AGENDA

Carlsbad Desalination Project Permit Renewal Meeting
May 11, 2017

1. Selection of Preferred Alternative
    a. Feasibility Determination Alternatives 1-10 (Appendix II August 2016)
    b. Feasibility Determination Alternatives 11-14 (Appendix CCC January 2017)
    c. Feasibility Determination Alternatives 15-20 (Appendix BBB March 2017)
2. Approval of Multiport Diffuser Mortality Assessment
    a. Multiport Diffuser Mortality (Appendix ZZ March 2017)
3. Process and Timeline for Completion of Permit Renewal and Water Code Determination
4. Identification of any other open issues

FEASIBILITY DETERMINATION
INTAKE ALTERNATIVES 1 THROUGH 10

Table 2
Overall Feasibility Assessment Intake and Discharge Alternatives

	Project Capable of Being Accomplished in a Reasonable Period of Time?	Is Project Economically Feasible?	Marine Life Mortality Ranking	Socially Feasible	Technically Feasible	Overall Feasibility
Alternatives	Yes/No	Yes/No	Ranked Lowest to Highest Impact	Yes/No	Yes/No	Yes/No
Surface Screened Intake with Flow Augmentation	Yes	Yes	3	Yes	Yes	Yes
Surface Screened Intake with Multiport Diffuser	No	No	7	Yes	Yes	No
Subsurface Intake with Flow Augmentation	No	No	1	No	No	No
Subsurface Intake with Multiport Diffuser	No	No	6	No	Yes	No
Offshore Wedgewire Screen with Flow Augmentation	No	No	5	Yes	Yes	No
Offshore Wedgewire Screen with Diffuser	No	No	10	Yes	Yes	No
Lagoon Wedgewire Screen with Flow Augmentation	No	No	2	Yes	No	No
Lagoon Wedgewire Screen with Diffuser	No	No	8	No	Yes	No
Lagoon Traveling Screen with Flow Augmentation	No	No	4	Yes	Yes	No
Lagoon Traveling Screen with Diffuser	No	No	9	Yes	Yes	No

Table 3
Comparison of Marine Life Mortality Impacts at Maximum Production of 60 mgd
Feasibility Assessment Intake and Discharge Alternatives

Impacts	Intake Water Potentially Exposed to 100% Mortality	Flow Augmentation Water Potentially Exposed to 100% Mortality	Diffuser Water Potentially Exposed to 100% Mortality	Total Water Potentially Exposed to 100% Mortality	Area of Production Foregone	Brine Mixing Zone @ 35.5 ppt	Permanent Construction Impacts to Marine Environment	Total Area Impacted	Marine Life Mortality Ranking
Alternatives	MGD	MGD	MGD	MGD	Acres	Acres	Acres	Acres	Ranked Lowest to Highest
Surface Screened Intake with Flow Augmentation	128	171	0	299	84.3	15.5	0	99.8	3
Surface Screened Intake with Multiport Diffuser	128	0	217	345	103.3	14.4	1.5	118.9	7
Subsurface Intake with Flow Augmentation	0	0	0	0	0	15.5	72	87.5	1
Subsurface Intake with Multiport Diffuser	0	0	217	217	67	14.4	33	114.4	6
Offshore Wedgewire Screen with Flow Augmentation	127	171	0	298	92	15.5	2.0	109.5	5
Offshore Wedgewire Screen with Diffuser	127	0	217	344	106.2	14.4	2.5	123.1	10
Lagoon Wedgewire Screen with Flow Augmentation	127	171	0	298	84	15.5	0.1	99.6	2
Lagoon Wedgewire Screen with Diffuser	127	0	217	344	103	14.4	1.6	119.0	8
Lagoon Traveling Screen with Flow Augmentation	128	171	0	299	84.3	15.5	0.1	99.9	4
Lagoon Traveling Screen with Diffuser	128	0	217	345	103.3	14.4	1.6	119.3	9

Table 4
Comparison of Time Required for Project Completion
Feasibility Assessment Intake and Discharge Alternatives

	Permitting and Property Acquisition	Construction, Commissioning and Startup	Total Time Required for Project Completion	Potential Duration CDP Is Without Source Water After 2018	Fixed Capital and Operating Costs Not Recovered While Plant is Out of Service After 2018	Project Capable of Being Accomplished in a Reasonable Period of Time?
Alternatives	Years	Years	Years	Years	$	Yes/No
Surface Screened Intake with Flow Augmentation	1	1.5	2.5	0	$0	Yes
Surface Screened Intake with Multiport Diffuser	3	3	6	3.5	$199,925,313	No
Subsurface Intake with Flow Augmentation	3	7.2	10.2	7.7	$423,770,193	No
Subsurface Intake with Multiport Diffuser	3	3.8	6.8	4.3	$242,696,411	No
Offshore Wedgewire Screen with Flow Augmentation	3	3	6	3.5	$199,925,313	No
Offshore Wedgewire Screen with Diffuser	3	3	6	3.5	$199,925,313	No
Lagoon Wedgewire Screen with Flow Augmentation	3	3	6	3.5	199,925,313	No
Lagoon Wedgewire Screen with Diffuser	3	3	6	3.5	$199,925,313	No
Lagoon Traveling Screen with Flow Augmentation	3	3	6	3.5	$199,925,313	No
Lagoon Traveling Screen with Diffuser	3	3	6	3.5	$199,925,313	No

Table 5
Economic Analysis
Feasibility Assessment Intake and Discharge Alternatives

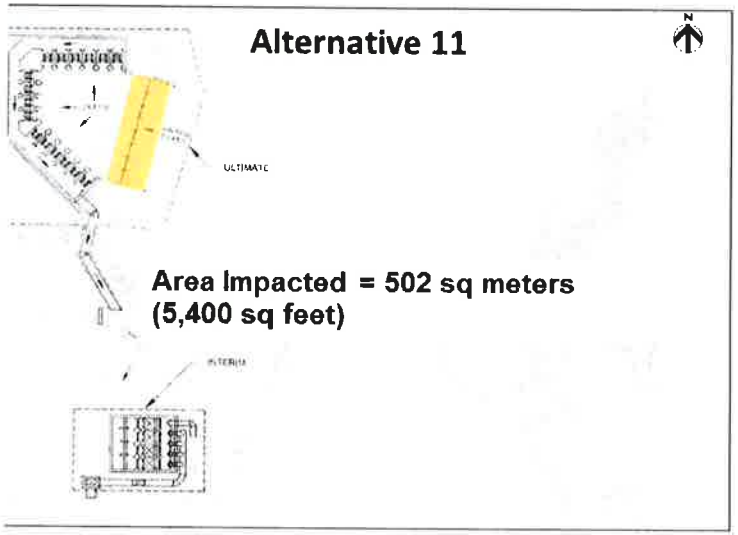
	Total Project Cost	Fixed Costs Not Recovered While Plant is Out of Service After 2018	Financing Period	Capital Charge	Out of Service Charge	O&M and Other Annual Costs	Total Annual Cost	Is Project Economically Feasible?
Alternatives	$	$	Years	$/Year	$/Year	$/Year	$/Year	Yes/No
Surface Screened Intake with Flow Augmentation	$49,061,041	$0	27.5	$4,077,205	$0	$4,455,035	$8,532,239	Yes
Surface Screened Intake with Multiport Diffuser	$428,639,220	$199,925,313	24	$37,464,471	$17,481,175	$6,790,828	$61,736,474	No
Subsurface Intake with Flow Augmentation	$1,037,702,060	$423,770,193	19.8	$100,112,270	$37,988,099	$20,965,196	$159,065,565	No
Subsurface Intake with Multiport Diffuser	$676,862,341	$242,696,411	23.2	$59,971,724	$21,509,330	$12,903,385	$94,384,439	No
Offshore Wedgewire Screen with Flow Augmentation	$285,490,487	$199,925,313	24	$24,952,799	$17,481,175	$6,566,746	$49,000,720	No
Offshore Wedgewire Screen with Diffuser	$576,823,886	$199,925,313	24	$50,416,311	$17,481,175	$8,211,320	$76,108,807	No
Lagoon Wedgewire Screen with Flow Augmentation	$126,904,462	$199,925,313	24	$11,100,609	$17,481,175	$5,246,746	$33,828,529	No
Lagoon Wedgewire Screen with Diffuser	$416,573,734	$199,925,313	24	$36,409,907	$17,481,175	$6,781,320	$60,672,403	No
Lagoon Traveling Screen with Flow Augmentation	$80,783,075	$199,925,313	24	$7,060,814	$17,481,175	$4,960,539	$29,502,528	No
Lagoon Traveling Screen with Diffuser	$405,778,290	$199,925,313	24	$35,466,357	$17,481,175	$6,719,356	$59,666,888	No

