6 FWO hydrology is at 97% and is maintained by Alt 5R, 2, and 13, but Alt 10 produces a target inundation of 90% inundation duration. GWP-7 hydrology in the FWO is around 89%. This hydrology is maintained in Alt 5R, decreased slightly to 85% in Alt 2 and 13, and decreased greatly to 60% in Alt 10, which is below the target of 70%. GWP-9 hydrology in the FWO is approximately 93% and is maintained in Alt 5R. Alt 2 and 13 decrease the inundation slightly to 90%, while Alt 10 decreases inundation to the target of 70%. GWP-10 hydrology in the FWO is around 97% and is maintained in Alt 5R. Alt 2 and 13 decrease inundation slightly to 93% and Alt 10 decreases moderately to 87%, towards the target inundation of 70% (**Figure C.2.37**).

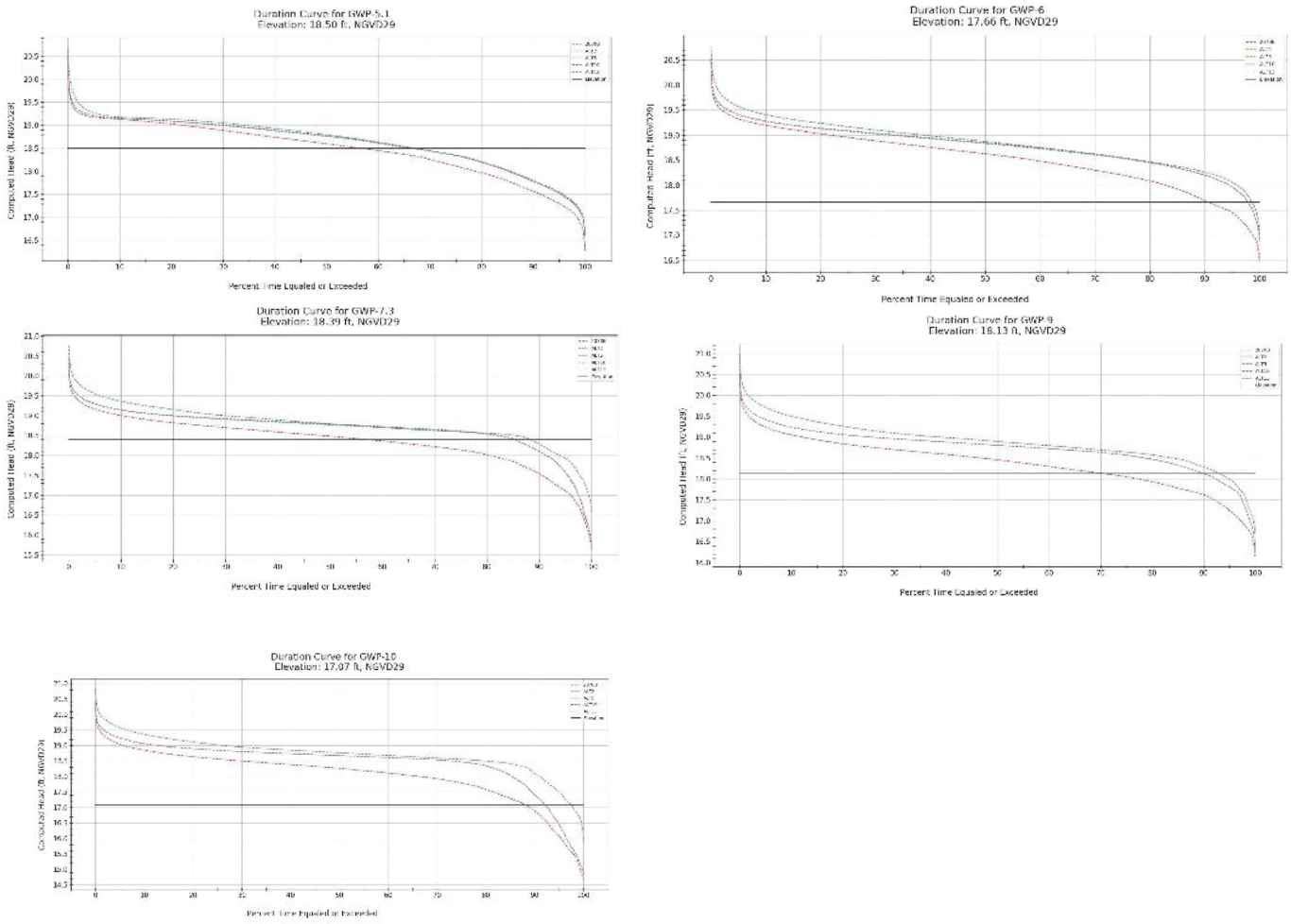

Figure C.2-37. Stage hydrograph of Grassy Waters Preserve.

C.2.13 Water Quality

The LRWRP project was evaluated in accordance to CERP Guidance Memorandum #23 (CGM 23). This guidance outlines three possible classifications for CERP projects. The possible classifications are:

- Components that include water quality improvement features
- Components that do not contain water quality improvement features but are designed to achieve water quality improvement

- Components for which the Comp Plan does not include Water Quality (WQ) improvement features or specifically reference water quality improvement to be addressed during design.

CGM 23 classification of the LRWRP is a Category B project as hydrologic restoration and features will likely benefit WQ but at a minimum will not degrade WQ conditions.

The SFWMD developed a water quality WQ spreadsheet tool that takes existing conditions for existing sources of water and modifies volumes of water using hydrologic input from the Lower East Coast Subregional North Palm LECSR-NP Model. The Total Phosophorus (TP) and Total Nitrogen (TN) concentrations and loads are calculated based on estimated concentration of each water input source and adjusted based on assumptions for project features that are known to have water quality improvements (deep storage vs. shallow storage reservoirs) (**Table C.2-19, Table C.2-20**). The assumptions made for the water quality evaluation tool are as follows:

- Reservoirs have a retention coefficient of 15% (percent total phosphorus retained in reservoir). (Koushel 2019; Yong et al. 1997, Walker 1987.)
- Aquifer Storage Recovery (ASR) has 40% TP removal and 10% TN removal based on 70% recovery efficiency (Vanderzalm et al. 2013).
- Runoff is based on MODFLOW Outputs.
- Shallow impoundment (less than 5' depth) has a concentration treatment reduction of 20% for TP and 6-10% for TN. (DEP 2010, Harper and Baker 2007, Yong et al. 1997, Walker 1987.)
- 7% seepage loss and 30.83% reduction in TP in M-Canal reach is observed from historical data between control structure (CS) 2 and 3.
- Wetland restoration for Cypress Creek, Moonshine Creek, and Kitching Creek include a conservative 5% reduction of nutrients (DEP 2010, Harper and Baker 2007)

The LECSR model used has been calibrated and evaluated and found to meet criteria for flow prediction. There is some uncertainty with the model that is different with the various monitoring stations. The greatest percent deviation in volume of discharged water was 9+/-% error.

Table C.2-19. Summary for TP concentrations and loads from LECSR-NP Modeling.

Site	ECB TP (ppb)	ECB Load (kg)	FWO TP (ppb)	FWO Loads (kg)	Alt 2 TP (ppb)	Alt 2 Load (kg)	Alt 5R TP (ppb)	Alt 5R Loads (kg)	Alt 10 Loads (ppb)	Alt 10 loads (kg)	Alt 13 TP (ppb)	Alt 13 Load (kg)
CS3	92	6,428	92	6,430	92	6,494	76	6,415	35	1,764	92	6,502
C-18W	41	2,226	41	2,294	34	2,276	28	2,279	31	2,621	25	1,742
G-161	10	0	10	0	10	12	10	34	35	463	10	13
G-92	41	3,502	41	3,517	24	2,636	21	2,265	22	2,521	19	1,885
Lainhart	43	5,674	43	5,688	31	4,805	28	4,432	28	4,676	27	4,075
S-46	41	2,326	41	2,326	24	1,093	21	1,006	22	1,017	19	858
LR_NWF	50*	12,695	50*	12,709	41	10,980	39*	10,607	39*	11,080	39*	10,142

*Target 54 ppb

Table C.2-20. Summary for TN Concentrations and Load from LECSR-NP Modeling.

Site	ECB TN (mg/L)	ECB Loads (tons)	FWO TN (mg/L)	FWO Loads (tons)	Alt 2 TN (mg/L)	Alt 2 Load (tons)	Alt 5R TN (mg/L)	Alt 5R Loads (tons)	Alt 10 TN (mg/L)	Alt 10 Loads (tons)	Alt 13 TN (mg/L)	Alt 13 Loads (tons)
G-92	0.92	78	0.92	78	0.87	94	0.87	96	0.87	102	0.87	88
S-46	0.95	53	0.95	53	0.90	40	0.90	44	0.90	42	0.90	41
LR_NWF	1.17*	297	1.17*	297	1.11*	297	1.10*	297	1.12*	314	1.12*	289

*Target 1.20 mg/L

WQ parameters were identified and are specific to water body type as different types of water bodies have different water quality concerns. **Table C.2-21** highlights WQ evaluation criteria selected by water body.

