CENTRAL EVERGLADES PLANNING PROJECT

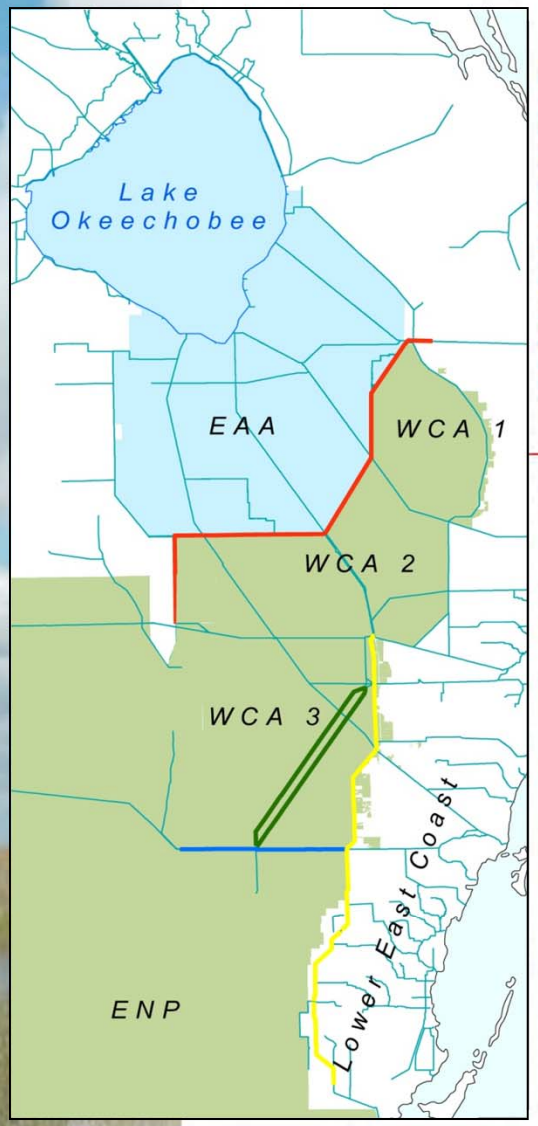
Greenline iModel Status and Strategies

PRESENTED BY

CEPP Modeling Team

October 25, 2012

CEPP PLAN FORMULATION FRAMEWORK



TREATMENT /STORAGE

CONVEYANCE/DISTRIBUTION/SEEPAGE

INITIAL SCREENING

RANGE OF QUANITY/QUALITY MEASURES

↓

SCREEN AND OPTIMIZE
(RESOPS, Eco-criteria, Cost)

↓

Option A | Option B

WATER BUDGET

COMBINE OPTION A AND OPTION B WITH CONVEYANCE, DISTRIBUTION AND SEEPAGE MEASURES

NOTE: Potentially large number of combinations

SCREEN AND OPTIMIZE
(RSM, Parametric Costs, Eco-Criteria) ← We are here

A1 A3 A7 B2 B3 B6

Final Array of Alternatives

DETAILED EVALUATION
(Ecological benefits, Planning-level Costs, CE/ICA, P&G criteria, System of Accounts)

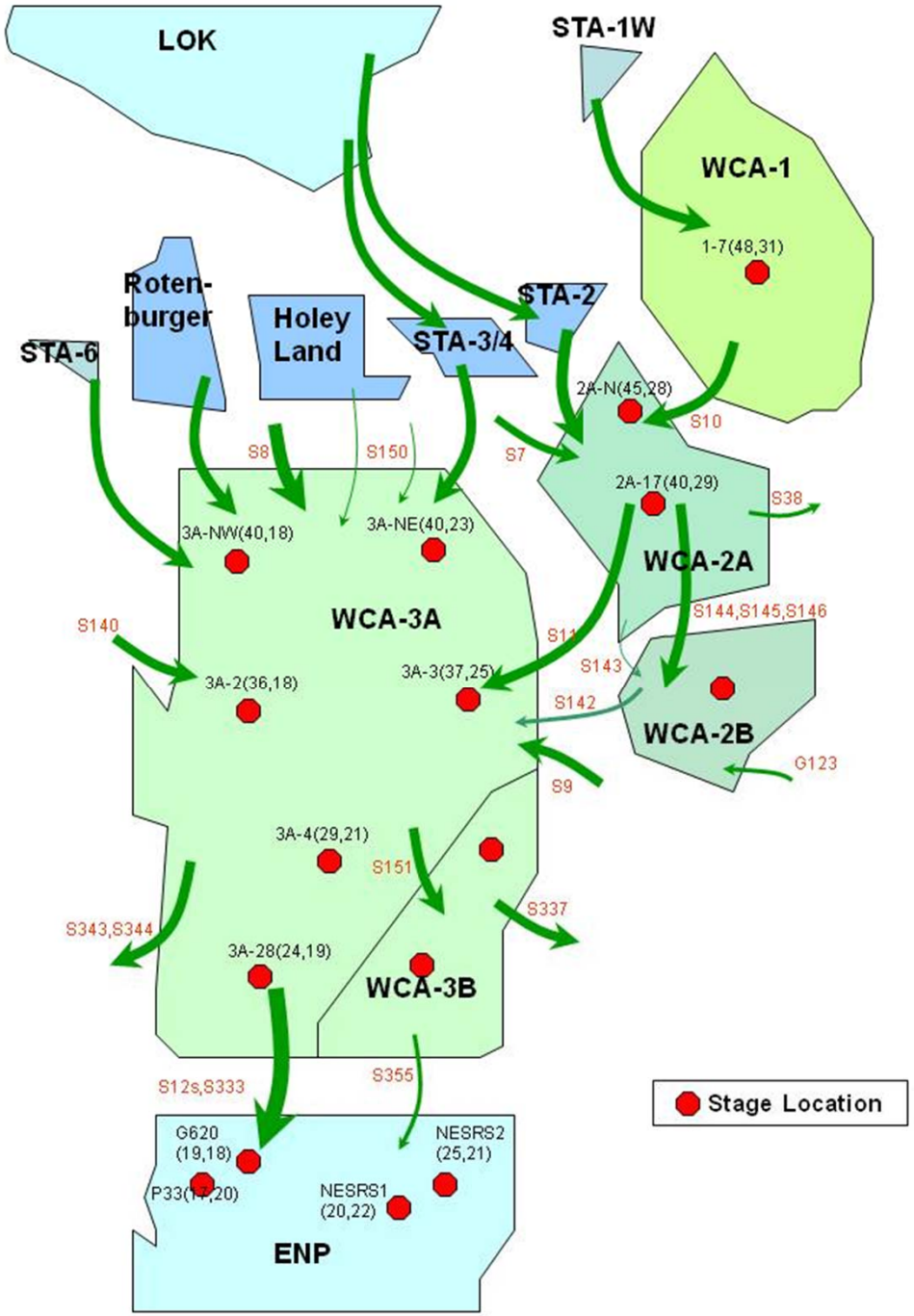
TSP

BACKGROUND

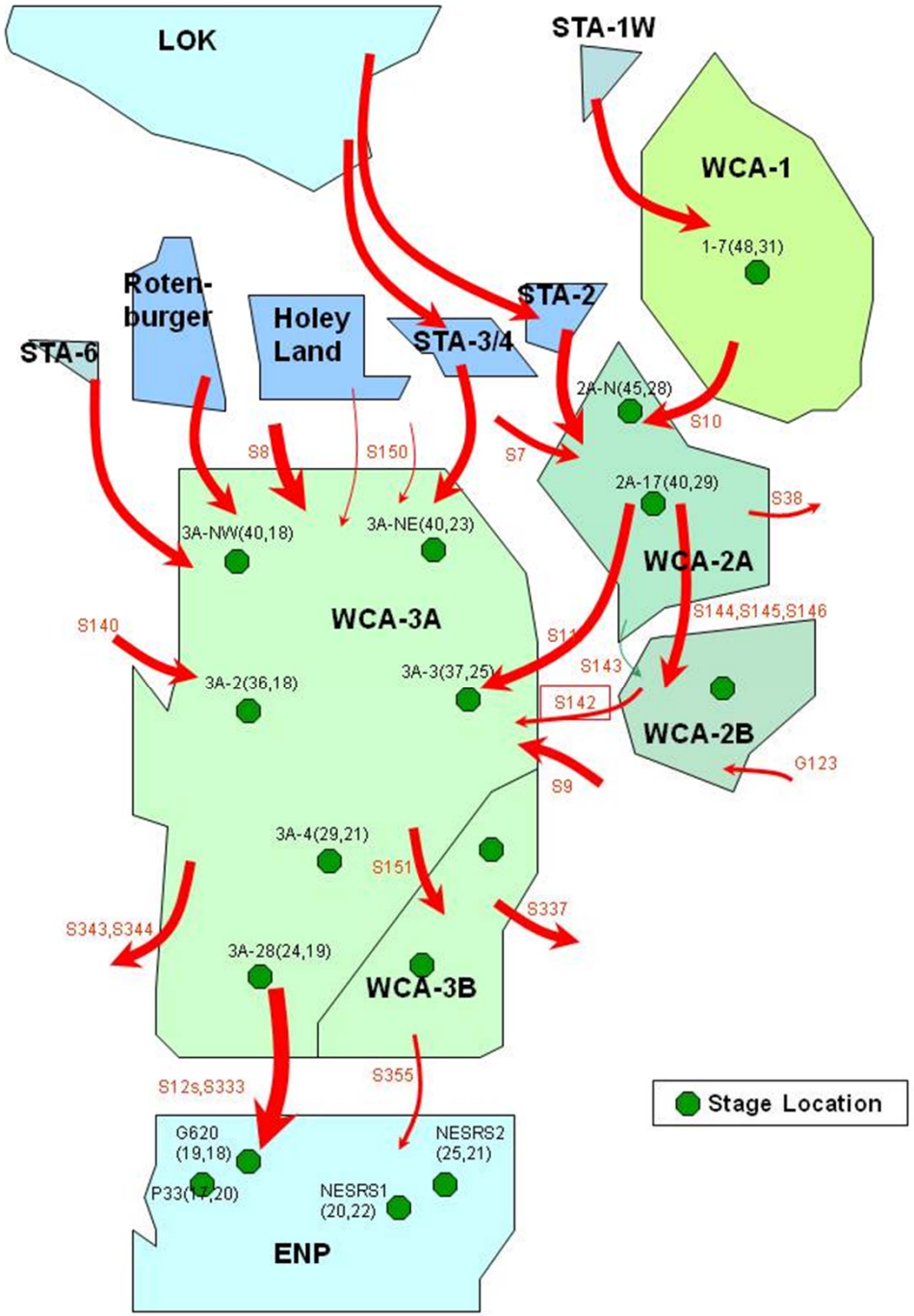
iModel Recap

- iModel is an inverse modeling tool that reverses the process of a traditional model
  - A traditional model **predicts** a system's **response** (e.g., stage) to the system's ***input*** (e.g., inflows, outflows)
  - iModel **computes** a system's ***required input*** (e.g., inflows, outflows) to achieve a system's **desired response** (e.g., stage)
- iModel has 2 primary components:
  - Hydrologic Model Emulators (HMEs)
  - Optimization Framework

DIRECT MODEL, → RSM



INVERSE MODEL, → iModel

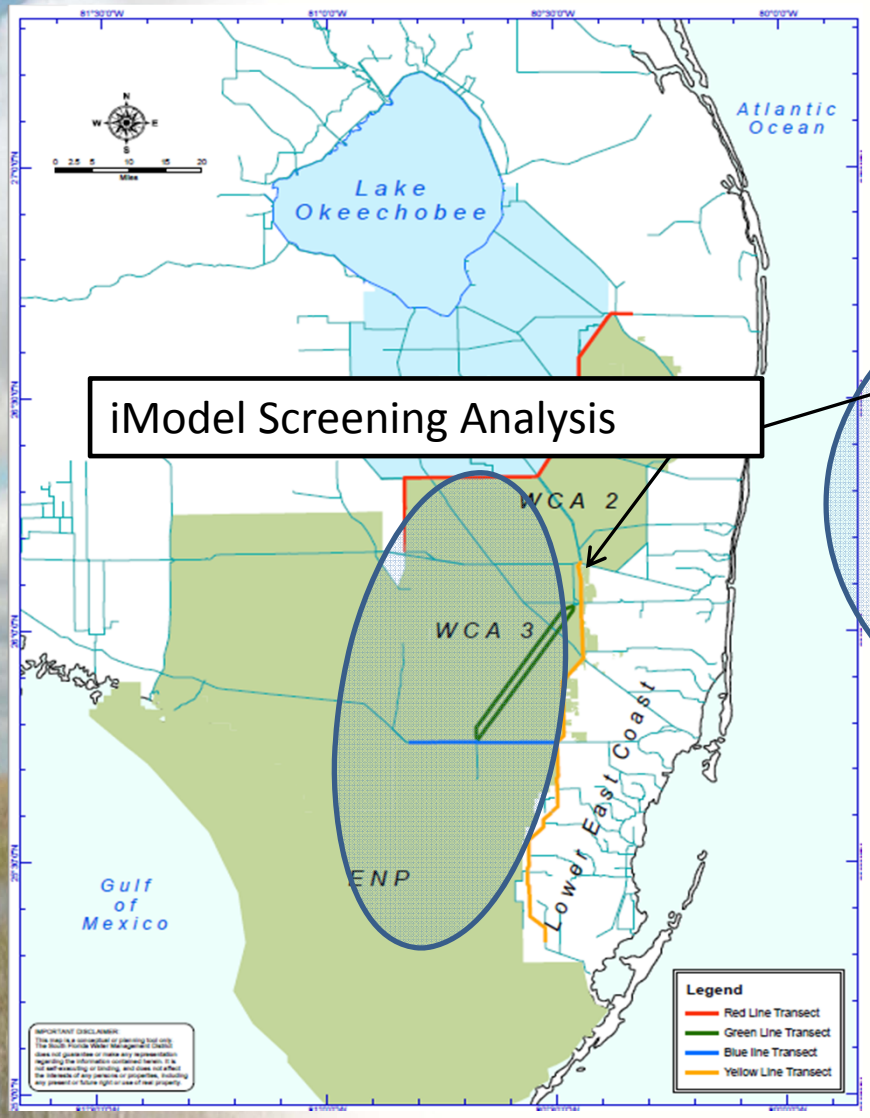


Benefits of using iModel

- Since CEPP is moving at a rapid pace, traditional analysis of multiple configurations is a challenge
  - Each iModel run represents hundreds of traditional (RSM) runs
- Use of inverse / optimization models in screening helps to mitigate risk associated with the rapid pace
  - Casts a “wide net” to consider many possible outcomes
  - Informs decisions on feasible system objectives
  - Assists in selecting infrastructure capable of meeting desired objectives
- Final array will be modeled using detailed RSMGL model, but this step helps to ensure that the final array is achieving maximum project benefit.

GREENLINE SCREENING

SPATIAL PERSPECTIVE



REDLINE –Flows from the Everglades Agricultural Area (EAA) into WCA 3A *(L-4, L-5 and L-6 levees and canals)*

GREENLINE – Flows through WCA 3A and WCA 3B *(L-67A and C levees and associated canals)*

BLUELINE – Flows from WCA 3A/3B into Everglades National Park (ENP) *(Tamiami Trail roadway and L-29)*

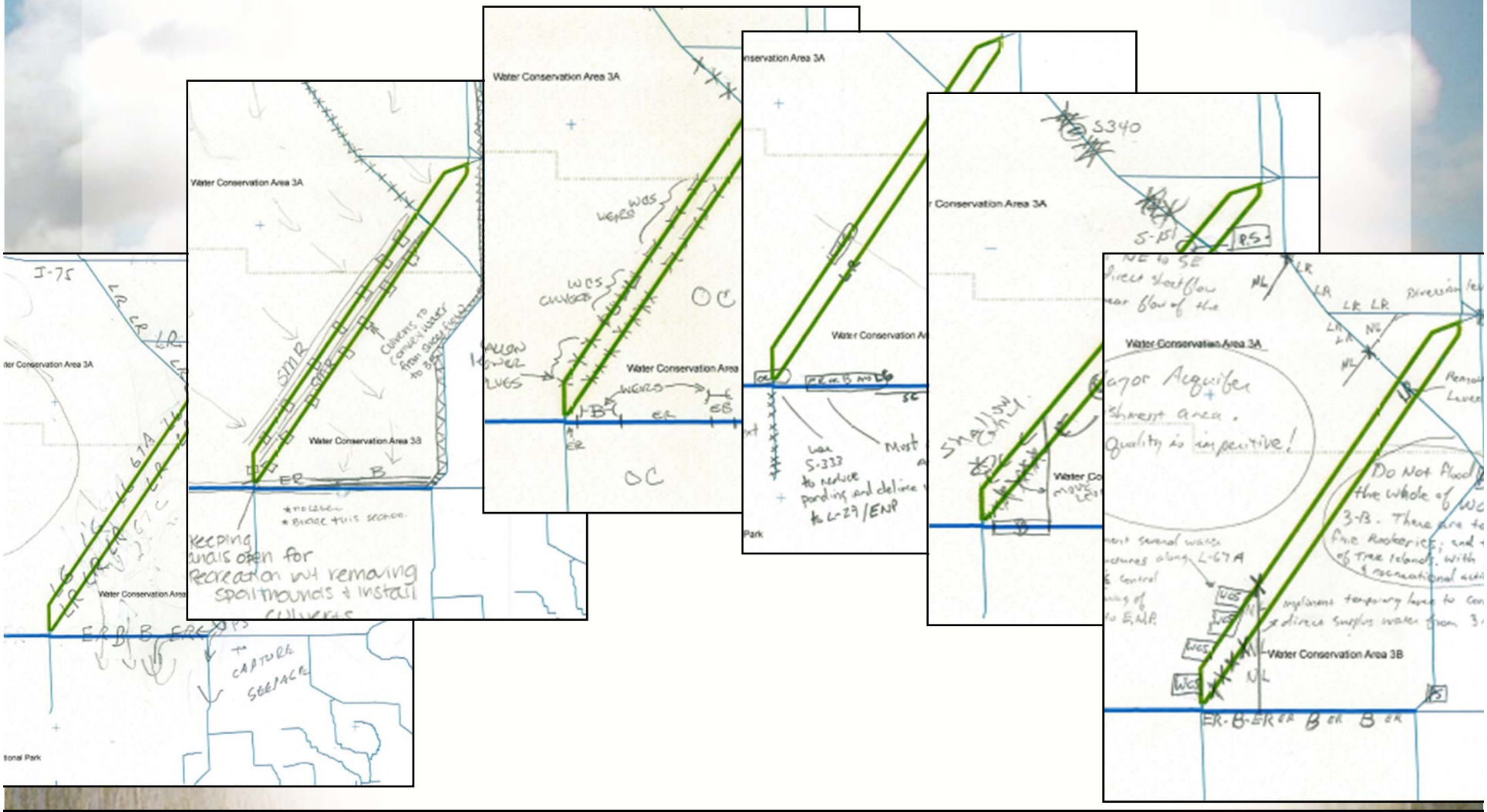
YELLOWLINE –Flows from WCA 3A/3B and ENP to the lower east coast *(east coast protective levee system, the L-30 and L-31N)*

GREENLINE and BLUELINE Formulation Process
Plan formulation and iModel Parallel Paths

Upstream CEPP infrastructure: A1/A2 jointly operated FEB, Spreader Canal/HRF, and Miami Canal Backfill included in all configurations.

- **Step 1: Conceptual Configurations**
  - **Plan Formulation:** Compiled management measures
  - **iModel:** Two configurations: with vs. without WCA3B Flow-way (Green2 vs. Green1)
- **Step 2: Holistic Targets**
  - **Plan Formulation:** Identified transitional ecological targets and system limitations (target contradictions, infrastructure limitations, water availability) using output from Step 1 iModel Output
  - **iModel:** Performed a series of runs to determine operations that meet holistic targets based on input from plan formulation and ecological sub-teams. Identify causal relationships (i.e. tradeoffs).
- **Step 3: Infrastructure Options**
  - **Plan Formulation:** Analysis of Steps 1 and 2 iModel output resulted in ten efficient infrastructure configurations identified
  - **iModel:** Ran ten iModel options using operational targets defined in Step 2
- **Step 4: Preliminary Option Screening for Final Array Consideration**
  - Analysis of infrastructure options resulting in four configurations
- **Next Steps**: Confirm, identify and refine configurations for final array

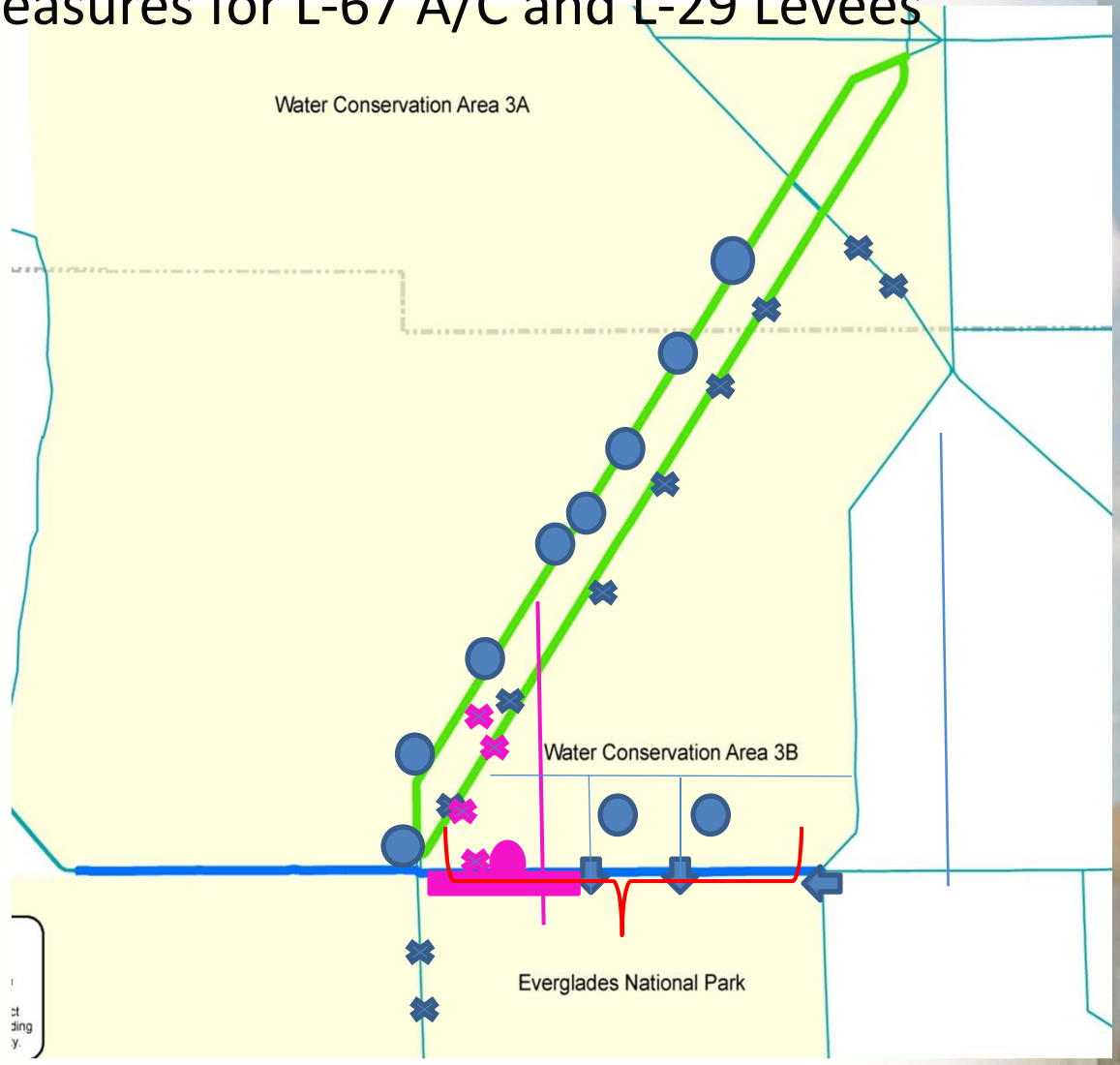
Step 1: Conceptual Configurations: Configuration Development Exercise



Step 1: Conceptual Configurations:

Management Measures for L-67 A/C and L-29 Levees

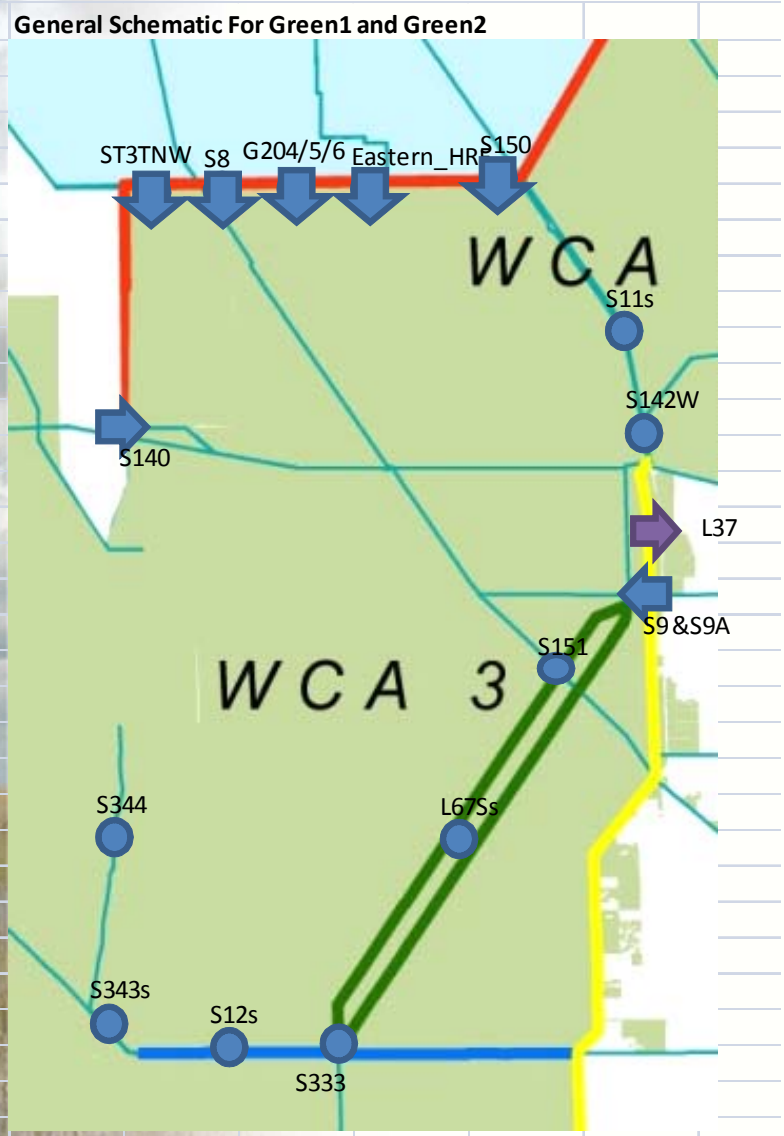
- New water control structures
- Levee degrade
- New pump stations
- New bridge
- Relocated (new) levee
- Road Raising



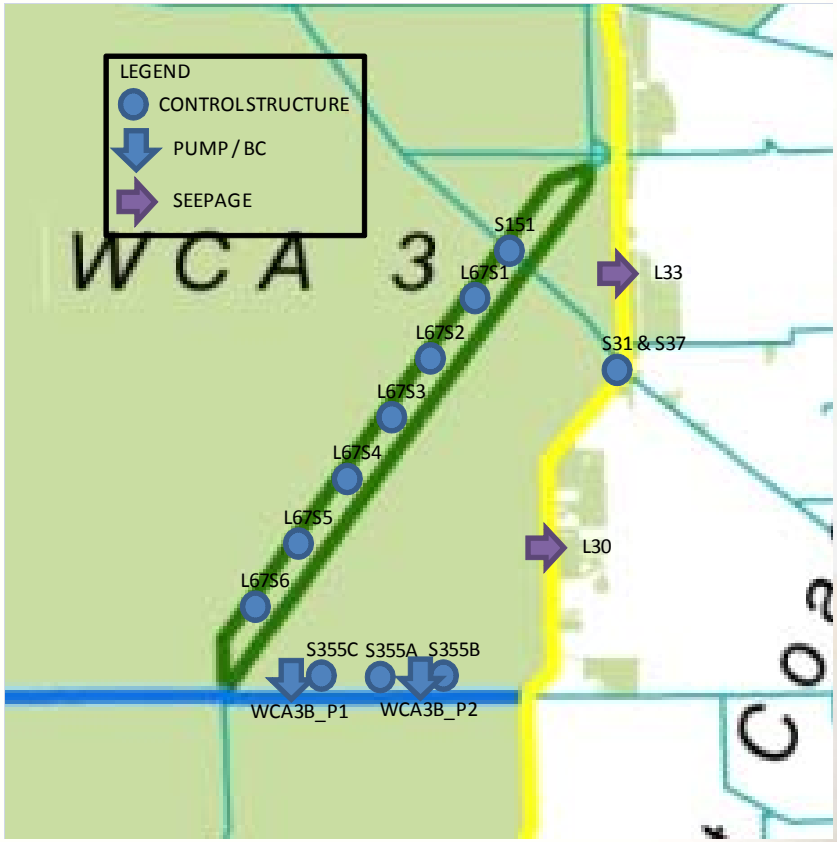
iModel Hydrologic Model Emulators

- Two RSMGL runs were performed to provide the physically based model outputs used to train the iModel HMEs as follows:
  - Green 1 scenario: equivalent to all blue structures from the previous figure including pumps and canal enhancements in southern WCA3B
  - Green 2 scenario: same as Green 1, but excluding pumps and canal enhancements in southern WCA3B and including pink levee / canal divide features in the Blue Shanty flowpath.
- Both scenarios incorporated known project features and inflows from previously identified CEPP components (e.g. FEB, HRFs, MC backfill, etc...)