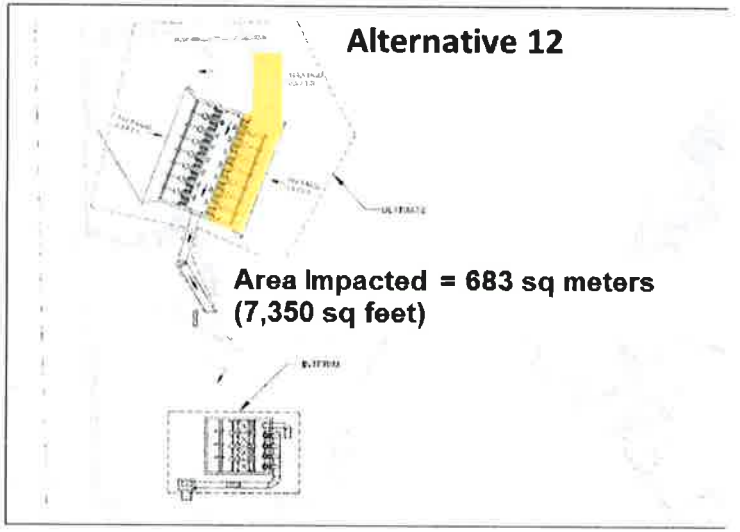
FEASIBILITY DETERMINATION
INTAKE ALTERNATIVES 1, 11, 12, 13, AND 14

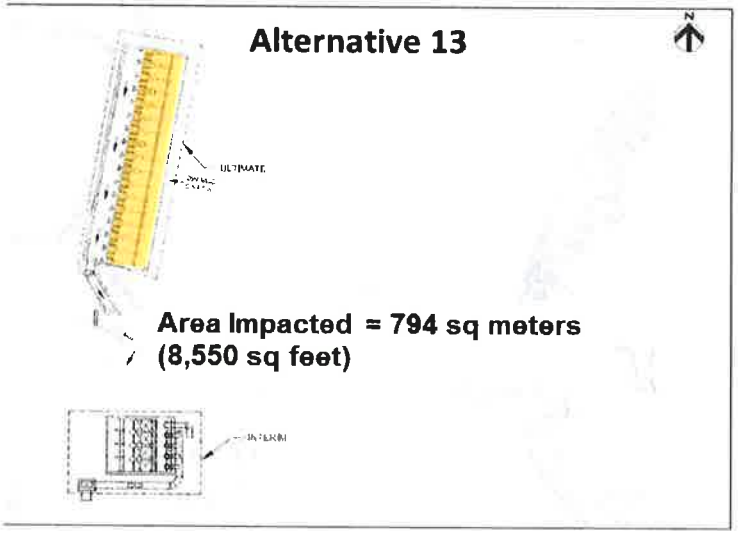
Feasibility Determination
Alternatives 1, 11, 12, 13, 14, and 20

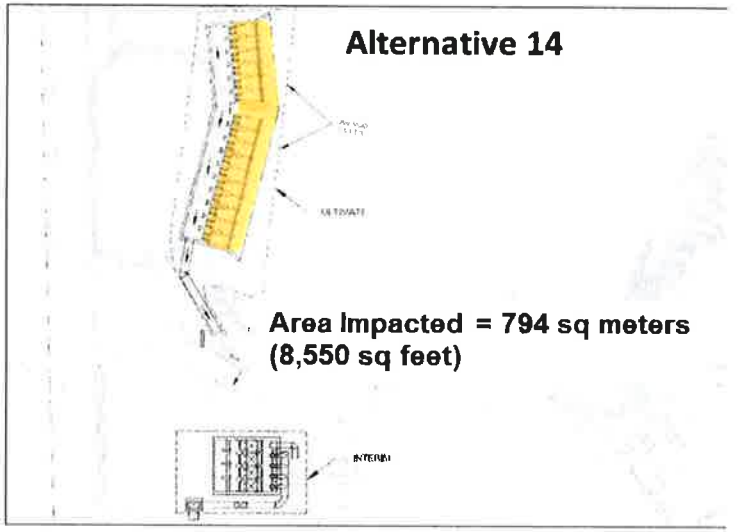
Comparison of Cost, Schedule, and Environmental Benefits								
Intake Alternatives 1, 11, 12, 13, and 14								
	Cost (2017 $)			Schedule	Environmental Cost/Benefit			
Alternative	Capital Cost	Annual Cost ($/Year)	Annual Cost Increase ($/Year)	Construction Schedule (Years)	Reduction in marine Life Mortality (lbs per day)	Additional Mortality Reduction (lbs per day)	Benefit Cost Ratio ($/lb)[1,2]	Feasibility Determination
1	$48,619,910	$6,916,213	NA	2.1	6.21	NA	NA	Feasible
11	$112,751,780	$12,999,991	$6,606,624	3.7	6.86	0.65	$27,847	Infeasible - significant additional cost, unfavorable B/C ratio.
12	$111,469,874	$12,887,098	$6,493,731	3.7	6.79	0.58	$30,674	Infeasible - significant additional cost, unfavorable B/C ratio.
13	$111,108,022	$12,855,552	$6,462,184	3.7	6.74	0.53	$33,405	Infeasible - significant additional cost, unfavorable B/C ratio.
14	$113,428,430	$13,105,163	$6,711,795	3.7	6.74	0.53	$34,695	Infeasible - significant additional cost, unfavorable B/C ratio.

1. Annual capital cost increase ($/year) divided by additional mortality reduction (lbs/year).
2. These costs are incurred starting in the year the intake improvements are completed and continue through 2045.









Construction cost	**$111,108,022 to $113,428,430**
Increased Capital and Operating Cost	**$6,462,184/year to $6,711,795/year**
Net Reduction from Alternative 1 Productivity Loss	**0.53 lbs/day to 0.65 lbs/day**
Incremental Cost to Achieve Reduced Mortality	**$27,847/lb to $34,695/lb**