Table C.2-21. LRWRP WQ evaluation criteria and key areas.

Area/Parameter	Total Phosphorus (µg/L)	P Load (kg)	Total Nitrogen (mg/L)	N Load	Specific Conductance (Micromhos/cm)
Grassy Waters Preserve: Control 2, Control 3, Control 4 – Water Supply Utilities	X	X	-	-	X
Loxahatchee Slough: C-18 West, G-161, and G-160	X	X	-	-	-
Loxahatchee River: G-92 and Lainhart Dam	X	X	X	X	-
Loxahatchee Estuary: S-46 to lower estuary, Loxahatchee River (see above) and tributaries (Cypress, Moonshine, Kitching Creek) and qualitative analysis as what gets delivered to middle estuary	X	X	X	X	-

X indicates important constituent to evaluate in this area.

The 62-302.531 (2) (c) 2 FAC establishes nutrient thresholds by watershed region in Florida. The Loxahatchee Basin (**Figure C.2.38**) is considered part of the Peninsula Biological Region but closely borders and could drain into the Everglades/South Florida Biological region. For water quality purposes the LRWRP will be evaluated as a Peninsular as the footprint of the project is within the Peninsular Region. The 62-302.531 (2)(c) 2 FAC geometric mean concentrations (not to be exceeded more than once in any three year period) for peninsular region for Total Phosphorus Nutrient Threshold is 0.12 mg/L and Total Nitrogen Nutrient Threshold of 1.54 mg/L.

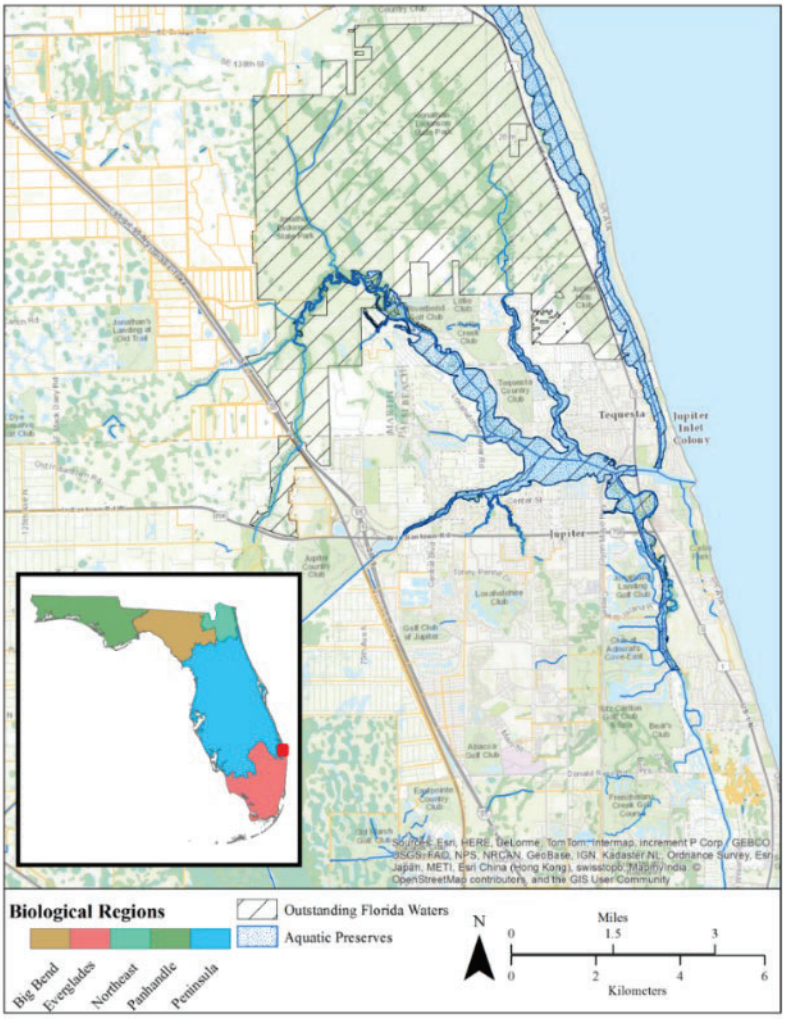

Figure C.2.38. Florida Biological Regions and Outstanding Florida Waters of project location.

The water quality analysis results from the spreadsheet tool are presented by alternative. Alt 2 Water Quality Evaluation is summarized below in **Table C.2-22** and **Table C.2-23** is the comparison between Alt 2 and the future without (FWO).

Table C.2-22. Alternative 2 Water Quality Evaluation.

Flow-way	Basin/Natural Area	Inflow			Outflow			Data Source
		Volume (ac-ft)	TP (mg/L)	TN (mg/L)	Volume (ac-ft)	TP (mg/L)	TN (mg/L)	
3	PalMar	Not measured	Not measured	Not measured	Not measured	Not measured	Not measured	N/A
3	Cypress Creek	Not measured	0.079	1.11	68,380	0.05	<1.54	LRD 2016

Flow-way	Basin/Natural Area	Inflow			Outflow			
		Volume (ac-ft)	TP (mg/L)	TN (mg/L)	Volume (ac-ft)	TP (mg/L)	TN (mg/L)	Data Source
3	Hobe-St. Lucie	Not measured	0.11	1.26	9,455	0.071	<1.54	LRD 2016
3	Kitching Creek	Not measured	0.079	1.32	12,906	0.068	1.363	LRD 2016
2	C-18 Basin	5,800	0.017	1	44,594	0.034	0.985	LRD 2016
2	C-18 Basin	16,790	0.0147	1.225	65,570	0.034	0.985	SFWMD DBHYDRO 2017
2	Lox Slough	13,814	0.011	1.011	54,773	0.013	0.81	Mock Roos 2017
1	Lake Okeechobee C10A	0	0	2.45				
1	L-8+Lake to C51	129,211	0.185	2.3	129,211	0.123	1.636	Julian 2016
1	ITID	16,518	0.039	1.352	16,518	0.039	1.352	ITID personal communication and SFWMD DBHYDRO 2017
1	Grassy Water Preserve	57,240	0.01	0.839	2,977	0.01	0.839	SFWMD DBHYDRO 2017
1	Grassy Water Preserve	57,240	0.01	0.839	17,660	0.013	1.011	SFWMD DBHYDRO 2017
River	Loxahatchee River NWF	216,608	0.041	1.11				Julian 2016
River	Middle Estuary (S/W Fork)	36,193	0.024	0.899				LRD 2016

Table C.2-23. Alternative 2: Comparison to FWO water quality analysis results.

		Inflow				Outflow			
Flow way	Basin/ Natural Area	TP (mg/L)	TP Difference To FWO (Alt 2-FWO)	TN (mg/L)	TN Difference To FWO (Alt 2-FWO)	TP (mg/L)	TP Difference To FWO (Alt 2-FWO)	TN (mg/L)	TN Difference To FWO (Alt 2-FWO)
3	PalMar	N/M		N/M		N/M		N/M	
3	Cypress Creek	0.079	0	1.11	0	0.05	-0.003	<1.54	0
3	Hobe-St. Lucie	0.11	0	1.26	0	0.071	0	<1.54	0
3	Kitching Creek	0.079	0	1.32	0	0.068	-0.007	1.363	0
2	C-18 Basin	0.017	0	1	0	0.034	0.017	0.985	0.005
2	C-18 Basin	0.0147	-0.0283	1.225	0.121	0.034	0.005	0.985	-0.052
2	Lox Slough	0.011	-0.004	1.011	0	0.013	-0.016	0.81	0
1	Lake Okeechobee C10A	0	-0.185	2.45	0		0		0
1	L-8+Lake to C51	0.185	0.062	2.3	0	0.123	-0.01	1.636	0
1	ITID	0.039	0	1.352	0	0.039	0	1.352	0
1	Grassy Water Preserve	0.01	0	0.839	0	0.01	0	0.839	0
1	Grassy Water Preserve	0.01	0	0.839	0	0.013	0	1.011	0
River	Loxahatchee River NWF	0.041	-0.009	1.11	-0.06				0
River	Middle Estuary (S/W Fork)	0.024	-0.017	0.899	-0.047				0

Alt 2 water quality effect is limited at most points where assessed by the model. Total Phosphorus (TP) and Total Nitrogen (TN) inflows are not significantly different. See **Figures C.2.39** and **C.2.40** for TP and TN flows. There are no negative impacts associated with this alternative.

