Appendix 6-A

Supplemental Water Budget Tables and Figures

TABLE 6A-1

HISTORICAL ANNUAL GROUNDWATER BUDGET - MONTEREY SUBBASIN

Water Year (Oct-Sept)	DWR Water Year Type[(2)]	Recharge	Pumping	Net Cross-Boundary Flow (Presumed Freshwater)	Net Cross-Boundary Flow (Presumed Seawater)	Annual Change in Groundwater Storage [AFY]	Cumulative Change in Groundwater Storage [AF]
2004	BN	6,557	-6,466	-10,825	0	-10,734	-10,734
2005	W	18,022	-5,939	-9,049	0	3,034	-7,700
2006	W	19,069	-5,801	-9,715	0	3,553	-4,147
2007	D	2,136	-5,982	-9,955	0	-13,801	-17,948
2008	C	8,590	-5,535	-10,512	0	-7,456	-25,404
2009	BN	10,705	-5,404	-10,071	0	-4,771	-30,175
2010	AN	16,446	-5,499	-7,184	0	3,763	-26,412
2011	AN	12,259	-5,423	-6,794	0	42	-26,370
2012	BN	1,775	-5,480	-7,752	0	-11,457	-37,827
2013	C	5,135	-5,636	-7,665	0	-8,166	-45,993
2014	C	1,886	-6,354	-9,621	0	-14,090	-60,082
2015	D	6,935	-4,530	-8,631	0	-6,226	-66,308
2016	AN	15,095	-5,160	-9,815	0	120	-66,188
2017	W	23,486	-5,508	-9,288	0	8,690	-57,498
2018	AN	2,722	-5,900	-5,841	0	-9,019	-66,517
AVERAGE (AFY)	-	**10,055**	**-5,641**	**-8,848**	**0**	**-4,434**	-

Abbreviations

AF = acre-feet
AFY = acre-feet per year
DWR = California Department of Water Resources
WBZ = Water Budget Zone
WY = Water Year

DWR Water Year Type

(green)	= Wet
(light green)	= Above Normal
(yellow)	= Below Normal
(pink)	= Dry
(red)	= Critical

Notes:

(1) All values in acre-feet per year (AFY) unless otherwise noted.

(2) Water Year Types were developed from the DWR method defined in DWR, 2021 and are classified as follows: W = Wet, AN = Above Normal, BN = Below Normal, D = Dry, C = Critical. Colors indicate Water Year Type where green is wetter and red is drier.

Sources:

DWR, 2021. Sustainable Groundwater Management Act Water Year Type Dataset Development Report. 17pp.

TABLE 6A-2

HISTORICAL ANNUAL GROUNDWATER BUDGET - MARINA/ORD AREA WATER BUDGET ZONE[1]

Water Year (Oct-Sept)	DWR Water Year Type[3]	Recharge	Pumping	Net Cross-Boundary Flow (Presumed Freshwater)	Net Cross-Boundary Flow (Presumed Seawater)	Net Corral de Tierra Exchange	Annual Change in Groundwater Storage [AFY]	Cumulative Change in Groundwater Storage [AF]
2004	BN	3,268	-5,414	-5,742	0	1,604	-6,284	-6,284
2005	W	11,243	-4,886	-4,232	0	1,604	3,730	-2,554
2006	W	12,038	-4,748	-5,112	0	1,592	3,769	1,215
2007	D	1,099	-4,929	-5,462	0	1,633	-7,659	-6,444
2008	C	4,599	-4,482	-5,848	0	1,607	-4,123	-10,568
2009	BN	6,723	-4,351	-5,678	0	1,520	-1,786	-12,354
2010	AN	10,384	-4,446	-3,514	0	1,646	4,070	-8,284
2011	AN	7,471	-4,369	-3,648	0	1,706	1,159	-7,125
2012	BN	1,023	-4,427	-4,241	0	1,649	-5,997	-13,122
2013	C	2,780	-4,584	-4,109	0	1,592	-4,321	-17,443
2014	C	1,040	-4,534	-5,804	0	1,426	-7,873	-25,316
2015	D	4,433	-3,606	-5,266	0	1,465	-2,974	-28,289
2016	AN	9,398	-3,278	-6,160	0	1,283	1,244	-27,046
2017	W	15,176	-3,417	-5,885	0	1,212	7,087	-19,959
2018	AN	1,489	-3,712	-3,924	0	1,628	-4,519	-24,478
AVERAGE (AFY)	-	**6,144**	**-4,346**	**-4,975**	**0**	**1,544**	**-1,632**	-

DWR Water Year Type

- = Wet
- = Above Normal
- = Below Normal
- = Dry
- = Critical

Abbreviations

AF = acre-feet
AFY = acre-feet per year
DWR = California Department of Water Resources
WBZ = Water Budget Zone
WY = Water Year

Notes:

(1) Marina/Ord Area WBZ includes the Reservation Road portion of the Corral de Tierra Management Area.
(2) All values in acre-feet per year (AFY) unless otherwise noted.
(3) Water Year Types were developed from the DWR method defined in DWR, 2021 and are classified as follows: W = Wet, AN = Above Normal, BN = Below Normal, D = Dry, C = Critical. Colors indicate Water Year Type where green is wetter and red is drier.

Sources:

DWR, 2021. Sustainable Groundwater Management Act Water Year Type Dataset Development Report. 17pp.

TABLE 6A-3

HISTORICAL ANNUAL GROUNDWATER BUDGET - CORRAL DE TIERRA AREA WATER BUDGET ZONE[1]

Water Year (Oct-Sept)	DWR Water Year Type[3]	Recharge	Pumping	Net Cross-Boundary Flow (Presumed Freshwater)	Net Cross-Boundary Flow (Presumed Seawater)	Net Marina-Ord Exchange	Annual Change in Groundwater Storage [AFY]	Cumulative Change in Groundwater Storage [AF]
2004	BN	3,289	-1,053	-5,083	0	-1,604	-4,450	-4,450
2005	W	6,779	-1,053	-4,818	0	-1,604	-696	-5,146
2006	W	7,031	-1,053	-4,603	0	-1,592	-216	-5,362
2007	D	1,037	-1,053	-4,493	0	-1,633	-6,141	-11,504
2008	C	3,991	-1,053	-4,664	0	-1,607	-3,333	-14,837
2009	BN	3,982	-1,053	-4,393	0	-1,520	-2,984	-17,821
2010	AN	6,062	-1,053	-3,670	0	-1,646	-306	-18,127
2011	AN	4,789	-1,053	-3,146	0	-1,706	-1,117	-19,244
2012	BN	752	-1,053	-3,511	0	-1,649	-5,461	-24,705
2013	C	2,355	-1,052	-3,556	0	-1,592	-3,845	-28,550
2014	C	846	-1,820	-3,817	0	-1,426	-6,217	-34,767
2015	D	2,502	-924	-3,366	0	-1,465	-3,252	-38,019
2016	AN	5,696	-1,881	-3,656	0	-1,283	-1,124	-39,143
2017	W	8,310	-2,092	-3,403	0	-1,212	1,604	-37,539
2018	AN	1,233	-2,188	-1,917	0	-1,628	-4,500	-42,039
AVERAGE (AFY)	-	**3,910**	**-1,296**	**-3,873**	**0**	**-1,544**	**-2,803**	-

DWR Water Year Type

- = Wet
- = Above Normal
- = Below Normal
- = Dry
- = Critical

Abbreviations

AF = acre-feet
AFY = acre-feet per year
DWR = California Department of Water Resources
WBZ = Water Budget Zone
WY = Water Year

Notes:

(1) Corral de Tierra Area WBZ excludes the Reservation Road portion of the Corral de Tierra Management Area.
(2) All values in acre-feet per year (AFY) unless otherwise noted.
(3) Water Year Types were developed from the DWR method defined in DWR, 2021 and are classified as follows: W = Wet, AN = Above Normal, BN = Below Normal, D = Dry, C = Critical. Colors indicate Water Year Type where green is wetter and red is drier.

Sources:

DWR, 2021. Sustainable Groundwater Management Act Water Year Type Dataset Development Report. 17pp.

TABLE 6A-4
HISTORICAL ANNUAL LAND SURFACE BUDGET - MONTEREY SUBBASIN

Water Year (Oct-Sept)	INFLOWS (AFY)				OUTFLOWS (AFY)						Change in Root Zone Storage (AFY)[d]
	Precipitation	Applied Water[b]	Leakage from Conveyance Systems [c]	TOTAL INFLOWS	Actual Evapotranspiration			Runoff	Recharge to Groundwater	TOTAL OUTFLOWS	
					Agricultural	Urban	Native				
2004	33,322	1,823	170	**35,315**	1,622	3,938	21,459	1,670	6,631	**35,320**	-4
2005	57,641	1,595	159	**59,395**	1,674	5,993	31,035	2,317	18,187	**59,206**	189
2006	52,700	1,343	142	**54,185**	1,410	5,130	26,649	1,521	19,243	**53,953**	232
2007	27,294	1,607	131	**29,031**	1,563	3,714	21,308	457	2,165	**29,206**	-175
2008	32,568	1,761	227	**34,556**	1,339	3,803	19,193	1,540	8,685	**34,560**	-4
2009	37,857	1,884	253	**39,994**	1,520	4,390	22,300	923	10,812	**39,946**	48
2010	53,817	1,715	253	**55,785**	1,464	5,180	29,400	2,923	16,597	**55,563**	222
2011	48,661	1,785	249	**50,695**	1,556	5,955	29,180	1,546	12,386	**50,623**	73
2012	30,385	2,161	251	**32,797**	1,794	4,161	24,417	802	1,794	**32,968**	-170
2013	28,578	2,017	258	**30,854**	1,580	3,668	19,050	1,340	5,194	**30,831**	23
2014	21,564	2,134	255	**23,953**	1,640	3,065	16,755	492	1,908	**23,861**	92
2015	33,237	1,853	201	**35,291**	1,549	3,570	19,983	3,170	7,006	**35,279**	12
2016	49,915	1,719	183	**51,818**	1,641	5,404	27,441	2,010	15,236	**51,731**	87
2017	60,649	1,741	200	**62,590**	1,672	5,498	29,130	2,492	23,685	**62,478**	112
2018	29,819	1,911	218	**31,948**	1,620	3,881	22,443	1,286	2,753	**31,982**	-34
AVERAGE	39,867	1,803	210	**41,881**	1,576	4,490	23,983	1,632	10,152	**41,834**	47
%	95%	4%	1%	--	4%	11%	57%	4%	24%	--	--

Abbreviations
AFY = acre-feet per year
WY = Water Year

Notes
(a) All values reported in acre-feet per year (AFY).
(b) Applied water includes deliveries from local water agencies and private groundwater used for irrigation.
(c) Leakage from water conveyance systems is assumed to contribute directly to groundwater recharge.
(d) Change in root zone storage calculated as the difference between inflows and outflows.

TABLE 6A-5

HISTORICAL ANNUAL LAND SURFACE BUDGET - MARINA/ORD AREA WATER BUDGET ZONE[(a)]

Water Year (Oct-Sept)	INFLOWS (AFY)				OUTFLOWS (AFY)						Change in Root Zone Storage (AFY)[(e)]
	Precipitation	Applied Water[(c)]	Leakage from Conveyance Systems [(d)]	TOTAL INFLOWS	Actual Evapotranspiration			Runoff	Recharge to Groundwater	TOTAL OUTFLOWS	
					Agricultural	Urban	Native				
2004	20,394	1,017	113	**21,525**	907	2,727	13,709	868	3,315	**21,526**	-1
2005	36,519	933	113	**37,565**	971	4,183	19,641	1,326	11,343	**37,464**	101
2006	33,751	752	93	**34,597**	816	3,634	17,058	857	12,140	**34,505**	91
2007	17,106	896	80	**18,082**	892	2,517	13,340	237	1,119	**18,104**	-22
2008	19,973	1,097	178	**21,249**	752	2,744	12,358	725	4,658	**21,237**	12
2009	24,203	1,168	203	**25,574**	868	3,121	14,227	525	6,789	**25,529**	45
2010	34,322	1,090	208	**35,619**	838	3,691	18,784	1,703	10,476	**35,492**	127
2011	30,730	1,138	204	**32,072**	900	4,249	18,481	850	7,550	**32,030**	42
2012	19,323	1,360	207	**20,890**	1,041	2,896	15,522	439	1,039	**20,937**	-48
2013	18,064	1,258	215	**19,537**	888	2,639	12,444	728	2,817	**19,516**	21
2014	13,560	1,347	212	**15,120**	948	2,139	10,651	249	1,056	**15,045**	75
2015	21,187	1,127	166	**22,481**	879	2,507	12,681	1,926	4,479	**22,473**	8
2016	31,814	1,022	150	**32,986**	929	3,861	17,466	1,179	9,484	**32,920**	66
2017	38,922	1,031	157	**40,109**	952	3,885	18,520	1,409	15,293	**40,058**	51
2018	18,980	1,151	171	**20,302**	926	2,702	14,382	754	1,513	**20,276**	25
AVERAGE	25,257	1,093	165	**26,514**	900	3,166	15,284	918	6,205	**26,474**	40
%	95%	4%	1%	--	3%	12%	58%	3%	23%	--	--

Abbreviations

AFY = acre-feet per year
WBZ = Water Budget Zone
WY = Water Year

Notes

(a) Marina/Ord Area WBZ includes the Reservation Road portion of the Corral de Tierra Management Area.
(b) All values reported in acre-feet per year (AFY).
(c) Applied water includes deliveries from local water agencies and private groundwater used for irrigation.
(d) Leakage from water conveyance systems is assumed to contribute directly to groundwater recharge.
(e) Change in root zone storage calculated as the difference between inflows and outflows.

TABLE 6A-6

HISTORICAL ANNUAL LAND SURFACE BUDGET - CORRAL DE TIERRA AREA WATER BUDGET ZONE[(a)]

Water Year (Oct-Sept)	INFLOWS (AFY)				OUTFLOWS (AFY)						Change in Root Zone Storage (AFY)[(e)]
	Precipitation	Applied Water[(c)]	Leakage from Conveyance Systems [(d)]	TOTAL INFLOWS	Actual Evapotranspiration			Runoff	Recharge to Groundwater	TOTAL OUTFLOWS	
					Agricultural	Urban	Native				
2004	12,928	805	57	**13,791**	715	1,210	7,750	802	3,316	**13,794**	-3
2005	21,122	662	47	**21,830**	703	1,810	11,395	991	6,844	**21,742**	89
2006	18,948	591	49	**19,588**	594	1,497	9,592	664	7,102	**19,448**	141
2007	10,188	711	51	**10,949**	671	1,197	7,969	220	1,046	**11,102**	-152
2008	12,594	664	49	**13,307**	586	1,060	6,835	815	4,027	**13,324**	-16
2009	13,654	716	50	**14,420**	653	1,269	8,074	398	4,023	**14,417**	4
2010	19,496	625	45	**20,166**	626	1,488	10,616	1,220	6,121	**20,071**	95
2011	17,931	647	45	**18,623**	656	1,706	10,699	696	4,836	**18,592**	31
2012	11,062	801	44	**11,908**	753	1,265	8,895	363	755	**12,031**	-123
2013	10,514	758	44	**11,317**	692	1,028	6,606	612	2,377	**11,315**	1
2014	8,004	787	43	**8,834**	692	926	6,104	243	852	**8,817**	17
2015	12,050	726	35	**12,810**	670	1,063	7,302	1,244	2,527	**12,806**	4
2016	18,101	697	34	**18,832**	712	1,543	9,975	830	5,751	**18,811**	21
2017	21,728	710	43	**22,481**	720	1,614	10,610	1,083	8,392	**22,421**	60
2018	10,839	760	47	**11,646**	694	1,179	8,061	532	1,240	**11,705**	-59
AVERAGE	14,611	711	45	**15,367**	676	1,324	8,699	714	3,947	**15,360**	7
%	95%	5%	0%	--	4%	9%	57%	5%	26%	--	--

Abbreviations

AFY = acre-feet per year
WBZ = Water Budget Zone
WY = Water Year

Notes

(a) Corral de Tierra Area WBZ excludes the Reservation Road portion of the Corral de Tierra Management Area.
(b) All values reported in acre-feet per year (AFY).
(c) Applied water includes deliveries from local water agencies and private groundwater used for irrigation.
(d) Leakage from water conveyance systems is assumed to contribute directly to groundwater recharge.
(e) Change in root zone storage calculated as the difference between inflows and outflows.

Table 6A-7. Comparison of Projected Water Budget Results Under "No Project" Scenarios with Variable Climate Conditions and Measurable Objective Boundary Conditions, Marina-Ord Area

Net Annual Groundwater Flows (a) (AFY)	Historical Annual Inflows/Outflows (WY 2004-2018)	Projected Annual Inflows/Outflows (b) Measurable Objective Boundary Conditions		
		Baseline Climate Conditions	2030 Climate Conditions	2070 Climate Conditions
Recharge				
● Rainfall, leakage, irrigation	6,144	6,356	6,823	7,509
	6,144	**6,356**	**6,823**	**7,509**
Well Pumping				
● Well Pumping	-4,346	-8,767	-8,767	-8,767
	-4,346	**-8,767**	**-8,767**	**-8,767**
Net Inter-Basin Flow				
● Seaside Subbasin	1,310	1,589	1,361	1,033
● 180/400 Foot Aquifer Subbasin	-8,633	-1,694	-1,927	-2,306
● Ocean (Presumed Freshwater)	-524	-721	-752	-804
● Ocean (Presumed Seawater)	2,872	2,288	2,369	2,534
	-4,975	**1,461**	**1,051**	**457**
Net Intra-basin Flow				
● From Corral de Tierra Area WBZ	1,544	998	1,026	1,063
	1,544	**998**	**1,026**	**1,063**
Net Surface Water Exchange				
● Salinas River Exchange	0	0	0	0
	0	**0**	**0**	**0**
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	**-1,632**	**49**	**133**	**262**

Abbreviations:

AFY = acre-feet per year
WBZ = Water Budget Zone
WY = Water Year

Notes:

(a) The Marina-Ord Area Zone Budget includes inflows to and outflows from the Reservation Road portion of the Corral de Tierra Management Area.
(b) Positive values indicate a net inflow and negative values indicate a net outflow.

Table 6A-8. Comparison of Projected Water Budget Results Under "No Project" Scenarios with Variable Conditions and Measurable Objective Boundary Conditions, Corral de Tierra Area

Net Annual Groundwater Flows (a) (AFY)	Historical Annual Inflows/Outflows (WY 2004-2018)	Projected Annual Inflows/Outflows (b) Measurable Objective Boundary Conditions		
		Baseline Climate Conditions	2030 Climate Conditions	2070 Climate Conditions
Recharge				
● Rainfall, leakage, irrigation	3,910	3,796	4,105	4,443
	3,910	**3,796**	**4,105**	**4,443**
Well Pumping				
● Well Pumping	-1,296	-2,188	-2,188	-2,189
	-1,296	**-2,188**	**-2,188**	**-2,189**
Net Inter-Basin Flow				
● Seaside Subbasin	-392	-62	-103	-148
● 180/400 Foot Aquifer Subbasin	-3,632	-1,376	-1,485	-1,595
	-4,024	**-1,438**	**-1,588**	**-1,743**
Net Intra-basin Flow				
● From Marina-Ord Area WBZ	-1,544	-998	-1,026	-1,063
	-1,544	**-998**	**-1,026**	**-1,063**
Net Surface Water Exchange				
● Salinas River Exchange	151	259	254	249
	151	**259**	**254**	**249**
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	**-2,803**	**-569**	**-443**	**-303**

Abbreviations:

AFY = acre-feet per year
WBZ = Water Budget Zone
WY = Water Year

Notes:

(a) The Corral de Tierra Area Zone Budget does not include inflows to and outflows from the Reservation Road portion of the Corral de Tierra Management Area
(b) Positive values indicate a net inflow and negative values indicate a net outflow.

TABLE 6A-A

AVERAGE ANNUAL PROJECTED GROUNDWATER BUDGET - MARINA/ORD AREA WATER BUDGET ZONE[(1)]

Scenario: 2030 Climate, no projects, MO boundary conditions

NET ANNUAL GROUNDWATER FLOWS[(2)]	**Dune Sand**	**Upper 180-Foot**	**Lower 180-Foot**	**400-Foot**	**Deep**	**TOTAL**
Recharge (AFY)	3,226	648	0	1,764	1,184	6,823
Well Pumping (AFY)[(3)]	0	0	-2,752	-954	-5,060	-8,767
Net Cross-Boundary Flows (AFY)	-1,167	-472	649	3,160	-94	2,078
Seaside Subbasin	*-19*	*-2*	*-3*	*1,764*	*-380*	*1,361*
180/400 Subbasin	*-396*	*-598*	*245*	*-200*	*-979*	*-1,927*
Corral de Tierra WBZ	*0*	*0*	*0*	*-206*	*1,232*	*1,026*
Ocean	*-752*	*128*	*407*	*1,802*	*32*	*1,617*
Presumed Freshwater	*-752*	*0*	*0*	*0*	*0*	*-752*
Presumed Seawater	*0*	*128*	*407*	*1,802*	*32*	*2,369*
Salinas River Exchange (AFY)	0	0	0	0	0	0
Overlying Unit Exchange (AFY)	0	2,017	2,183	102	3,927	8,228
Underlying Unit Exchange (AFY)	-1,996	-2,138	-71	-3,927	0	-8,132

CHANGE IN GROUNDWATER STORAGE	**Dune Sand**	**Upper 180-Foot**	**Lower 180-Foot**	**400-Foot**	**Deep**	**TOTAL**
ANNUAL AVERAGE (AFY)	**63**	**56**	**8**	**145**	**-43**	**230**
50-YEAR CUMULATIVE (AF)	*952*	*841*	*122*	*2,174*	*-638*	*3,451*

Notes:

(1) Marina/Ord Area WBZ includes the Reservation Road portion of the Corral de Tierra Management Area.

(2) All values in acre-feet per year (AFY) unless otherwise noted.

(3) Includes 287 AFY of pumping from the Reservation Road portion of the Corral de Tierra Management Area.

Abbreviations:

AF = acre-feet

AFY = acre-feet per year

DWR = California Department of Water Resources

MO = Measurable Objectives

WBZ = Water Budget Zone

WY = DWR Water Year (October - September)

TABLE 6A-B

AVERAGE ANNUAL PROJECTED GROUNDWATER BUDGET - MARINA/ORD AREA WATER BUDGET ZONE[(1)]

Scenario: 2030 Climate, no projects, MT boundary conditions

NET ANNUAL GROUNDWATER FLOWS[(2)]	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
Recharge (AFY)	3,226	648	0	1,764	1,184	6,823
Well Pumping (AFY)[(3)]	0	0	-2,752	-954	-5,060	-8,767
Net Cross-Boundary Flows (AFY)	-1,121	-624	493	2,959	95	1,801
Seaside Subbasin	*-16*	*-1*	*-2*	*2,632*	*-101*	*2,513*
180/400 Subbasin	*-380*	*-900*	*-17*	*-1,547*	*-1,004*	*-3,849*
Corral de Tierra WBZ	*0*	*0*	*0*	*-238*	*1,161*	*923*
Ocean	*-725*	*276*	*512*	*2,112*	*38*	*2,214*
Presumed Freshwater	*-725*	*0*	*0*	*0*	*0*	*-725*
Presumed Seawater	*0*	*276*	*512*	*2,112*	*38*	*2,939*
Salinas River Exchange (AFY)	0	0	0	0	0	0
Overlying Unit Exchange (AFY)	0	2,094	2,140	-92	3,653	7,795
Underlying Unit Exchange (AFY)	-2,052	-2,109	118	-3,653	0	-7,697

CHANGE IN GROUNDWATER STORAGE	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
ANNUAL AVERAGE (AFY)	**52**	**9**	**-1**	**23**	**-128**	**-44**
50-YEAR CUMULATIVE (AF)	*787*	*128*	*-10*	*347*	*-1,919*	*-667*

Notes:

(1) Marina/Ord Area WBZ includes the Reservation Road portion of the Corral de Tierra Management Area.

(2) All values in acre-feet per year (AFY) unless otherwise noted.

(3) Includes 287 AFY of pumping from the Reservation Road portion of the Corral de Tierra Management Area.

Abbreviations:

AF = acre-feet

AFY = acre-feet per year

DWR = California Department of Water Resources

MT = Minimum Thresholds

WBZ = Water Budget Zone

WY = DWR Water Year (October - September)

TABLE 6A-C

AVERAGE ANNUAL PROJECTED GROUNDWATER BUDGET - MARINA/ORD AREA WATER BUDGET ZONE[1]

Scenario: 2030 Climate, no projects, seawater intrusion protective boundary conditions

NET ANNUAL GROUNDWATER FLOWS[2]	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
Recharge (AFY)	3,226	648	0	1,764	1,184	6,823
Well Pumping (AFY)[3]	0	0	-2,752	-954	-5,060	-8,767
Net Cross-Boundary Flows (AFY)	-1,227	-492	1,247	3,546	-752	2,323
Seaside Subbasin	*-24*	*-3*	*-4*	*454*	*-770*	*-347*
180/400 Subbasin	*-409*	*-350*	*1,042*	*2,084*	*-1,196*	*1,171*
Corral de Tierra WBZ	*0*	*0*	*0*	*-208*	*1,193*	*985*
Ocean	*-794*	*-138*	*209*	*1,216*	*21*	*514*
Presumed Freshwater	*-794*	*0*	*0*	*0*	*0*	*-794*
Presumed Seawater	*0*	*-138*	*209*	*1,216*	*21*	*1,308*
Salinas River Exchange (AFY)	0	0	0	0	0	0
Overlying Unit Exchange (AFY)	0	1,922	2,090	609	4,676	9,298
Underlying Unit Exchange (AFY)	-1,920	-1,987	-565	-4,676	0	-9,148

CHANGE IN GROUNDWATER STORAGE	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
ANNUAL AVERAGE (AFY)	**79**	**92**	**20**	**290**	**48**	**529**
50-YEAR CUMULATIVE (AF)	*1,186*	*1,382*	*294*	*4,347*	*722*	*7,931*

Notes:

(1) Marina/Ord Area WBZ includes the Reservation Road portion of the Corral de Tierra Management Area.

(2) All values in acre-feet per year (AFY) unless otherwise noted.

(3) Includes 287 AFY of pumping from the Reservation Road portion of the Corral de Tierra Management Area.

Abbreviations:

AF = acre-feet

AFY = acre-feet per year

DWR = California Department of Water Resources

WBZ = Water Budget Zone

WY = DWR Water Year (October - September)

TABLE 6A-D

AVERAGE ANNUAL PROJECTED GROUNDWATER BUDGET - MARINA/ORD AREA WATER BUDGET ZONE[1]

Scenario: 2030 Climate, with projects, MO boundary conditions

NET ANNUAL GROUNDWATER FLOWS[2]	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
Recharge (AFY)	3,226	648	0	1,764	1,184	6,823
Well Pumping (AFY)[3]	0	0	-1,364	-476	-2,648	-4,488
Net Cross-Boundary Flows (AFY)	-1,183	-609	-261	623	-574	-2,005
Seaside Subbasin	*-21*	*-2*	*-3*	*1,173*	*-535*	*612*
180/400 Subbasin	*-398*	*-698*	*-590*	*-1,928*	*-1,287*	*-4,901*
Corral de Tierra WBZ	*0*	*0*	*0*	*-219*	*1,220*	*1,001*
Ocean	*-764*	*91*	*332*	*1,596*	*28*	*1,283*
Presumed Freshwater	*-764*	*0*	*0*	*0*	*0*	*-764*
Presumed Seawater	*0*	*91*	*332*	*1,596*	*28*	*2,047*
Salinas River Exchange (AFY)	0	0	0	0	0	0
Overlying Unit Exchange (AFY)	0	1,994	1,932	286	2,017	6,228
Underlying Unit Exchange (AFY)	-1,976	-1,972	-293	-2,017	0	-6,257

CHANGE IN GROUNDWATER STORAGE	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
ANNUAL AVERAGE (AFY)	**67**	**61**	**14**	**180**	**-21**	**301**
50-YEAR CUMULATIVE (AF)	*1,005*	*911*	*210*	*2,696*	*-313*	*4,509*

Notes:

(1) Marina/Ord Area WBZ includes the Reservation Road portion of the Corral de Tierra Management Area.

(2) All values in acre-feet per year (AFY) unless otherwise noted.

(3) Includes 287 AFY of pumping from the Reservation Road portion of the Corral de Tierra Management Area.

Abbreviations:

AF = acre-feet

AFY = acre-feet per year

DWR = California Department of Water Resources

MO = Measurable Objectives

WBZ = Water Budget Zone

WY = DWR Water Year (October - September)

TABLE 6A-E

AVERAGE ANNUAL PROJECTED GROUNDWATER BUDGET - MARINA/ORD AREA WATER BUDGET ZONE(1)

Scenario: 2030 Climate, with projects, MT boundary conditions

NET ANNUAL GROUNDWATER FLOWS(2)	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
Recharge (AFY)	3,226	648	0	1,764	1,184	6,823
Well Pumping (AFY)(3)	0	0	-1,364	-476	-2,648	-4,488
Net Cross-Boundary Flows (AFY)	-1,138	-761	-423	426	-384	-2,279
Seaside Subbasin	*-18*	*-2*	*-2*	*2,052*	*-253*	*1,776*
180/400 Subbasin	*-382*	*-999*	*-859*	*-3,280*	*-1,314*	*-6,833*
Corral de Tierra WBZ	*0*	*0*	*0*	*-251*	*1,149*	*898*
Ocean	*-738*	*239*	*438*	*1,906*	*34*	*1,879*
Presumed Freshwater	*-738*	*0*	*0*	*0*	*0*	*-738*
Presumed Seawater	*0*	*239*	*438*	*1,906*	*34*	*2,617*
Salinas River Exchange (AFY)	0	0	0	0	0	0
Overlying Unit Exchange (AFY)	0	2,070	1,889	86	1,742	5,788
Underlying Unit Exchange (AFY)	-2,032	-1,945	-97	-1,742	0	-5,816

CHANGE IN GROUNDWATER STORAGE	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
ANNUAL AVERAGE (AFY)	**56**	**13**	**6**	**58**	**-106**	**27**
50-YEAR CUMULATIVE (AF)	*839*	*202*	*84*	*876*	*-1,591*	*410*

Notes:

(1) Marina/Ord Area WBZ includes the Reservation Road portion of the Corral de Tierra Management Area.

(2) All values in acre-feet per year (AFY) unless otherwise noted.

(3) Includes 287 AFY of pumping from the Reservation Road portion of the Corral de Tierra Management Area.

Abbreviations:

AF = acre-feet

AFY = acre-feet per year

DWR = California Department of Water Resources

MT = Minimum Thresholds

WBZ = Water Budget Zone

WY = DWR Water Year (October - September)

TABLE 6A-F

AVERAGE ANNUAL PROJECTED GROUNDWATER BUDGET - MARINA/ORD AREA WATER BUDGET ZONE[1]

Scenario: 2030 Climate, with projects, seawater intrusion protective boundary conditi

NET ANNUAL GROUNDWATER FLOWS[2]	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
Recharge (AFY)	3,226	648	0	1,764	1,184	6,823
Well Pumping (AFY)[3]	0	0	-1,364	-476	-2,648	-4,488
Net Cross-Boundary Flows (AFY)	-1,244	-630	340	1,006	-1,234	-1,762
Seaside Subbasin	*-26*	*-4*	*-4*	*-152*	*-928*	*-1,115*
180/400 Subbasin	*-411*	*-451*	*209*	*368*	*-1,503*	*-1,788*
Corral de Tierra WBZ	*0*	*0*	*0*	*-222*	*1,180*	*958*
Ocean	*-806*	*-175*	*135*	*1,011*	*17*	*182*
Presumed Freshwater	*-806*	*0*	*0*	*0*	*0*	*-806*
Presumed Seawater	*0*	*-175*	*135*	*1,011*	*17*	*989*
Salinas River Exchange (AFY)	0	0	0	0	0	0
Overlying Unit Exchange (AFY)	0	1,899	1,840	798	2,768	7,305
Underlying Unit Exchange (AFY)	-1,900	-1,821	-791	-2,768	0	-7,280

CHANGE IN GROUNDWATER STORAGE	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
ANNUAL AVERAGE (AFY)	**83**	**97**	**25**	**324**	**70**	**598**
50-YEAR CUMULATIVE (AF)	*1,238*	*1,449*	*372*	*4,860*	*1,045*	*8,964*

Notes:

(1) Marina/Ord Area WBZ includes the Reservation Road portion of the Corral de Tierra Management Area.
(2) All values in acre-feet per year (AFY) unless otherwise noted.
(3) Includes 287 AFY of pumping from the Reservation Road portion of the Corral de Tierra Management Area.

Abbreviations:

AF = acre-feet
AFY = acre-feet per year
DWR = California Department of Water Resources
WBZ = Water Budget Zone
WY = DWR Water Year (October - September)

TABLE 6A-G

AVERAGE ANNUAL PROJECTED GROUNDWATER BUDGET - MARINA/ORD AREA WATER BUDGET ZONE[(1)]

Scenario: Baseline Climate, no projecs, MO boundary conditions

NET ANNUAL GROUNDWATER FLOWS[(2)]	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
Recharge (AFY)	3,020	605	0	1,627	1,104	6,356
Well Pumping (AFY)[(3)]	0	0	-2,752	-954	-5,060	-8,767
Net Cross-Boundary Flows (AFY)	-1,101	-439	660	3,348	-9	2,459
Seaside Subbasin	*-16*	*-2*	*-2*	*1,873*	*-265*	*1,589*
180/400 Subbasin	*-364*	*-556*	*273*	*-84*	*-962*	*-1,694*
Corral de Tierra WBZ	*0*	*0*	*0*	*-189*	*1,187*	*998*
Ocean	*-721*	*119*	*390*	*1,748*	*31*	*1,567*
Presumed Freshwater	*-721*	*0*	*0*	*0*	*0*	*-721*
Presumed Seawater	*0*	*119*	*390*	*1,748*	*31*	*2,288*
Salinas River Exchange (AFY)	0	0	0	0	0	0
Overlying Unit Exchange (AFY)	0	1,916	2,076	7	3,889	7,888
Underlying Unit Exchange (AFY)	-1,887	-2,029	24	-3,889	0	-7,781

CHANGE IN GROUNDWATER STORAGE	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
ANNUAL AVERAGE (AFY)	**31**	**53**	**8**	**139**	**-76**	**156**
50-YEAR CUMULATIVE (AF)	*472*	*802*	*116*	*2,087*	*-1,142*	*2,334*

Notes:

(1) Marina/Ord Area WBZ includes the Reservation Road portion of the Corral de Tierra Management Area.

(2) All values in acre-feet per year (AFY) unless otherwise noted.

(3) Includes 287 AFY of pumping from the Reservation Road portion of the Corral de Tierra Management Area.

Abbreviations:

AF = acre-feet

AFY = acre-feet per year

DWR = California Department of Water Resources

MO = Measurable Objectives

WBZ = Water Budget Zone

WY = DWR Water Year (October - September)

TABLE 6A-H

AVERAGE ANNUAL PROJECTED GROUNDWATER BUDGET - MARINA/ORD AREA WATER BUDGET ZONE[1]

Scenario: Baseline Climate, with projects, MO boundary conditions

NET ANNUAL GROUNDWATER FLOWS[2]	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
Recharge (AFY)	3,020	605	0	1,627	1,104	6,356
Well Pumping (AFY)[3]	0	0	-1,364	-476	-2,648	-4,488
Net Cross-Boundary Flows (AFY)	-1,118	-576	-250	810	-489	-1,623
Seaside Subbasin	*-18*	*-2*	*-3*	*1,283*	*-420*	*840*
180/400 Subbasin	*-366*	*-656*	*-563*	*-1,813*	*-1,271*	*-4,668*
Corral de Tierra WBZ	*0*	*0*	*0*	*-202*	*1,174*	*972*
Ocean	*-734*	*82*	*315*	*1,542*	*27*	*1,233*
Presumed Freshwater	*-734*	*0*	*0*	*0*	*0*	*-734*
Presumed Seawater	*0*	*82*	*315*	*1,542*	*27*	*1,966*
Salinas River Exchange (AFY)	0	0	0	0	0	0
Overlying Unit Exchange (AFY)	0	1,893	1,825	192	1,979	5,889
Underlying Unit Exchange (AFY)	-1,867	-1,863	-198	-1,979	0	-5,908

CHANGE IN GROUNDWATER STORAGE	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
ANNUAL AVERAGE (AFY)	**35**	**58**	**14**	**174**	**-54**	**226**
50-YEAR CUMULATIVE (AF)	*523*	*873*	*204*	*2,609*	*-816*	*3,393*

Notes:

(1) Marina/Ord Area WBZ includes the Reservation Road portion of the Corral de Tierra Management Area.
(2) All values in acre-feet per year (AFY) unless otherwise noted.
(3) Includes 287 AFY of pumping from the Reservation Road portion of the Corral de Tierra Management Area.

Abbreviations:

AF = acre-feet
AFY = acre-feet per year
DWR = California Department of Water Resources
MO = Measurable Objectives
WBZ = Water Budget Zone
WY = DWR Water Year (October - September)

TABLE 6A-I

AVERAGE ANNUAL PROJECTED GROUNDWATER BUDGET - MARINA/ORD AREA WATER BUDGET ZONE[1]

Scenario: 2070 Climate, no projects, MO boundary conditions

NET ANNUAL GROUNDWATER FLOWS[2]	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
Recharge (AFY)	3,606	710	0	1,932	1,261	7,509
Well Pumping (AFY)[3]	0	0	-2,752	-954	-5,060	-8,767
Net Cross-Boundary Flows (AFY)	-1,293	-537	633	2,908	-191	1,521
Seaside Subbasin	*-25*	*-3*	*-3*	*1,576*	*-512*	*1,033*
180/400 Subbasin	*-464*	*-677*	*199*	*-363*	*-1,001*	*-2,306*
Corral de Tierra WBZ	*0*	*0*	*0*	*-225*	*1,289*	*1,063*
Ocean	*-804*	*143*	*437*	*1,920*	*34*	*1,730*
Presumed Freshwater	*-804*	*0*	*0*	*0*	*0*	*-804*
Presumed Seawater	*0*	*143*	*437*	*1,920*	*34*	*2,534*
Salinas River Exchange (AFY)	0	0	0	0	0	0
Overlying Unit Exchange (AFY)	0	2,199	2,353	254	3,986	8,792
Underlying Unit Exchange (AFY)	-2,192	-2,312	-225	-3,986	0	-8,714

CHANGE IN GROUNDWATER STORAGE	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
ANNUAL AVERAGE (AFY)	**122**	**61**	**9**	**154**	**-4**	**341**
50-YEAR CUMULATIVE (AF)	*1,823*	*916*	*134*	*2,306*	*-62*	*5,117*

Notes:

(1) Marina/Ord Area WBZ includes the Reservation Road portion of the Corral de Tierra Management Area.

(2) All values in acre-feet per year (AFY) unless otherwise noted.

(3) Includes 287 AFY of pumping from the Reservation Road portion of the Corral de Tierra Management Area.

Abbreviations:

AF = acre-feet

AFY = acre-feet per year

DWR = California Department of Water Resources

MO = Measurable Objectives

WBZ = Water Budget Zone

WY = DWR Water Year (October - September)

TABLE 6A-J

AVERAGE ANNUAL PROJECTED GROUNDWATER BUDGET - MARINA/ORD AREA WATER BUDGET ZONE[1]

Scenario: 2070 Climate, with projects, MO boundary conditions

NET ANNUAL GROUNDWATER FLOWS[2]	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
Recharge (AFY)	3,606	710	0	1,932	1,261	7,509
Well Pumping (AFY)[3]	0	0	-1,364	-476	-2,648	-4,488
Net Cross-Boundary Flows (AFY)	-1,310	-675	-277	371	-671	-2,562
Seaside Subbasin	*-27*	*-3*	*-4*	*985*	*-668*	*283*
180/400 Subbasin	*-466*	*-777*	*-636*	*-2,091*	*-1,309*	*-5,279*
Corral de Tierra WBZ	*0*	*0*	*0*	*-238*	*1,276*	*1,038*
Ocean	*-817*	*106*	*363*	*1,714*	*30*	*1,396*
Presumed Freshwater	*-817*	*0*	*0*	*0*	*0*	*-817*
Presumed Seawater	*0*	*106*	*363*	*1,714*	*30*	*2,213*
Salinas River Exchange (AFY)	0	0	0	0	0	0
Overlying Unit Exchange (AFY)	0	2,176	2,101	437	2,075	6,790
Underlying Unit Exchange (AFY)	-2,171	-2,145	-446	-2,075	0	-6,837

CHANGE IN GROUNDWATER STORAGE	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
ANNUAL AVERAGE (AFY)	**125**	**66**	**15**	**188**	**17**	**411**
50-YEAR CUMULATIVE (AF)	*1,876*	*987*	*221*	*2,827*	*262*	*6,172*

Notes:

(1) Marina/Ord Area WBZ includes the Reservation Road portion of the Corral de Tierra Management Area.
(2) All values in acre-feet per year (AFY) unless otherwise noted.
(3) Includes 287 AFY of pumping from the Reservation Road portion of the Corral de Tierra Management Area.

Abbreviations:

AF = acre-feet
AFY = acre-feet per year
DWR = California Department of Water Resources
MO = Measurable Objectives
WBZ = Water Budget Zone
WY = DWR Water Year (October - September)

TABLE 6A-K
AVERAGE ANNUAL CURRENT GROUNDWATER BUDGET - MARINA/ORD AREA WATER BUDGET ZONE[1]
DWR Water Years 2015 - 2018

NET ANNUAL GROUNDWATER FLOWS[2]	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
Recharge (AFY)	3,360	791	0	2,207	1,266	7,624
Well Pumping (AFY)[3]	0	0	-581	-198	-2,723	-3,503
Net Cross-Boundary Flows (AFY)	-855	-855	-935	-872	-394	-3,912
Seaside Subbasin	*-12*	*0*	*1*	*2,515*	*-788*	*1,715*
180/400 Subbasin	*-268*	*-1,344*	*-1,470*	*-5,204*	*-1,421*	*-9,707*
Corral de Tierra WBZ	*0*	*0*	*0*	*-379*	*1,776*	*1,397*
Ocean	*-574*	*489*	*534*	*2,196*	*39*	*2,684*
Presumed Freshwater	*-574*	*0*	*0*	*0*	*0*	*-574*
Presumed Seawater	*0*	*489*	*534*	*2,196*	*39*	*3,258*
Salinas River Exchange (AFY)	0	0	0	0	0	0
Overlying Unit Exchange (AFY)	0	2,044	1,919	376	1,428	5,767
Underlying Unit Exchange (AFY)	-1,854	-2,029	-397	-1,428	0	-5,709

CHANGE IN GROUNDWATER STORAGE	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
ANNUAL AVERAGE (AFY)	**651**	**-48**	**5**	**83**	**-423**	**267**
WY 2004 - 2018 CUMULATIVE (AF)	*2,604*	*-194*	*18*	*334*	*-1,694*	*1,069*

Notes:
(1) Marina/Ord Area WBZ includes the Reservation Road portion of the Corral de Tierra Management Area.
(2) All values in acre-feet per year (AFY) unless otherwise noted.
(3) Includes 285 AFY of pumping from the Reservation Road portion of the Corral de Tierra Management Area.

Abbreviations:
AF = acre-feet
AFY = acre-feet per year
DWR = California Department of Water Resources
WBZ = Water Budget Zone
WY = DWR Water Year (October - September)

TABLE 6A-L

AVERAGE ANNUAL HISTORICAL GROUNDWATER BUDGET - MARINA/ORD AREA WATER BUDGET ZONE(1)

DWR Water Years 2004 - 2018

NET ANNUAL GROUNDWATER FLOWS(2)	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
Recharge (AFY)	2,557	639	0	1,794	1,154	6,144
Well Pumping (AFY)(3)	0	0	-1,336	-467	-2,543	-4,346
Net Cross-Boundary Flows (AFY)	-886	-840	-656	-1,242	194	-3,431
Seaside Subbasin	*-13*	*0*	*0*	*2,268*	*-945*	*1,310*
180/400 Subbasin	*-349*	*-1,236*	*-1,115*	*-5,071*	*-861*	*-8,633*
Corral de Tierra WBZ	*0*	*0*	*0*	*-421*	*1,965*	*1,544*
Ocean	*-524*	*396*	*459*	*1,982*	*35*	*2,348*
Presumed Freshwater	*-524*	*0*	*0*	*0*	*0*	*-524*
Presumed Seawater	*0*	*396*	*459*	*1,982*	*35*	*2,872*
Salinas River Exchange (AFY)	0	0	0	0	0	0
Overlying Unit Exchange (AFY)	0	1,894	1,705	-273	276	3,602
Underlying Unit Exchange (AFY)	-1,595	-1,778	258	-276	0	-3,392

CHANGE IN GROUNDWATER STORAGE	Dune Sand	Upper 180-Foot	Lower 180-Foot	400-Foot	Deep	TOTAL
ANNUAL AVERAGE (AFY)	**76**	**-87**	**-29**	**-464**	**-918**	**-1,422**
WY 2004 - 2018 CUMULATIVE (AF)	*1,138*	*-1,299*	*-442*	*-6,963*	*-13,768*	*-21,334*

Notes:

(1) Marina/Ord Area WBZ includes the Reservation Road portion of the Corral de Tierra Management Area.

(2) All values in acre-feet per year (AFY) unless otherwise noted.

(3) Includes 287 AFY of pumping from the Reservation Road portion of the Corral de Tierra Management Area.