FEASIBILITY DETERMINATION
INTAKE ALTERNATIVES 1, 15, 16, 17, 18, 19, AND 20

Feasibility Determination
Alternatives 1, 15, 16, 17, 18, 19, and 20

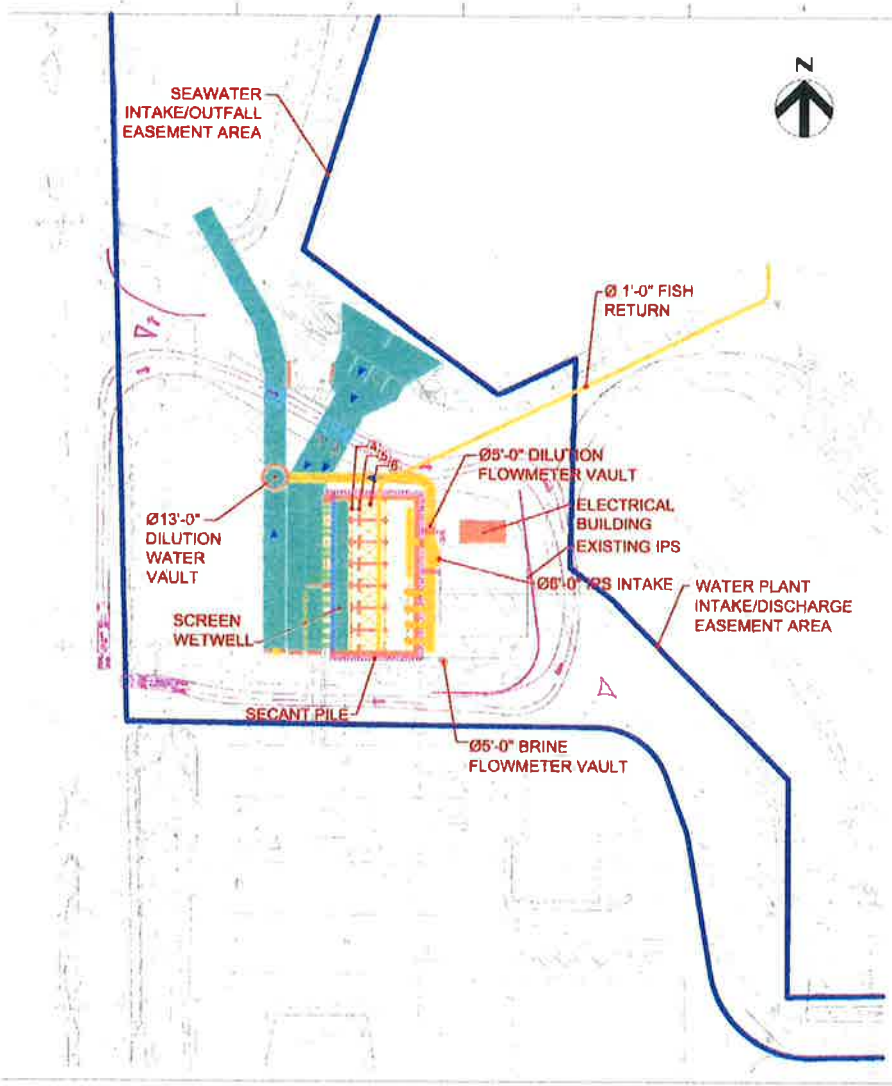
Comparison of Cost, Schedule, and Environmental Benefits

Intake Alternatives 1, 15, 16, 17, 18, 19, and 20

	Cost (2017 $)			Schedule		Environmental Cost/Benefit					
Alternative	Capital Cost	Annual Cost ($/Year)	Annual Cost Increase ($/Year)	Construction Schedule (Years)	Plant Shutdown Cost	Reduction in marine Life Mortality (lbs per day)	Additional Mortality Reduction (lbs per day)	Benefit Cost Ratio ($/lb)[1,3]	Additional Mortality Reduction (Number of Fish per day)	Benefit Cost Ratio ($/Fish)[2,3]	Feasibility Determination
1	$ 48,619,910	$ 6,916,213	NA	2.1	$ 7,644,000	6.21	NA	NA	NA	NA	Feasible
15	$ 52,995,714	$ 7,375,248	$ 459,034	2.2	$ 15,288,000	6.28	0.07	$ 17,966	4	$ 314	Infeasible - unfavorable B/C ratio, increased plant shutdown.
16	$ 66,284,901	$ 8,665,307	$ 1,749,094	3.3	$ 62,244,000	6.21	0.00	NA	0	NA	Infeasible - added cost with no additional environmental benefit, schedule constraints, significant plant shutdown costs.
17	$ 70,071,529	$ 9,076,324	$ 2,160,111	3.5	$ 69,888,000	6.28	0.07	$ 84,544	4	$ 1,480	Infeasible - significant additional cost, unfavorable B/C ratio, schedule constraints, significant plant shutdown costs.
18	$ 78,924,730	$ 9,996,398	$ 3,080,184	4.0	$ 74,984,000	6.31	0.10	$ 84,389	8	$ 1,055	Infeasible - significant additional cost, unfavorable B/C ratio, schedule constraints, significant plant shutdown costs.
19	$ 59,552,659	$ 7,992,141	$ 1,075,928	2.4	$ 58,604,000	6.31	0.10	$ 29,477	8	$ 368	Infeasible - significant additional cost, unfavorable B/C ratio, schedule constraints, significant plant shutdown costs.
20	$ 71,178,591	$ 9,108,976	$ 2,192,763	2.2	$ 15,288,000	6.28	0.07	$ 60,076	4	$ 1,502	Infeasible - significant additional cost, unfavorable B/C ratio, schedule constraints, significant plant shutdown costs, site layout extends outside available property

1. Annual capital cost increase ($/year) divided by additional mortality reduction (lbs/year).
2. Annual capital cost increase ($/year) divided by additional mortality reduction (number of fish per year).
3. These costs are incurred starting in the year the intake improvements are completed and continue through 2045.

Alternative 1 – Original Proposal



ALTERNATIVE EVALUATION

ITEM	COMMENT
ALTERNATIVE	1 (Original Proposal)
DESCRIPTION	Discharger's proposed project
KEY ELEMENTS	• Existing bar rack at 1.06 fps inlet velocity. • 2 east intake channels at 2.63 fps respectively. • 7-1mm center flow screens. • Existing west channel for combined dilution and brine line.
CONSTRUCTION COST	$ 34.7 Million *
PHASING	Phase 1-Screen Intake Structure
FOOTPRINT	Original Proposal
CONSTRUCTION DURATION	2.1 Years (24.7 Months) (107 Weeks)
OPERATION & MAINTENANCE	Original Proposal
COMPLEXITY	Original Proposal
PLANT SHUT DOWN IMPACT	42 days to connect 1st and 2nd tunnels to screen wet well
PLANT SHUT DOWN COST($182,000/day)	$ 7,644,000 *
FISH RETURN MARINE LIFE MORTALITY - JUVENILE AND ADULT FISH (LBS/D)	0.85
SITE INGRESS/EGRESS IMPACT	Fish return line construction Dilution line construction