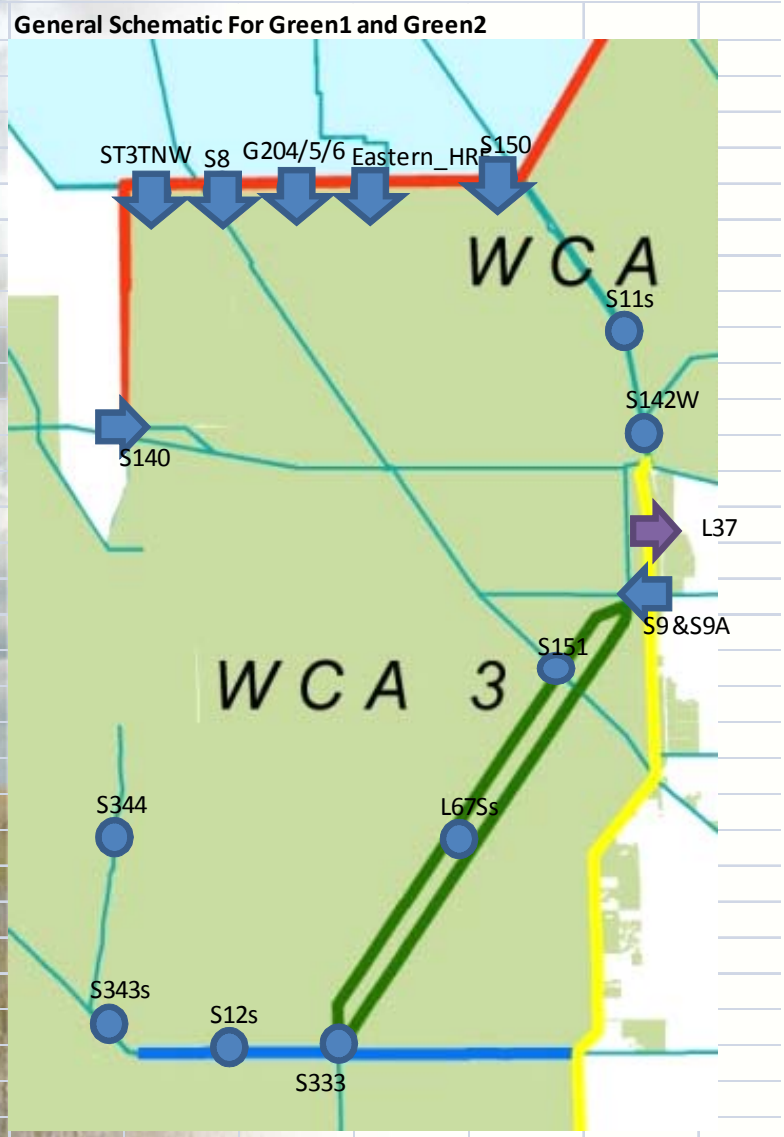
Green 1 Schematic



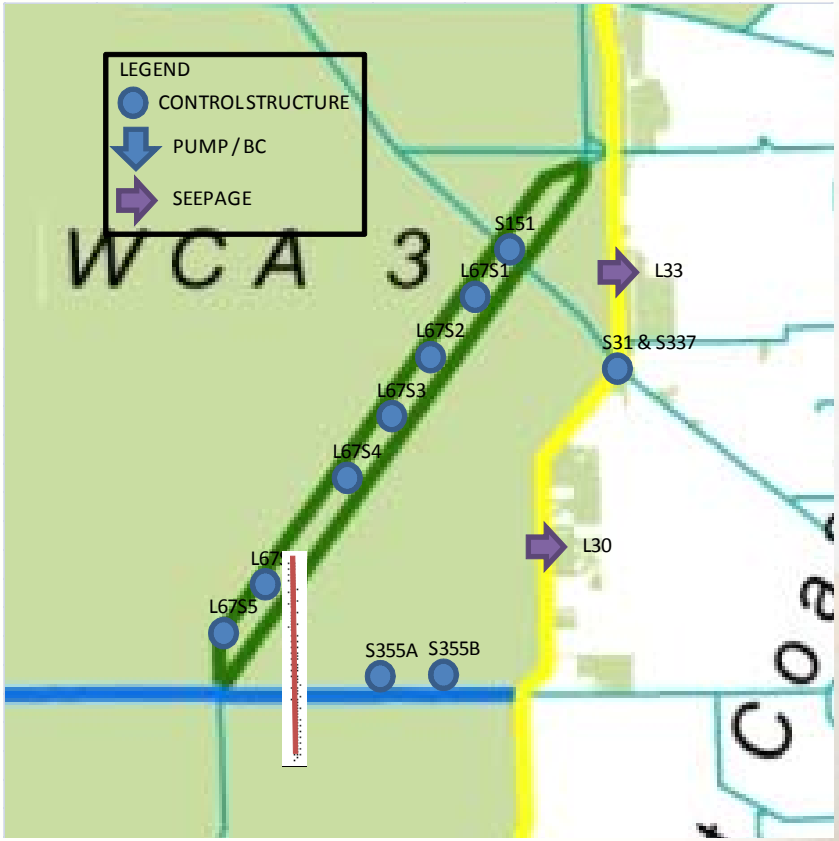
WCA3B / ENP Details



Green 2 Schematic



WCA3B / ENP Details



System-wide Optimization

- As we have all experienced, identifying proposed system infrastructure and operational improvements is a highly complex problem, frequently challenged by unclear objectives and unintended consequences.
- The CEPP eco-subteam rose to challenge of providing system ecological objectives – THANK YOU!

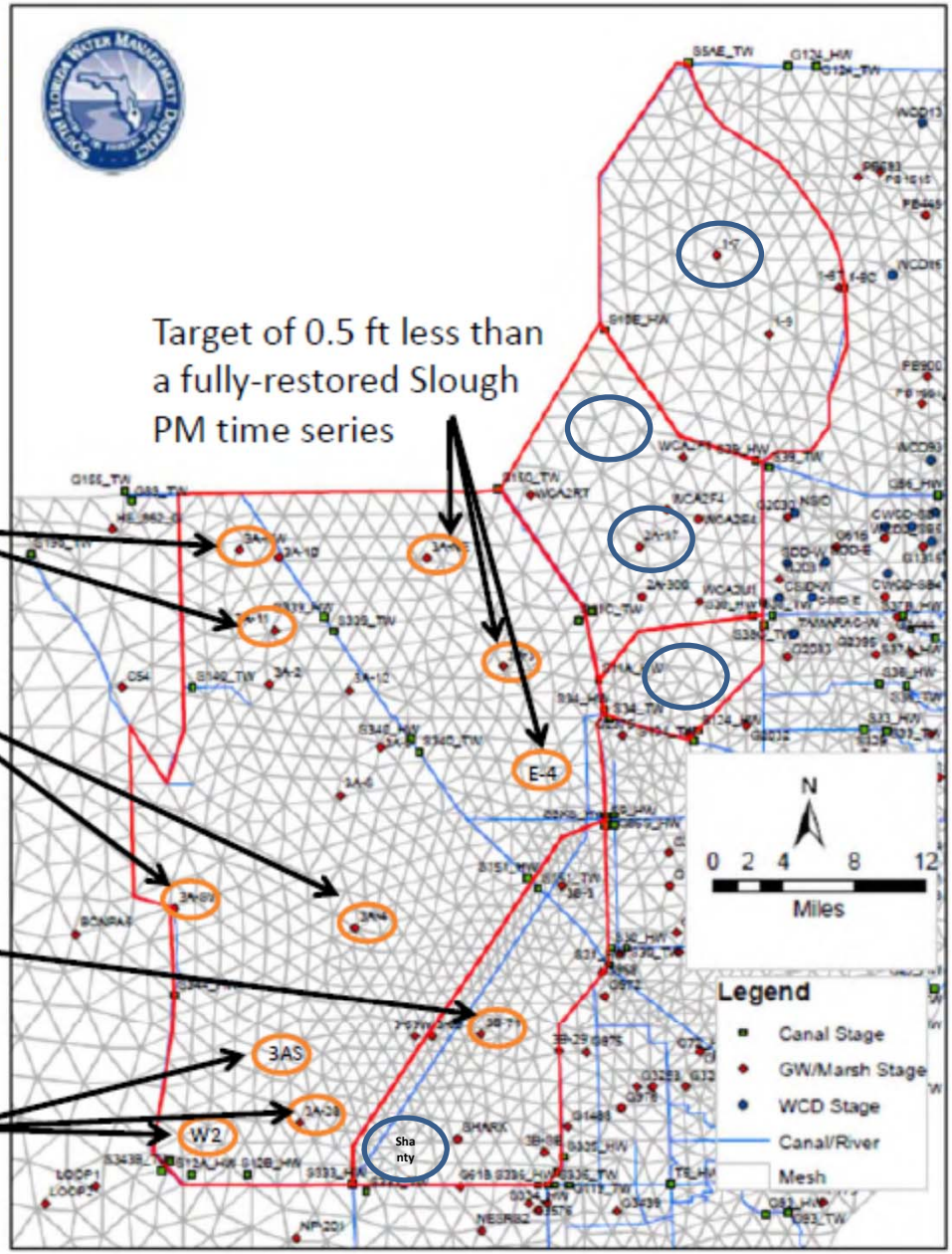
Location of Gages in WCA3 A&B and Draft Proposed Targets

Target of 0.25 ft less than a fully-restored Slough PM time series

Target is a fully-restored (Site 64) Slough PM time series

Target is a "lower" Slough PM time series and 2.5-3.0 ft not to exceed ~~90~~ 60 days duration for more than 3 consecutive years

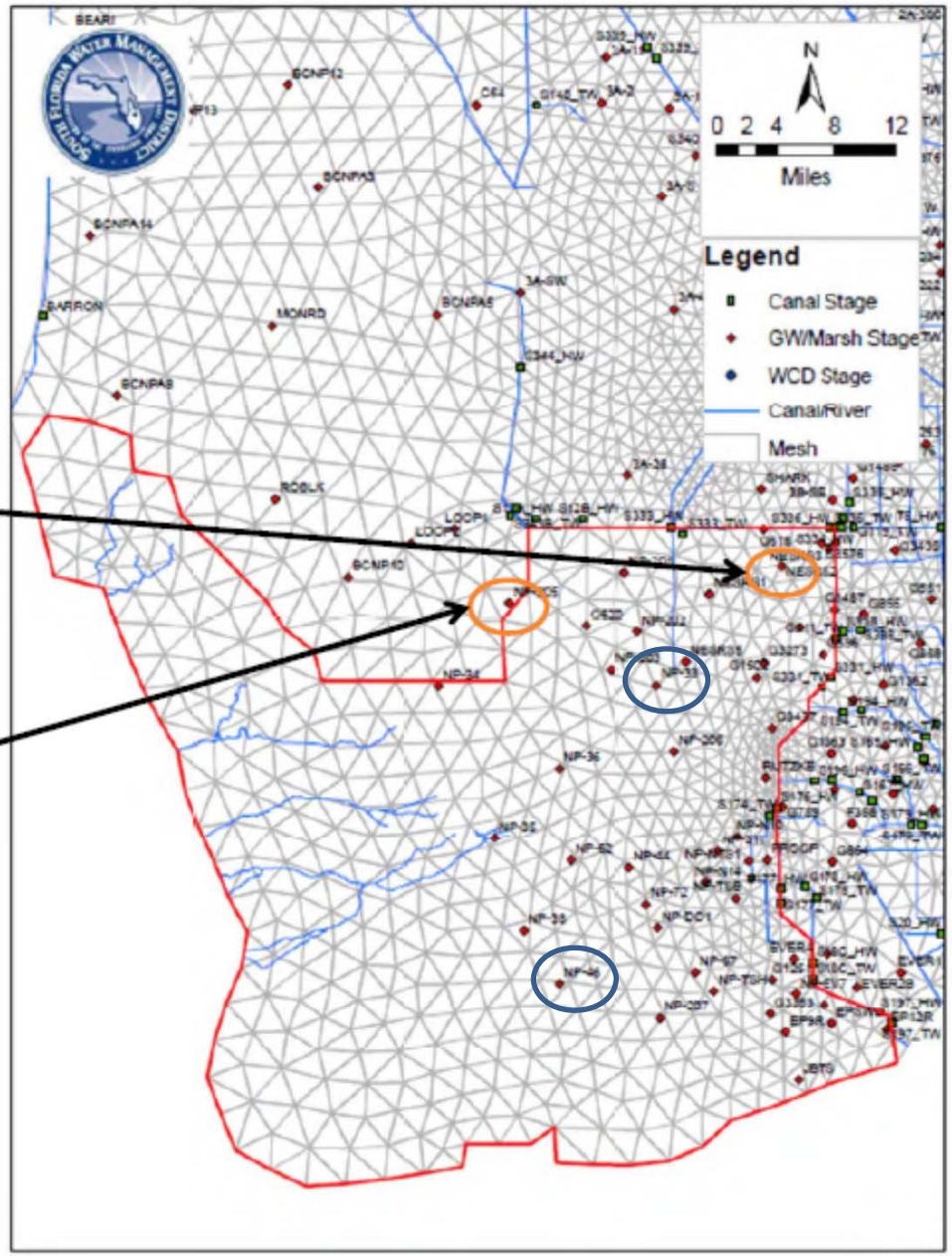
Target is a fully-restored Slough PM time series



Location of Gages in ENP and Draft Proposed Targets

Target is a fully restored Slough PM time series at NE-2

Target is a time series that mimics a preserved marl prairie water depths (approx. -0.5 to 1.25 ft)



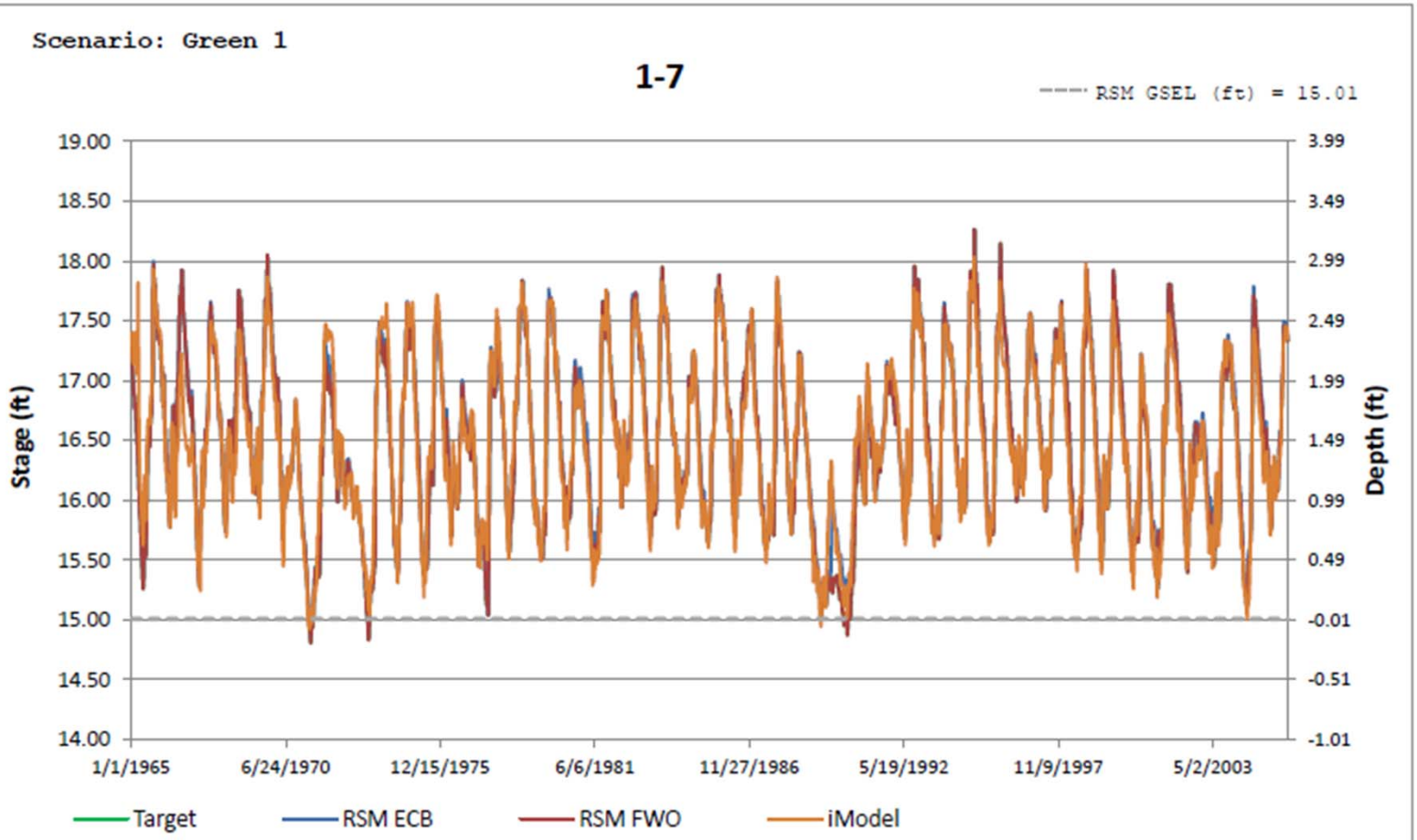
Additional Objectives

- Try to honor the WCA3A regulation schedule (in particular Zone A)
- Attempt to honor recession rate targets for WCA3A 3-gauge average.

Undesirable	> 0.10
Marginal	0.07 - 0.10
Preferred	0.03 - 0.06
Marginal	0.00 - 0.02
Undesirable	< 0.00

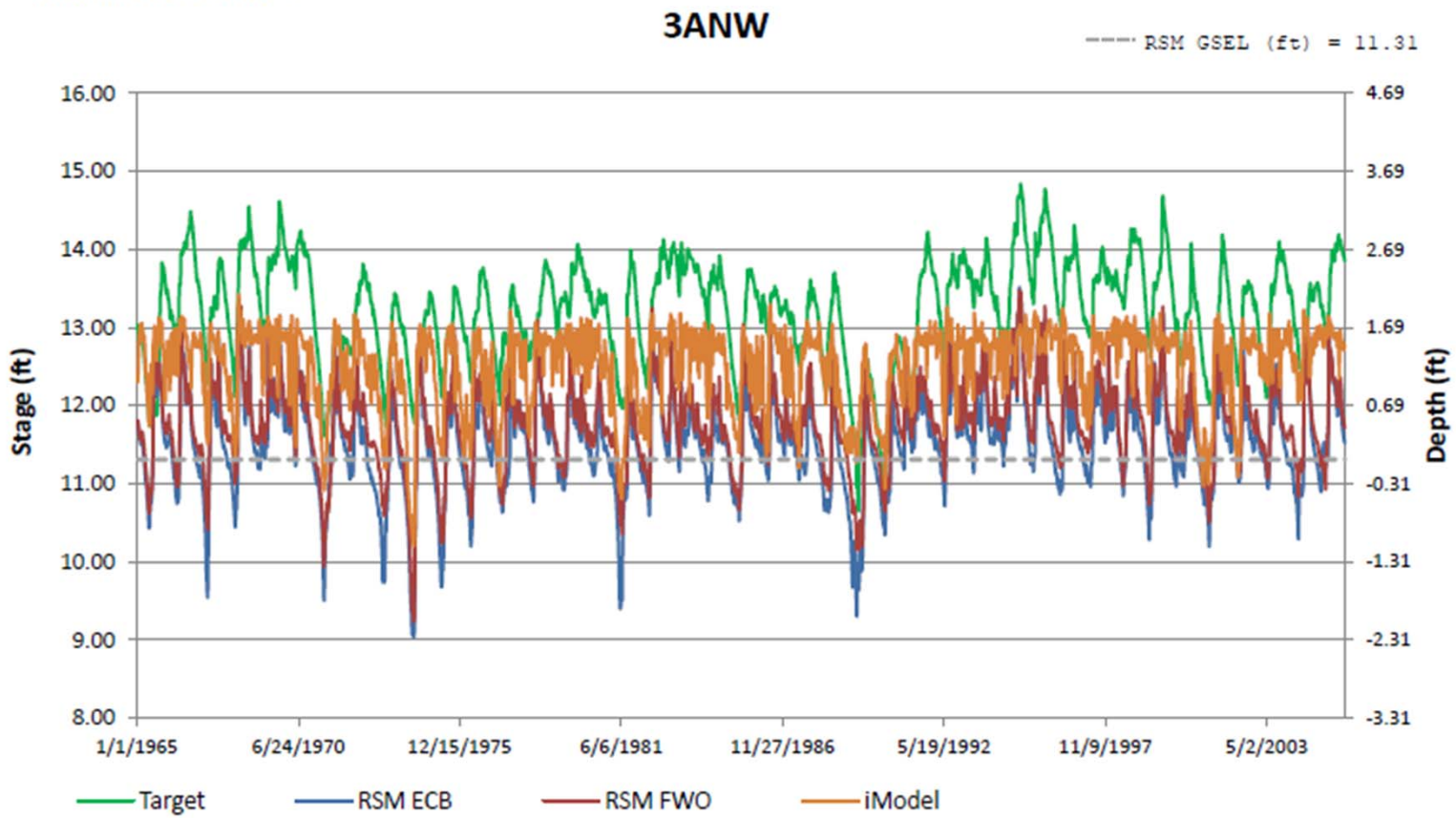
EXAMPLE SCREENING OUTCOMES

STEP 1



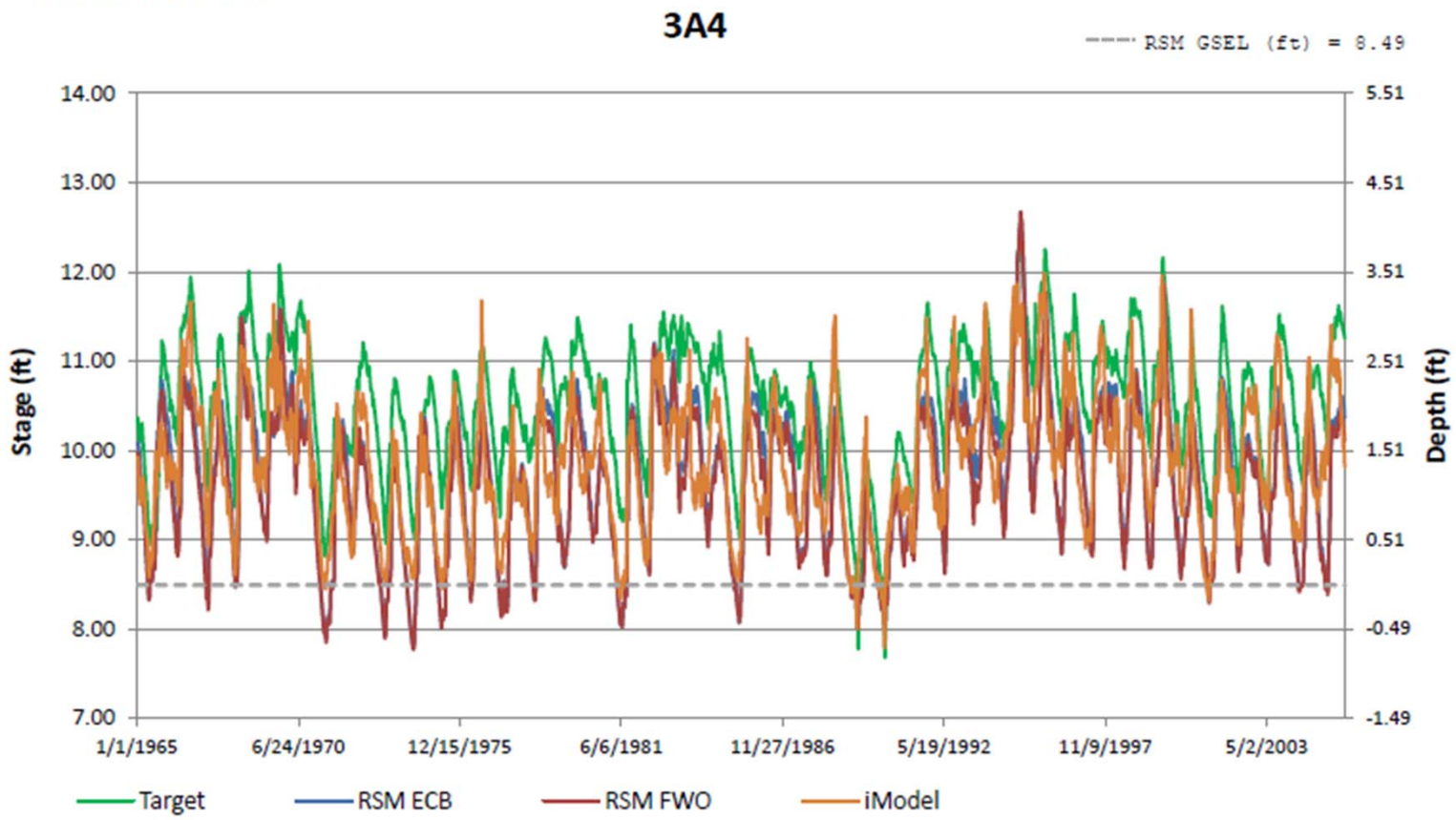
1.48	1.52	1.48	1.48	Avg. Ponding Depth (ft)
99.11	99.53	99.11	99.58	% Time Above GSEL
	0.08	0.00	0.23	RMSE (ft)
	0.04	0.00	0.00	BIAS (ft)

Scenario: Green 1



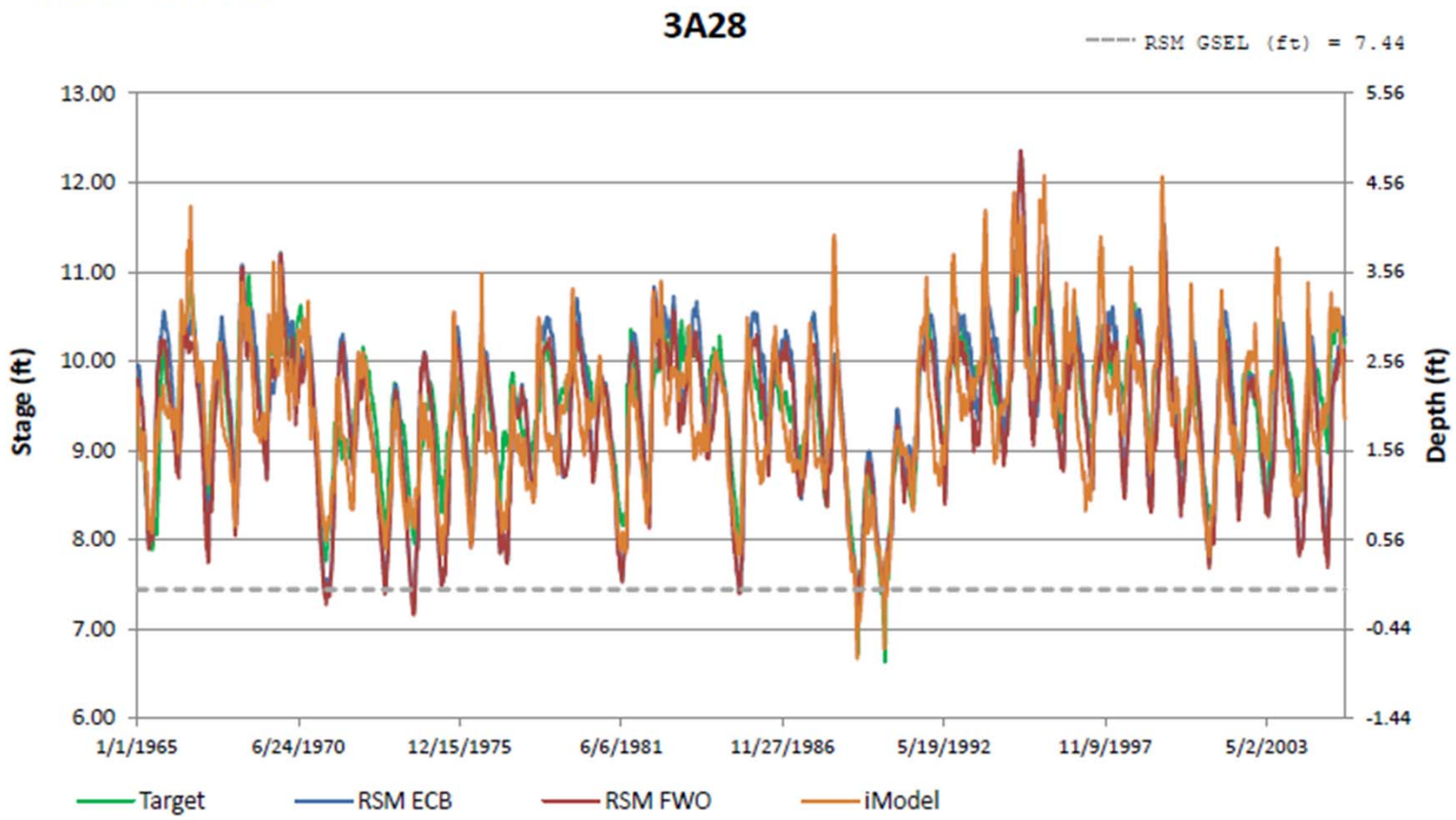
1.91	0.25	0.46	1.20	Avg. Ponding Depth (ft)
99.53	68.15	81.62	97.05	% Time Above GSEL
	1.74	1.53	0.88	RMSE (ft)
	-1.66	-1.45	-0.70	BIAS (ft)