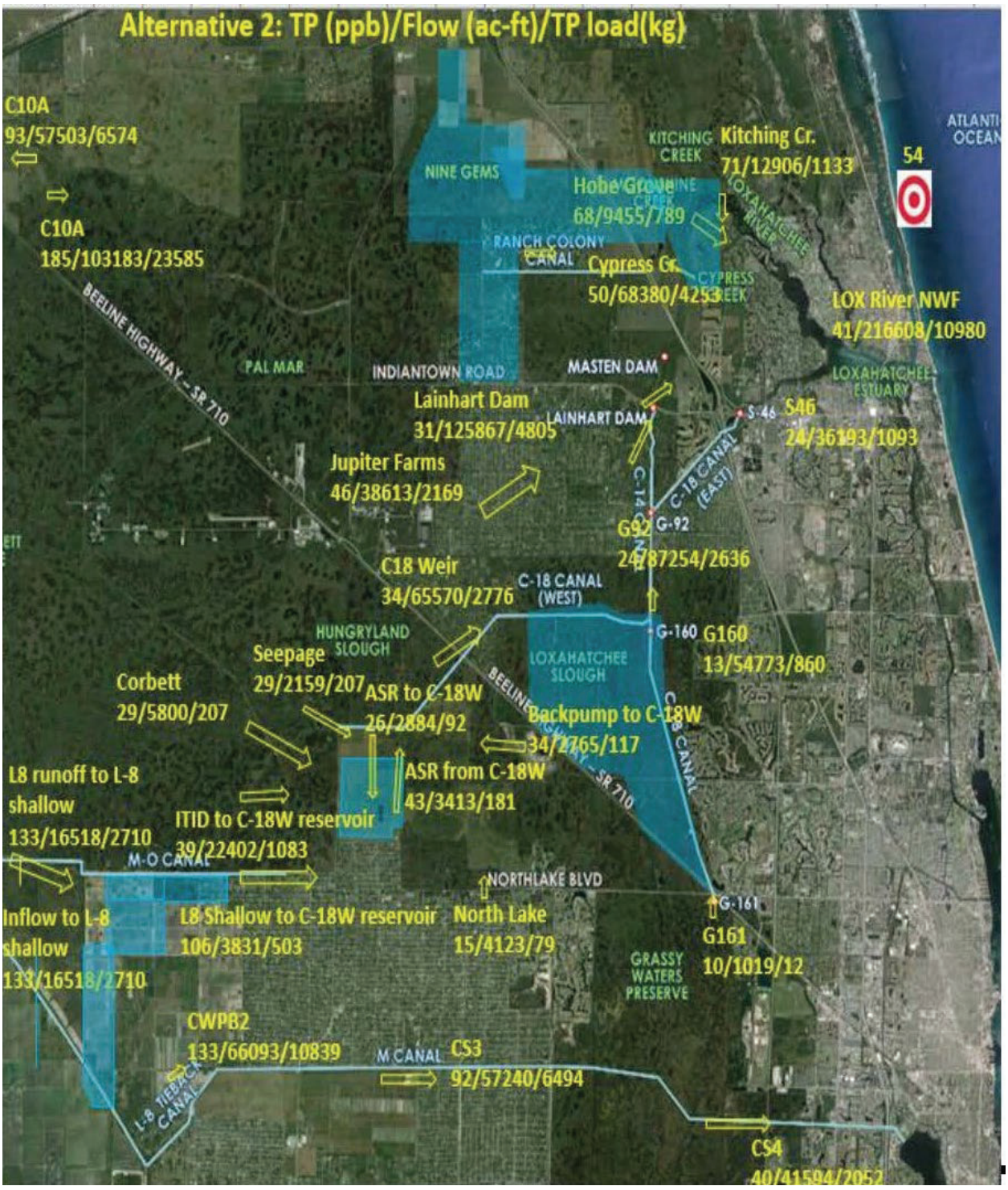

Figure C.2-39 Alternative 2 total phosphorous (TP) flow map.

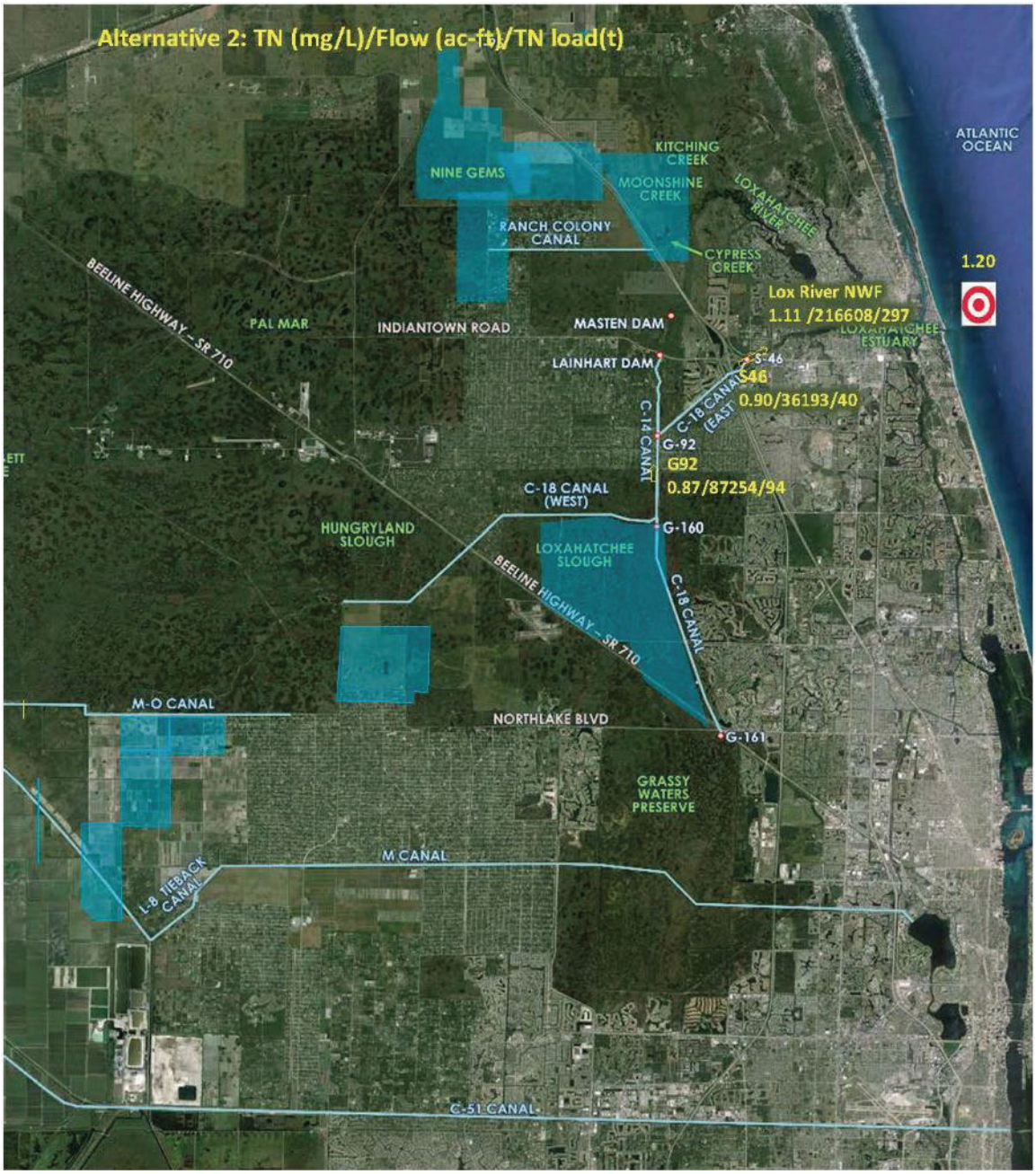

Figure C.2-40: Alternative 2 Total Nitrogen flow map and structures.

Alt 5R Water Quality Evaluation is summarized below in Table **C.2-24** and Table **C.2-25** is the comparison between Alt 5R and the future without (FWO).

Table C.2-24. Alternative 5R Water Quality Evaluation.

Flow-way	Basin/Natural Area	Inflow			Outflow			Data Source
		Volume (ac-ft)	TP (mg/L)	TN (mg/L)	Volume (ac-ft)	TP (mg/L)	TN (mg/L)	
3	PalMar	N/M	N/M	N/M	N/M	N/M	N/M	N/A
3	Cypress Creek	N/M	0.05	1.11	68,380	0.05	<1.54	LRD 2016
3	Hobe-St. Lucie	N/M	0.11	1.26	9,455	0.068	<1.54	LRD 2016
3	Kitching Creek	N/M	0.079	1.32	12,900	0.071	1.363	LRD 2016
2	C-18 Basin	6,214	0.029	1	66,888	0.028	0.985	LRD 2016
2	C-18 Basin	2,988	0.029	1.225	66,888	0.028	0.985	SFWMD DBHYDRO 2017
2	Lox Slough	9,634	0.014	1.011	59,334	0.013	0.81	Mock Roos 2017
1	Lake Okeechobee C10A	103,183	0.185	2.45				
1	L-8+Lake to C51	203,864	0.133	2.3	203,864	0.123	1.636	Julian 2016
1	ITID	27,639	0.039	1.352	27,639	0.039	1.352	ITID personal communication and SFWMD DBHYDRO 2017
1	Grassy Waters Preserve	68,134	0.01	0.839	9,872	0.01	0.839	SFWMD DBHYDRO 2017
1	Grassy Waters Preserve	38,134	0.01	0.839	6,834	0.02	1.011	SFWMD DBHYDRO 2017
River	Loxahatchee River NWF	218,363	0.039	1.11				Julian 2016
River	Middle Estuary (S/W Fork)	39,561	0.021	0.899				LRD 2016

Table C.2-25. Alternative 5R Comparison to FWO Table.