* 2017 Dollar Value

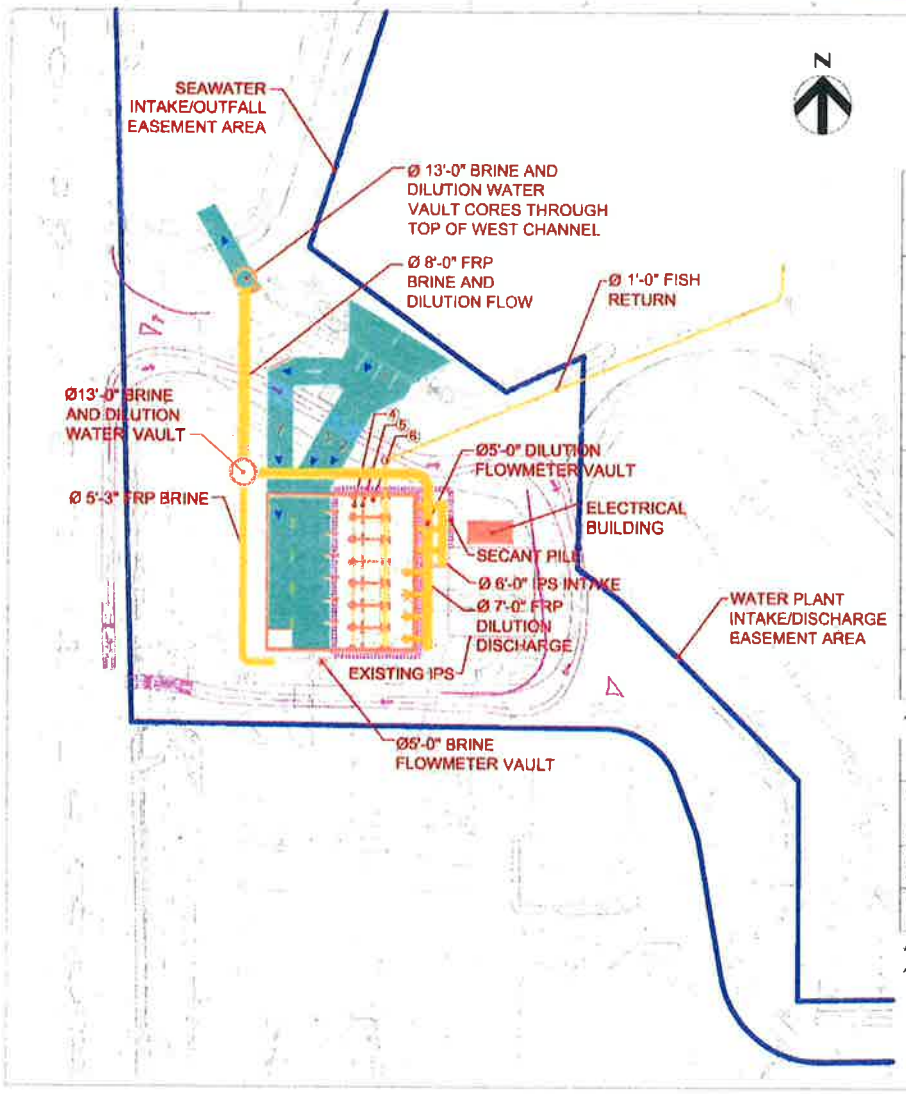
ALTERNATIVE 1

No.	DESCRIPTION	VELOCITY *	COMMENT
(1)	EXIST. BAR RACK INTAKE	1.06 FPS **	(4)-10 FT BAR RACK
(2)	EXIST.INTAKE CHANNEL EAST	2.63 FPS	149.5 MGD
(3)	EXIST.INTAKE CHANNEL WEST	2.63 FPS	149.5 MGD
(4)	SCREEN UPSTREAM CHANNEL	0.33 FPS	4.0 METER
(5)	SCREEN INFLUENT THROAT	0.73 FPS	1.82 METER
(6)	THROUGH SCREEN VELOCITIES WITH 15% FOULING	0.44 FPS	3.5 METER CENTER FLOW

* ALL VELOCITY SHOWN ARE AT MLLW UNLESS OTHERWISE NOTED.

** VELOCITY THROUGH BAR RACK.

Alternative 15 – Repurpose Discharge Channel to Intake



ALTERNATIVE EVALUATION

ITEM	COMMENT
ALTERNATIVE	15
DESCRIPTION	Discharger's proposed project with discharge channel repurposed as an intake.
KEY ELEMENTS	• Existing bar rack at 1.06 fps inlet velocity. • 3 intake channels at 1.54, 1.54 and 1.60 fps inlet velocity respectively. • 7-1mm center flow screens. • Additional brine discharge and combined dilution and brine line.
CONSTRUCTION COST	$ 38.3 Million* (Incremental Increase from Alt 1 is $ 3.6 Million)
PHASING	Phase 1A-Screen intake structure Phase 1B-Dilution and brine line
FOOTPRINT	Same as original proposal
CONSTRUCTION DURATION	2.2 Years (26.1 Months) (113 weeks) (Incremental increase from Alt 1 is 6 weeks)
OPERATION & MAINTENANCE	Same as original proposal
COMPLEXITY	3rd inlet tunnel New combined dilution and brine discharge
PLANT SHUT DOWN IMPACT	42 days to connect 1st and 2nd tunnels to screen wet well 28 days for blocking existing channel and cutting roof and connect to 3rd tunnel 14 days for pipeline connection. Total of 84 days
PLANT SHUT DOWN COST($182,000/day)	$ 15,288,000* (INCREMENTAL INCREASE FROM ALT 1 is $ 7,644,000)
FISH RETURN MARINE LIFE MORTALITY JUVENILE AND ADULT FISH (LBS/D)	0.78
SITE INGRESS/EGRESS IMPACT	Fish return line construction Dilution line construction Combined dilution and brine line construction

* 2017 Dollar Value

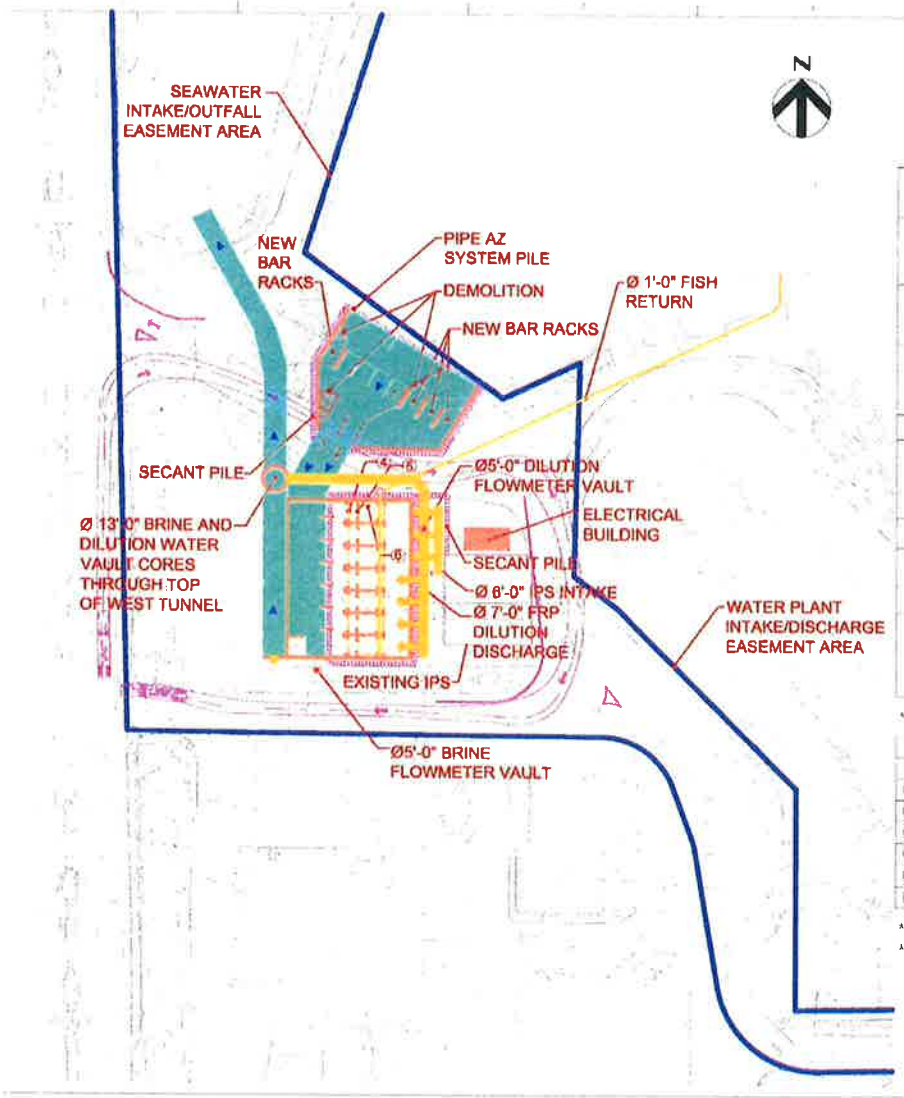
ALTERNATIVE 15

No.	DESCRIPTION	VELOCITY *	COMMENT
(1)	EXIST. BAR RACK INTAKE	1.06 FPS **	(4)-10 FT BAR RACK
(2)	EXIST.INTAKE CHANNEL EAST	1.64 FPS	87.5 MGD
(3)	EXIST.INTAKE CHANNEL WEST	1.54 FPS	87.5 MGD
(4)	SCREEN UPSTREAM CHANNEL	0.33 FPS	4.0 METER
(5)	SCREEN INFLUENT THROAT	0.73 FPS	1.82 METER
(6)	THROUGH SCREEN VELOCITIES WITH 15% FOULING	0.44 FPS	3.5 METER CENTER FLOW
(7)	EXIST.DISCH. CHANNEL REPURPOSED	1.60 FPS	124 MGD