Scenario: Green 1



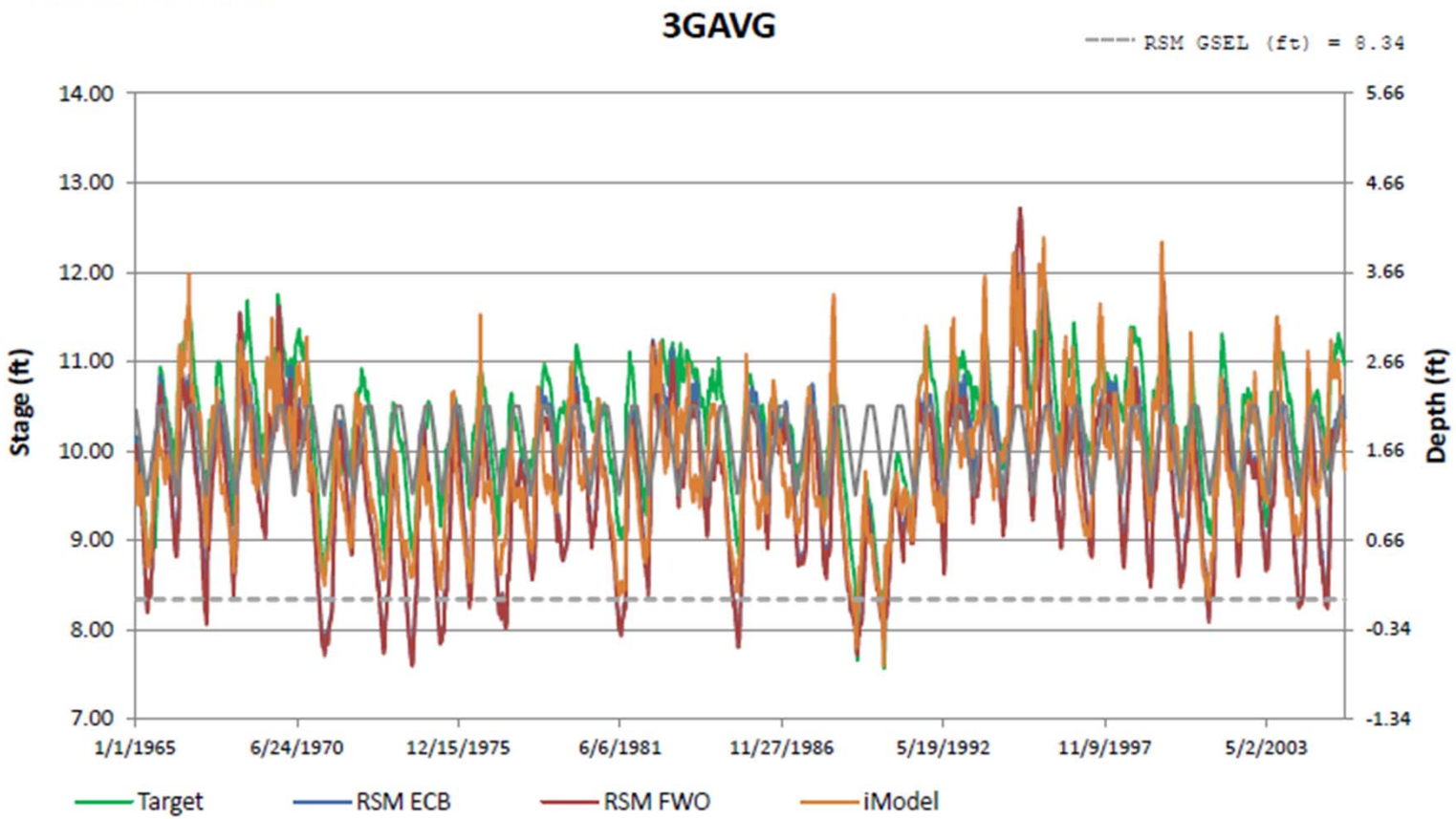
2.07	1.23	1.13	1.38	Avg. Ponding Depth (ft)
99.53	92.38	91.35	98.41	% Time Above GSEL
	0.93	1.02	0.83	RMSE (ft)
	-0.84	-0.94	-0.69	BIAS (ft)

Scenario: Green 1

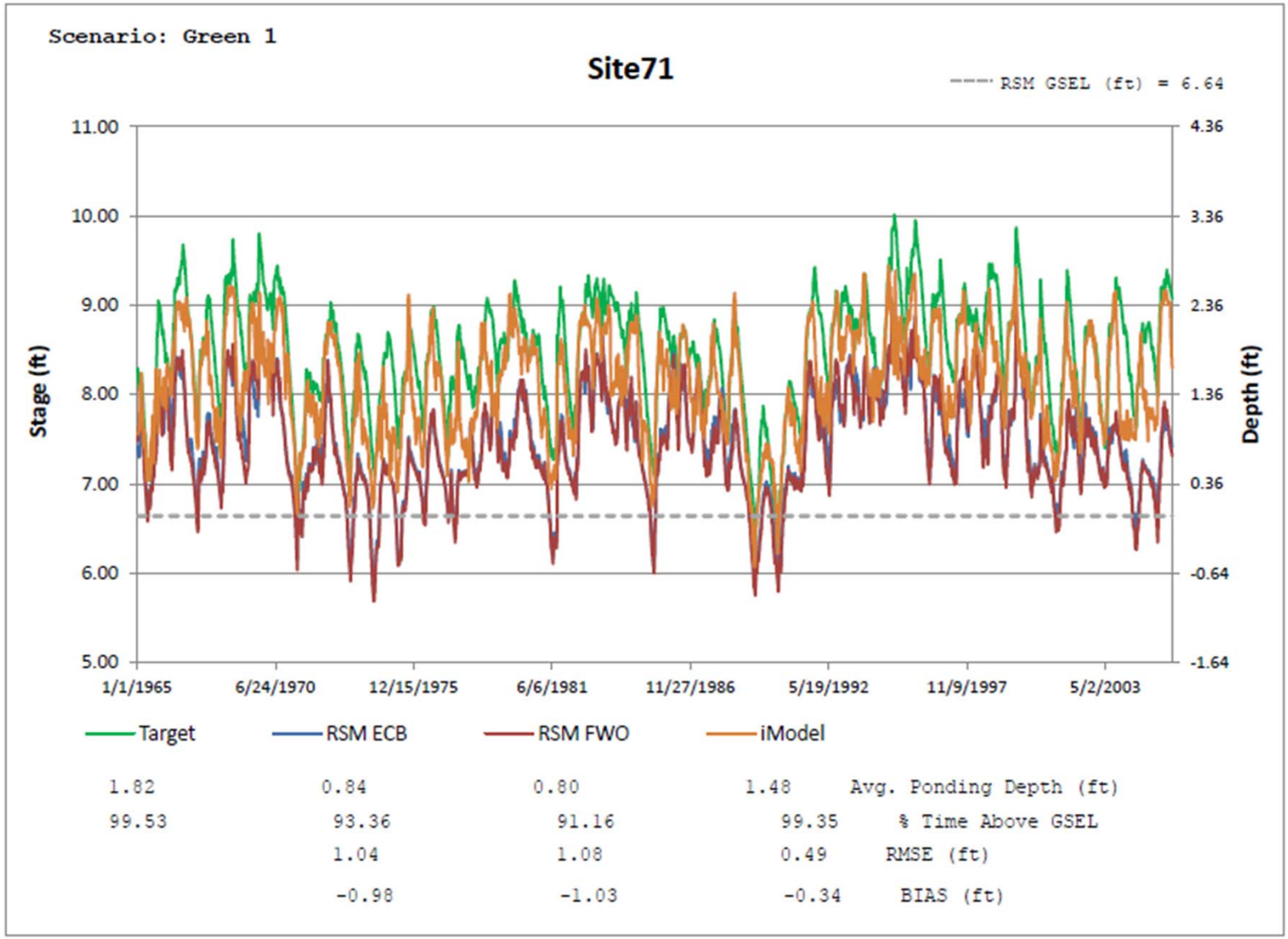


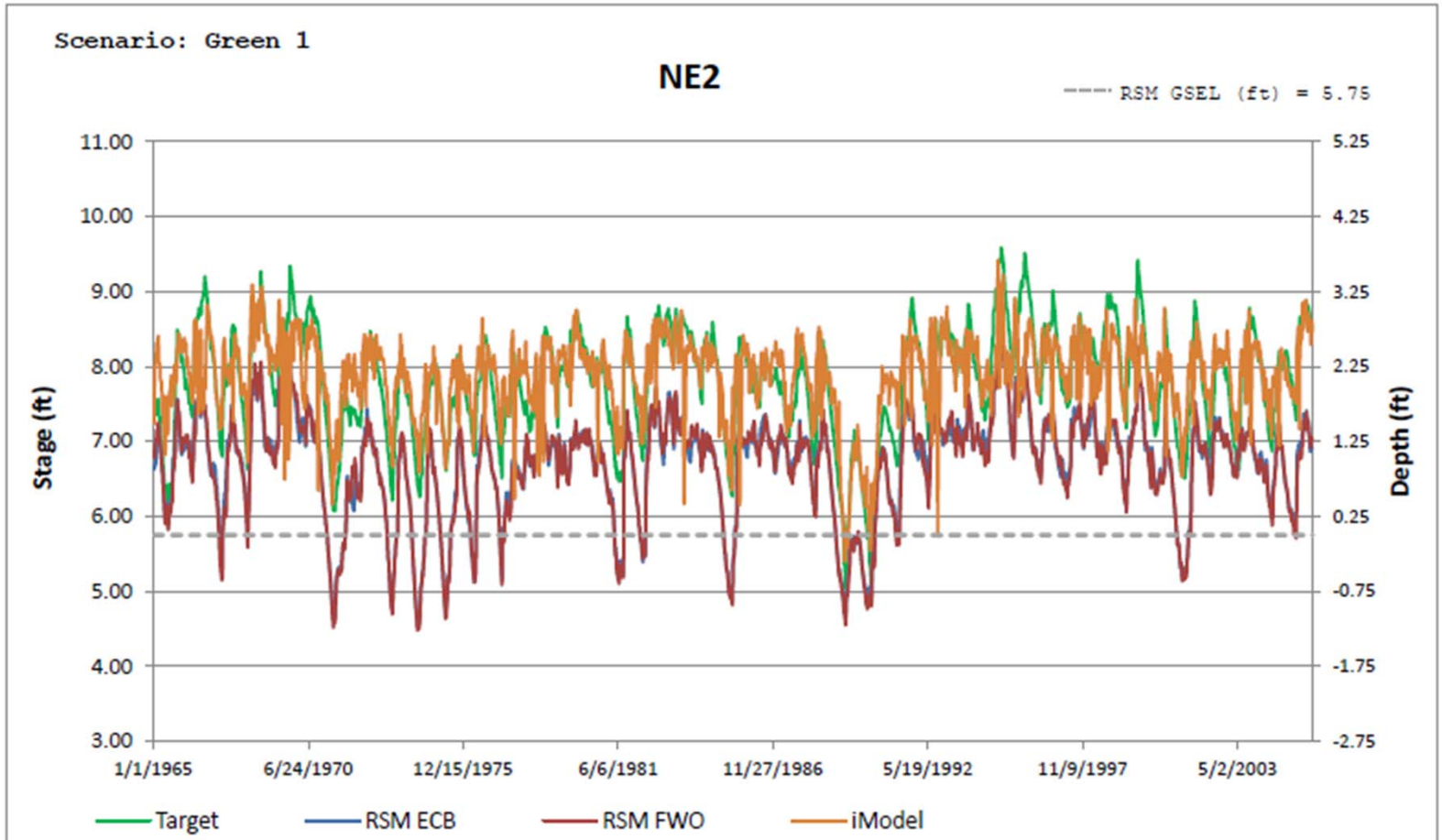
2.07	2.03	1.90	1.94	Avg. Ponding Depth (ft)
99.53	99.25	98.97	99.16	% Time Above GSEL
	0.45	0.45	0.47	RMSE (ft)
	-0.05	-0.17	-0.13	BIAS (ft)

Scenario: Green 1

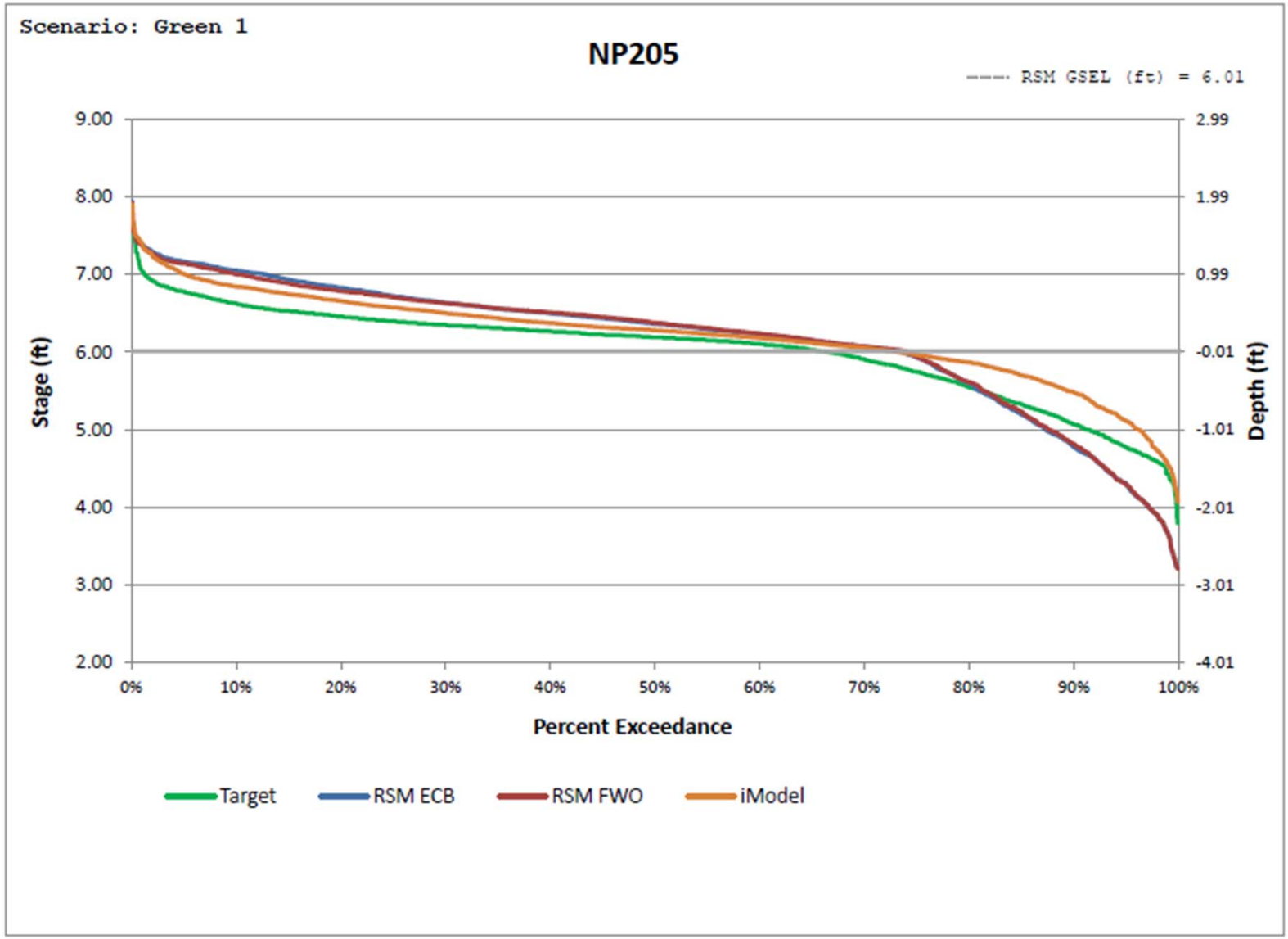


64.69	32.51	18.80	35.13	% Time > Zone A
18.21	12.90	13.46	35.97	% Preferred Recession
51.02	35.75	36.09	31.22	% Marginal Recession


Scenario: Green 1
Site71
RSM GSEL (ft) = 6.64
Stage (ft)
Depth (ft)
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.36
3.36
2.36
1.36
0.36
-0.64
-1.64
1/1/1965
6/24/1970
12/15/1975
6/6/1981
11/27/1986
5/19/1992
11/9/1997
5/2/2003
Target
RSM ECB
RSM FWO
iModel
1.82 0.84 0.80 1.48 Avg. Ponding Depth (ft)
99.53 93.36 91.16 99.35 % Time Above GSEL
1.04 1.08 0.49 RMSE (ft)
-0.98 -1.03 -0.34 BIAS (ft)

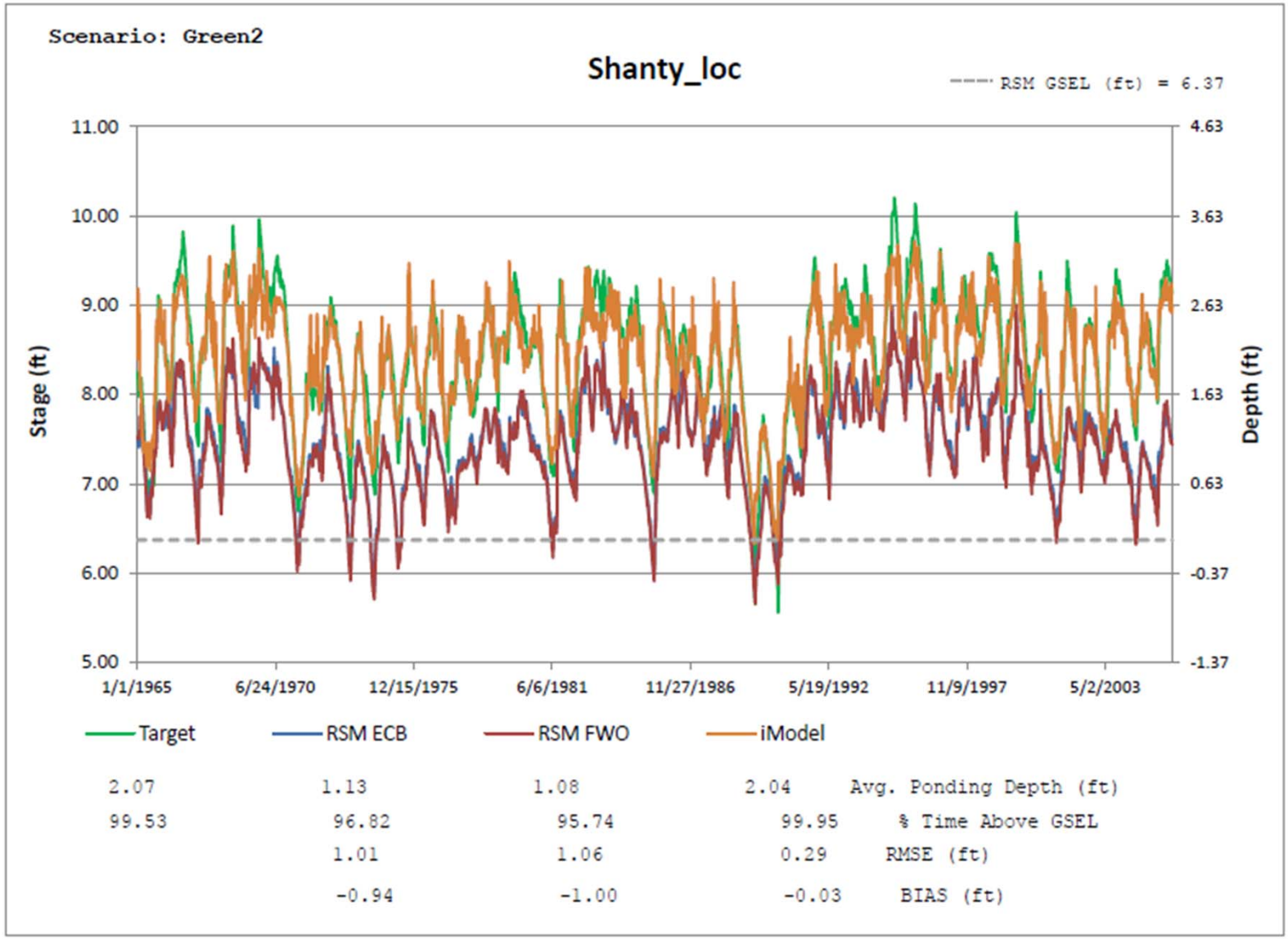


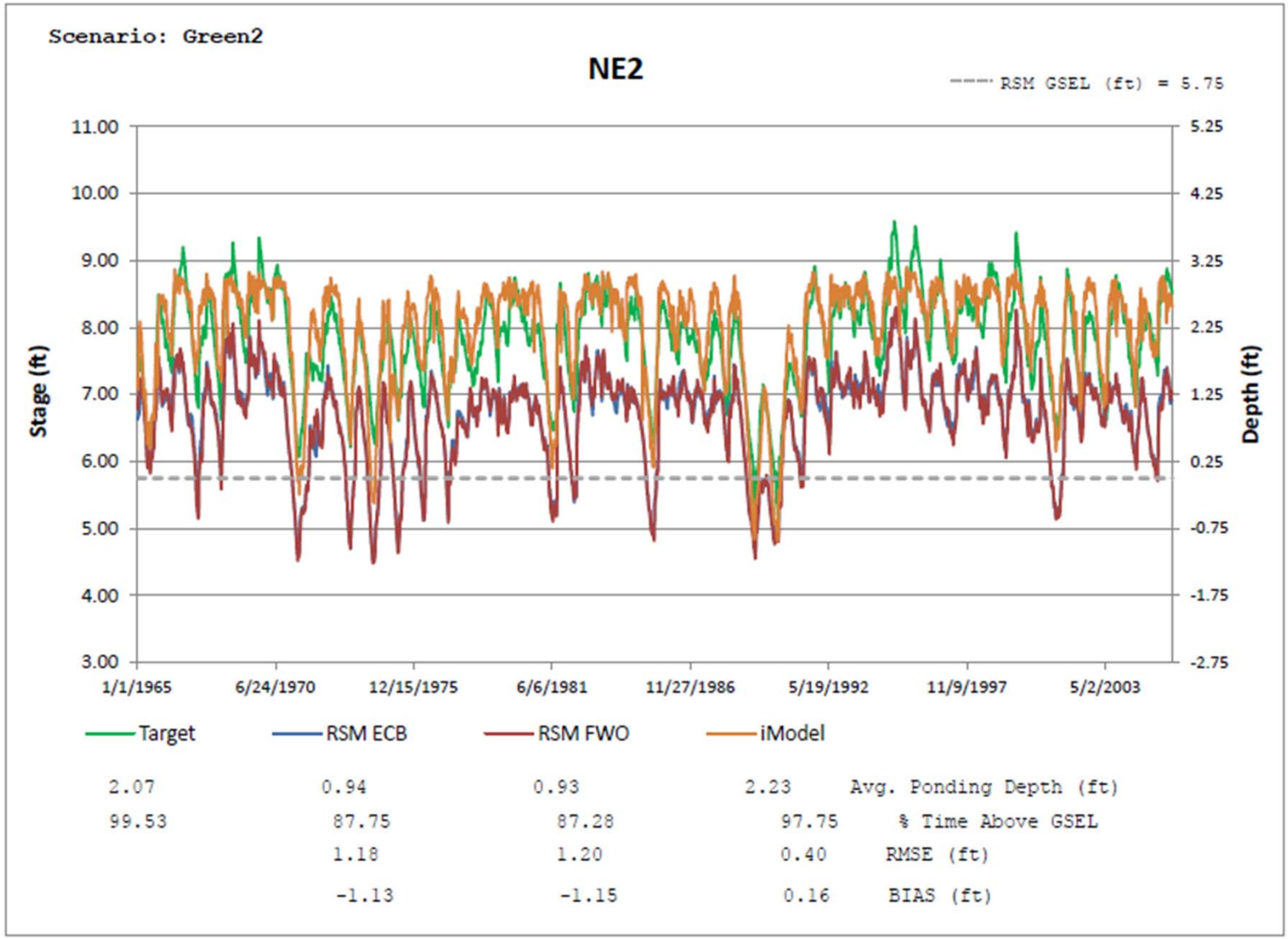
2.07	0.94	0.93	2.11	Avg. Ponding Depth (ft)
99.53	87.75	87.28	99.49	% Time Above GSEL
	1.18	1.20	0.50	RMSE (ft)
	-1.13	-1.15	0.04	BIAS (ft)


Scenario: Green 1
NP205
RSM GSEL (ft) = 6.01
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
Stage (ft)
2.99
1.99
0.99
-0.01
-1.01
-2.01
-3.01
-4.01
Depth (ft)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent Exceedance
Target
RSM ECB
RSM FWO
iModel

Central Everglades Planning - Greenline Screening
Optimized iModel results, Stage Table 1 of 5
Scenario: Green2
Average % time above ground surface elevation (GSEL)

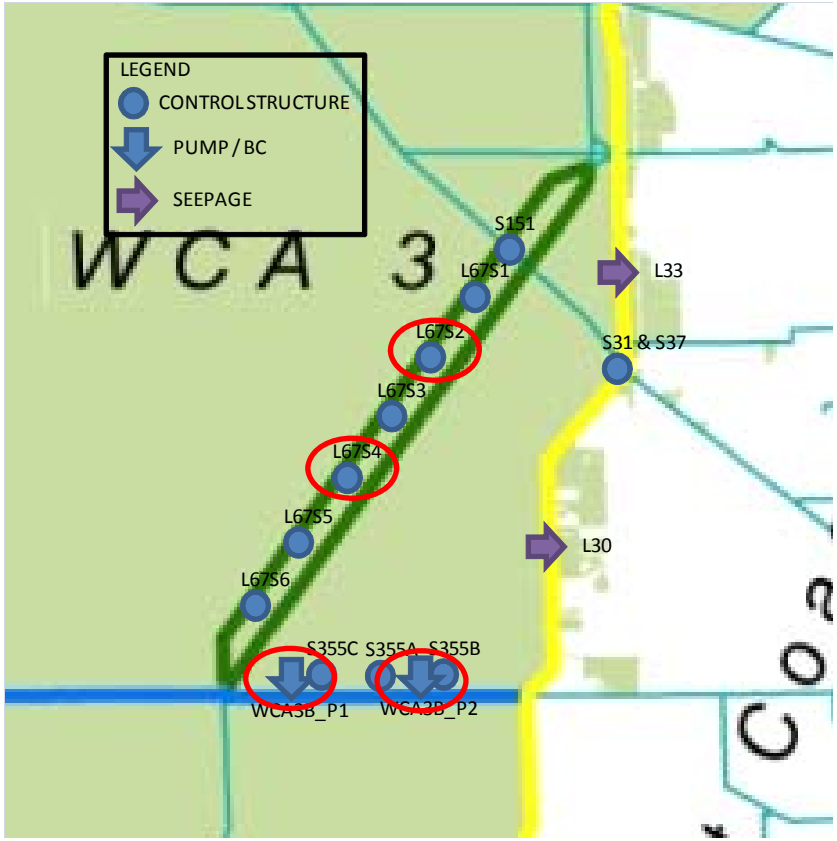
Location	Target	RSM ECB	RSM FWO	iModel
1-7	99.11	99.53	99.11	99.49
2A-159	90.74	91.96	93.97	92.38
2A-17	84.75	87.32	87.65	87.37
EDEN-13	97.29	95.00	97.29	99.02
3ANW	99.53	68.15	81.62	97.85
3A11	99.53	47.43	47.90	86.25
3ASW	99.53	83.82	81.95	91.39
W2	99.53	98.46	97.94	99.72
3A4	99.53	92.38	91.35	95.88
3AS	99.53	86.34	87.18	97.71
3ANE	99.53	69.27	66.18	93.12
3A28	99.53	99.25	98.97	99.77
EDEN-4	99.53	95.09	94.34	98.46
3A3	99.53	79.42	77.03	94.11
Site71	99.53	93.36	91.16	99.44
Shanty_loc	99.53	96.82	95.74	99.95
NP205	66.18	73.53	74.04	78.81
P33	98.78	89.34	89.10	99.39
NE2	99.53	87.75	87.28	97.75
NP46	66.18	63.05	64.27	73.48