Flow way	Basin/Natural Area	Inflow				Outflow			
		TP (mg/L)	TP Diff. To FWO (Alt-FWO)	TN (mg/L)	TN Diff. To FWO (Alt-FWO)	TP (mg/L)	Diff. To FWO (Alt - FWO)	TN (mg/L)	Diff. TN To FWO (Alt-FWO)
3	PalMar	N/M		N/M		N/M		N/M	
3	Cypress Creek	0.05	-0.029	1.11	0	0.05	-0.003	<1.54	0
3	Hobe-St. Lucie	0.11	0	1.26	0	0.068	-0.003	<1.54	0
3	Kitching Creek	0.079	0	1.32	0	0.071	-0.004	1.363	0
2	C-18 Basin	0.029	0.012	1	0	0.028	0.011	0.985	0.005
2	C-18 Basin	0.029	-0.014	1.225	0.121	0.028	-0.001	0.985	-0.052
2	Lox Slough	0.014	-0.001	1.011	0	0.013	-0.016	0.81	0
1	Lake Okeechobee C10A	0.185	0	2.45	0		0		0
1	L-8+Lake to C51	0.133	0.01	2.3	0	0.123	-0.01	1.636	0
1	ITID	0.039	0	1.352	0	0.039	0	1.352	0
1	Grassy Waters Preserve	0.01	0	0.839	0	0.01	0	0.839	0
1	Grassy Waters Preserve	0.01	0	0.839	0	0.02	0.007	1.011	0
River	Loxahatchee River NWF	0.039	-0.011	1.11	-0.06		0		0
River	Middle Estuary (S/W Fork)	0.021	-0.02	0.899	-0.047		0		0

Alt 5R TP and TN inflows are not significantly different from FWO. Outflows are similar for TP and TN with the notable exception of L-8+Lake to C51, similar to Alt 2. There are no negative impacts of this alternative in regards to water quality, See **Figures C.2.41** and **C.2.42**.

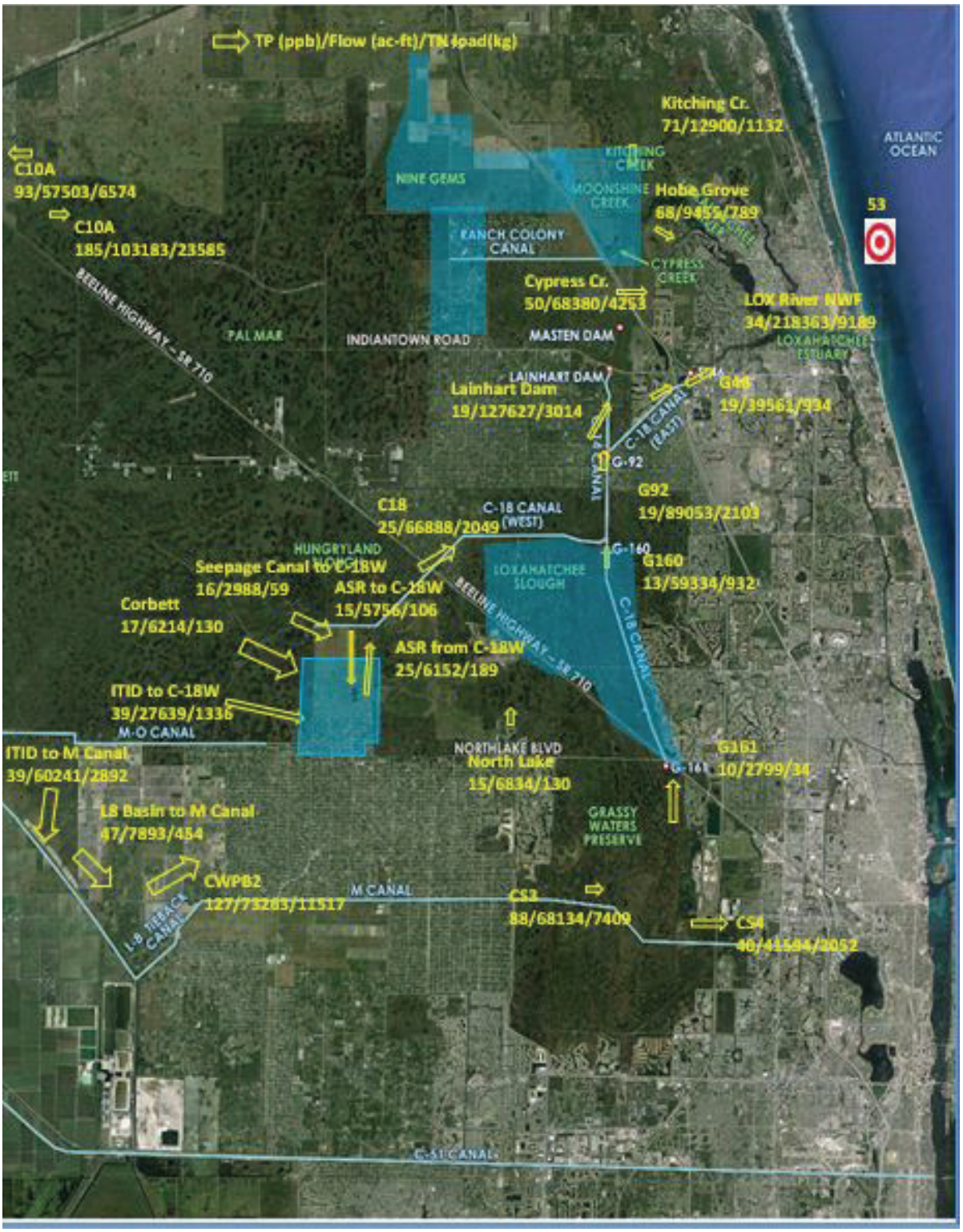

Figure C.2-41: Alternative 5R total phosphorous (TP) flow map.

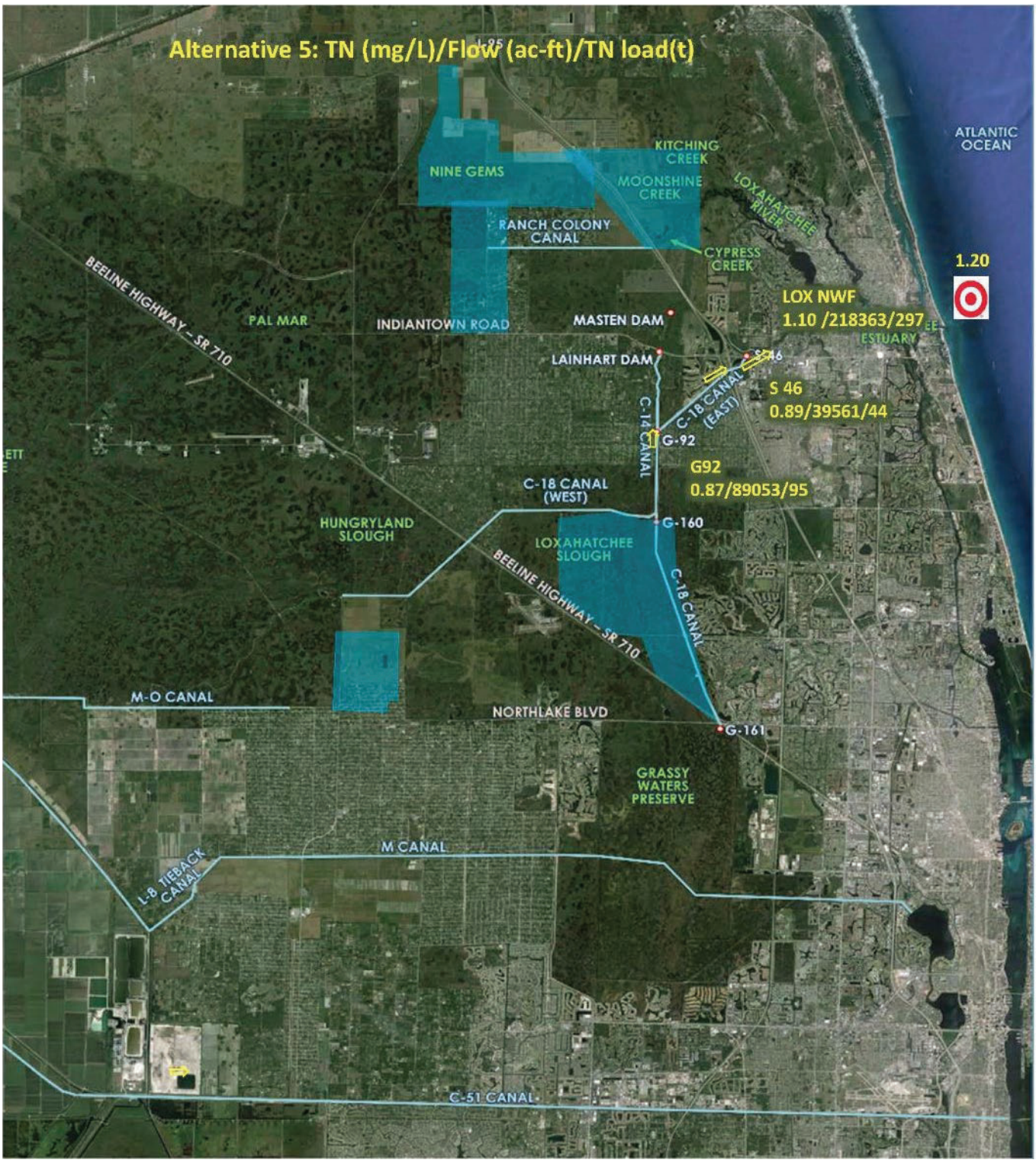

Figure C.2-42: Alternative 5R total nitrogen (TN) flow map.