Abbreviations:

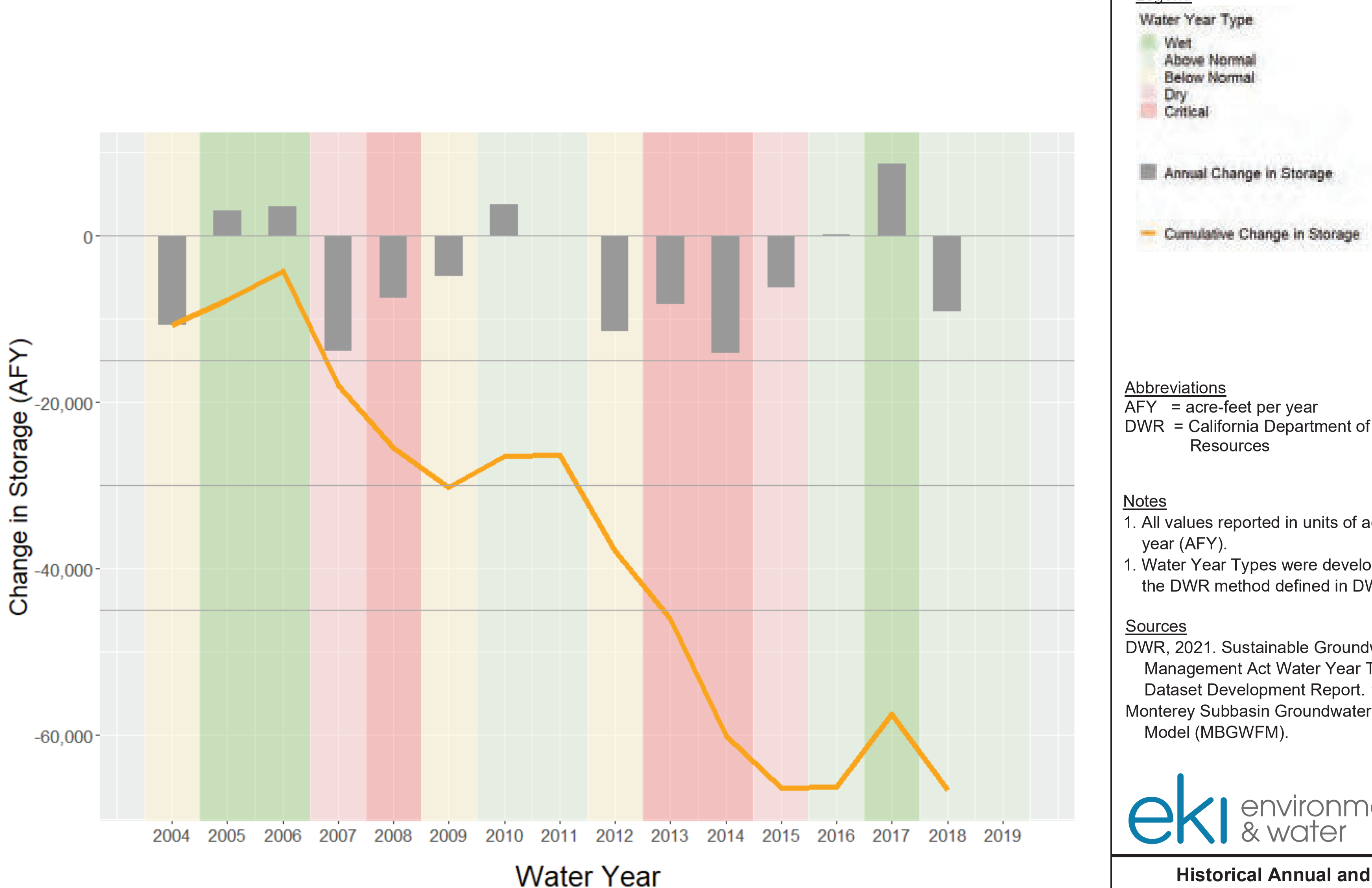
AF = acre-feet

AFY = acre-feet per year

DWR = California Department of Water Resources

WBZ = Water Budget Zone

WY = DWR Water Year (October - September)



Abbreviations
AFY = acre-feet per year
DWR = California Department of Water Resources

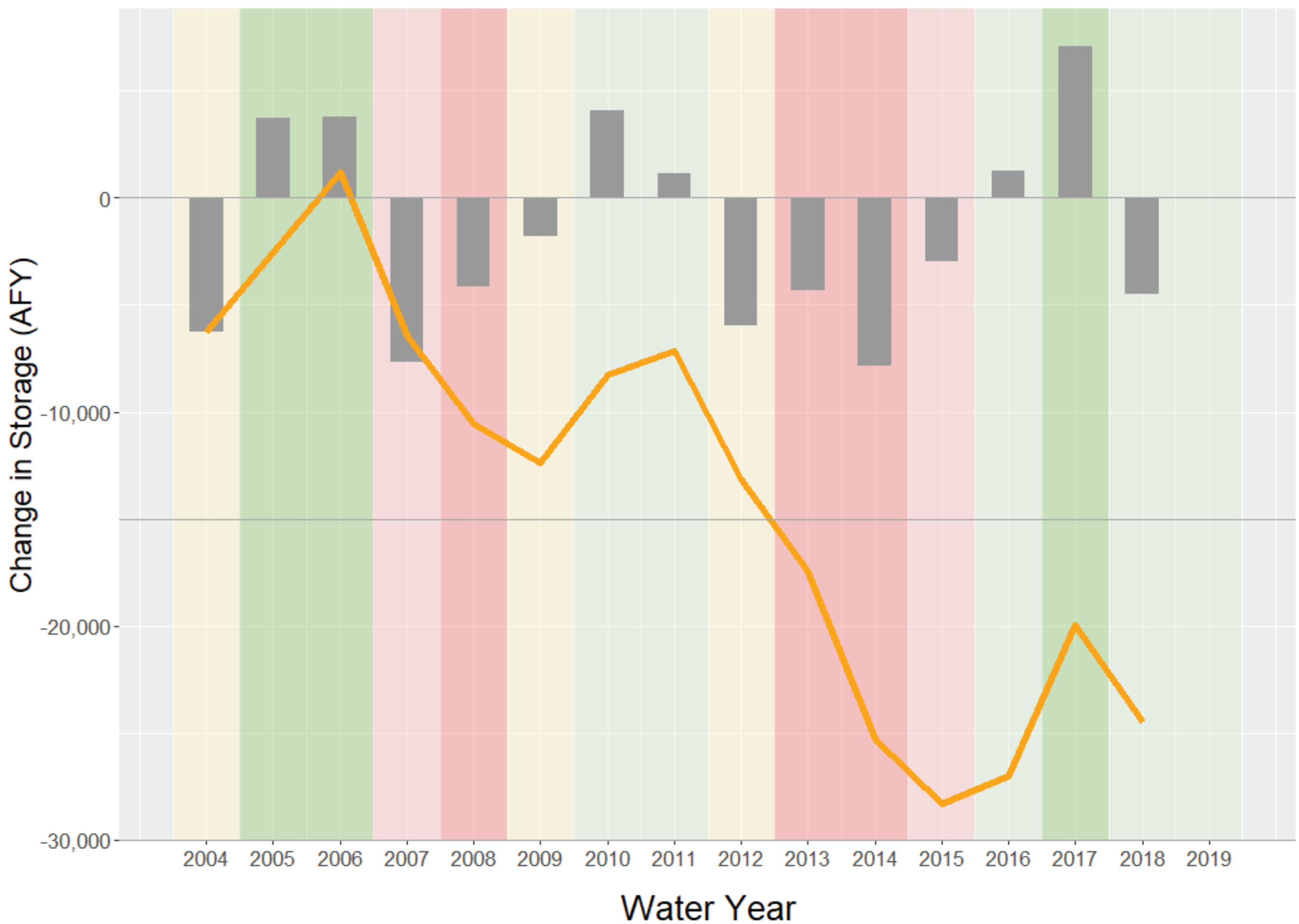
Notes
1. All values reported in units of acre-feet per year (AFY).
1. Water Year Types were developed from the DWR method defined in DWR, 2021.

Sources
DWR, 2021. Sustainable Groundwater Management Act Water Year Type Dataset Development Report. 17pp.
Monterey Subbasin Groundwater Flow Model (MBGWFM).

Historical Annual and Cumulative Change in Groundwater Storage – Monterey Subbasin

Monterey Subbasin
Monterey Subbasin Sustainability Plan
January 2022

Figure 6A-1



Legend

Water Year Type
- Wet
- Above Normal
- Below Normal
- Dry
- Critical

Annual Change in Storage

Cumulative Change in Storage

Abbreviations
AFY = acre-feet per year
DWR = California Department of Water Resources

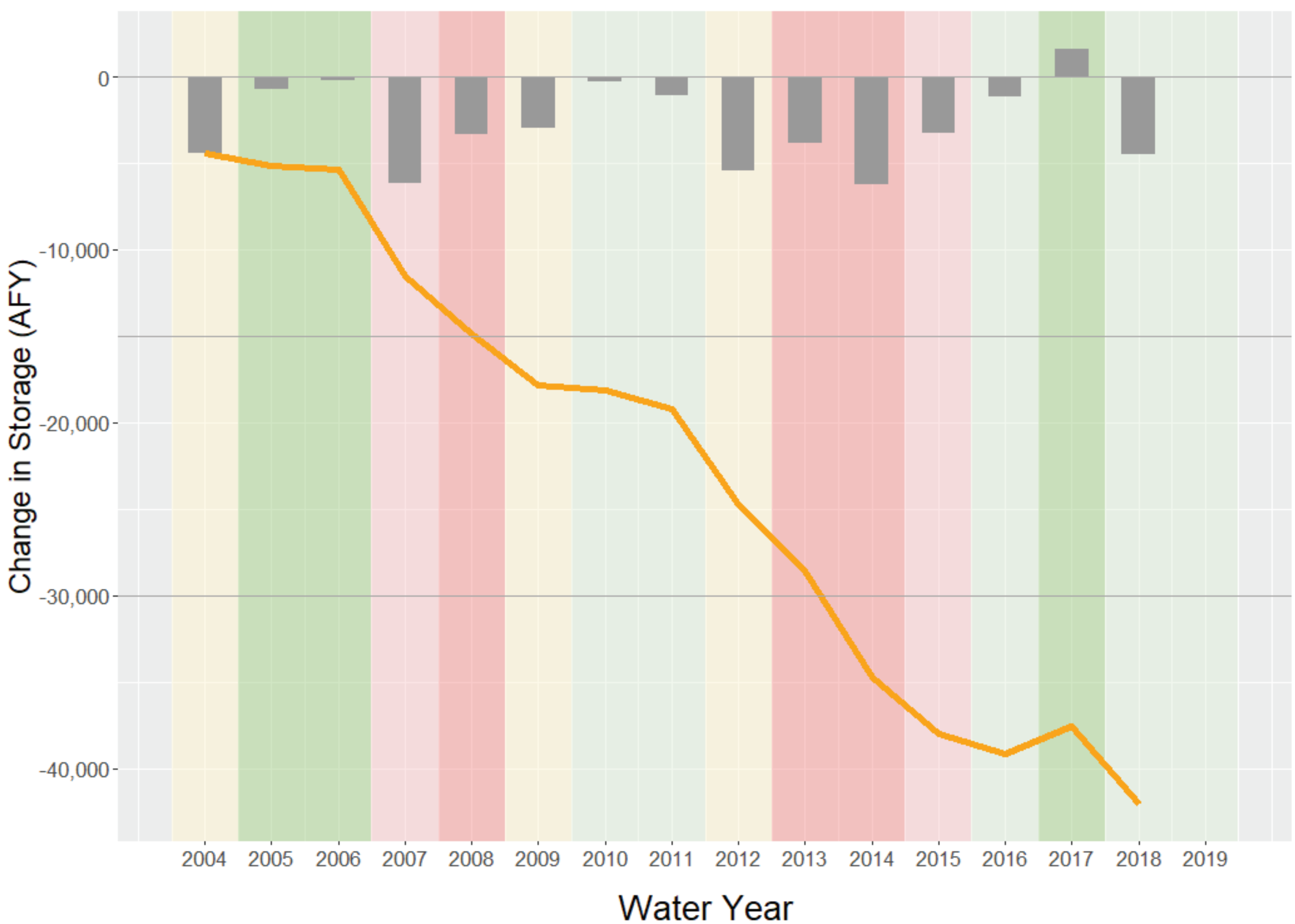
Notes
1. All values reported in units of acre-feet per year (AFY).
1. Water Year Types were developed from the DWR method defined in DWR, 2021.

Sources
DWR, 2021. Sustainable Groundwater Management Act Water Year Type Dataset Development Report. 17pp.
Monterey Subbasin Groundwater Flow Model (MBGWFM).

eki environment & water

Historical Annual and Cumulative Change in Groundwater Storage – Marina-Ord Area – Water Budge Zone

Monterey Subbasin
Monterey Subbasin Sustainability Plan
January 2022
Figure 6A-2



Legend

Water Year Type
- Wet
- Above Normal
- Below Normal
- Dry
- Critical

Annual Change in Storage

Cumulative Change in Storage

Abbreviations
AFY = acre-feet per year
DWR = California Department of Water Resources

Notes
1. All values reported in units of acre-feet per year (AFY).
1. Water Year Types were developed from the DWR method defined in DWR, 2021.

Sources
DWR, 2021. Sustainable Groundwater Management Act Water Year Type Dataset Development Report. 17pp.
Monterey Subbasin Groundwater Flow Model (MBGWFM).

eki environment & water

Historical Annual and Cumulative Change in Groundwater Storage – Corral de Tierra Area – Water Budget Zone

Monterey Subbasin
Monterey Subbasin Sustainability Plan
January 2022
Figure 6A-3

Appendix 6-B

Monterey Subbasin Groundwater Flow Model Documentation

MONTEREY SUBBASIN GROUNDWATER FLOW MODEL DOCUMENTATION

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ATTACHMENTS

ABBREVIATIONS AND ACRONYMS

AF	acre-feet
AFY	acre-feet per year
BAS	MODFLOW Basic Package
CalVeg	USDA Forest Service Region 5 Classification and Assessment with Landsat of Visible Ecological Groupings
CCR	California Code of Regulations
CIMIS	California Irrigation Management Information System
CVHM	Central Valley Hydrologic Model
CWS	California Water Service
DEM	Digital Elevation Model
DWR	California Department of Water Resources
EKI	EKI Environment & Water, Inc.
ET	Evapotranspiration
ETo	Reference evapotranspiration
ft	feet
ft bgs	feet below ground surface
ft/d	feet per day
ft/yr	feet per year
GHB	MODFLOW General-Head Boundary Package
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HCM	Hydrogeological Conceptual Model
Kh	Horizontal Hydraulic Conductivity
Kv	Vertical Hydraulic Conductivity
MBGWFM	Monterey Subbasin Groundwater Flow Model
MCWD	Marina Coast Water District
MCWRA	Monterey County Water Resources Association
NMGWM	North Marina Groundwater Model
MT	Minimum Threshold
MO	Measurable Objective
PEST	Model-Independent Parameter Estimation and Uncertainty Analysis
PRISM	Parameter-elevation Regressions on Independent Slopes Model
RCH	MODFLOW Recharge package
RIV	MODFLOW River package
RMSE	root mean square error
SMB	Soil moisture budget accounting model
Ss	Specific Storage
SSURGO	USDA Soil Survey Geographic Database

STR	MODFLOW Stream Package
SVBGSA	Salinas Valley Basin Groundwater Sustainability Agency
SVIHM	Salinas Valley Integrated Hydrologic Model
SWI	Seawater Intrusion
Sy	Specific Yield
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VIC	Variable Infiltration Capacity
WEL	MODFLOW Well Package
WY	Water Year

1. MODEL DEVELOPMENT OVERVIEW

The Monterey Subbasin Groundwater Flow Model (MBGWFM or "model") is an approximation of the spatial extent and variability of the groundwater system in the Monterey Subbasin (Basin) and can be used to quantitatively evaluate local hydrogeologic conditions associated with water inflows, outflows, and associated connectivity between the adjacent Seaside Subbasin, 180/400-Foot Aquifer Subbasin, and the Pacific Ocean. The purpose of the MBGWFM is to quantify the historical, current, and projected water budgets for the Basin and their uncertainties, and to evaluate the impacts of future land use, hydrologic, and water supply/demand projections as well as any proposed management decisions on groundwater conditions within the Basin. The model can also help identify gaps in available data and deficiencies in the conceptual understanding of groundwater conditions in the Basin. These results help prioritize plans for future data collection and other Groundwater Sustainability Plan (GSP) implementation activities.

1.1 Use of Information from SVIHM

Some results from the Salinas Valley Integrated Hydrologic Model (SVIHM) were used in developing the MBGWFM or to compare with results from the MBGWFM. It is important to note that the SVIHM results utilized are preliminary and draft. The SVIHM is being developed by the U.S. Geological Survey (USGS). A written disclaimer for the SVIHM has been provided by the USGS and is excerpted below:

> *This data (model and/or model results) are preliminary or provisional and are subject to revision. This model and model results are being provided to meet the need for timely best science. The model has not received final approval by the USGS. No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the model and related material nor shall the fact of release constitute any such warranty. The model is provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the model.*

2. METHODOLOGY AND APPROACH

2.1 Model Source Code

The MBGWFM utilizes the United States Geological Survey (USGS) computer code MODFLOW-NWT (Niswonger et al., 2011); MODFLOW is a widely used model code and is publicly available and supported by the USGS. MODFLOW-NWT is a Newton formulation of MODFLOW-2005 which excels at solving models whose cells have active drying and rewetting in the unconfined groundwater flow equation (Niswonger et al., 2011). As the Basin has variable degrees of confinement depending on aquifer formation and location, MODFLOW-NWT is an appropriate and effective computer code to solve the groundwater flow equation.

MODFLOW-NWT's utility is enhanced by additional software processes for model development, processing, and analysis of results. Specifically, ZONEBUDGET version 3 (Harbaugh, 1990) is a post-processor used to extract water budget results for user-defined model subareas.

As discussed in more detail in *Section 3.1* and ***Attachment 2***, a soil moisture balance code was developed to represent the root zone processes and ultimately create the recharge datasets within the MBGWFM.

2.2 Discretization

When employing numerical models, the spatial domain is discretized into "model cells" and time is discretized into "stress periods". The discretization of the spatial domain is referred to as the spatial approach and the discretization of time is referred to as the temporal approach. Both approaches are further discussed below.

2.2.1 Spatial Approach

MODFLOW represents the groundwater system as a set of discrete, rectangular blocks (cells) forming a grid in space. MODFLOW then computes an approximate solution to the groundwater flow mathematical equations at each model cell. The model grid consists of 260 rows and 214 columns of cells that cover the entire extent of the California Department of Water Resources (DWR) Basin boundary (DWR No. 3-004.01) as well as areas on the periphery of the boundary (**Figure 1**). The rectangular cells have a variable dimension of 200 feet (ft) up to 675 ft on a side, with the most resolved (200 x 200 ft) grid cells located in the Marina-Ord area where the majority of groundwater extraction and monitoring occurs within the Basin. The coordinates of the lower left corner of the grid are 5,740,227 E., 2,169,843 N. (CA State Plane Zone 4, NAD83, Feet). The grid is rotated 240 degrees counterclockwise so that the columns align approximately with the 180/400-Foot Aquifer Subbasin boundary to the north and the Seaside Subbasin boundary to the south, consistent with the alignment of the Seaside Basin Groundwater Model (*Hydrometrics 2009 & 2019,* see *Section 2.4.2.2*).

The rectangular model grid has been further segmented into an active area (i.e., where groundwater flow is explicitly simulated) and an inactive area (where cells are assigned no-flow boundary conditions). The active area covers the entirety of the Basin as well as the small portion of the 180/400-Foot Aquifer Subbasin south of the Salinas River. The northern boundary of the active grid is the Salinas River, the western boundary is the Pacific Ocean, the southern boundary is the Seaside Subbasin boundary, and the eastern boundary is the Basin edge (i.e., where aquifer sediments come in contact with low permeability bedrock). Transient groundwater conditions along each of the active model boundaries are represented using unique boundary conditions as further described in *Section 2.4*. The number and location of active cells varies by model layer based on previously mapped aquifer extents as further described in *Section 2.2.3*.

2.2.2 Temporal Approach

2.2.2.1 Historical Simulation

The historical simulation is discretized temporally into 240 monthly stress periods, representing a 20-year simulation period from DWR Water Year (WY) 1999 (i.e., October 1998) through WY 2018 (i.e., September 2018). All 20 years of the historical simulation period were used for model calibration as further described in *Section 4*.

GSPs are required to "*provide a quantitative assessment of the historical water budget, starting with the most recently available data and extending back a minimum of 10 years, or as is sufficient to calibrate and reduce the uncertainty of the tools and methods used to estimate and future water budget information and future aquifer response to proposed sustainable groundwater management practices over the planning and implementation horizon*" (23-California Code of Regulations [CCR] §354.18(b)(2)). The historical water budget accounting period is WY 2004 – 2018, which allows for a five-year pre-conditioning period (i.e., WY 1999 – 2003) to minimize the influence of uncertainty in the specified initial conditions.

2.2.2.2 Projected Simulations

Projected water budgets are required "*to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation*" (23-CCR §354.18(b)(3)). The projected water budget "*must use 50 years of historical precipitation, evapotranspiration (ET), and streamflow information as the basis for evaluating future conditions under baseline and climate-modified scenarios*" (23-CCR §354.18(e)(2)(A)).

Several projected scenarios were developed from the historical model to evaluate aquifer response to future climate, land use, and water supply and demand conditions (See GSP *Section 6.5 Projected Water Budget* for further details). To develop the required 50 years-worth of hydrologic input information, first an "analog period" was created from the 20 years of historical information (WY 1999-2018) by combining the years in a specific way that, on average, maintained the long-term average hydrologic conditions. This approach allowed for the creation of a complete 50-year period to inform the projected water budget analysis, even when certain component datasets were not available for that length of time. The sequence of historical years that were combined to create the 50-year analog period is as follows:

- Analog Years 1-20: Based on historical years 1999-2018
- Analog Years 21-40: Based on historical years 1999-2018
- Analog Years: 41-50: Based on historical years 1999-2008

The above mapping of historical years to analog years within the required 50-year projected water budget period applies to precipitation and ET datasets.

The projected simulations are discretized temporally into 600 monthly stress periods, representing a simulated analog period from WY 2019 (i.e., October 2018) through WY 2068 (i.e., September 2068). This 50-year simulation was used to develop projected water budget estimates and to evaluate the benefits of proposed projects and management actions over the 50-year planning and implementation period following GSP submittal.

2.2.3 Vertical Geometry

The model is discretized vertically into eight layers as described below:

- **Layer 1** represents Dune Sand Aquifer;
- **Layer 2** represents the Fort Ord/Salinas Valley Aquitard;
- **Layer 3** represents the Upper 180-Foot Aquifer;
- **Layer 4** represents the 180-Foot Aquitard;
- **Layer 5** represents the Lower 180-Foot Aquifer;
- **Layer 6** represents the 180/400-Foot Aquitard;
- **Layer 7** represents the 400-Foot Aquifer; and
- **Layer 8** represents the Deep Aquifer / El Toro Primary Aquifer[1]

[1] The El Toro Primary Aquifer is defined as the only Principal Aquifer unit within the Corral de Tierra Management Area and is generally consistent in hydrogeology to the lower 400-Foot and Deep Aquifers within the Main Basin. See GSP *Section 4.2.2.* for further details.

Each layer of the MBGWFM represents a unique Principal Aquifer or Aquitard unit defined in the GSP and is consistent with previous hydrogeologic conceptualizations of the Basin. A more detailed description of the hydrogeology, geometry, and current groundwater conditions of each Principal Aquifer and Aquitard unit within the Basin is provided in *Sections 4 and 5* of the GSP. A summary table of the geologic-hydrogeologic relationships of each Principal Aquifer and Aquitard unit is provided in **Table 1** below:

Table 1. Generalized Geologic – Hydrogeologic Relationships

<table>
<tr><th>Period/Epoch</th><th>Geological Unit</th><th>Principal Aquifers and Aquitards</th></tr>
<tr><td>Holocene</td><td>Recent Dune Sand (Qd)
Older Dune Sand (Qod)</td><td>Dune Sand Aquifer</td></tr>
<tr><td rowspan="8">Pleistocene</td><td rowspan="2">Old Alluvium / Valley Fill Deposits (Qo/Qvf)</td><td>Fort Ord-Salinas Valley Aquitard</td></tr>
<tr><td rowspan="2">180-Foot Aquifer (1)</td></tr>
<tr><td rowspan="3">Aromas Sand (Qae)</td></tr>
<tr><td>180/400-Foot Aquitard</td></tr>
<tr><td rowspan="2">400-Foot Aquifer</td></tr>
<tr><td rowspan="3">Paso Robles Formation (QT)</td></tr>
<tr><td>400-Foot/Deep Aquitard(2)</td></tr>
<tr><td rowspan="4">Deep Aquifers</td></tr>
<tr><td rowspan="2">Pliocene</td><td>Purisima Formation (Ppu)</td></tr>
<tr><td rowspan="2">Santa Margarita Formation (Msm)</td></tr>
<tr><td rowspan="2">Miocene</td></tr>
<tr><td>Monterey Formation (Mmd)</td><td>N/A
(Minimally Water-Bearing)</td></tr>
</table>

Notes:

(1) The 180-Foot Aquifer is separated into “upper” and “lower” zones, separated by a thin clay layer known as the “180-Foot Aquitard”. Data collected within the former Fort Ord show that significant head differences exist between the upper and lower zones of the 180-Foot Aquifer.

(2) The presence and extent of the “400-Foot/Deep Aquitard” is not well understood within the Monterey Subbasin and thus is not represented by a unique layer in the MBGWFM. The Deep Aquifer (MGWFM Layer 8) has been parameterized to reflect zones of low vertical hydraulic conductivity where this aquitard is presumed to exist in the subbasin (see Section 2.5.1 for further details).

As described in detail in GSP *Sections 4 and 5*, Principal Aquifer units within the Basin have varied spatial extent, thickness, and degrees of confinement. As part of GSP development, a three-dimensional (3D) hydrostratigraphy model of the Basin was prepared using the Leapfrog Geo[2] geologic modeling software program to provide for a more accurate representation of Principal Aquifer and Aquitard geometries and to facilitate MBGWFM grid development. The Leapfrog hydrostratigraphy model of the Basin was originally developed as part of two Airborne Electromagenetic (AEM) geophysical surveys conducted by Marina Coast Water District (MCWD) in 2017 and 2019 (*Stanford/Aqua Geo Frameworks, 2017; Aqua Geo Frameworks, 2019*) to help characterize seawater intrusion within the Basin. The Leapfrog hydrostratigraphy model was revisited and modified by EKI in 2020 to incorporate additional lithologic and hydrostratigraphy data from various well and borehole logs and well as several cross-sections previously developed for the Basin (*Harding ESE, 2001; GeoSyntec, 2007; GeoSyntec, 2010*). The updated Leapfrog hydrostratigraphy model was used as the basis to inform the spatial extents, elevations, and thicknesses of each layer within the MBGWFM. **Figure 2** shows a representative cross-section of the Marina-Ord area of the Basin derived from the Leapfrog hydrostratigraphy model and corresponding MBGWFM layers.

One limitation of the Leapfrog hydrostratigraphy model is that it does not extend into the southern portion of the Corral de Tierra Management Area on the southeastern side of the Basin. Within the southern Corral de Tierra area, aquifers have historically been described by their geologic names, such as the Aromas Sand, Paso Robles Formation, and Santa Margarita Sandstone (*Geosyntec, 2007; Yates 2005*). Based on best available information, these geologic formations are grouped together to form the “El Toro Primary Aquifer System” for the Corral de Tierra Area as described in further detail in GSP *Section 4*. These geologic formations also comprise the lower portions of the 400-Foot Aquifer and the Deep Aquifers in the northern Salinas Valley including the Marina-Ord Area. As such, the El Toro Primary Aquifer was represented using model Layer 8, which is the only active model layer within the Corral de Tierra Management Area (see **Figure 3**).

Another limitation of the Leapfrog hydrostratigraphy model is that it does not effectively map the bottom of the Basin, which is defined as the top of the Monterey Formation (see GSP *Section 4*). As such, the bottom of MBGWFM Layer 8 (Deep Aquifer / El Toro Primary Aquifer) was delineated in the MBGWFM using a surface representing the Top of Monterey Formation Elevations previously developed by the Seaside Basin Watermaster (see GSP *Figure 4-3*).

Figure 3 shows the active extents of each layer within the MBGWFM and the uppermost active Principal Aquifer units encountered across the model domain. **Figure 4** and **Figure 5** show the top elevations of each model layer, while **Figure 6** and **Figure 7** show the layer thicknesses. These figures demonstrate that the MBGWFM reasonably represents the geometry and extent of each Principal Aquifer unit defined within the Basin as described in detail in *Section 4* of the GSP.

As described in *Section 5* of the GSP, each Principal Aquifer unit may experience varied degrees of confinement depending on location within the Basin, presence of overlying aquitard units, and current groundwater level conditions. As such, each layer was assigned a “convertible” layer type in the Upstream Weighting Package (UPW) of the MODFLOW-NWT program to allow for continued transition between confined and unconfined conditions throughout the model simulation depending on transient groundwater head conditions. Similarly, as mentioned in *Section 2.1,* the Newton formulation version of MODFLOW-2005 (MODFLOW-NWT) was employed for the MBGWFM because it allows for rewetting of cells (i.e., keeping them active as opposed to deactivating them) in the event the water table drops below the bottom elevation of a given cell at any point during the transient simulation.

[2] https://www.seequent.com/products-solutions/leapfrog-geo/

Finally, there are areas of the Basin where certain aquifer or aquitard units pinch out to zero thickness and terminate, resulting in direct connectivity between non-sequential aquifer units. An example of this is the Fort Ord/Salinas Valley Aquitard (Layer 2), which only exists in a portion of the Marina-Ord Area. Where the aquitard is not present, the Dune Sand Aquifer (Layer 1) is in direct contact with the Upper 180-Foot Aquifer (Layer 3). Pinch-out geometries are challenging to accurately represent in MODFLOW-NWT because cells with zero thickness and inactivated cells will act as no-flow boundaries and prevent vertical hydraulic connection between overlying and underlying model layers. A minimum cell thickness of five feet was applied to model cells in these pinch-out areas to allow for continued hydraulic connectivity between non-sequential model layers. As described further in *Section 2.5,* these cells were assigned the same aquifer parameters as the nearest overlying active model layer such that they essentially act as "flow-through" cells allowing vertical groundwater flow between non-sequential model layers. The location of these "flow-through" cells are shown by layer on **Figure 6** and **Figure 7.**

2.3 Initial Conditions

2.3.1 Historical Simulation

The availability and density of historical groundwater elevation data varies substantially throughout the Basin, both spatially and temporally. While the Monterey County Water Resources Association (MCWRA) maintains a database of water level records throughout the entire Salinas Valley Groundwater Basin, available records before WY 1999 were generally limited to the Marina-Ord Management Area of the Basin. As such, initial heads in the MBGWFM were derived from Fall 1998 water level data wherever available and supplemented with historical water level contour maps previously created for the Corral de Tierra Management Area to provide for complete coverage of the Basin.

Fall 1998[3] water levels were compiled from MCRWA records for 362 wells within the Basin and in the surrounding Seaside and 180/400-Foot Aquifer Subbasins and used to create preliminary surfaces (i.e., rasters) of initial heads for the MBGWFM historical simulation. Initial head rasters were created in Surfer using the Kriging interpolation method, whereby a Gaussian model variogram was fitted to the water level datasets and applied to create rasters of Fall 1998 water levels for each Principal Aquifer unit.

As mentioned previously, initial heads in the Corral de Tierra Management Area were also informed by contoured water level maps previously created by Geosyntec Consultants as part of the El Toro Groundwater Study (*Geosyntec, 2007*). Specifically, a contour map of January 2001 groundwater elevations (Figure 4-5 of *Geosyntec, 2007*) was digitized (i.e., converted into a series of point elevations) and subsequently used to refine and extend the initial head rasters so that they covered the entirety of the Basin.

Groundwater elevations were subsequently extracted from the initial head rasters at every active grid cell for each aquifer layer of the MBGWFM (i.e., layers 1, 3, 5, 7, and 8) to populate the initial head arrays in the Basic (BAS) package of MODFLOW-NWT. Initial heads were assigned to the aquitard layers (i.e., layers 2, 4, and 6) using water level surfaces from the overlying aquifer unit where applicable.

[3] Seasonal average water levels were calculated for each well, where Fall includes measurements from August 15th to November 15th and Spring includes measurements from January 15th to April 15th.

2.3.1 Projected Simulations

Initial heads for all projected simulations in the MBGWFM were defined using the final head outputs from the historical simulation (i.e., simulated heads from September 30, 2018).

2.4 Boundary Conditions

Boundary conditions represent flow constraints in the model domain. Three types of boundary conditions are specified in the MBGWFM: 1) no-flow boundary, 2) general-head boundary, and 3) river boundary. Each of these boundary conditions are discussed in greater detail below. A schematic summarizing all boundary conditions employed in the model is presented in **Figure 8**.

2.4.1 No-Flow Boundary

A no-flow boundary is employed wherever groundwater flow is assumed to be zero within a cell, effectively removing it from the groundwater flow simulation. No-flow boundaries are commonly used to represent contacts with impermeable (non-water bearing) formations or to inactivate a portion of the model grid that is outside the study area. The following areas are represented as no-flow boundaries within the MBGWFM:

- The eastern Basin boundary, where aquifer sediments of the El Toro Primary Aquifer (Layer 8) come in contact with impermeable bedrock outcrops;
- The model bottom, which coincides with the top of the Monterey Formation (i.e. bedrock); and
- The western Basin boundary within the Deep Aquifer (Layer 8), as it is assumed the Deep Aquifer is not hydraulically connected to the Pacific Ocean (see *Section 2.4.2.3*).

All other cells outside the active model area are also assigned as no-flow cells such that they are excluded from the MODFLOW simulation.

2.4.2 General-Head Boundary

The general-head boundary (GHB) is a head-dependent flow boundary, and the flow across this boundary is proportional to the difference between the model-calculated head at the boundary and a general head located a certain distance from the boundary. The proportionality constant used to calculate the flow is the conductance, which is calculated from the hydraulic conductivity of the boundary cell, the area of the face of the boundary cell, and the distance from the boundary cell to the general head location.

As described in more detail in GSP *Sections 4 and* 5, the northern, southern, and western boundaries of the Basin are hydraulically connected to aquifer units of the 180/400-Foot Aquifer Subbasin, Seaside Subbasin, and the Pacific Ocean, respectively. As such, the northern, southern, and western boundaries of the active model domain are represented by GHBs[4].

The general process for developing GHBs in the MBGWFM was to: (1) identify GHB cells for each active model layer, (2) gather transient general head data from nearby locations to the GHB cells outside the

[4]Two exceptions to this are: (1) the northern boundary of Layers 1 and 2, where the Salinas River is directly simulated using a River boundary (see *Section 2.4.3*), and (2) the western boundary of Layer 8, which is represented as a no-flow boundary because is assumed the Deep Aquifer is not hydraulically connected to the Pacific Ocean.

active model domain, (3) calculate distances and associate GHB cells with their nearest general head location, and (4) assign transient general heads and conductance properties to each GHB cell[5]. The methods and datasets used to develop GHBs at each boundary are further described below.

2.4.2.1 *Northern Boundary (Salinas River / 180-400-Foot Aquifer Subbasin)*

As mentioned in *Section 2.2.1,* the active model area extends north of the Basin boundary up to the Salinas River, thus including a small portion of the 180/400-Foot Aquifer Subbasin. While the Salinas River is explicitly simulated in MBGWFM layers 1 and 2 (see *Section 2.4.3*), the northern boundary in underlying layers (i.e., layers 3-8) is represented by GHBs in the model to simulate groundwater exchanges between the Monterey Subbasin the neighboring 180/400-Foot Aquifer Subbasin.

2.4.2.1.1 Historical Simulation

Transient general heads were assigned to northern boundary GHB cells using historical groundwater elevation monitoring data provided by MCWRA. Groundwater elevation measurements from the historical simulation period (i.e., October 1999 – September 2018) were compiled from all monitoring wells to the immediate north of the Salinas River and examined for quality. A subset of these wells were ultimately selected as "representative" monitoring wells to assign transient general heads at GHB cells along the northern boundary for model layers 3–8. The selection of representative wells to use for GHB parameterization was informed by the availability, frequency, and quality of historical monitoring data as well as the location and distribution of wells along the northern boundary.

The final network of representative monitoring wells includes seven wells in the Upper 180-Foot Aquifer (Layer 3), 12 wells in the Lower 180/400-Foot Aquifer (Layers 5 and 7)[6], and three wells in the Deep Aquifer (Layer 8). Each active GHB cell in model layers 3–8 was associated to the nearest representative well[7] and the distance between the GHB cell and its associated representative well was calculated to inform the GHB conductance term. GHB cells along the northern model boundary and their associated representative monitoring wells are shown for each model layer in **Figure 9.**

Historical groundwater elevation data from each representative monitoring well was pre-processed to create a continuous monthly timeseries of general heads to assign to its associated GHB cells. Where multiple records existed for a well within a given month, an average groundwater elevation was calculated for that month. Where data was unavailable at a well for a particular month, the monthly water level was either estimated via (Pearson) correlation[8] to nearby monitoring wells with data for that month or, when

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[5] GHB conductance parameters were adjusted during calibration as described in *Section 4.3*.

[6] Along most of the northern MBGWFM boundary, the 180-Foot Aquitard is present while the 180/400-Foot Aquitard is absent (see **Figures 6 and 7**). Historical water level observations collected in this area indicate that groundwater elevations within the Lower 180-Foot Aquifer closely resemble water levels in the 400-Foot Aquifer along the northern basin boundary. Furthermore, water level contour maps for the Lower 180-Foot Aquifer created by EKI closely resemble MCWRA contour maps of the 400-Foot Aquifer along the boundary. As such, northern GHB heads were assigned to MBGWFM Layers 5 and 7 using water levels collected from MCWRA wells characterized in the "180/400-Foot Aquifer."

[7] Specified heads were assigned to GHB cells in aquitard units (i.e., model layers 4 and 6) using water level data from representative wells in the overlying aquifer unit (i.e., model layers 3 and 5, respectively).

[8] A linear regression (Pearson) correlation matrix was developed for all representative wells within a Principal Aquifer unit to identify "well-correlated" wells for use in data-gap filling. A correlation coefficient (R) threshold of $R \geq 0.8$ was used to determine if wells were well-correlated and thus suitable for use in estimating missing water level data. The final linear regression equations used to estimate missing water level records were derived from the nearby well with the highest R value (where $R \geq 0.8$) to the representative well in question.

no well-correlated data was available, via linear interpolation between measurements at the well. The final (post-processed) monthly water level datasets from each representative monitoring well were subsequently used to assign transient general heads at all associated GHB cells throughout the historical model simulation period.

2.4.2.1.2 Projected Simulations

The same approach described above was used to set up the northern boundary GHB in the projected simulations, except now the general heads were informed by groundwater elevation Sustainability Criteria defined in the 180/400-Foot Aquifer Subbasin GSP ("180/400 GSP", *SVBGSA, 2020)* as opposed to historical monitoring data. Specifically, the "representative" monitoring well network used to inform historical general heads at nearby GHB cells was updated to include all SGMA monitoring network wells located immediately north of the Salinas River in the 180/400-Foot Aquifer Subbasin. In many cases, these SGMA monitoring wells were the same representative wells employed in the historical simulation.

The final network of SGMA monitoring wells used for projected simulations includes seven wells in the Upper 180-Foot Aquifer (Layer 3), 10 wells in the Lower 180/400-Foot Aquifer (Layers 5 and 7), and three wells in the Deep Aquifer (Layer 8). Each active GHB cell in model layers 3–8 was reassociated to the nearest SGMA monitoring well[9] and assigned a GHB conductance term from the calibrated historical model. GHB cells along the northern model boundary and their associated SGMA monitoring wells are shown for each model layer in **Figure 10.**

Depending on the projected scenario, GHB cells were then assigned general heads based on one of the following three ranges in future groundwater level conditions that could be encountered at the 180/400-Foot Aquifer Subbasin while maintaining SGMA compliance:

- **"Minimum Threshold" (MT)** water levels (as defined in the 180/400 GSP)
- **"Measurable Objective" (MO)** water levels (as defined in the 180/400 GSP)
- **"Seawater Intrusion (SWI) Protective"** water levels (see *Section 2.4.2.3* for further details).

For all projected scenarios, initial general heads at the GHB cells were informed by final head outputs from the historical simulation (i.e., simulated heads from September 30, 2018)[10]. General heads were then adjusted using a 20-year "ramp up" period to reach the projected water level conditions described above. For the "MT" and "SWI Protective" water level scenarios, the ramp up period was applied linearly over 20 years. For the "MO" water level scenario, the ramp up period was informed by five-year interim milestones defined at each SGMA monitoring well in the 180/400 GSP. All projected water levels at the GHB cells were then held constant for the remaining 30 years of the projected simulations, under the assumption that these water levels would be maintained in perpetuity after the 20-year SGMA implementation deadline.

[9] *Ibid [6].*

[10] Review of historical groundwater level data indicates that September water levels represent a reasonable annual average condition (i.e., between seasonal high and low conditions) within the 180/400-Foot Aquifer subbasin and are thus appropriate to use as a starting point for developing projected heads at the northern GHB boundary.

2.4.2.2 Southern Boundary (Seaside Subbasin)

As mentioned in *Section 2.2.1,* the southern boundary of the active model area is aligned with the Seaside Subbasin boundary. This boundary was represented as a GHB in the MBGWFM to simulate groundwater exchanges between the Monterey Subbasin the neighboring Seaside Subbasin.

2.4.2.2.1 Historical Simulation

Transient general heads were assigned for southern boundary GHB cells in the MBGWFM historical simulation using head outputs from the Seaside Basin Groundwater Model ("Seaside Model") (*Hydrometrics, 2009 & 2019*). The Seaside Model simulates groundwater flow within the Seaside Subbasin from January 1987 – January 2018 and extends partially into the Monterey Subbasin. A copy of the Seaside Model was provided to EKI by the Seaside Basin Watermaster in early 2020 to facilitate direct incorporation of simulated head outputs from the Seaside Model along the Basin boundary into the MBGWFM.

EKI extracted simulated head outputs from the Seaside Model at a series of 20 regularly spaced "proxy" monitoring locations distributed along the south side of the Seaside boundary. Each active GHB cell along the Seaside boundary in the MBGWFM was subsequently associated to its nearest proxy monitoring location, and transient general heads were assigned to the GHB cells using the monthly simulated head outputs from the Seaside Model at their respective proxy monitoring locations[11]. GHB cells along the Seaside boundary and their associated proxy monitoring locations are shown in **Figure 11.**

While employing the Seaside Model to develop Seaside boundary GHBs in the MBGWFM provides for a common set of assumptions regarding historical heads along the boundary, there are notable differences in hydrogeologic conceptualization and geometry between the two models that will result in imperfect matching of head conditions and unique estimates of cross-boundary flows. Notably, the Seaside Model defines aquifer units differently than the MBGWFM and includes a different number of layers. The Seaside Model is comprised of five layers that represent the following aquifer units (*Hydrometrics, 2009*):

- Layer 1 represents the Older Dune deposits and Aromas Red Sands
- Layer 2 represents the upper Paso Robles Aquifer
- Layer 3 represents the "brown sand layer" of the lower Paso Robles Aquifer
- Layer 4 represents the "semi-continuous blue clays" encountered at the base of the Paso Robles Aquifer
- Layer 5 represents the Santa Margarita/Purisima Aquifer

As demonstrated in **Table 1** (see *Section 2.2.3*), these aquifer units are generally defined based on the geologic formations encountered in the region and are only loosely tied to the Principal Aquifer Units defined in the Monterey Subbasin. For example, Older Dune deposits and Aromas Red Sands deposits (Seaside Model layer 1) have been further stratified into the Dune Sand Aquifer (Layer 1), Upper 180-Foot Aquifer (Layer 3), Lower 180-Foot Aquifer (Layer 5), and 400-Foot Aquifer (Layer 7) in the MBGWFM. Previous hydrogeologic investigations (see *GSP Section 4*) indicate that the 400-Foot Aquifer is likely comprised of both Aromas Sands (Seaside Model layer 1) as well as upper portions of the Paso Robles

[11] As the Seaside Model historical simulation period ends in January 2018, simulated head outputs were estimated in the MBGWFM for Feb. 2018 – Sept. 2018 using Seaside Model head outputs for Feb. 2017 – Sept. 2017.

formation (Seaside Model layer 2) depending on location within the Monterey Subbasin. Similarly, the Deep Aquifer (Layer 8) of MBGWFM represents the combined lower Paso Robles (Seaside Model layers 3-4) and Santa Margarita / Purisima (Seaside Model layer 5) formations.

