,000 cfs Min. through-Delta conveyance from October-March and July-September
  - Minimum 3,000 cfs Rio Vista flow maintained
  - Delta Cross Channel gates closed for all months, except July and August
  - IF diversion not included in export restrictions

Preferred Program Alternative



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PPA with Hood Diversion Assumptions - Criterion A

- No Action & South Delta Criterion A
- North Delta Criterion A (2,000 cfs Hood Facility)
  - Hood Diversion are limited to:
    - 50% of South Delta exports
    - 5,000 cfs in May
    - 35% of Sacramento flow in March & June
    - 15% of Sacramento flow in April & May
  - Minimum 3,000 cfs Rio Vista flow maintained
  - Delta Cross Channel gates closed for all months, except June (Dry, Critical, and Below Normal WY)

PPA with Hood Diversion Assumptions - Criterion B

- No Action & South Delta Criterion B
- North Delta Criterion B (4,000 cfs Hood Facility)
  - Hood Diversion are limited to:
    - 100% of South Delta exports
    - 5,000 cfs in May
  - Minimum 3,000 cfs Rio Vista flow maintained
  - Delta Cross Channel gates closed for all months, except July and August

CALFED Modeling Studies

Alternative Configuration		Water Management Criteria	Storage Components (Maximum Storage Volumes in MAF)					DWRSIM Study	DWRDSM2 Study
			Sacramento Valley Ground Water Storage	Upstream Surface Storage Sacramento River Trib.	Upstream Surface Storage San Joaquin River Trib.	San Joaquin Valley Ground Water Storage	South of Delta Aqueduct Surface Storage		
Exist Cond.								771	1EX
No Action		A						785	1A-A
		B						786	1A-B
Alternative 1		A						789	1C-A
		A	0.25	3.0	0.25	0.5	2.0	808	
		B						809	
		B	0.25	3.0	0.25	0.5	2.0	801	1C-BS
Alternative 2		A						790	2B-A
		A	0.25	3.0	0.25	0.5	2.0	810	
		B						811	
		B	0.25	3.0	0.25	0.5	2.0	803	2B-BS

Alternative Configuration		Water Management Criteria	Storage Components (Maximum Storage Volumes in MAF)					DWRSIM Study	DWRDSM2 Study
			Sacramento Valley Ground Water Storage	Upstream Surface Storage Sacramento River Trib.	Upstream Surface Storage San Joaquin River Trib.	San Joaquin Valley Ground Water Storage	South of Delta Aqueduct Surface Storage		
Alternative 3	15K IF	A						804	3E-A
		A	0.25	3.0	0.25	0.5	2.0	812	
	5k IF	B						820	
		B	0.25	3.0	0.25	0.5	2.0	791	3B-BS
Preferred Alternative	w/o Hood Diversion	A						789	1C-A
		A	0.25	3.0	0.25	0.5	2.0	808	
		B						809	
		B	0.25	3.0	0.25	0.5	2.0	801	1C-BS
	w/ Hood Diversion	A						793	2P-A
		A	0.25	3.0	0.25	0.5	2.0	821	
		B						822	
		B	0.25	3.0	0.25	0.5	2.0	792	2P-BS

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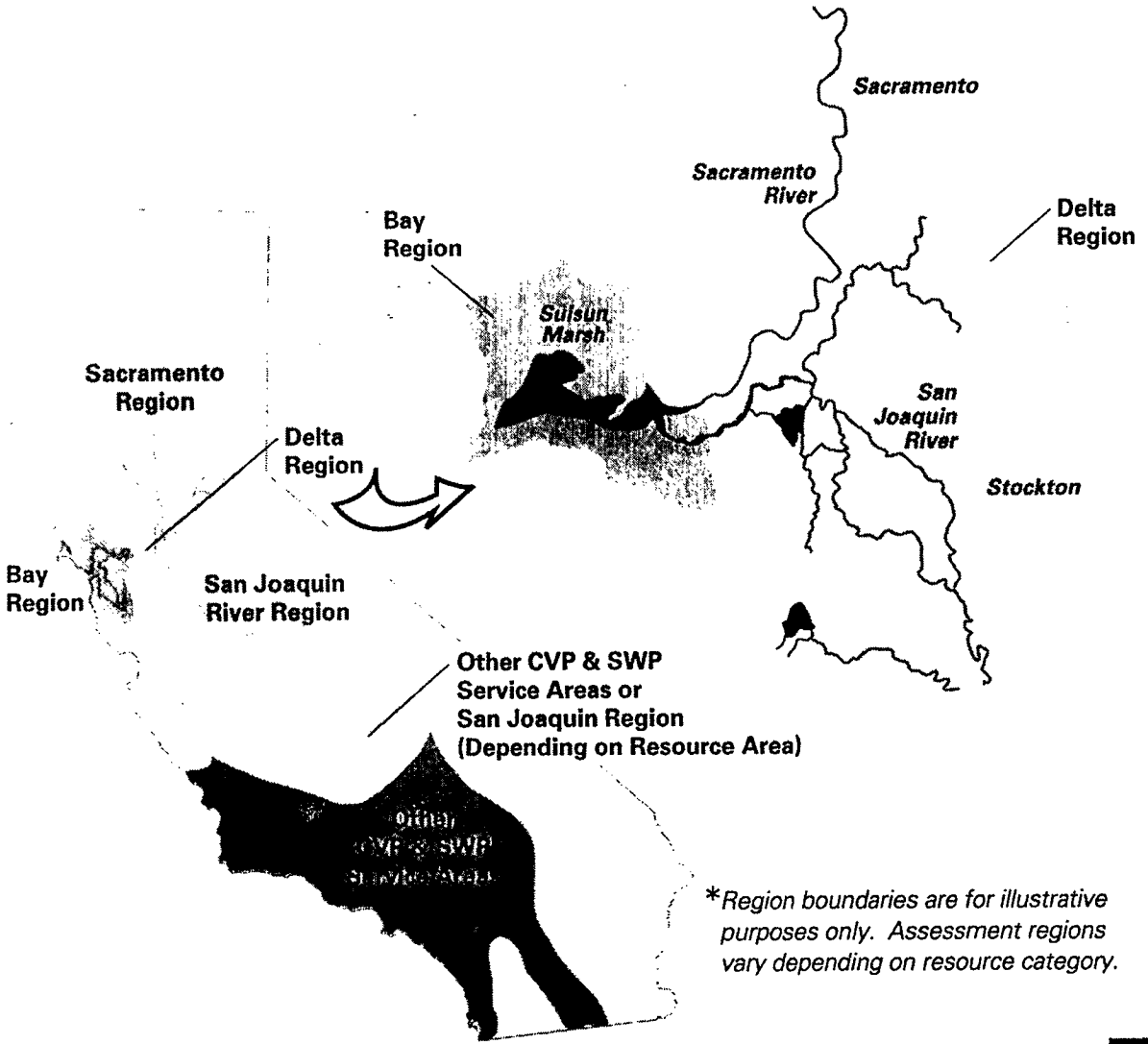
Five Program Regions

- Delta
- Bay
- Sacramento River
- San Joaquin River
- Other SWP / CVP Service Areas
  - –South of Delta SWP / CVP Service Areas
  - –Outside Central Valley

PEIS/R Assessment Regions



*Region boundaries are for illustrative purposes only. Assessment regions vary depending on resource category.

Assessment Modeling

- Department of Water Resources Planning Simulation Model (DWRSIM)
- Delta Simulation Model 2 (DSM2)

Evaluation Approach

- Long Term Monthly Averages
- Dry and Critical WY Monthly Averages
- Monthly Exceedance
- Monthly Time Series