Alt 10 Water Quality Evaluation is summarized below in Table **C.2-26** and Table **C.2-27** is the comparison between Alt 10 and the future without (FWO).

Table C.2-26. Alternative 10 water quality evaluation.

Flow way	Basin/ Natural Area	Inflow			Outflow			Data Source
		Volume (ac-ft)	TP (mg/L)	TN (mg/L)	Volume (ac-ft)	TP (mg/L)	TN (mg/L)	
3	PalMar	N/M	N/M	N/M	N/M	N/M	N/M	N/A
3	Cypress Creek	N/M	0.079	1.11	73,586	0.05	<1.54	LRD 2016
3	Hobe-St. Lucie	N/M	0.11	1.26	8,390	0.068	<1.54	LRD 2016
3	Kitching Creek	N/M	0.079	1.32	12,833	0.071	1.363	LRD 2016
2	C-18 Basin	5,212	0.017	1	68,544	0.031	0.985	LRD 2016
2	C-18 Basin	0	0	1.225	68,544	0.031	0.985	SFWMD DBHYDRO 2017
2	Lox Slough	13,409	0.031	1.011	73,308	0.013	0.81	Mock Roos 2017
1	Lake Okeechobee C10A	103,183	0.185	2.45				
1	L-8+Lake to C51	0	0	2.3	43,590	0.0.06	1.636	Julian 2016
1	ITID	97,974	0.039	1.352	87,974	0.039	1.352	ITID personal communication and SFWMD DBHYDRO 2017
1	Grassy Waters Preserve	40,538	0.01	0.839	10,633	0.01	0.839	SFWMD DBHYDRO 2017
1	Grassy Waters Preserve	40,538	0.01	0.839	2,776	0.0154385	1.011	SFWMD DBHYDRO 2017
River	Loxahatchee River NWF	227,979	0.039	1.12				Julian 2016
River	Middle Estuary (S/W Fork)	38,228	0.022	0.899				LRD 2016

Table C.2-27. Alternative 10 Comparison to FWO Table.

		Inflow				Outflow			
Flow way	Basin/Natural Area	TP (mg/L)	Diff. To FWO (Alt-FWO)	TN (mg/L)	Diff. To FWO (Alt-FWO)	TP (mg/L)	Diff. To FWO (Alt -FWO)	TN (mg/L)	Diff. To FWO (Alt-FWO)
3	PalMar	N/M		N/M		N/M		N/M	
3	Cypress Creek	0.079	0	1.11	0	0.05	-0.003	<1.54	0
3	Hobe-St. Lucie	0.11	0	1.26	0	0.068	-0.003	<1.54	0
3	Kitching Creek	0.079	0	1.32	0	0.071	-0.004	1.363	0
2	C-18 Basin	0.017	0	1	0	0.031	0.014	0.985	0.005
2	C-18 Basin	0	-0.043	1.225	0.121	0.031	0.002	0.985	-0.052
2	Lox Slough	0.031	0.016	1.011	0	0.013	-0.016	0.81	0
1	Lake Okeechobee C10A	0.185	0	2.45	0		0		0
1	L-8+Lake to C51	0	-0.123	2.3	0	0.0.06	-0.73	1.636	0
1	ITID	0.039	0	1.352	0	0.039	0	1.352	0
1	Grassy Waters Preserve	0.01	0	0.839	0	0.0.035	0	0.839	0.025
1	Grassy Waters Preserve	0.01	0	0.839	0	0.035		1.011	0.02
River	Loxahatchee River NWF	0.039	-0.011	1.12	-0.05		0		0
River	Middle Estuary (S/W Fork)	0.022	-0.019	0.899	-0.047		0		0

Alt 10 inflows show significant change between Alt 10 and FWO with respect to reduction in TP from the lake to 0 mg/L and ultimately overall reduction of TP from L-8 and Lake O combined to C-51 down to 60 mg/L TP. However, TP concentration in GWP flows to Loxahatchee Slough increase by 20-25 mg/L due to the force main direct transmission of M-canal water to GWP. All other alternatives send a small amount of water from G-161 in northern GWP where TP concentration is naturally lower. This is a result of increased flow to the spreader canal as the other alternatives. There are no significant impacts to water quality associated with this alternative, See **Figure C.2.43** and **C.2.44**.

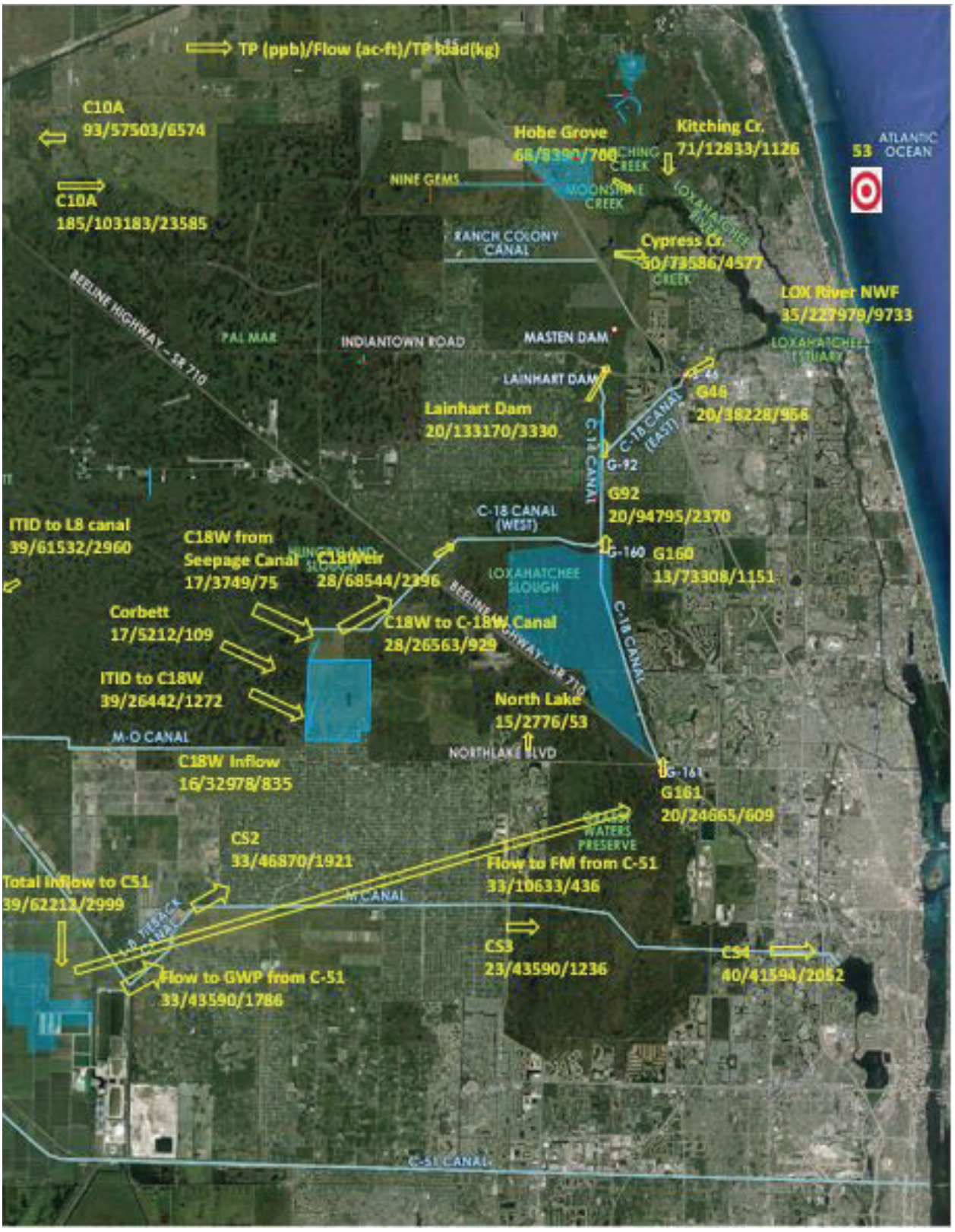

Figure C.2-43: Alternative 10 total phosphorous (TP) flow map.