* ALL VELOCITY SHOWN ARE AT MLLW UNLESS OTHERWISE NOTED

** VELOCITY THROUGH BAR RACK.

Alternative 16 – Double Width of Bar Rack



ALTERNATIVE EVALUATION

ITEM	COMMENT
ALTERNATIVE	16
DESCRIPTION	Discharger's proposed project with bar rack inlet structure improved to limit intake velocities to 0.5 fps. Note that this alternative requires two construction phases as identified below. Phase 1 allows for plant operations while applying for USACE permits for lagoon construction. Phase 2 requires shoring around the existing intake to allow construction to occur in dry conditions. See below for plant shutdown durations for each phase
KEY ELEMENTS	• Additional bar racks at 0.53 fps inlet velocity • 2 east intake channels at 2.63 fps respectively. • 7-1mm center flow screens. • Existing west channel for combined dilution and brine line.
CONSTRUCTION COST	$ 47.2 Million [A] (Incremental Increase from Alt 1 is $ 12.5 Million)
PHASING	Phase 1-Screen intake structure
	Phase 2- Additional bar rack structure
FOOTPRINT	Same as original proposal + Additional bar rack
CONSTRUCTION DURATION	2.1 Years (24.7 Months) (107 Weeks) Phase 1 1.3 Years (15.5 Months) (67 Weeks) Phase 2 Total: 3.3 Years (40.2 Months) (174 Weeks) (Incremental Increase from Alt 1 is 67 weeks)
OPERATION & MAINTENANCE	Same as original proposal + Additional 4 bar racks
COMPLEXITY	Phase 2 double width of bar racks
PLANT SHUT DOWN IMPACT	42 days for 1st and 2nd tunnels to screen wet well 300 days Phase 2 double width of intake and install 40' of new bar rack
PLANT SHUT DOWN COST($182,000/day)	$ 62,244,000 [A] (INCREMENTAL INCREASE FROM ALT 1 is $ 54,600,000)
FISH RETURN MARINE LIFE MORTALITY - JUVENILE AND ADULT FISH (LBS/D)	0.85
SITE INGRESS/EGRESS IMPACT	Fish return line construction Dilution line construction Double width of intake and install 40' of new bar racks

[A] 2017 Dollar Value

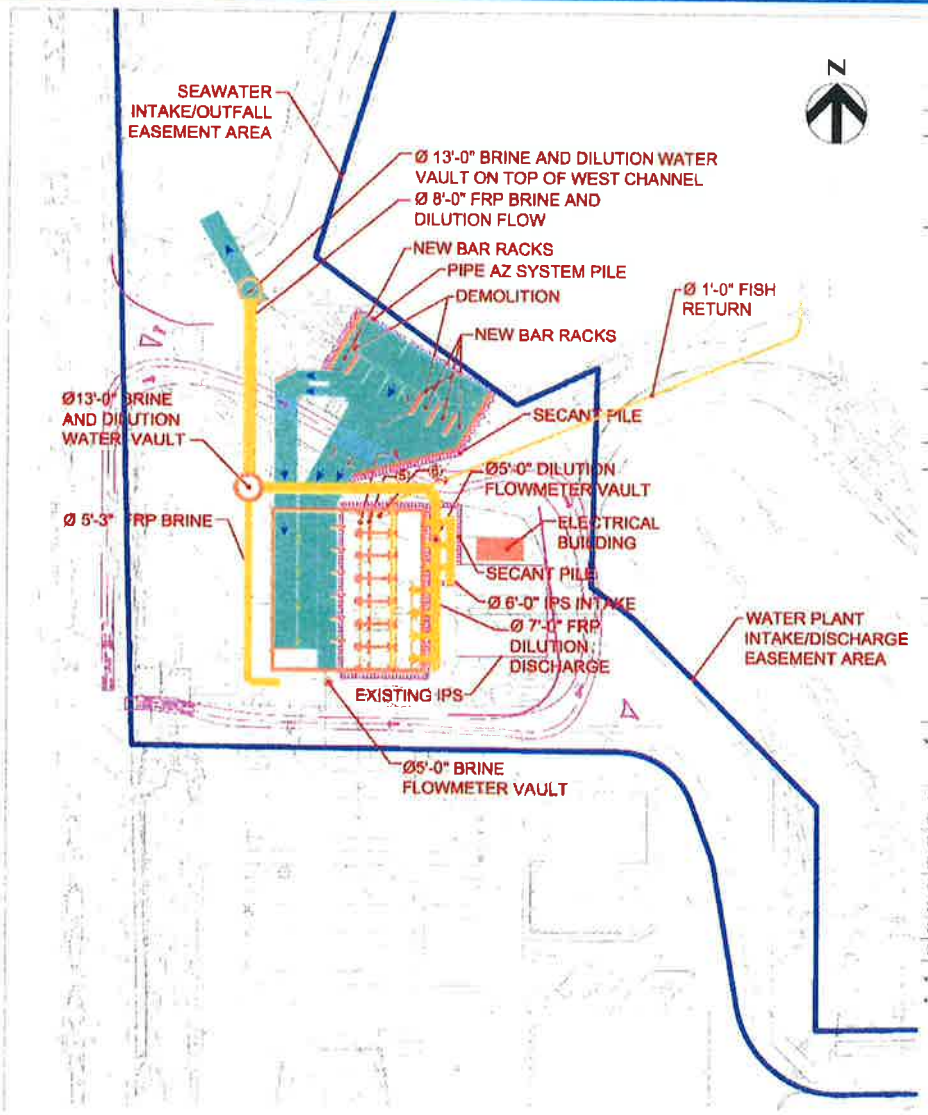
ALTERNATIVE 16

No.	DESCRIPTION	VELOCITY [A]	COMMENT
1	UPGRADED BAR RACK INTAKE	0.53 FPS [A,*]	(8)-10 FT BAR RACK
2	EXIST INTAKE CHANNEL EAST	2.63 FPS	149.5 MGD
3	EXIST INTAKE CHANNEL WEST	2.63 FPS	149.5 MGD
4	SCREEN UPSTREAM CHANNEL	0.33 FPS	4.0 METER
5	SCREEN INFLUENT THROAT	0.73 FPS	1.82 METER
6	THROUGH SCREEN VELOCITIES WITH 15% FOULING	0.44 FPS	3.5 METER CENTER FLOW

[A] ALL VELOCITY SHOWN ARE AT MLLW UNLESS OTHERWISE NOTED.

[A,*] VELOCITY THROUGH BAR RACK.

Alternative 17 - Double Width of Bar Rack and Repurpose Discharge Channel as Intake



ALTERNATIVE EVALUATION

ITEM	COMMENT
ALTERNATIVE	17
DESCRIPTION	Discharger's proposed project with bar rack inlet structure improved to limit intake velocities to 0.5 fps and with discharge tunnel repurposed as an intake (combination of Alternatives 15 and 16). Note that this alternative requires two construction phases as identified below. Phase 1 allows for plant operations while applying for USACE permits for lagoon construction. Phase 2 requires shoring around the existing intake to allow construction to occur in dry conditions. See below for plant shutdown durations for each phase.
KEY ELEMENTS	• Additional bar racks at 0.53 fps inlet velocity. • 3 intake channel at 1.54, 1.54 and 1.60 fps inlet velocity respectively. • 7-1mm center flow screens • Additional brine discharge and combined dilution and brine line.
CONSTRUCTION COST	$ 50.2 Million* (Incremental Increase from Alt 1 is $ 15.5 Million)
PHASING	Phase 1A-Screen intake structure Phase 1B-Dilution and brine line Phase 2- Additional bar rack structure
FOOTPRINT	Same as original proposal + Additional bar rack
CONSTRUCTION DURATION	2.2 Years (26.1 Months) (113 weeks) for Phase 1 1.3 Years (15.5 Months) (67 Weeks) Phase 2 Total: 3.5 Years 41.5 Months) (180 Weeks) (Incremental Increase from Alt 1 is 73 weeks)
OPERATION & MAINTENANCE	Same as original proposal + Additional 4 bar racks
COMPLEXITY	3rd tunnel connection Phase 2 double width of intake, install new bar racks New combined dilution and brine discharge
PLANT SHUT DOWN IMPACT	42 days to connect 1st and 2nd tunnels to screen wet well 28 days for blocking existing channel and cutting roof and connect to 3rd tunnel 14 days for pipeline connection. Total of 84 days 300 days Phase 2 double width of intake and install 40' of new bar rack
PLANT SHUT DOWN COST($182,000/day)	$ 89,888,000* (INCREMENTAL INCREASE FROM ALT 1 $ 82,244,000)
FISH RETURN MARINE LIFE MORTALITY - JUVENILE AND ADULT FISH (LBS/D)	0.78
SITE INGRESS/EGRESS IMPACT	Fish return line construction Dilution line construction Double width of intake and install 40' of new bar racks Combined dilution and brine line construction