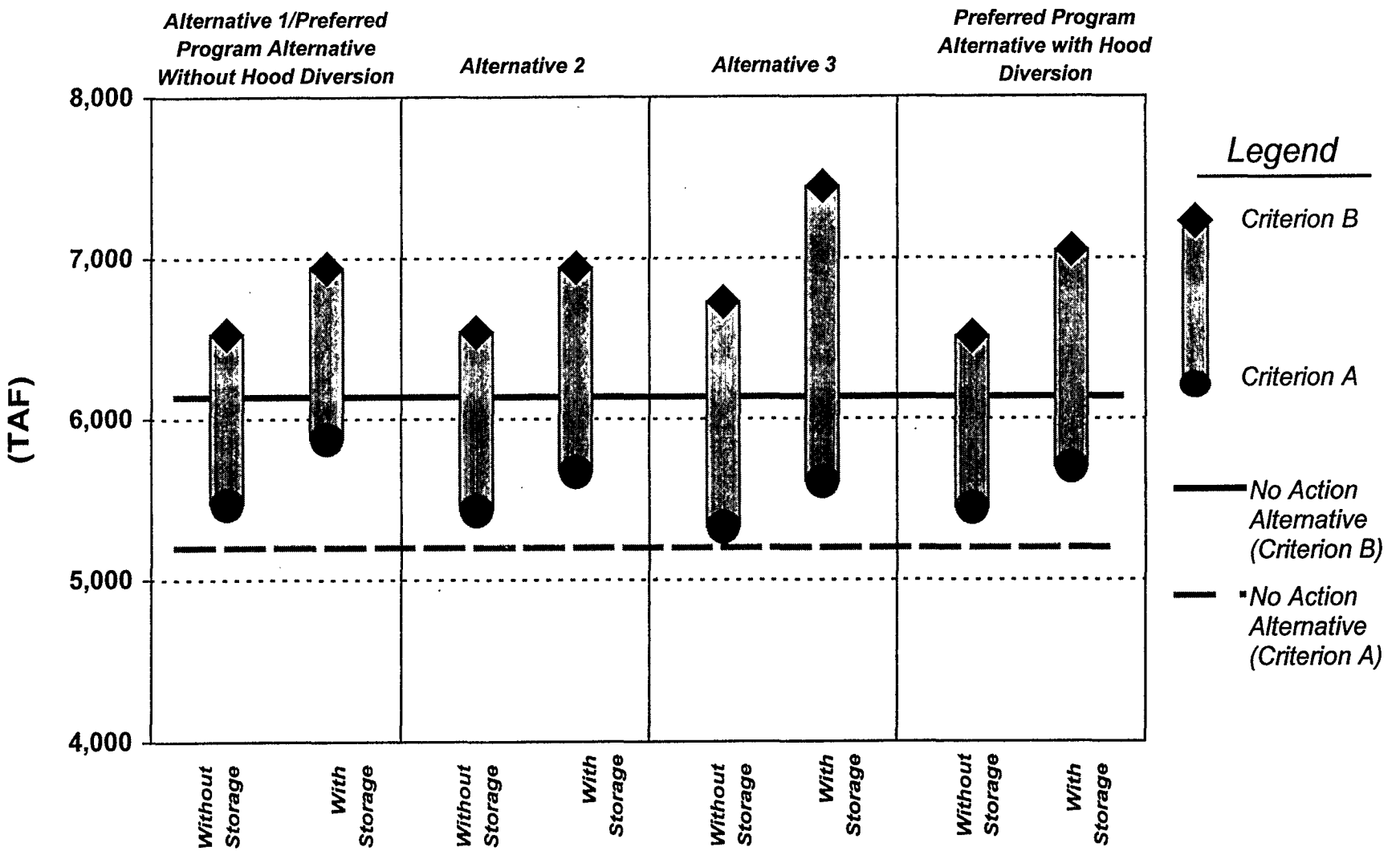
Section 5.1

Water Supply
and
Water Management

Delta Region Assessments

- Delta Exports (Banks and Tracy)
- Hood / Isolated Facility Diversions

Average Annual Delta Exports under All Program Alternatives - Long Term Period



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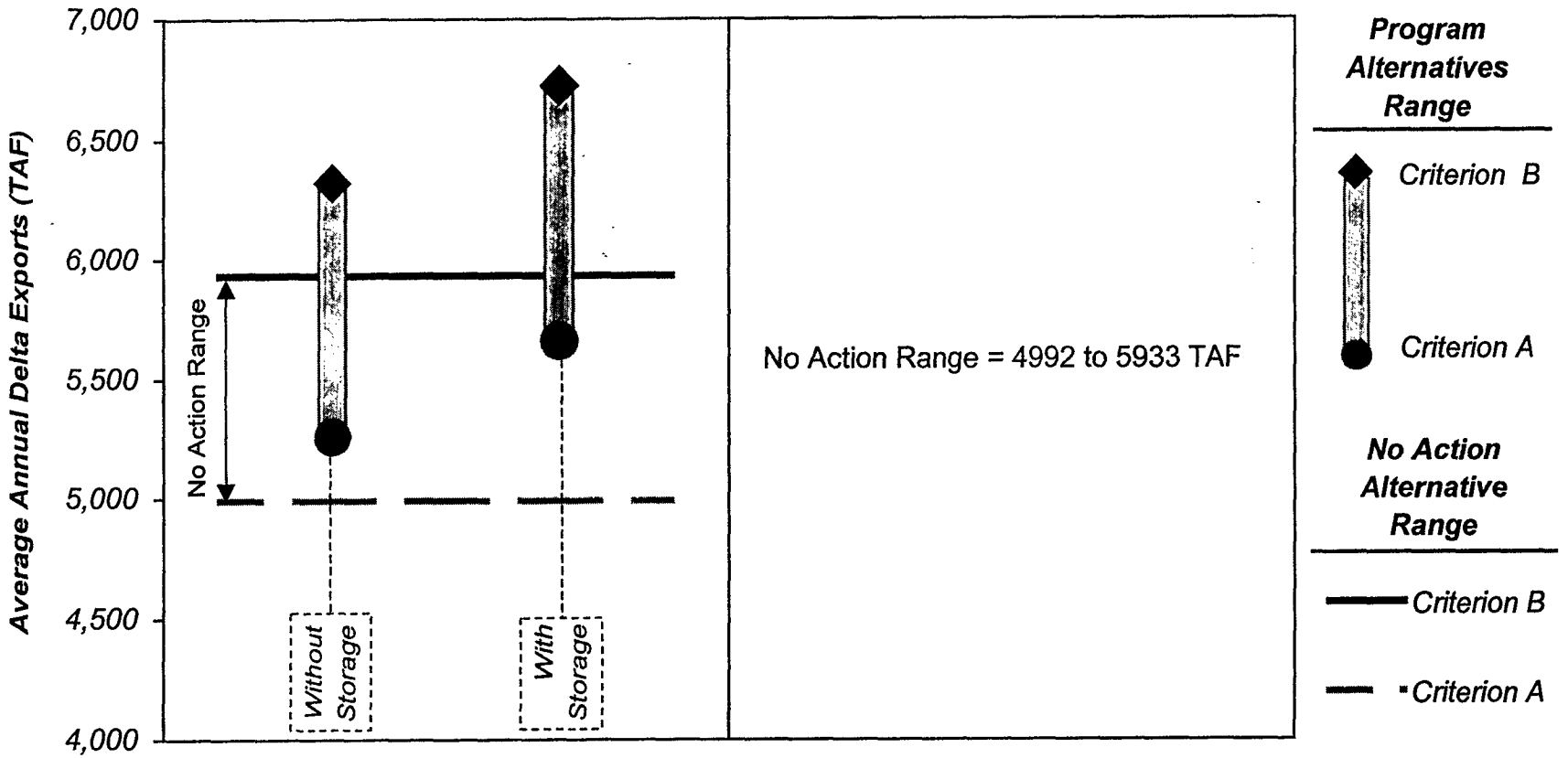
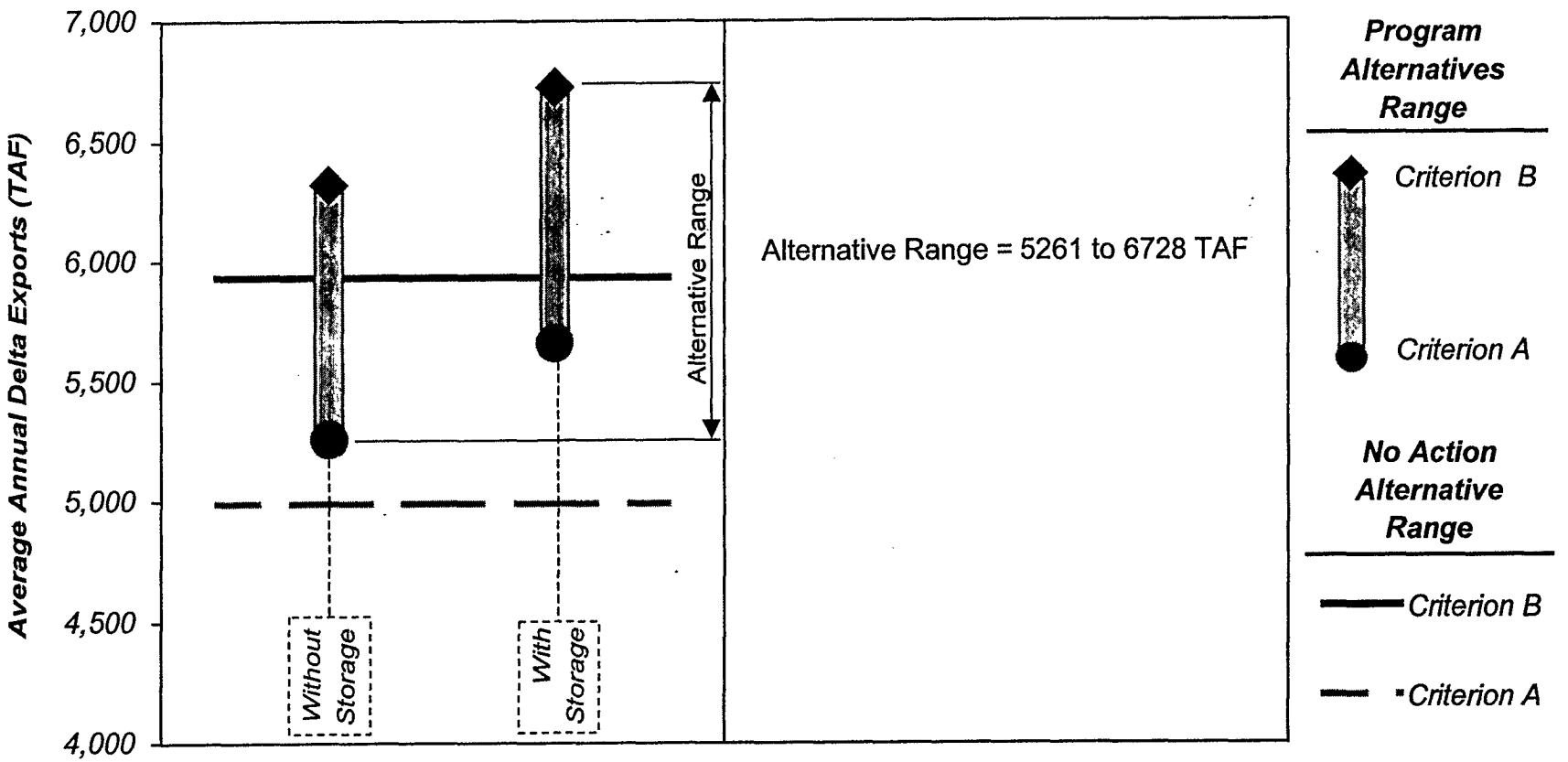
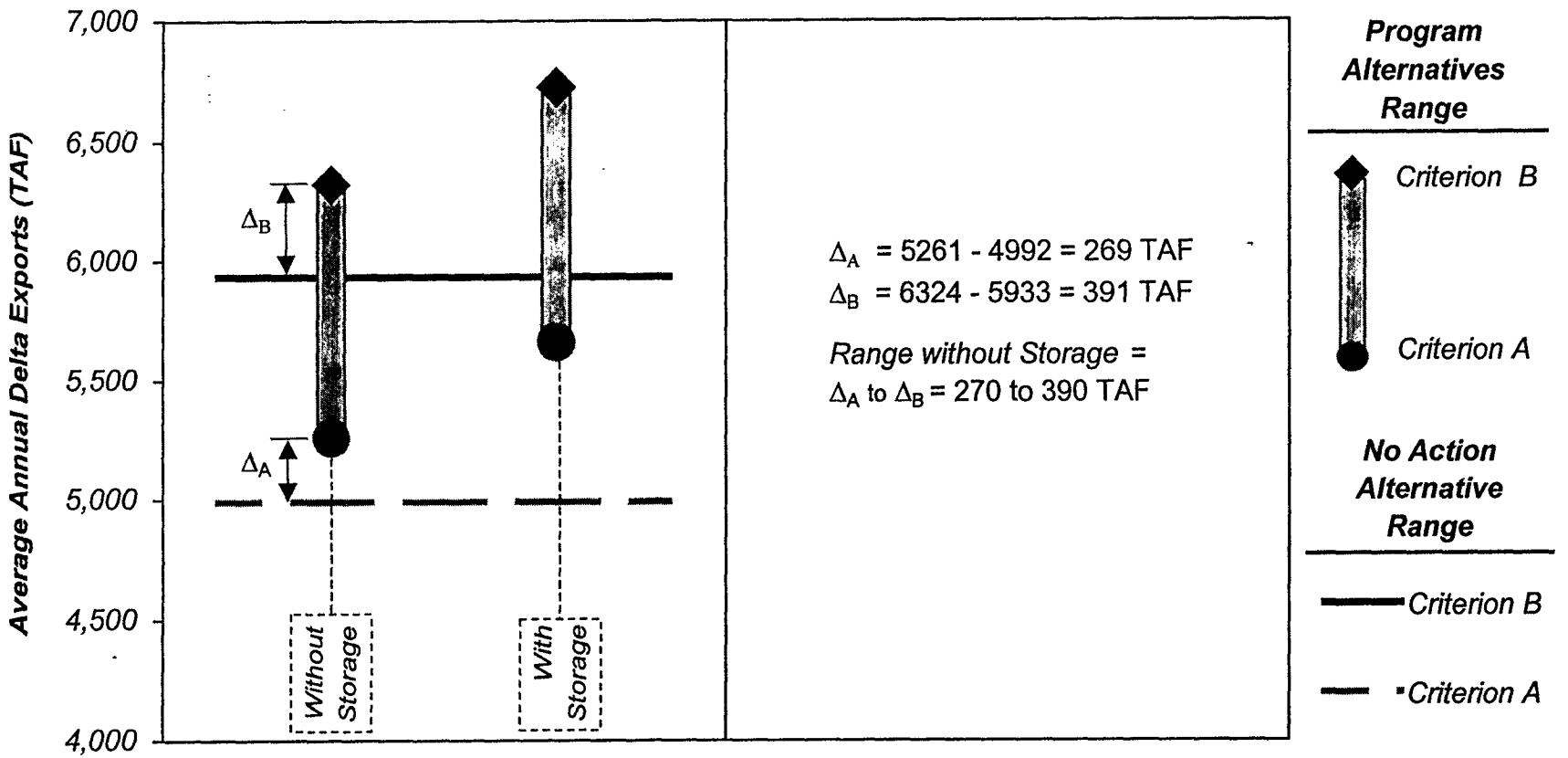
Example Delta Export Assessment Graph under Alternative 1 - Long Term Period