Scenario: Green2
Shanty_loc
RSM GSEL (ft) = 6.37
Stage (ft)
Depth (ft)
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.63
3.63
2.63
1.63
0.63
-0.37
-1.37
1/1/1965
6/24/1970
12/15/1975
6/6/1981
11/27/1986
5/19/1992
11/9/1997
5/2/2003
Target
RSM ECB
RSM FWO
iModel
2.07 1.13 1.08 2.04 Avg. Ponding Depth (ft)
99.53 96.82 95.74 99.95 % Time Above GSEL
1.01 1.06 0.29 RMSE (ft)
-0.94 -1.00 -0.03 BIAS (ft)

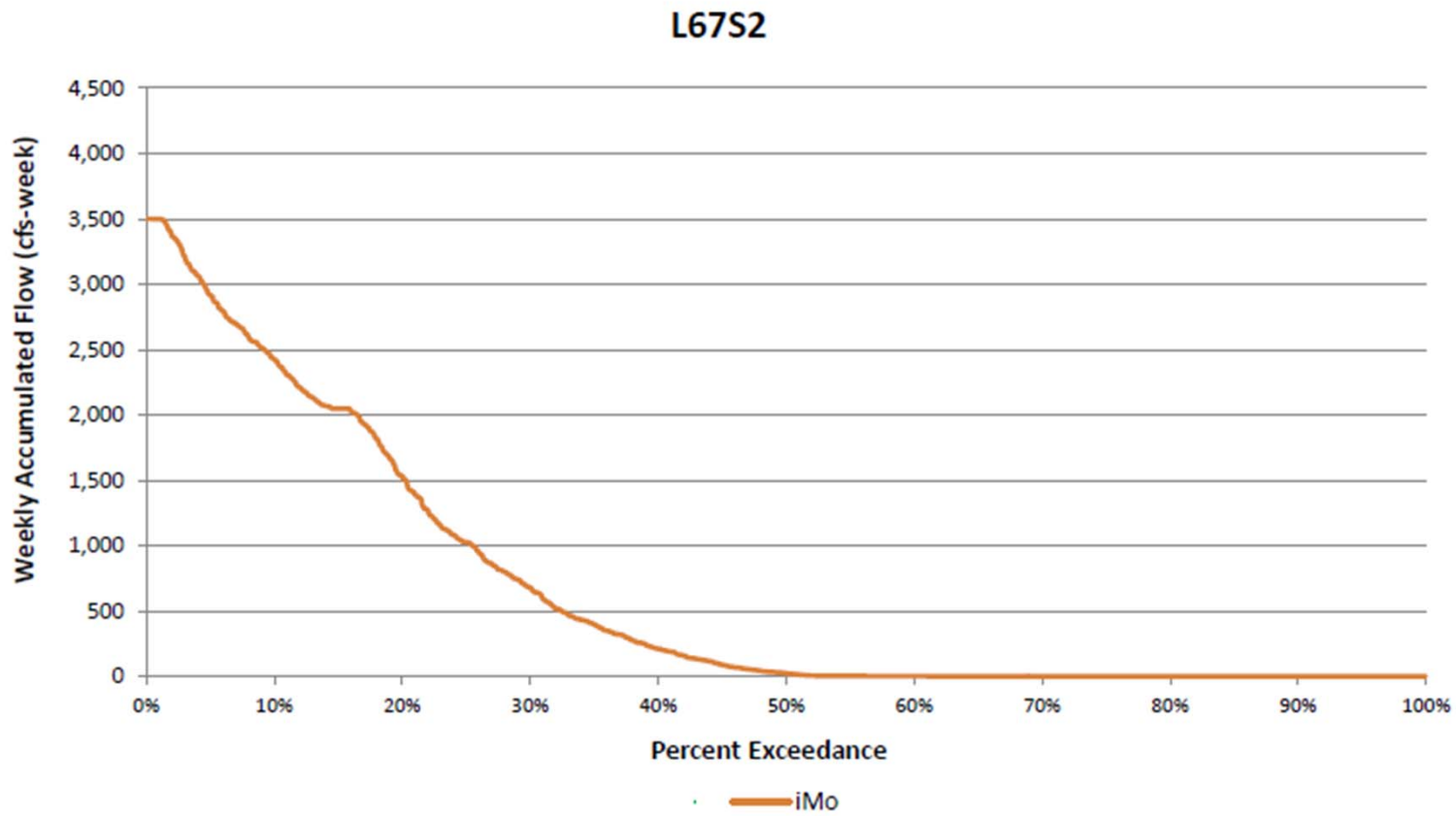

Scenario: Green2
NE2
RSM GSEL (ft) = 5.75
Stage (ft)
Depth (ft)
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
5.25
4.25
3.25
2.25
1.25
0.25
-0.75
-1.75
-2.75
1/1/1965
6/24/1970
12/15/1975
6/6/1981
11/27/1986
5/19/1992
11/9/1997
5/2/2003
Target
RSM ECB
RSM FWO
iModel
2.07 0.94 0.93 2.23 Avg. Ponding Depth (ft)
99.53 87.75 87.28 97.75 % Time Above GSEL
1.18 1.20 0.40 RMSE (ft)
-1.13 -1.15 0.16 BIAS (ft)

Example Structure Outcomes

Green1



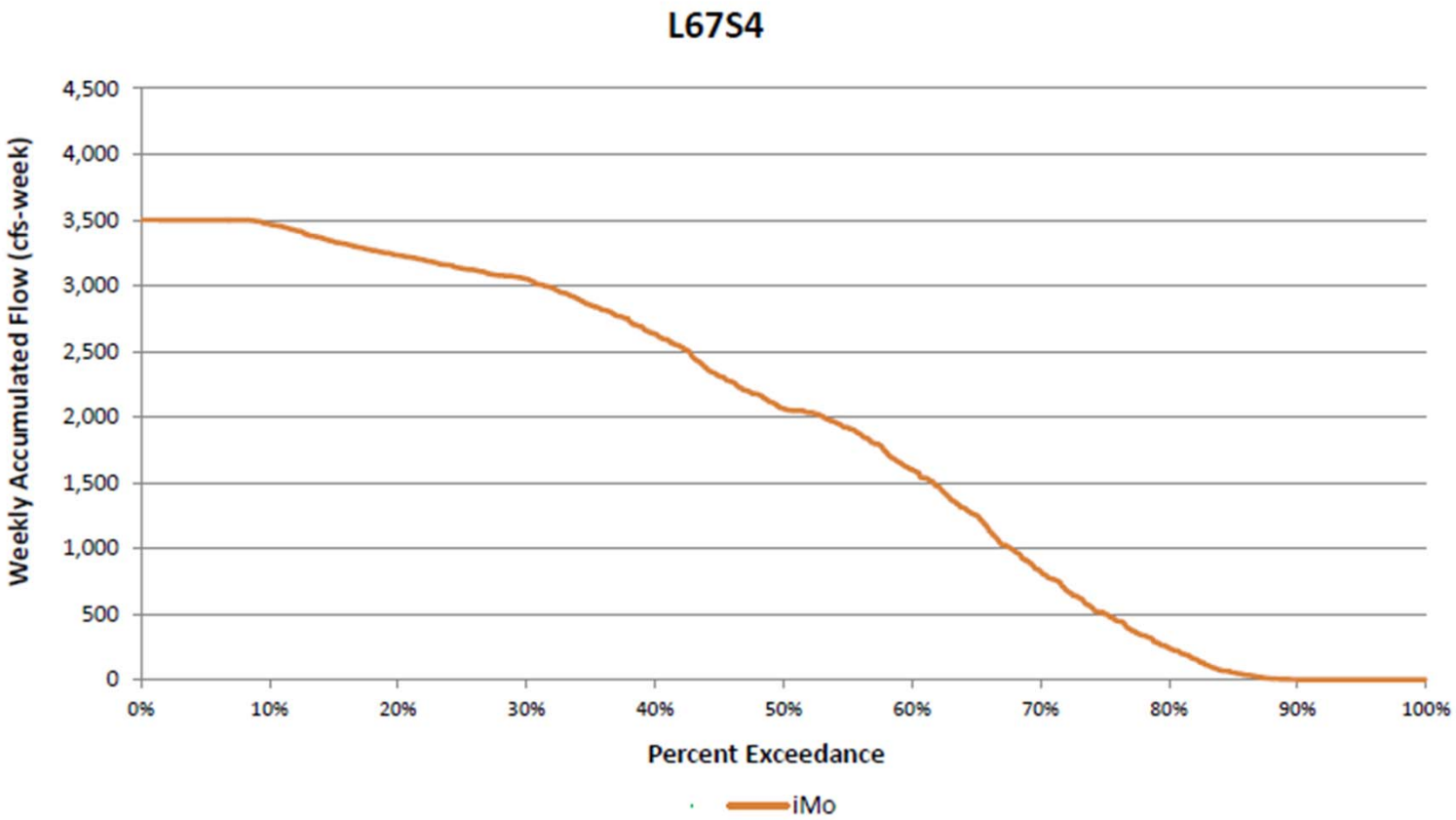
Scenario: Green2



Median (ac-ft/wk) = 44
10th Percentile (ac-ft/wk) = 0
90th Percentile (ac-ft/wk) = 4795

Median (cfs) = 3
10th Percentile (cfs) = 0
90th Percentile (cfs) = 345

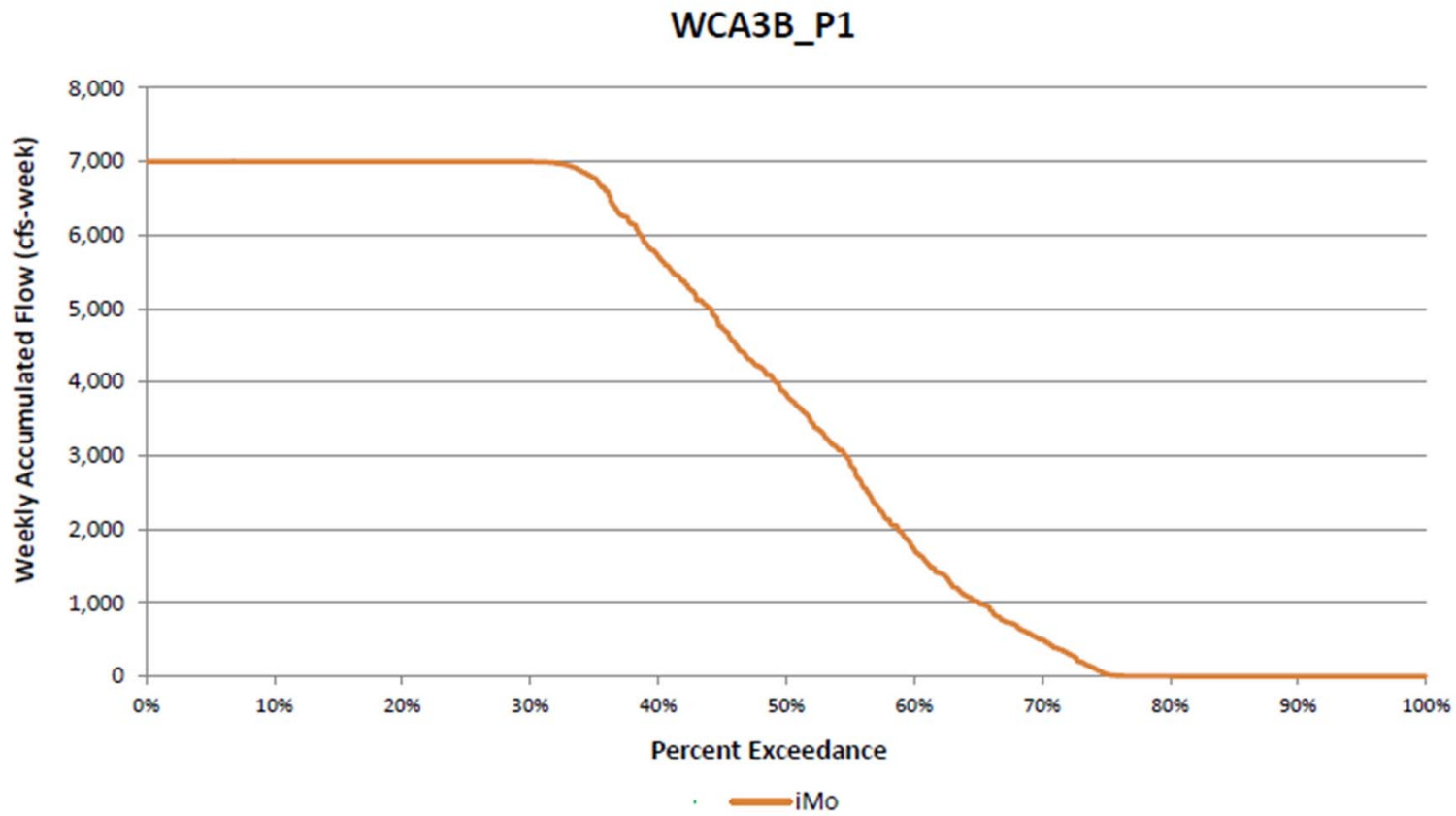
Scenario: Green2



Median (ac-ft/wk) = 4093
10th Percentile (ac-ft/wk) = 0
90th Percentile (ac-ft/wk) = 6873

Median (cfs) = 295
10th Percentile (cfs) = 0
90th Percentile (cfs) = 495

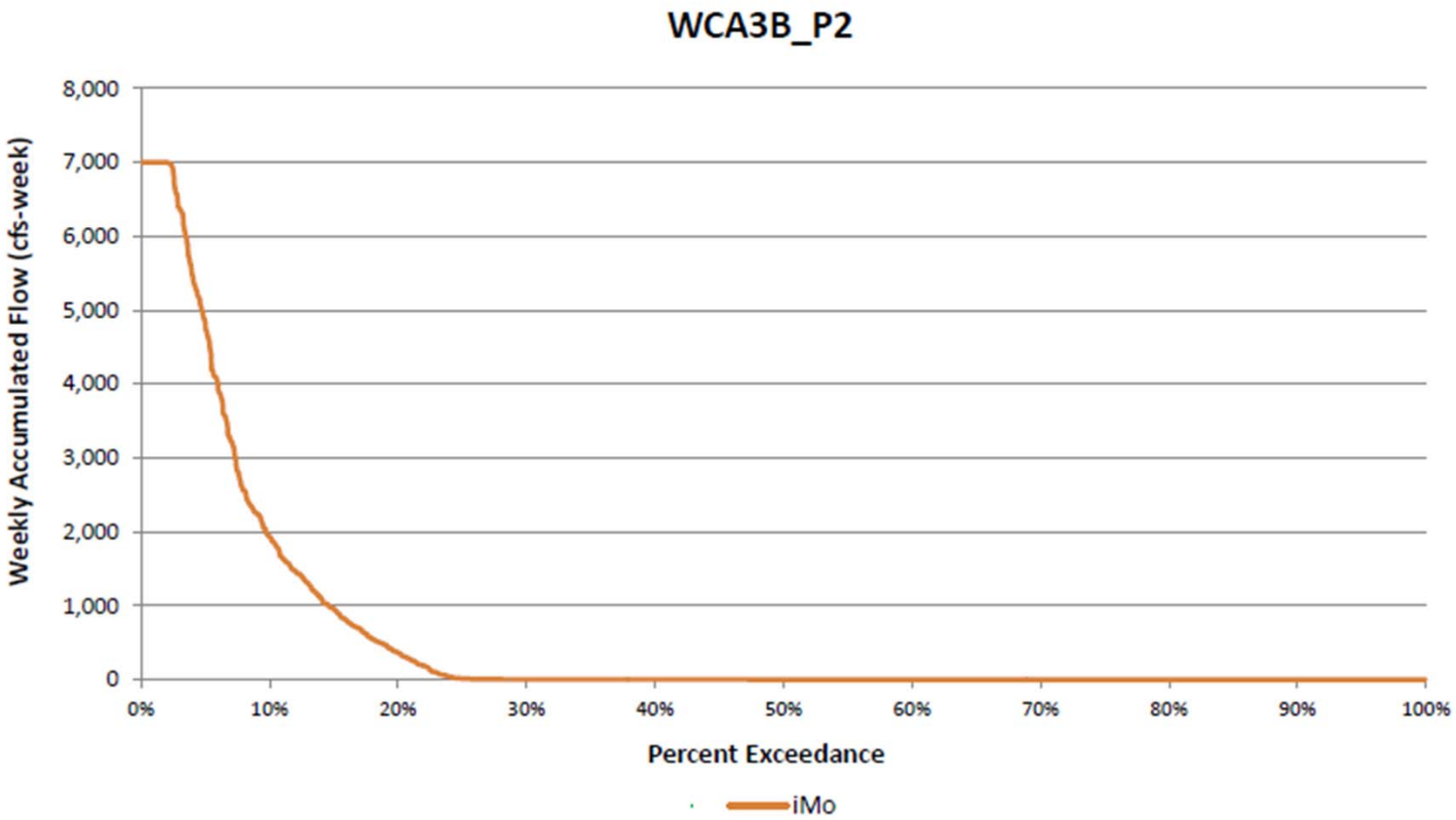
Scenario: Green1



Median (ac-ft/wk) = 7608
10th Percentile (ac-ft/wk) = 0
90th Percentile (ac-ft/wk) = 13885

Median (cfs) = 548
10th Percentile (cfs) = 0
90th Percentile (cfs) = 1000

Scenario: Green1



Median (ac-ft/wk) = 0
10th Percentile (ac-ft/wk) = 0
90th Percentile (ac-ft/wk) = 3807

Median (cfs) = 0
10th Percentile (cfs) = 0
90th Percentile (cfs) = 274

Step 2: Holistic Targets

"Using Ridge & Slough hydrologic goals as a base, refine and optimize targets to ensure targets harmoniously optimize the holistic system"

- Transitional Ecological Targets used during Screening
  - Do no damage to WCA 1 and WCA 2
  - Three Primary Regions: WCA 3A, WCA 3B and ENP
    - Balance variable ecological communities
      - Ridge and Slough, Tree Islands, Sawgrass Plains, Marl Prairie, Terrestrial Habitat
    - Balance variable landscape pattern changes and degree of degradation
  - Recession Rates
  - Wet Season – Dry Season variability
  - T&E Species

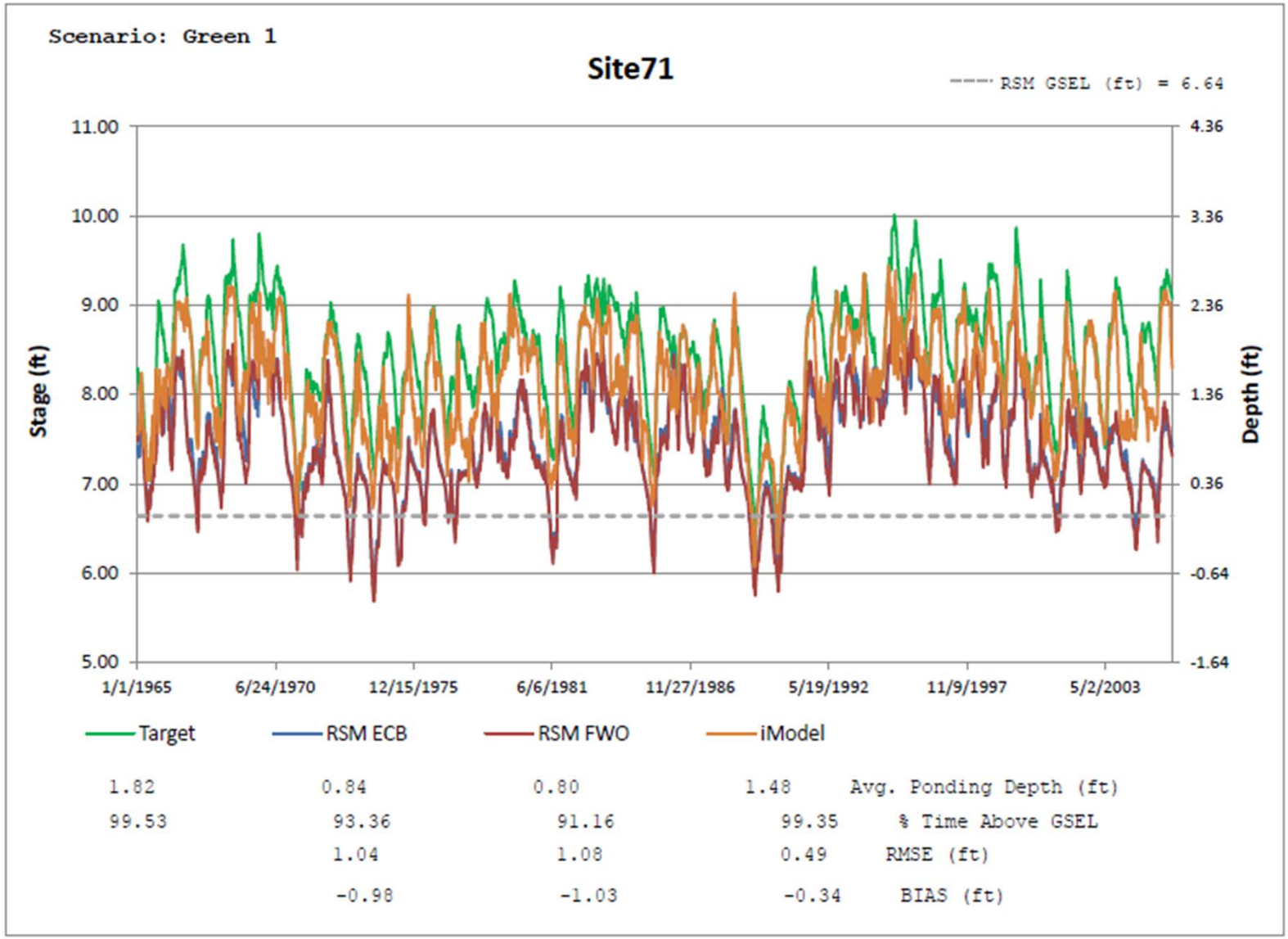
- Infrastructure limitations
  - Redline water budget
  - L-29
    - Operational Stage of Canal
    - Design Specification of Levee
- Recreational Accessibility
- Savings Clause: Water Supply and Flood Control

Step 2 Greenline Screening

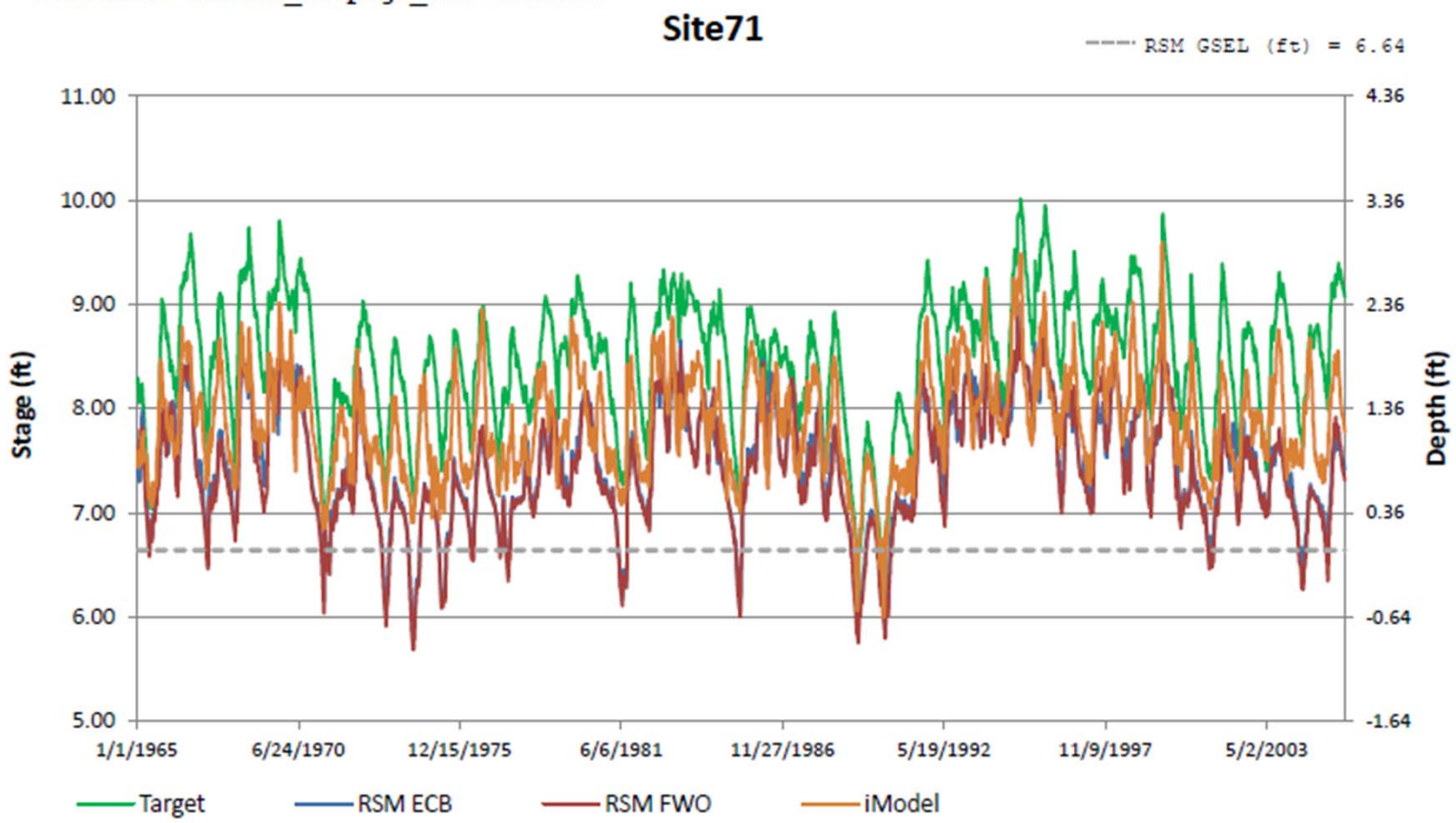
- Sensitivities Modeled in Step 2 in order to assist in Refinement of System-wide Objective for CEPP
  - Keep WCA1 near baselines
  - Keep WCA2A near guidance from FWS
  - No L6 diversion
  - Try to keep WCA3A below Zone A similar to Future Without Project
  - Investigate relationship between Site 71 & 3B seepage
  - Test L29 stage constraints of 8.5 / 8.0
  - Increase target matching for ENP marl areas
  - Improve conditions in at 3A-4