* 2017 Dollar Value

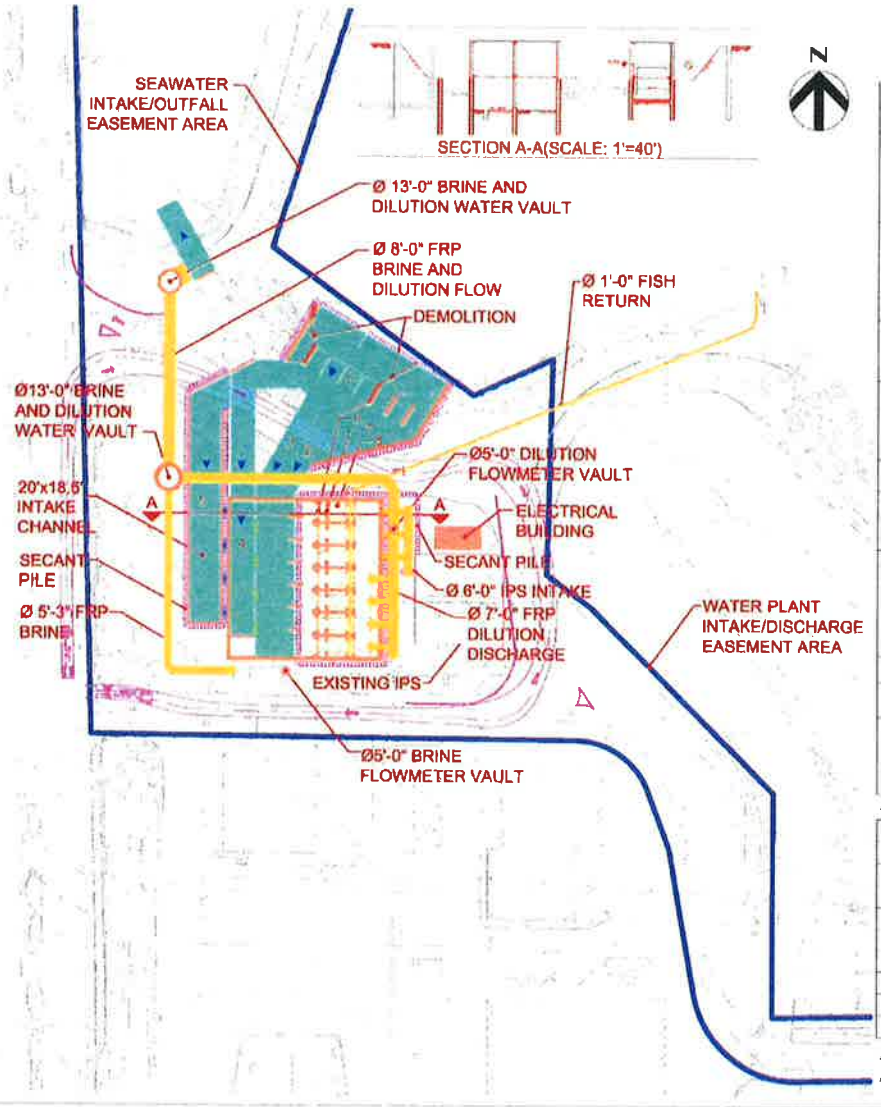
ALTERNATIVE 17

No.	DESCRIPTION	VELOCITY *	COMMENT
1	UPGRADED BAR RACK INTAKE	0.53 FPS **	(8)-10 FT BAR RACK
2	EXIST.INTAKE CHANNEL EAST	1.54 FPS	87.5 MGD
3	EXIST.INTAKE CHANNEL WEST	1.54 FPS	87.5 MGD
4	SCREEN UPSTREAM CHANNEL	0.33 FPS	4.0 METER
5	SCREEN INFLUENT THROAT	0.73 FPS	1.82 METER
6	THROUGH SCREEN VELOCITIES WITH 15% FOULING	0.44 FPS	3.5 METER CENTER FLOW
7	EXIST.DISCH. CHANNEL REPURPOSED	1.60 FPS	124 MGD

* ALL VELOCITY SHOWN ARE AT MLLW UNLESS OTHERWISE NOTED.

** VELOCITY THROUGH BAR RACK.

Alternative 18 – Double Width of Bar Rack, Repurpose Discharge Channel as Intake, and Construct New Intake Channel



ALTERNATIVE EVALUATION

ITEM	COMMENT
ALTERNATIVE	18
DESCRIPTION	Discharger's proposed project with bar rack inlet structure improved to limit intake velocities to 0.5 fps, discharge tunnel repurposed as an intake, and a fourth intake tunnel added to reduce intake velocities (combination of Alternatives 16 and 17 with a new tunnel). Note that this alternative requires two construction phases as identified below. Phase 1 allows for plant operations while applying for USACE permits for lagoon construction. Phase 2 requires shoring around the existing intake to allow construction to occur in dry conditions. See below for plant shutdown durations for each phase
KEY ELEMENTS	• Additional bar racks at 0.53 fps inlet velocity • 4 intake channels at 0.68, 0.66, 0.67 and 1.04 fps inlet velocity respectively • 7-1mm center flow screens. • Additional brine discharge and combined dilution and brine line.
CONSTRUCTION COST	$ 56.3 Million* (Incremental increase from Alt 1 is $ 21.8 Million)
PHASING	Phase 1A-Screen intake structure Phase 1B-New 4th intake channel Phase 1C-Dilution and brine line Phase 2- Additional bar rack structure
FOOTPRINT	Same as original proposal + Additional 4 bar racks+Additional 4 th tunnel
CONSTRUCTION DURATION	2.7 Years (32.5 Months) (141 weeks) for Phase 1 1.3 Years (15.5 Months) (67 Weeks) Phase 2 Total: 4 Years (48.0 Months) (208 Weeks) (Incremental increase from Alt 1 is 201 weeks)
OPERATION & MAINTENANCE	Same as original proposal + Additional 4 bar racks + Additional removal of mussels and other fouling organisms in the new tunnel.
COMPLEXITY	3rd tunnel connection Phase 2 double width of intake, install new bar racks Construct 4th intake channel New combined dilution and brine discharge
PLANT SHUT DOWN IMPACT	42 days to connect 1st and 2nd tunnels to screen wet well 28 days for blocking existing channel and cutting roof and connect to 3rd tunnel 14 days for pipeline connection. 28 days for new tunnel connection. Total of 112 days for plant shut down. 300 days Phase 2 double width of intake and install 40' of new bar rack
PLANT SHUT DOWN COST($182,000/day)	$ 74,984,000* (INCREMENTAL INCREASE FROM ALT 1 is $ 67,340,000)
FISH RETURN MARINE LIFE MORTALITY - JUVENILE AND ADULT FISH (LBS/D)	0.75
SITE INGRESS/EGRESS IMPACT	Fish return line construction Dilution line construction Double width of intake, install 40' of new bar racks Construct 4th intake channel Combined dilution and brine line construction