Example Delta Export Assessment Graph under Alternative 1 - Long Term Period



Example Delta Export Assessment Graph under Alternative 1 - Long Term Period



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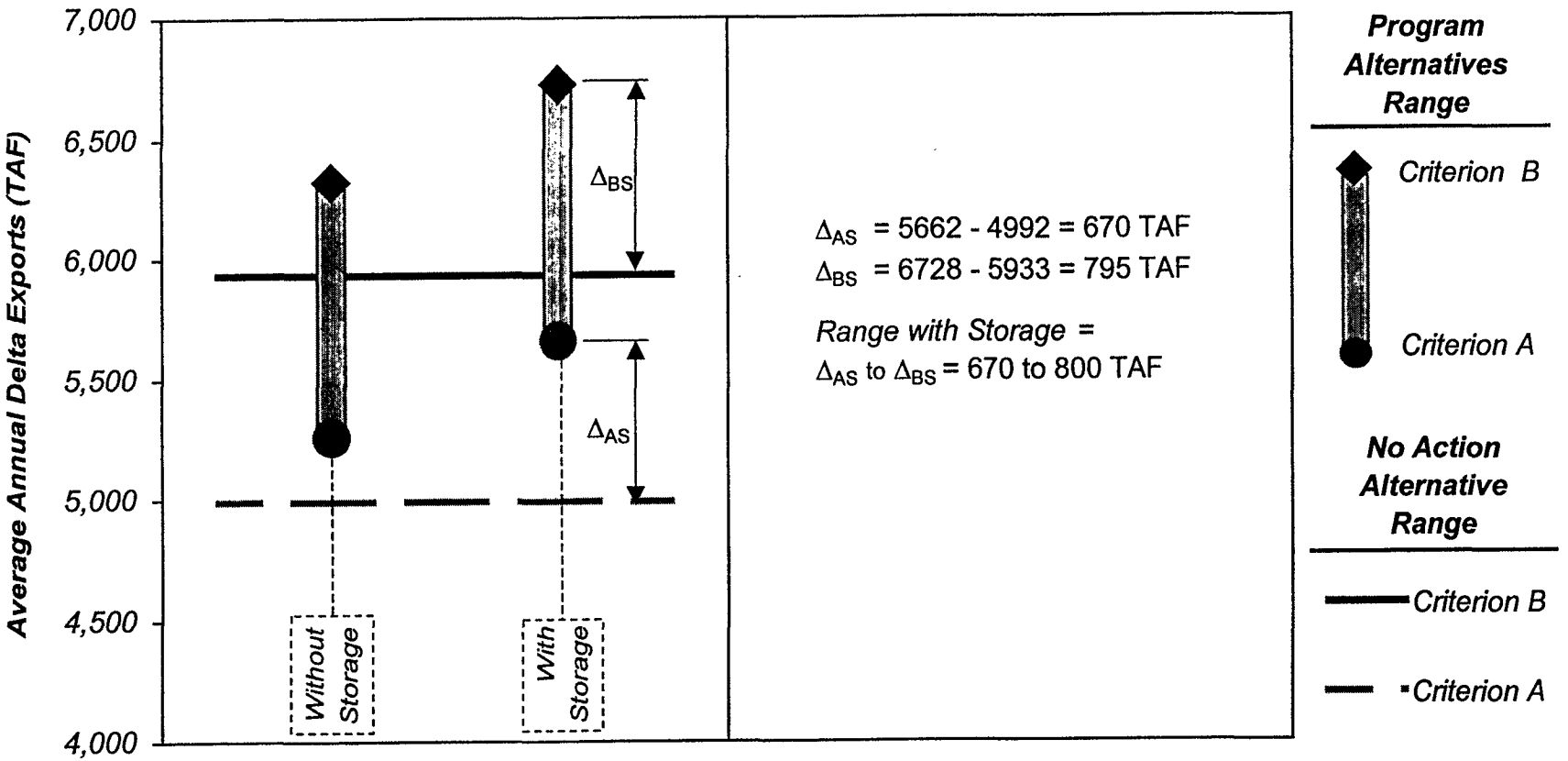
Example Delta Export Assessment Graph under Alternative 1 - Long Term Period



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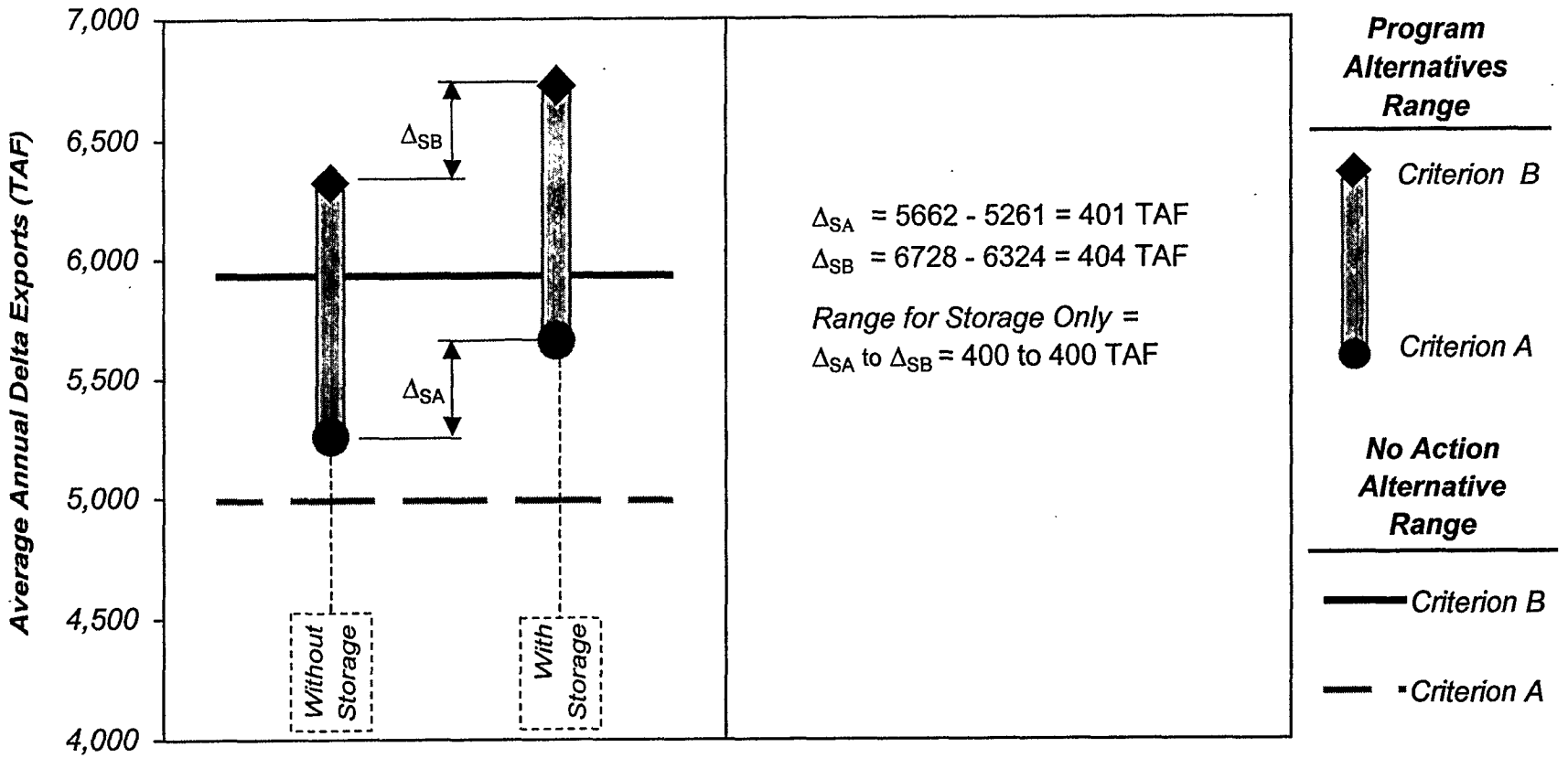
Example Delta Export Assessment Graph under Alternative 1 - Long Term Period



Summary of Delta Exports under All Program Alternatives - Long Term Period

	No Action	Alt 1/PPA (Without Hood)	Alt 2	Alt 3	PPA (With Hood)
High Export Month (January)	560 - 680	540 - 760	540 - 760	560 - 760	540 - 790
Low Export Month (May)	120 - 200	120 - 210	120 - 210	120 - 200	120 - 210
Annual Difference Without Storage	---	270 - 390	230 - 400	140 - 590	250 - 380
Annual Difference With Storage	---	670 - 800	460 - 800	410 - 1,310	490 - 900

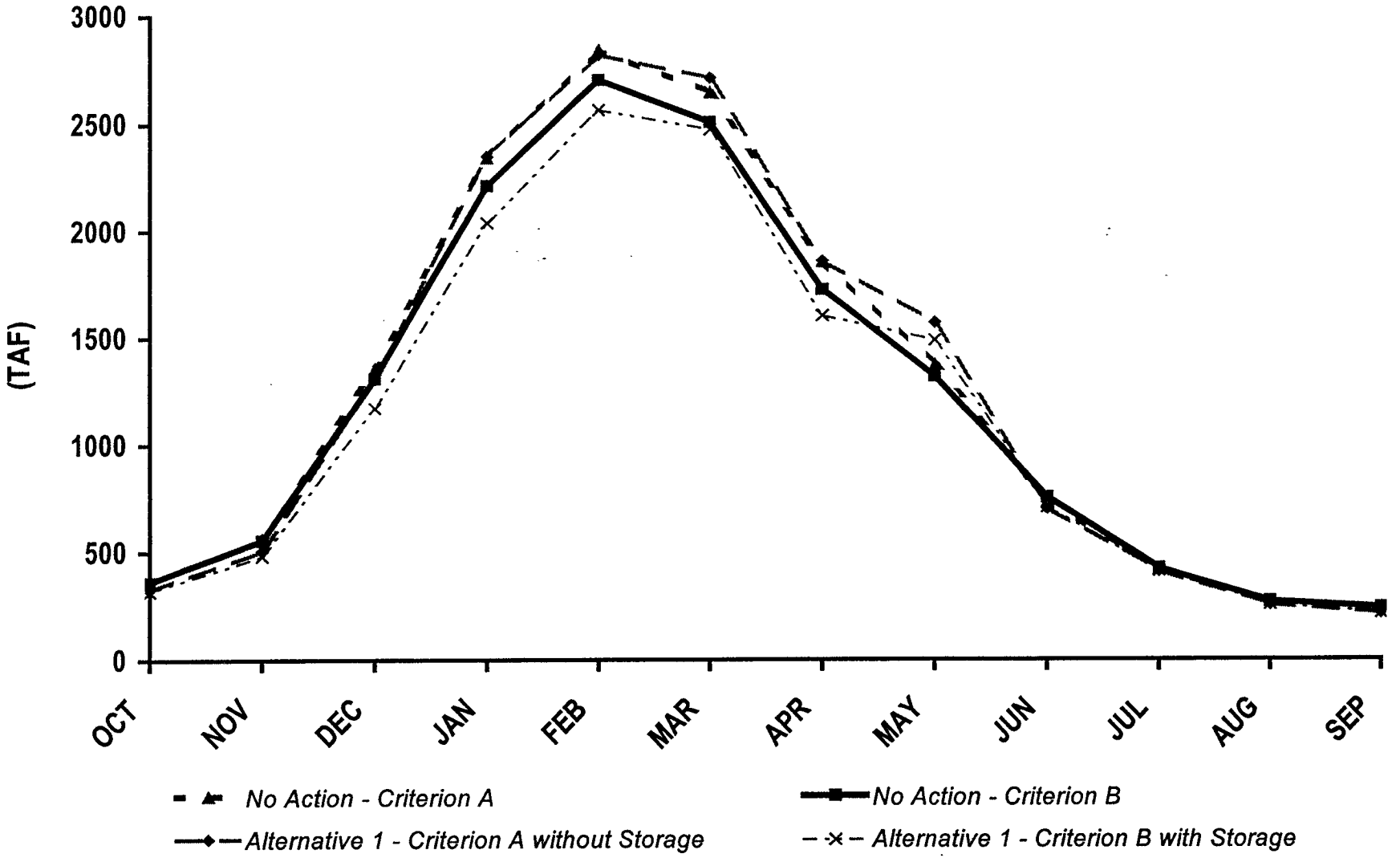
PPA = Preferred Program Alternative

Note: Units in thousand acre-feet

Bay Region Assessments

- Delta Outflow

Delta Outflow under Alternative 1
Long Term Period



Delta Outflow under All Program Alternatives
Long Term Period

	No Action	Alt 1/PPA (Without Hood)	Alt 2	Alt 3	PPA (With Hood)
High Outflow Month (February)	2,700 - 2,840	2,560 - 2,840	2,560 - 2,840	2,560 - 2,760	2,550 - 2,810
Annual Difference Without Storage	-	(-80) - 30	(-90) - 60	(-250) - 220	(-70) - 50
Annual Difference With Storage	-	(-660) - (-460)	(-660) - (-270)	(-1,100) - (-150)	(-760) - (-290)