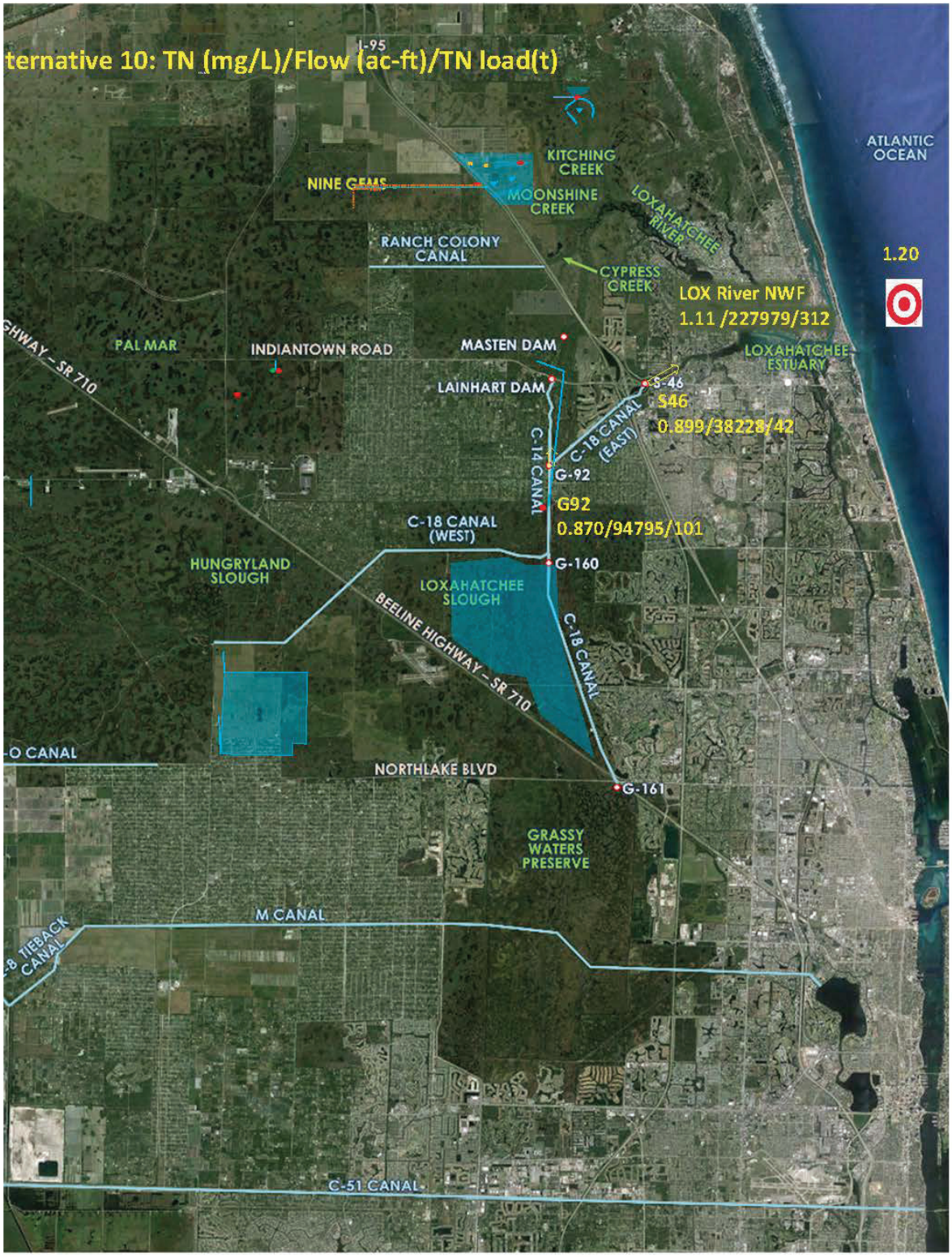

Figure C.2-44: Alternative 10 total nitrogen (TN) flow map.

C.2.13.1 Conductivity

Conductivity (chlorides) was only a major concern in Flow-way 1 and primarily Alt 10. The formula that is used to determine conductivity and its relationship with TDS is 0.6*conductivity = TDS. To meet the TDS criteria the conductivity for class I waters needs to be below 800 µS/cm. Once it hits the 800 threshold there is a human health concern, and the chlorides would get harder to dilute. The conductivity levels will be evaluated at Control 2 for flow-way 1. Alt 10 is the primary alternative needed for this evaluation. Monitoring and modelling of chlorides in this system would need to be put in place to inform operations given the seasonal nature of rainfall and water levels in deep reservoirs to minimize risk of moving high chlorides downstream. To analyze effects of different water sources chlorides the following Table **C.2-28** lists assumptions for conductivity levels, as source water will effect analysis:

Table C.2-28. Historical Source Water Conductance.

Water Body or Source	Specific Conductance Level
Lake Okeechobee	550 Micromohs/cm
L-8	500 Micromohs/cm up to 1275 (limit to release)
ITID	550
Loxahatchee River	Varied from 230 Micromohs/cm from Lainhart Dam to 550 Micromohs/cm at east of I-95

Modeling based on spreadsheet analysis of existing conductance conditions and flow volumes from the LECSR model is presented in **Figure C.2.45** and **Table C.2.29**. Conductivity increases from ECB (used for FWO assumption) of 548 µS/cm at Control 2 structure to 758 µS/cm. This is a significant increase by 38% but is below the threshold of concern 800 µS/cm identified by the City of West Palm Beach for water supply purposes. If this alternative were to be selected, there is an assumption that limiting the depth of the reservoir would avoid high chlorides. Pre-L-8 Flow Equalization Basin construction revealed high chlorides in the L-8 area. To ensure lower risk of chlorides (which cause heavy water to sink to bottom), releases should not be made below a certain water levels in the reservoir. L-8 data would need to be reviewed to determine exact threshold of reservoir stage to higher chloride incidence, if this alternative were selected.

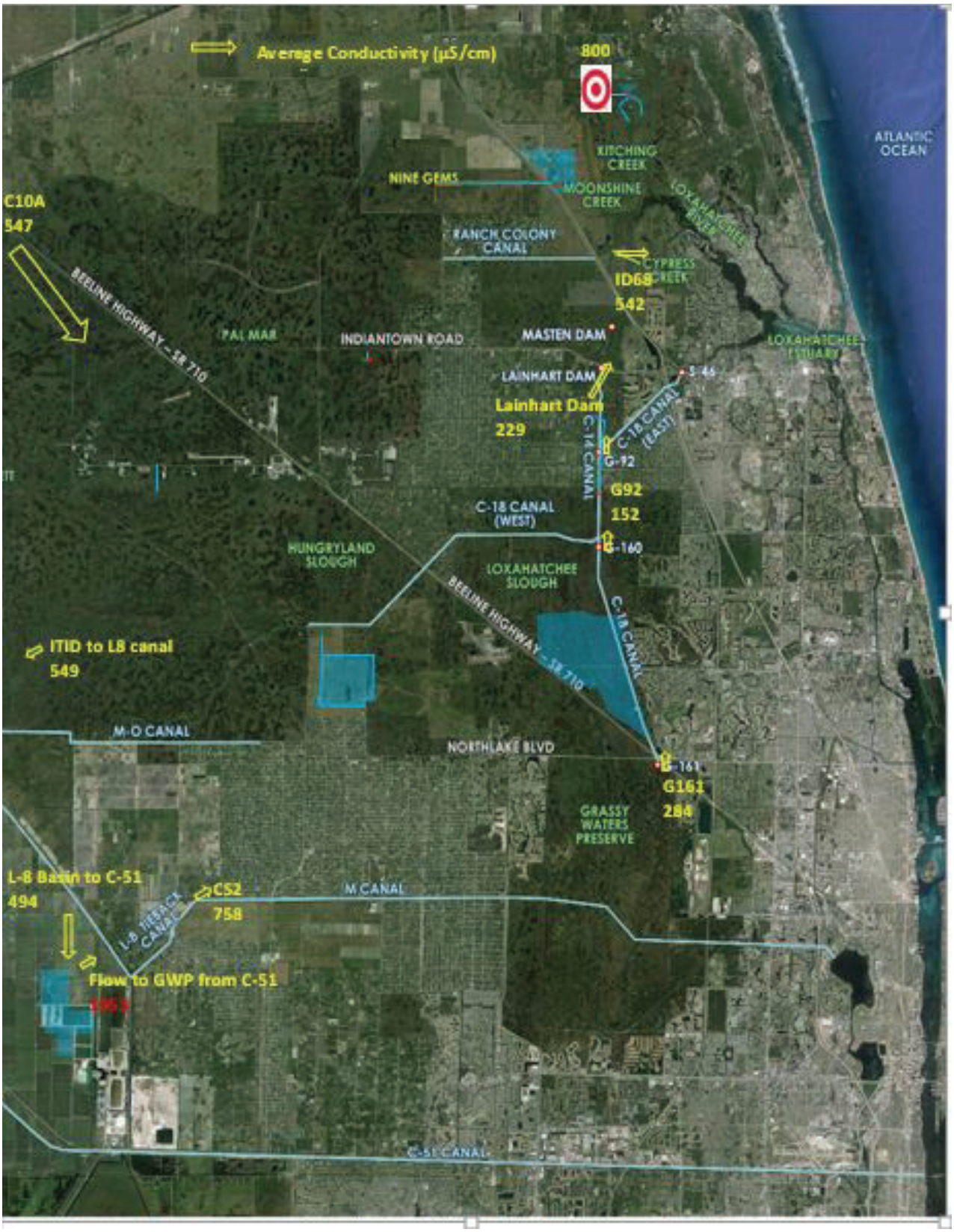

Figure C.2-45: Alternative 10 Conductivity Flow Map

Table C.2-29: Alternative 10 Summary Table Conductivity Analysis.