EXAMPLE SCREENING OUTCOMES

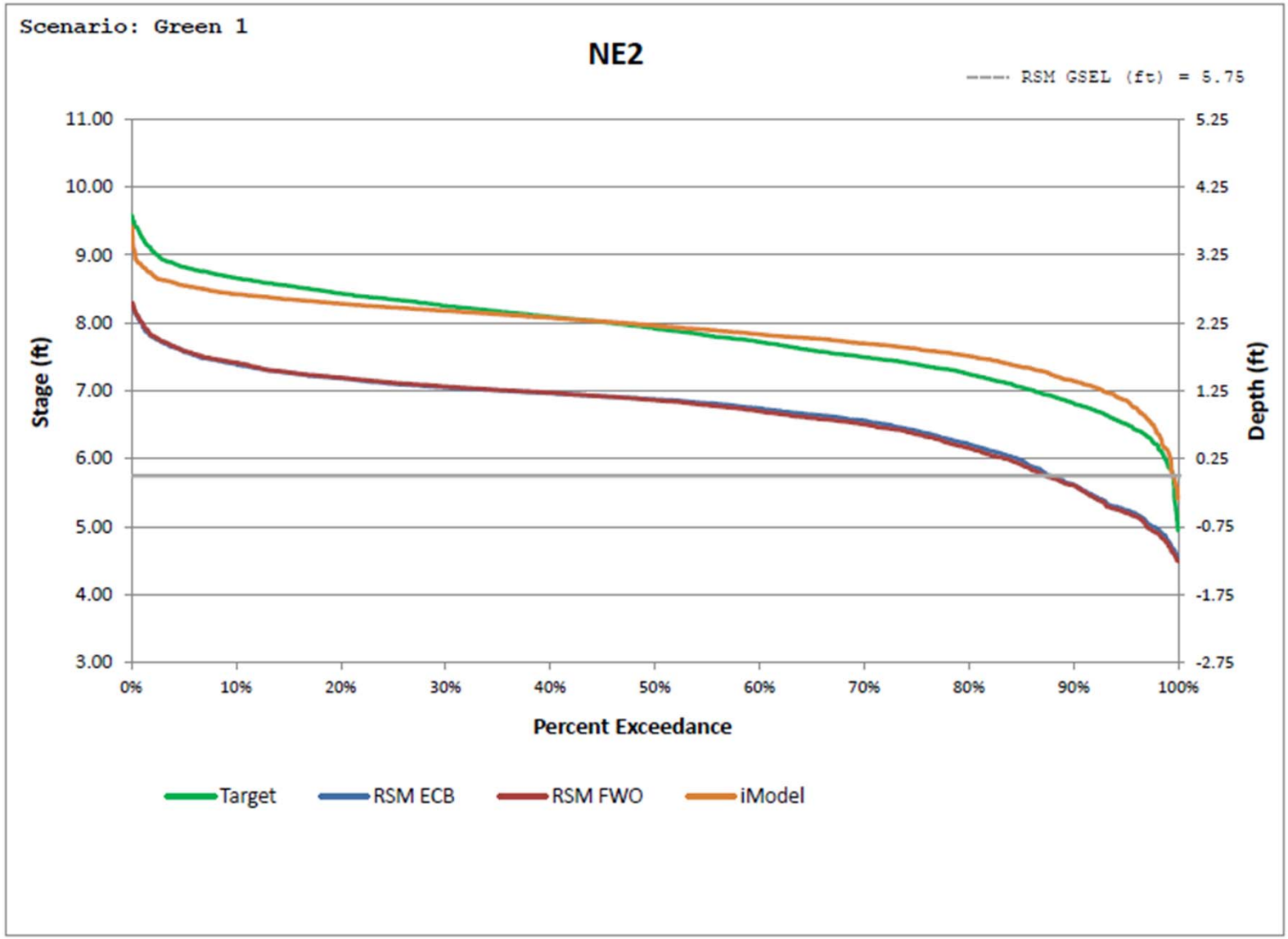
STEP 2

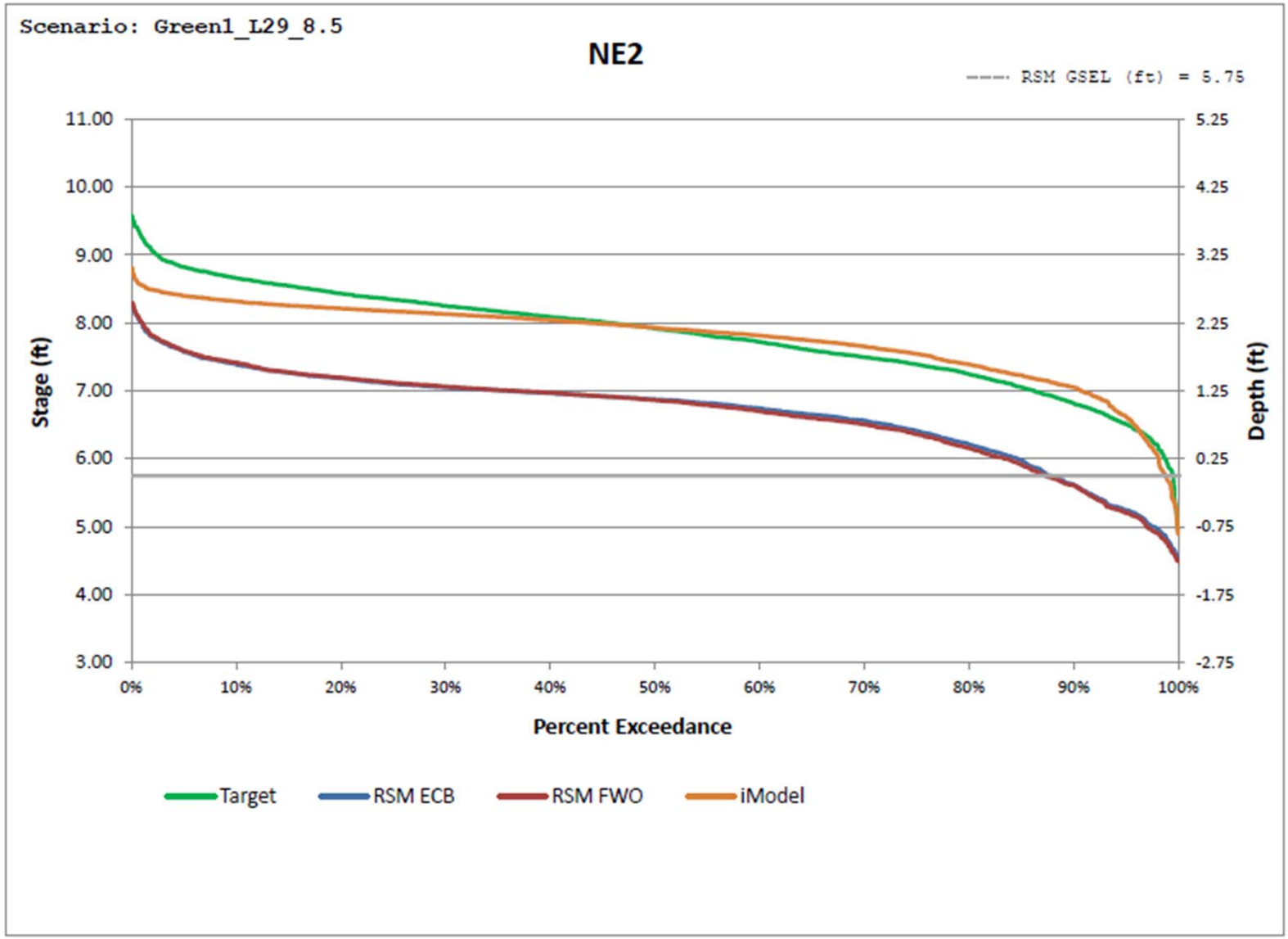

Scenario: Green 1
Site71
RSM GSEL (ft) = 6.64
Stage (ft)
Depth (ft)
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.36
3.36
2.36
1.36
0.36
-0.64
-1.64
1/1/1965
6/24/1970
12/15/1975
6/6/1981
11/27/1986
5/19/1992
11/9/1997
5/2/2003
Target
RSM ECB
RSM FWO
iModel
1.82 0.84 0.80 1.48 Avg. Ponding Depth (ft)
99.53 93.36 91.16 99.35 % Time Above GSEL
1.04 1.08 0.49 RMSE (ft)
-0.98 -1.03 -0.34 BIAS (ft)

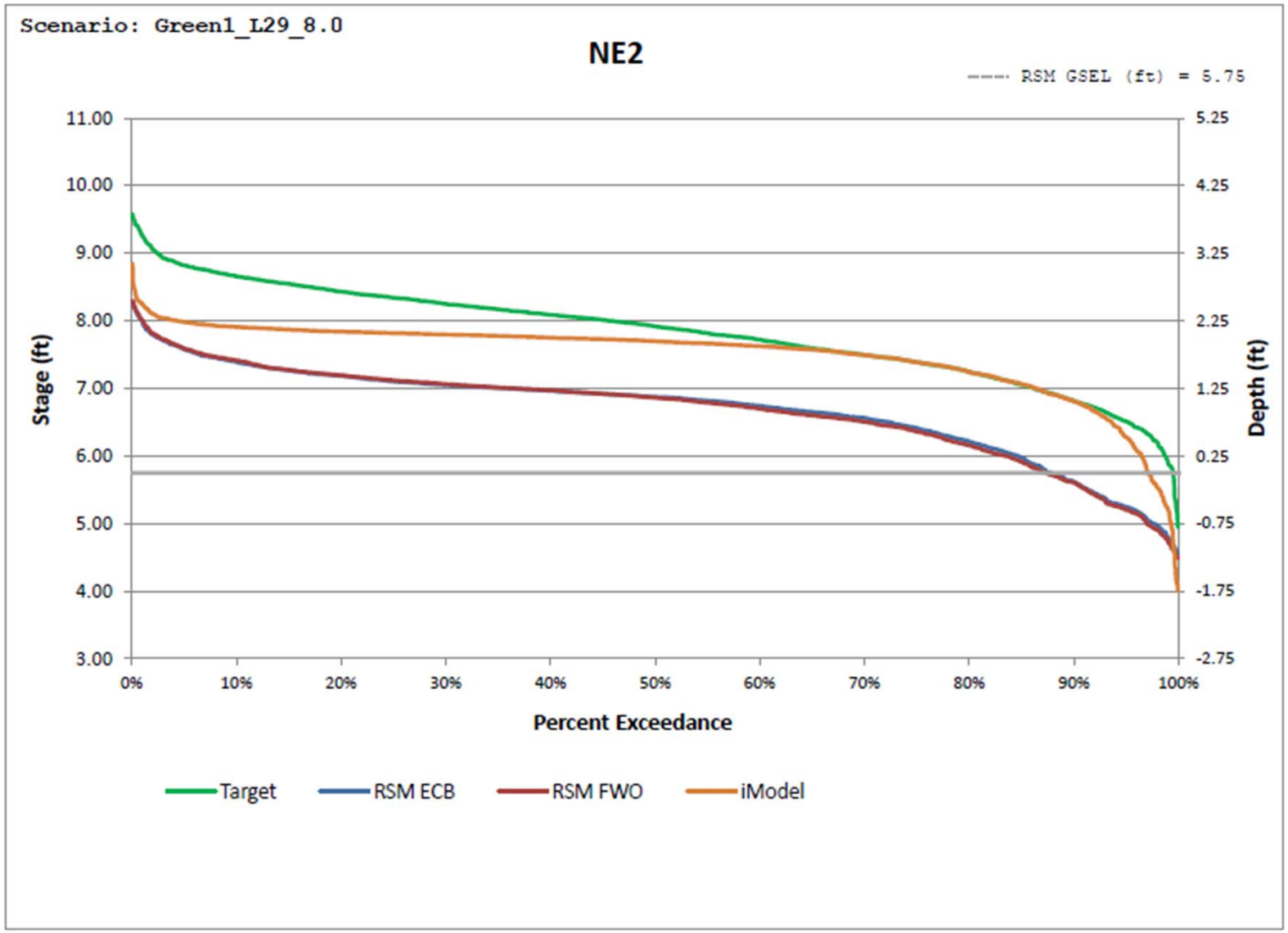
Scenario: Green2_Seepage_Constrained



1.82	0.84	0.80	1.23	Avg. Ponding Depth (ft)
99.53	93.36	91.16	99.44	% Time Above GSEL
	1.04	1.08	0.68	RMSE (ft)
	-0.98	-1.03	-0.59	BIAS (ft)


Scenario: Green 1
NE2
RSM GSEL (ft) = 5.75
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
Stage (ft)
5.25
4.25
3.25
2.25
1.25
0.25
-0.75
-1.75
-2.75
Depth (ft)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent Exceedance
Target
RSM ECB
RSM FWO
iModel


Scenario: Green1_L29_8.5
NE2
RSM GSEL (ft) = 5.75
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
Stage (ft)
5.25
4.25
3.25
2.25
1.25
0.25
-0.75
-1.75
-2.75
Depth (ft)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent Exceedance
Target
RSM ECB
RSM FWO
iModel


Scenario: Green1_L29_8.0
NE2
RSM GSEL (ft) = 5.75
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
Stage (ft)
5.25
4.25
3.25
2.25
1.25
0.25
-0.75
-1.75
-2.75
Depth (ft)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent Exceedance
Target
RSM ECB
RSM FWO
iModel

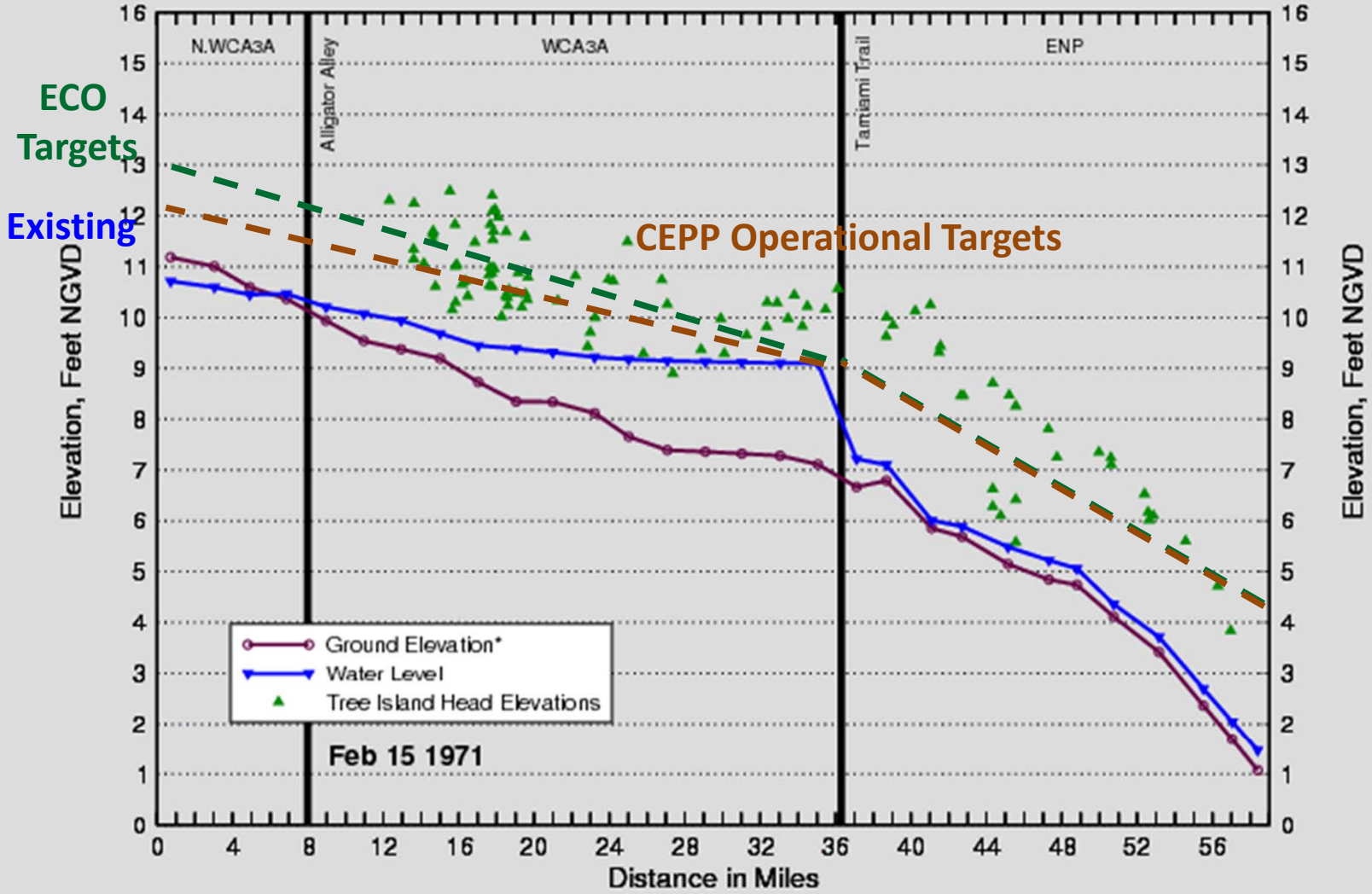
Operational Target Development

Guidance identified for operational targets

- Keep WCA1 near baselines
- Keep WCA2A near guidance from FWS
- Allow L6 diversion (benefits observed)
- To honor Zone A and CEPP water budget, develop a "continuous water surface" for WCA 3A.
- Link 3B seepage management to project features
- Allow L29 up to 9.7 ft
- Increase weighting for ENP marl areas and lower NP205 hydroperiod to ~ 210 days on average
- Do not increase weighting for 3A-4

Water Depth Viewing Window

Transect L1 for Scenario RSM_PCB1_GLD_rev_4848



NOTE: TARGETS ARE NOT TO SCALE

* Within the ridge & slough landscape, ground elevation = slough bottom.
For other landscapes, ground elevation = average model ground surface.

Script used: depth_transects.scr
Filename: depth_transects_L1_RSM_PCB1_GLD_rev_4848.agr

Step 3: Infrastructure Formulation

Key Questions for Trend Analysis :

1. Is restoration of/and conveyance through 3B needed to progress towards meeting targets in ENP and southern WCA3A?

2. Where (in general) should we send water across the L-67s if a degree of restoration in 3B is attainable and/or WCA 3B is needed to get restoration targets in the park and southern 3A?

3. In the absence of the Blue Shanty flowway, are pumps necessary to flow water out of 3B, and if so how many,? Is this tied to particular inflow location into 3B?

4. What additional benefits are provided by the Blue Shanty flowway?

Step 3: Infrastructure Formulation

- Identified large array of feasible configurations of management measures
  - Organized by "trend analysis" driven infrastructure needs and locations
  - Resulted in 23 identified options

- Identified a refined array of options to undergo iModel infrastructure screening analysis
  - Using iModel output from Step 1 and Step 2
  - Identify preferentially utilized structures and pumps
  - Establish bookends: Minimal configuration to configurations that maximize achievement of holistic operational targets
  - Incrementally build options from the minimal to maximal practicable to ensure robust evaluation
  - Resulted in 10 additional iModel scenarios

Not all possible configuration needs to be modeled, but all configurations identified to be modeled should provide insight

Step 3: Infrastructure Options

Option	Title	S-333	3B/L-67A levee	L67C levee	L-29 levee	Blue Shanty levee, 3B	3B Seepage Management
1A	No - WCA 3B	2000					Constrained
3A1	Southerly Orientation 3B	2000	S4, S5, S6 @500cfs	Gaps at structures	355A,B,C		Unconstrained
3A2	Southerly Orientation 3B	2000	S4, S5, S6 @750cfs	Gaps at structures	355A,B,C		Unconstrained
3B2	Southerly Orientation 3B	2000	S 4, S5, S6 @750 cfs	Gaps at structures	355A,B,C Pump 1		Unconstrained
3B3	Southerly Orientation 3B	2000	S 4, S5, S6 @750 cfs	Gaps at structures	355A,B,C Pump 1		Constrained
4A	Southwest 3B - Blue Shanty	Existing	S5, S6 and S1-4	Degrade west of Blue Shanty levee	Degrade west of blue shanty levee	From L67A to L-29	Constrained
4B	Southwest 3B - Blue Shanty	Existing	S5, S6 and S4	Degrade west of Blue Shanty levee	Degrade west of blue shanty levee	From L67A to L-29	Constrained
4C	Southwest 3B - Blue Shanty	Existing	S5, S6	Degrade west of Blue Shanty levee	Degrade west of blue shanty levee	From L67A to L-29	Constrained
9A	Entire L-67A extent	2000	6 structures S(1-6)	Gaps at structures	more 355s; gravity		Unconstrained
10A	North/South	2000	S2,S3 S5,S6 @500cfs	Gaps at structures	355A,B,C 2 pumps @500cfs		Unconstrained

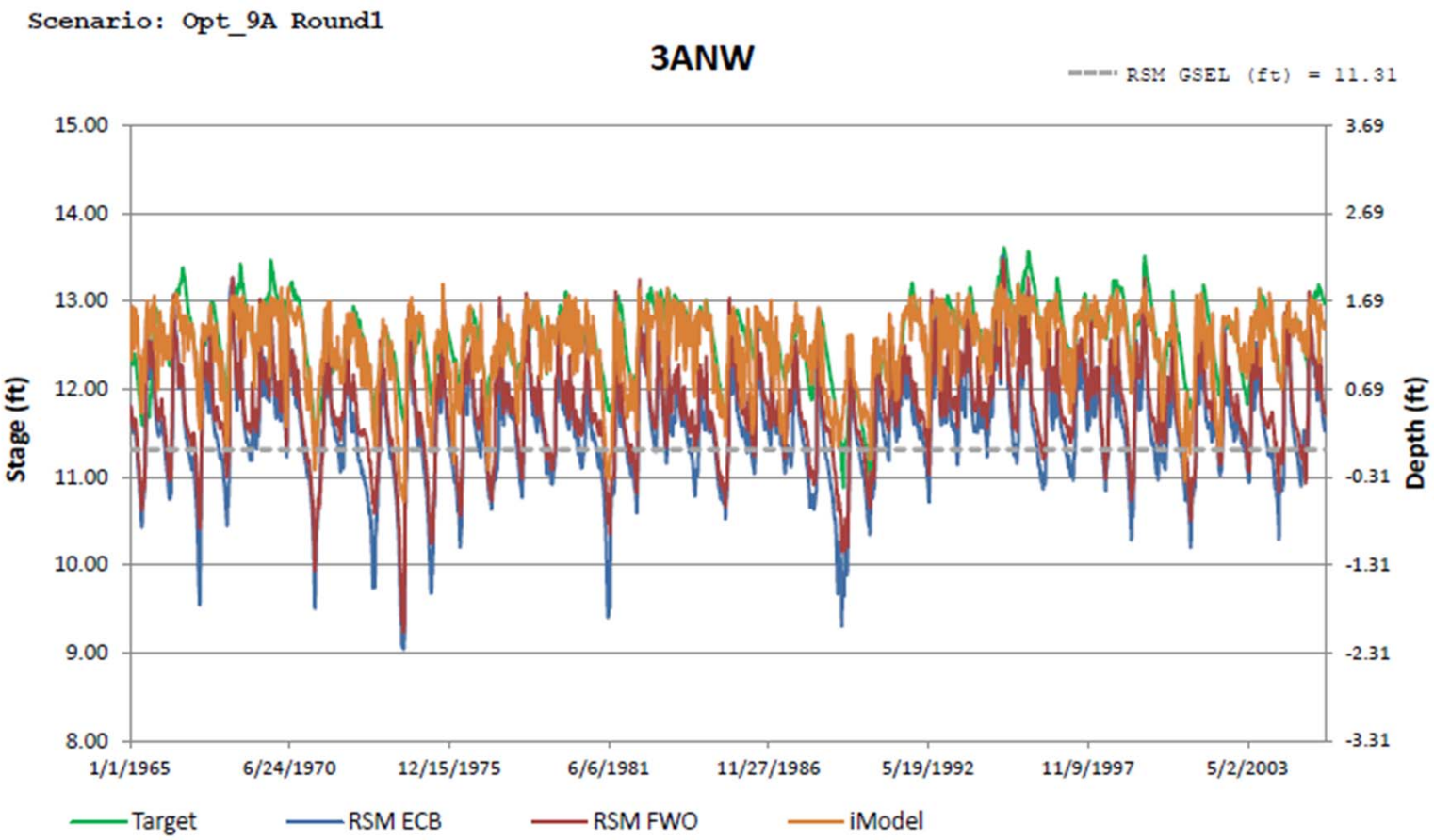
Step 3: Infrastructure Options Evaluation – Criteria Hierarchy

- **Level 1** – Primary CEPP Ecological Objectives
  - Hydro-ecological target evaluation of iModel results
- **Level 2** – Other important considerations
  - **Connectivity**
    - Miles of marsh reconnected and acres of marsh restored
  - **Adaptability: Adaptive Management considerations**
    - Robustness
    - Future Compatibility
  - **Recreational Impacts**
    - Hunting/Fishing Impacts
  - **Costs**

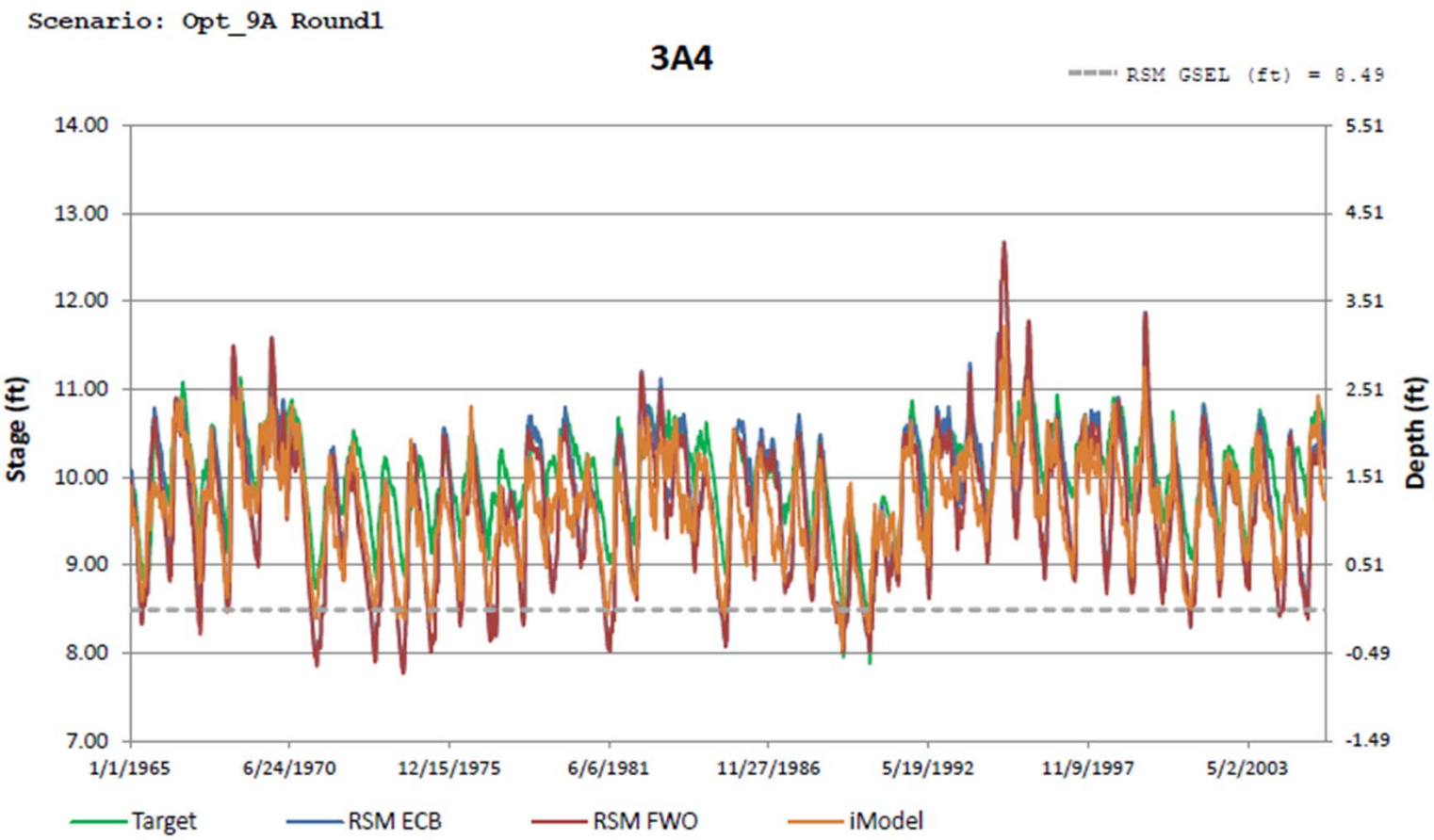
EXAMPLE SCREENING OUTCOMES

STEP 3

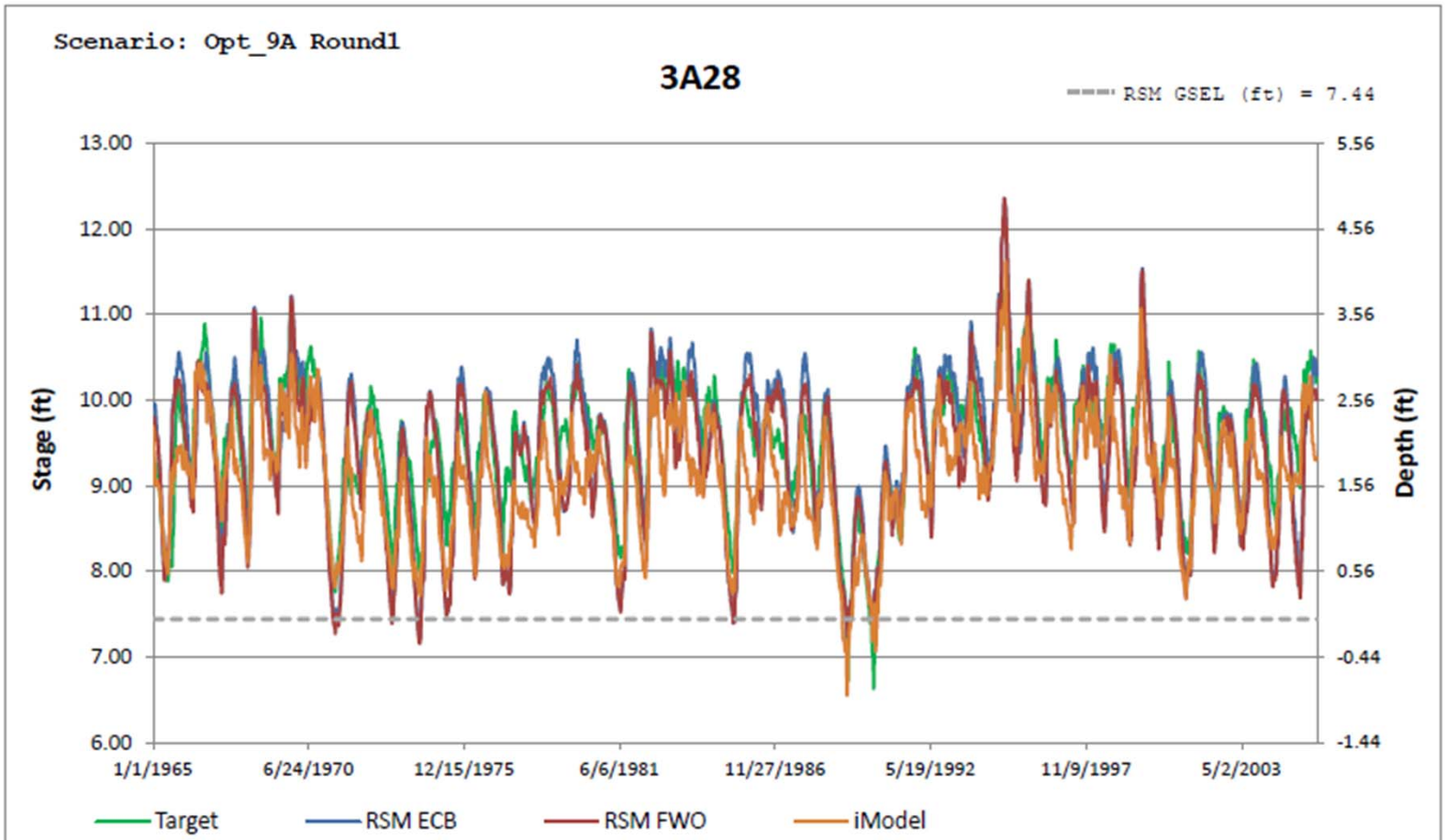
Option	S-333	3B/L-67A levee	L-29 levee	Blue Shanty levee, 3B	Blue Shanty levee, ENP	L-29 canal operational limit	3B Seepage Management
1A	2000					9.7	Constrained
3A1	2000	S4, S5, S6 @500cfs	355A,B,C			9.7	Unconstrained
3A2	2000	S4, S5, S6 @750cfs	355A,B,C			9.7	Unconstrained
3B2	2000	S 4, S5, S6 @750 cfs	355A,B,C Pump 1			9.7	Unconstrained
3B3	2000	S 4, S5, S6 @750 cfs	355A,B,C Pump 1			9.7	Constrained
4A	2000	S5, S6 and S1-4	Degrade west of blue shanty levee	From L67A to L-29	Yes	9.7	Constrained
4B	2000	S5, S6 and S4	Degrade west of blue shanty levee	From L67A to L-29	Yes	9.7	Constrained
4C	2000	S5, S6	Degrade west of blue shanty levee	From L67A to L-29	Yes	9.7	Constrained
9A	2000	6 structures	more 355s; gravity			9.7	Unconstrained
10A	2000	S2,S3 S5,S6 @500cfs	355A,B,C 2 pumps @500cfs			9.7	Unconstrained