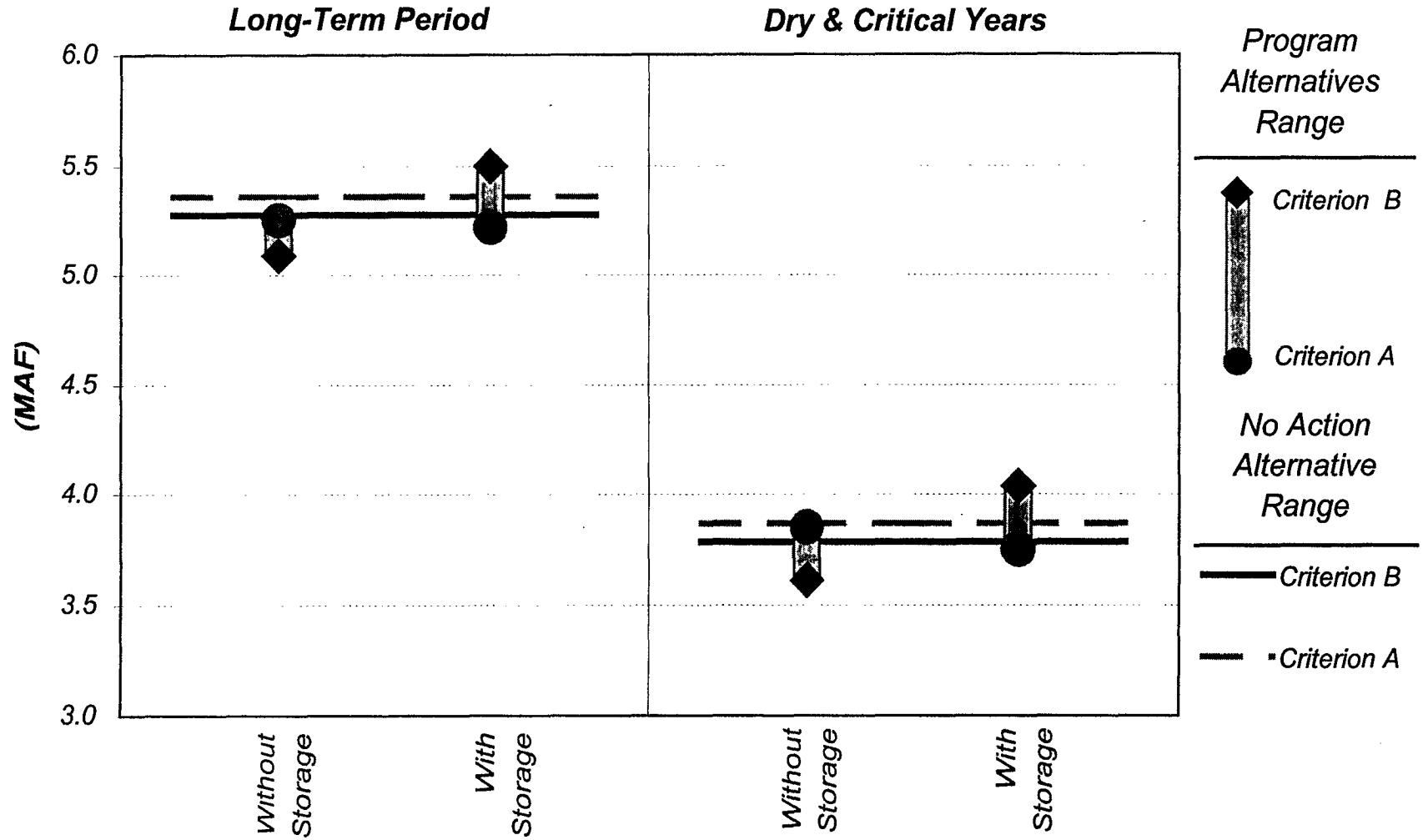
PPA = Preferred Program Alternative

Note: Units in thousand acre-feet

Sacramento River and San Joaquin River Assessments

- Proposed ERP Water Acquisitions
- Cumulative Existing Storage
    1) Sacramento River (Shasta, Oroville, Folsom)
    2) San Joaquin River (New Melones, New Don Pedro, McClure)
- New Surface Storage
    1) Sacramento River
    2) San Joaquin River

Carryover Storage for Existing Surface Reservoirs in the Sacramento River Region under Alternative 1



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ERP Water Acquisitions Without New Storage

Location	Critical	Dry	Below Normal	Above Normal	Wet
Sacramento River	0	0 - 10	90	20	0
Yuba River	0	10	<10	0	0
Feather River	0	50	80	60	<10
American River	0	30	40	20	40
Lower Sacramento River	0	80 - 100	10	0	<10
Additional Delta Flows	0	90 - 110	180 - 210	250 - 270	10
Stanislaus River	0	10	30	40	40
Tuolumne River	50	40	40	50	40
Merced River	40	20	20	40	30
Total Acquisitions	90	330 - 380	490 - 520	480 - 500	160

Note: Units in thousand acre-feet

ERP Water Acquisitions With New Storage

Location	Critical	Dry	Below Normal	Above Normal	Wet
Sacramento River	0	<10	30 - 50	0 - 10	0
Yuba River	0	10	<10	0	0
Feather River	0	40	70	40	0
American River	0	30	40	20	40
Lower Sacramento River	0	0 - 30	0	0	0
Additional Delta Flows	0	30 - 40	110 - 120	180 - 200	<10
Stanislaus River	0	10	30	40	40
Tuolumne River	60	30	20	30	20
Merced River	30	10	0	10	10
Total Acquisitions	90	160 - 200	300 - 330	320 - 350	110

Note: Units in thousand acre-feet

South of Delta CVP / SWP Service Area Assessments

- CVP / SWP Deliveries
- Cumulative Existing Off-Aqueduct Storage (San Luis)
- New Off-Aqueduct Surface Storage

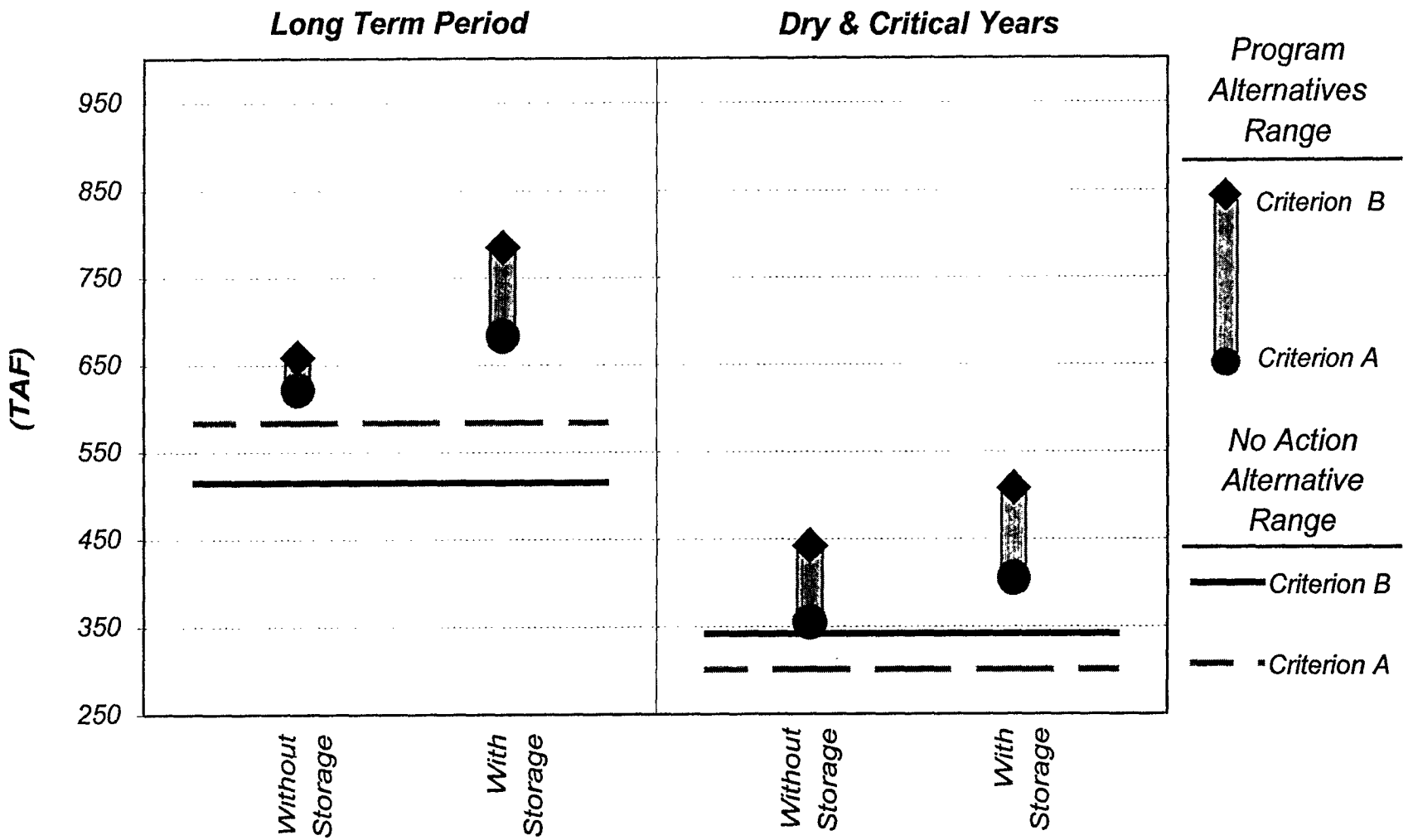
Total Delta Deliveries under All Program Alternatives - Long Term Period

	No Action	Alt 1/PPA (Without Hood)	Alt 2	Alt 3	PPA (With Hood)
Total Annual Deliveries	4,820 - 5,750	5,090 - 6,540	5,060 - 6,540	4,960 - 7,000	5,070 - 6,660
Annual Difference Without Storage	---	270 - 380	240 - 400	140 - 560	250 - 370
Annual Difference With Storage	---	670 - 790	450 - 790	380 - 1,250	470 - 910

PPA = Preferred Program Alternative

Note: Units in thousand acre-feet

Carryover Storage for San Luis Reservoir under Alternative 1



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Section 5.2

Bay-Delta Hydrodynamics and Riverine Hydraulics

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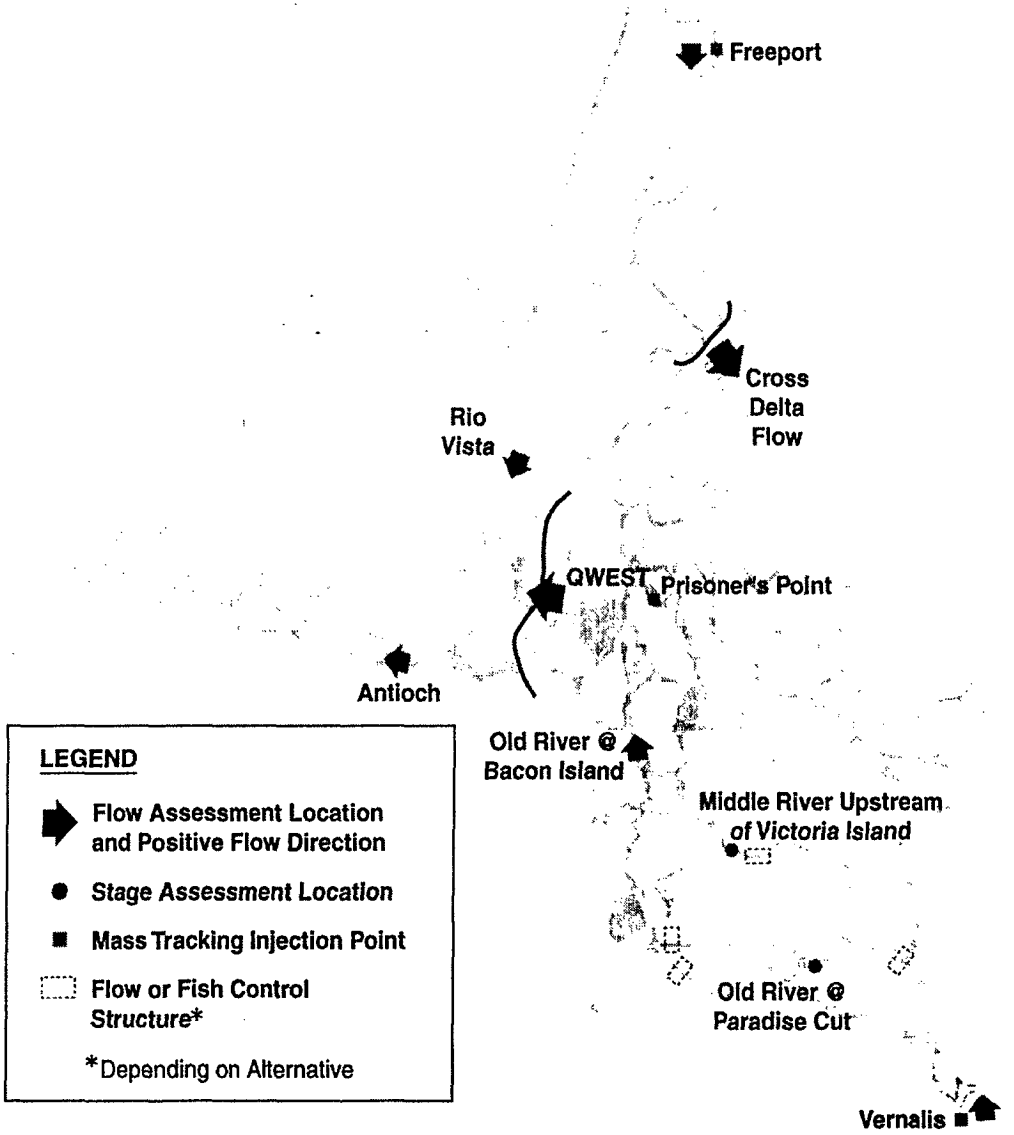
Delta Region Assessments