	Alt 10 Max	Alt 10 Expected	ECB
C-51 Area (acres)	1,600		-
C-51 Volume (ac-ft)	44,000		-
C-51 Depth (ft)	27.5		-
Seepage rate (in/day)	0.33[1]	0.25[2]	
Annual seepage Qseep (ac-ft)	16,060	12,034	-
% of Seepage (Qseep/Qtotal)	26%	19%	-
Seepage Specific Conductance (µS/cm)	3,220[3]	3,220	-
Specific Conductance of C-51 Reservoir (µS/cm)	1,053	936	-
Specific Conductance of C-51 Reservoir at CS2 (µS/cm)	758[4]	709	548
Seepage Specific Conductance (µS/cm) for 800 (µS/cm) target at CS2	3,700	4,565	-

1 and 2. Hu, Gordon, 2012. Personnel Communication. Seepage analysis of L8 Reservoir for South Florida Water Management District

3. SFWMD, 2014-2017. South Florida Environmental Report. Vol III, Appendix 2-2, L-8 Reservoir Permit Report.

4. SFWMD, 2018. LRWRP_Water_Quality_Conductivity_Diagram_MST-Final.xlsx: Approximation of CS2 conductance based on DBHYDRO data and Modflow outputs for Alt 10 for target of specific conductance of 800 us/cm (or equivalent of Total Dissolved Solid Concentration of 500 mg/L) at seepage rate of 0.33 in/day.

Alt 13 Water Quality Evaluation is summarized below in Table **C.2-30** and Table **C.2-31** is the comparison between Alt 13 and the future without (FWO).

Table C.2-30. Alternative 13 Water Quality Evaluation.

Flow way	Basin/ Natural Area	Inflow			Outflow			Data Source
		Volume (ac-ft)	TP (mg/L)	TN (mg/L)	Volume (ac-ft)	TP (mg/L)	TN (mg/L)	
3	PalMar	N/M	N/M	N/M	N/M	N/M	N/M	N/A
3	Cypress Creek	N/M	0.079	1.11	66,636	0.05	<1.54	LRD 2016
3	Hobe-St. Lucie	N/M	0.11	1.26	9,459	0.071	<1.54	LRD 2016
3	Kitching Creek	N/M	0.079	1.32	12,906	0.071	1.363	LRD 2016
2	C-18 Basin	4,598	0.029	1	57,494	0.025	0.985	LRD 2016
2	C-18 Basin	0	0	1.225	10,613	0.025	0.985	SFWMD DBHYDRO 2017

Flow way	Basin/ Natural Area	Inflow			Outflow			Data Source
		Volume (ac-ft)	TP (mg/L)	TN (mg/L)	Volume (ac-ft)	TP (mg/L)	TN (mg/L)	
2	Lox Slough	10,787	0.023	1.011	56,946	0.013	0.81	Mock Roos 2017
1	Lake Okeechobee C10A	0	0	2.45				
1	L-8+Lake to C51	0	0	2.3	61,613	0.031	1.636	Julian 2016
1	ITID	33,071	0.039	1.352	33,071	0.039	1.352	ITID personal communication and SFWMD DBHYDRO 2017
1	Grassy Waters Preserve	57,300	0.01	0.839	9,862	0.01	0.839	SFWMD DBHYDRO 2017
1	Grassy Waters Preserve	57,300	0.01	0.839	4,133	0.015	1.011	SFWMD DBHYDRO 2017
River	Loxahatchee River NWF	209,823	0.039	1.116				Julian 2016
River	Middle Estuary (S/W Fork)	37,235	0.019	0.8987				LRD 2016

Table C.2-31. Alternative 13 Comparison to FWO.

Flow way	Basin/ Natural Area	Inflow				Outflow			
		TP (mg/L)	Diff. To FWO (Alt-FWO)	TN (mg/L)	Diff. To FWO (Alt-FWO)	TP (mg/L)	Diff. To FWO (Alt - FWO)	TN (mg/L)	Diff. To FWO (Alt-FWO)
3	PalMar	N/M		N/M		N/M		N/M	
3	Cypress Creek	0.079	0	1.11	0	0.05	-0.003	<1.54	0
3	Hobe-St. Lucie	0.11	0	1.26	0	0.071	0	<1.54	0
3	Kitching Creek	0.079	0	1.32	0	0.071	-0.004	1.363	0
2	C-18 Basin	0.029	0.012	1	0	0.025	0.008	0.985	0.005

Flow way	Basin/ Natural Area	Inflow				Outflow			
		TP (mg/L)	Diff. To FWO (Alt-FWO)	TN (mg/L)	Diff. To FWO (Alt-FWO)	TP (mg/L)	Diff. To FWO (Alt - FWO)	TN (mg/L)	Diff. To FWO (Alt-FWO)
2	C-18 Basin	0	-0.043	1.225	0.121	0.025	-0.004	0.985	-0.052
2	Lox Slough	0.023	0.008	1.011	0	0.013	-0.016	0.81	0
1	Lake Okeechobee C10A	0	-0.185	2.45	0		0		0
1	L-8+Lake to C51	0	-0.123	2.3	0	0.031	--.102	1.636	0
1	ITID	0.039	0	1.352	0	0.039	0	1.352	0
1	Grassy Waters Preserve	0.01	0	0.839	0	0.01	0	0.839	0
1	Grassy Waters Preserve	0.01	0	0.839	0	0.015	0.002	1.011	0
River	Loxahatchee River NWF	0.039	-0.011	1.116	-0.054		0		0
River	Middle Estuary (S/W Fork)	0.019	-0.022	0.8987	-0.0473		0		0

Alt 13 inflows show no significant change between Alt 13 and FWO. As with other alternatives there is an increase of TN at L-8+Lake to C51 of 1.636. This is a result of increased flow to the spreader canal. There are no significant impacts to water quality associated with this alternative, see **Figure C.2.46** and **C.2.47**.