Given the imperfect match in conceptualization and layering between the two models, a few simplifying assumptions were needed to effectively link head outputs from the Seaside model to GHB cells along with southern boundary of the MBGWFM. Ultimately, the selection of which Seaside Model layers should be associated to GHB cells in the MBGWFM was informed by: (1) a comparison of Seaside Model head outputs along the boundary with recent (i.e., Spring and Fall 2017) contour maps of each Principal Aquifer Unit in the Monterey Subbasin; and (2) an iterative evaluation of water budget and simulated head outputs from MBGWFM to ensure cross-boundary flow estimates generally agreed with Seaside Model outputs, both in magnitude and in spatial trends. The final mapping of MBGWFM GHB cells to their corresponding Seaside Model layers is presented in **Table 2** below:

Table 2. Mapping of Seaside Model Layers to MBGWFM GHB Cells at the Seaside Boundary

MBGWFM GHB Layer	MBGWFM Principal Aquifer Unit	Seaside Model Layer	Seaside Model Aquifer Unit
1	Dune Sand Aquifer	1	Older Dune deposits and Aromas Red Sands
3	Upper 180-Foot Aquifer	1	Older Dune deposits and Aromas Red Sands
5	Lower 180-Foot Aquifer	1	Older Dune deposits and Aromas Red Sands
7	400-Foot Aquifer	2	Upper Paso Robles Aquifer
8	Deep Aquifer / El Toro Primary Aquifer	3 (Proxy Points 1-9)	Lower Paso Robles Aquifer
		4 (Proxy Point 10)(1)	Paso Robles Base (Blue Clays)
		5 (Proxy Points 11-20)(2)	Santa Margarita / Purisima Aquifer

<u>**Notes:**</u>

(1) Seaside Model layer 3 becomes dry moving east of proxy point 9 along the boundary, and thus the uppermost active unit is layer 4.

(2) Seaside Model layer 4 is either dry or constrained by dry cells and shows erroneously high-water levels (i.e., >200 feet above ground surface) moving east of proxy point 10. Thus, the only reliable layer to use east of proxy point 10 becomes layer 5.

Annual net cross-boundary flow estimates from the Seaside Model and the calibrated MBGWFM over the historical water budget period[12] are compared on **Figure 12.** Over like timeframes, the Seaside Model estimates an average net inflow from the Seaside Subbasin to the Monterey Subbasin of +935 acre-feet per year (AFY) while the MBGWFM estimates an average net inflow of +918 AFY. These results indicate that the calibrated MBGWFM reasonably recreates historical groundwater level conditions simulated by Seaside Model along the boundary and that resulting water budget estimates of historical cross-boundary flows between the two models are in very close agreement at the Basin-level. Further refinements could bring the historical models into closer agreement.

2.4.2.2.2 Projected Simulations

Unlike the 180/400-Foot Aquifer Subbasin, the Seaside Subbasin is an adjudicated groundwater basin and is not subject to many aspects of SGMA. As such, no Sustainability Criteria have been defined for groundwater elevations within the Seaside Subbasin, as the basin is required to manage to a groundwater budget as opposed to groundwater elevations. The adjudication also states that management of the Seaside Basin cannot result in “material injury” to the Basin, which could include low groundwater elevations that impact production rates.

For the projected simulations, a simplifying assumption was made that the Seaside Subbasin would be able to maintain Fall 2017 water levels over the long term, thus managing to a balanced water budget (i.e., no long-term depletion of groundwater storage). As such, September 2017 water level outputs from the Seaside Model were used to define reference heads along the southern GHB boundary for all MBGWFM projected simulations throughout the entire 50-year simulation period.

One exception to the assumption described above is along the southeastern edge of the Seaside-Monterey boundary (i.e., near Laguna Seca). In this area, simulated Fall 2017 water levels from the Seaside Model were already below the Minimum Thresholds (MTs) defined for wells in the Corral de Tierra Management Area on the Monterey Subbasin side of the boundary (i.e., 170 feet above mean sea level [ft msl], see GSP *Sections 7 and 8*). Projected GHB reference heads were set at the minimum threshold of 170 ft msl in the MBGWFM for all GHB cells in the Laguna Seca area whose simulated water levels were below 170 ft msl in the Seaside Model as of September 2017. This assumption was considered reasonable because Cal-Am ceased all its municipal pumping from the Laguna Seca area in 2021, reducing total pumping in that area by approximately 30%. While the effect of this pumping reduction is still to be established, it is likely that pumping in the Laguna Seca will not be the driver of lower groundwater levels. This adjustment was ultimately made to all GHB cells associated with “proxy” monitoring points 14 and 15 along the Seaside boundary (see **Figure 11**).

It is recognized that there is considerable uncertainty regarding future groundwater conditions within the Seaside Subbasin (particularly within the Laguna Seca area) and that groundwater management decisions in the Monterey Subbasin are likely to impact groundwater conditions within the Seaside Subbasin, and vice-a-versa. Various studies and projects have been proposed (see *GSP Section 9*) or are already being implemented by water management entities in both subbasins to better characterize and model local groundwater conditions and cross-boundary flows in the Laguna Seca area and across the entire Monterey-Seaside boundary. As more data and information is

[12] WY 2018 is excluded from the comparison as the Seaside Model only simulates historical groundwater conditions through January 2018

developed in the coming years, the MBGWFM will be revised and updated accordingly as part of the next five-year update to the GSP.

2.4.2.3 Western Boundary (Pacific Ocean)

As mentioned in *Section 2.2.1,* the western boundary of the active model area is aligned with the Pacific Ocean. This boundary was represented as a GHB in the MBGWFM to simulate exchanges between the Basin and the ocean and to inform estimates of potential seawater intrusion rates into the Basin.

The current version of the MBGWFM does not directly simulate variable-density groundwater flow and transport. Instead, the Pacific Ocean boundary is represented as a GHB using freshwater equivalent sea levels calculated at the aquifer-seafloor interface for each Principal Aquifer unit assumed to be in hydraulic connection with the ocean.

Freshwater equivalent sea levels are calculated based on the equivalent freshwater head formula for variable density groundwater flow presented in the USGS *User's Guide to SEAWAT* (*Guo and Langevin, 2002*), which states:

$$h_{fw} = \frac{\rho}{\rho_f} h - \frac{\rho - \rho_f}{\rho_f} Z$$

where h_{fw} = freshwater equivalent head, h = sea level, ρ = saline water density, ρ_f = freshwater density, and Z = elevation of measuring point. In this instance, since the equivalent freshwater head is being calculated at the (offshore) ocean-aquifer interface, Z represents the depth to the seafloor at the estimated seafloor-aquifer contact location.

Previous hydrogeologic investigations along the Monterey coastline indicate that the Recent and Older Dune Deposits, Aromas Red Sands, and Paso Robles Formations are at least partially in contact with the seafloor at varying distances offshore from the Basin, while the deeper Santa Margarita and Purisima Formations may be hydraulically restricted from the sea floor by the Monterey Bay Fault Zone (*Feeney, 2003).* More recent investigations of seawater intrusion conditions within the Basin (*Aqua Geo Frameworks, 2019,* see GSP *Section 5*) also indicate that the Deep Aquifer is not currently seawater intruded along the Monterey coastline. As such, GHB cells were assigned along the Pacific Ocean boundary for all layers in the MBGWFM apart from layer 8 (i.e., the Deep Aquifer), which was modeled as a no-flow boundary at the Monterey coastline.

2.4.2.3.1 <u>Historical Simulation</u>

For the historical simulation, freshwater equivalent sea levels were calculated for each model layer using the *Guo & Langevin, 2002* equation described above at a sea level elevation (*h*) of zero (0) ft msl and a saline water density of 1.025 grams per cubic centimeter (g/cm^3). Average elevations (i.e., depths below sea level) at which each Principal Aquifer unit are assumed to contact the seafloor were estimated using a previously developed geologic cross-section of the Monterey Bay coastal aquifer system (see Figure 5 of *Feeney, 2003*). Corresponding offshore distances to the assumed point of contact with the seafloor were then calculated at each GHB cell using a bathymetry map of seafloor elevations and used to inform conductance term at each cell. **Table 3** below presents a summary of freshwater heads assigned to each model layer for the historical simulation.

Table 3. Freshwater Equivalent Sea Levels – Historical Simulation

MBGWFM GHB Layer	Corresponding Geologic Formation from *Feeney, 2003*	Average Offshore Distance to Seafloor Contact (ft)	Average Elevation of Seafloor – Aquifer Contact (ft msl)	Calculated Freshwater Equivalent Head (ft msl)
1 – 6	Recent / Older Dune Deposits	9,000	-155	3.8
7	Aromas Red Sands / Paso Robles	26,800	-335	8.4

Calculated freshwater heads were held constant in Pacific Ocean GHB cells throughout the historical simulation under the assumption that the sea level did not change significantly between WY 1999 – 2018.

2.4.2.3.2 Projected Simulations

As further described in *Section 3.1*, three climate change scenarios were modeled in the MBGWFM projected simulations. Each of these scenarios employed unique assumptions regarding future sea level rise that were derived from the 180/400 GSP (*SVBGSA, 2020*). These included:

- **Baseline Conditions** – assumes no change in sea level (0 ft msl)
- **2030 Climate Change –** assumes a "moderate" increase in sea levels of 15 cm (+ 0.492 ft msl)
- **2070 Climate Change** – assumes a "severe" increase in sea levels of 45 cm (+ 1.475 ft msl)

Freshwater equivalent ocean heads were recalculated under each projected scenario using the same assumptions about offshore contact depths and distances employed in the historical simulation (see **Table 3** above). **Table 4** below presents a summary of freshwater heads assigned to Pacific Ocean GHB cells for each model layer under the various projected scenarios.

Table 4. Freshwater Equivalent Sea Levels – Projected Simulations

MBGWFM GHB Layer	"Baseline" Freshwater Equivalent Head (ft msl)	"2030 Climate Change" Freshwater Equivalent Head (ft msl)	"2070 Climate Change" Freshwater Equivalent Head (ft msl)
1 – 6	3.8	4.3	5.4
7	8.4	8.9	9.9

Calculated freshwater heads were held constant in Pacific Ocean GHB cells throughout each of the 50-year projected simulations.

As described in *Section 2.4.2.1.2*, projected simulations along the northern GHB boundary included a "Seawater Intrusion (SWI) Protective" water level scenario to estimate potential cross-boundary flows assuming the 180/400-Foot Aquifer Subbasin is able to maintain freshwater equivalent sea levels along the entire length of the 180/400-Monterey boundary. For this scenario, GHB cells along the northern boundary were assigned specified heads using the freshwater equivalent sea levels calculated under each climate scenario shown in **Table 4**. Consistent with the MT and MO scenarios, GHB cells along the northern boundary were allowed a 20-year "ramp up" period starting from their Fall 2018 heads to reach these SWI Protective water levels and were then held constant for the remaining 30 years of the projected simulation period.

2.4.3 River Boundary

The Salinas River was explicitly simulated in model layers 1 and 2 at the MBGWFM northern boundary using MODFLOW's River (RIV) package[13] (**Figure 9**). The RIV package is used to simulate head-dependent flux boundaries between a river and the underlying groundwater system.

RIV cells were identified in the MBGWFM using a shapefile of the Salinas River obtained from the National Hydrography Dataset (NHD). River segment lengths were calculated at each model cell from the NHD shapefile, and land surface elevations were estimated using a 30-meter USGS National Elevation Dataset (NED) raster. Streambed widths were assigned to each RIV cell using data obtained from the North Marina Groundwater Model (NMGWM) (*Hydrofocus, 2017)*. A streambed thickness of five (5) feet was assigned to each RIV cell consistent with the NMGWM and the Salinas Valley Integrated Ground and Surface Water Model (SVIGSM)[14] (MCWRA & *LSCE, 2006*), and river bottom elevations were calculated as the land surface elevation minus the streambed thickness. Riverbed conductance values were initially assigned to each RIV cell using parameters obtained from the NMGWM and were subsequently adjusted during model calibration (see *Section 0*).

2.4.3.1 Historical Simulation

For the historical simulation, river stages were assigned to each RIV cell using historical streamflow monitoring data obtained from the USGS Spreckels Gauge (Site No. 11152500)[15]. The Spreckels Gauge is conveniently located in the active MBGWFM domain at model cell [40,85] and thus serves as a reasonable proxy for estimating Salinas River stages along the length of the northern model boundary.

The Spreckels Gauge provides monthly discharge rates within the river and a series of field measurements that contain both stage and flow data at the monitoring station. These field measurements were used to develop a streamflow rating curve for the site, which was subsequently applied to estimate river stages at the Spreckels Gauge location from monthly discharge data for October 1998 – September 2018 (**Figure 13).** River stage elevations were subsequently assigned to each RIV cell upstream and downstream of the Spreckels Gauge location using differences in land surface elevations as an adjustment factor.

[13] A small number of RIV cells were also assigned to model layer 7 at the northeastern Basin boundary, where layer 7 is the uppermost active model unit (**Figure 9**).

[14] The SVIGSM was recently updated to the Salinas Valley Integrated Hydrologic Model (SVIHM) by the USGS, with preliminary outputs released to the public in mid-2021. The SVIHM was not available for use at the time of MBGWFM construction.

[15] https://waterdata.usgs.gov/nwis/uv?site_no=11152500

2.4.3.2 Projected Simulations

At the time of MBGWFM construction, no information was readily available to assign projected Salinas River flow conditions under future baseline or climate change conditions. As such, a simplifying assumption was made that Salinas River stages would mimic historical trends depending on water year type. Transient RIV stages were therefore estimated for all projected scenarios using historical stages calculated for the 50-year "analog" hydrologic period described in *Section 2.2.2.2*, where:

- Analog Years 1-20: Based on historical years 1999-2018
- Analog Years 21-40: Based on historical years 1999-2018
- Analog Years: 41-50: Based on historical years 1999-2008

2.5 Aquifer Properties

Aquifer properties were initialized in the MBGWFM using available pumping test data and relevant information from prior hydrogeological studies and were subsequently refined during model calibration (see *Section 4.3*). A summary of the initial model parameterization process for hydraulic conductivity and storage properties is provided below.

2.5.1 Hydraulic Conductivity

In alluvial aquifers, the spatial distribution of hydraulic conductivity is influenced by the distribution of sediment texture (i.e., the fraction of coarse-grained sand and gravel relative to the fraction of fine-grained silt and clay), the size and shape of the pores between the sediment grains, and the effectiveness of the interconnections between those pores. To better represent the spatial distribution in hydraulic conductivities within each Principal Aquifer unit, texture maps were constructed for each aquifer layer of the MBGWFM (i.e., layers 1, 3, 5, 7, and 8) based on lithologic descriptions from 332 boreholes distributed throughout the model domain[16]. The final texture maps assigned to each layer are shown on **Figure 14 through Figure 18**.

The texture maps are based on the lithologic descriptions from borehole logs. The borehore logs vary in depth and may be used to assign texture classifications to multiple layers. Layer 1 utilized 145 borehole logs, layer 3 utilized 212 borehole logs, layer 5 utilized 65 borehole logs, layer 7 utilized 178 borehole logs, and layer 8 utilized 144 borehole logs. The logs were coded on a 1-ft interval as either coarse-grained or fine-grained material, using a rubric consistent with the USGS' Central Valley Hydrologic Model (CVHM; *Faunt et al., 2009*). For each borehole, the average fraction of coarse-grained sediment was calculated over the total thickness of each model layer at the borehole location. Resultant values were interpolated in Surfer using the Kriging interpolation method to create rasters of coarse-grained fractions for each aquifer layer and were subsequently assigned to each active model cell by layer (**Figure 14 through Figure 18**). In general, the borehole data indicate that layer 1 has the greatest fraction of coarse-grained sediment, and the sediments generally become finer with depth.

Areas and depth intervals characterized with relatively coarse-grained sediments transmit water at a higher rate than areas and depth intervals characterized by fine-grained sediments. The resulting distributions in the fraction of coarse-grained sediment was therefore utilized to specify the spatial

[16] Texture maps were not created for the aquitard layers of the model (i.e., layers 2, 4, and 6) as it is assumed they are predominantly fine-grained in nature. Final hydraulic conductivities assigned to aquitard units were determined through model calibration as further discussed in *Section 4.2*.

distribution in horizontal and vertical hydraulic conductivity. The modeled horizontal hydraulic conductivity is calculated as the product of the fraction of coarse-grained sediment and specified coarse-grained horizontal hydraulic conductivity. Vertical hydraulic conductivity is typically less than horizontal hydraulic conductivity because fine-grained beds can impede the downward movement of water. The modeled vertical hydraulic conductivity is therefore calculated as the specified vertical hydraulic conductivity divided by the fraction of fine-grained sediment, where the fine-grained fraction is calculated as one minus the coarse-grained fraction.

Aquifer test results compiled from 161 pumping tests conducted throughout the Basin were used to inform initial estimates of coarse-grained horizontal hydraulic conductivities within the model.[17] The locations of pumping test wells within the Basin are shown on **Figure 19**. A summary of horizontal hydraulic conductivities estimated from pumping tests is provided in **Table 5** below.

Initial coarse-grained hydraulic conductivities were assigned to each aquifer layer using average hydraulic conductivities calculated from pumping tests for wells whose coarse-grained fractions were in the upper 50th percentile of the texture map for that layer. The final specified coarse-grained horizontal and vertical hydraulic conductivities vary by layer and were determined by calibration, as discussed below in *Section 4.3.*

Table 5. Horizontal Hydraulic Conductivity (Kh) Estimates from Pumping Tests

Principal Aquifer Unit	Horizontal Hydraulic Conductivity (Kh), [ft/d]		
	Minimum	Average	Maximum
Dune Sand Aquifer	2.7	72	750
180/400-Foot Aquifers	0.04	168	1110
Deep Aquifer	2.2	11.6	25.4

2.5.2 Storage

As mentioned above, each Principal Aquifer unit within the Basin may experience varied degrees of confinement depending on location within the Basin, presence of overlying aquitard units, and current groundwater level conditions. As such, both the specific yield (Sy) and specific storage (Ss) parameters must be specified in order to effectively simulate transient head conditions in the Basin.

Aquifer test results compiled from 40 pumping tests conducted throughout the Basin were used to inform initial estimates of specific storage (Ss) within the model[18]. The locations of pumping test wells within the

[17] Aquifer transmissivity (T) measurements from pumping test data were converted to effective hydraulic conductivities by dividing the T value by the entire length of well screen.

[18] Confined storativity (S) measurements from pumping test data were converted to specific storage by dividing the S value by the entire length of well screen.

Basin are shown on **Figure 19**. A summary of Ss values estimated from pumping tests is provided in **Table 6** below. Final Ss values were determined by calibration, as discussed below in *Section 4.3.*

Table 6. Specific Storage (Ss) Measurements from Pumping Tests

Principal Aquifer Unit	Specific Storage (Ss) [1/ft]		
	Minimum	Average	Maximum
Dune Sand Aquifer	1.6E-05	9.5E-04	4.8E-03
180/400-Foot Aquifers	9.9E-07	3.4E-05	2.6E-04
Deep Aquifer (1)	N/A	N/A	N/A

Notes:

(1) No Ss data is currently available from pumping tests for the Deep Aquifer.

Very little data exists to inform estimates of specific yield within individual aquifer units of the Basin. Specific yields have been estimated to range from 0.04 to 0.4 within the Dune Sand Aquifer, and a bulk specific yield of 0.12 was used for the El Toro Primary Aquifer in prior studies (*Todd, 2016*). As such, an initial specific yield (Sy) value of 0.12 was assigned to all aquifer units in the model, consistent with values reported for silty sands in the literature. Final Sy values were determined by calibration, as discussed below in *Section 4.3.*

3. STRESSES

3.1 Recharge

Recharge is simulated using the Recharge (RCH) Package. To quantify the spatial and temporal distribution of recharge across the MBGWFM domain, a Soil Moisture Budget accounting model (SMB) was developed using *MATLAB* programming code. The SMB simulates land surface processes (e.g., precipitation, applied water, and plant evapotranspiration [ET]) and root zone processes which ultimately determine the amount of deep percolation on a grid cell basis that is specified as groundwater recharge to the uppermost active layer of the MBGWFM grid. Detailed documentation of the SMB model and associated input datasets is provided in ***Attachment 2*****.**

The SMB uses a mass-balance approach to quantify the movement of water that arrives at the land surface from either precipitation or irrigation and subsequent movement into the subsurface or atmosphere. The water movement processes included in the SMB model are (1) precipitation, (2) interception, (3) evaporation from canopy and depression storage, (4) rainfall excess runoff, (5) applied water from District deliveries, (6) applied water from private pumping (deficit pumping), (7) ET by vegetation, (8) recharge, (9) saturation excess runoff, and (10) dynamic soil moisture storage.

The SMB calculates the above processes on a grid cell basis across the entire active MBGWFM grid. Spatially variable parameters within the SMB include:

- Soil types (**Figure 20**) and properties, including soil hydrologic group (**Figure 21**), vertical hydraulic conductivity (**Figure 22**), soil depth, field capacity, wilting point, and total porosity, from the United States Department of Agriculture (USDA) Soil Survey Geographic Database (SSURGO)[19]
- Spatial land use data from the U.S. Department of Agriculture (USDA) Forest Service Region 5 Classification and Assessment with Landsat of Visible Ecological Groupings (CalVeg) dataset for Zone 5 (Central Valley)[20] and from various historical and projected land use surveys (see *Sections 3.1.1 and 3.1.2* below)
- Gridded daily precipitation data from the 4-kilometer *Parameter-elevation Regressions on Independent Slopes Model* (PRISM)[21] dataset (**Figure 23**)
- Daily reference evapotranspiration (ETo) data measured at California Irrigation Management Information System (CIMIS) Salinas North #116 and Laguna Seca #229 stations
- Water service area boundaries for the five water service areas within the Basin, including MCWD, CalAm (Ambler, Hidden Hills and Toro Units) and California Water Service (CWS) (**Figure 24**)

Additional parameters to the SMB include:

- Curve numbers for runoff for agriculture, urban, and native vegetation classifications including conifer forest/woodland, hardwood forest/woodland, mixed conifer and hardwood forest/woodland, shrub, herbaceous, and barren (*USDA, 1986*)
- Monthly crop coefficients and canopy storage properties for native, agricultural, and urban land use types from California Polytechnic State University's Irrigation Training and Research Center (*Howes et al., 2015*)

The combination of soil type and land use type determines the Curve Number (runoff coefficient) that controls rainfall excess runoff. ET is calculated for each land use type from the crop coefficient method using daily CIMIS ETo rates and monthly crop coefficients specific to the land use type. ET is limited when soil moisture declines to the wilting point. Irrigation with private groundwater occurs for irrigated agricultural lands when the combination of precipitation, applied delivered water, and soil moisture storage is insufficient to meet vegetative water demand (ET). Private groundwater pumping rates are further adjusted to account for irrigation inefficiency[22].

The SMB calculates a running soil moisture balance for each grid cell on a daily timestep and is driven by daily spatially variable daily precipitation data from the PRISM dataset. Recharge is simulated to occur when the water content in the soil column after infiltration of precipitation, applied water, and ET uptake is greater than the field capacity of the soil. When this occurs, recharge is released from the soil column to the point where soil water content equals field capacity. Daily calculated recharge rates are summed into monthly totals for use as input to the MBGWFM.

In addition to the recharge calculated by the SMB, the MBGWFM also includes water distribution and conveyance system leakage in the RCH Package. Leakage was estimated as 5% of delivered water and was uniformly distributed across all cells within each of the five water service areas in the Basin (**Figure 24**).

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[19] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2_053627

[20] https://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5347192

[21] https://prism.oregonstate.edu/recent/

[22] A uniform irrigation efficiency of 85% was assumed in the calculation of private groundwater pumping on agricultural lands in line with values commonly employed for high-efficiency (e.g., micro-drip) irrigation systems.

A more detailed description of the transient input datasets to the SMB for the historical and projected simulations is provided below.

3.1.1 Historical Simulation

3.1.1.1 Climate

The historical SMB simulation calculates recharge rates for the period October 1, 1998 through September 30, 2018 using daily precipitation data from PRISM and daily ETo data from CIMIS as described above.

3.1.1.2 Land Use

As limited historical land use information exists within the Basin, spatial land use classifications were derived from the CalVeg dataset (10x10 meter resolution). The CalVeg land use map was further supplemented with a map of 2014 land use classes prepared by DWR to identify irrigated agricultural parcels within the Basin and their respective crop types. A single historical land use class was subsequently assigned to each active grid cell based on the dominant land use type mapped within the cell area and was assumed to remain static throughout the duration of the 20-year historical simulation. The final historical land use map is shown in **Figure 25.**

3.1.1.3 Deliveries

Monthly historical delivery records were obtained for the three water suppliers within the Basin (MCWD, CalAm, and CWS) and used to estimate historical outdoor delivery rates within each of the five water service areas in the Basin. MCWD pumping records were obtained directly from MCWD, while monthly delivery records for the each of the CalAm and CWS service areas were provided by the Seaside Basin Watermaster. As no detailed breakdown of indoor vs. outdoor deliveries was available for any of the water agency delivery records, a simplifying assumption was made that 25% of total deliveries within the service area would be used for outdoor consumption (i.e., irrigation) over a 6-month growing season (i.e., April through September). This assumption generally consistent with information provided in MCWD's 2020 Urban Water Management Plan (UWMP, *Schaff & Wheeler, 2021*) and assumptions used in the Seaside Model (*Hydrometrics, 2019)*. Monthly outdoor deliveries were uniformly distributed across all cells within each of the five water service areas in the Basin (**Figure 24**). As mentioned above, an additional 5% of total monthly deliveries were added to the recharge outputs from the SMB for all cells within a water service area to simulate leakage contributions to the Basin. Leakage was assumed to occur throughout the entire calendar year.

3.1.2 Projected Simulations

3.1.2.1 Climate

As mentioned in *Section 2.4.2.3.2*, three climate change scenarios were modeled in the MBGWFM projected simulations. These climate change scenarios were informed by climate change modeling completed by DWR (*DWR, 2020*) and include the following:

- **Baseline Conditions –** no climate change impacts
- **2030 Climate Change (Central Tendency) –** "moderate" climate change impacts
- **2070 Climate Change (Central Tendency) –** accounts for "severe" climate change impacts

For the Baseline scenario, projected daily precipitation and ETo datasets were developed using historical PRISM and CIMIS data for the 50-year "analog" hydrologic period described in *Section 2.2.2.2*, where:

- Analog Years 1-20: Based on historical years 1999-2018
- Analog Years 21-40: Based on historical years 1999-2018
- Analog Years: 41-50: Based on historical years 1999-2008

For the 2030 and 2070 climate change scenarios, DWR provided monthly scaling factors to account for impacts of climate change on precipitation and ET rates. Precipitation and ET climate change factors are spatially variable and mapped to a variable infiltration capacity (VIC) grid (**Figure 26**). These monthly climate change factors were extracted for VIC grid cells that intersect the Basin and used to modify the 50-year historical "analog" precipitation and ET datasets developed for the Baseline projected scenario.

On average, applying the 2030 climate change factors resulted in a -0.5% decrease in precipitation rates and a +3.1% increase in ET rates throughout the Basin relative to Baseline projected conditions, while applying the 2070 climate change factors resulted in a -2.2% decrease in precipitation rates and a 7.7% increase in ET rates throughout the Basin relative to Baseline projected conditions. Notably, the DWR climate change factors dataset appears to indicate that precipitation events within the Basin are projected to be less frequent and of significantly higher intensity as climate change impacts become more severe, with a single-month maximum change in precipitation rates of +56% under the 2030 climate scenario and +71% under the 2070 climate scenario. This could result in comparatively higher average recharge rates within the Basin relative to Baseline conditions, even though total precipitation rates are projected to remain nearly constant. On the other hand, the DWR climate change dataset appears to indicate that ET rates are projected to be marginally yet consistently higher as climate change impacts become more severe, with a single-month maximum change in ET rates of +7% under the 2030 climate scenario and +17% under the 2070 climate scenario.

3.1.2.2 Land Use

For all projected scenarios, the historical land use map was updated to reflect future planned urban development and expansion of the MCWD service area in line with future land use conditions specified in MCWD's 2020 Water Master Plan (*AKEL, 2020*). Specifically, a map of future land use (Figure 2.3 of the MCWD Master Plan) was used to adjust the urban footprint within the Marina-Ord Management Area to include all future residential, commercial, industrial, institutional, and mixed-use parcels designated for development over the next 20 years (i.e., by 2040)[23]. Land use in the remaining areas of the Basin was assumed to remain constant with current conditions, in line with the assumption of no future increases in water demands within the Corral de Tierra Management Area (see *Section 3.1.2.3*). The final future land use map is shown in **Figure 27.**

Additionally, for all projected scenarios a stormwater catchment area was delineated around the future MCWD service area boundary to track urban runoff rates in the SMB. Here, an adjustment was made to the SMB code that allowed runoff on urban lands within the future MCWD service area to be re-routed into recharge as a means of directly simulating MCWD's ongoing stormwater recharge management program (see GSP *Section 9.4.4., project M1)*. The SMB estimates that full implementation of this stormwater recharge management program could provide as much as ~1,100 AFY of additional recharge to the future MCWD service area under Baseline projected conditions. It is important to note however

[23] The future (i.e., 2040) MCWD land use map was applied over the entire 50-year projected simulation period to simulate future impacts to recharge rates under full buildout of the City of Marina.

that this added recharge from stormwater capture is at least partially offset by reduced recharge in newly urbanized areas. The MCWD stormwater catchment area is included on the future land use map (**Figure 27**).

3.1.2.3 Deliveries

Projected MCWD deliveries were estimated within the SMB using projected total future water demands from 2020 through 2040 specified in Table 4.10 of the 2020 UWMP (*Schaff & Wheeler, 2021)*. Projected deliveries within the future MCWD service area are detailed in **Table 7** below.

Table 7. Projected MCWD Deliveries

Year	Projected Demand (AFY)
2020	3,367
2025	6,001
2030	7,802
2035	8,879
2040	9,584

Projected MCWD deliveries were scaled linearly over five-year increments up through 2040 (i.e., projected model year 2022), and were then held constant through the remainder of the 50-year projected simulation period.

Deliveries from all other water service areas within the Basin (including CalAm and CWS service areas) were assumed to remain constant at current (i.e., WY 2018) rates throughout the entire 50-year projected simulation period.

Consistent with the historical model, it was assumed that 25% of total projected deliveries would be applied for outdoor uses between April – September, while the remainder of deliveries would be used to meet potable and non-potable indoor demands. It was also assumed that 5% of total projected deliveries would be lost to leakage and thus contribute directly to recharge within each water service area of the Basin.

3.2 Pumping

Pumping is simulated in the MBGWFM using the Well (WEL) Package. Monthly pumping rates were estimated for all known municipal/public supply, agricultural, and domestic wells within the Basin based on available data provided by MCWD (for the Marina-Ord Management Area) and SVBGSA (for the Corral de Tierra Management Area). All pumping was vertically distributed based on available well construction information (i.e., screened interval depths or total well depths). When well construction information was unavailable, pumping was distributed based on aquifer classifications previously determined by MCWD or SVBGSA. A subset of wells are presumed to screen multiple Principal Aquifer units; for these wells, pumping was assigned proportionally to model layers based on the total screen intervals within each layer.

A summary of the datasets and assumptions used to develop historical and projected pumping datasets is provided below. Locations of the pumping wells specified in the model and their relative historical average monthly pumping rates are shown on **Figure 28**.

3.2.1 Historical Simulation

Historical pumping within the Marina-Ord Management Area was estimated from records provided by MCWD. Monthly historical pumping rates from October 1998 – September 2018 were provided for all nine (9) MCWD-owned production wells within the Basin that were in operation over the historical period.

Historical pumping within the Corral de Tierra Management Area was estimated from records provided by SVBGSA. Annual historical pumping rates from October 1998 – September 2018 were estimated for 393 known public supply, agricultural, and domestic wells based on an analysis of public water system wells and information obtained from recent water demand studies within the Corral de Tierra (*Wallace Group, 2020)*.

Additional historical pumping records were obtained from MCWRA for five MCWRA-owned wells north of the Basin boundary.

3.2.2 Projected Simulations

Projected pumping within the Marina-Ord Management area was estimated using projected MCWD water demands specified in the 2020 UWMP (*Schaff & Wheeler, 2021)* and outlined in **Table 7** above. Specifically, two projected pumping scenarios were estimated for MCWD:

- **"No-Projects" Scenario –** assumes 100% of future water demands will be met by groundwater pumping from the MCWD well network
- **"Projects" Scenario –** assumes a portion of future water demands will be met by recycled water or other augmented water supplies (see GSP *Sections 6.5.2 and 9.4.6*)

Under the "Projects" scenario, it is assumed that a portion of MCWD's projected water demand will be satisfied through some form of water supply augmentation. For evaluation purposes, the current projections assume that all recycled water generated by MCWD will be used to augment water supplies within its service area. This project is consistent with the Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse project described in GSP *Section 9.4.6* (project M3). Practically, projected MCWD pumping is reduced from the total projected demands specified in the 2020 UWMP to account for increased availability of recycled water (or other augmented water supplies) over the 20-year planning period. These augmented water supplies are currently modeled as "in-lieu" of groundwater pumping, i.e., through direct, proportional reductions in groundwater pumping from MCWD-owned wells relative to the "no project" scenario pumping demands.

A summary of the projected pumping rates within MCWD under each scenario is provided in **Table 8** below. For both scenarios, pumping was distributed within individual MCWD wells based on historical monthly and total pumping rates at each well[24]. All pumping was scaled linearly over five-year increments

[24] One exception to this is that all historical pumping contributions from MCWD Well 12 will be redistributed to Well 34 since Well 12 was recently taken offline.

up through 2040 (i.e., projected model year 2022), and was then held constant through the remainder of the 50-year projected simulation period.

Table 8. Projected MCWD Pumping Rates

Year	"No Projects" Scenario Pumping (AFY)	Recycled / Augmented Water Supply Offset (AFY)	"Projects" Scenario Pumping (AFY)
2020	3,367	(0)	3,367
2025	6,001	(600)	5,401
2030	7,802	(4,571)	3,231
2035	8,879	(5,129)	3,880
2040	9,584	(5,495)	4,089

Consistent with information and projections provided by SVBGSA, projected pumping within the Corral de Tierra Management Area was assumed to remain constant at current (WY 2018) rates.

4. CALIBRATION

4.1 Calibration Approach

A primary goal of model calibration is to minimize the residual (i.e., difference) between simulated and observed water levels throughout the Basin. This is primarily achieved through systematic and reasonable modifications to model parameters such that simulated water levels match well with observed measurements, both spatially and temporally. Additionally, it is important to observe and account for water budget outputs during model calibration to ensure that groundwater inflows and outflows are within reasonable ranges based on prior available information and studies conducted within the Basin.

In total, 65 unique parameters are specified within the MBGWFM. Model parameters primarily relate to aquifer properties (i.e., hydraulic conductivity and storage) defined within each model layer and for each boundary condition (e.g., conductance terms for the RIV and GHB packages). Given the high complexity and parameterization of the model, calibration was primarily conducted using a software package for Model-Independent Parameter Estimation and Uncertainty Analysis (PEST)[25]. PEST manages the systematic changes to the model parameters, runs the model multiple times, evaluates the effect on simulated water levels, and attempts to minimize model error through use of an objective function. PEST calibration is guided by user input, including specifying priors, bounds, and relationships between model parameters, and can thus be systematically applied to achieve an acceptable model error while keeping the parameter space constrained within reasonable limits.

Further details regarding the model calibration process and results are provided below.

[25] https://pesthomepage.org/

4.2 Calibration Data

Historical groundwater elevation data collected from wells located throughout the Basin were used to calibrate the model. In total, 30,354 groundwater elevation observations collected from 603 wells between October 1998 and September 2018 were used for model calibration. Calibration well locations are shown in **Figure 29**.

4.3 Aquifer Properties

As described in *Section 2.5,* preliminary estimates of aquifer properties were used as initial conditions within the MBGWFM. Through an iterative approach, the modeled water-transmitting and storage properties were calibrated by systematically adjusting the parameter values in PEST to minimize water level residuals.

The calibrated distribution of horizontal hydraulic conductivities are mapped by model layer in **Figure 30** and **Figure 31**. The calibrated distribution of vertical hydraulic conductivities are mapped by model layer in **Figure 32** and **Figure 33**. **Table 9** presents the calibrated storage parameters (including specific yield and specific storage) by model layer.

Table 9. MBGWFM Calibrated Storage Parameters

MBGWFM Layer	Specific Yield (Sy) [-]	Specific Storage (Ss) [1/ft]
1	0.12	1.0E-05
2	0.12	1.0E-05
3	0.12	5.0E-06
4	0.12	5.0E-06
5	0.12	4.0E-06
6	0.12	1.0E-05
7	0.12	3.0E-05
8	0.12	1.0E-05

4.3.1 Evaluation of Calibrated Aquifer Properties

Horizontal hydraulic conductivities (Kh) differ substantially by model layer. Within aquifer units, Kh values are generally highest in model layers 3, 5, and 7 (the Upper 180-Foot, Lower 180-Foot, and 400-Foot Aquifer) and lowest in model layer 8 (the Deep Aquifer). Kh values in aquitard units (i.e., layers 2, 4, and 6) are almost always lower than in overlying and underlying aquifer layers. Boxplots showing a comparison of Kh values estimated from pumping tests (see *Section 2.5*) and model calibrated Kh values are shown in **Figure 34**. In nearly all cases, calibrated Kh values are within the range of values estimated from aquifer pumping tests and other previous hydrogeologic studies as presented in *Section 2.5*.

Vertical hydraulic conductivities (Kv) also differ substantially by layer. Within aquifer units, Kv values are generally highest in layers 5 and 7 (Lower 180-Foot and 400-Foot Aquifers) and lowest in layer 3 (Upper 180-foot aquifer). Kv values in aquitard units (i.e., layers 2,4, and 6) are almost always lower than in overlying and underlying aquifer layers. Kv values are always lower than their Kh counterparts for each model layer, which is indicative of the vertical anisotropy in transmissivity observed within the Basin. No field estimates are currently available to validate Kv values in the Basin, though the calibrated values are generally within the range for alluvial aquifer systems and aquitard units presented in the literature (*Freeze & Cherry, 1979*).

Specific storage (Ss) values differ by aquifer layer. Within aquifer units, Ss values are highest in model layer 7 (400-Foot Aquifer) and lowest in model layers 3 and 5 (Upper and Lower 180-Foot Aquifers). In most cases, calibrated Ss values fall within the range of values estimated from aquifer pumping tests and other previous hydrogeologic studies as presented in *Section 2.5*. Calibrated Ss in model layer 1 (Dune Sand Aquifer) looks to be somewhat low compared to pumping test measurements, though layer 1 is almost always unconfined and thus Ss is usually not employed in head and storage change calculations within this aquifer unit.

Specific yield (Sy) values were ultimately held constant at 0.12 after final model calibration. This is within the range of estimates provided from prior hydrogeologic studies as presented in *Section 2.5*.

4.4 GHB Conductance

GHB conductance terms along each model boundary were ultimately coupled with the Kh values by model layer to provide for a continuous distribution in horizontal hydraulic conductivity along the Basin boundaries.

As discussed in *Section 2.4.2.2.1*, calibrated GHB conductance terms along the southern model boundary result in a reasonable match in historical estimates of Seaside Subbasin cross-boundary flows with the Seaside Model. As discussed in GSP *Section 4,* MBGWFM estimates of historical cross-boundary flows with the 180/400-Foot Aquifer Subbasin are significantly higher than analogous estimates provided in the 180/400 GSP (*SVBGSA, 2016*), though both acknowledge a consistent outflow gradient from Monterey Subbasin to the 180/400-Foot Aquifer Subbasin. This discrepancy is not surprising and well founded. Due to time constraints, historical and current water budgets presented in the 180/400 Foot Aquifer GSP were developed by aggregating data and analyses from previous reports and other available sources. No numerical modeling was completed to develop the historical or current water budget. The limitations of the historical water budget analyses included in the 180/400 Foot Aquifer GSP are well acknowledged within the GSP and additional analyses are being conducted as part of the 5-year review process.

In fact, as noted in the 180/400 Foot Aquifer GSP, the estimated inflow from the Monterey Subbasin of 3,000 AFY/year was taken from a Montgomery Watson document produced in 1997. This document generally looks at data that pre-dates the Historical Period evaluated in the Monterey GSP (1994 through 2018). It is based on a very limited data set and does not reflect conditions within these subbasins over the last 15 years. The Salinas Valley Integrated Hydrologic Model (SVIHM), which was developed by the U.S. Geological Survey (USGS) for the entire Salinas Valley Groundwater, was used to develop projected water budgets in the 180/400 Foot Aquifer GSP and water budgets for other Salinas Valley subbasins. However, as discussed in detail in Montgomery & Associates 2 April 2021 Technical Memorandum to the SVBGSA Advisory Committee (GSP Appendix 6C) "SVIHM does not accurately reflect hydrologic conditions in the Monterey Subbasin. SVIHM calibration efforts primarily focus on other portions of the Salinas Valley Groundwater Basin where there is significant agricultural groundwater use. The SVIHM was not calibrated to any groundwater level data from the Seaside Subbasin and included only one calibration location in the Monterey Subbasin. M&A believes the SVIHM is not detailed or accurate in the Monterey Subbasin." Thus, any direct comparison between cross-boundary subbasin flow estimates developed using the MBGWFM and those presented in the 180/400 Subbasin GSP or developed using SVIHM are not useful. No prior estimates of volumetric exchanges between the Monterey Subbasin and the Pacific Ocean are available for comparison.

SVBGSA is in the process of developing a variable density driven groundwater model for the coastal regions of the greater Salinas Valley Basin. This model will incorporate the MBGWFM and be used to further assess volumetric exchanges between the ocean and the Salinas Valley groundwater basin. It will also aid in evaluating flows across subbasin boundaries and will be used evaluate impacts of potential regional projects that have been proposed in this GSP and other GSPs to address seawater intrusion in the Salinas Valley groundwater basin.

4.5 Streambed Conductance

Streambed conductance terms were adjusted in PEST and range from 0.1 ft/d to 10 ft/d depending on reach and uppermost active underlying model layer. Model results indicate the Salinas River is largely hydraulically disconnected from the Basin due to its presence on top of the largely impermeable Fort Ord/Salinas Valley Aquitard. An exception to this is in the northeastern corner of the Basin within the Corral de Tierra Management Area, where the Salinas River is directly underlain by the more permeable El Toro Primary Aquifer System. Here, the Salinas River is estimated to contribute a net inflow of ~150 AFY to the Basin during the historical model period.

4.6 Recharge

Unlike with aquifer storage properties, recharge rates are difficult to quantify with precision due to the general absence of direct monitoring data to support model calibration. Recharge inputs to the MBGWFM were not explicitly included as a parameter in the PEST calibration routine, but were rather manually adjusted through systematic modifications to parameters in the SMB to ensure recharge rates were within reasonable ranges when compared to other regional models and prior studies.

Annual, historical land surface water budget outputs from the calibrated SMB model are provided for the entire Basin and by Management Area in **Appendix 6A** of the GSP (see *Tables 6A-4 through 6A-6).* On average, the calibrated SMB calculates 10,055 AFY of recharge to the Basin, or 0.33 ft/yr. This represents a normalized recharge rate of 24% of total precipitation and applied water within the Basin, which is within the range of typical recharge rates estimated for the region. Recharge rates vary significantly by year, with most recharge occurring during wet years (e.g., 0.62 ft/yr in WY 2006) and very little occurring during dry years (e.g., 0.06 ft/yr in WY 2012). Recharge rates are typically highest in undeveloped areas of the Basin and are lowest in urbanized areas with significant impervious lands.

As part of SMB calibration, recharge outputs were compared to analogous outputs from the Salinas Valley Integrated Hydrologic Model (SVIHM)[26] (**Figure 35**). The SVIHM employs the MODFLOW Farm Package to estimate recharge rates, which functions similarly to the SMB developed for the MBGWFM. Comparison between the SMB and SVIHM indicates that average Basin-wide recharge rates calculated from the SMB are +12% higher than those calculated from the SVIHM over like timeframes. However, it is important to note that data and assumptions on land use classes, applied water, and other parameters differ between

[26] *Ibid [14].*

the two models, and thus a direct comparison of recharge volumes may be misleading. When looking closer at normalized recharge rates, it appears that the SMB and SVIHM track very closely in most areas of the Basin. For example, the SMB calculated ~25.3% of total precipitation and applied water as contributing to recharge in the Corral de Tierra Management Area, compared to ~25.6% calculated from the SVIHM. The most significant difference between the two models is within urban areas, where the SMB calculates ~11.6% recharge of precipitation and applied water compared to ~5.8% calculated from SVIHM. Notably, the SVIHM does not appear to account for deliveries from the various water suppliers within the basin in its Urban "farm", which may in part explain the discrepancy. The SVIHM also does not account for leakage from water conveyance systems within these areas. Therefore, it appears the discrepancy in Basin-level recharge between the two models can be primarily explained by differences in input datasets and assumptions between the two models rather than fundamental differences in recharge calculation methodologies.

4.7 Calibration Results

MBGWFM calibration was assessed using statistics calculated from the differences between observed and simulated water levels (residuals), a map of residuals, plots of calibration results, and hydrographs of observed and calculated water levels. Final model calibration statistics are summarized by aquifer layer and for the entire model in **Table 10**.

Table 10. MBGWFM Calibration Statistics

MBGWFM Layer	Water Level Count	Range in Observations (ft)	Mean Residual (ft)	Residual Standard Deviation (ft)	RMSE (ft)	Normalized RMSE (%)
1	11,941	123.2	-0.3	11.3	11.3	9.2%
3	9,032	98.7	-2.1	5.2	5.7	5.7%
5	4,785	74.6	-6.5	3.5	7.3	9.8%
7	1,836	119.9	-5.0	5.2	7.2	6.0%
8	3,210	728.4	7.1	19.6	20.8	2.9%
ALL	**30,354**	**728.4**	**-1.3**	**10.7**	**10.8**	**1.5%**

The root-mean square error (RMSE)[27] for the entire model is **10.8 ft** and the mean residual (error) is **-1.3 ft**, indicating that simulated water levels are underestimated by 1.3 ft on average. The normalized RMSE, expressed as a percent of the observed range in water levels, is below 10% within individual model layers and **1.5%** for the entire model. A generalized rule of thumb in model calibration is that the model is considered well-calibrated when the normalized RMSE is less than 10%.[28] The low normalized RMSEs are therefore an indicator that the model is well-calibrated as a whole and within individual layers given the range of observed data.