- Flow
- Stage
- Mass Tracking

Flow Assessments

- Sacramento River @ Rio Vista
- QWEST
- Cross Delta Flow
- Old River @ Bacon Island
- San Joaquin River @ Antioch

Assessment Locations



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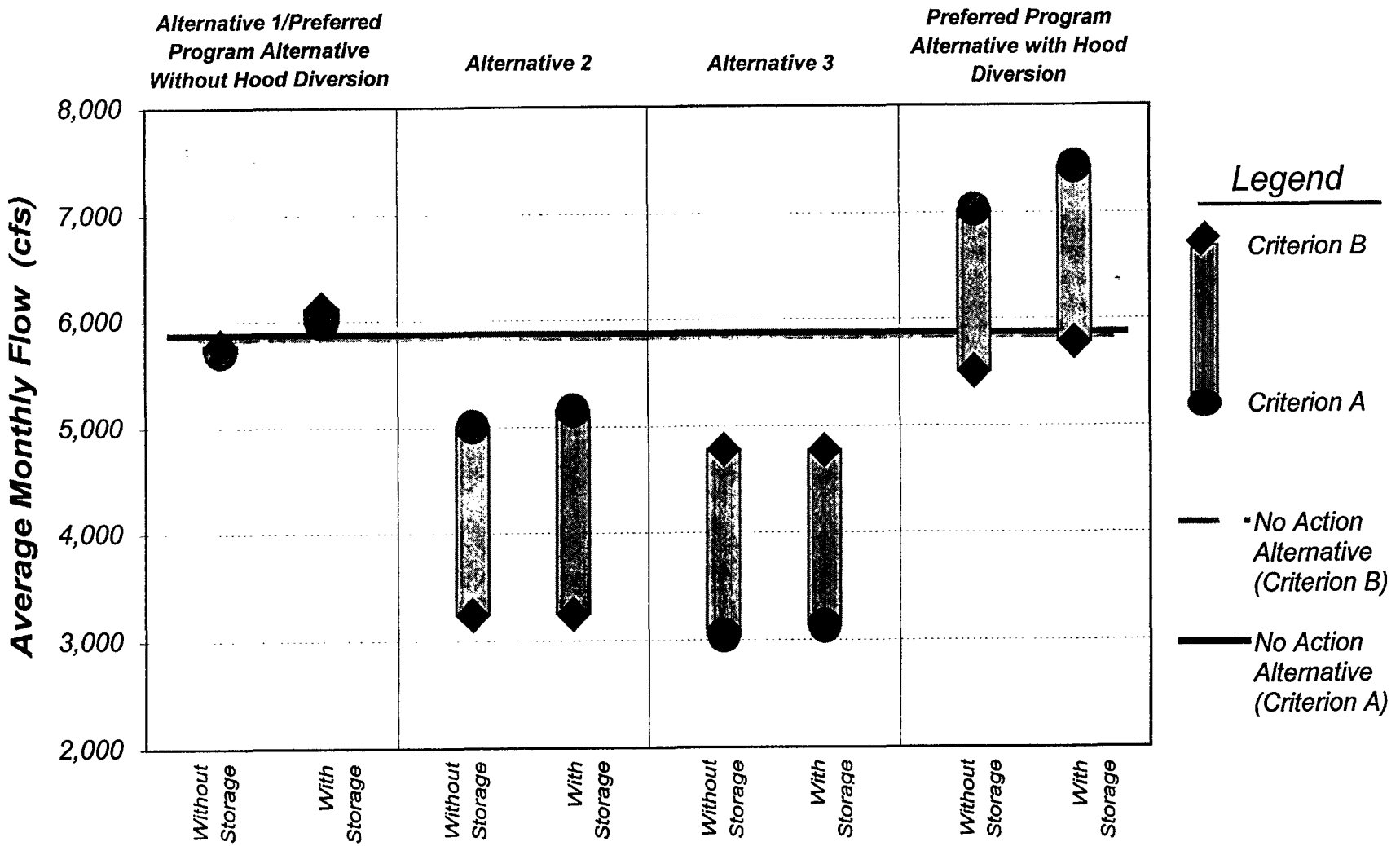
Rio Vista Flows for September under All Program Alternatives - Long Term Period



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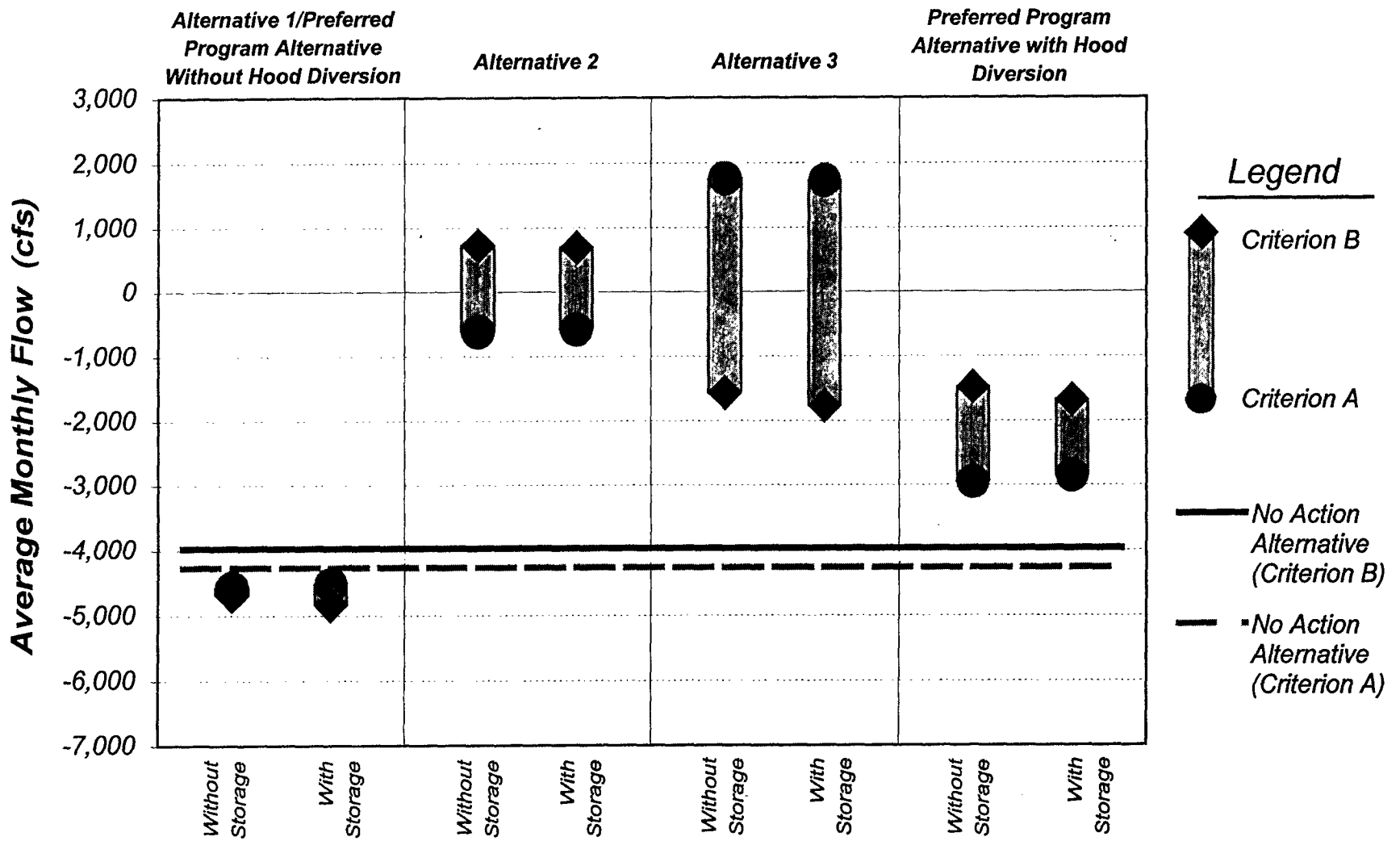
Sacramento River Flow @ Rio Vista under All Program Alternatives - Long Term Period

	No Action	Alt 1/PPA (Without Hood)	Alt 2	Alt 3	PPA (With Hood)
Peak Monthly Flow (February)	42,600 - 42,900	41,600 - 42,500	34,100 - 39,300	35,200 - 37,900	38,400 - 40,800
Low Monthly Flow (September)	5,800 - 5,900	5,700 - 6,100	3,200 - 5,200	3,000 - 4,800	5,500 - 7,400

PPA = Preferred Program Alternative

Note: Units in cubic feet per second

QWEST Flows for October under All Program Alternatives - Long Term Period



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QWEST Flow under All Program Alternatives Long Term Period

	No Action	Alt 1/PPA (Without Hood)	Alt 2	Alt 3	PPA (With Hood)
Peak Positive Monthly Flow (April)	6,400 - 9,100	5,800 - 9,100	8,900 - 10,300	6,100 - 11,200	8,300 - 10,000
Peak Negative Monthly Flow (October)	(-4,000) - (-4,300)	(-4,800) - (-4,500)	(-600) - 700	(-1,800) - 1,800	(-3,000) - (-1,500)