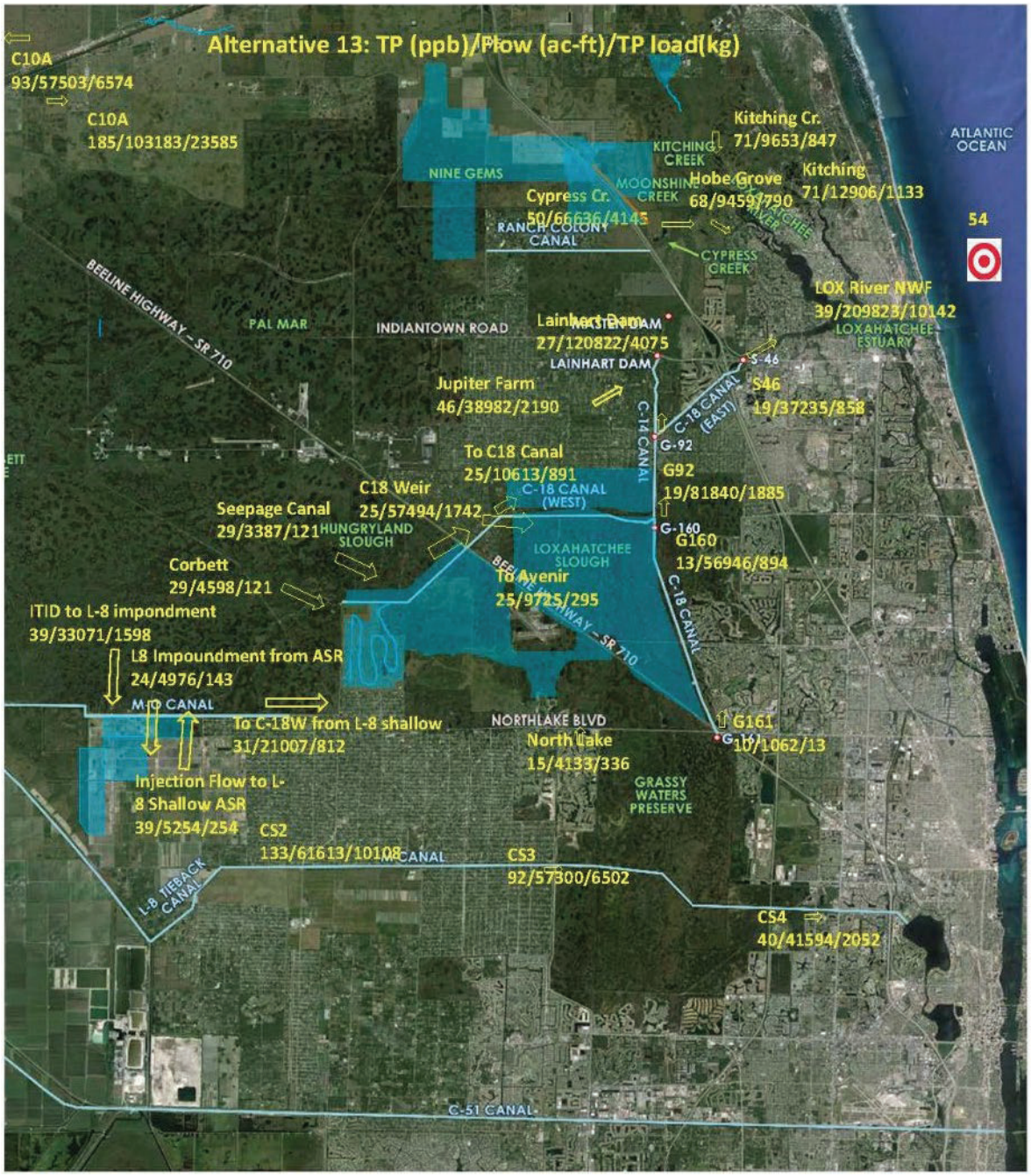

Figure C.2-46: Alternative 13 Total Phosphorous (TP) Flow Map.

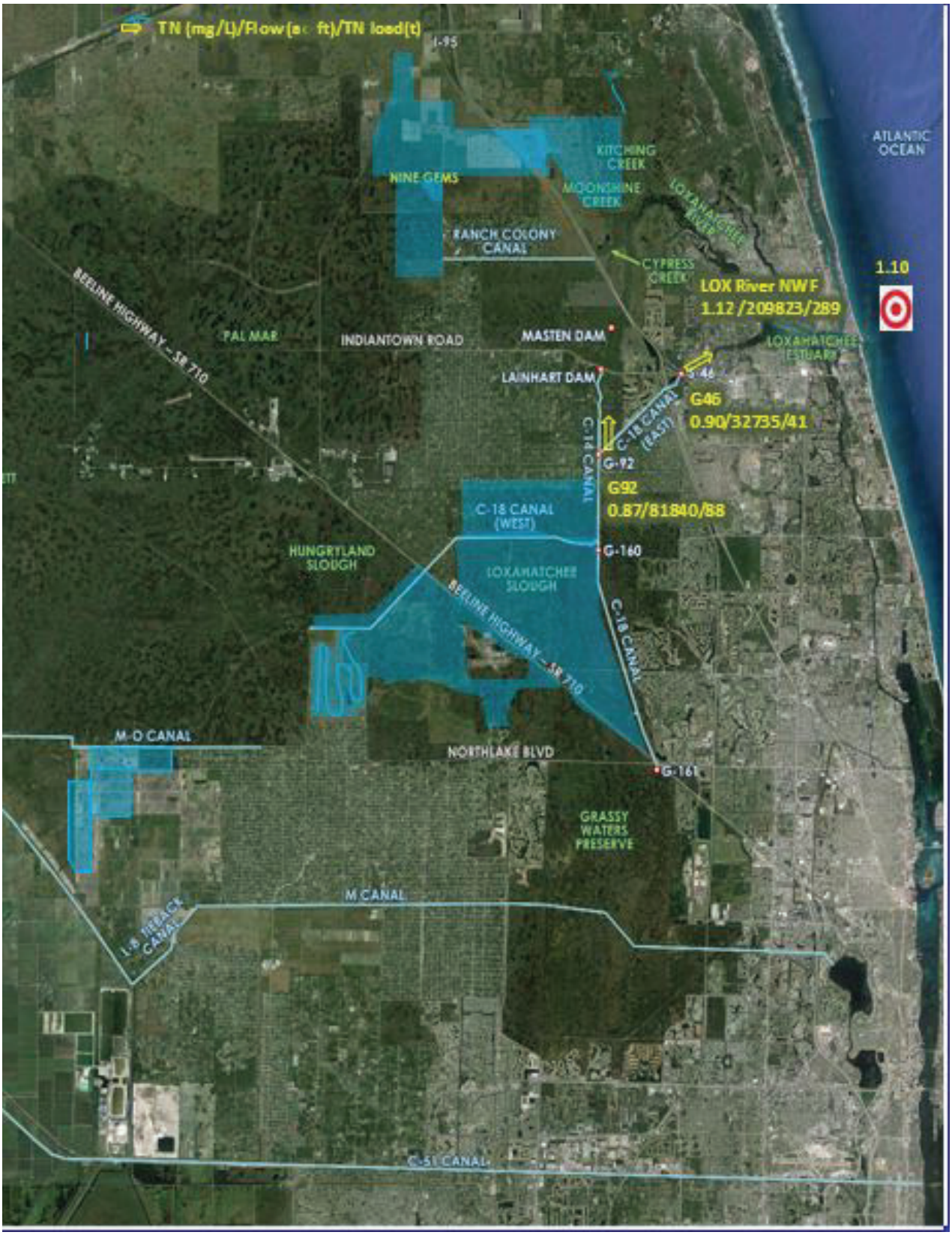

Figure C.2-47: Alternative 13 Total Nitrogen (TN) Flow Map.

C.2.14 Air Quality

The FWO long term impact of the project neither improves nor degrades air quality. The short term impact without project is a slight temporary decrease in emissions and particulates from construction. The alternatives all have short-term impact from emissions by the construction equipment associated with the project but will not significantly impact air quality. Exhaust emissions of the construction equipment would have a temporary effect on the air quality, but no permanent impacts are expected. The temporary effects from construction are not expected to cause a non-attainment for air quality. There will be no long-term impacts to air quality from any alternative as all structures are either unpowered and the only powered feature, the ASR well pumps, will be electric.

C.2.15 Hazardous, Toxic, and Radioactive Waste

C.2.15.1 Residual Agricultural Chemicals

The USACE HTRW policy (ER-1165-2-132) directs that Construction of Civil Works projects in HTRW-contaminated areas should be avoided where practicable. In September 2011, the ASA (CW) provided an exception to this HTRW policy for CERP Projects (Memorandum for Deputy Commanding General for Civil and Emergency Operations, Subject: Comprehensive Everglades Restoration Plan (CERP) – Residual Agricultural Chemicals, Dated September 14, 2011). A copy of this policy is included in **Appendix C.4.42**. If specific criteria are met, this policy memorandum allows residual agrichemicals to remain on project lands and allows the USACE to integrate response actions directly (cost share) into the construction plan. However for this project, the SFWMD will assume 100% of any remediation cost required for HTRW or residual agricultural chemical concerns and this remediation will not be part of the construction plan. The SFWMD will be responsible for obtaining written concurrence from the USFWS that the water impoundment areas are acceptable for intended project use with regards to ecosystem risk. The SFWMD will also be also be responsible for obtaining written concurrence from the Florida Department of Environmental Protection (FDEP) Waste Cleanup Group that all projects lands are clear of HTRW and acceptable for intended project use. The USFWS is the final federal authority for endangered species issues/ecosystem risk. The FDEP is the EPA-delegated authority to address HTRW/human health risk. No further federal approvals are needed relative to contamination issues if the local sponsor is the action agent for any remediation activities with no federal cost share for those activities.

C.2.15.2 Recommendation

The FWO project has no relation to HTRW issues. Remediation may or may not commence without the project and it is dependent upon the responsible parties to ensure remediation.

The main areas that would require potential assessment and remediation vary by the area affected by alternative. **Table C.2-32** summarizes, by alternative, whether further HTRW assessment and clearance would be needed if implemented, based on the summary from the ECB/FWO write-up. Prior to construction, HTRW and residual agricultural chemical issues will be satisfactorily addressed by the non-federal sponsor. Prior to construction and during operation, the USACE and the non-federal sponsor will comply with applicable requirements. There is also the potential for HTRW release associated with the operation of project pump stations (i.e., oil spills); however, with modern facilities and best management practices, this presents a minor risk to the environment.

The non-federal sponsor will provide all lands free and clear of any and all environmental issues and the property will have no limitations that will prevent the selected remedy from achieving goals. The local