[27] RMSE is a quantitative measure of the closeness of fit and is calculated as the square root of the average squared residuals.
[28] If there is a large range in observed water levels, as is the case in the MBGWFM, normalized calibration metrics can be less reliable (Anderson and Woessner, 1991).

A scatter plot of calculated vs. observed water levels and a histogram of residuals are shown in **Figure 36**. In a perfect calibration, the points would plot exactly along the solid 1:1 match line. Points above the line represent simulated water levels that are overestimated relative to observed data and points below the line represent simulated water levels that are underestimated relative to observed data. The scatter plot shows a fairly equal distribution of points above and below the line. The slope of the regression line (0.97) and near-zero intercept (-0.68) indicates that there is a good match between calculated and observed water levels, with only a slight negative bias in the residuals. The histogram of residuals shown on **Figure 36** are roughly evenly distributed around a mean of -1.3 feet with a standard deviation of 10.7 feet. Most residuals lie within one standard deviation of the mean. The slight bias of residuals to the negative side of zero indicates that the simulated water levels tend to be slightly smaller than observed water levels.

Average residuals are shown by well on **Figure 37**. Residuals are representative of site-specific errors between the modeled and observed water. A positive value indicates simulated water levels are greater than observed water levels and a negative value indicates simulated water levels are less than observed water levels. Average residuals are spatially variable, though some patterns appear to exist within individual model layers:

- In Layer 1, simulated water levels are generally overestimated at wells located near the coast and underestimated at wells located east of the City of Marina;
- In Layer 3, simulated water levels are underestimated by ~13 feet on average at the cluster of wells located just south of the Salinas River, and by ~3 feet on average at the cluster of wells located along the coast;
- In Layer 5, simulated water levels are persistently underestimated by ~6 feet on average at all observation wells;
- In general, the greatest residuals occur within the Corral de Tierra Management Area in model Layer 8, where limited historical water level data are available to inform model calibration. Simulated water levels are overestimated by ~18 feet on average within the Corral de Tierra Management Area, though residuals range from +79 feet to -46 feet at individual wells.

The high residuals observed at calibration wells in the Corral de Tierra Management Area can in part be explained by the simplified conceptualization and model representation of the aquifer system in this portion of the Basin. As described in *Section 2.2.3*, a single principal aquifer unit (the “El Toro Primary Aquifer”) has been defined within the Corral de Tierra and is currently being represented in the MBGWFM using a single model layer (Layer 8). As further described in *Section 4* of the GSP, historical water level measurements collected from wells screening the El Toro Primary Aquifer can vary substantially with well depth, indicating the presence of vertical gradients. These depth-dependent trends in measured water levels within the El Toro Primary Aquifer Unit contribute to the high range and magnitude in residuals seen at Layer 8 wells within the Corral de Tierra portion of the MBGWFM. In general, the historical model tends to overestimate simulated water levels at calibration wells screening the shallow portion of the El Toro Primary Aquifer Unit (e.g., MPWMD FO-05S) and underestimate water levels at the deeper screened calibration wells (e.g., MPWMD FO-05D).

Hydrographs of simulated and observed water levels are included in ***Attachment 1*.** The locations of wells with hydrographs are shown on **Figure 29**. Hydrographs of measured and simulated water levels generally match well for most wells within the Basin, especially within model layers 1, 3, 5, and 7. As mentioned above, model errors are noticeably greater at certain wells in model layer 8, where less data is available to inform aquifer properties and their spatial and vertical distribution. A more complete discussion of model limitations and suggested future refinements is provided in *Section 6* below.

5. SENSITIVITY ANALYSIS

A sensitivity analysis was conducted to evaluate the effects of changing model parameters on model calibration. The analysis was conducted by changing model parameters in a systematic way and assessing the impact on the simulated water levels. The sensitivity analysis was conducted using PEST. PEST manages the systematic changes to the model parameters, runs the model multiple times, evaluates the effect on simulated water levels, and calculates the composite sensitivities for each parameter of interest.

The composite sensitivity was calculated for **65** parameters representing horizontal hydraulic conductivity, vertical hydraulic conductivity, specific storage, specific yield, general-head boundary conductance, and streambed conductance. The composite sensitivities were calculated for each layer represented by these parameters. Composite sensitivities for the 10 most sensitive parameters are shown in **Figure 38.** These 10 parameters represent 99.8% of the total composite sensitivities in the model. The composite sensitivities for the 54 parameters not shown in the figure are each less than 0.13%.

The most sensitive parameters in the MBGWFM are, by relative order: (1) the vertical hydraulic conductivity of Layer 2 (the Fort Ord/Salinas Valley Aquitard); (2) the specific storage values for all layers; and (3) the specific yield values for layer 1.

Vertical conductivity (Kv) in layer 2 appears to govern how much recharge enters the lower layers of the model versus being withheld within layer 1 (i.e., the Dune Sand Aquifer). As such, it is to be expected that Kv of layer 2 will have a substantial influence on simulated water levels in all layers. The final calibrated Kv of layer 2 was set at 2.0E-4 ft/d, in line with typical vertical conductivities for a clay-rich confining unit (*Freeze & Cherry, 1979)*. Additional data collection regarding seepage rates through the Salinas Valley Aquitard and interconnectivity between the Dune Sand and underlying 180-Foot Aquifer could help further constrain this parameter and thus improve model calibration.

There are very little data characterizing specific storage or specific yield values in the Basin apart from a limited number of pumping test measurements (see *Section 2.5.2*), which are in themselves quite variable. Given the uncertainty in measured values of specific storage and specific yield and the high sensitivity of these parameters, additional data collection (e.g., more pumping tests) could help constrain the range of values specified in the model.

Sensitivity analysis was performed on inputs to the SMB to determine which inputs have the largest impacts on recharge outputs. Recharge calculations in the SMB were found to be most sensitive to precipitation and ET inputs. Precipitation input to the SMB was estimated using PRISM data and ET input was estimated using crop coefficients and CIMIS reference evapotranspiration data (see *Section 3.1)*. A 10% change in precipitation input to the SMB model resulted in a 7% change in recharge. A 10% change in ET input to the SMB resulted in a 7% change in recharge. Recharge is less sensitive to other parameters and assumptions in the SMB such as soil depth, depression storage, and the ET stress function multiplier.

6. MODEL LIMITATIONS AND SUGGESTED FUTURE REFINEMENTS

Numerical models are mathematical representations of physical systems. They have limitations in their ability to represent physical systems exactly and due to limitations in the data inputs used. There is also inherent uncertainty in groundwater flow modeling itself, since mathematical (or numerical) models can only approximate physical systems and have limitations in how they compute results. However, DWR recognizes that although models are not exact representations of physical systems because mathematical depictions are imperfect, they are powerful tools that can provide useful insights (*DWR, 2018*).

The MBGWFM was developed using established scientific practices and principals for groundwater flow simulation and calibrated using the best available data within the Basin. Inputs to the models are carefully selected using best available data, the model's calculations represent established science for groundwater flow, and the model calibration error is within acceptable bounds. Therefore, the models are the best available tools for estimating water budgets and simulating projected groundwater conditions. As demonstrated by the calibration error statistics summarized in *Section 4.7* the MBGWFM reasonably represents historical groundwater conditions within the Subbasin using a set of parameters that are within the range of real-world observations and established scientific principles.

As is the case with any numerical groundwater flow model, the MBGWFM is subject to uncertainties and data gaps in hydrogeologic conceptualization (e.g., depth and extent of principal aquifer units), model parameterization (e.g., aquifer transmitting and storage properties) and calibration data (i.e., historical water level monitoring data), and simulated stresses (e.g., recharge, pumping, and boundary conditions). Here, "uncertainty" refers to the incomplete understanding of the physical setting, characteristics, and current conditions that significantly affect calculation of the water budgets presented above. "Data gaps" refer to limitations in the spatial coverage of measured data, or periods of time when no data are available. Each of these main categories of uncertainty and/or data gaps contribute to overall uncertainty in the water budget outputs from MBGWFM.

A summary of the main limitations of the model and corresponding water budgets identified from this analysis is provided below.

- **Uncertainty in Simulated Boundary Conditions.** As described in *Section 2.4.2*, inter-basin cross-boundary flows were simulated at the 180/400 Foot Aquifer Subbasin boundary based on historical groundwater elevation measurements from nearby wells, at the Seaside Subbasin boundary based on outputs from the historical Seaside Basin Groundwater Flow Model (*Hydrometrics 2009 & 2018*), and at the Monterey Coast based on freshwater equivalent sea levels. The datasets and assumptions used to model boundary conditions at each Subbasin boundary are subject to their own uncertainties, data gaps, and limitations, including:
  - *Lack of Deep Aquifer wells with historical data in the 180/400 Foot Aquifer Subbasin.* As described in *Section 2.4.2.1*, only a small number of wells exist in the Deep Aquifer within the 180/400 Foot Aquifer Subbasin with observed water level data spanning the full duration of the Historical Period. As such, simulated Deep Aquifer heads along the northern model boundary are subject to the limitations in available data to the north of the boundary, which may impact resulting calculations of 180/400 Foot Aquifer Subbasin exchanges within the water budget.
  - *Incomplete conceptualization of Principal Aquifer units in the Seaside Basin Groundwater Flow Model.* As described in *Section 2.4.2.2*, The Seaside model does not explicitly simulate groundwater flow from each Principal Aquifer unit defined in the Monterey Subbasin GSP, but rather uses a unique conceptualization of aquifer units that is primarily based on the main geologic formations encountered in the Seaside Area Subbasin (i.e., the Aromas Sands, Paso Robles Formation, and Santa Margarita/Purisima Formations). As such, there is considerable uncertainty surrounding the assumptions employed to link outputs from the Seaside model to individual layers of the MBGWFM, which may impact resulting calculations of Seaside Area Subbasin exchanges within the water budget.

- *Uncertainty in freshwater equivalent head calculations at the Monterey Coast.* As discussed in *Section 2.4.2.3*, freshwater equivalent sea levels at the Monterey Coastline are calculated based on the USGS equivalent freshwater head formula (*Guo & Langevin, 2002*). The depths and distances at which principal aquifer units outcrop along the seafloor were estimated to inform corresponding freshwater equivalent heads at the aquifer-seafloor interface. There is considerable uncertainty surrounding the depths and distances at which each principal aquifer unit comes in contact with the sea floor, which may impact resulting calculations of Ocean exchanges within the water budget.

- **Uncertainty in Pumping Estimates within the Corral de Tierra (CDT) Management Area.** Very limited historical groundwater pumping data are available for the CDT Management Area. As such, CDT groundwater pumping demands were estimated for small water systems and domestic wells by SVBGSA using extraction reported to MCWRA and SWRCB where available, and approximated based on the number of deliveries for the small water systems and parcel size for the *de minimis* users (i.e., domestic wells). Therefore, the accuracy of CDT groundwater pumping estimates included in the water budget is limited by the lack of available pumping data and uncertainty in the CDT pumping estimates provided by SVBGSA.

- **Uncertainty in Deep Aquifer Representation.** Groundwater elevation data collected from the Deep Aquifer and the El Toro Primary Aquifer System (both represented by model layer 8) show heterogeneous conditions in the upper and lower portions of these aquifers. As discussed in GSP *Section 5*, a vertical gradient exists between the Paso Robles and Santa Margarita formations of the El Toro Primary Aquifer System. In addition, heterogeneous groundwater elevations were observed in the shallow and deep screens of Deep Aquifer well clusters as shown in GSP Figure 5-14. However, currently there is not enough spatial coverage of data to characterize the upper and lower portions of these aquifers as separate aquifers. Refining representation of the Deep Aquifer(s) and the El Toro Primary Aquifer System will facilitate connectivity between the MBGWFM and the Seaside Subbasin Model, and therefore refine calculation of inter-basin flows. Additional data is needed within both (a) the Monterey Subbasin to characterize and calibrate upper and lower portions of these aquifers and (b) the adjacent subbasins to establish boundary conditions.

- **Lack of Water Level Calibration Data.** Though the MCWD service area, former Fort Ord Site, and CWS/Cal-Am water service areas within CDT are well monitored, very limited historical groundwater elevation data exists in other portions of the Basin including near the Reservation Road area, in the Fort Ord Hills, and within the Deep Aquifer unit. As such, MBGWFM calibration in these areas is limited by the lack of available calibration data to quantify model error and inform localized adjustments to model parameterization.

- **Climate Change Uncertainty.** As described in *Section 3.1.2.1*, climate change scenarios were developed based on DWR's 2030 and 2070 Central Tendency climate modeling scenarios (DWR, 2020). These climate scenarios provide a standard framework for defining what might be considered the most likely future climate conditions within the Basin; however, they are inherently subject to considerable uncertainty. As stated in DWR (2018):

    - *"Although it is not possible to predict future hydrology and water use with certainty, the models, data, and tools provided [by DWR] are considered current best available* science *and, when used appropriately should provide GSAs with a reasonable* point *of reference for future planning."*

  - *"All models have limitations in their interpretation of the physical system and the types of data inputs used and outputs generated, as well as the interpretation of outputs. The climate models used to generate the climate and hydrologic data for use in water budget development were recommended by [the DWR Climate Change Technical Advisory Group] for their applicability to California water resources planning."*

- **Uncertainty in Aquifer Parameters.** As described in *Section 5*, a sensitivity analysis was performed to identify the most sensitive aquifer parameters that will impact simulated water levels and was subsequently used to direct further calibration efforts. In general, it was discovered that the model was most sensitive to specific storage parameters in each principal aquifer unit as well as the vertical hydraulic conductivity in the Fort Ord/Salinas Valley Aquitard. These aquifer parameters were further calibrated using a combination of PEST calibration procedures and professional judgement. As described in *Section 4*, all final calibrated aquifer parameters fall within their respective ranges reported in available pumping test data collected from wells within the Basin.

7. REFERENCES

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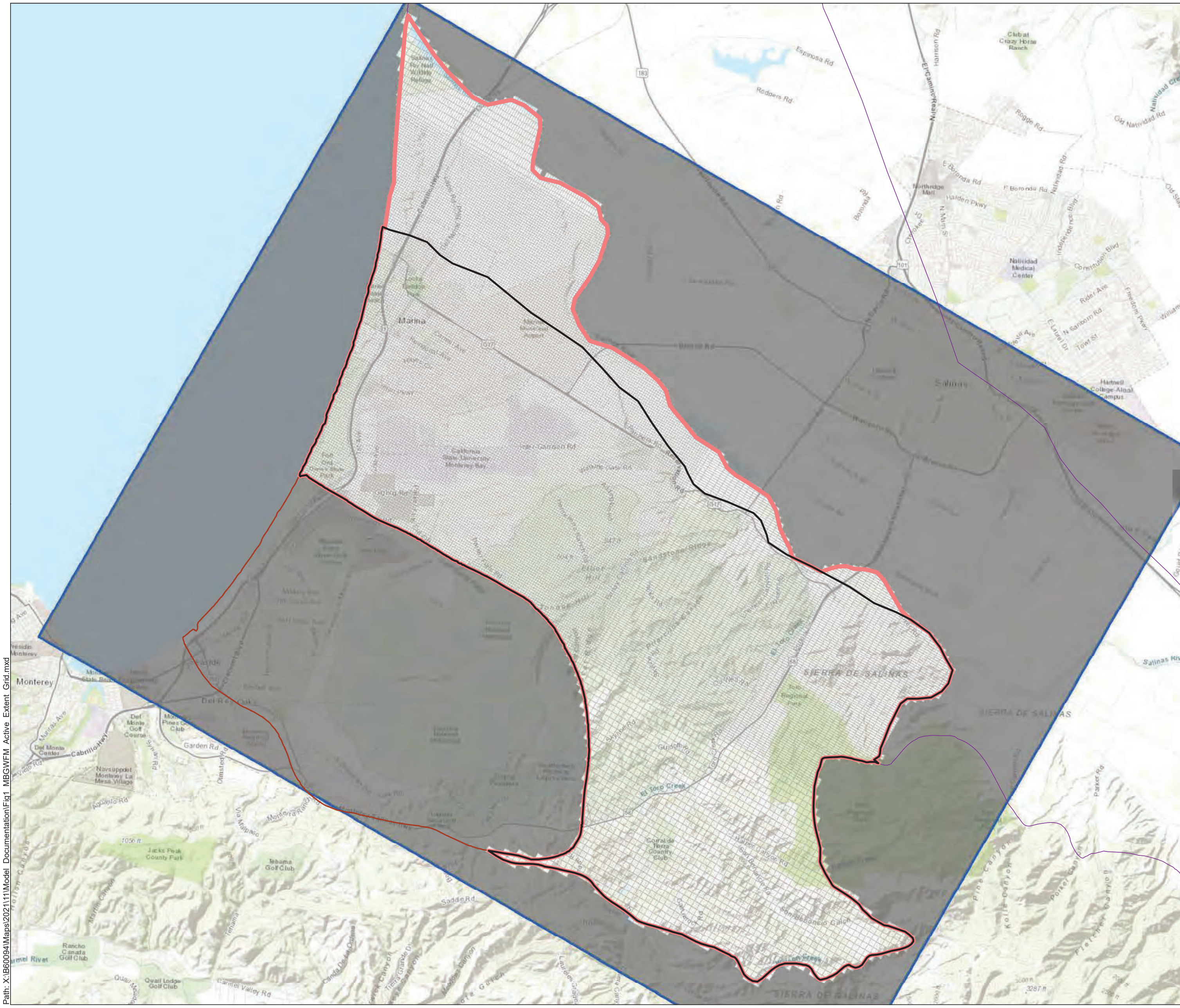


Legend

- Monterey Subbasin
- 180/400-Foot Aquifer Subbasin
- Seaside Subbasin
- Grid Extent
- MBGWFM Active Area

MBGWFM Grid

- Active Cells
- Inactive Cells

Abbreviations

DWR = California Department of Water Resources

MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes

1. All locations are approximate.

Sources

1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

N 0 1 2 (Scale in Miles)

MBGWFM Active Extent and Grid

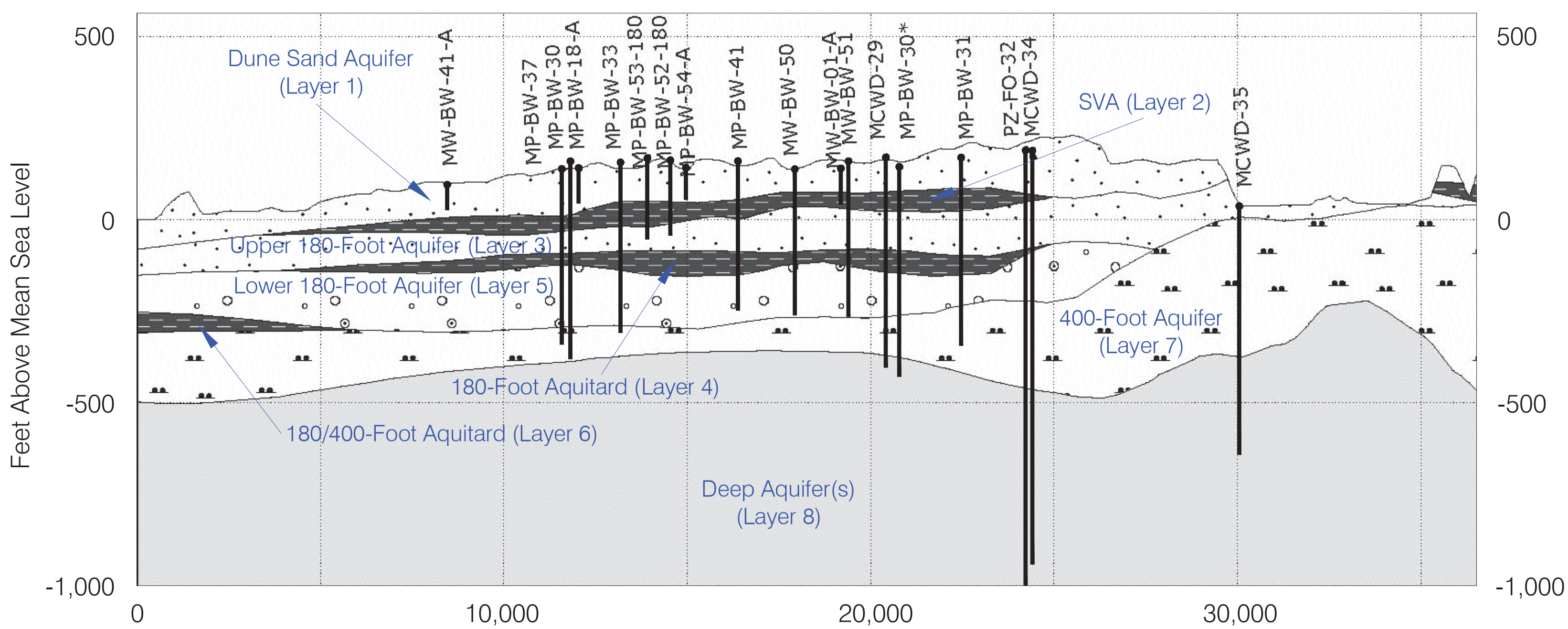
Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03

Figure 1

eki environment & water

Path: X:\B60094\Maps\2021\11\Model Documentation\Fig1 MBGWFM Active Extent Grid.mxd

20200921.140133 G:\B60094.09\2020-09\Figure 3-5.dwg section b



Key Map

Legend:

Hydrostratigraphy Model
- Aquifers
- Aquitards
- Deep Aquitard / Deep Aquifer(s)
- Borehole

(Vertical Scale in Feet) 0 100 200 300 400 500

(10X Vertical Exaggeration)

5,000 10,000
(Horizontal Scale in Feet)

Abbreviations:

AEM = airborne electromagnetic
mg/L = milligrams per liter
SVA = Salinas Valley Aquitard

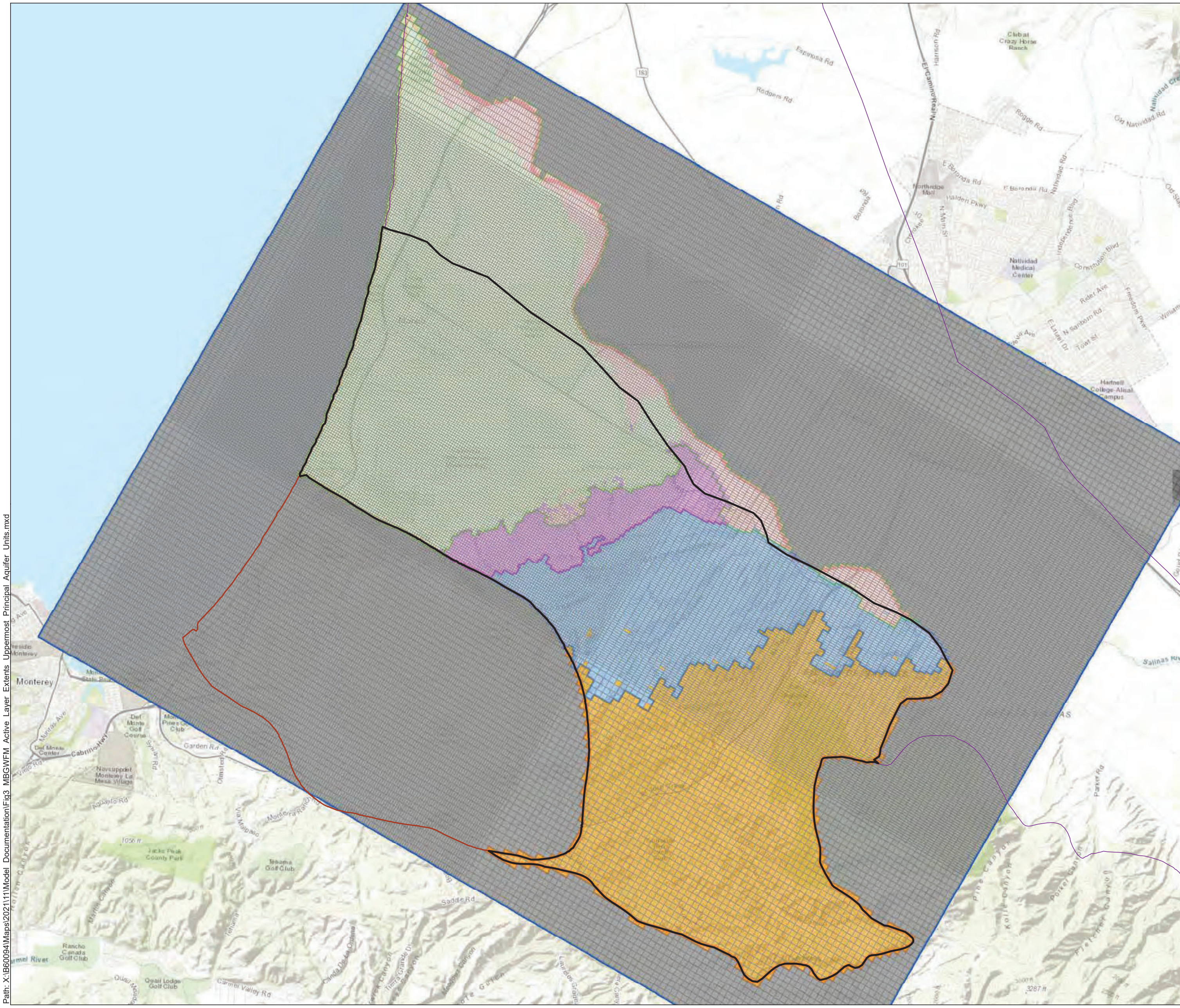
Notes:

1. All locations are approximate.
2. The hydrostratigraphy model is Model A obtained from Stanford/Aqua Geo Frameworks (2018), developed based on cross-sections from previously published reports, borehole lithology logs, and 2017 AEM survey data. The hydrostratigraphy model is approximate.

Leapfrog Cross-Section and MBGWFM Layering within the Marina-Ord Management Area

Monterey Subbasin
Groundwater Sustainability Plan
November 2021

Figure 2



Legend

- Monterey Subbasin
- Seaside Subbasin
- 180/400-Foot Aquifer Subbasin

Uppermost Active Unit

- Layer 1
- Layer 2
- Layer 3
- Layer 6
- Layer 7
- Layer 8
- Inactive

MBGWFM Grid

- Active Cells
- Inactive Cells
- Grid Extent
- Layers 1-2 Extent
- Layers 3-6 Extent
- Layer 7 Extent
- Layer 8 Extent
- MBGWFM Active Area

Abbreviations
DWR = California Department of Water Resources
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. All locations are approximate.

Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

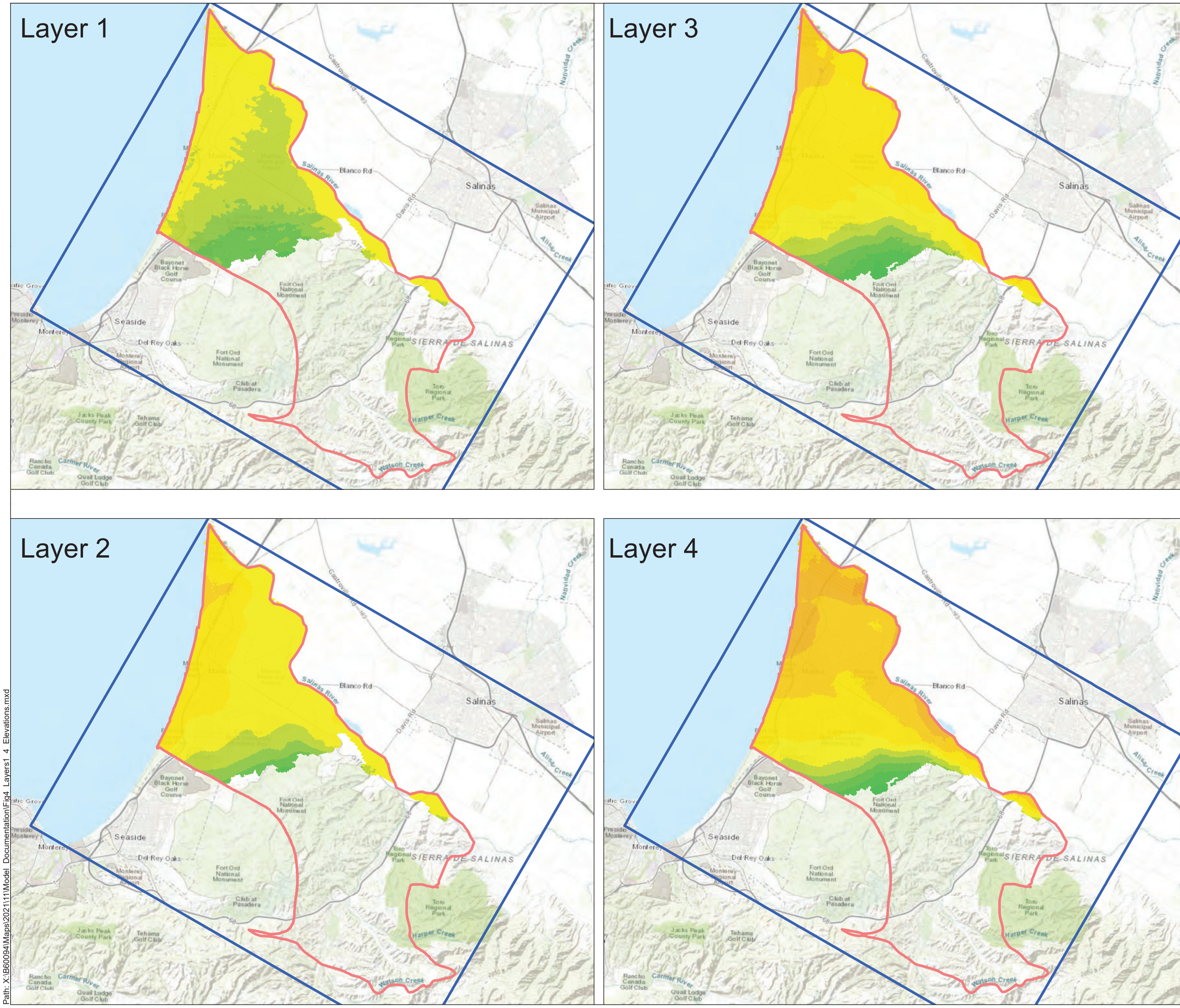
N 0 1 2 (Scale in Miles)

MBGWFM Active Layer Extents and Uppermost Principal Aquifer Units

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03
Figure 3

eki environment & water

Path: X:\B60094\Maps\2021\11\Model Documentation\Fig3 MBGWFM Active Layer Extents Uppermost Principal Aquifer Units.mxd



Legend
- Grid Extent
- MBGWFM Active Area

Layer Top Elevation (ft msl)
- <-700
- -699 - -600
- -599 - -500
- -499 - -400
- -399 - -300
- -299 - -200
- -199 - -100
- -99 - 0
- 1 - 100
- 101 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- 501 - 600
- 601 - 700
- 701 - 800
- 801 - 900
- 901 - 1000
- 1001 - 1100
- 1101 - 1200
- >1201

Abbreviations
ft msl = feet above mean sea level
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. All locations are approximate.

Sources
1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 9 November 2021.

N
0 3 6
(Scale in Miles)

MBGWFM Layer Top Elevations
Layers 1 - 4

Marina Coast Water District
Monterey County, CA
November 2021
EKI B60094.03
Figure 4

eki environment & water

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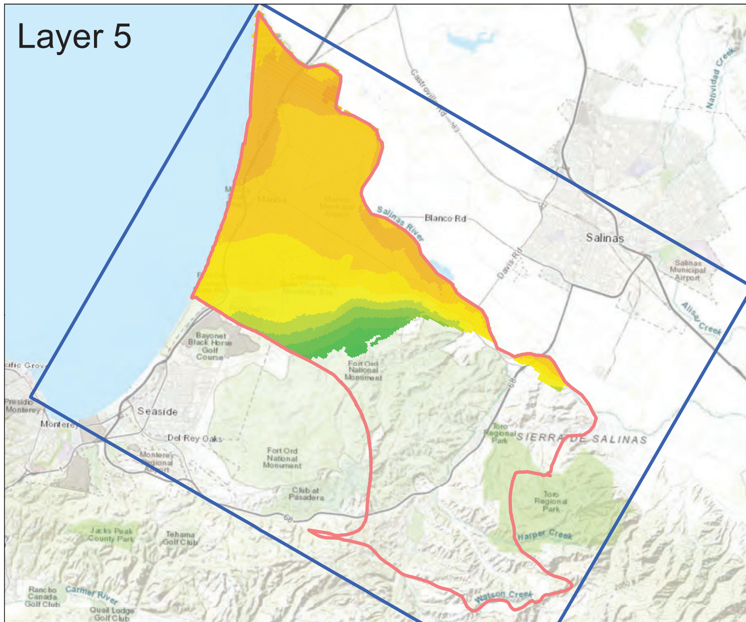

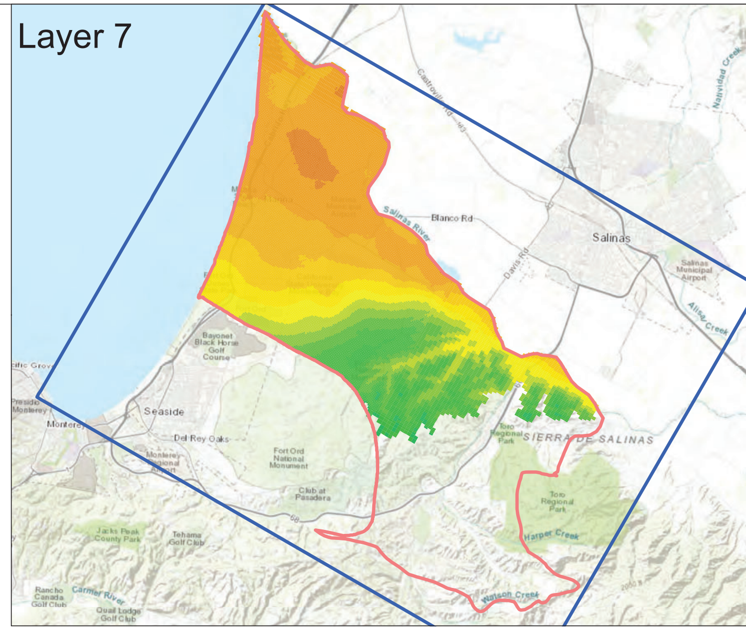

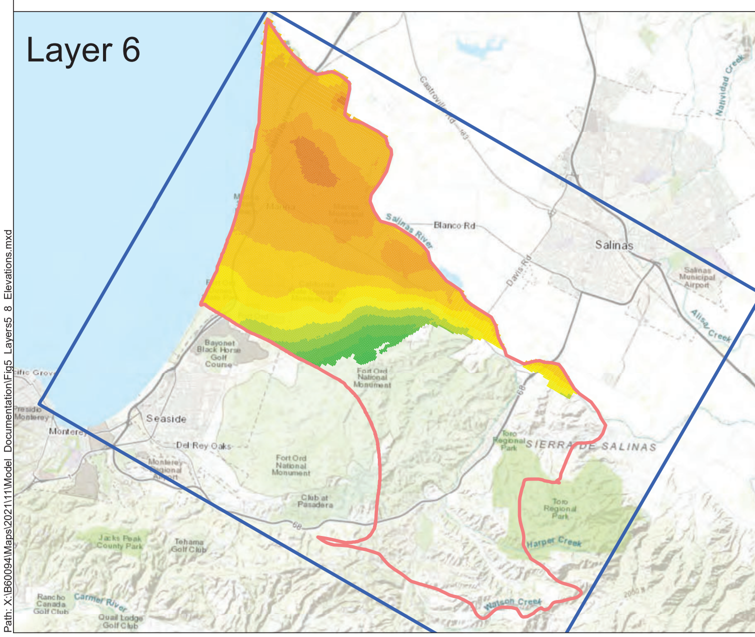

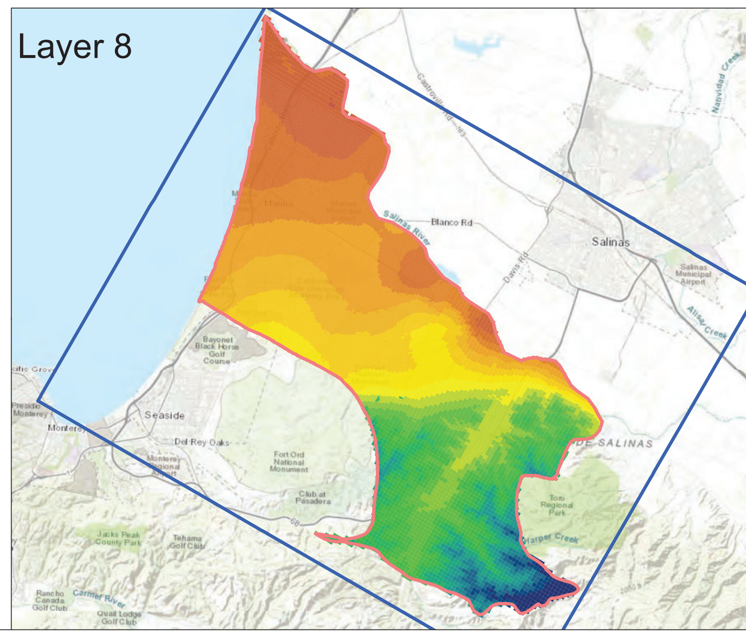

Legend

Grid Extent

MBGWFM Active Area

Layer Top Elevation (ft msl)

- <-700
- -699 - -600
- -599 - -500
- -499 - -400
- -399 - -300
- -299 - -200
- -199 - -100
- -99 - 0
- 1 - 100
- 101 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- 501 - 600
- 601 - 700
- 701 - 800
- 801 - 900
- 901 - 1000
- 1001 - 1100
- 1101 - 1200
- >1201

Abbreviations

ft msl = feet above mean sea level

MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 9 November 2021.

N

0 3 6

(Scale in Miles)

MBGWFM Layer Top Elevations
Layers 5 - 8

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Marina Coast Water District
Monterey County, CA
November 2021
EKI B60094.03

Figure 5

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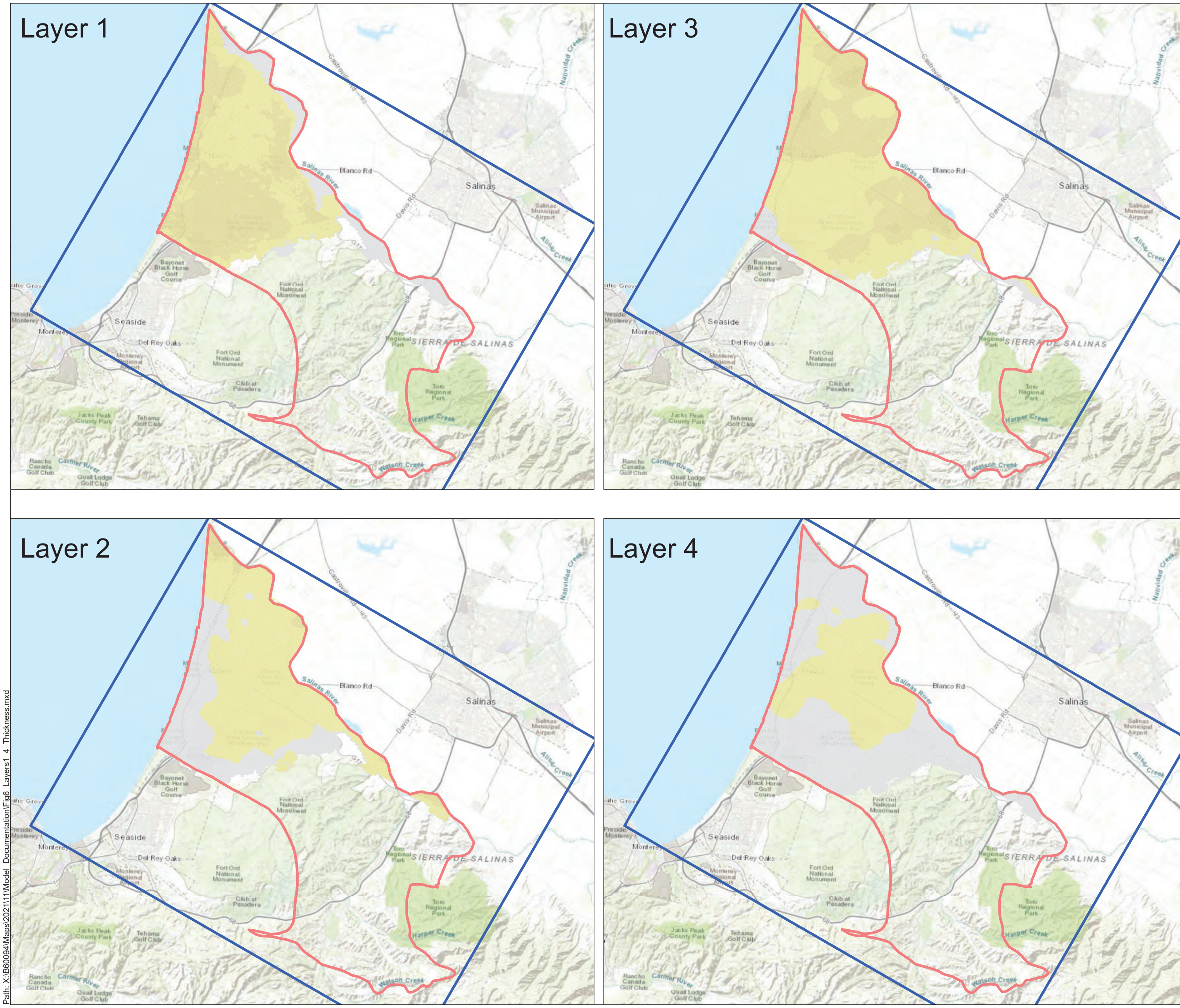

Legend
Grid Extent
MBGWFM Active Area

Layer Thickness (ft)

5 ft (flow-through cells)	1201 - 1300
6 - 100	1301 - 1400
101 - 200	1401 - 1500
201 - 300	1501 - 1600
301 - 400	1601 - 1700
401 - 500	1701 - 1800
501 - 600	1801 - 1900
601 - 700	1901 - 2000
701 - 800	2001 - 2015
801 - 900	2016 - 2200
901 - 1000	2201 - 2300
1001 - 1100	2301 - 2400
1101 - 1200	2401 - 2500
	>2501

Abbreviations
ft = feet
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. All locations are approximate.

Sources
1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 23 November 2021.