* 2017 Dollar Value

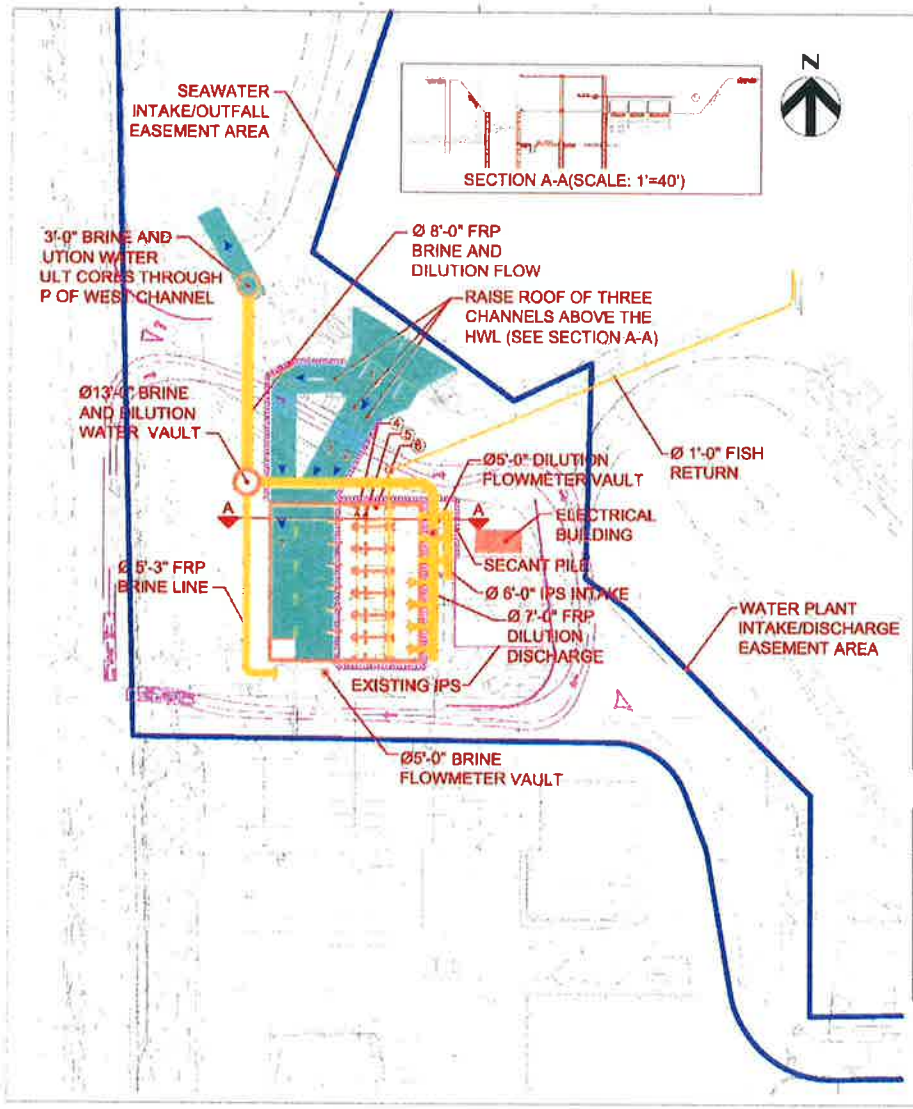
ALTERNATIVE 18

No.	DESCRIPTION	VELOCITY *	COMMENT
1	EXIST. BAR RACK INTAKE	0.53 FPS **	(8)-10 FT BAR RACK
2	EXIST.INTAKE CHANNEL EAST	0.68 FPS	39 MGD
3	EXIST.INTAKE CHANNEL WEST	0.66 FPS	37 MGD
4	EXIST.DISCH. CHANNEL REPURPOSED	0.67 FPS	52 MGD
5	NEW INTAKE CHANNEL	1.04 FPS	171 MGD OPEN CHANNEL
6	SCREEN UPSTREAM CHANNEL	0.33 FPS	4.0 METER
7	SCREEN INFLUENT THROAT	0.73 FPS	1.82 METER
8	THROUGH SCREEN VELOCITIES WITH 15% FOULING	0.44 FPS	3.5 METER CENTER FLOW

* ALL VELOCITY SHOWN ARE AT MLLW UNLESS OTHERWISE NOTED.

** VELOCITY THROUGH BAR RACK.

Alternative 19 - Repurpose Discharge Channel to Intake, Raise Height of All Three Intake Channel to Allow Unrestricted Flow at High Water Level



ALTERNATIVE EVALUATION

ITEM	COMMENT
ALTERNATIVE	19
DESCRIPTION	Discharger's proposed project with discharge tunnel repurposed as an intake and all intake tunnel roofs raised to accommodate HWL without restriction. Note that this alternative requires three construction phases as identified below. Phase 1 allows for plant operations while applying for USACE permits for lagoon construction. Phase 2 requires shoring around the existing intake to allow tunnel modifications to occur in dry conditions. Phase 3 allows for construction of dilution and brine lines. See below for plant shutdown durations for each phase.
KEY ELEMENTS	• Existing bar rack at 1.06 fps inlet velocity. • 3 intake channels at 0.94, 0.94 and 1.05 fps inlet velocity respectively. • Raise roof of three intake channels 10.5 ft • 7-1mm center flow screens. • Additional brine discharge and combined dilution and brine line.
CONSTRUCTION COST	$ 43.6 Million*(Incremental increase from Alt 1 is $ 8.9 Million)
PHASING	Phase 1A-Screen intake structure Phase 1B-Raising existing channel walls and adding new roof Phase 1C- Dilution and brine line
FOOTPRINT	Raise roof on intake channels 10.5 ft
CONSTRUCTION DURATION	2.4 Years (29 Months) (124 Weeks) (Incremental increase from Alt 1 is 17 weeks)
OPERATION & MAINTENANCE	Same as original proposal
COMPLEXITY	3rd tunnel connection Raising all three tunnel walls and adding new roof New combined dilution and brine discharge
PLANT SHUT DOWN IMPACT	224 days for raising all three tunnel roofs (to include 42 days to connect 1st and 2nd tunnels to screen wet well and 28 days for blocking existing channel and cutting roof and connect to 3rd tunnel); 84 days for pipeline construction. 14 days for pipeline tie-in. Total of 322 days plant shut down.
PLANT SHUT DOWN COST($162,000/day)	$ 58,604,000* (INCREMENTAL INCREASE FROM ALT 1 is $ 50,950,000)
FISH RETURN MARINE LIFE MORTALITY - JUVENILE AND ADULT FISH (LBS/D)	0.75
SITE INGRESS/EGRESS IMPACT	Fish return line construction Dilution line construction Combined dilution and brine line construciton Raise roof on intake channels 10.5 ft