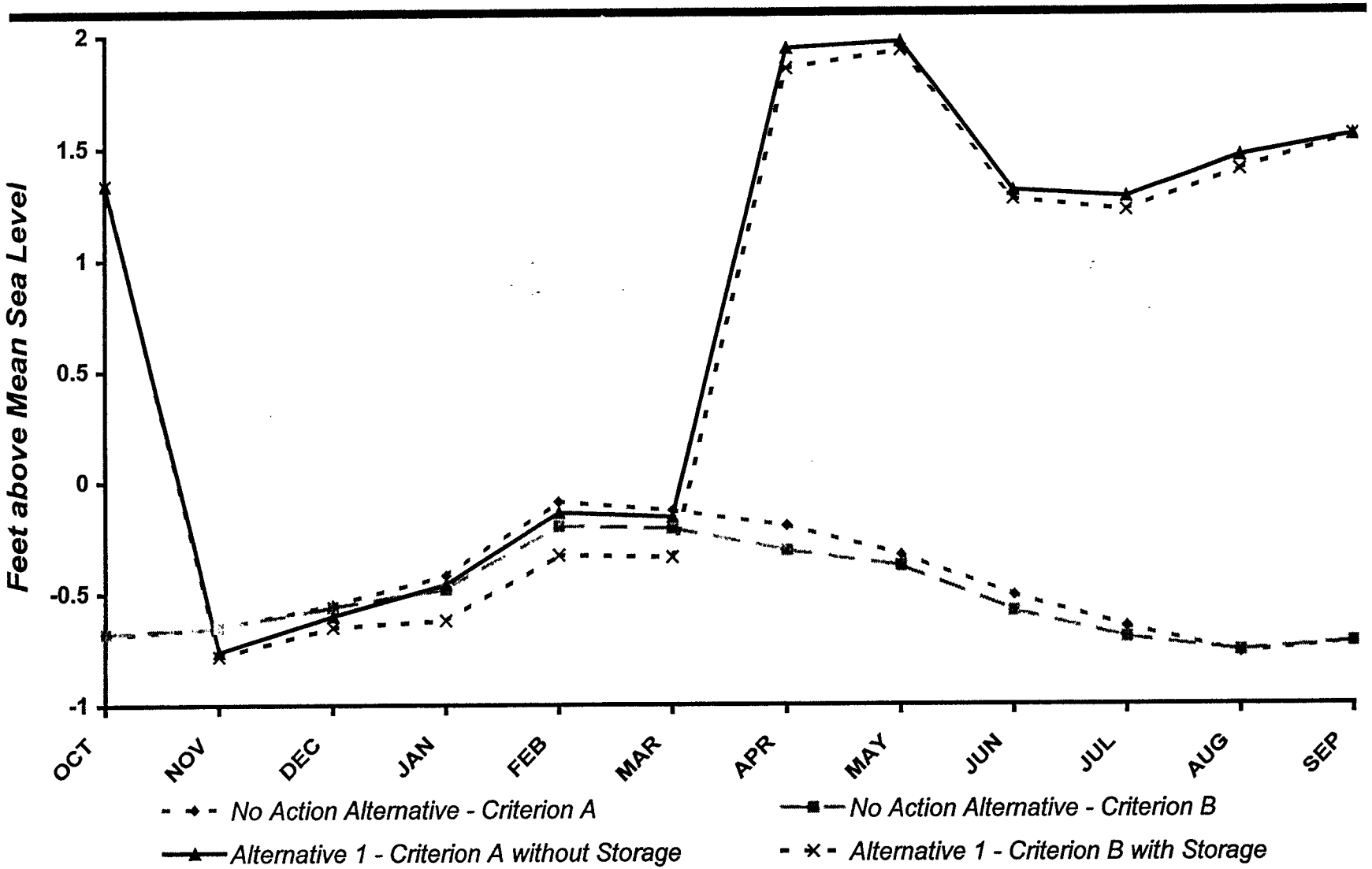
PPA = Preferred Program Alternative

Note: Units in cubic feet per second

Stage Assessments

- Old River @ Paradise Cut
- Middle River Upstream of Victoria Island

Stage along Middle River Upstream of Victoria Island under Alternative 1 - Long Term Period



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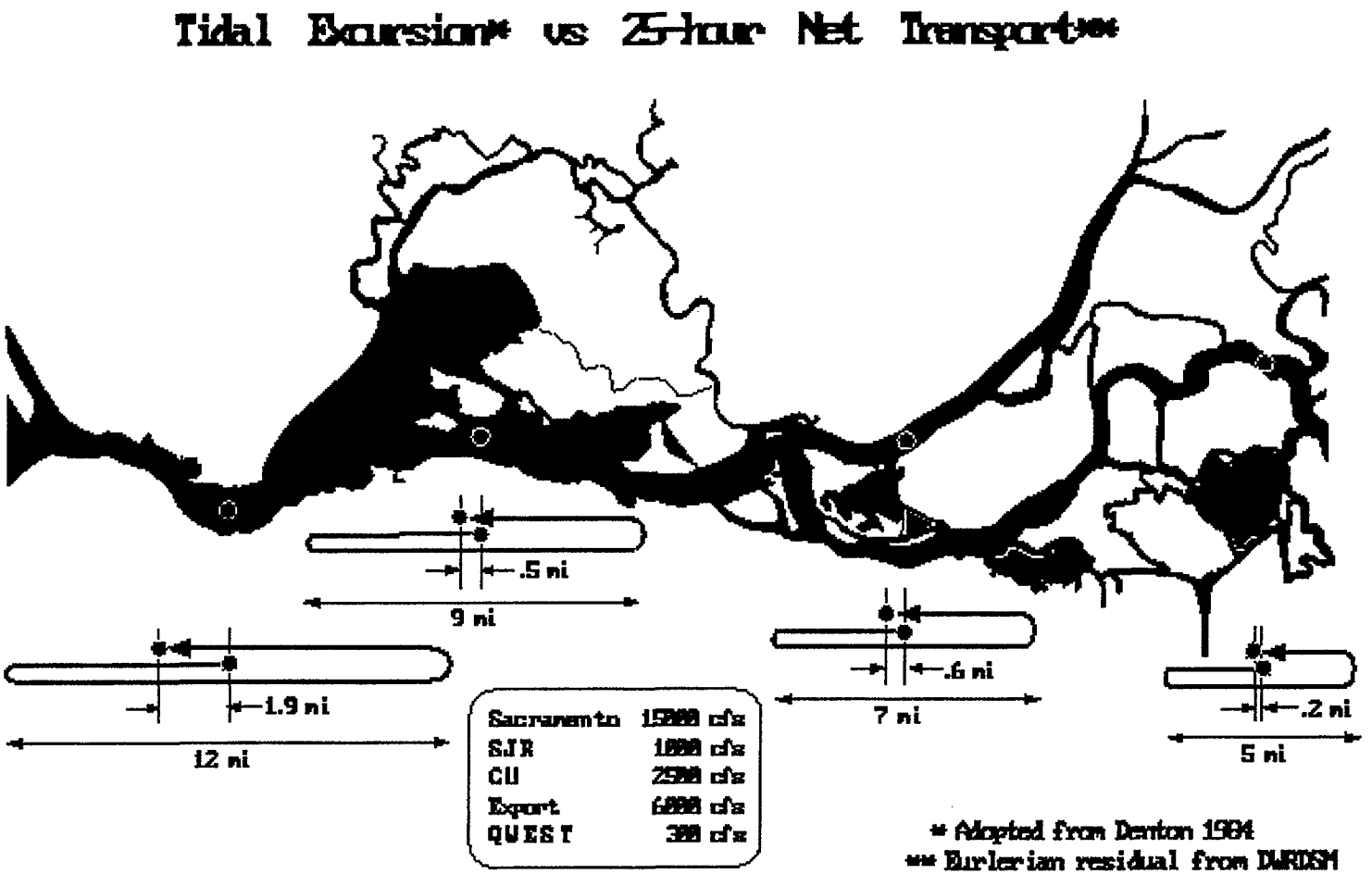
Mass Tracking Assessments

- High Inflow / High Export Conditions
- Low Inflow / High Export Conditions
- Mass Injection Locations
  - Freeport
  - Prisoner's Point
  - Vernalis

Delta Tidal Excursion



Mass Tracking Results - All Program Alternatives
High Inflow / High Export Conditions (%)

Alternative	Chipps Island	Exports	Delta Islands	In-Channel
Mass Injection at Freeport				
Existing Condition	96.5	1.7	0.6	1.2
No Action (Alt. 1A)	95.0	3.0	0.6	1.4
Alternative 1C-BS	88.8	8.4	0.6	2.2
Alternative 2B-BS	85.0	13.3	0.8	0.9
Alternative 3X-BS	72.3	27.0	0.4	0.3
Alternative 2P-BS	86.5	11.0	0.8	1.7
Mass Injection at Prisoners Point				
Existing Condition	77.8	15.8	1.3	5.1
No Action (Alt. 1A)	65.8	26.8	1.1	6.3
Alternative 1C-BS	33.2	59.5	1.0	6.3
Alternative 2B-BS	55.7	42.3	0.8	1.2
Alternative 3X-BS	97.8	0.0	0.5	1.7
Alternative 2P-BS	45.3	50.7	1.0	3.0
Mass Injection at Vernalis				
Existing Condition	8.8	82.6	2.4	6.2
No Action (Alt. 1A)	4.4	89.5	2.1	4.0
Alternative 1C-BS	0.7	96.2	1.9	1.2
Alternative 2B-BS	1.5	95.8	1.9	0.8
Alternative 3X-BS	38.3	39.8	3.0	18.9
Alternative 2P-BS	0.9	96.3	1.9	0.9

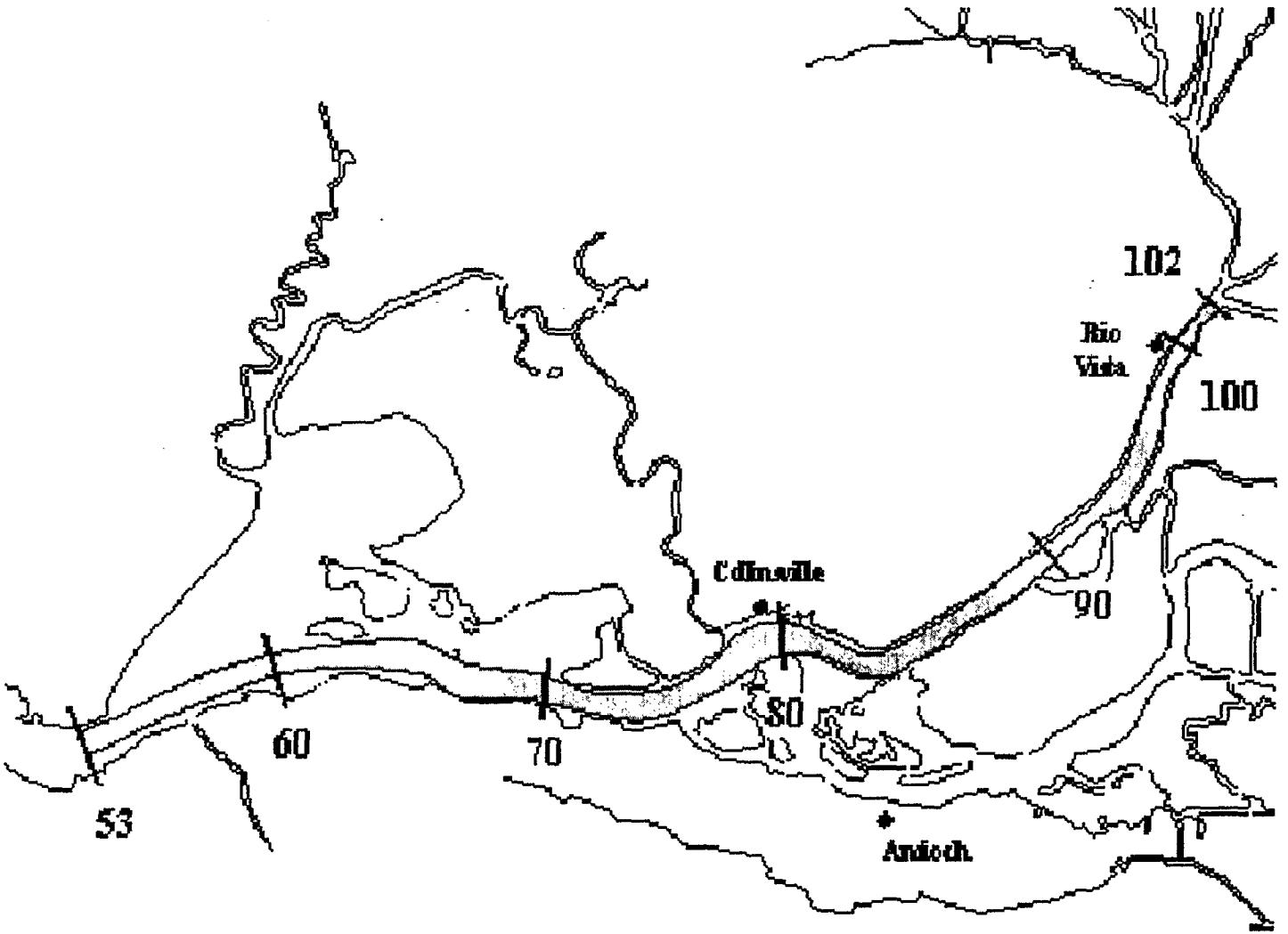
Mass Tracking Results - All Program Alternatives Low Inflow / High Export Conditions (%)

Alternative	Chipps Island	Exports	Delta Islands	In-Channel
Mass Injection at Freeport				
Existing Condition	19.8	39.0	6.5	34.7
No Action (Alt. 1A)	19.7	41.6	7.5	31.2
Alternative 1C-BS	19.1	40.3	7.6	33.0
Alternative 2B-BS	11.6	44.7	7.9	35.8
Alternative 3X-BS	16.5	47.6	4.2	31.7
Alternative 2P-BS	21.0	45.0	7.0	27.0
Mass Injection at Prisoners Point				
Existing Condition	7.7	69.1	3.5	19.7
No Action (Alt. 1A)	6.4	73.2	4.3	16.1
Alternative 1C-BS	7.2	70.3	4.3	18.2
Alternative 2B-BS	9.9	65.9	4.2	20.0
Alternative 3X-BS	16.5	6.9	5.4	71.2
Alternative 2P-BS	4.5	80.9	4.2	10.4
Mass Injection at Vernalis				
Existing Condition	0.0	92.4	6.0	1.6
No Action (Alt. 1A)	0.0	91.4	7.6	1.0
Alternative 1C-BS	0.0	76.0	13.2	10.8
Alternative 2B-BS	0.0	76.3	13.2	10.5
Alternative 3X-BS	0.2	5.7	16.3	77.8
Alternative 2P-BS	0.0	81.6	12.9	5.5