N
0 3 6
(Scale in Miles)

MBGWFM Layer Thickness
Layers 1 - 4

Marina Coast Water District
Monterey County, CA
November 2021
EKI B60094.03
Figure 6

eki environment & water

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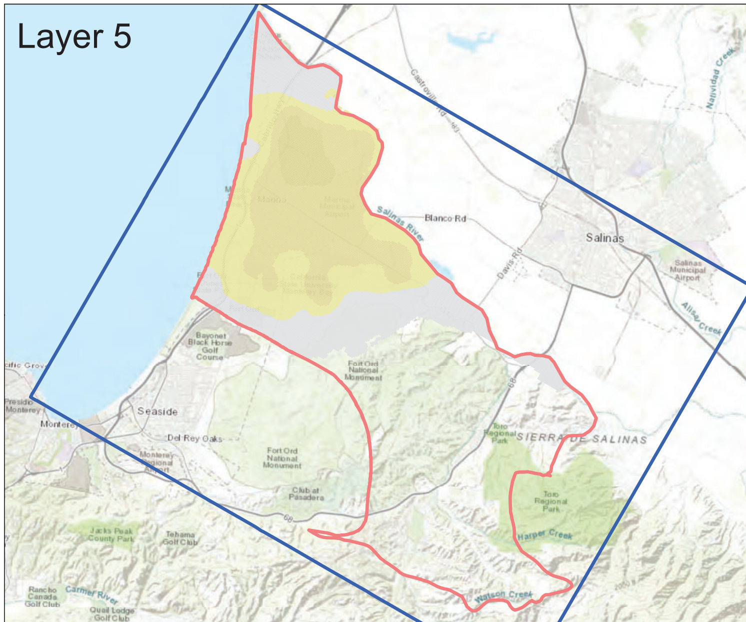

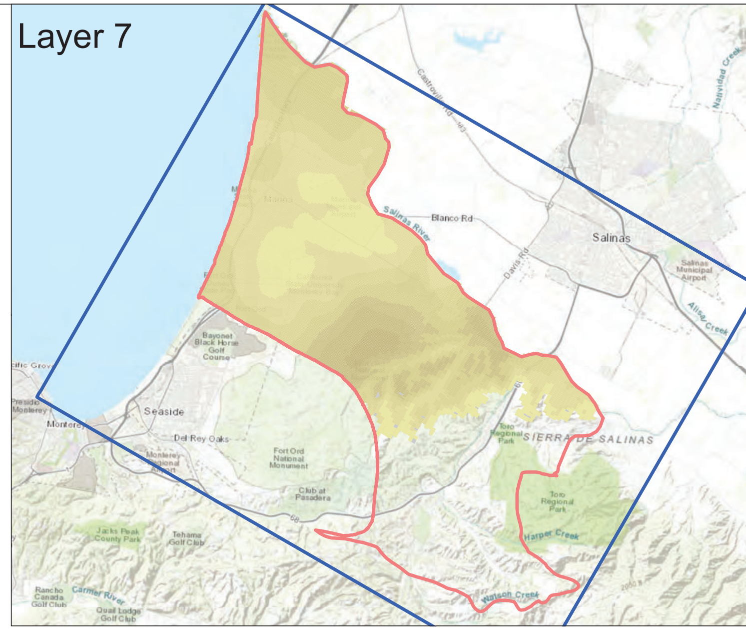

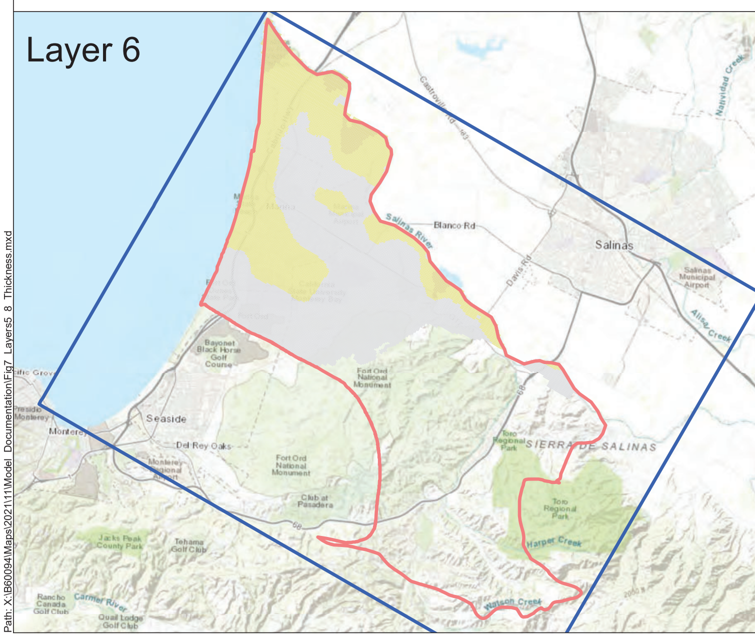

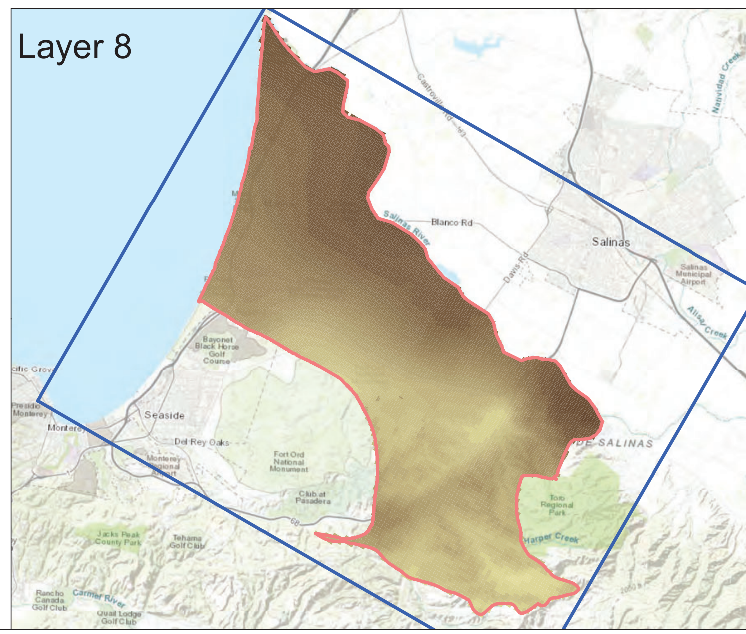

Legend

Grid Extent

MBGWFM Active Area

Layer Thickness (ft)

5 ft (flow-through cells)	1201 - 1300
6 - 100	1301 - 1400
101 - 200	1401 - 1500
201 - 300	1501 - 1600
301 - 400	1601 - 1700
401 - 500	1701 - 1800
501 - 600	1801 - 1900
601 - 700	1901 - 2000
701 - 800	2001 - 2015
801 - 900	2016 - 2200
901 - 1000	2201 - 2300
1001 - 1100	2301 - 2400
1101 - 1200	2401 - 2500
	>2501

Abbreviations

ft = feet

MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 9 November 2021.

N

0 3 6

(Scale in Miles)

MBGWFM Layer Thickness
Layers 5 - 8

Marina Coast Water District
Monterey County, CA
November 2021
EKI B60094.03

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Figure 7

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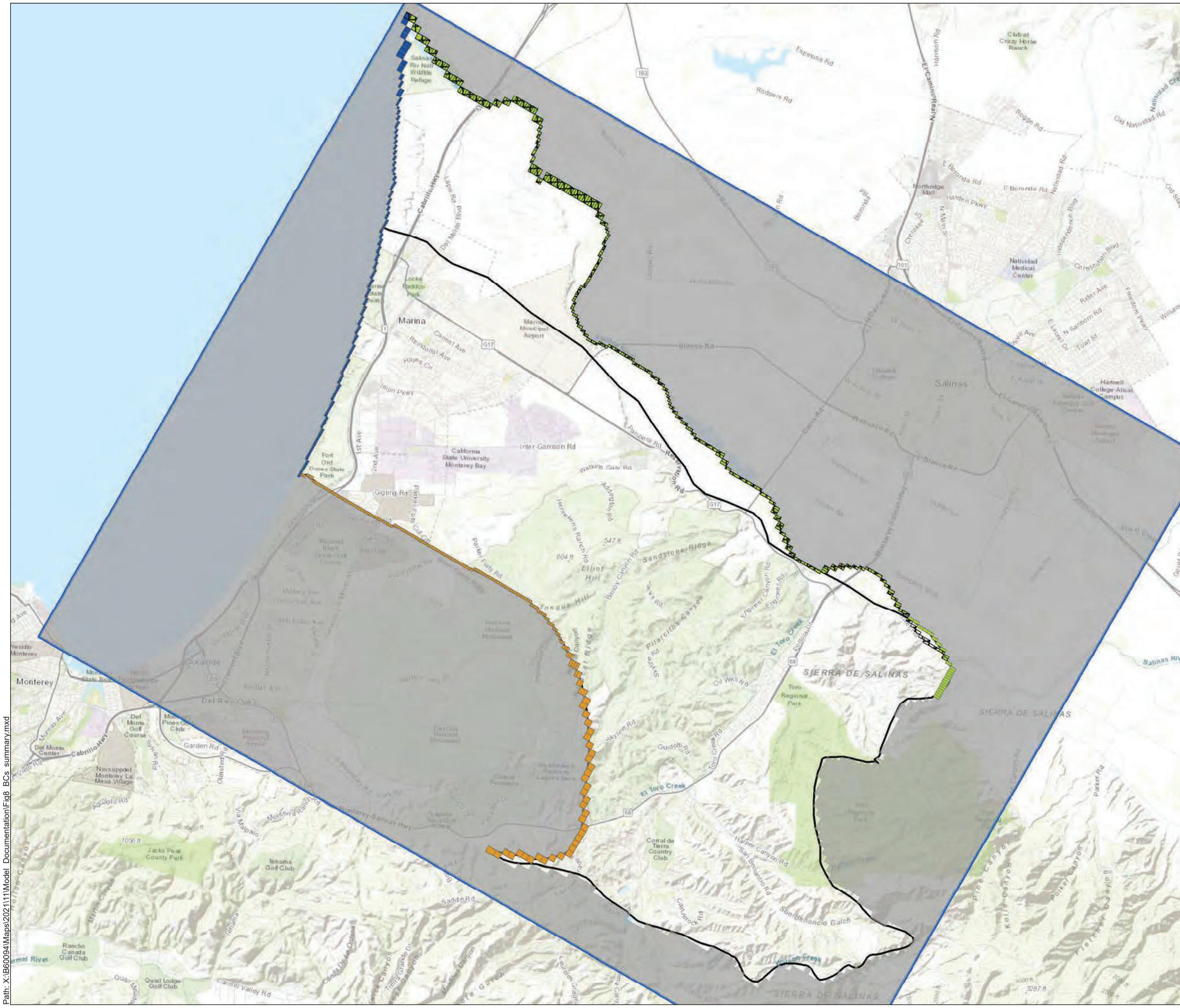

Legend

- Monterey Subbasin
- Grid Extent
- River Cells (Layers 1-2,7)
- GHB Cells - Seaside Boundary (Layers 1-8)
- GHB Cells - Northern Boundary (Layers 3-8)
- GHB Cells - Pacific Ocean (Layers 1-7)
- No-Flow Cells

Abbreviations
DWR = California Department of Water Resources
GHB = General-Head Boundary
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. All locations are approximate.

Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

N
0 1 2
(Scale in Miles)

MBGWFM Boundary Conditions Summary

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03
Figure 8

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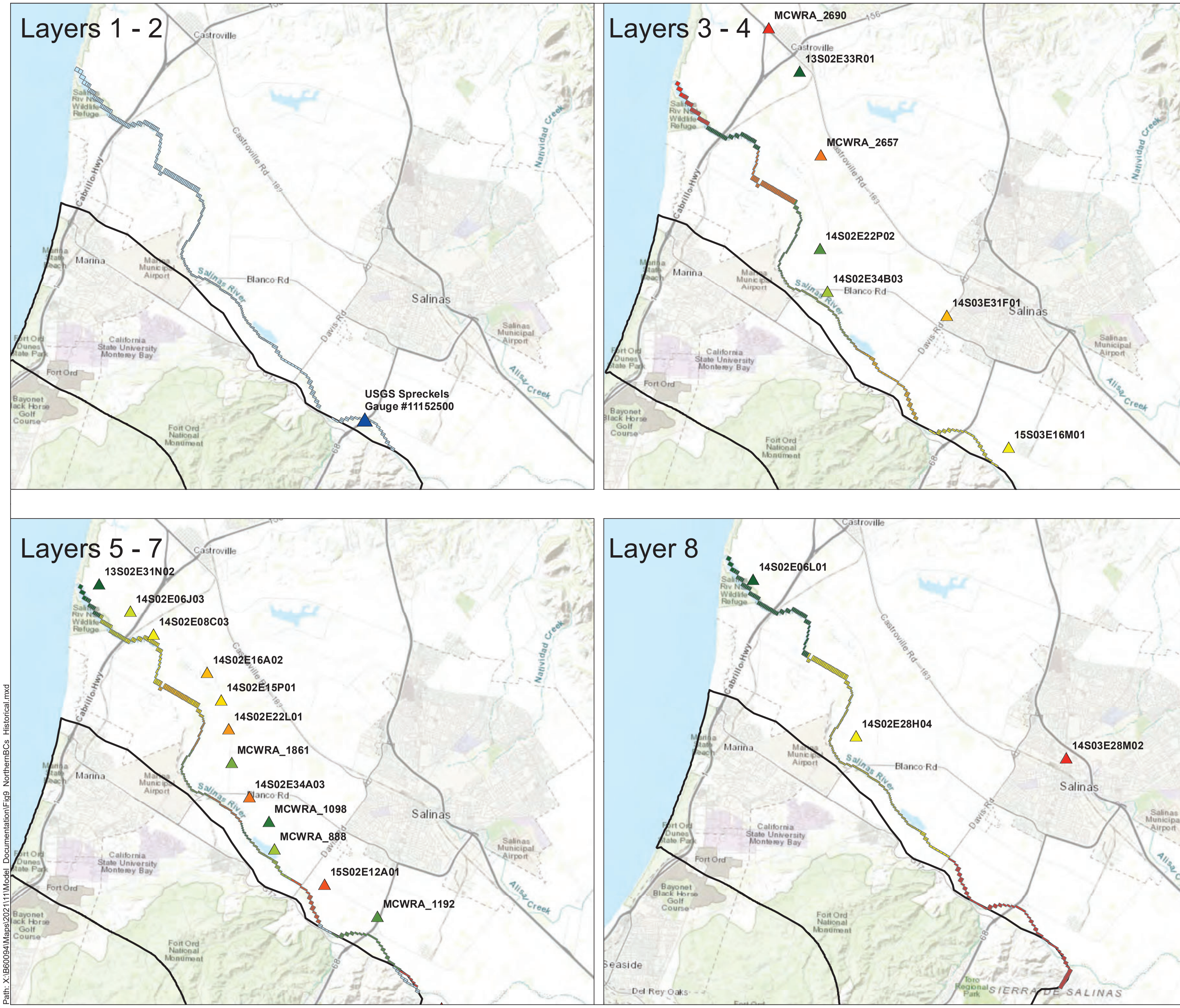

Legend
- Monterey Subbasin
- Representative Monitoring Well (see Note 1)
- GHB Cells (see Note 1)
- River Cells

Abbreviations
ft msl = feet above mean sea level
GHB = General-Head Boundary
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. GHB cells are color-coded by their associated representative monitoring well that is used to inform specified heads.
2. All locations are approximate.

Sources
1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 7 January 2022.

N

0 2 4
(Scale in Miles)

MBGWFM Northern Boundary Conditions - Historical Simulation

Marina Coast Water District
Monterey County, CA
November 2021
EKI B60094.03

Figure 9

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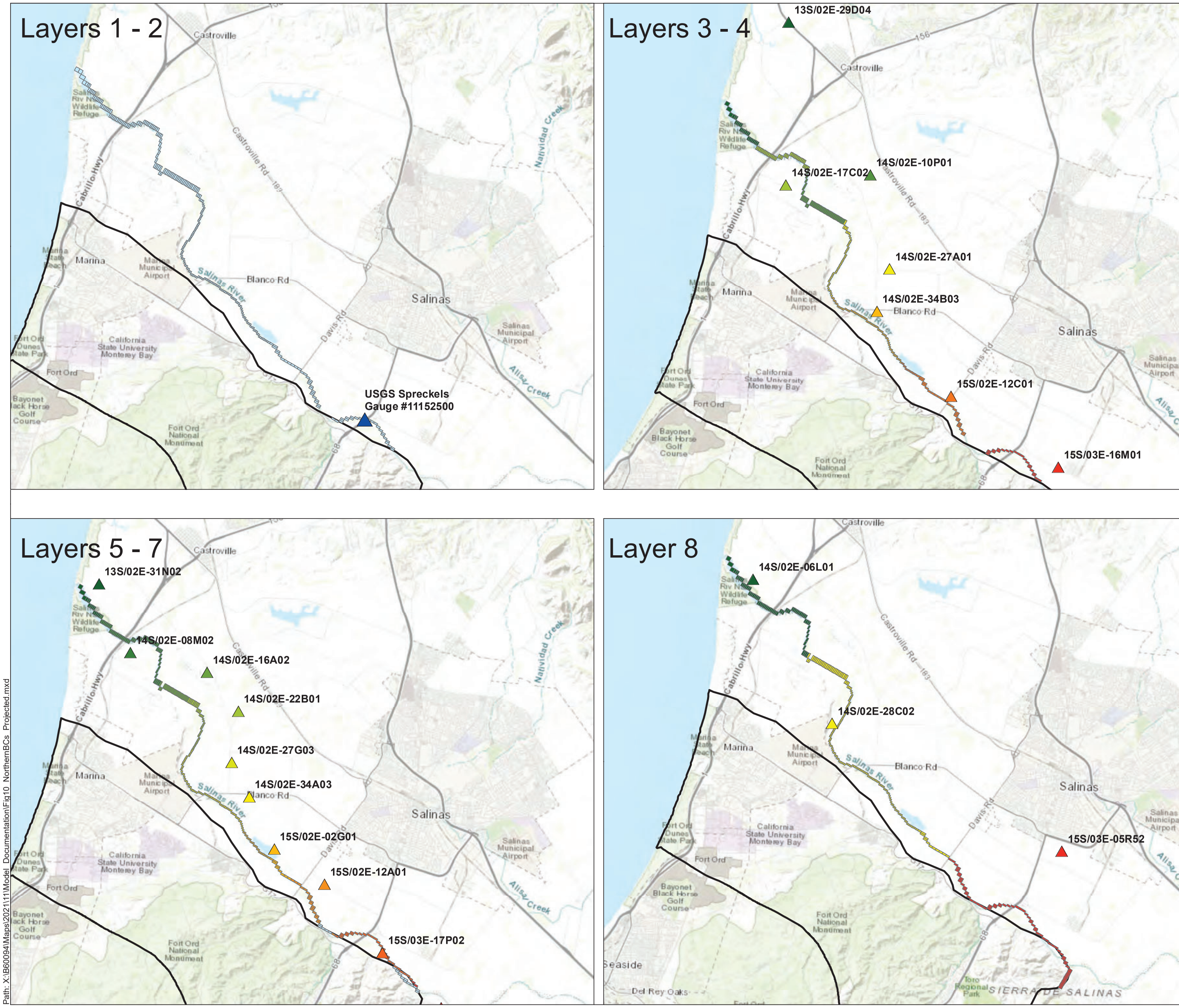
Path: X:\B60094\Maps\2021\11\Model_Documentation\Fig9_NorthernBCs_Historical.mxd



Legend
- Monterey Subbasin
- SGMA Monitoring Well (see Note 1)
- GHB Cells (see Note 1)
- River Cells

Abbreviations
ft msl = feet above mean sea level
GHB = General-Head Boundary
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. GHB cells are color-coded by their associated representative monitoring well that is used to inform specified heads.
2. All locations are approximate.

Sources
1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 7 January 2022.

N
0 2 4
(Scale in Miles)

MBGWFM Northern Boundary Conditions - Projected Simulations

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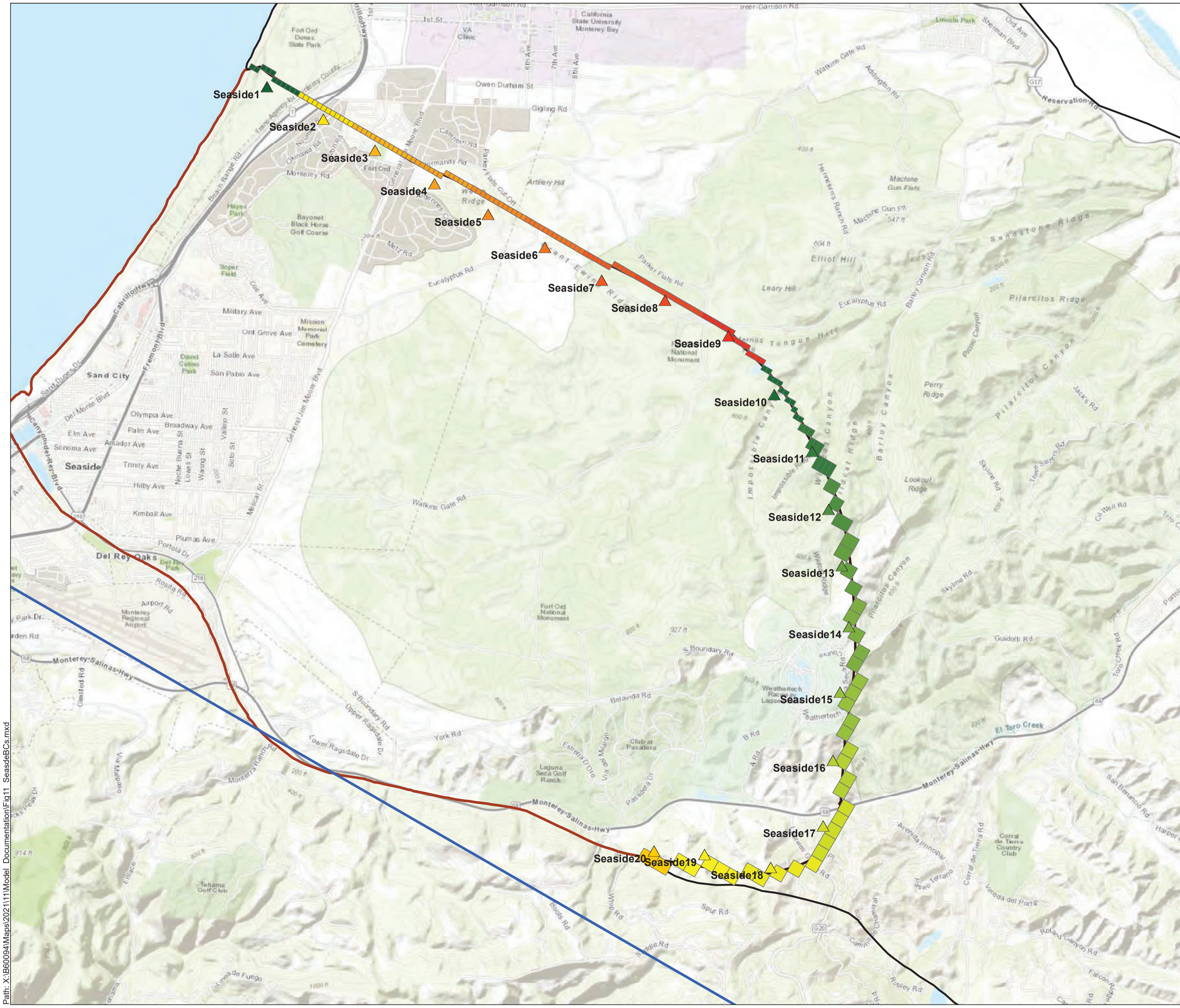
Marina Coast Water District
Monterey County, CA
November 2021
EKI B60094.03
Figure 10

Path: X:\B60094\Maps\2021\11\Model_Documentation\Fig10_NorthernBCs_Projected.mxd



Legend

- Monterey Subbasin
- Seaside Subbasin
- Seaside Proxy Monitoring Location (see Note 1)
- GHB Cells (see Note 1)

Abbreviations
DWR = California Department of Water Resources
GHB = General-Head Boundary
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. GHB cells are color-coded by their associated Seaside proxy monitoring well that is used to inform specified heads.
2. All locations are approximate.

Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

N 0 0.5 1 (Scale in Miles)

MBGWFM Southern Boundary Conditions

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03

Figure 11

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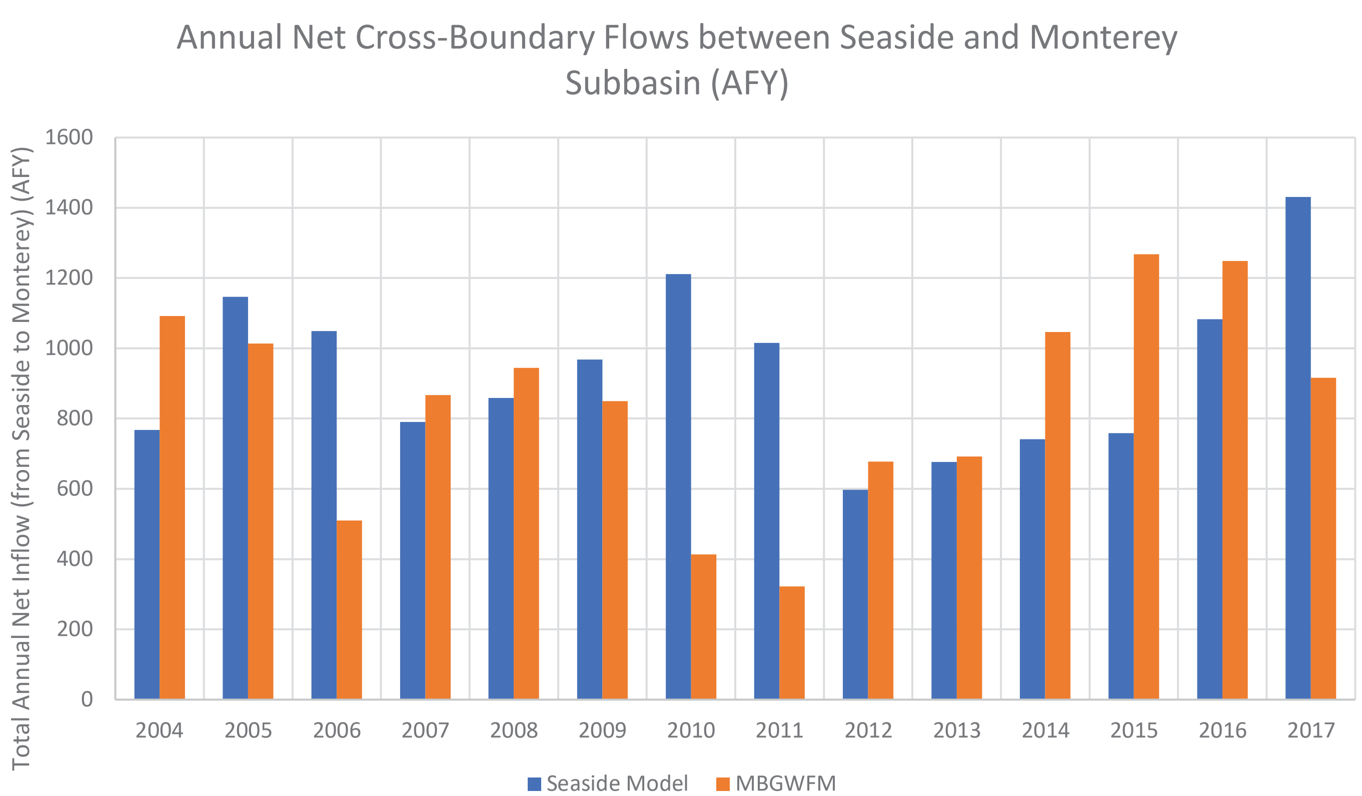
Path: X:\B60094\Maps\2021\11\Model_Documentation\Fig11_SeasideBCs.mxd



Legend

= Seaside Model

= MBGWFM

Abbreviations

AFY = acre-feet per year

MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes

1. Positive values indicate a net inflow from Seaside to the Monterey Subbasin.

Sources

1. MBGWFM
2. Seaside Groundwater Flow Model

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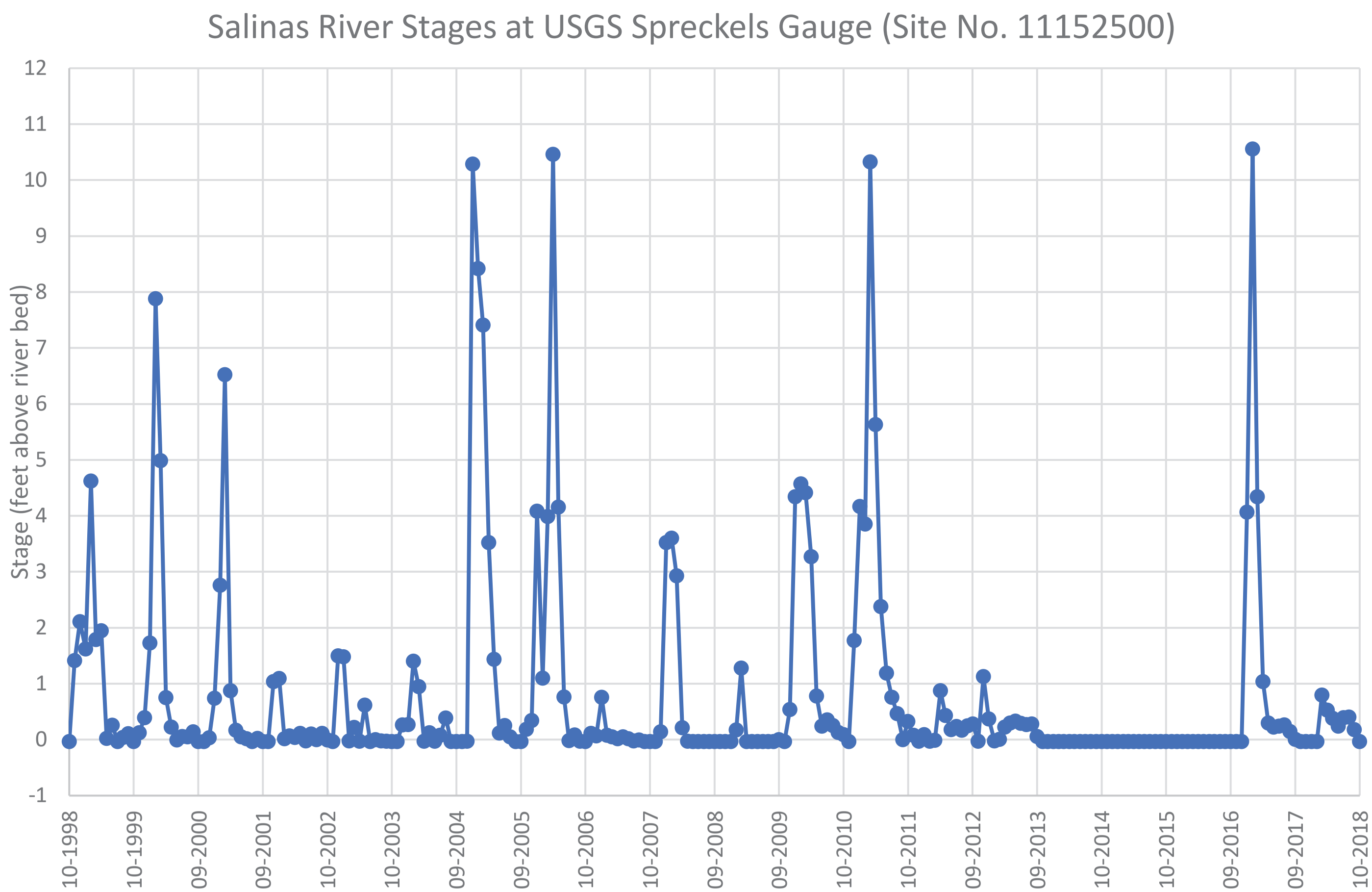
Annual Net Cross-Boundary Flow Estimates between the Seaside and Monterey Subbasins

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.12

Figure 12



Legend

= Salinas River Stage (ft)

Abbreviations
ft = feet

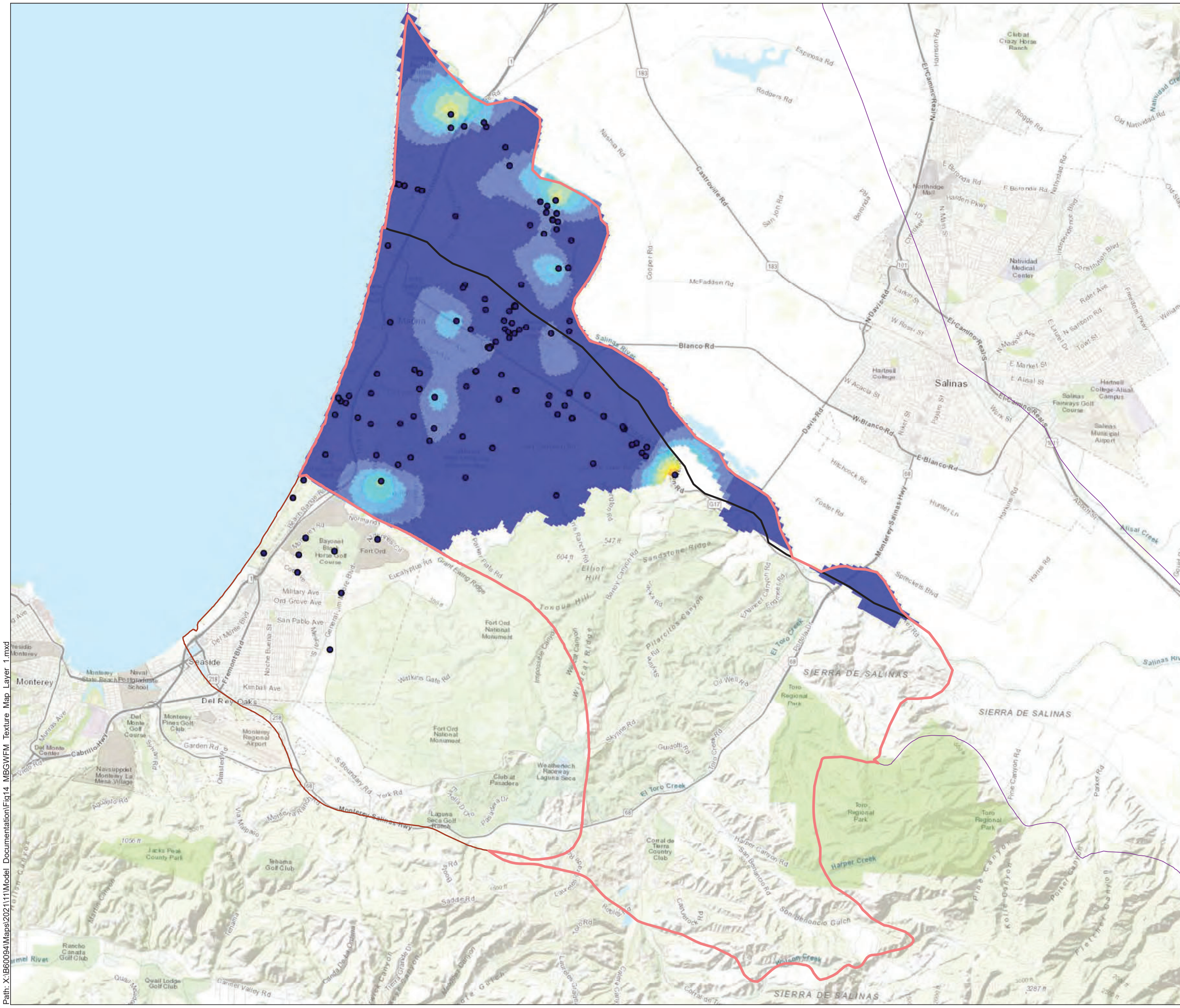
Notes
1. Salinas River stages are approximated from flow data (see *Section 2.4.3*).

Sources
1. Monterey Subbasin Groundwater Flow Model

eki environment & water

Salinas River Stages at USGS Spreckels Gauge

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.12
Figure 13



Legend

- Monterey Subbasin
- Seaside Subbasin
- 180/400-Foot Aquifer Subbasin
- MBGWFM Active Area
- Borehole Location

Layer 1 % Coarse

- 0.00 - 0.10
- 0.11 - 0.20
- 0.21 - 0.30
- 0.31 - 0.40
- 0.41 - 0.50
- 0.51 - 0.60
- 0.61 - 0.70
- 0.71 - 0.80
- 0.81 - 0.90
- 0.91 - 1.00

Abbreviations

DWR = California Department of Water Resources

MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes

1. All locations are approximate.

Sources

1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

N

0 1 2

(Scale in Miles)

MBGWFM Texture Map - Layer 1

Marina Coast Water District

Monterey County, California

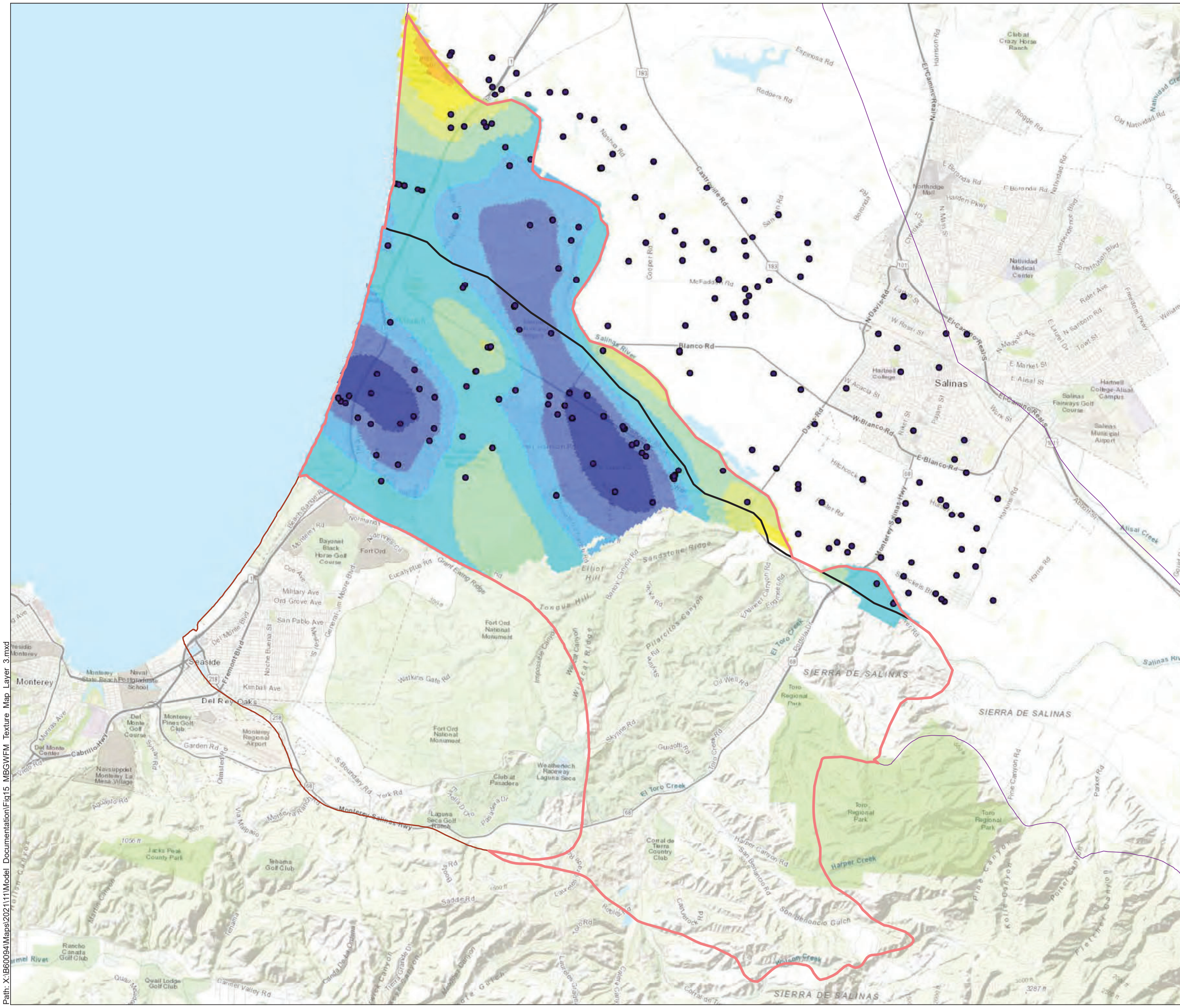
November 2021

EKI B60094.03

Figure 14

eki environment & water

Path: X:\B60094\Maps\2021\11\Model Documentation\Fig14 MBGWFM Texture Map Layer 1.mxd



Legend

- Monterey Subbasin
- Seaside Subbasin
- 180/400-Foot Aquifer Subbasin
- MBGWFM Active Area
- Borehole Location

Layer 3 % Coarse

- 0.00 - 0.10
- 0.11 - 0.20
- 0.21 - 0.30
- 0.31 - 0.40
- 0.41 - 0.50
- 0.51 - 0.60
- 0.61 - 0.70
- 0.71 - 0.80
- 0.81 - 0.90
- 0.91 - 1.00

Abbreviations
DWR = California Department of Water Resources
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. All locations are approximate.

Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

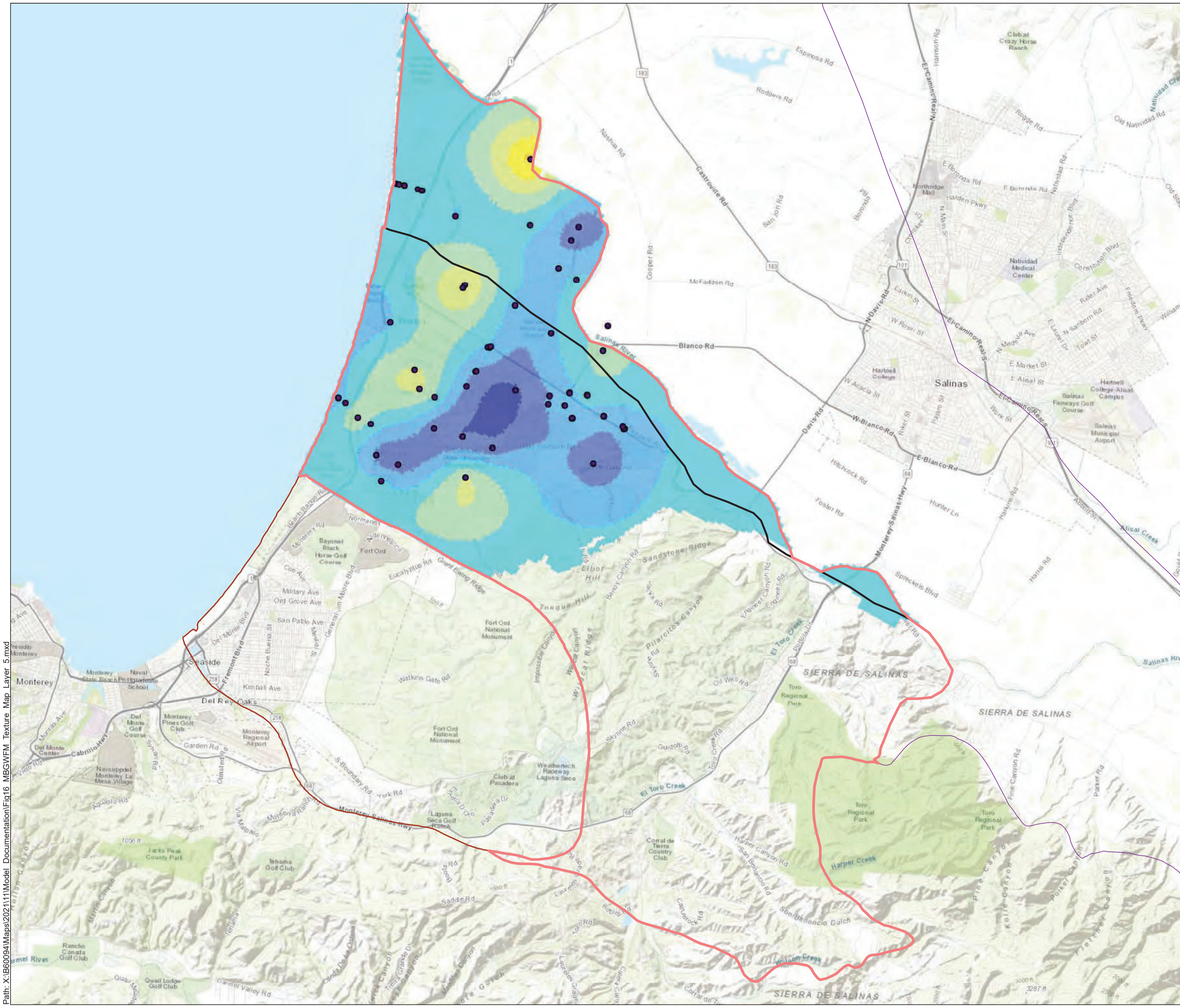
N 0 1 2 (Scale in Miles)

MBGWFM Texture Map - Layer 3

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03
Figure 15

eki environment & water

Path: X:\B60094\Maps\2021\11\Model Documentation\Fig15_MBGWFM_Texture_Map_Layer_3.mxd



Legend

- Monterey Subbasin
- Seaside Subbasin
- 180/400-Foot Aquifer Subbasin
- MBGWFM Active Area
- Borehole Location

Layer 5 % Coarse

- 0.00 - 0.10
- 0.11 - 0.20
- 0.21 - 0.30
- 0.31 - 0.40
- 0.41 - 0.50
- 0.51 - 0.60
- 0.61 - 0.70
- 0.71 - 0.80
- 0.81 - 0.90
- 0.91 - 1.00

N

0 1 2

(Scale in Miles)

Abbreviations
DWR = California Department of Water Resources
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. All locations are approximate.

Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

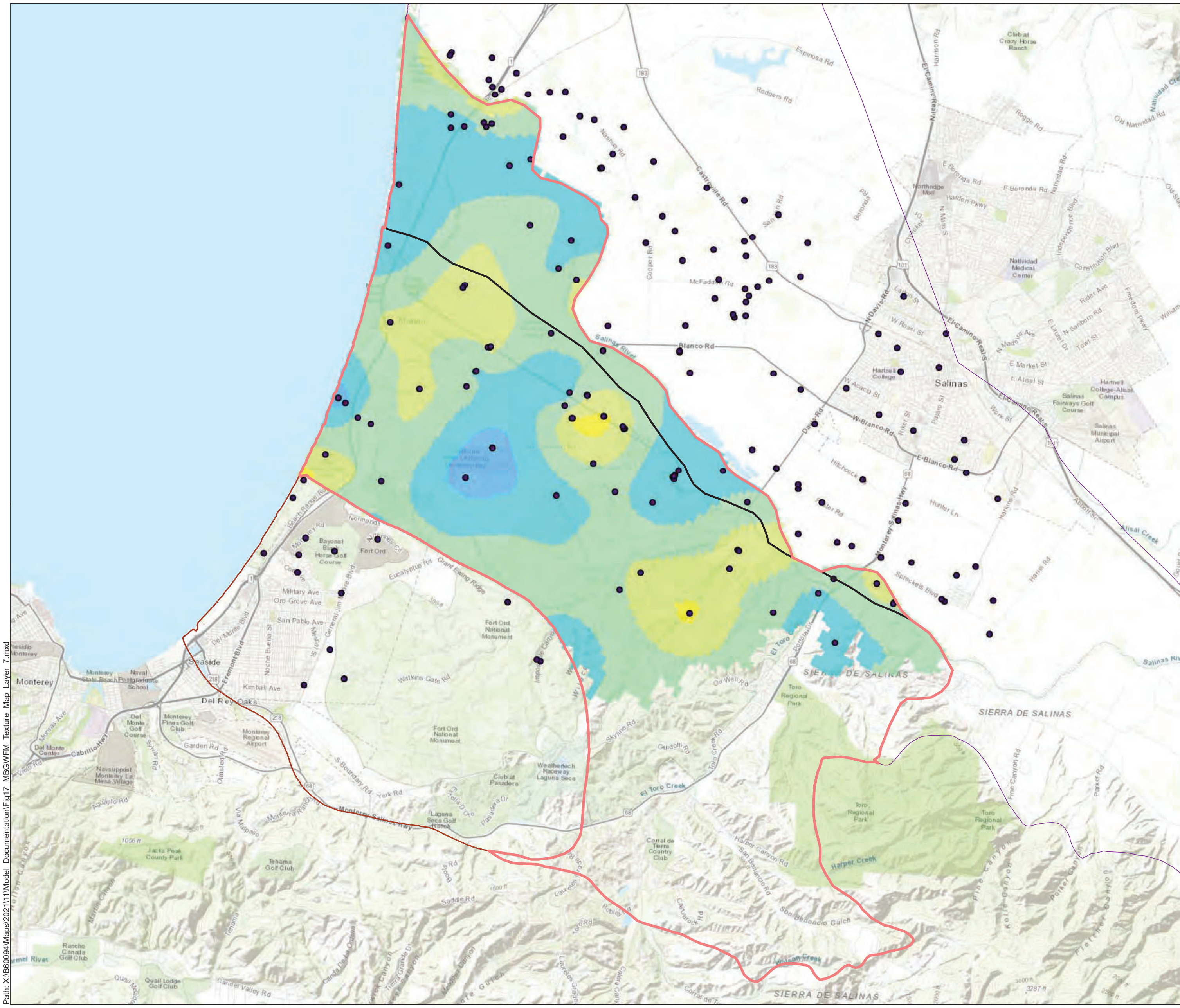
MBGWFM Texture Map - Layer 5

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03

Figure 16

eki environment & water

Path: X:\B60094\Maps\2021\11\Model Documentation\Fig16 MBGWFM Texture Map Layer 5.mxd



Legend

- Monterey Subbasin
- Seaside Subbasin
- 180/400-Foot Aquifer Subbasin
- MBGWFM Active Area
- Borehole Location

Layer 7 % Coarse

- 0.00 - 0.10
- 0.11 - 0.20
- 0.21 - 0.30
- 0.31 - 0.40
- 0.41 - 0.50
- 0.51 - 0.60
- 0.61 - 0.70
- 0.71 - 0.80
- 0.81 - 0.90
- 0.91 - 1.00

Abbreviations

DWR = California Department of Water Resources
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes

1. All locations are approximate.

Sources

1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

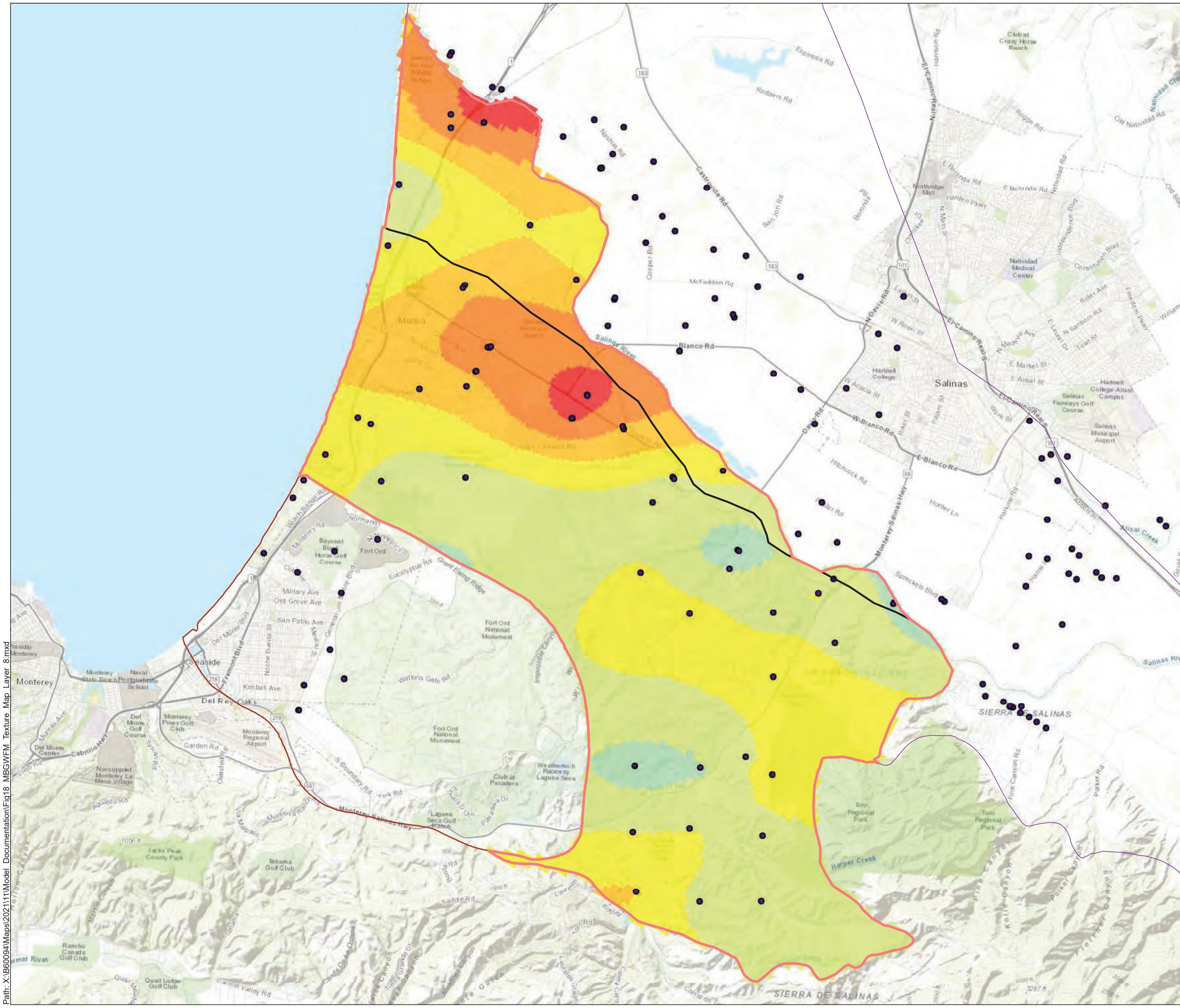
N 0 1 2 (Scale in Miles)

MBGWFM Texture Map - Layer 7

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03
Figure 17

eki environment & water

Path: X:\B60094\Maps\2021\11\Model Documentation\Fig17 MBGWFM Texture Map Layer 7.mxd



Legend

- Monterey Subbasin
- Seaside Subbasin
- 180/400-Foot Aquifer Subbasin
- MBGWFM Active Area
- Borehole Location

Layer 8 % Coarse

- 0.00 - 0.10
- 0.11 - 0.20
- 0.21 - 0.30
- 0.31 - 0.40
- 0.41 - 0.50
- 0.51 - 0.60
- 0.61 - 0.70
- 0.71 - 0.80
- 0.81 - 0.90
- 0.91 - 1.00

Abbreviations
DWR = California Department of Water Resources
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. All locations are approximate.

Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

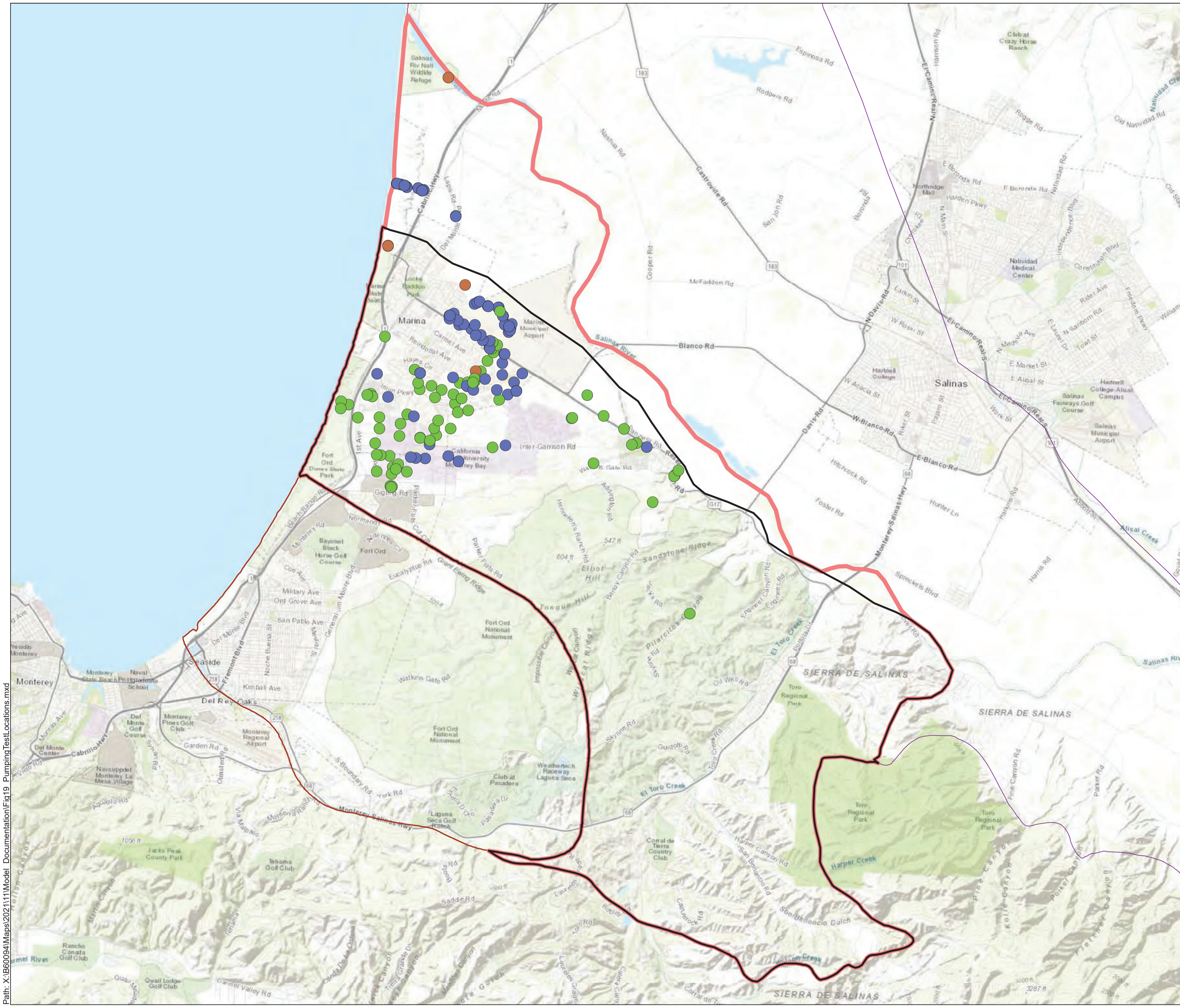
N
0 1 2
(Scale in Miles)

MBGWFM Texture Map - Layer 8

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03
Figure 18

eki environment & water

Path: X:\B60094\Maps\2021\11\Model_Documentation\Fig18_MBGWFM_Texture_Map_Layer_8.mxd



Abbreviations
DWR = California Department of Water Resources
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. All locations are approximate.

Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

Pumping Test Well Locations

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03

Figure 19

eki environment & water

Path: X:\B60094\Maps\2021\11\Model_Documentation\Fig19_PumpingTestLocations.mxd

Legend

- Monterey Subbasin
- Seaside Subbasin
- 180/400-Foot Aquifer Subbasin
- MBGWFM Active Area
- Grid Extent

MBGWFM Grid

- Active Cells
- Inactive Cells

SSURGO Soil Map Unit

300	CbA	GhD	Pm	SfE
Ac	CbB	GkB	PnA	SfF
Ad	CbC	HbB	PnC	Sg
AeA	CcG	LaE	PnD	ShC
AeC	Cf	LaF	PnE	ShD
AeD	Cg	LcG2	Pr	ShD2
Af	Cm	LhE	RaA	ShE
AkD	CnA	Me	RaC	SoD
AkF	CnC	Mf	RaD	SoG
Am	DaC	Mg	Rb	TaC
Ar	DbD	MnA	Rc	TbB
AsB	DbE	MoA	SaA	VaE
AsC	DbF	NcC	SbA	VaG
AvB	DdE	OaD	SbC	Vb
Ba	Df	Pa	ScE	W
BbC	EaA	PdC	ScG	Xb
CaE	EbC	PdD	SdF	Xc
CaF	GhC	Pf	SfD	Xd

Abbreviations
DWR = California Department of Water Resources
MBGWFM = Monterey Subbasin Groundwater Flow Model
SSURGO = Soil Survey Geographic Database

Notes
1. All locations are approximate.
2. List of SSURGO soil unit keys and corresponding names can be found at https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2_053627.

Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

N

0 1 2
(Scale in Miles)

SSURGO Soil Types

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03

Figure 20

eki environment & water

Path: X:\B60094\Maps\2021\11\Model Documentation\Fig20 SSURGO Soil Types.mxd

Legend

- Monterey Subbasin
- Seaside Subbasin
- 180/400-Foot Aquifer Subbasin
- MBGWFM Active Area
- Grid Extent

MBGWFM Grid

- Active Cells
- Inactive Cells

Hydrologic Soil Groups

- A
- A/D
- B
- C
- C/D
- D

Abbreviations
DWR = California Department of Water Resources
MBGWFM = Monterey Subbasin Groundwater Flow Model
SSURGO = Soil Survey Geographic Database

Notes
1. All locations are approximate.

Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

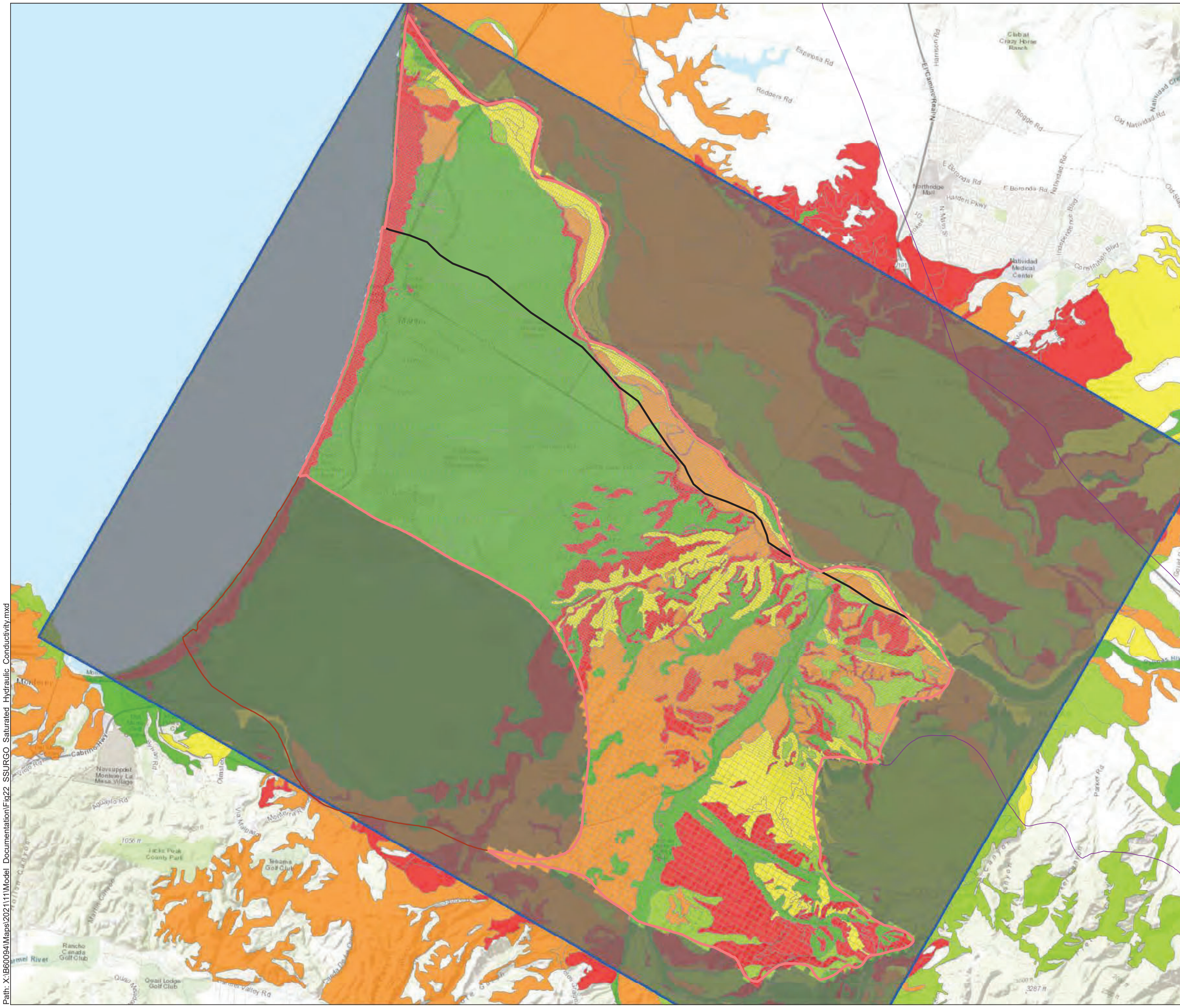
N 0 1 2 (Scale in Miles)

SSURGO Hydrologic Soil Groups

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03
Figure 21

eki environment & water

Path: X:\B60094\Maps\2021\11\Model Documentation\Fig21 SSURGO Hydrologic Soil Groups.mxd



Legend

- Monterey Subbasin
- Seaside Subbasin
- 180/400-Foot Aquifer Subbasin
- MBGWFM Active Area
- Grid Extent

MBGWFM Grid

- Active Cells
- Inactive Cells

Saturated Hydraulic Conductivity (ft/d)

- 0.00 - 3.23
- 3.24 - 9.00
- 9.01 - 18.92
- 18.93 - 35.32
- 35.33 - 232.00

Abbreviations
DWR = California Department of Water Resources
ft/d = feet per day
MBGWFM = Monterey Subbasin Groundwater Flow Model
SSURGO = Soil Survey Geographic Database

Notes
1. All locations are approximate.

Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

N 0 1 2 (Scale in Miles)

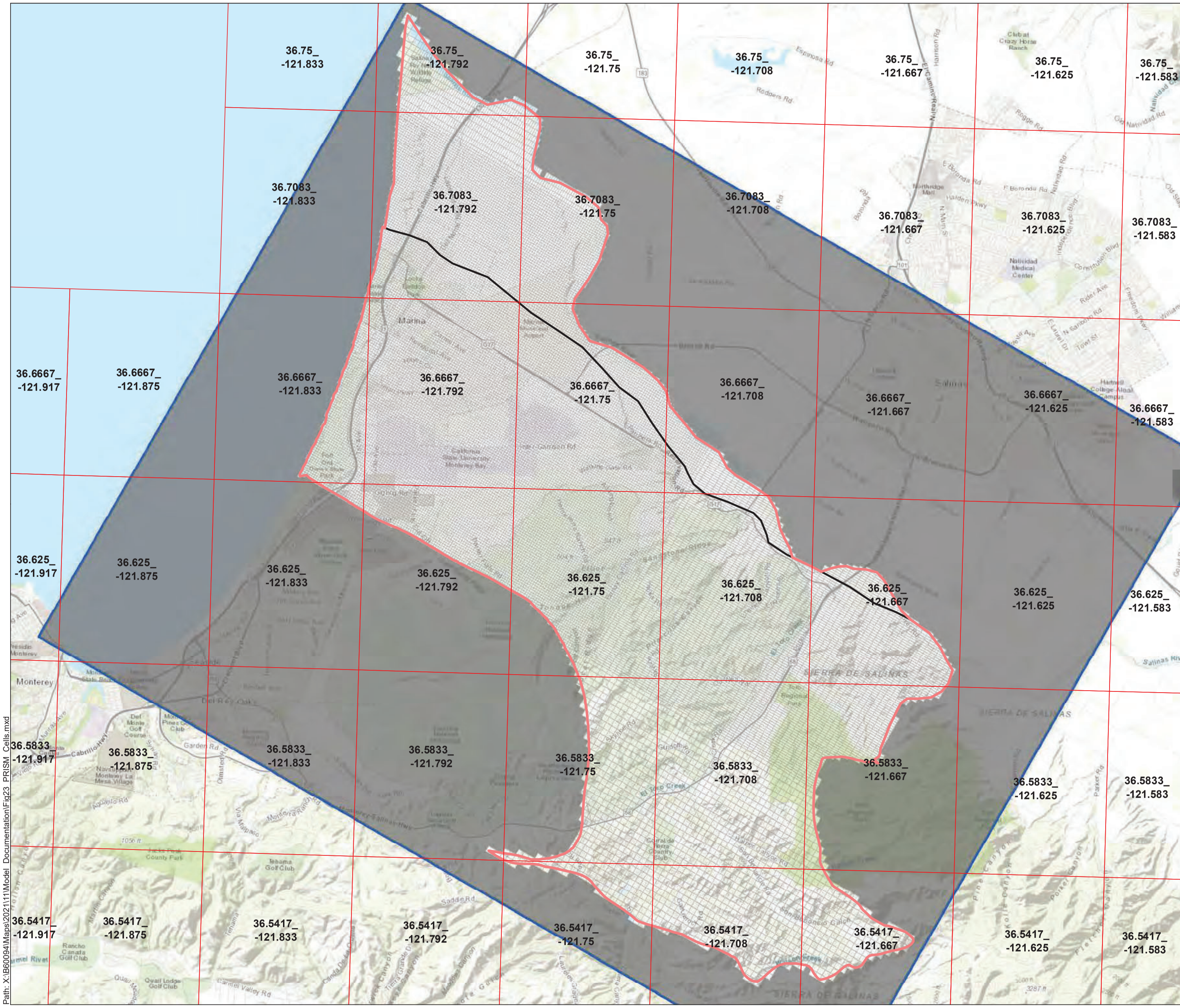
SSURGO Saturated Vertical Hydraulic Conductivity

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03

eki environment & water

Figure 22

Path: X:\B60094\Maps\2021\11\Model Documentation\Fig22 SSURGO Saturated Hydraulic Conductivity.mxd



Legend

- PRISM Cells
- MBGWFM Active Area
- Monterey Subbasin

MBGWFM Grid

- Active Cells
- Inactive Cells
- Grid Extent

Abbreviations

DWR = California Department of Water Resources
Lat/Long = latitude and longitude
MBGWFM = Monterey Subbasin Groundwater Flow Model
PRISM = Parameter-elevation Regressions on Independent Slopes Model

Notes

1. All locations are approximate.
2. Labels show PRISM cell identifiers in Lat_Long convention.

Sources

1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

N 0 1 2 (Scale in Miles)

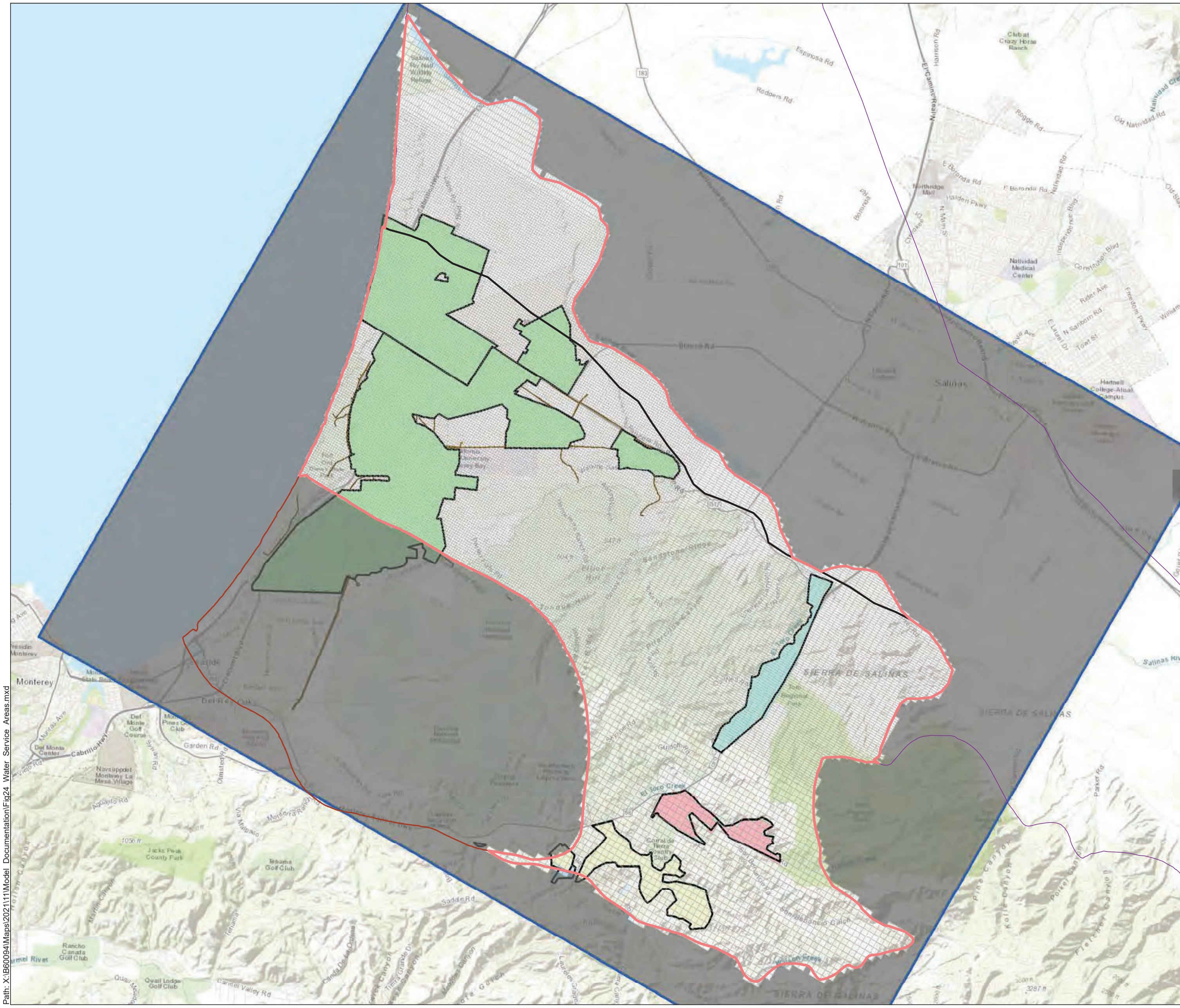
eki environment & water

PRISM Cells

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03

Figure 23

Path: X:\B60094\Maps\2021\11\Model_Documentation\Fig23_PRISM_Cells.mxd



Legend

- MBGWFM Active Area
- Monterey Subbasin
- Seaside Subbasin
- 180/400-Foot Aquifer Subbasin

MBGWFM Grid

- Active Cells
- Inactive Cells
- Grid Extent

Water Service Areas

- CAW Ambler
- CAW Hidden Hills
- CAW Toro
- CWS
- MCWD

Abbreviations
DWR = California Department of Water Resources
CAW = CalAm Water
CWS = California Water Service
MBGWFM = Monterey Subbasin Groundwater Flow Model
MCWD = Marina Coast Water District

Notes
1. All locations are approximate.

Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

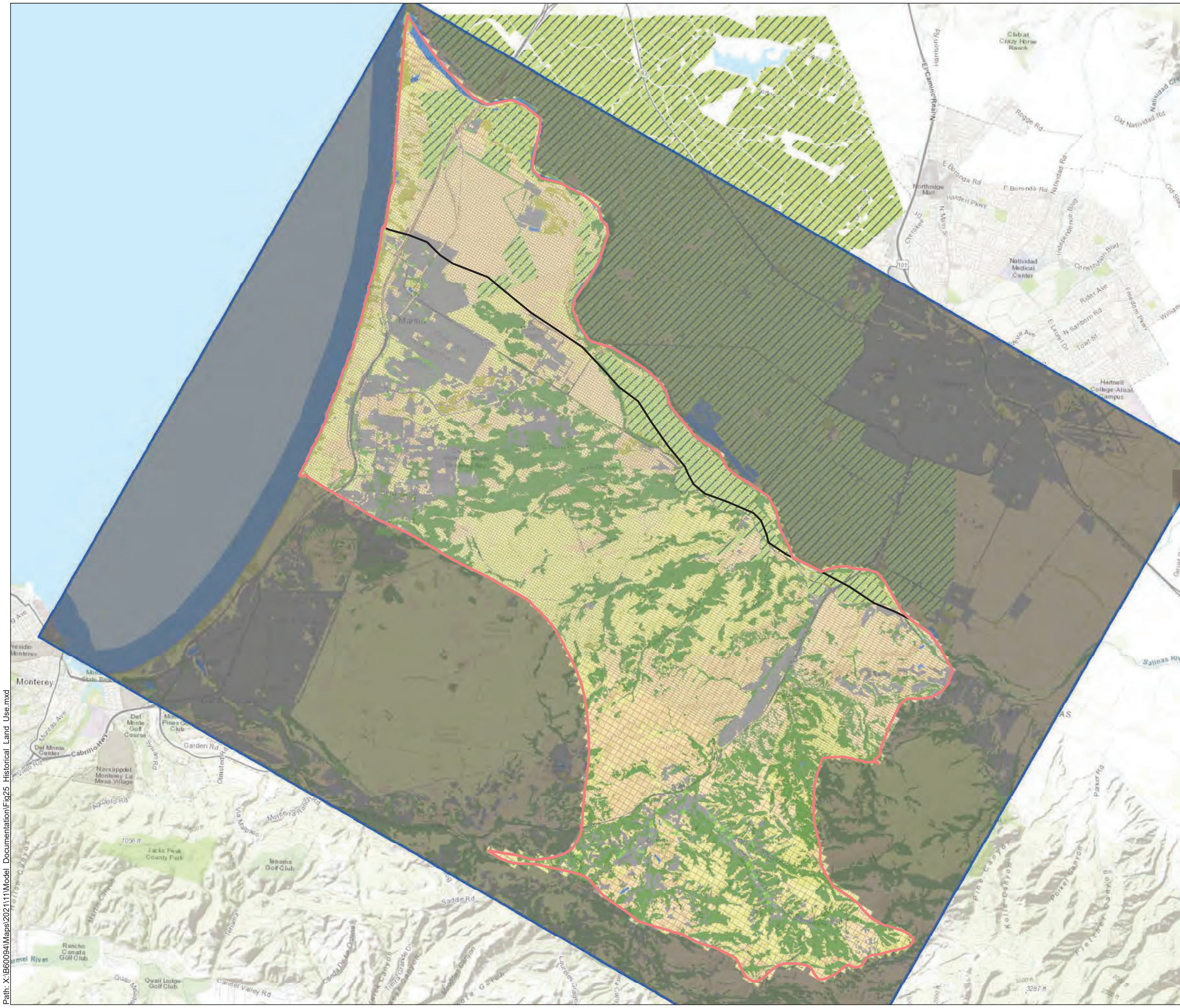
N 0 1 2 (Scale in Miles)

eki environment & water

Water Service Areas

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03
Figure 24

Path: X:\B60094\Maps\2021\11\Model Documentation\Fig24 Water Service Areas.mxd



Legend

- Monterey Subbasin
- MBGWFM Active Area
- Grid Extent

MBGWFM Grid

- Active Cells
- Inactive Cells

Agricultural Areas

- Truck Nursery and Berry Crops

CalVeg Land Use Classes

- Barren
- Conifer / Woodland
- Hardwood Forest/Woodland
- Herbaceous
- Mixed Conifer & Hardwood Forest
- Shrub
- Urban
- Water

Abbreviations

CalVeg = Classification and Assessment with Landsat of Visible Ecological Groupings
DWR = California Department of Water Resources
MBGWFM = Monterey Subbasin Groundwater Flow Model
USDA FS = United States Department of Agriculture, Forest Service

Notes

1. All locations are approximate.

Sources

1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. CalVeg data sourced from the USDA FS website.
3. Basemap courtesy of ESRI.

N 0 1 2 (Scale in Miles)

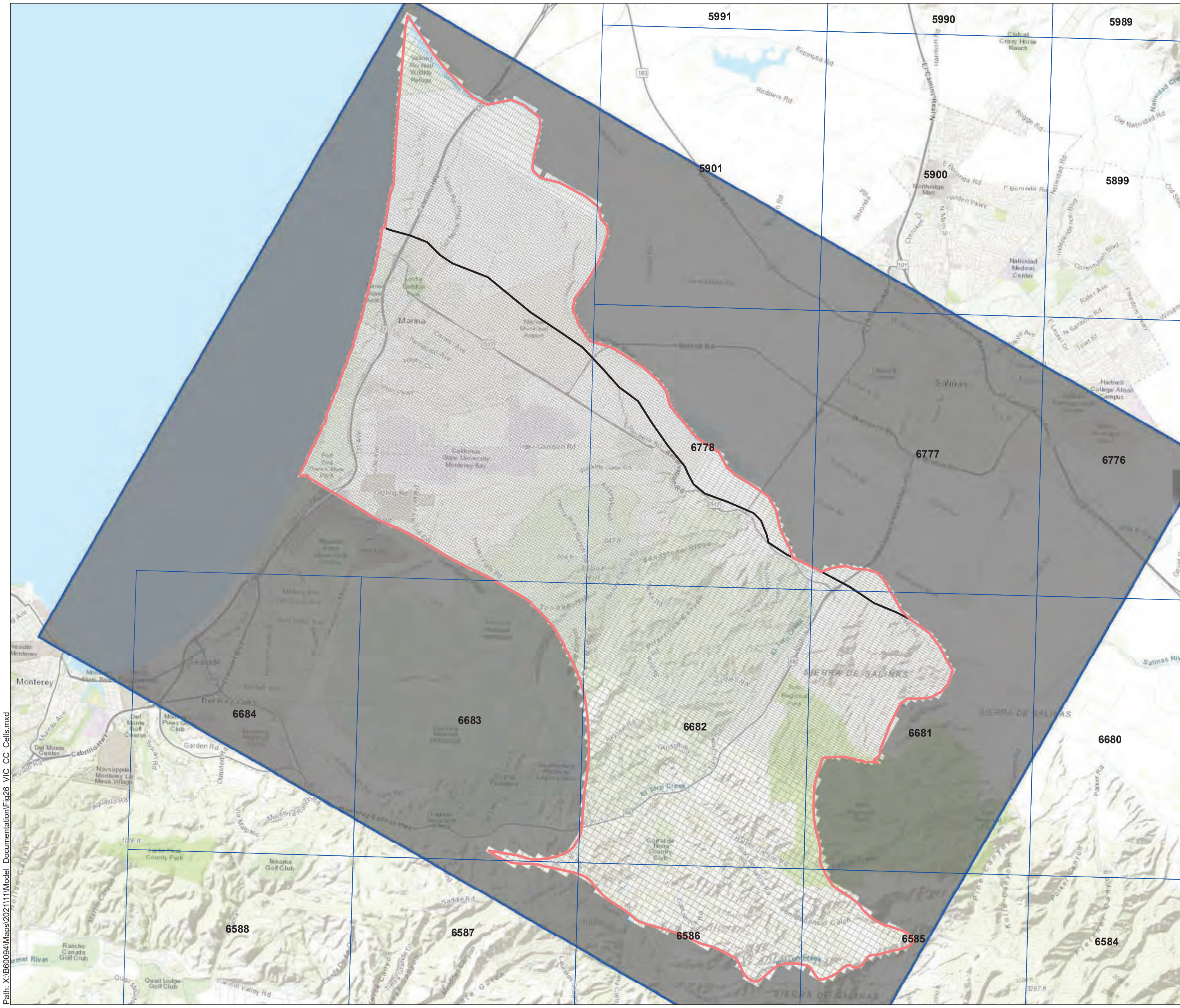
Historical Land Use

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03

eki environment & water

Figure 25

Path: X:\B60094\Maps\2021\11\Model_Documentation\Fig25_Historical_Land_Use.mxd



Legend

- VIC Grid Cells
- MBGWFM Active Area
- Monterey Subbasin

MBGWFM Grid

- Active Cells
- Inactive Cells
- Grid Extent

Abbreviations

DWR = California Department of Water Resources
MBGWFM = Monterey Subbasin Groundwater Flow Model
VIC = Variable Infiltration Capacity

Notes

1. All locations are approximate.
2. Labels show VIC cell identifiers.
3. Climate change factors for areas within the active MBGWFM grid not covered by a VIC grid cell were estimated by taking an average from VIC cells 5901 and 6778.

Sources

1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

N 0 1 2 (Scale in Miles)

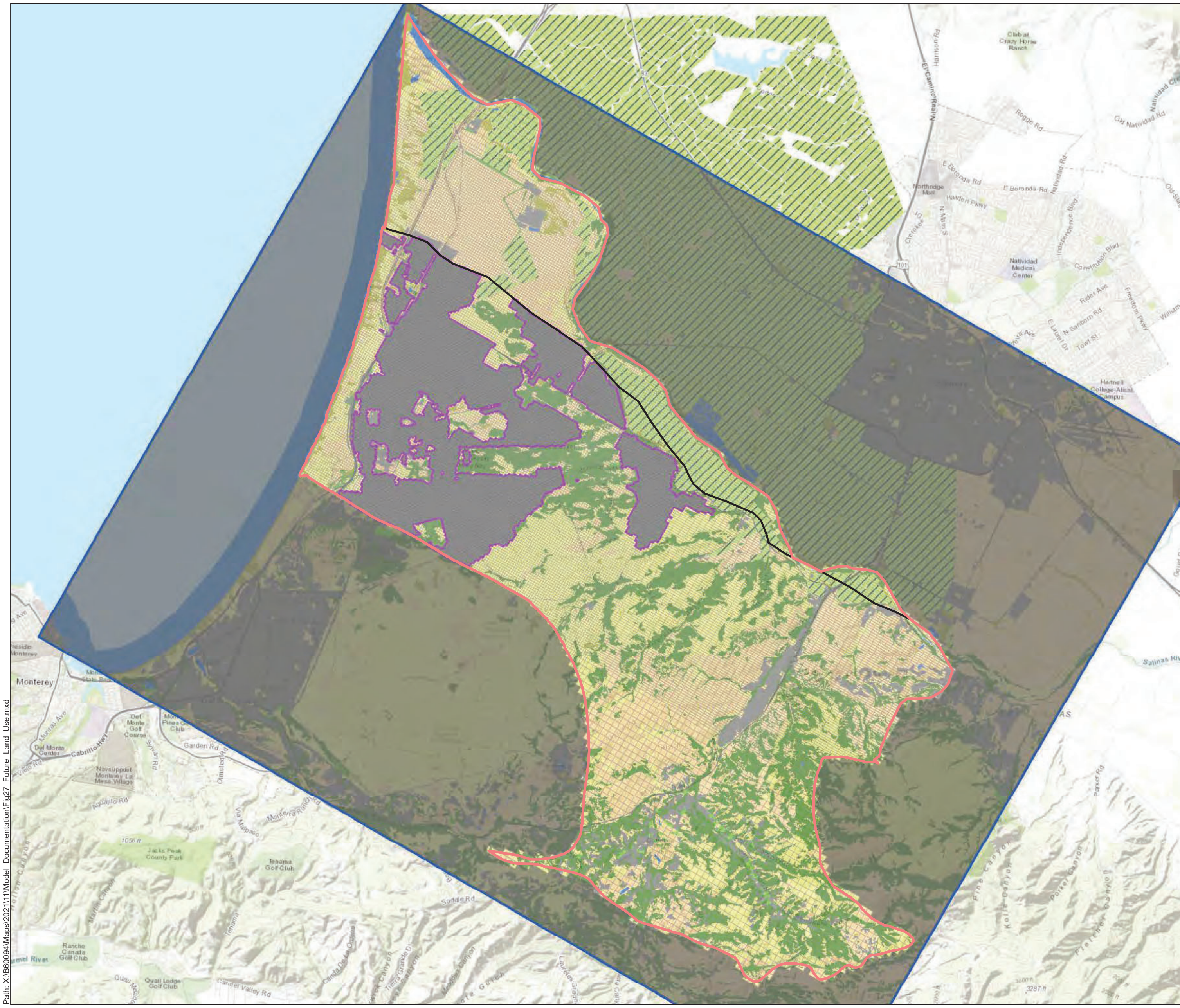
VIC Grid Cells Used for Climate Change Scenarios

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03

Figure 26

eki environment & water

Path: X:\B60094\Maps\2021\11\Model_Documentation\Fig26_VIC_CC_Cells.mxd



Legend

- Monterey Subbasin
- MBGWFM Active Area
- Grid Extent
- MCWD Future Stormwater Catchment Area

MBGWFM Grid

- Active Cells
- Inactive Cells

Agricultural Areas

- Truck Nursery and Berry Crops

CalVeg Land Use Classes

- Barren
- Conifer / Woodland
- Hardwood Forest/Woodland
- Herbaceous
- Mixed Conifer & Hardwood Forest
- Shrub
- Urban
- Water

Abbreviations
CalVeg = Classification and Assessment with Landsat of Visible Ecological Groupings
DWR = California Department of Water Resources
MBGWFM = Monterey Subbasin Groundwater Flow Model
MCWD = Marina Coast Water District
USDA FS = United States Department of Agriculture, Forest Service

Notes
1. All locations are approximate.

Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. CalVeg data sourced from the USDA FS website.
3. Future MCWD land use based on map obtained from 2019 Water Master Plan
4. Basemap courtesy of ESRI.

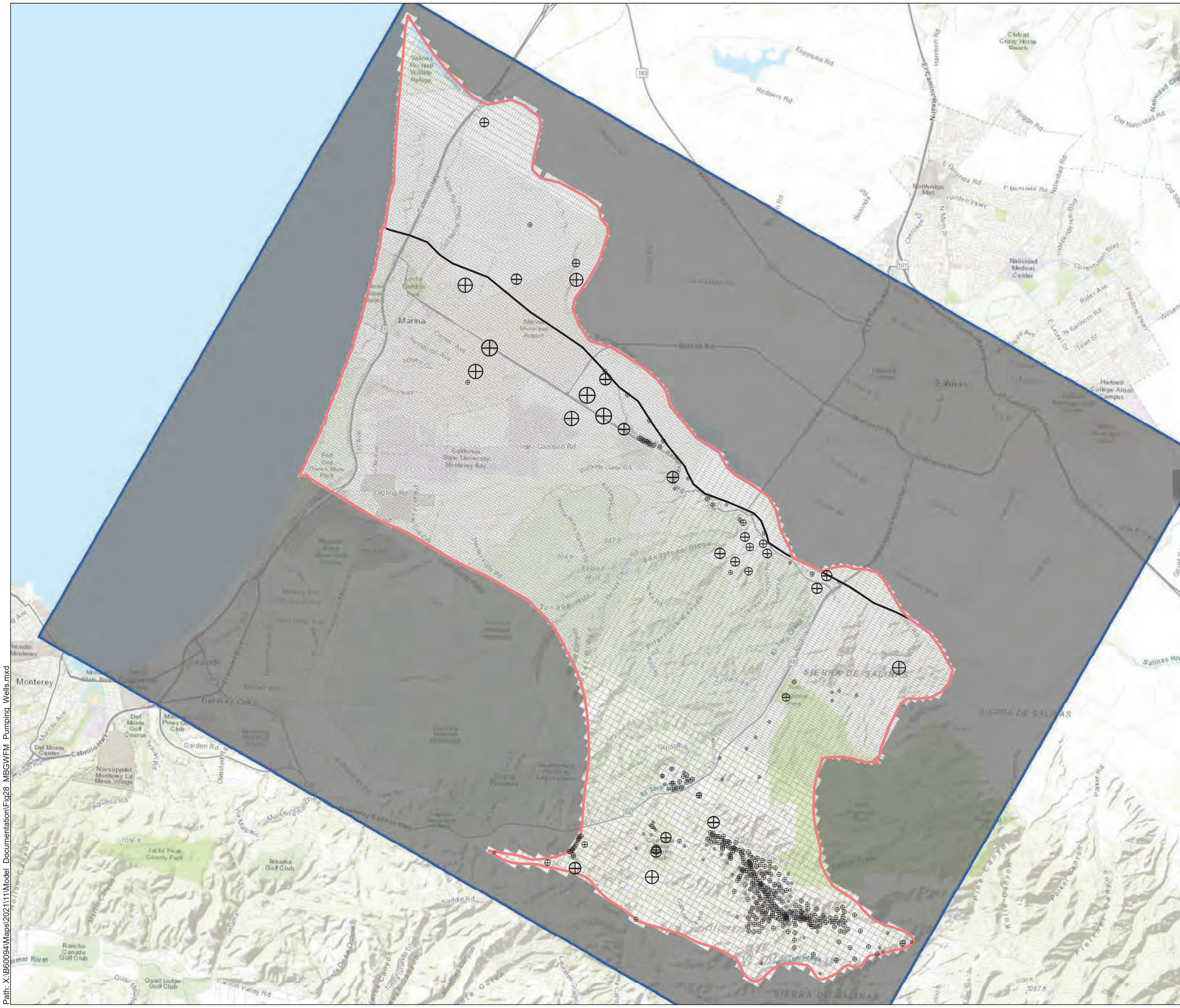
N
0 1 2
(Scale in Miles)

Future Land Use

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03
Figure 27

eki environment & water

Path: X:\B60094\Maps\2021\11\Model_Documentation\Fig27_Future_Land_Use.mxd



Legend

- Monterey Subbasin
- MBGWFM Active Area
- Grid Extent

MBGWFM Grid

- Active Cells
- Inactive Cells

Pumping Wells

Average Monthly Pumping Rate (AF/month)

- 0.00 - 0.02
- 0.03 - 0.31
- 0.32 - 1.11
- 1.12 - 2.22
- 2.23 - 4.49
- 4.50 - 8.62
- 8.63 - 15.80
- 15.81 - 22.45
- 22.46 - 49.40
- 49.41 - 74.28

Abbreviations
AF = acre-feet
DWR = California Department of Water Resources
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. All locations are approximate.
2. Pumping well symbol size reflects average historical pumping rate in units of acre-feet per month.

Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

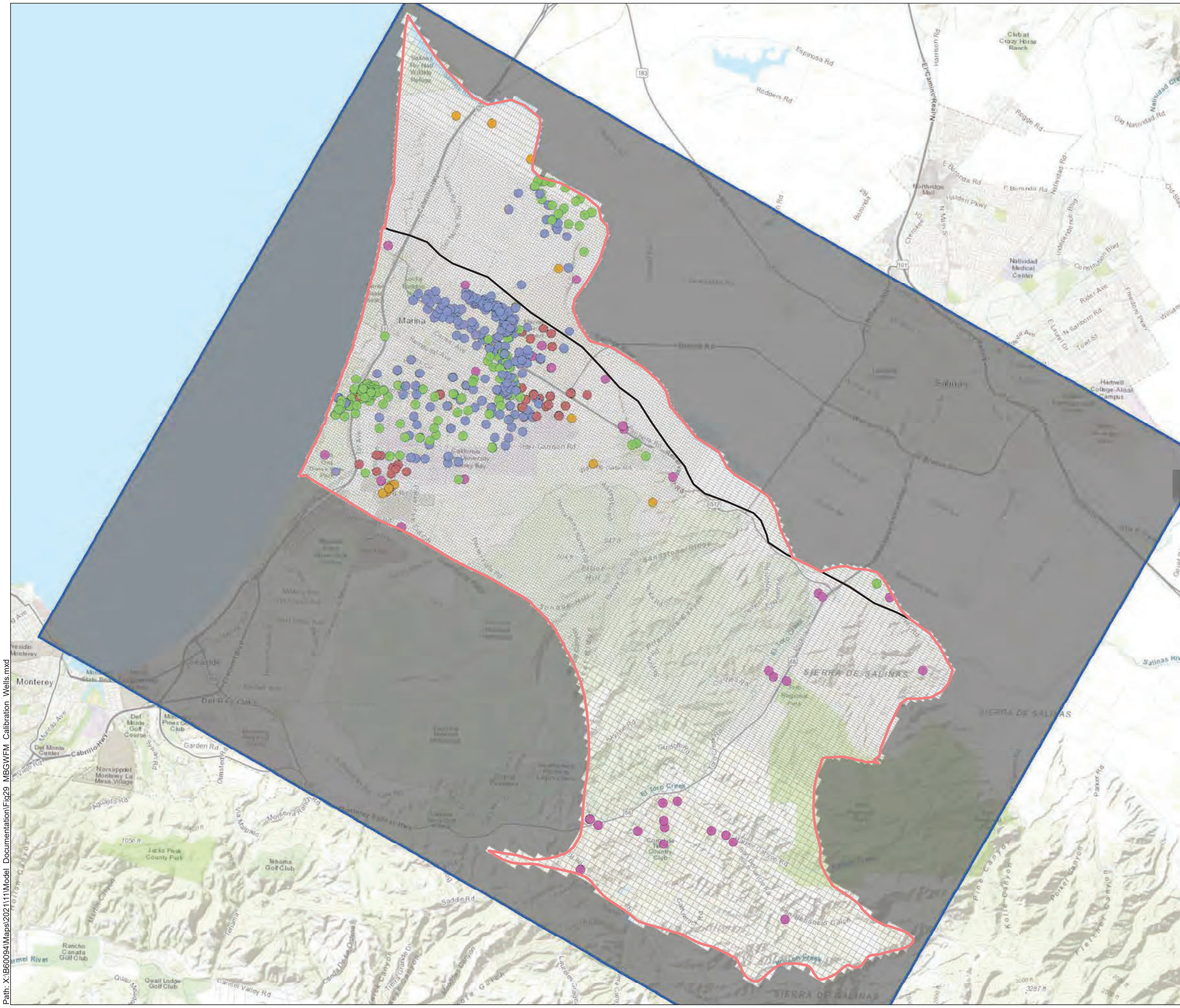
N 0 1 2
(Scale in Miles)

MBGWFM Pumping Wells

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03
Figure 28

eki environment & water

Path: X:\B60094\Maps\2021\11\Model_Documentation\Fig28_MBGWFM_Pumping_Wells.mxd



Abbreviations
DWR = California Department of Water Resources
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. All locations are approximate.

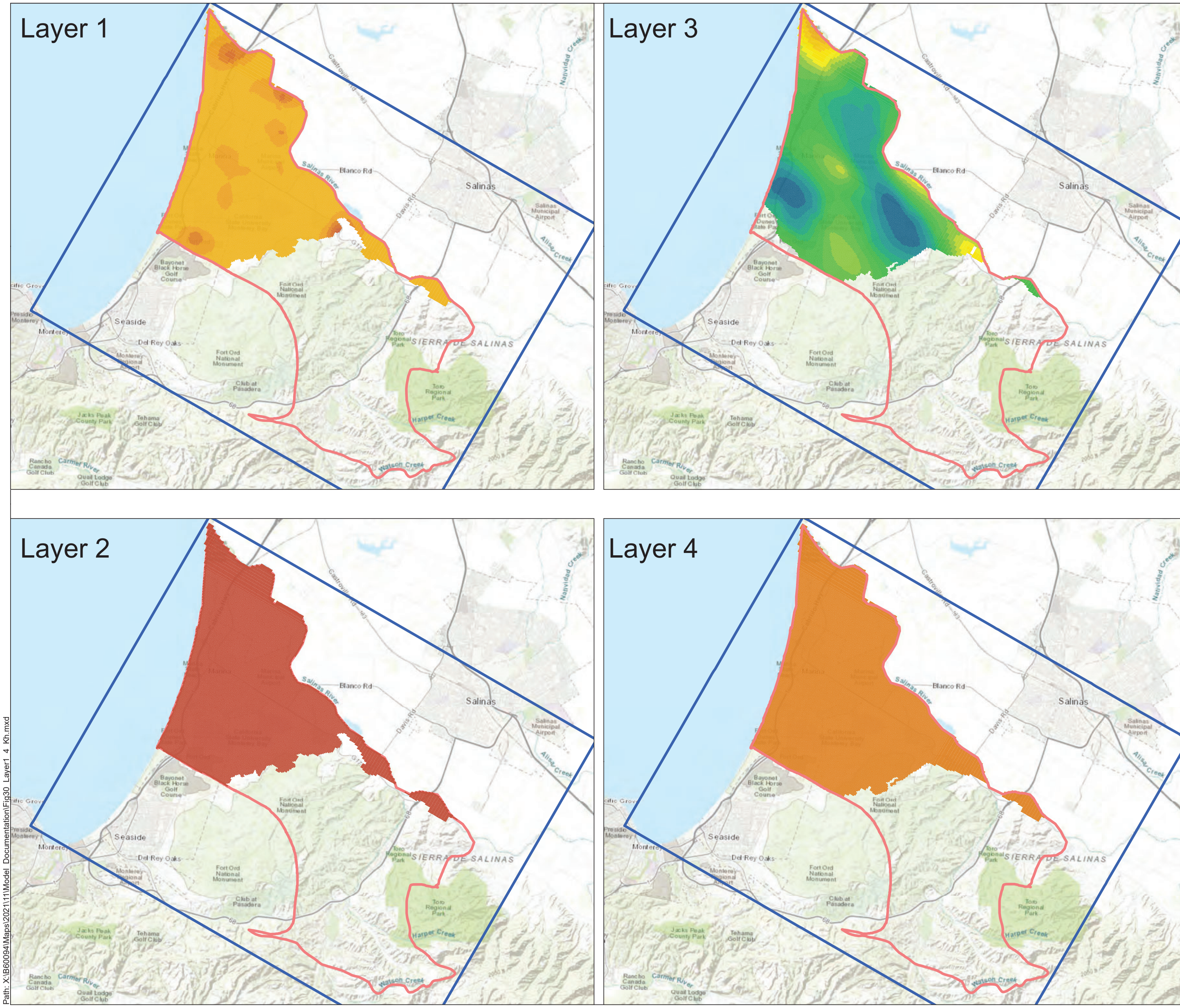
Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

MBGWFM Calibration Wells

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03
Figure 29

eki environment & water

Path: X:\B60094\Maps\2021\11\Model Documentation\Fig29 MBGWFM Calibration Wells.mxd



Legend

Grid Extent

MBGWFM Active Area

Horizontal Hydraulic Conductivity (ft/d)

- < 5
- 6 - 10
- 11 - 15
- 16 - 20
- 21 - 25
- 26 - 30
- 31 - 35
- 36 - 40
- 41 - 45
- 46 - 50
- 51 - 55
- 56 - 60
- 61 - 65
- 66 - 70
- 71 - 75
- 76 - 80
- 81 - 85
- 86 - 90
- 91 - 95
- 96 - 100
- > 100

Abbreviations

ft/d = feet per day

MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 9 November 2021.

N

0 3 6

(Scale in Miles)

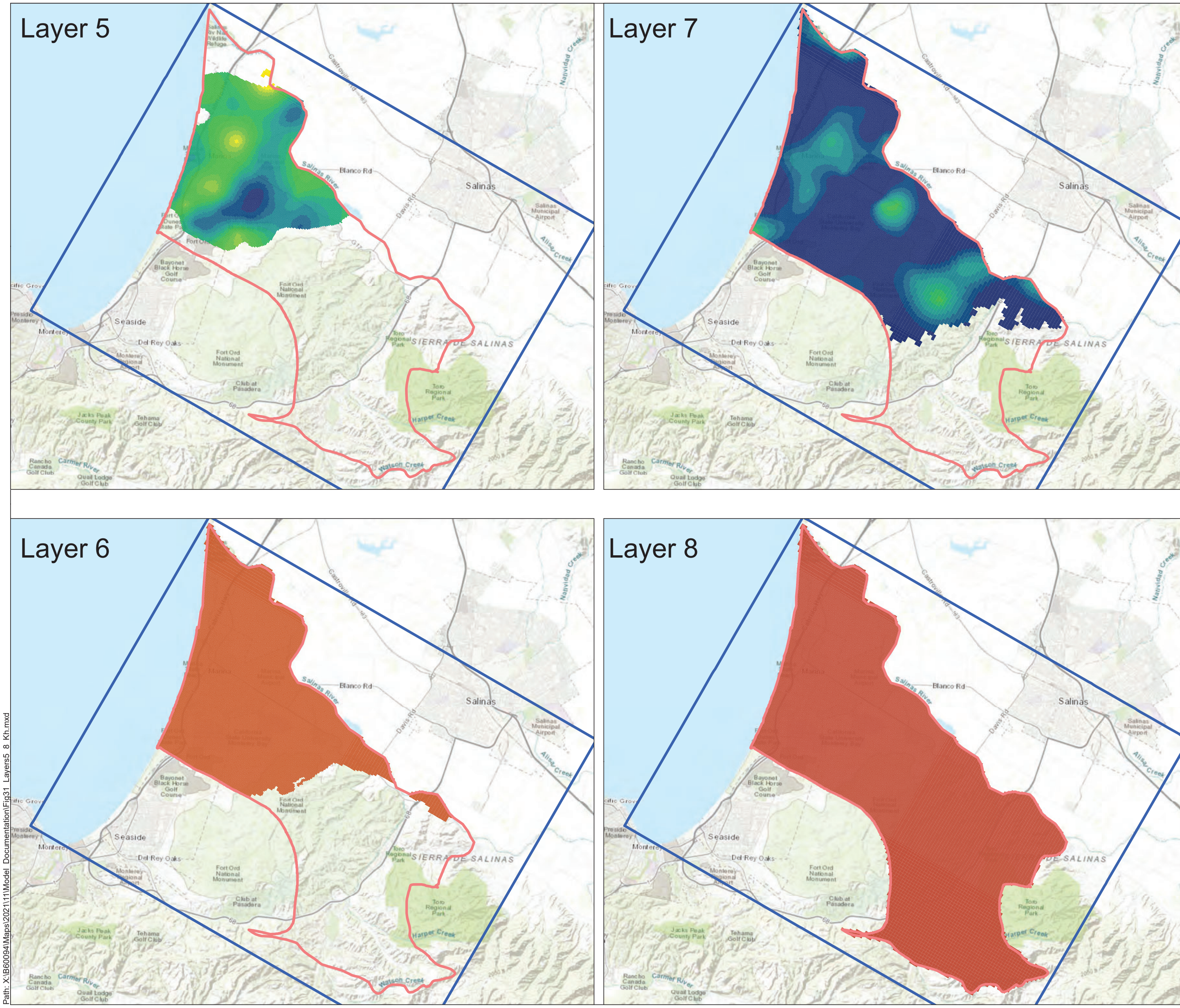
Horizontal Hydraulic Conductivity
Layers 1 - 4

Marina Coast Water District
Monterey County, CA
November 2021
EKI B60094.12

Figure 30

eki environment & water

Path: X:\B60094\Maps\2021\11\Model_Documentation\Fig30_Layer1_4_Kh.mxd



Legend

Grid Extent

MBGWFM Active Area

Horizontal Hydraulic Conductivity (ft/d)

- < 5
- 6 - 10
- 11 - 15
- 16 - 20
- 21 - 25
- 26 - 30
- 31 - 35
- 36 - 40
- 41 - 45
- 46 - 50
- 51 - 55
- 56 - 60
- 61 - 65
- 66 - 70
- 71 - 75
- 76 - 80
- 81 - 85
- 86 - 90
- 91 - 95
- 96 - 100
- > 100

Abbreviations

ft/dl = feet per day

MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 9 November 2021.

N

0 3 6

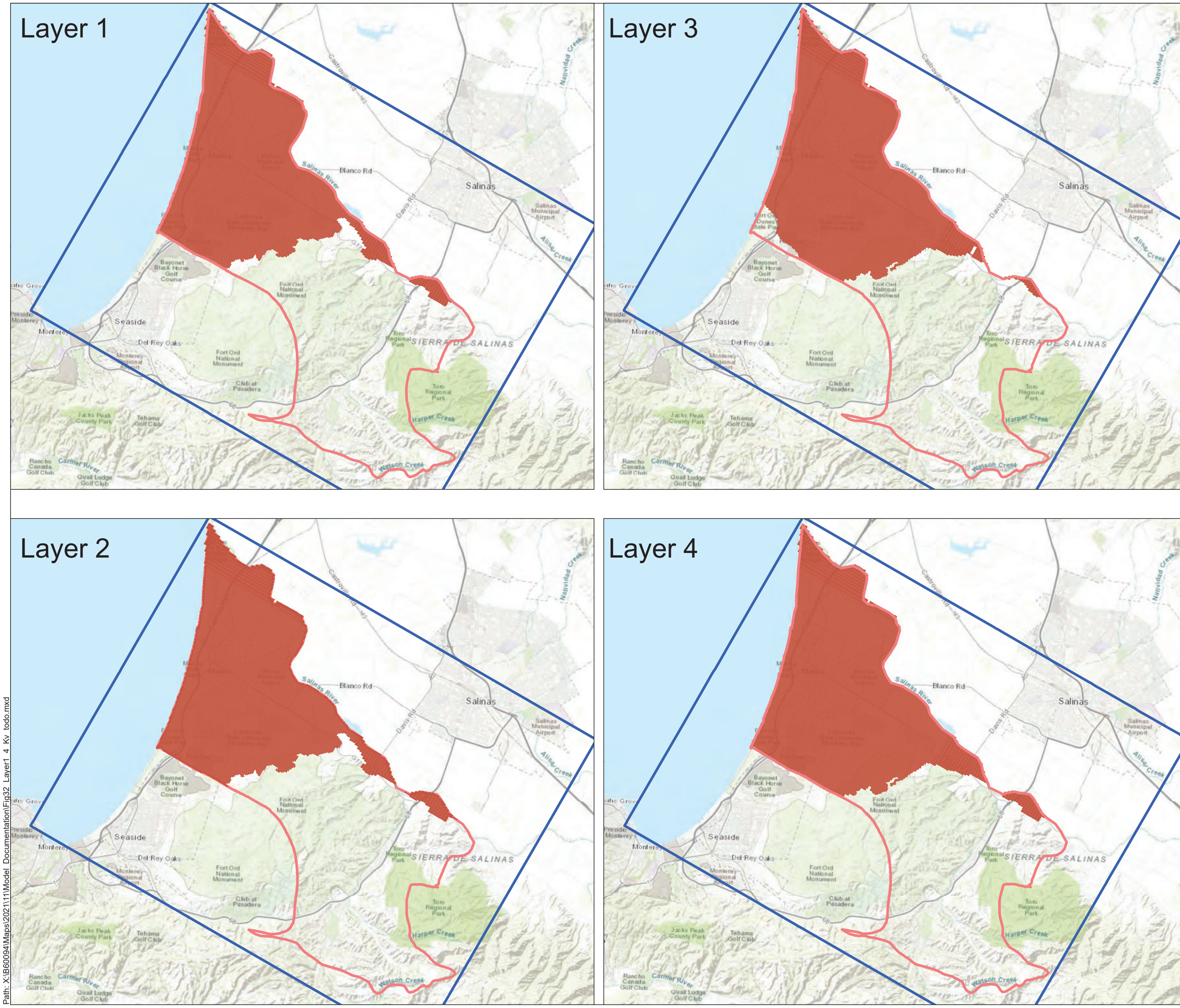
(Scale in Miles)

Horizontal Hydraulic Conductivity
Layers 5 – 8

Marina Coast Water District
Monterey County, CA
November 2021
EKI B60094.12
Figure 31

eki environment & water

Path: X:\B60094\Maps\2021\11\Model_Documentation\Fig31_Layers5_8_Kh.mxd



Legend

Grid Extent

MBGWFM Active Area

Vertical Hydraulic Conductivity (ft/d)

- < 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- > 60

Abbreviations

ft/d = feet per day

MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 9 November 2021.

N

0 3 6

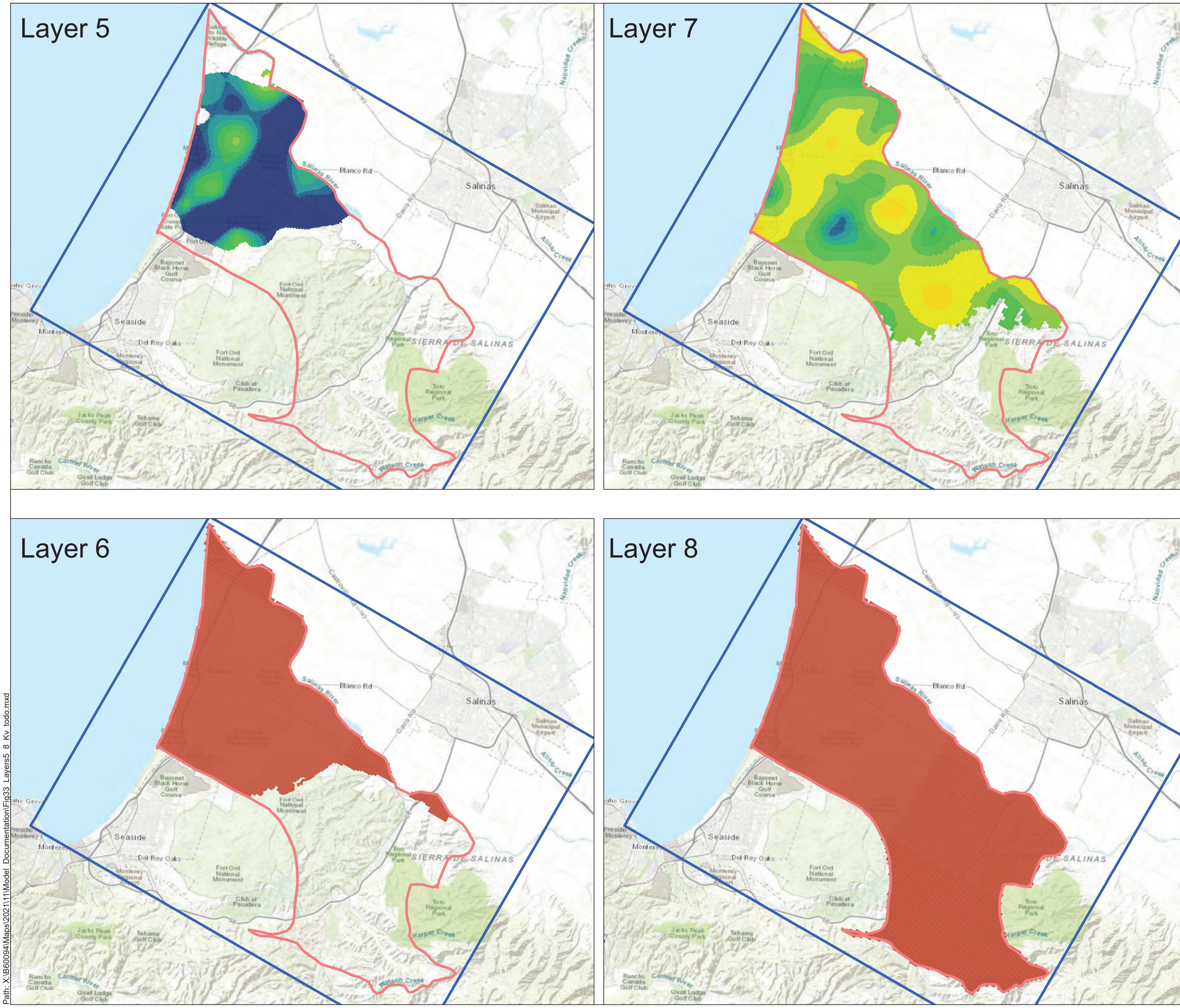
(Scale in Miles)

Vertical Hydraulic Conductivity
Layers 1 - 4

Marina Coast Water District
Monterey County, CA
November 2021
EKI B60094.12
Figure 32

eki environment & water

Path: X:\B60094\Maps\2021\11\Model Documentation\Fig32 Layer1 4 Kv todo.mxd



Legend

- Grid Extent
- MBGWFM Active Area

Vertical Hydraulic Conductivity (ft/d)

- < 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- > 60

Abbreviations
ft/dl = feet per day
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. All locations are approximate.

Sources
1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 9 November 2021.

N

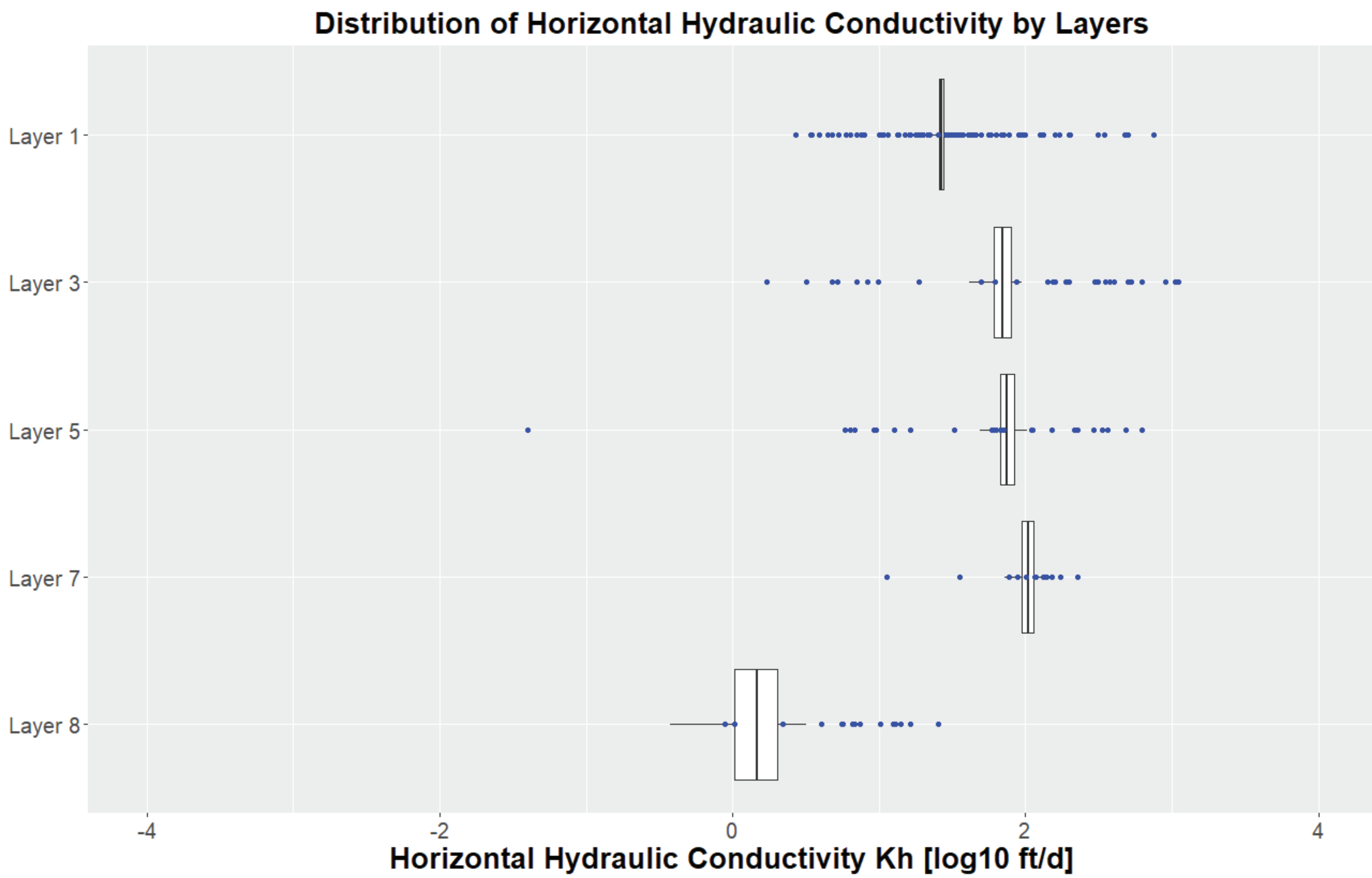
0 3 6
(Scale in Miles)

Vertical Hydraulic Conductivity
Layers 5 – 8

Marina Coast Water District
Monterey County, CA
November 2021
EKI B60094.12
Figure 33

eki environment & water

Path: X:\B60094\Maps\2021\11\Model Documentation\Fig33_Layers5_8_Kv_todo.mxd

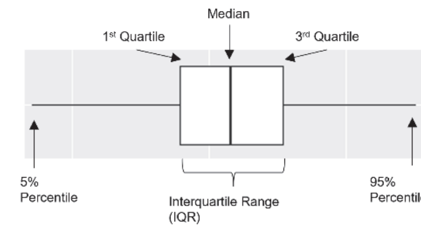


Legend

Observed:

Pumping Test Measurement

Modeled:



Abbreviations

Kh: Horizontal Hydraulic Conductivity

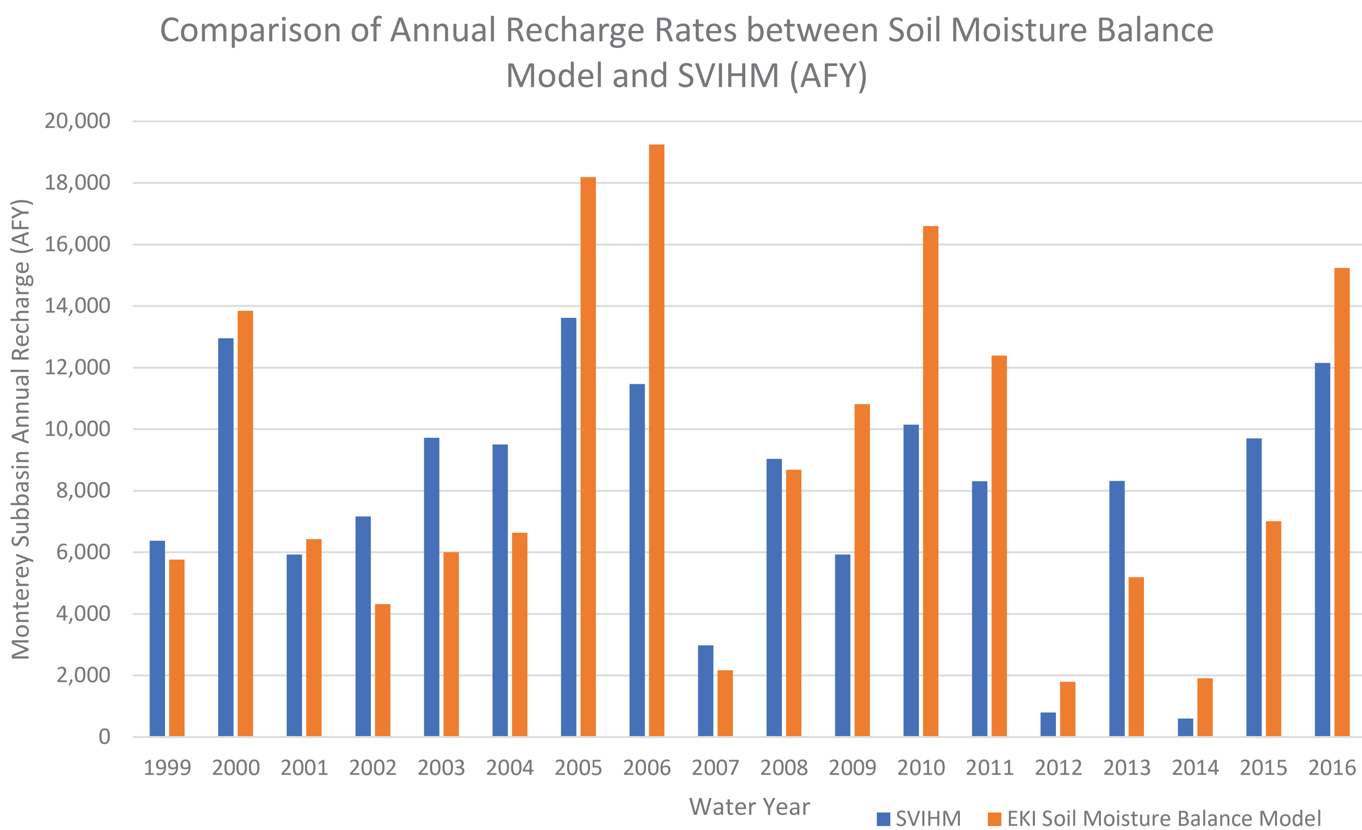
Notes

eki environment & water

Comparison of Modeled and Observed Horizontal Hydraulic Conductivity

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03

Figure 34



Legend

- = SVIHM (USGS)
- = Soil Moisture Balance Model (EKI)

Abbreviations

AFY = acre-feet per year
SVIHM = Salinas Valley Integrated Hydrologic Model
USGS = United States Geological Survey

Notes

1. Reported annual recharge rates are for the entire Monterey Subbasin.

Sources

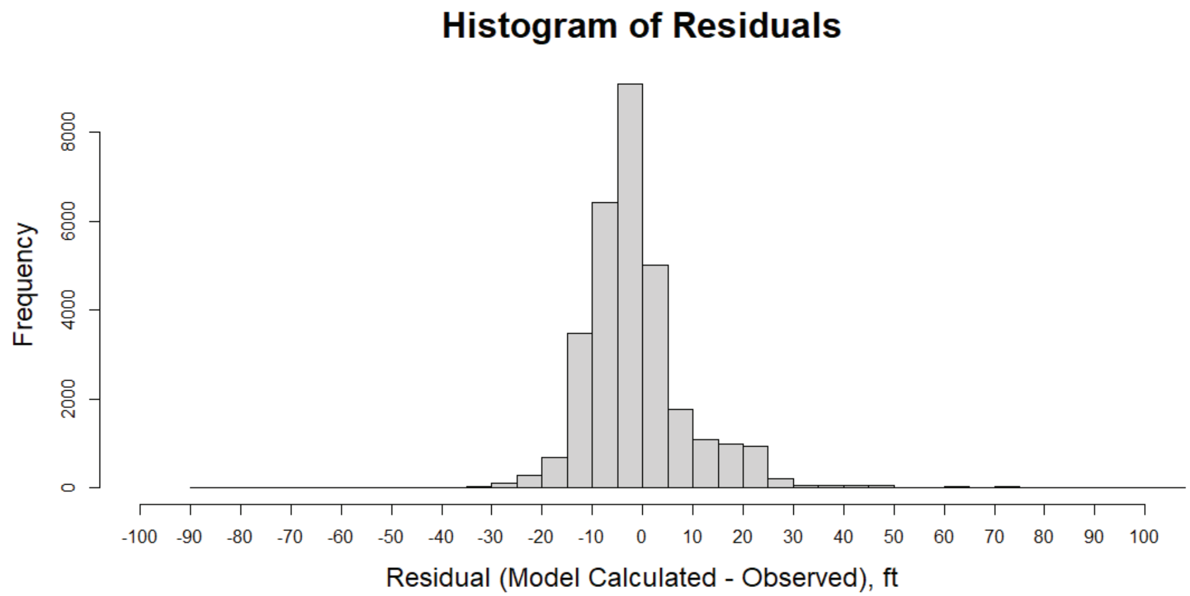
1. Soil Moisture Balance Model (EKI)
2. SVIHM (USGS)

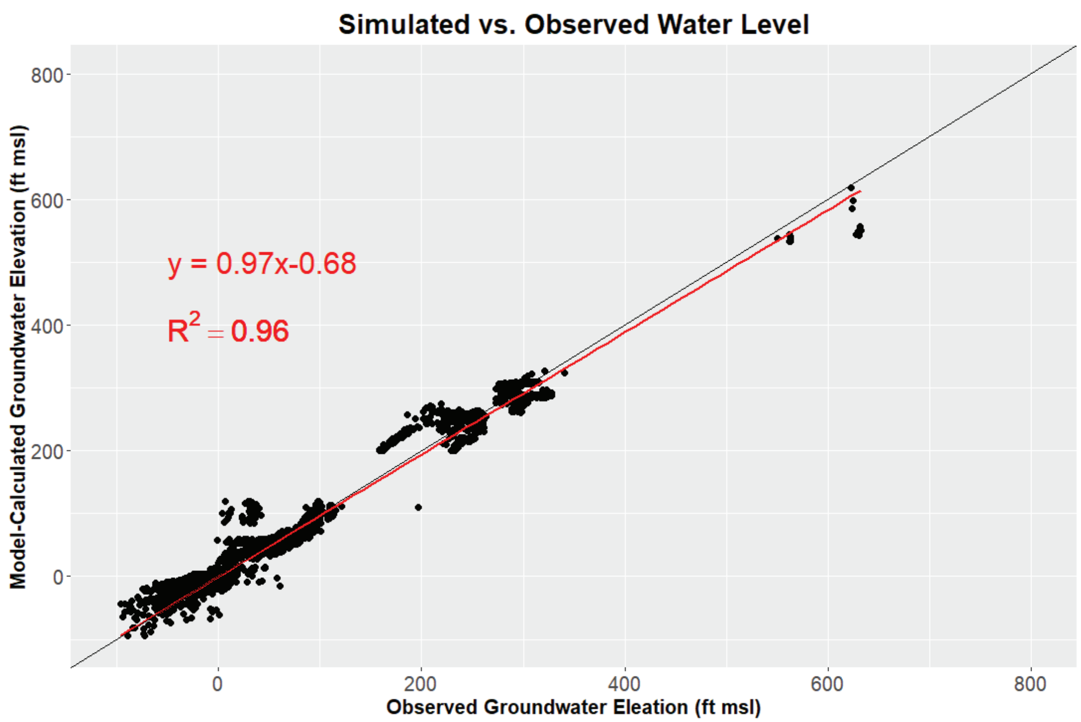
eki environment & water

Comparison of Annual Recharge Rates between Soil Moisture Balance Model and SVIHM

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.12

Figure 35





Legend

= 1:1

= Linear (Observed)

= Oberved Groundwater Elevation

Abbreviations

ft = feet

ft msl = feet above mean sea level

Notes

1. Residual is calculated as model-calculated minus observed groundwater elevation

Sources

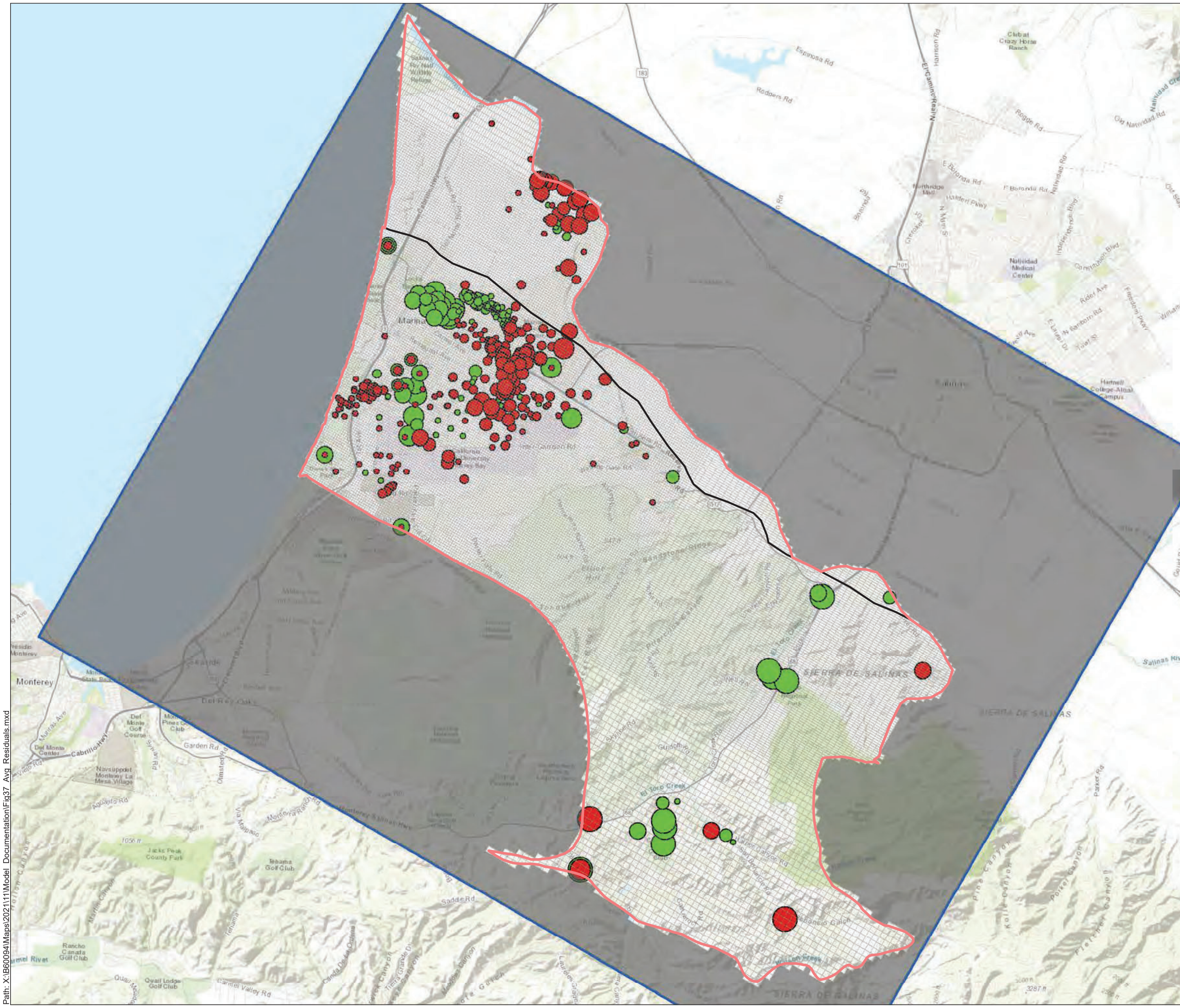
1. Monterey Subbasin Groundwater Flow Model

eki environment & water

Calibration Statistics

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.12

Figure 36



Legend

- Monterey Subbasin
- MBGWFM Active Area
- Grid Extent

MBGWFM Grid

- Active Cells
- Inactive Cells

Average Water Level Residual (ft)

- < - 25
- -25 to -20
- -20 to -15
- -15 to -10
- -10 to -5
- -5 to 0
- 0 to 5
- 5 to 10
- 10 to 15
- 15 to 20
- 20 to 25
- >25

Abbreviations
DWR = California Department of Water Resources
ft = feet
MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes
1. All locations are approximate.
2. Average residuals are calculated as the difference between model-calculated and observed water levels. A larger residual magnitude equates to a larger model error at the well.

Sources
1. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
2. Basemap courtesy of ESRI.

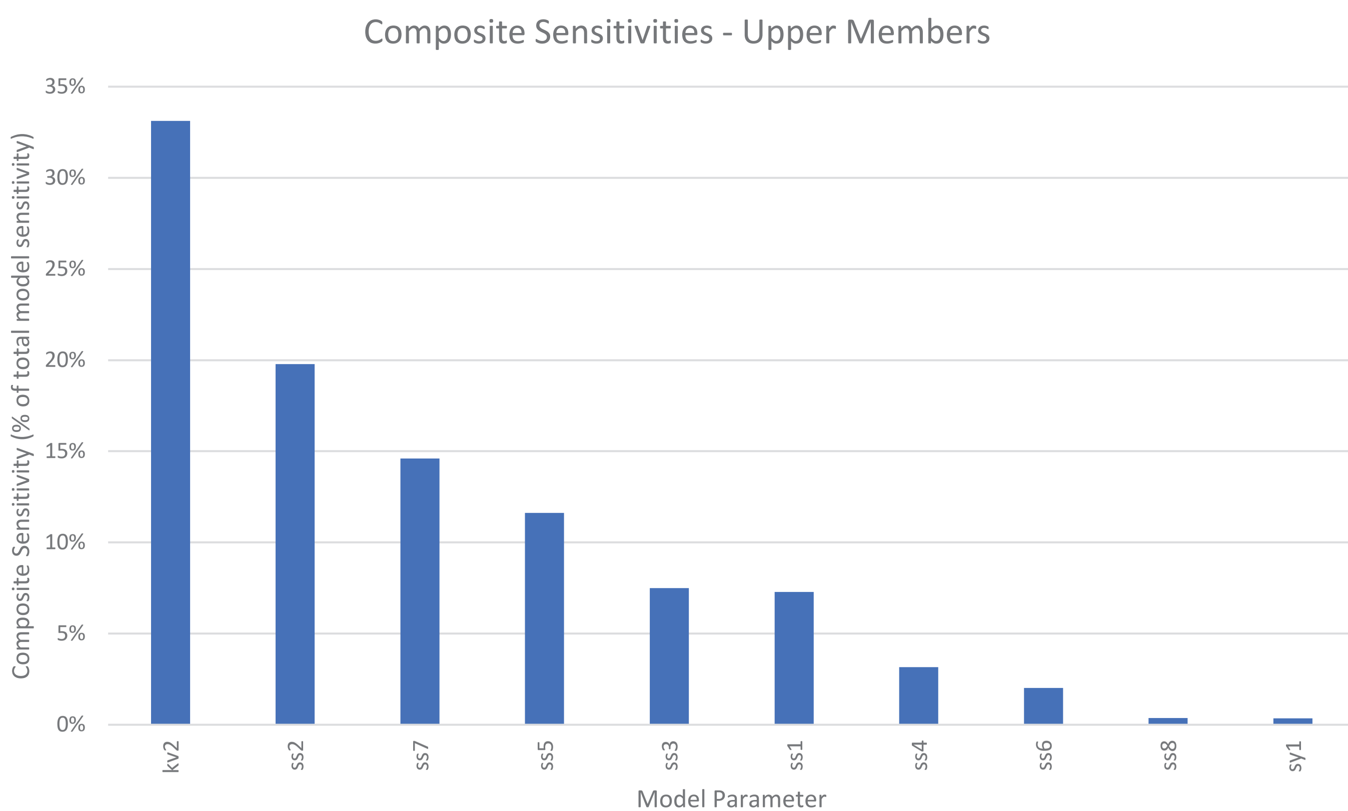
N
0 1 2
(Scale in Miles)

Average Residuals by Well

Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.03
Figure 37

eki environment & water

Path: X:\B60094\Maps\2021\11\Model Documentation\Fig37_Avg_Residuals.mxd



Legend

= Composite Sensitivity

Abbreviations

MBGWFM = Monterey Subbasin Groundwater Flow Model

Notes

1. Composite Sensitivites are calculated by dividing the parameter sensitivity by the total sensitivity of all model parameters.