* 2017 Dollar Value

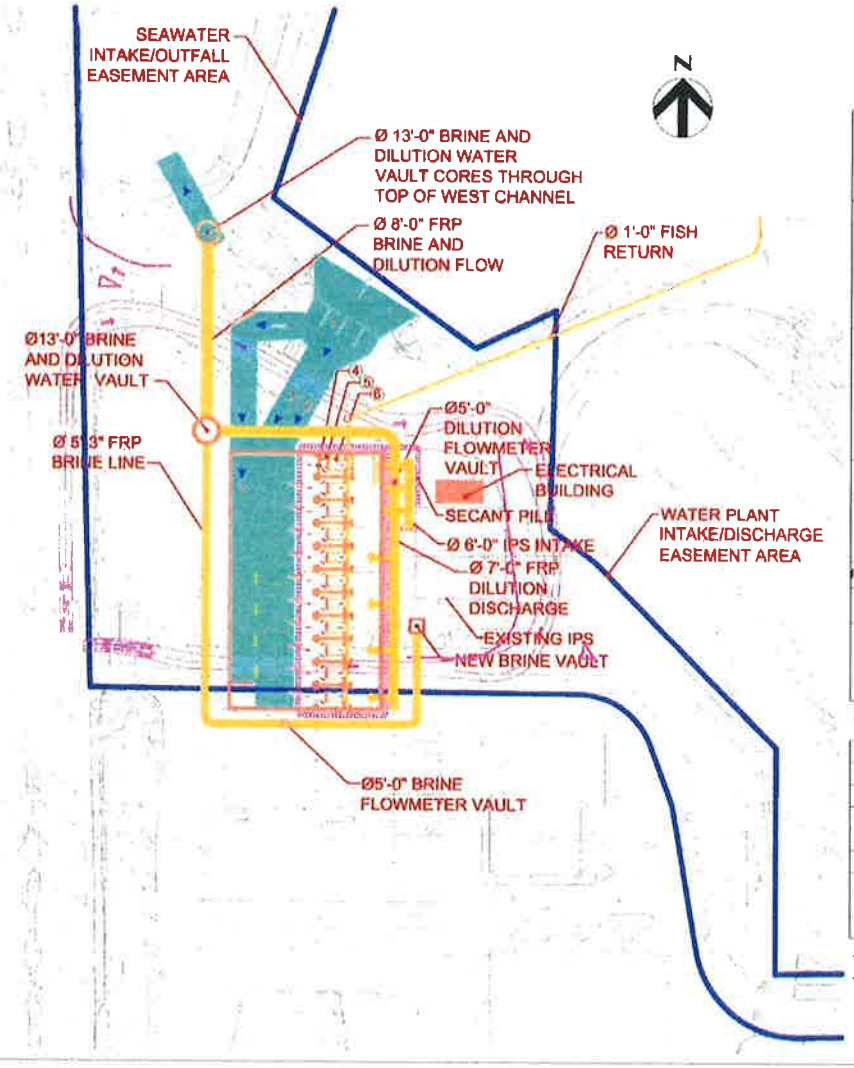
ALTERNATIVE 19

No.	DESCRIPTION	VELOCITY *	COMMENT
(1)	EXIST. BAR RACK INTAKE	1.06 FPS **	(4)-10 FT BAR RACK
(2)	EXIST.INTAKE CHANNEL EAST	0.94 FPS	85 MGD
(3)	EXIST.INTAKE CHANNEL WEST	0.94 FPS	85 MGD
(4)	SCREEN UPSTREAM CHANNEL	0.33 FPS	4.0 METER
(5)	SCREEN INFLUENT THROAT	0.73 FPS	1.82 METER
(6)	THROUGH SCREEN VELOCITIES WITH 15% FOULING	0.44 FPS	3.5 METER CENTER FLOW
(7)	EXIST.DISCH. CHANNEL REPURPOSED	1.05 FPS	129 MGD

* ALL VELOCITY SHOWN ARE AT MLLW UNLESS OTHERWISE NOTED.

** VELOCITY THROUGH BAR RACK.

Alternative 20 – Change the Type and Increase the Number of Screens to Reduce Entrance Velocity in Screening Area



ALTERNATIVE EVALUATION

ITEM	COMMENT
ALTERNATIVE	20
DESCRIPTION	Discharger's proposed project with change in screen type from a single entry (inside-out) to a double entry (outside-in) type screen to achieve 0.5 fps screen entry velocity. This increases the number of screens required from 7 to 11, resulting in a structure length increase of 64 feet.
KEY ELEMENTS	• Existing bar rack at 1.06 fps inlet velocity. • 3 intake channels at 1.54, 1.54 and 1.60 fps inlet velocity respectively. •11-1mm dual flow screens (through screen velocity at 0.49 ft/sec,inlet throat velocity at 0.47 fps) • Additional brine discharge and combined dilution and brine line.
CONSTRUCTION COST	$ 54.3 Million* (Incremental increase from Alt 1 is $ 19.6 Million)
PHASING	Phase 1A-Screen intake structure Phase 1B-Dilution and brine line
FOOTPRINT	Largor intake structure to accommodate additional fish screens
CONSTRUCTION DURATION	2.2 Years (26.1 Months) (113 weeks) (Incremental increase from Alt 1 is 6 weeks)
OPERATION & MAINTENANCE	Same as original proposal + Additional 4 screen Dual Flow screen is primarily used for retrofit. Dual Flow screen (double entry single exit outside in) has O&M issue on sediment removal compared with Center Flow screen (single entry double exit inside out) as the sediment will be accumulated prior to entering the screen from outside.
COMPLEXITY	3rd tunnel connection New combined dilution and brine discharge
PLANT SHUT DOWN IMPACT	42 days to connect 1st and 2nd tunnels to screen wet well 28 days for blocking existing channel and cutting roof and connect to 3rd tunnel 14 days for pipeline connection. Total of 84 days
PLANT SHUT DOWN COST($182,000/day)	$ 15,288,000* (INCREMENTAL INCREASE FROM ALT 1 IS $ 7,644,000)
FISH RETURN MARINE LIFE MORTALITY - JUVENILE AND ADULT FISH (LBS/D)	0.78
SITE INGRESS/EGRESS IMPACT	Intake screen structure Fish return line construction Dilution line construction Combined dilution and brine line construction Brine line construction

* 2017 Dollar Value

ALTERNATIVE 20

No.	DESCRIPTION	VELOCITY *	COMMENT
(1)	EXIST. BAR RACK INTAKE	1.06 FPS **	(4)-10 FT BAR RACK
(2)	EXIST.INTAKE CHANNEL EAST	1.54 FPS	87.5 MGD
(3)	EXIST.INTAKE CHANNEL WEST	1.54 FPS	87.5 MGD
(4)	SCREEN UPSTREAM CHANNEL	0.19 FPS	13.5 FT
(5)	SCREEN INFLUENT THROAT	0.47 FPS	5.5 FT
(6)	THROUGH SCREEN VELOCITIES WITH 15% FOULING	0.49 FPS	10 FT DUAL FLOW
(7)	EXIST.DISCH. CHANNEL REPURPOSED	1.60 FPS	124 MGD

* ALL VELOCITY SHOWN ARE AT MLLW UNLESS OTHERWISE NOTED.

** VELOCITY THROUGH BAR RACK

MULTIPORT DIFFUSER DISCHARGE MORTALITY

Multiport Diffuser – Shear Stress Mortality

- The multiport diffuser alternative contemplates that the CDP will discharge approximately 60 MGD of brine through a 72" outfall pipeline extending approximately 4,000 feet offshore to four duck-bill diffuser ports would eject the brine into the water column at a high velocity to promote rapid mixing.
- In order to comply with the Ocean Plan Amendment requirement that the brine is diluted to a salinity of no greater than 2 ppt over natural background salinity, 945 MGD of the surrounding seawater needs to be entrained in the discharge.
- Section 8.5.1.2 of the Ocean Plan Amendment acknowledges that there is no empirical data showing the level of mortality caused by multiport diffusers. Until the Ocean Plan is updated to reflect data that becomes available from the actual operation of multiport diffusers, owners and operators interested in demonstrating that an alternative technology provides a comparable level of intake and mortality of all forms of marine life as multiport diffusers are directed to assume that larvae in 23 percent of the total entrained volume of diffuser dilution water are killed by exposure to lethal turbulence:

  [U]ntil additional data is available, we assume that larvae in 23 percent of the total entrained volume of diffuser dilution water are killed by exposure to lethal turbulence. The actual percentage of killed organisms will likely change as more desalination facilities are built and more studies emerge. Future revisions or updates to the Ocean Plan may reflect additional data that becomes available. (Section 8.5.1.2 Staff Report/SED)
- With the CDP operation at the proposed maximum production of 60 MGD, 23 percent of the total entrained volume of diffuser dilution water exposed to morality would be 217 MGD.
- The APF associated with 217 MGD of dilution water exposed to 100% mortality was calculated using the methodology set forth in Ocean Plan Amendment Appendix E.

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