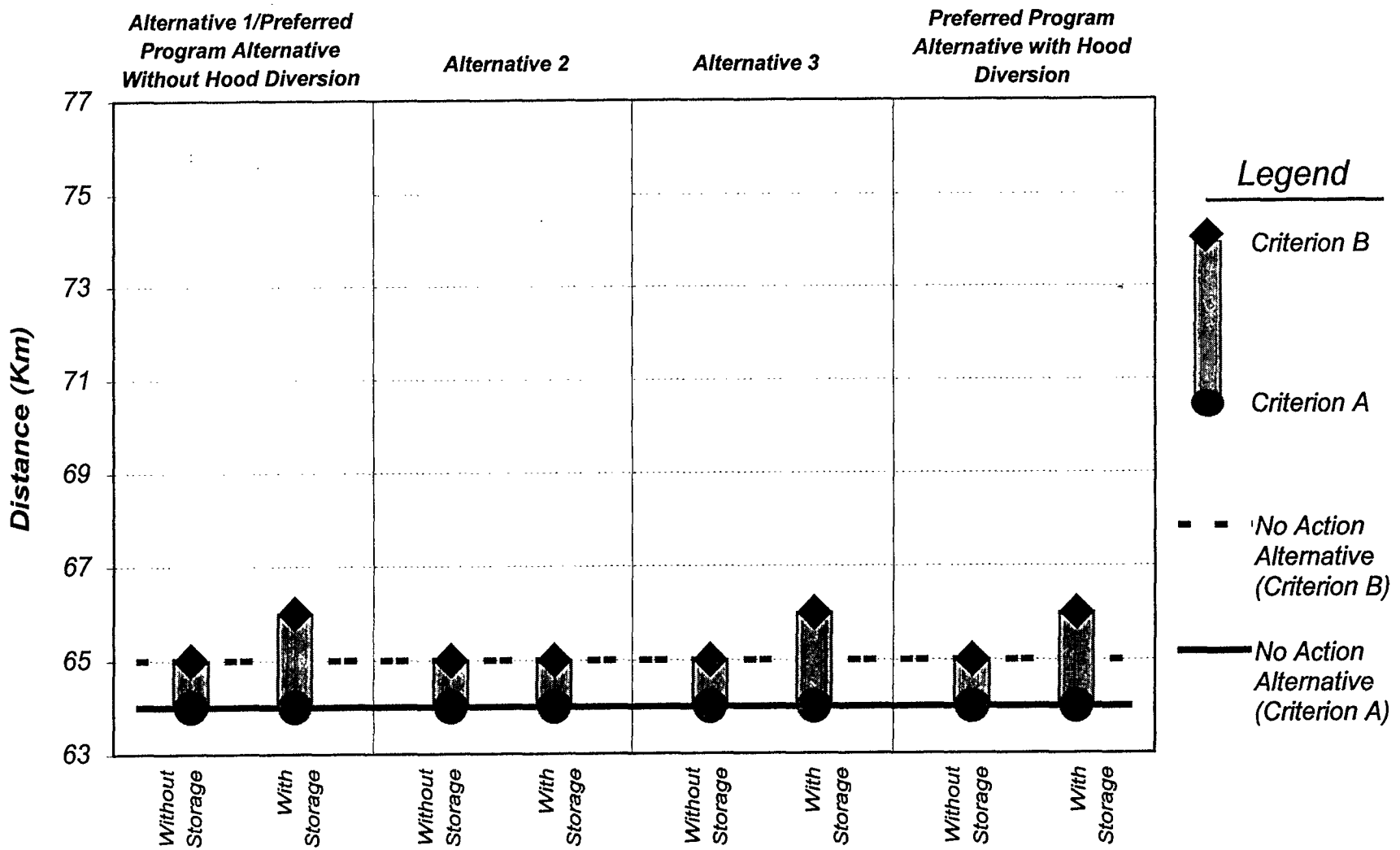
Bay Region Assessments

- X2 Position
  - The mean distance in kilometers from the Golden Gate Bridge where the bottom salinity concentration is 2 parts per thousand and the electrical conductivity is 2,640 μmhos/cm

Distance from Golden Gate Bridge in Kilometers



March X2 Position under All Program Alternatives - Long Term Period



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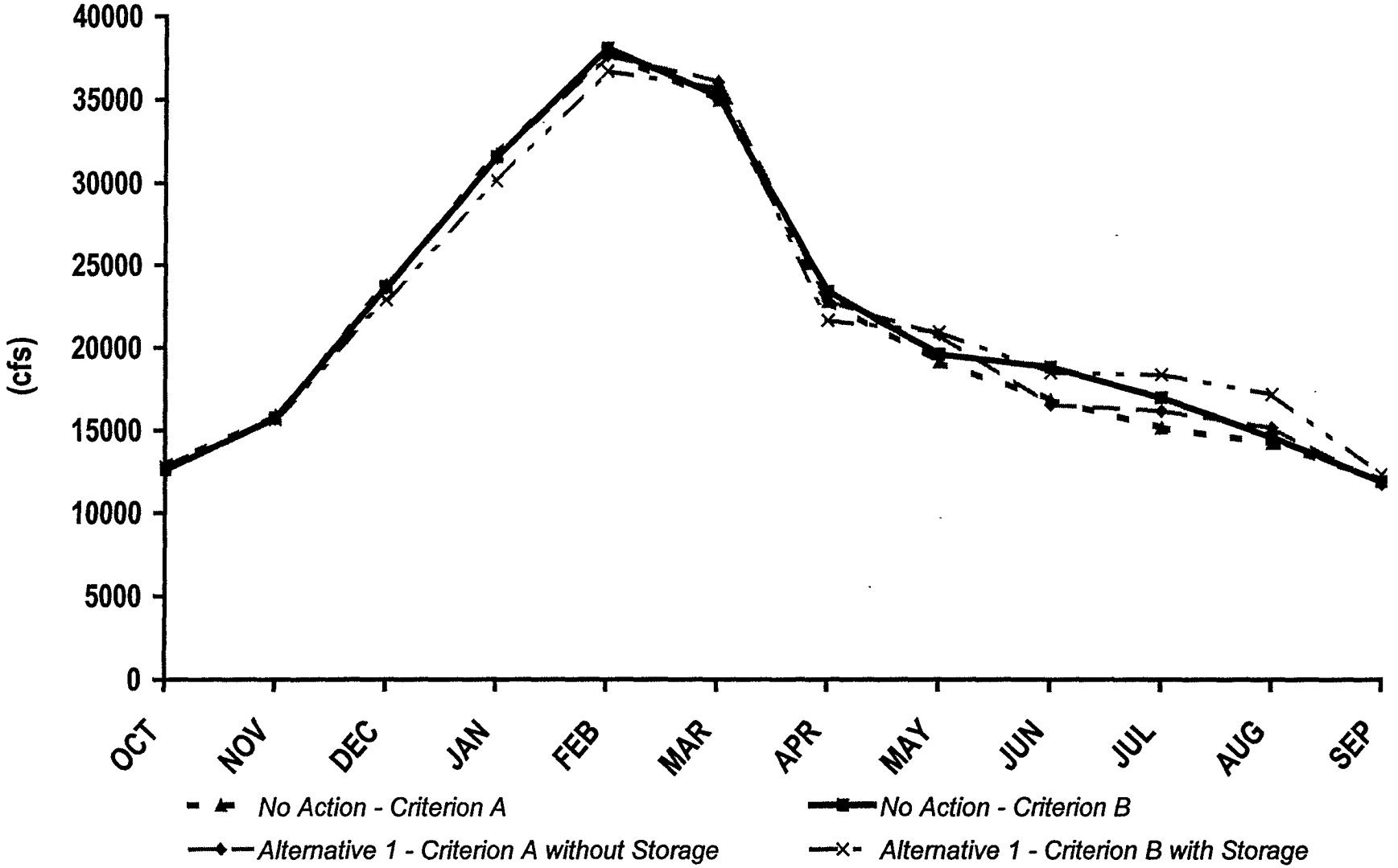
Sacramento and San Joaquin River Region Assessments

- Existing Reservoir Releases
- New Surface Storage Diversions and Releases
    1) Sacramento River
    2) San Joaquin River
- River Flows
    1) Sacramento River at Freeport
    2) San Joaquin River at Vernalis

Sacramento River Flow at Freeport under Alternative 1 - Long Term Period



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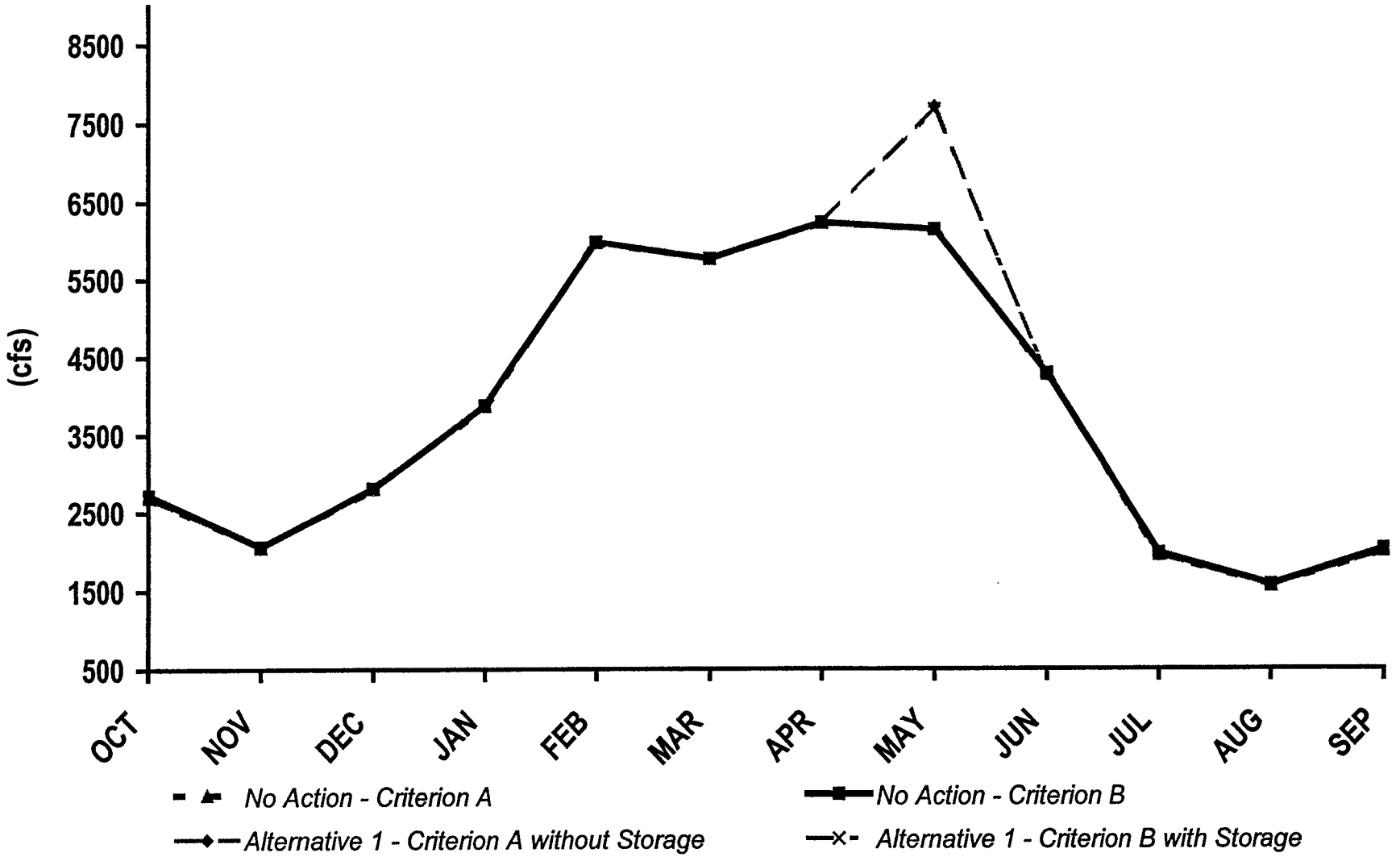
San Joaquin River Flow at Vernalis under Alternative 1 - Long Term Period