1.24	0.25	0.46	1.16	Avg. Ponding Depth (ft)
99.53	68.15	81.62	98.13	% Time Above GSEL
	1.10	0.89	0.35	RMSE (ft)
	-0.99	-0.78	-0.09	BIAS (ft)

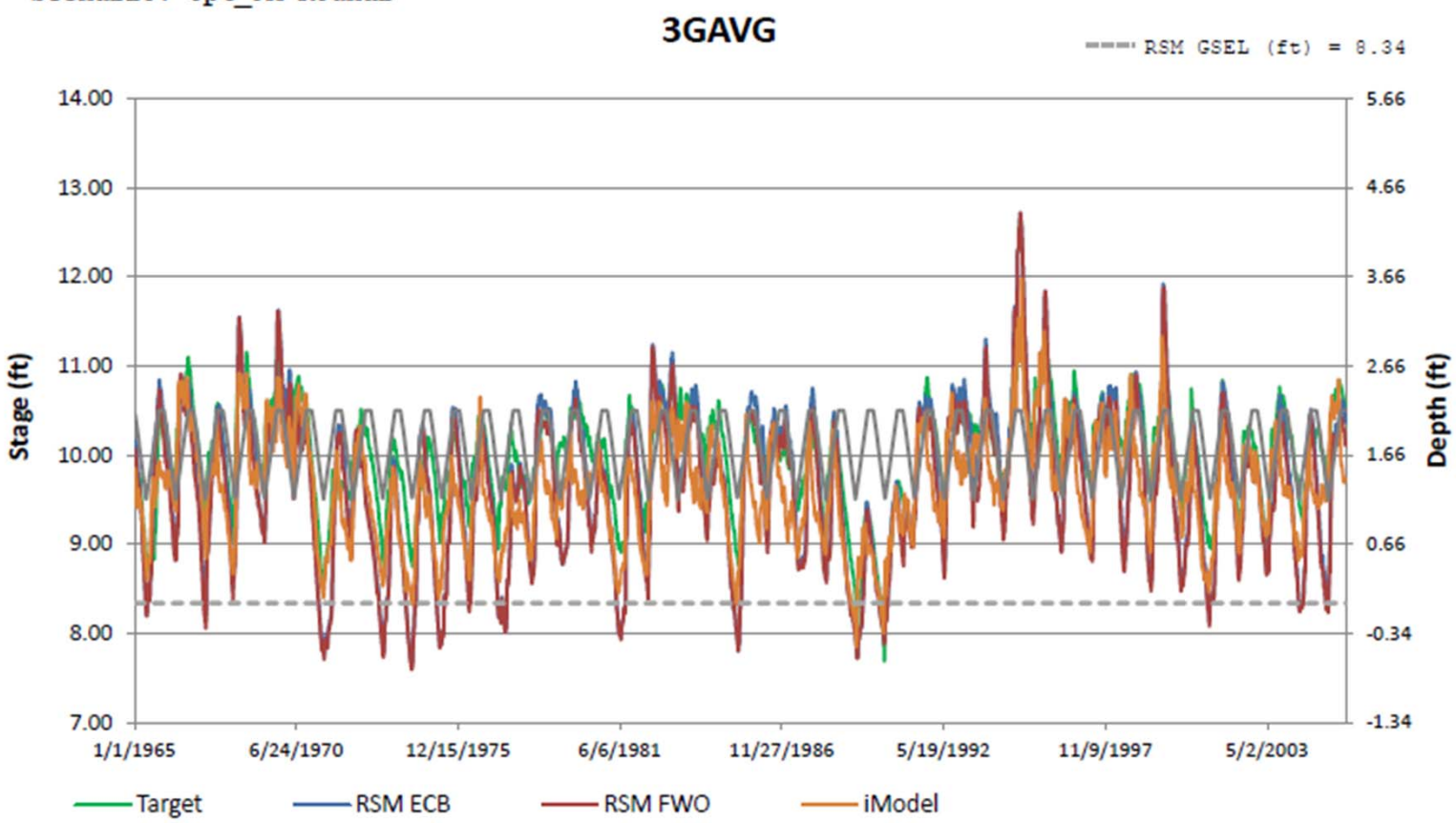


1.55	1.23	1.13	1.16	Avg. Ponding Depth (ft)
99.53	92.38	91.35	97.71	% Time Above GSEL
	0.55	0.60	0.51	RMSE (ft)
	-0.32	-0.42	-0.40	BIAS (ft)

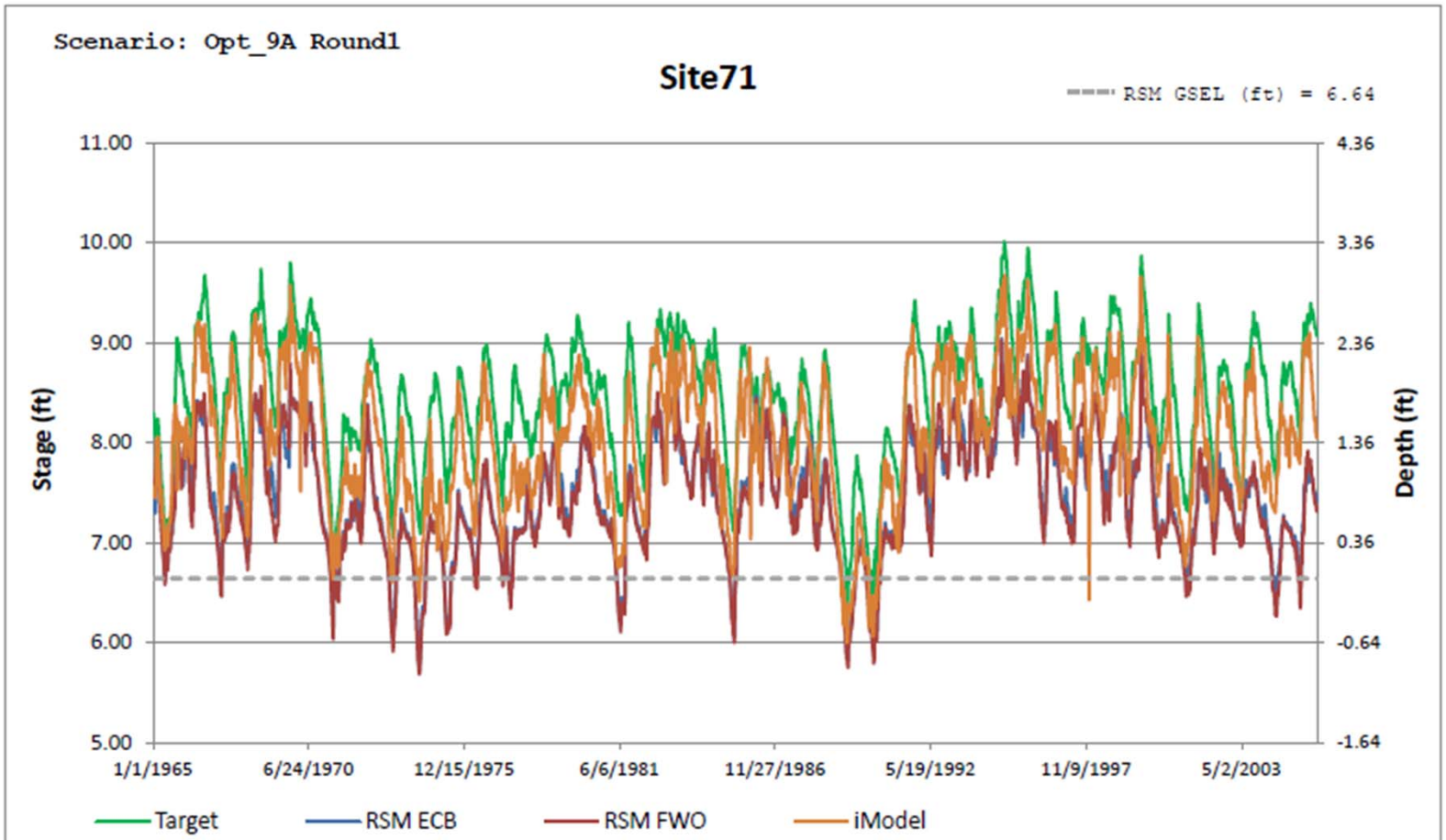


2.07	2.03	1.90	1.68	Avg. Ponding Depth (ft)
99.53	99.25	98.97	98.92	% Time Above GSEL
	0.45	0.45	0.53	RMSE (ft)
	-0.05	-0.17	-0.40	BIAS (ft)

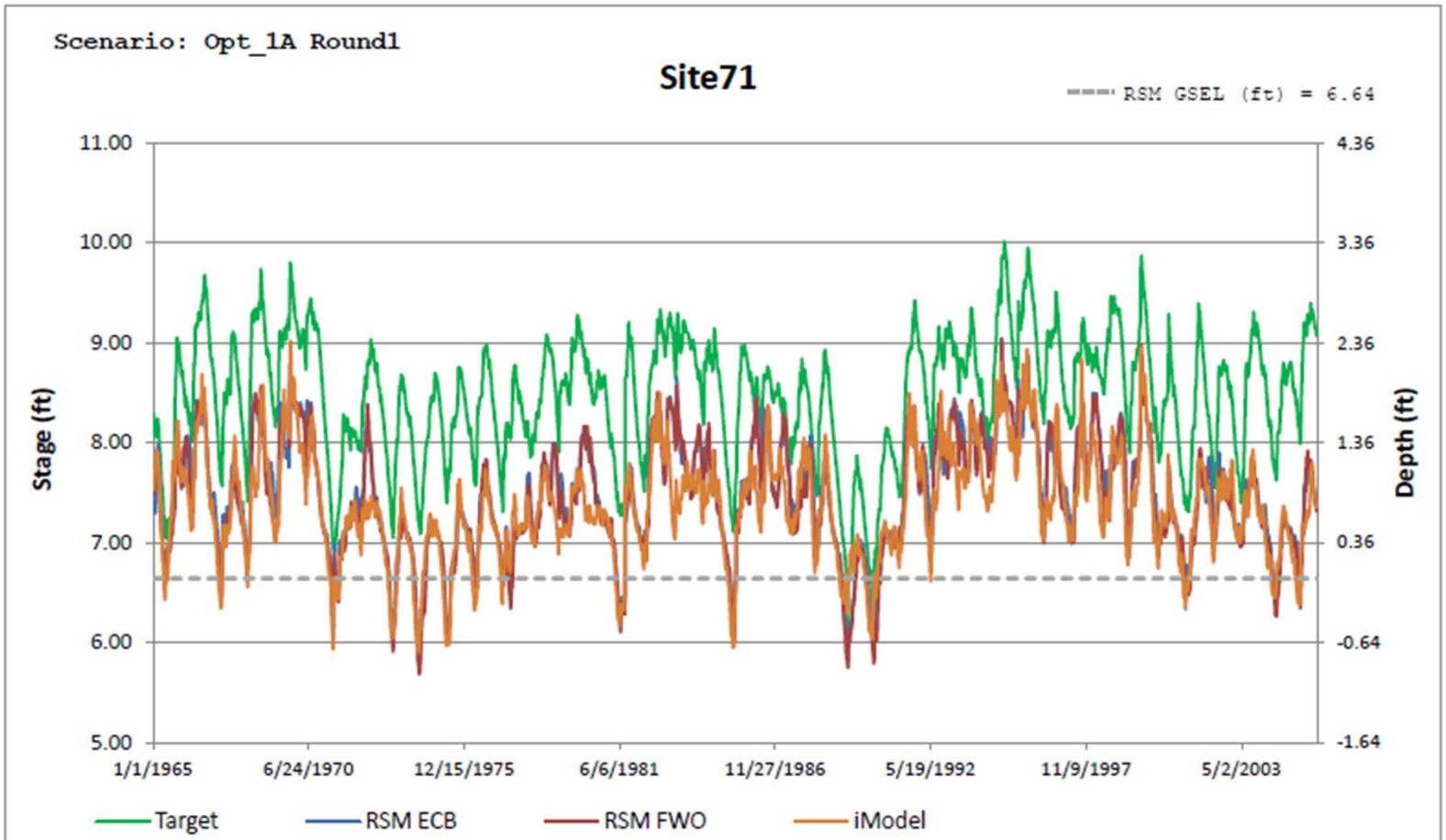
Scenario: Opt_9A Round1



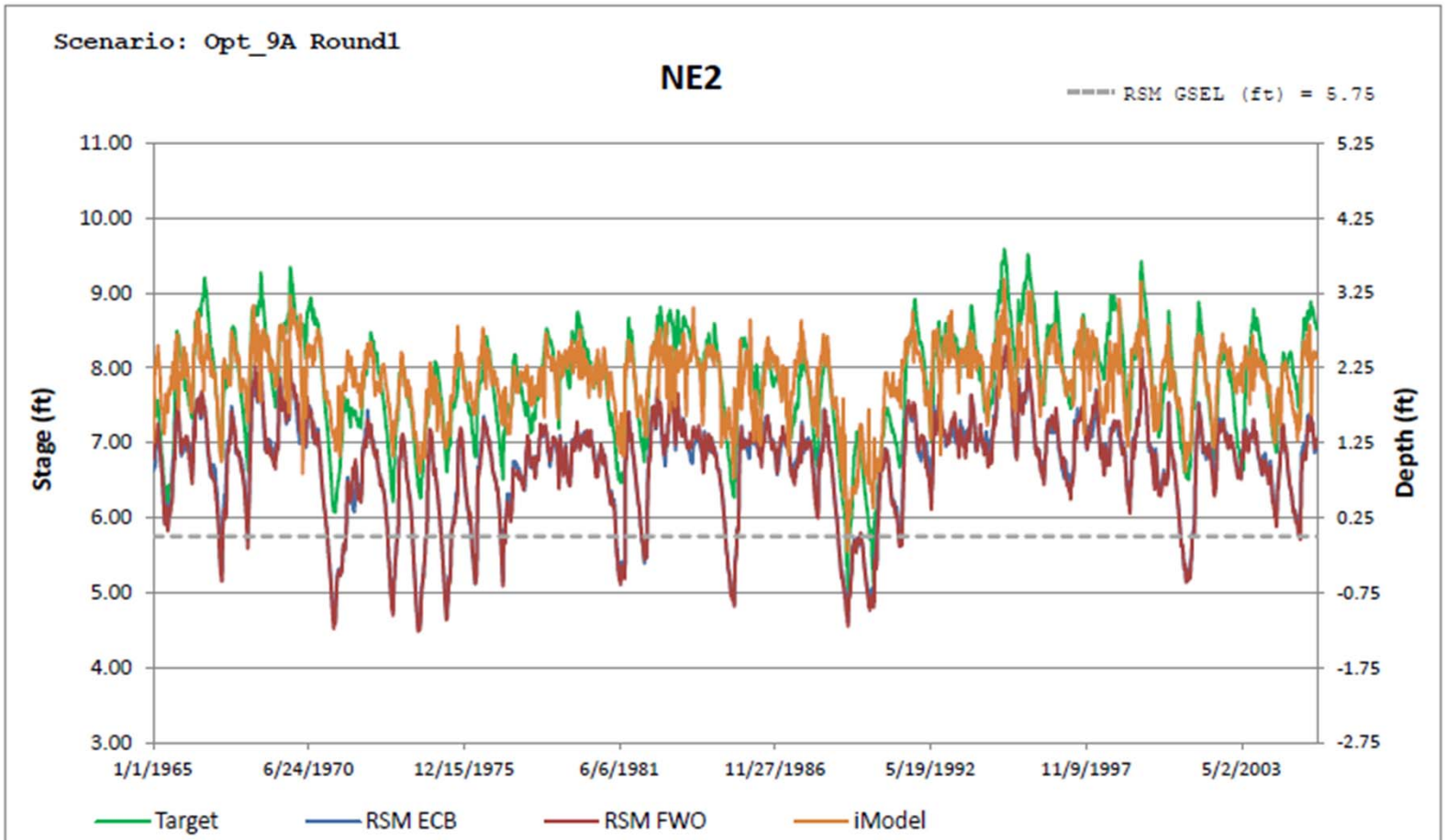
44.39	32.51	18.80	22.87	% Time > Zone A
25.23	12.90	13.46	38.01	% Preferred Recession
54.19	35.75	36.09	34.05	% Marginal Recession



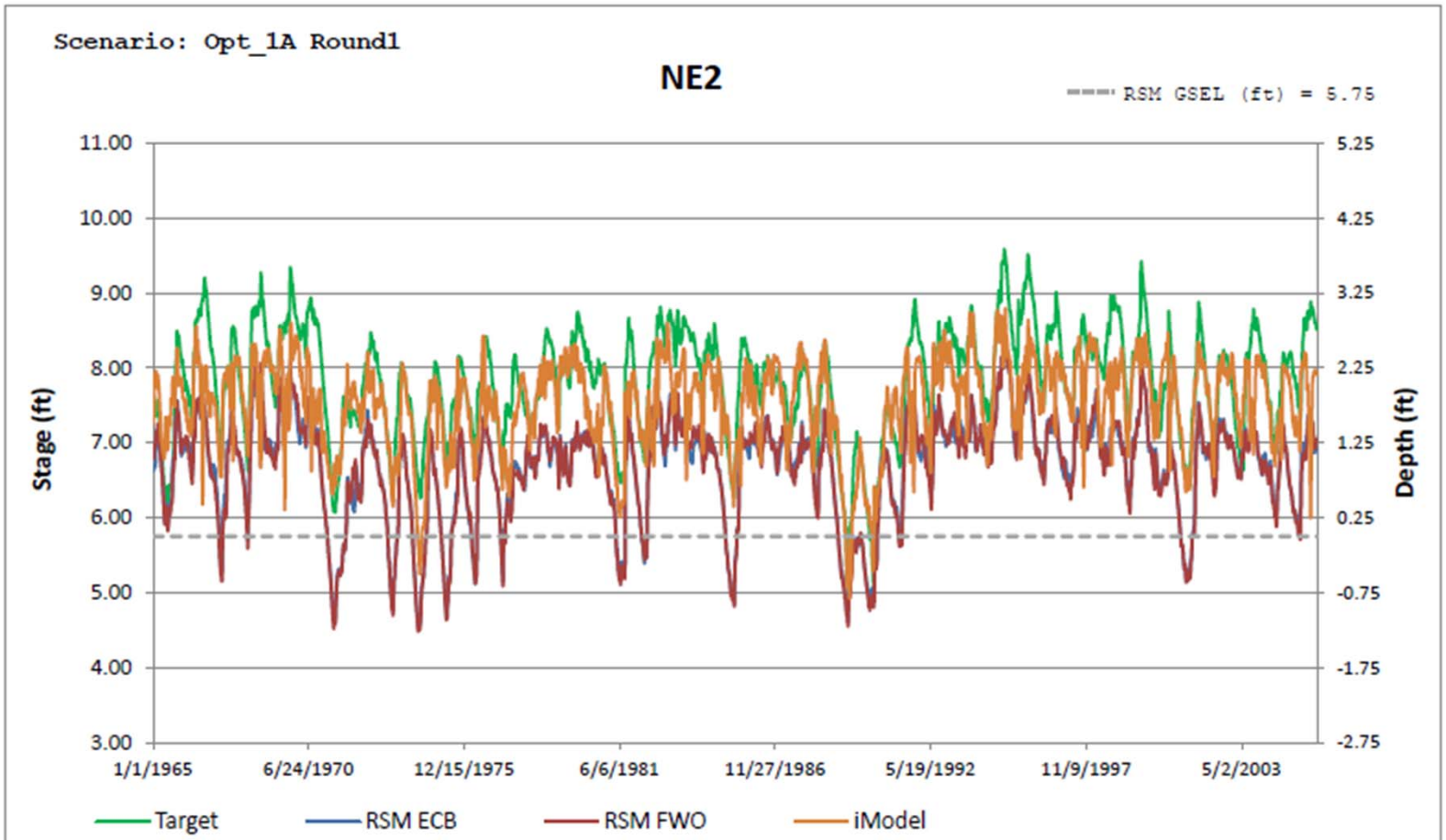
1.82	0.84	0.80	1.40	Avg. Ponding Depth (ft)
99.53	93.36	91.16	97.61	% Time Above GSEL
	1.04	1.08	0.51	RMSE (ft)
	-0.98	-1.03	-0.42	BIAS (ft)



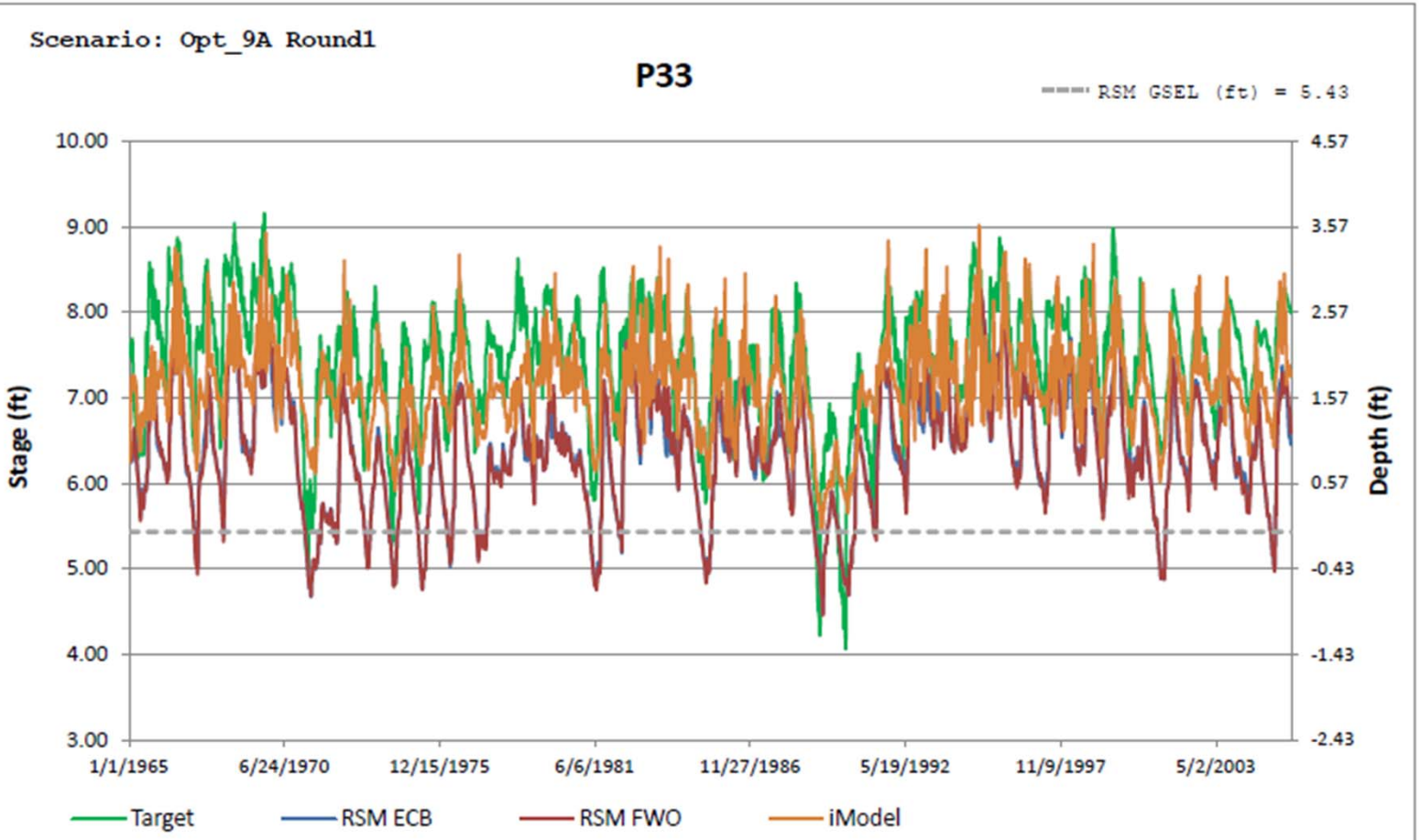
1.82	0.84	0.80	0.73	Avg. Ponding Depth (ft)
99.53	93.36	91.16	90.93	% Time Above GSEL
	1.04	1.08	1.15	RMSE (ft)
	-0.98	-1.03	-1.09	BIAS (ft)



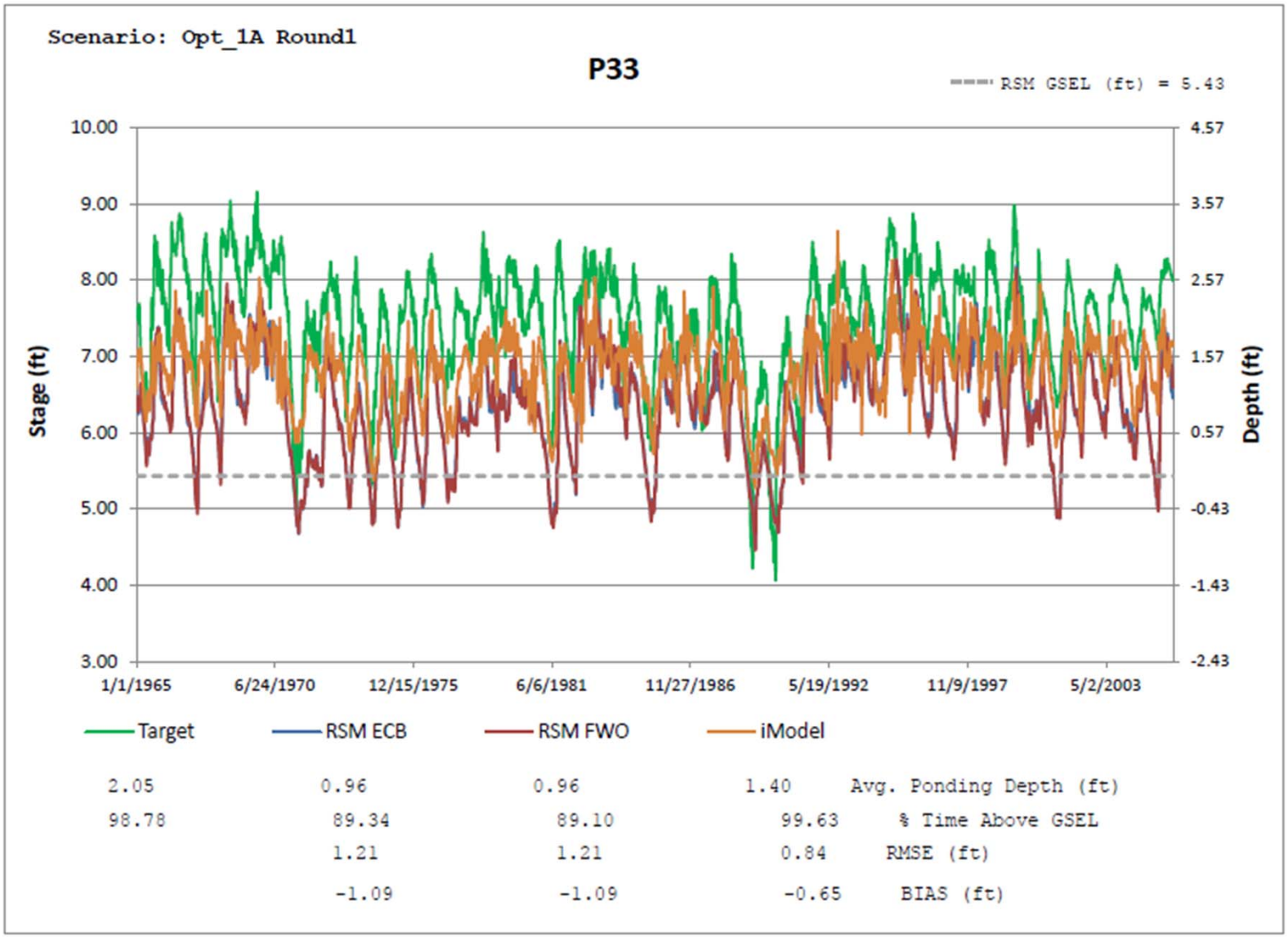
2.07	0.94	0.93	2.09	Avg. Ponding Depth (ft)
99.53	87.75	87.28	99.95	% Time Above GSEL
	1.18	1.20	0.44	RMSE (ft)
	-1.13	-1.15	0.02	BIAS (ft)