Section 5.3

Water Quality

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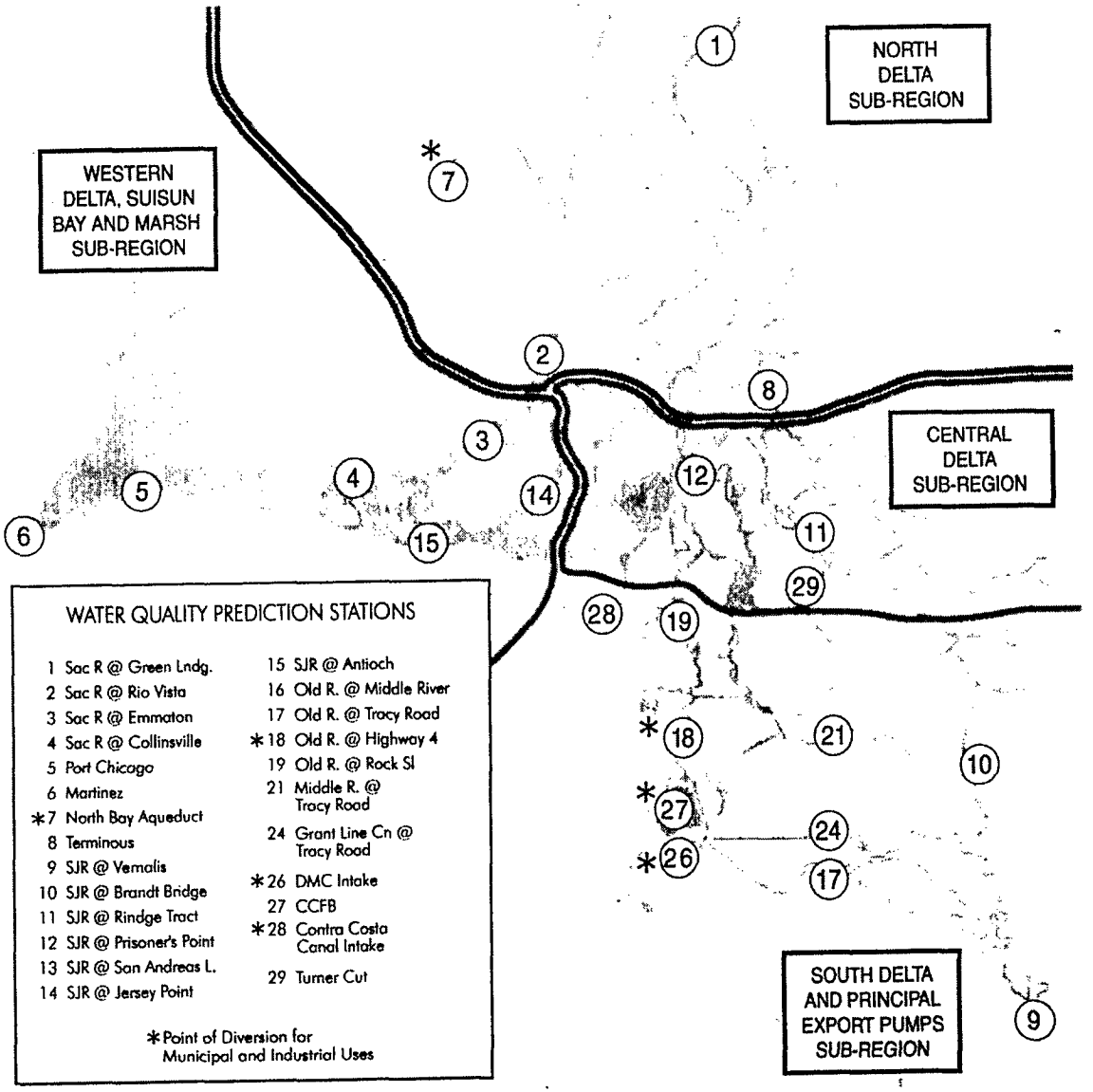
Delta Region Assessments

- North Delta Sub-Region
- Central Delta Sub-Region
- South Delta & Principal Export Pumps Sub-Region
- West Delta, Suisun Bay & Marsh Sub-Region

Key Delta Water Quality Simulation Stations and Delta Sub-Regions



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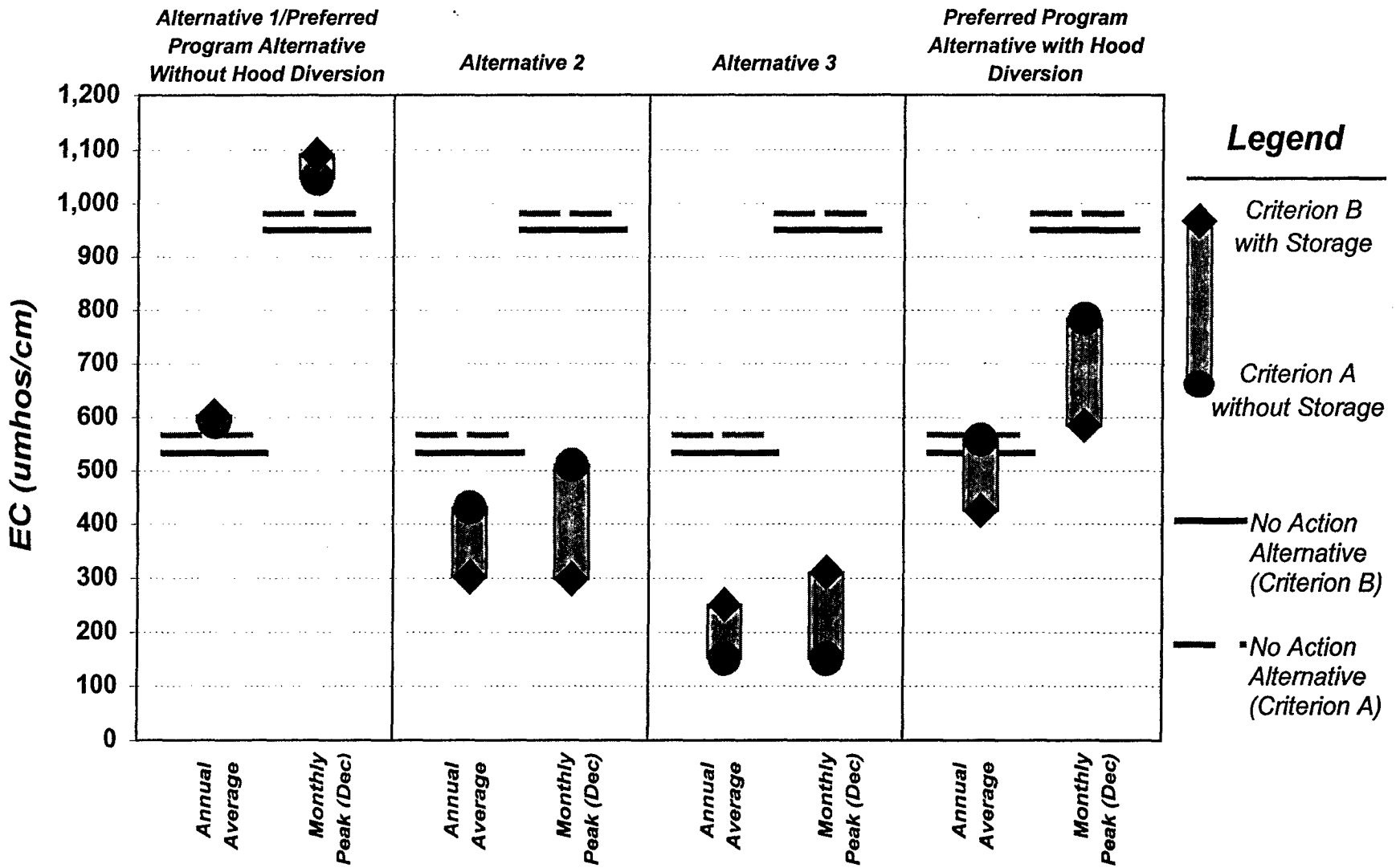
Clifton Court EC under All Program Alternatives
Long Term Period



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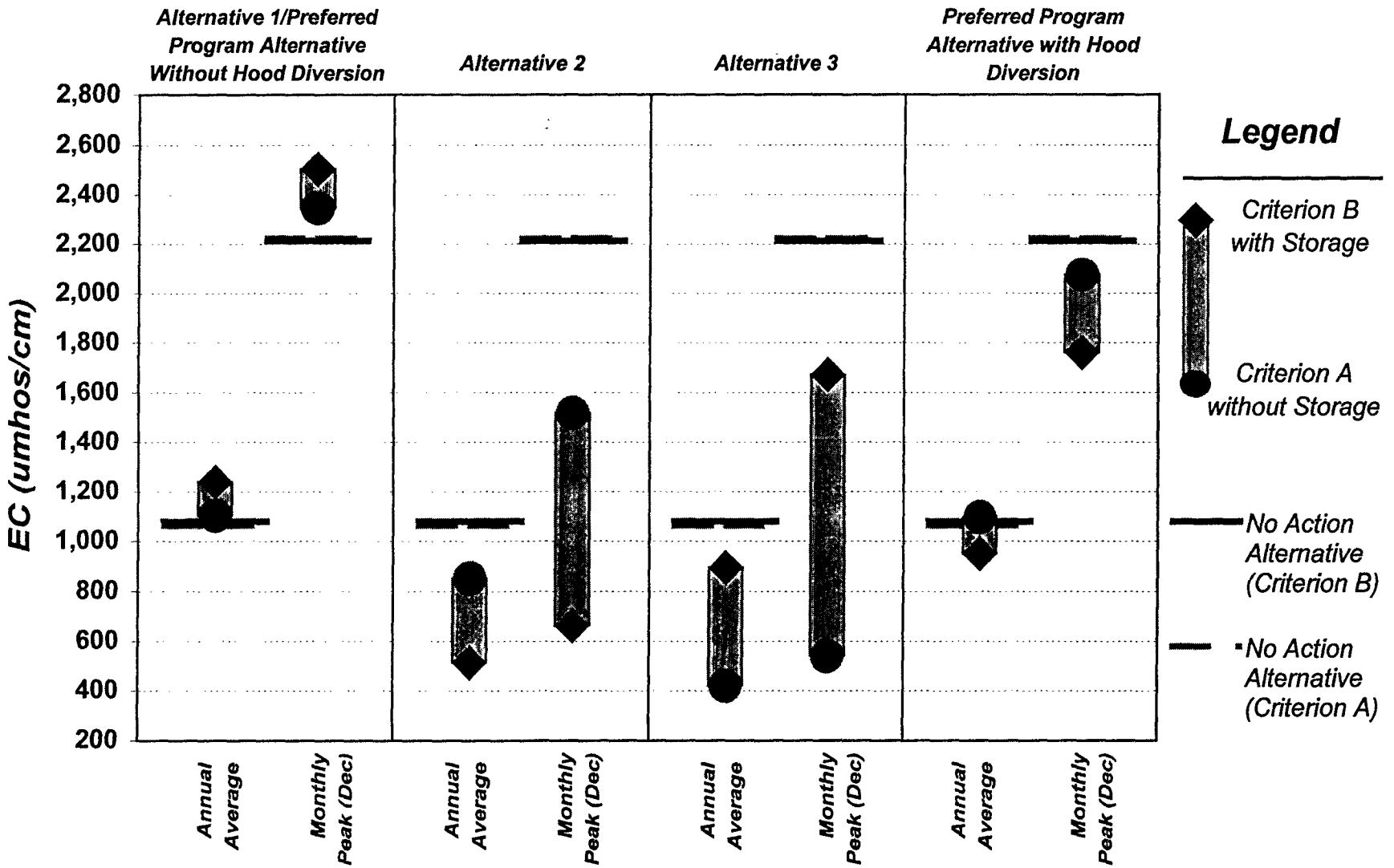
Jersey Point EC under All Program Alternatives
Long Term Period



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