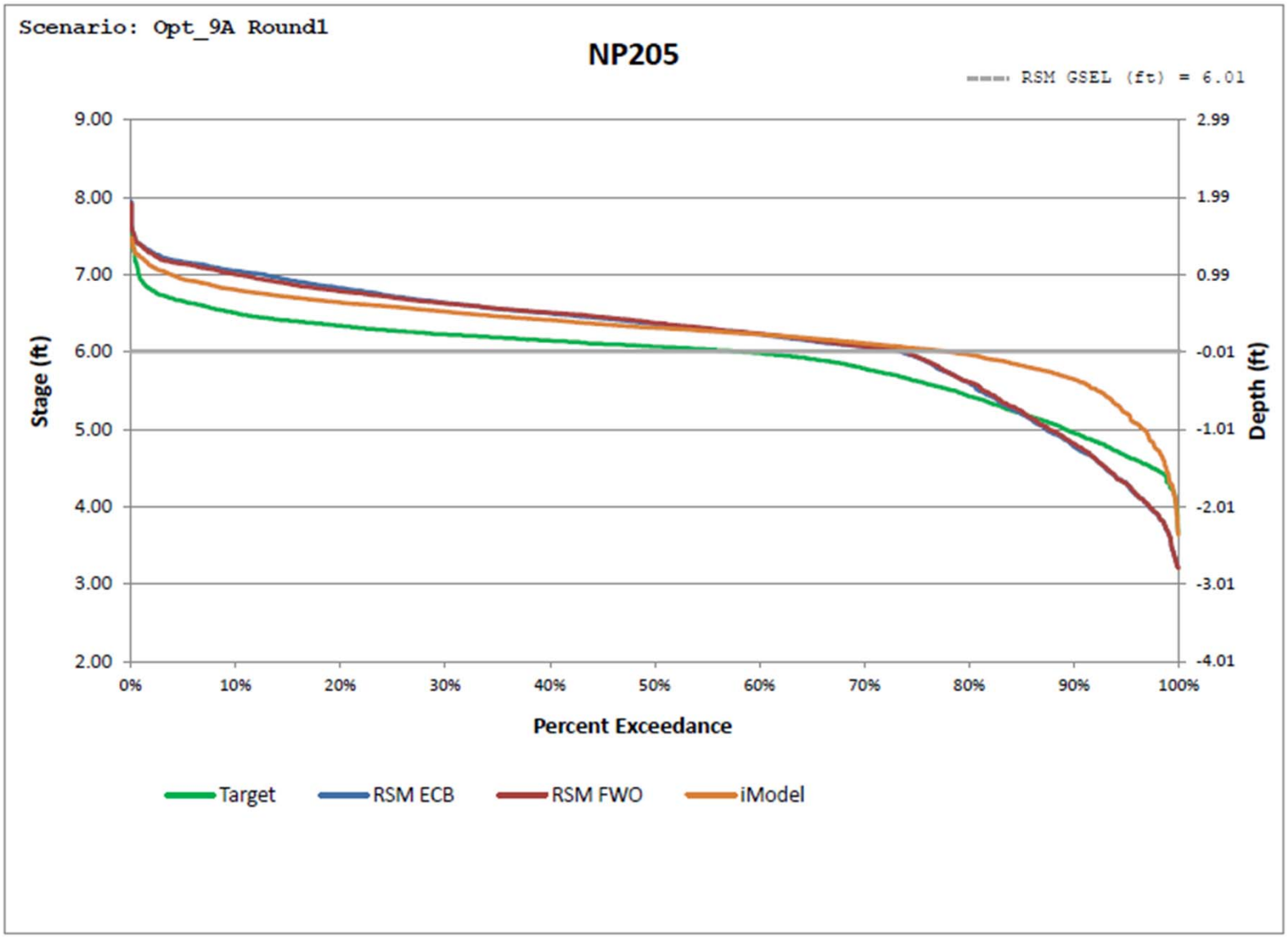


2.07	0.94	0.93	1.77	Avg. Ponding Depth (ft)
99.53	87.75	87.28	99.02	% Time Above GSEL
	1.18	1.20	0.58	RMSE (ft)
	-1.13	-1.15	-0.30	BIAS (ft)



2.05	0.96	0.96	1.69	Avg. Ponding Depth (ft)
98.78	89.34	89.10	100.00	% Time Above GSEL
	1.21	1.21	0.63	RMSE (ft)
	-1.09	-1.09	-0.36	BIAS (ft)

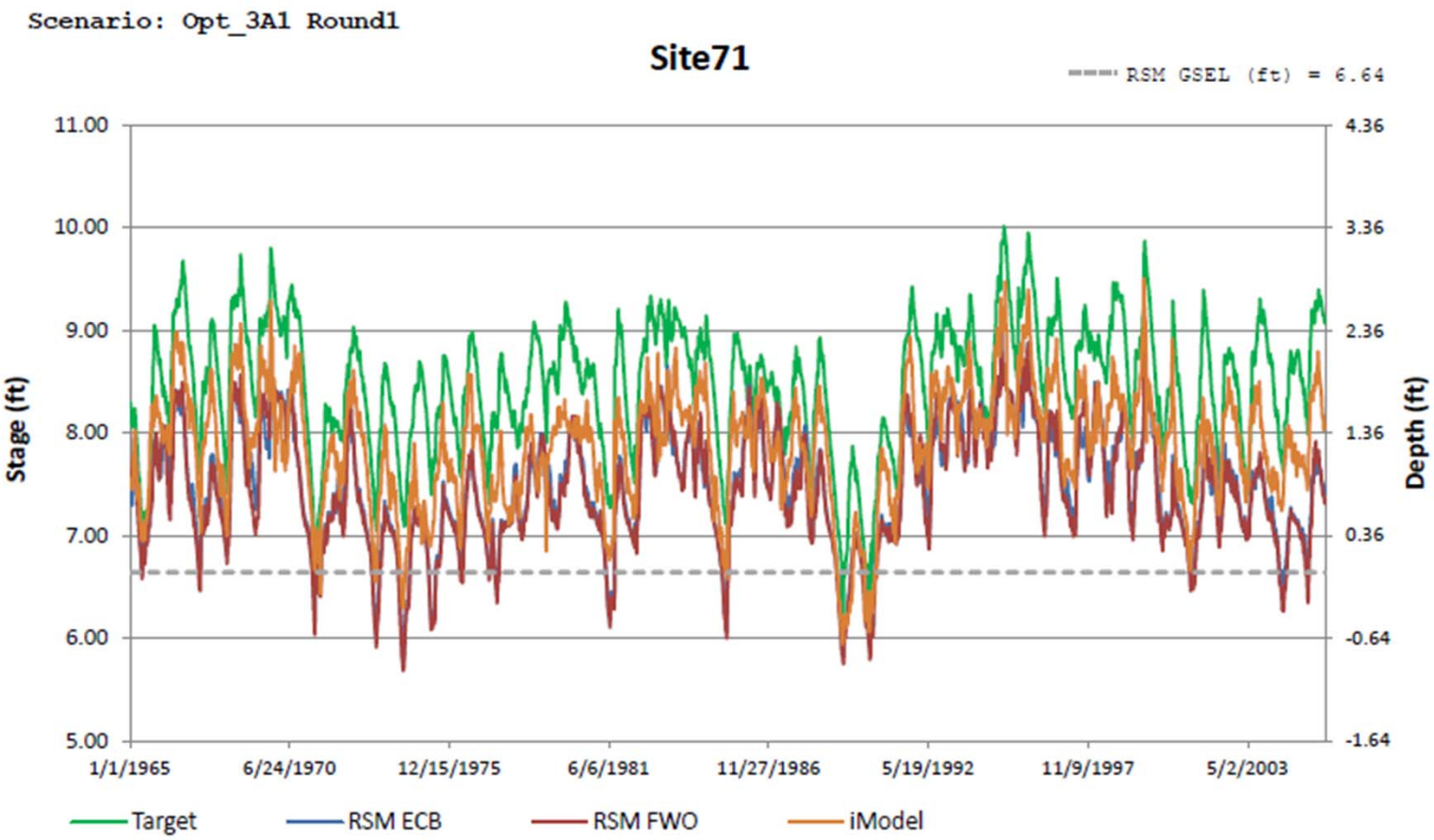

Scenario: Opt_1A Round1
P33
RSM GSEL (ft) = 5.43
Stage (ft)
Depth (ft)
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
4.57
3.57
2.57
1.57
0.57
-0.43
-1.43
-2.43
1/1/1965
6/24/1970
12/15/1975
6/6/1981
11/27/1986
5/19/1992
11/9/1997
5/2/2003
Target
RSM ECB
RSM FWO
iModel
2.05 0.96 0.96 1.40 Avg. Ponding Depth (ft)
98.78 89.34 89.10 99.63 % Time Above GSEL
1.21 1.21 0.84 RMSE (ft)
-1.09 -1.09 -0.65 BIAS (ft)


Scenario: Opt_9A Round1
NP205
RSM GSEL (ft) = 6.01
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
Stage (ft)
2.99
1.99
0.99
-0.01
-1.01
-2.01
-3.01
-4.01
Depth (ft)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent Exceedance
Target
RSM ECB
RSM FWO
iModel

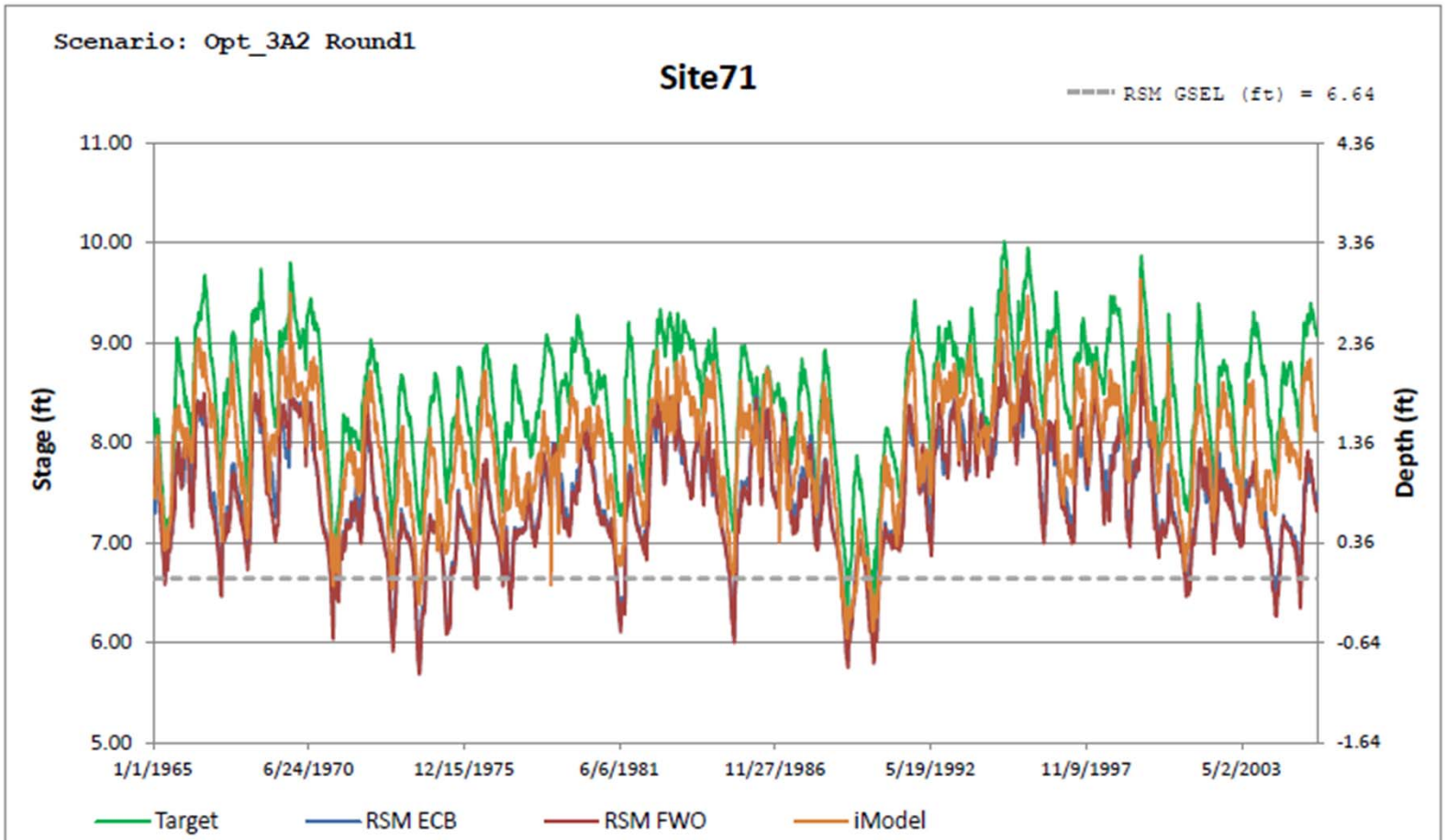
Opt 1A and Opt 9A Preliminary Conclusions

- Plans perform similarly for WCAs 1, 2 & 3A
  - Rehydration of Northern 3A
  - Extended hydroperiod in Northern / Central 3A
  - Slightly lower depths in Southern 3A
  - **Same trends observed across ALL Option runs**
- Significant ENP improvements can be achieved with S333 improvement & operational refinement
- Additional L67 / L29 infrastructure capable of moving toward restoration objectives in WCA 3B & ENP

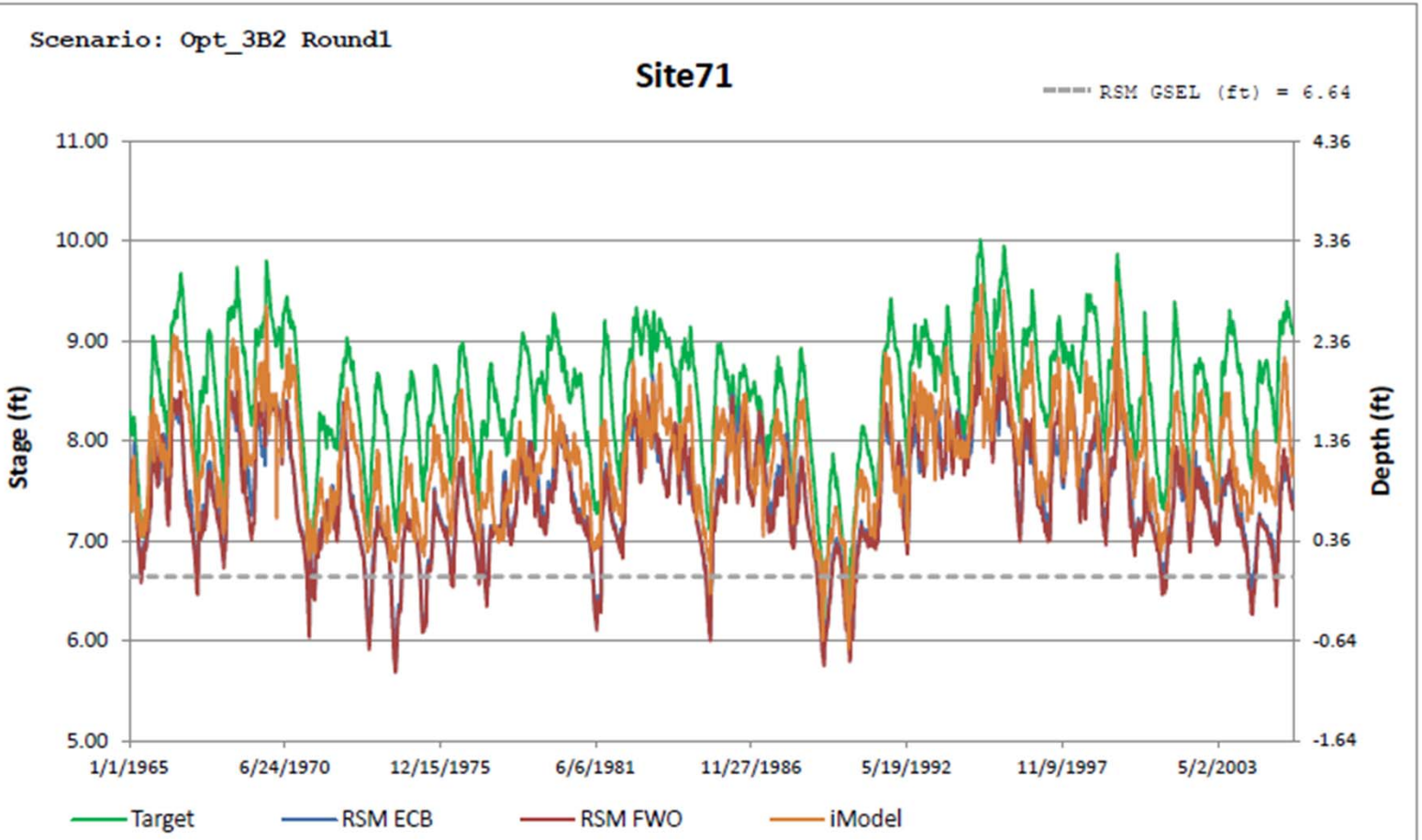
Option	S-333	3B/L-67A levee	L-29 levee	Blue Shanty levee, 3B	Blue Shanty levee, ENP	L-29 canal operational limit	3B Seepage Management
1A	2000					9.7	Constrained
3A1	2000	S4, S5, S6 @500cfs	355A,B,C			9.7	Unconstrained
3A2	2000	S4, S5, S6 @750cfs	355A,B,C			9.7	Unconstrained
3B2	2000	S 4, S5, S6 @750 cfs	355A,B,C Pump 1			9.7	Unconstrained
3B3	2000	S 4, S5, S6 @750 cfs	355A,B,C Pump 1			9.7	Constrained
4A	2000	S5, S6 and S1-4	Degrade west of blue shanty levee	From L67A to L-29	Yes	9.7	Constrained
4B	2000	S5, S6 and S4	Degrade west of blue shanty levee	From L67A to L-29	Yes	9.7	Constrained
4C	2000	S5, S6	Degrade west of blue shanty levee	From L67A to L-29	Yes	9.7	Constrained
9A	2000	6 structures	more 355s; gravity			9.7	Unconstrained
10A	2000	S2,S3 S5,S6 @500cfs	355A,B,C 2 pumps @500cfs			9.7	Unconstrained



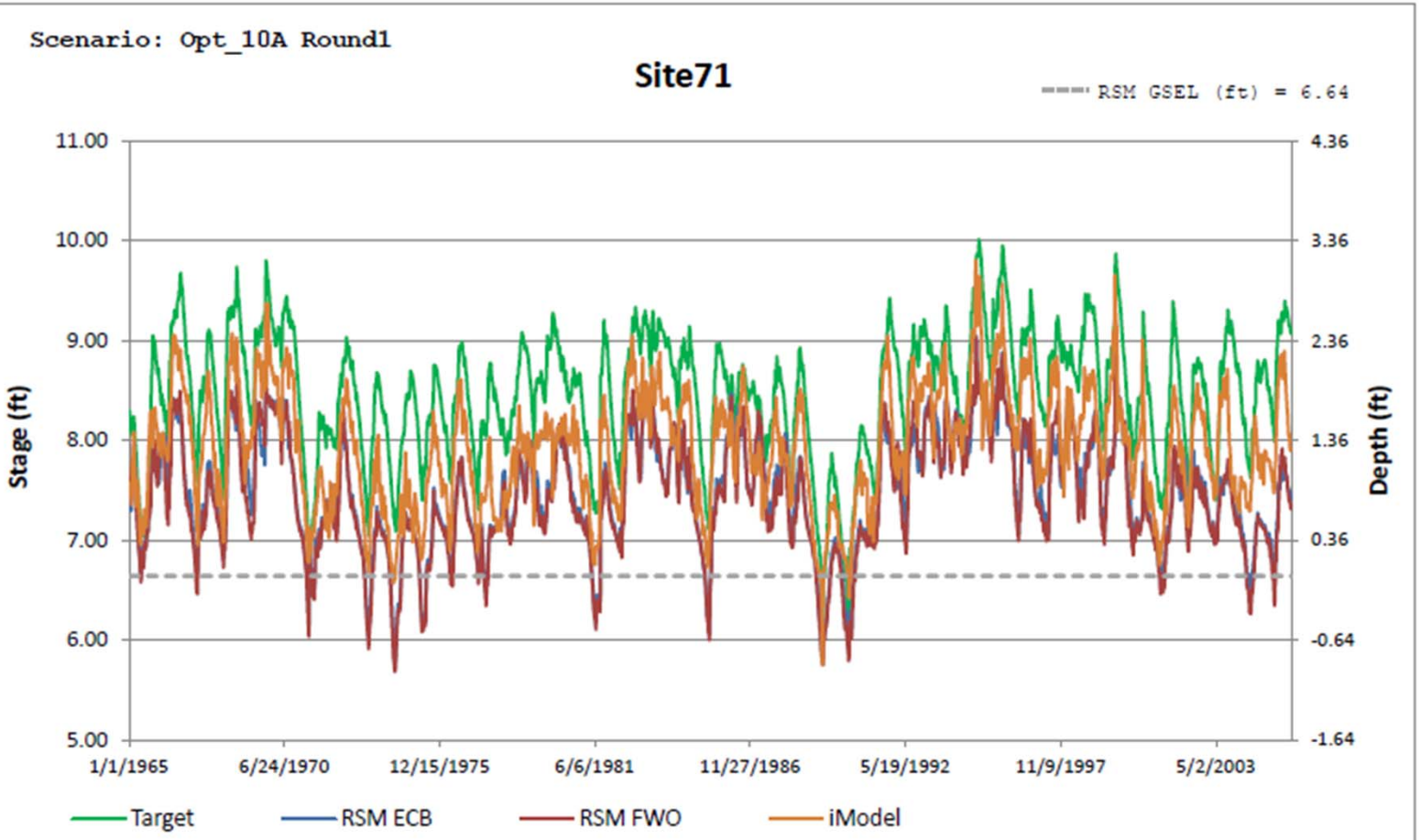
1.82	0.84	0.80	1.24	Avg. Ponding Depth (ft)
99.53	93.36	91.16	97.01	% Time Above GSEL
	1.04	1.08	0.66	RMSE (ft)
	-0.98	-1.03	-0.59	BIAS (ft)



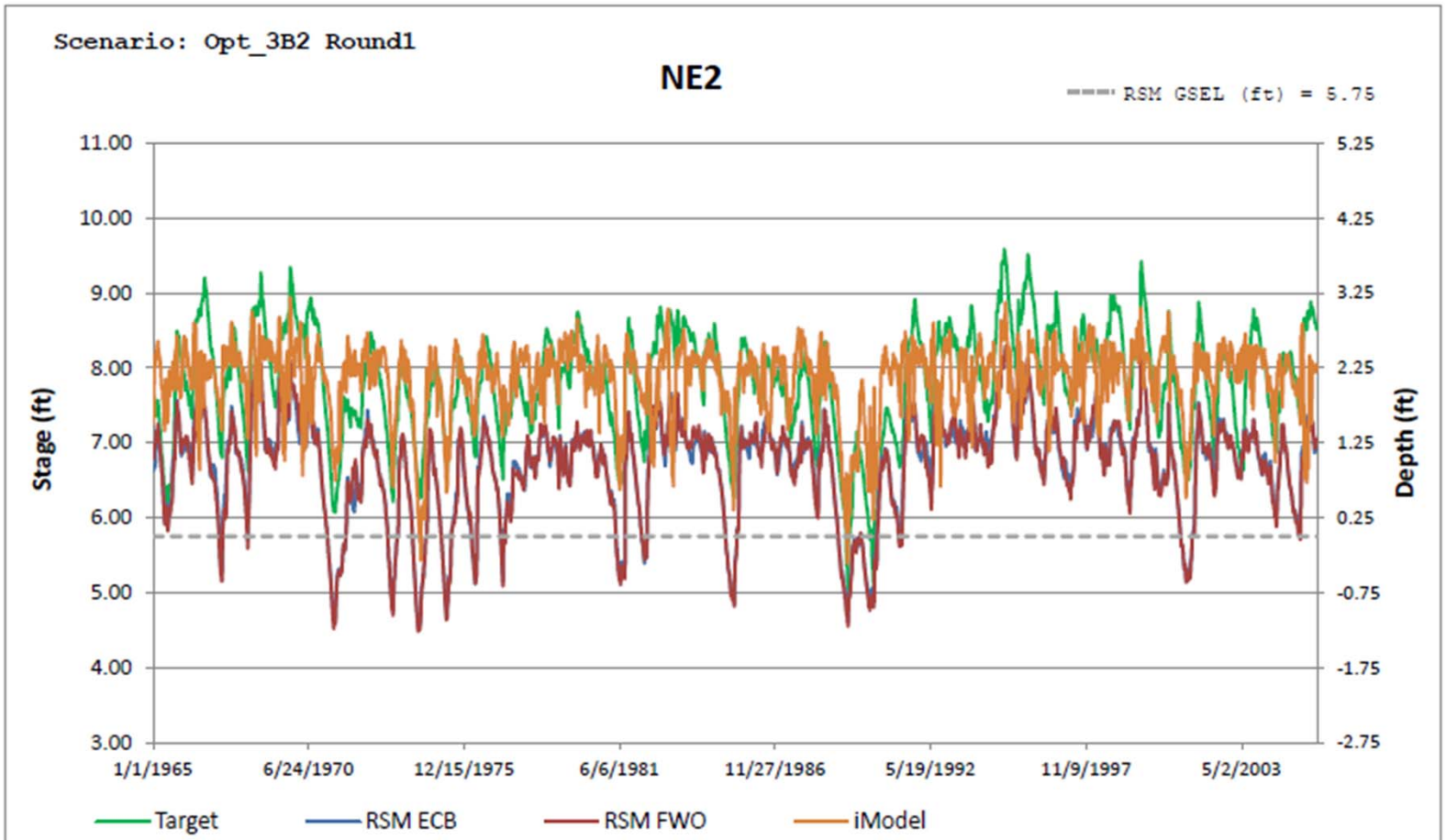
1.82	0.84	0.80	1.31	Avg. Ponding Depth (ft)
99.53	93.36	91.16	97.10	% Time Above GSEL
	1.04	1.08	0.59	RMSE (ft)
	-0.98	-1.03	-0.51	BIAS (ft)



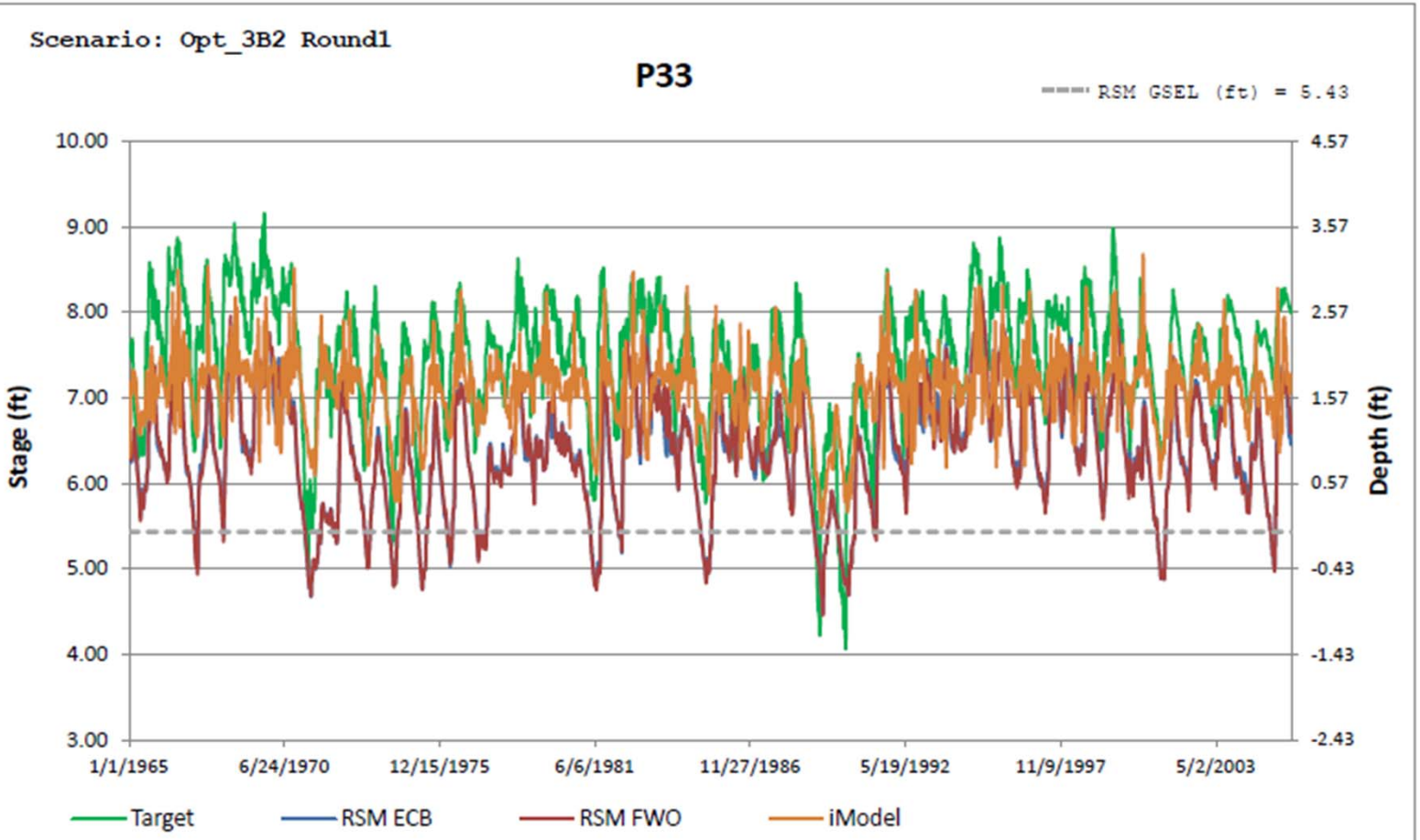
1.82	0.84	0.80	1.21	Avg. Ponding Depth (ft)
99.53	93.36	91.16	99.02	% Time Above GSEL
	1.04	1.08	0.69	RMSE (ft)
	-0.98	-1.03	-0.61	BIAS (ft)



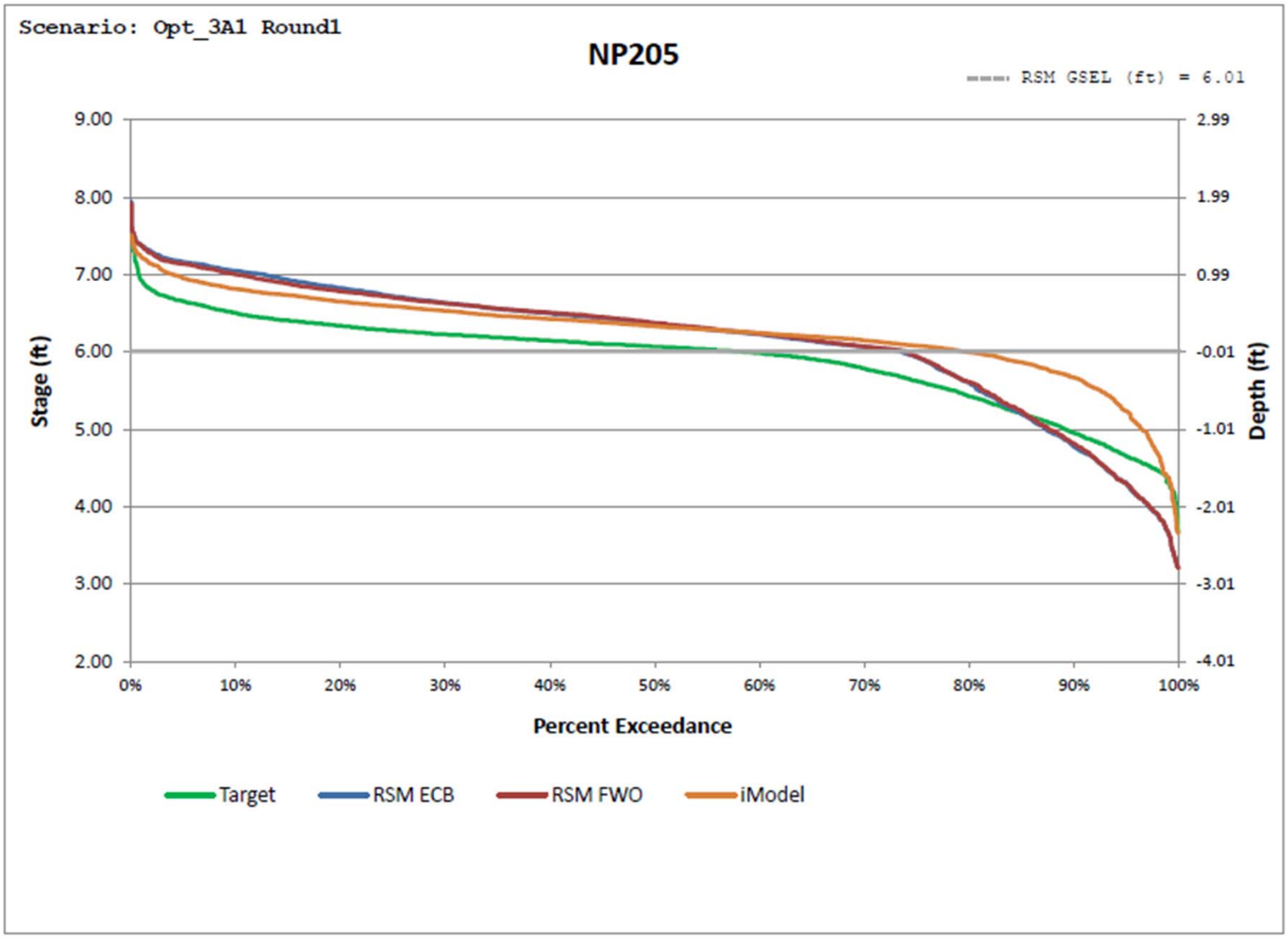
1.82	0.84	0.80	1.29	Avg. Ponding Depth (ft)
99.53	93.36	91.16	99.25	% Time Above GSEL
	1.04	1.08	0.62	RMSE (ft)
	-0.98	-1.03	-0.53	BIAS (ft)

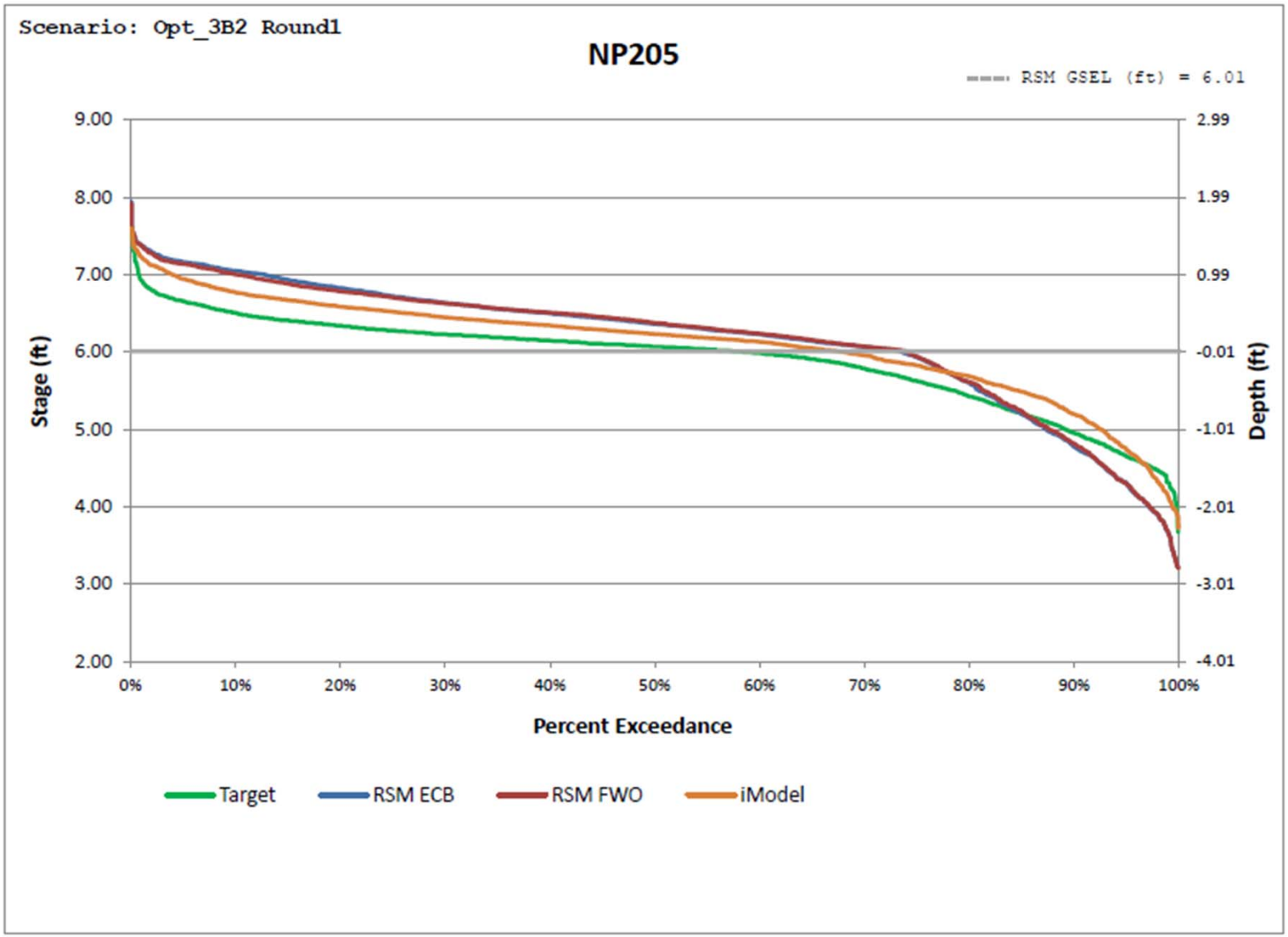


2.07	0.94	0.93	2.10	Avg. Ponding Depth (ft)
99.53	87.75	87.28	99.77	% Time Above GSEL
	1.18	1.20	0.61	RMSE (ft)
	-1.13	-1.15	0.03	BIAS (ft)



2.05	0.96	0.96	1.65	Avg. Ponding Depth (ft)
98.78	89.34	89.10	100.00	% Time Above GSEL
	1.21	1.21	0.70	RMSE (ft)
	-1.09	-1.09	-0.40	BIAS (ft)

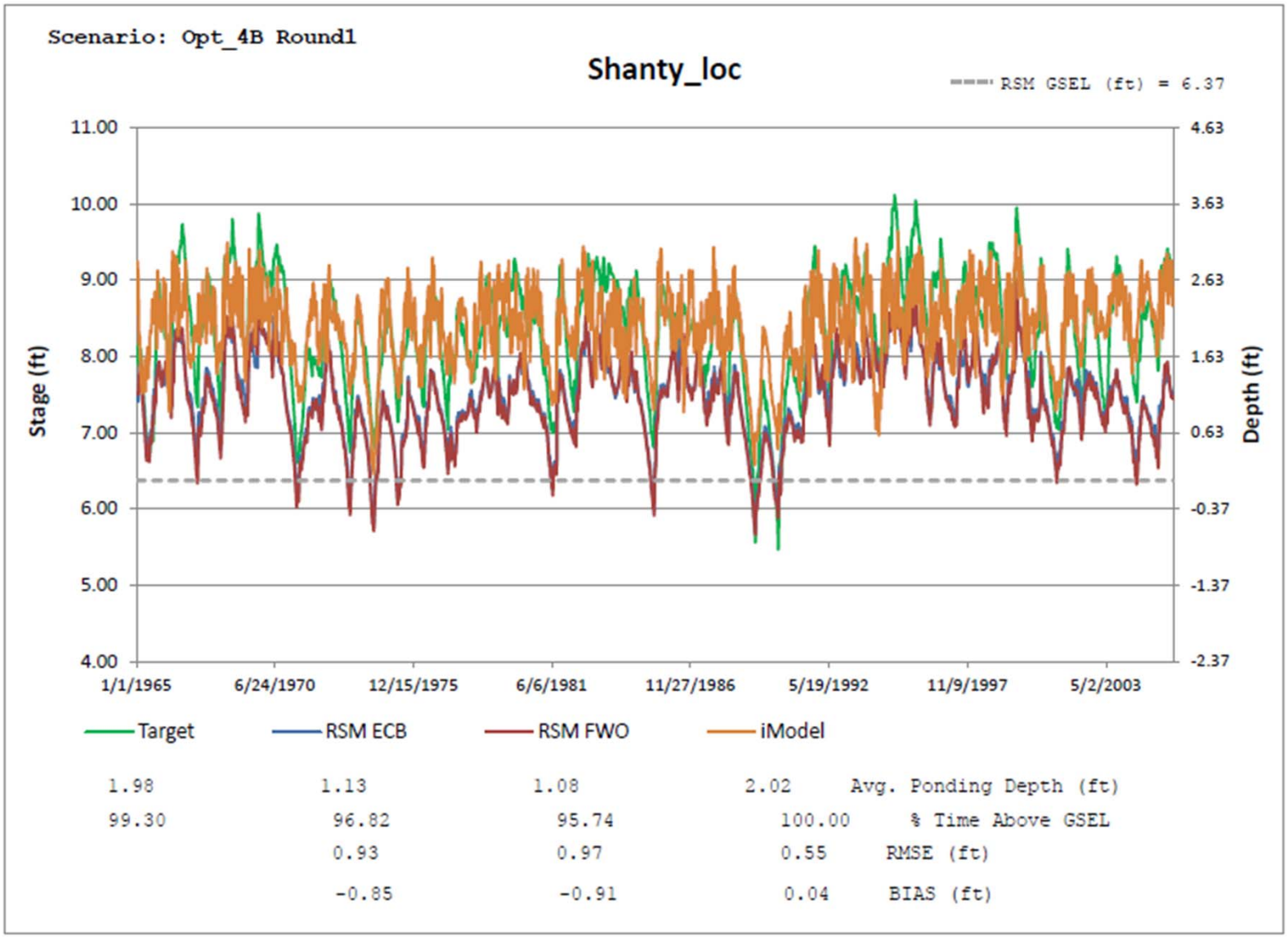

Scenario: Opt_3A1 Round1
NP205
RSM GSEL (ft) = 6.01
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
Stage (ft)
2.99
1.99
0.99
-0.01
-1.01
-2.01
-3.01
-4.01
Depth (ft)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent Exceedance
Target
RSM ECB
RSM FWO
iModel

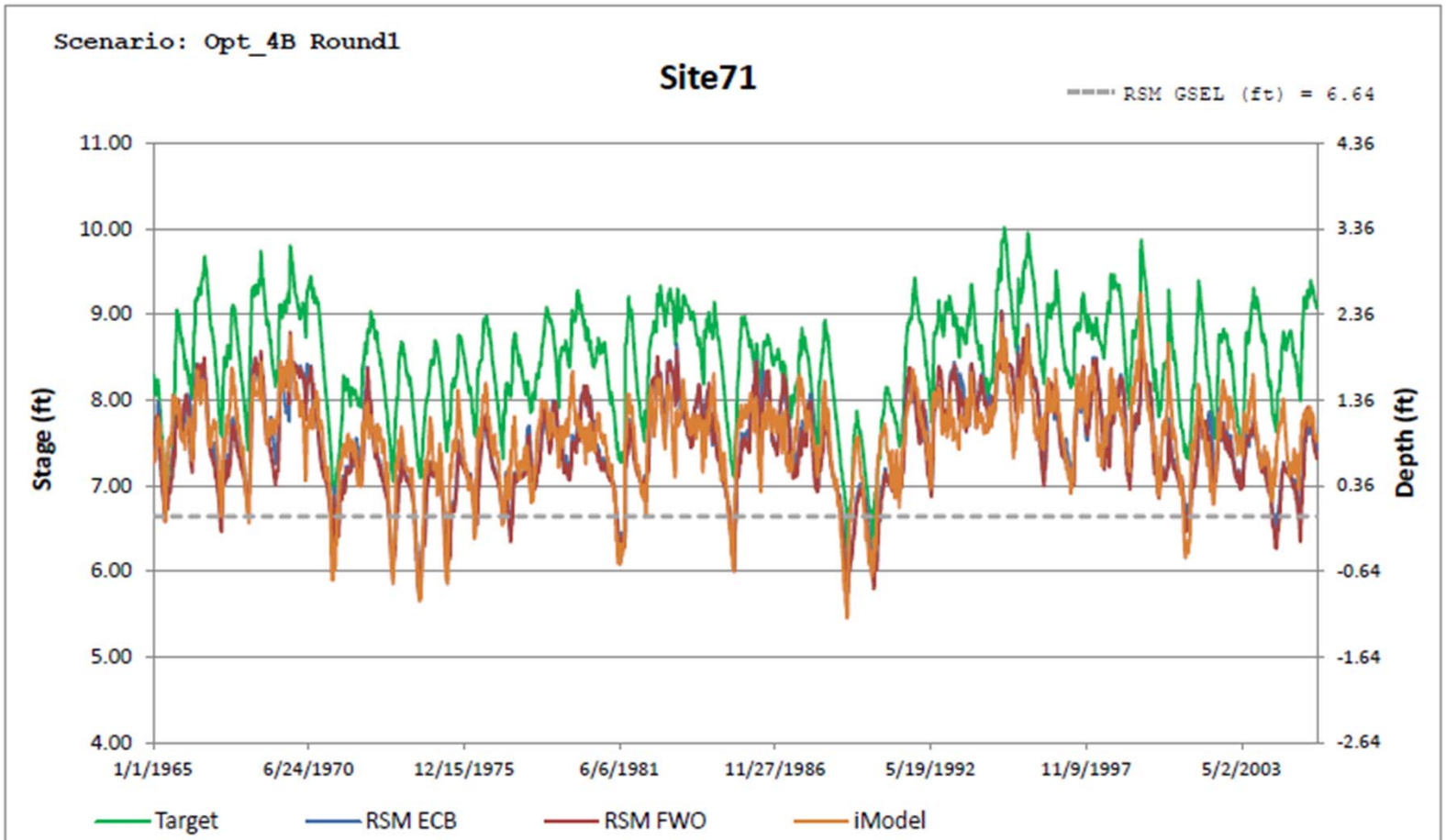

Scenario: Opt_3B2 Round1
NP205
RSM GSEL (ft) = 6.01
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
Stage (ft)
2.99
1.99
0.99
-0.01
-1.01
-2.01
-3.01
-4.01
Depth (ft)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent Exceedance
Target
RSM ECB
RSM FWO
iModel

Opt 3 and Opt 10A Preliminary Conclusions

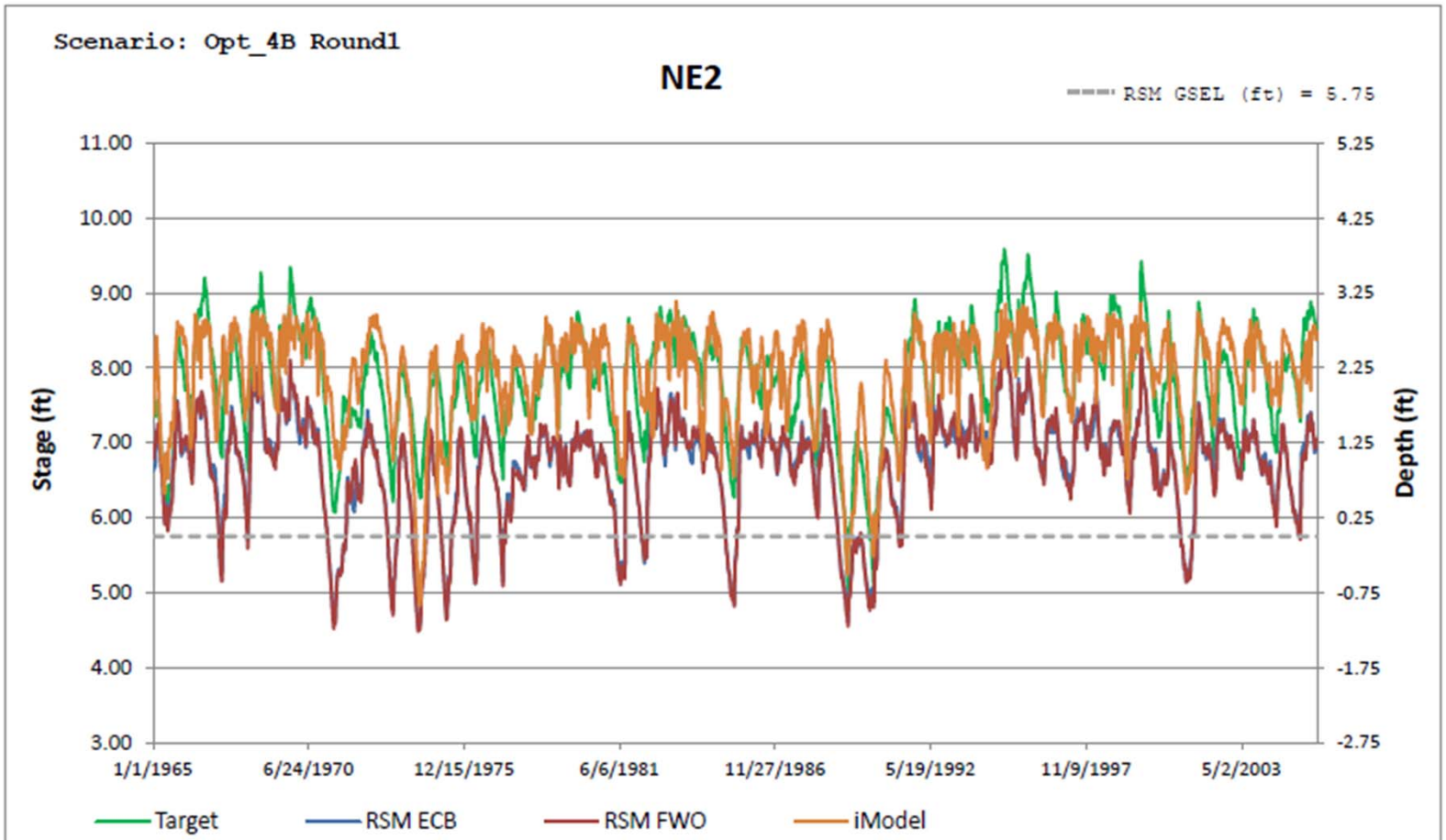
- Southern L67 infrastructure performs well and can produce a wide range of 3B hydrology.
- Larger capacity structures (e.g. 750 cfs) do get utilized at times.
- WCA 3A & ENP performance improvements can be obtained with gravity structures only.
- L29 pumps help to promote water movement through WCA3B and improve conditions at NP-205.

Option	S-333	3B/L-67A levee	L-29 levee	Blue Shanty levee, 3B	Blue Shanty levee, ENP	L-29 canal operational limit	3B Seepage Management
1A	2000					9.7	Constrained
3A1	2000	S4, S5, S6 @500cfs	355A,B,C			9.7	Unconstrained
3A2	2000	S4, S5, S6 @750cfs	355A,B,C			9.7	Unconstrained
3B2	2000	S 4, S5, S6 @750 cfs	355A,B,C Pump 1			9.7	Unconstrained
3B3	2000	S 4, S5, S6 @750 cfs	355A,B,C Pump 1			9.7	Constrained
4A	2000	S5, S6 and S1-4	Degrade west of blue shanty levee	From L67A to L-29	Yes	9.7	Constrained
4B	2000	S5, S6 and S4	Degrade west of blue shanty levee	From L67A to L-29	Yes	9.7	Constrained
4C	2000	S5, S6	Degrade west of blue shanty levee	From L67A to L-29	Yes	9.7	Constrained
9A	2000	6 structures	more 355s; gravity			9.7	Unconstrained
10A	2000	S2,S3 S5,S6 @500cfs	355A,B,C 2 pumps @500cfs			9.7	Unconstrained

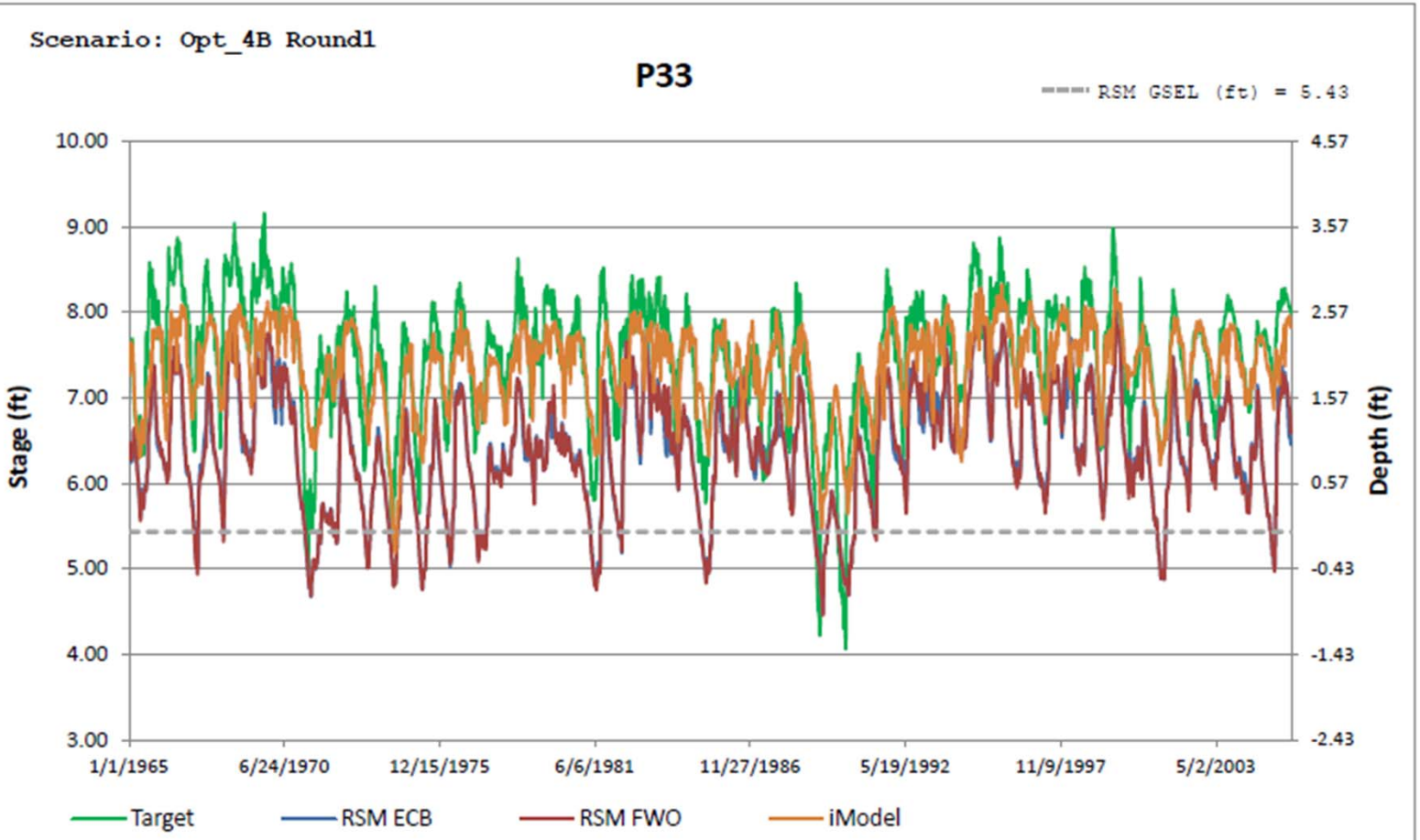

Scenario: Opt_4B Round1
Shanty_loc
RSM GSEL (ft) = 6.37
Stage (ft)
Depth (ft)
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
4.63
3.63
2.63
1.63
0.63
-0.37
-1.37
-2.37
1/1/1965
6/24/1970
12/15/1975
6/6/1981
11/27/1986
5/19/1992
11/9/1997
5/2/2003
Target
RSM ECB
RSM FWO
iModel
1.98 1.13 1.08 2.02 Avg. Ponding Depth (ft)
99.30 96.82 95.74 100.00 % Time Above GSEL
0.93 0.97 0.55 RMSE (ft)
-0.85 -0.91 0.04 BIAS (ft)



1.82	0.84	0.80	0.90	Avg. Ponding Depth (ft)
99.53	93.36	91.16	93.55	% Time Above GSEL
	1.04	1.08	0.99	RMSE (ft)
	-0.98	-1.03	-0.92	BIAS (ft)



2.07	0.94	0.93	2.16	Avg. Ponding Depth (ft)
99.53	87.75	87.28	98.50	% Time Above GSEL
	1.18	1.20	0.46	RMSE (ft)
	-1.13	-1.15	0.09	BIAS (ft)



2.05	0.96	0.96	1.93	Avg. Ponding Depth (ft)
98.78	89.34	89.10	99.72	% Time Above GSEL
	1.21	1.21	0.50	RMSE (ft)
	-1.09	-1.09	-0.11	BIAS (ft)

Opt 4
Preliminary Conclusions

- "Blue Shanty" flowway effective at improving conditions in WCA3A & ENP.
- WCA3B can be independently managed to assist in seepage control.
- Highest performance at NP33 (and as a result Florida Bay) observed in Option 4 series.
- Potential to impact marl areas observed in iModel screening; may be mitigated through additional refinement to plan (e.g. remove L29 tieback levee or L67 extension)

Next Steps

- Continue review of iModel results for additional details (e.g. structure utilization & seepage trends)
- Select L67 / L29 infrastructure to move forward to final array
- Utilize “Greenline” outcomes to feed “Yellowline” screening in WCA3B and L31N vicinity.

QUESTIONS?

Visit www.evergladesplan.org for updates and current information