Sources

1. MBGWFM

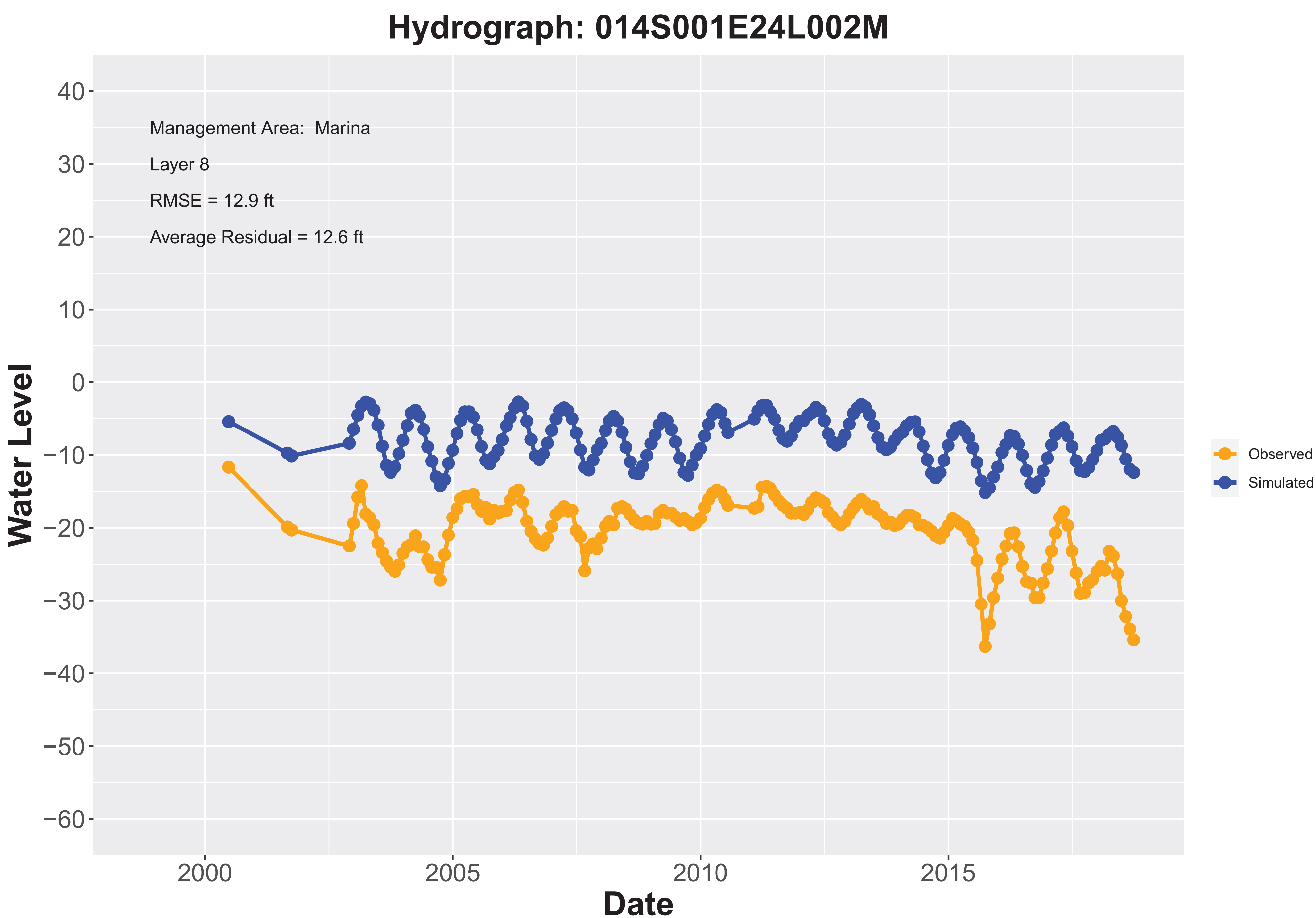
eki environment & water

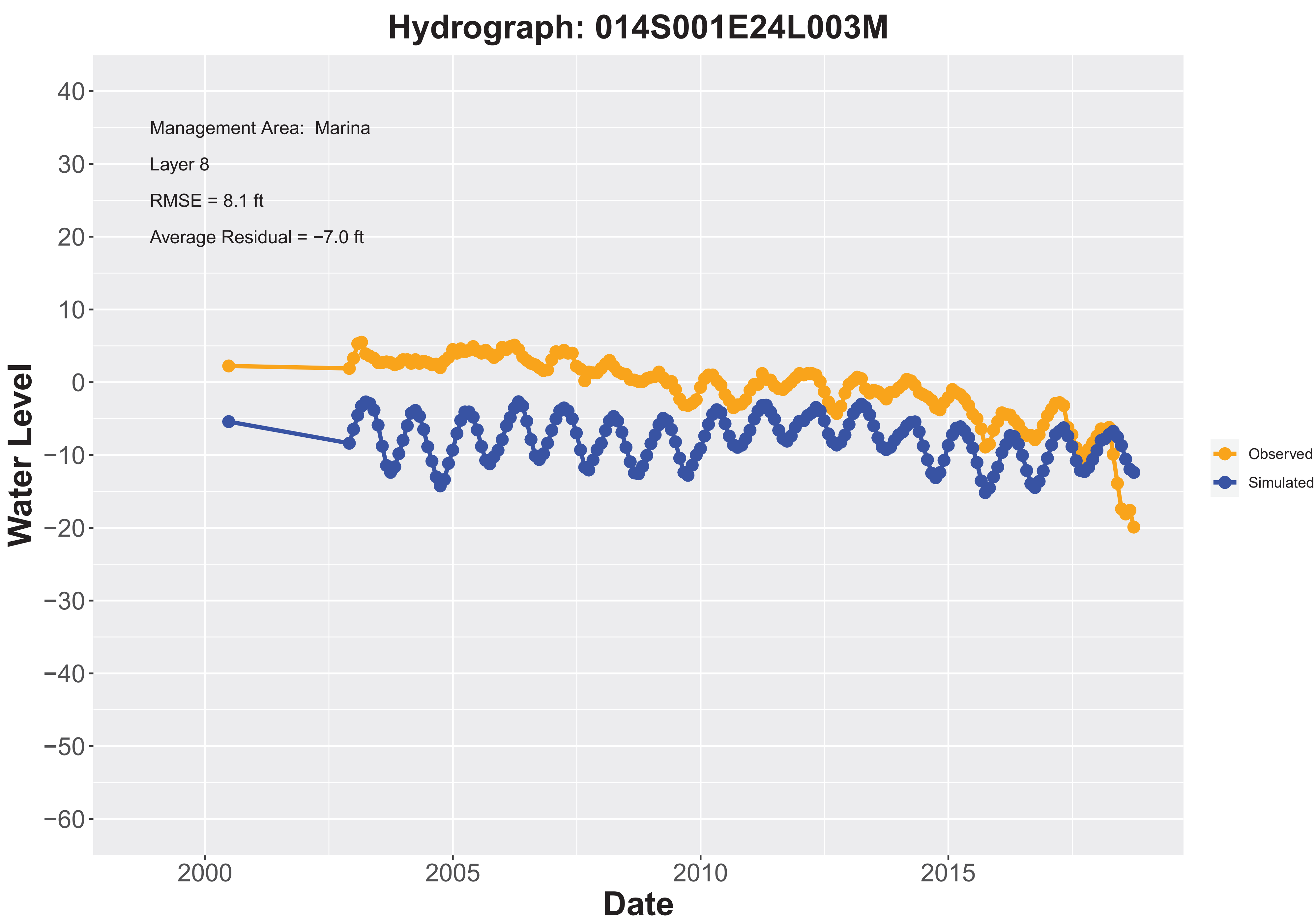
Composite Sensitivities for the Most Sensitive Model Parameters

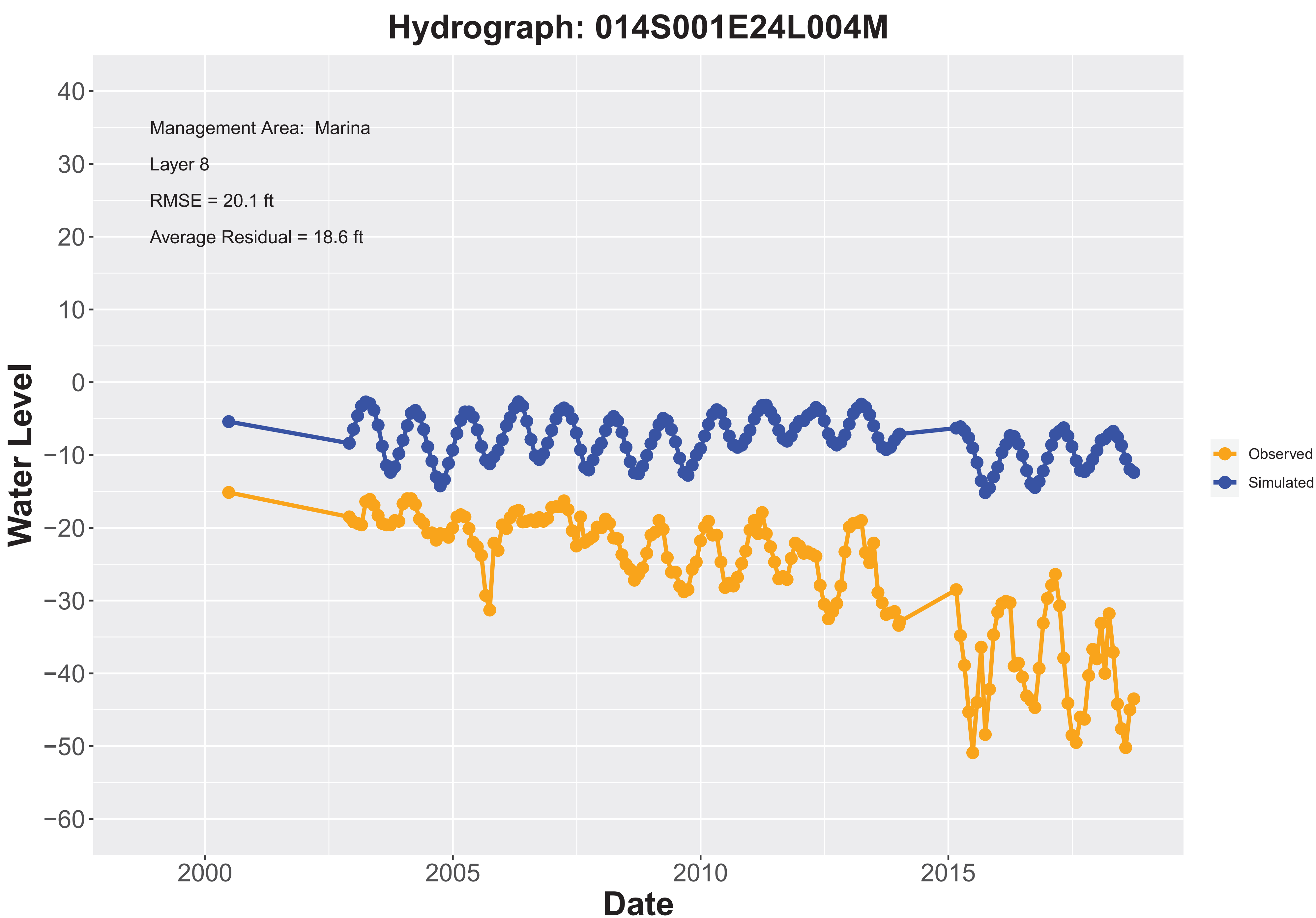
Marina Coast Water District
Monterey County, California
November 2021
EKI B60094.12

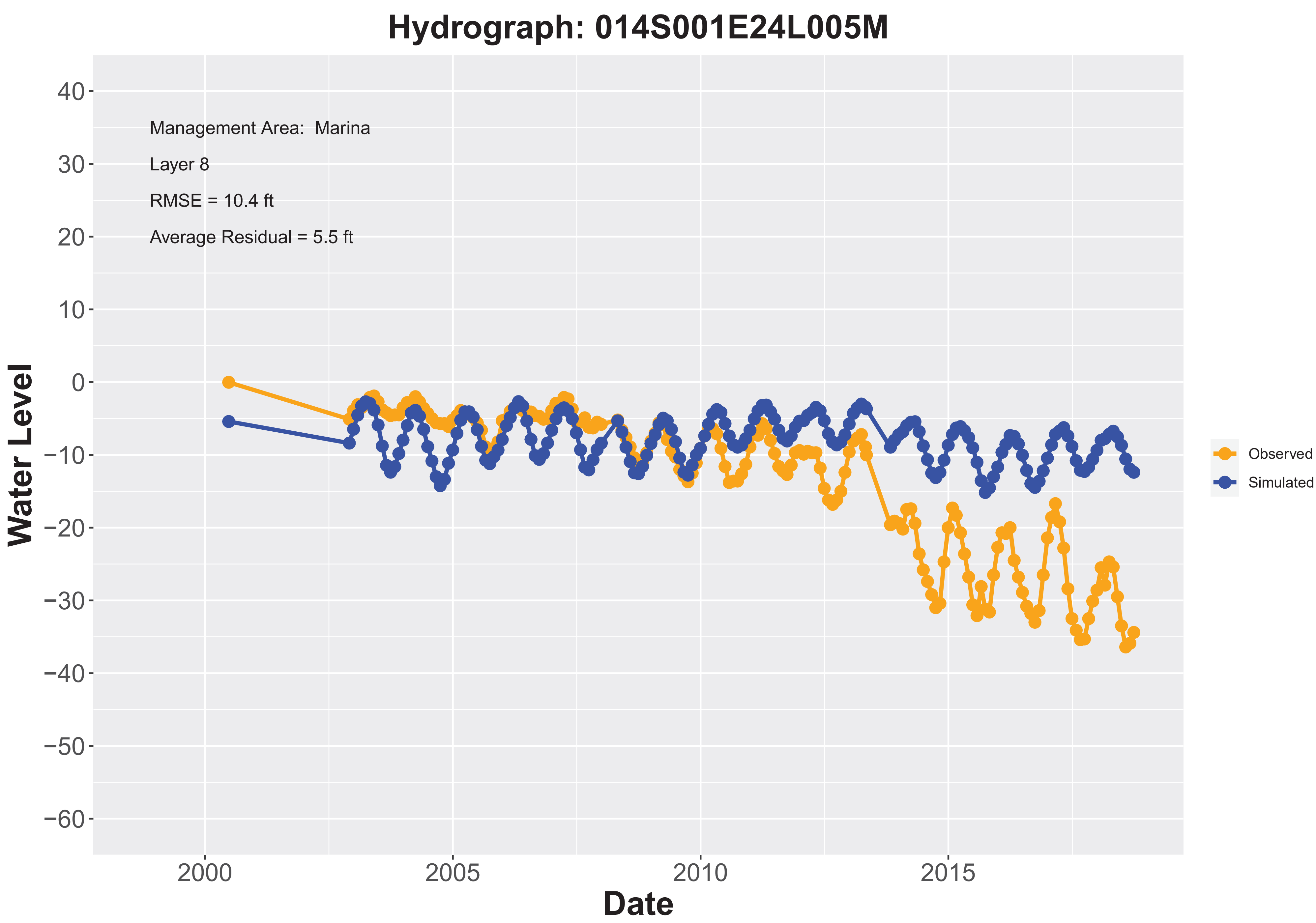
Figure 38

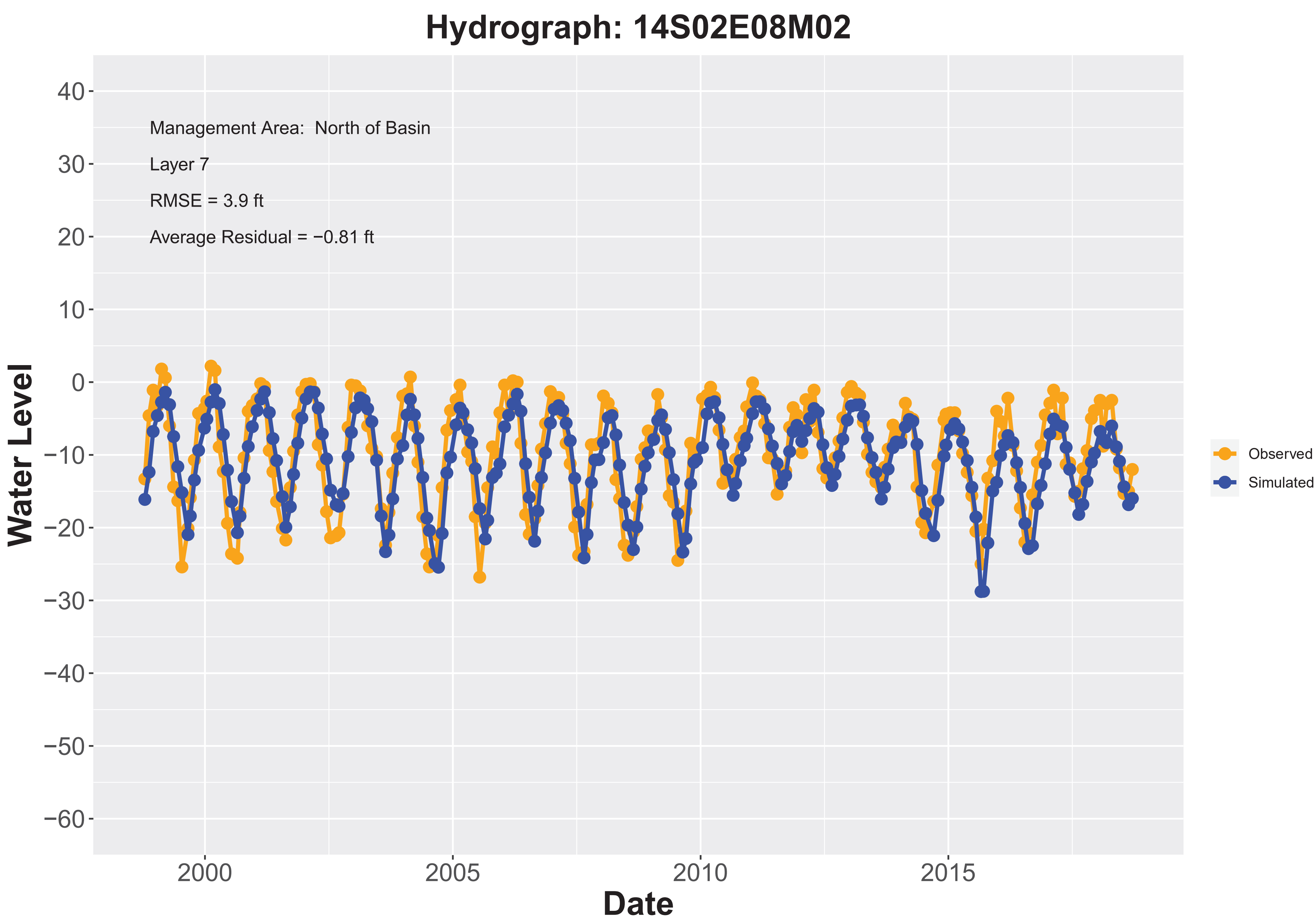
Attachment 1. Hydrographs


Hydrograph: 014S001E24L002M
Management Area: Marina
Layer 8
RMSE = 12.9 ft
Average Residual = 12.6 ft
Water Level
Date
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Observed
Simulated

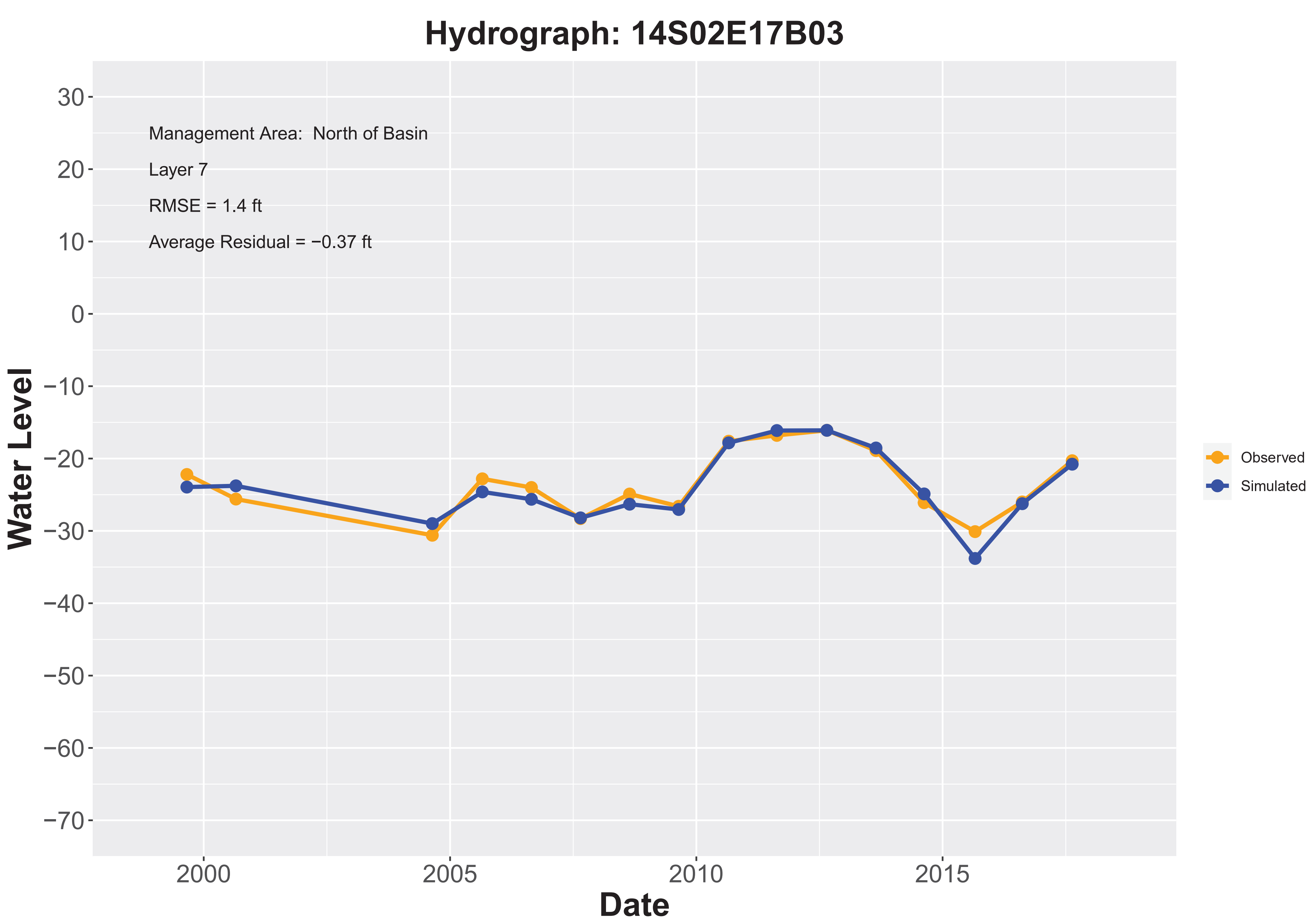

Hydrograph: 014S001E24L003M
Management Area: Marina
Layer 8
RMSE = 8.1 ft
Average Residual = −7.0 ft
Water Level
Date
Observed
Simulated


Hydrograph: 014S001E24L004M
Management Area: Marina
Layer 8
RMSE = 20.1 ft
Average Residual = 18.6 ft
Water Level
Date
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Observed
Simulated

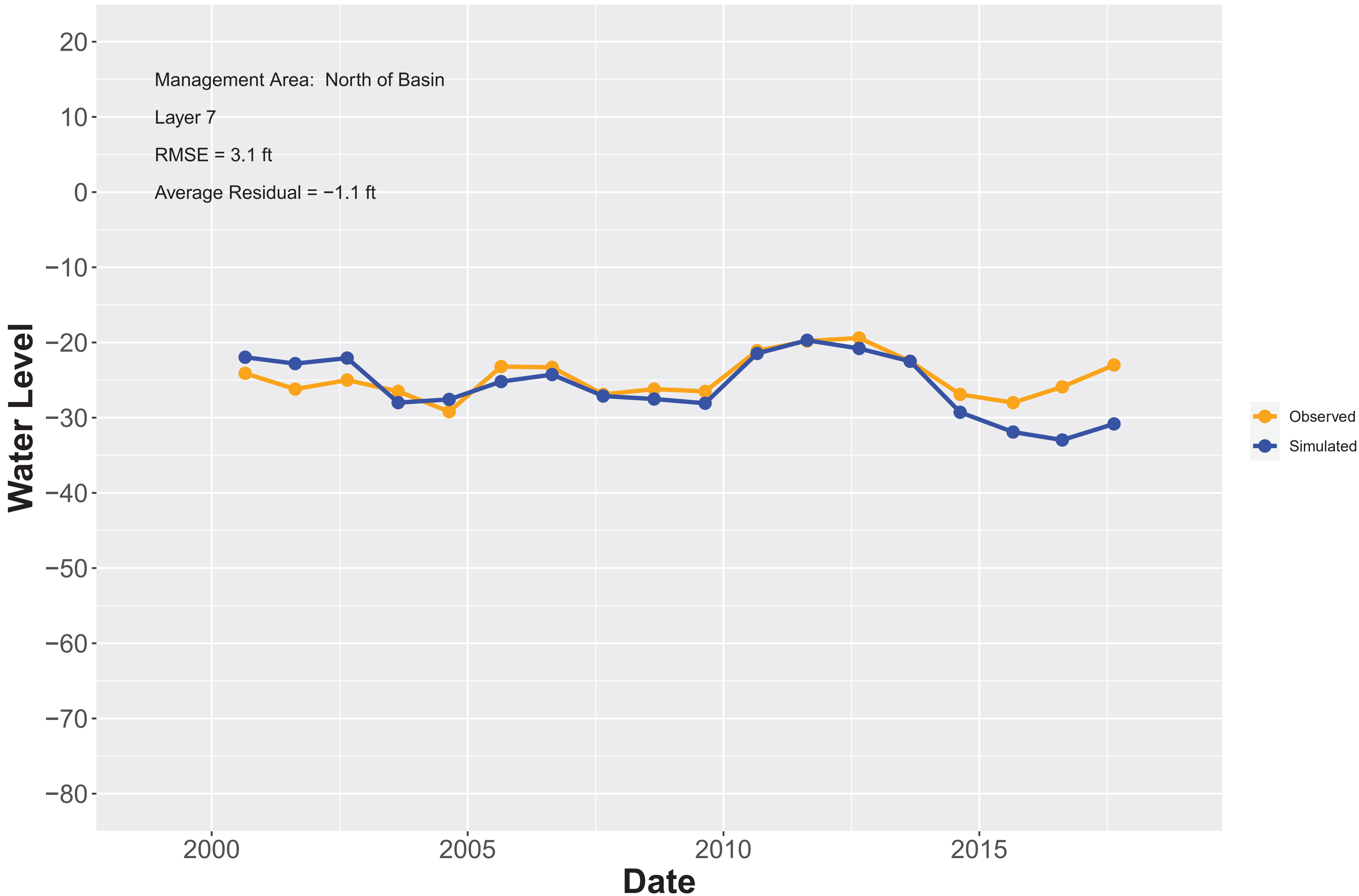

Hydrograph: 014S001E24L005M
Management Area: Marina
Layer 8
RMSE = 10.4 ft
Average Residual = 5.5 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

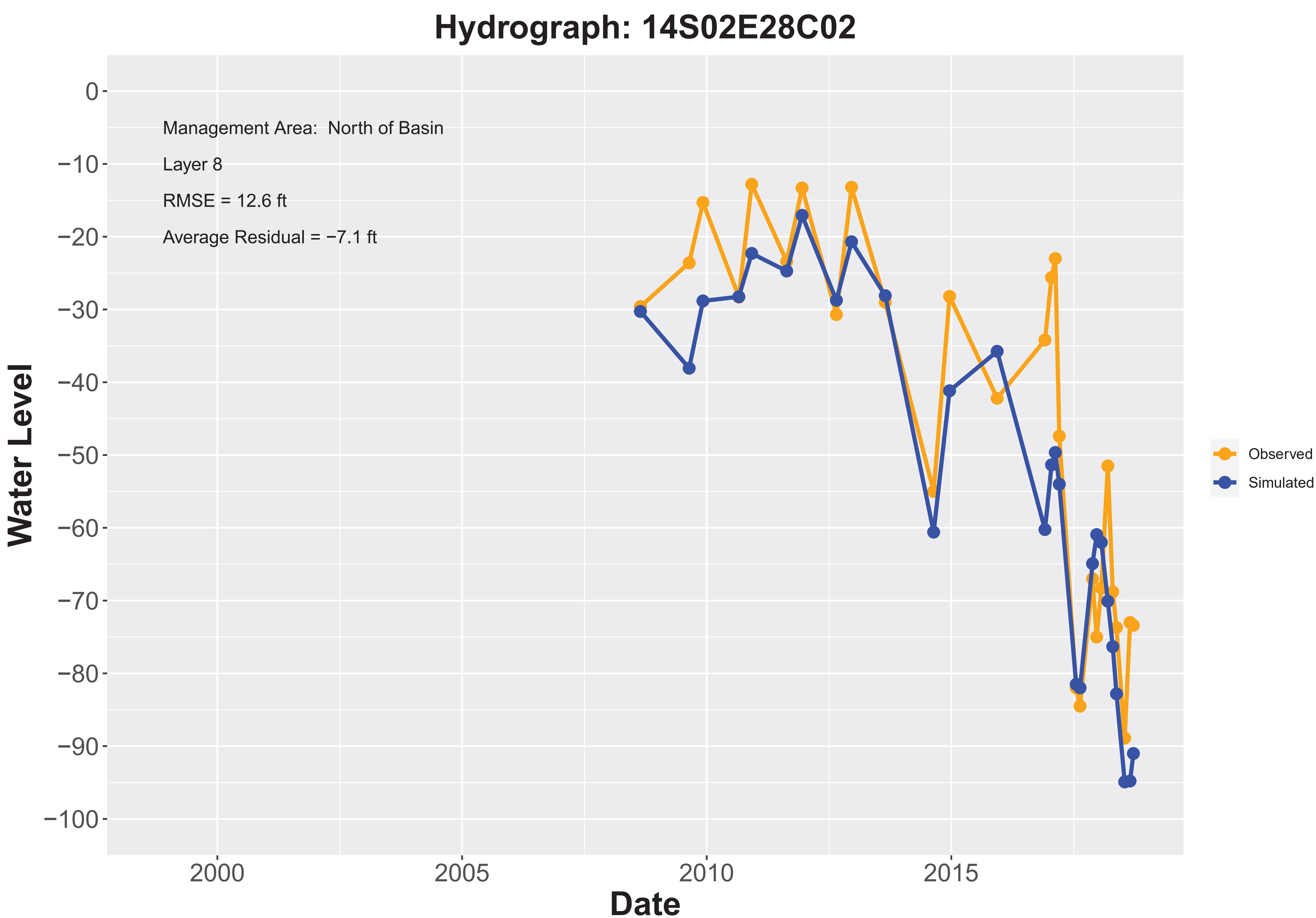


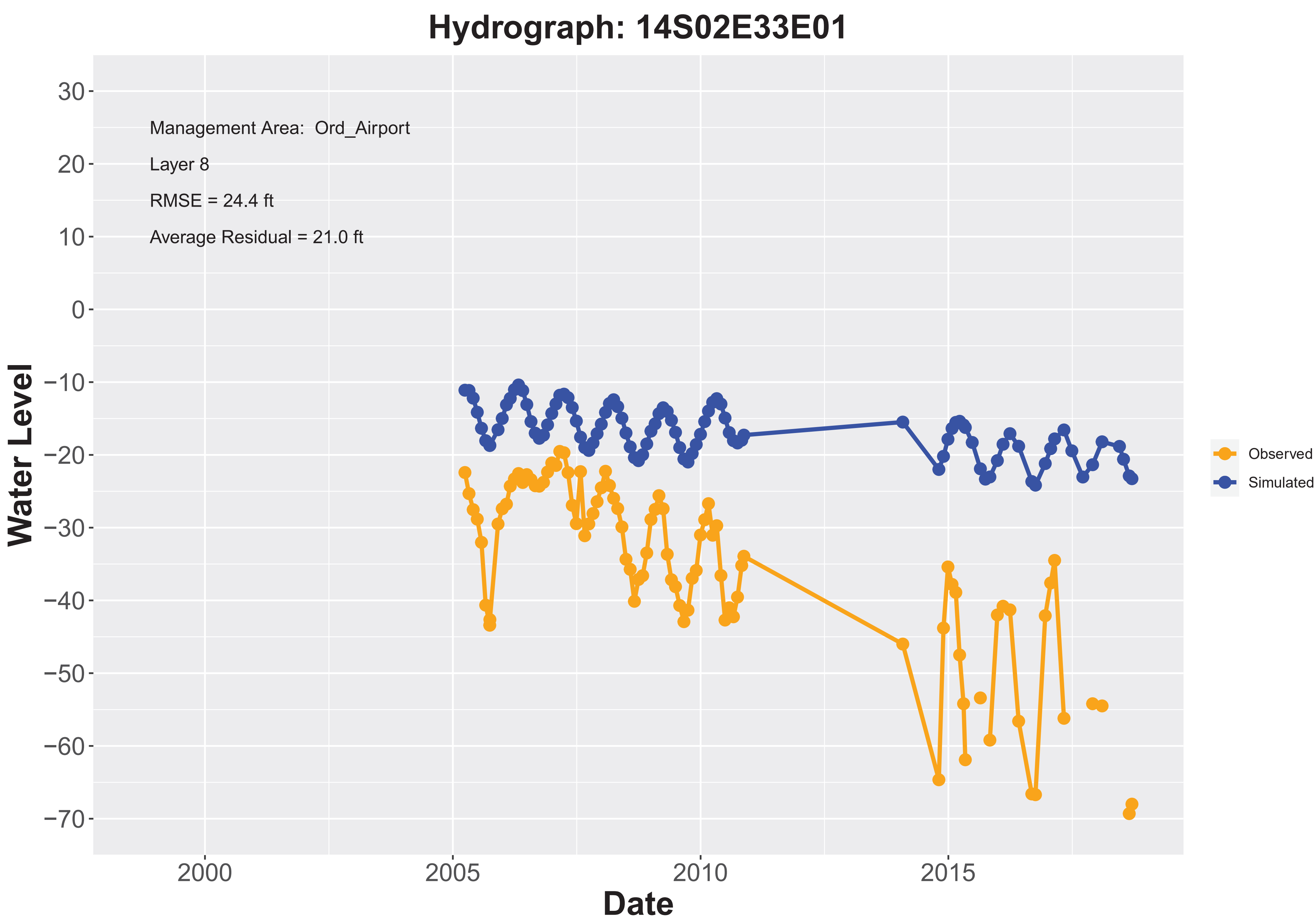
Hydrograph: 14S02E08M02
Management Area: North of Basin
Layer 7
RMSE = 3.9 ft
Average Residual = −0.81 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

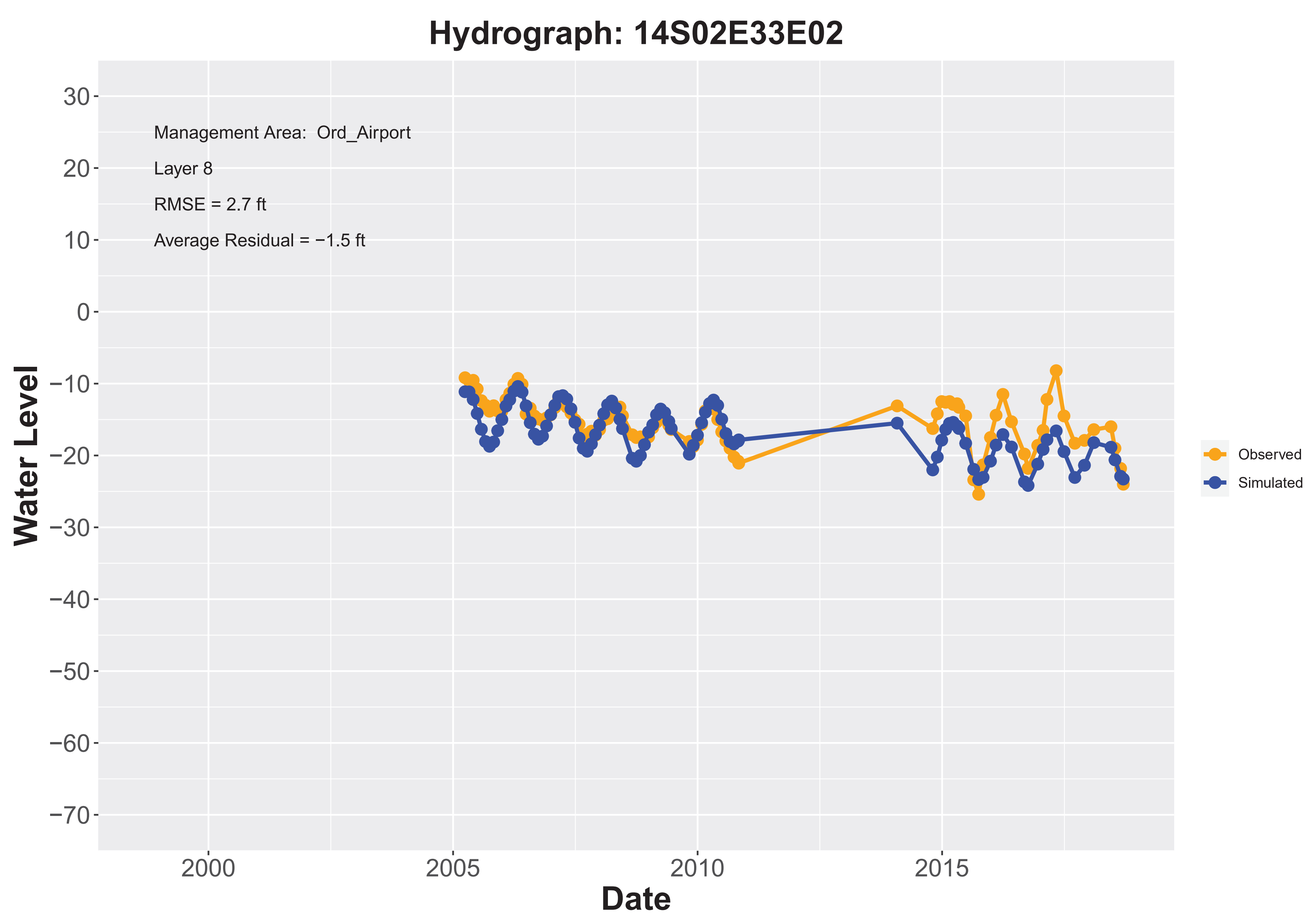

Hydrograph: 14S02E17B03
Management Area: North of Basin
Layer 7
RMSE = 1.4 ft
Average Residual = −0.37 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: 14S02E21N01

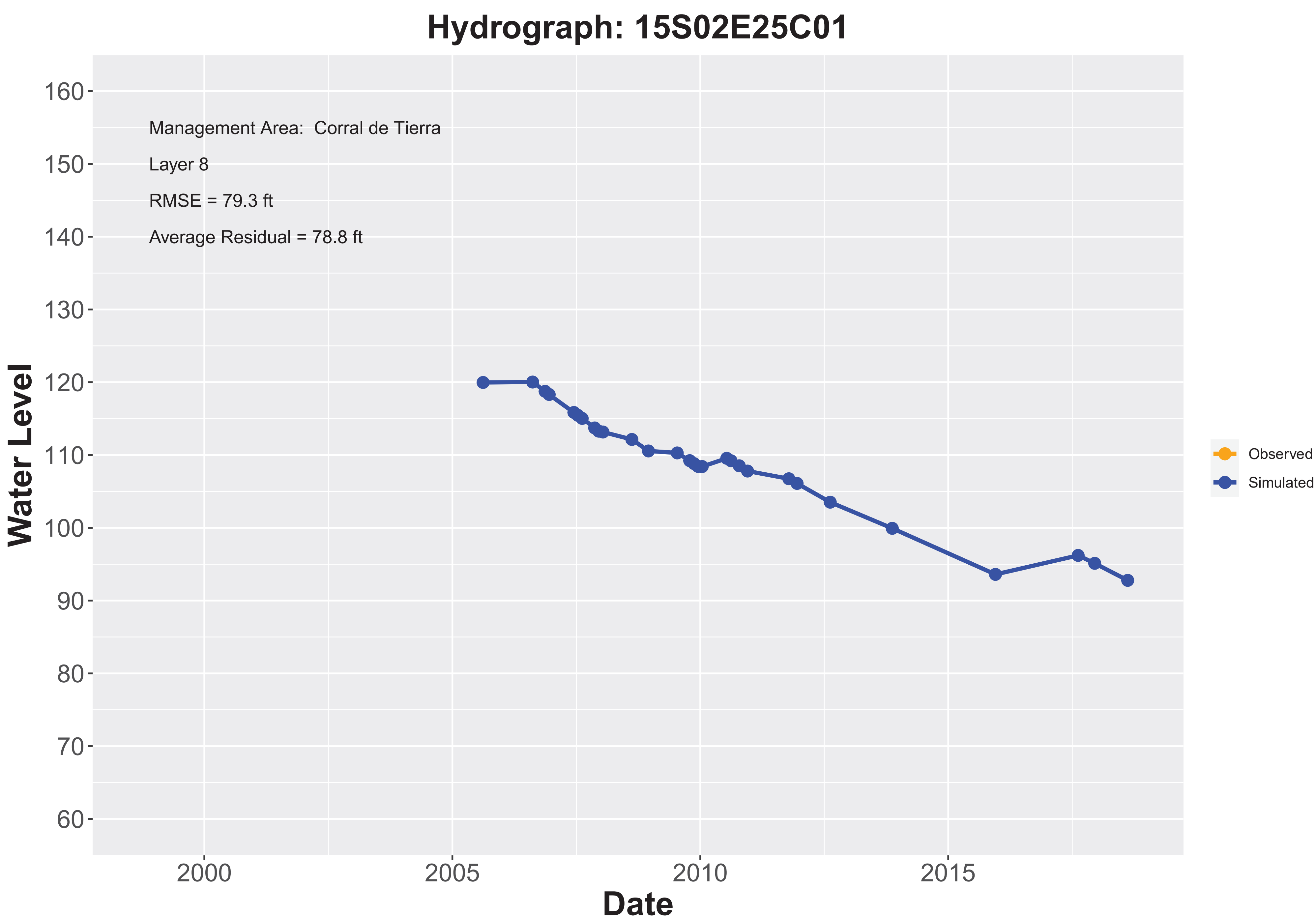


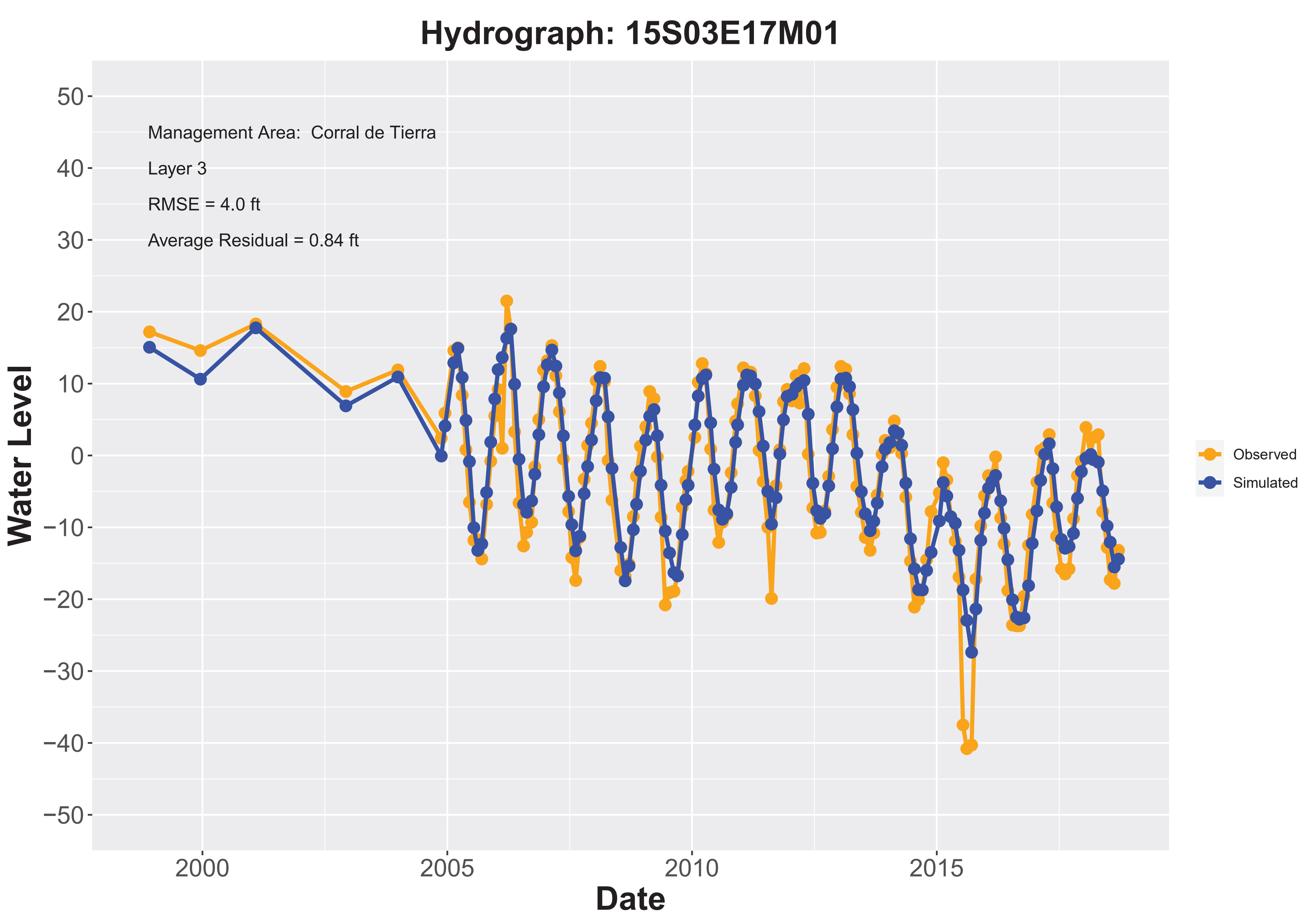

Hydrograph: 14S02E28C02
Management Area: North of Basin
Layer 8
RMSE = 12.6 ft
Average Residual = −7.1 ft
Water Level
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: 14S02E33E01
Management Area: Ord_Airport
Layer 8
RMSE = 24.4 ft
Average Residual = 21.0 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated

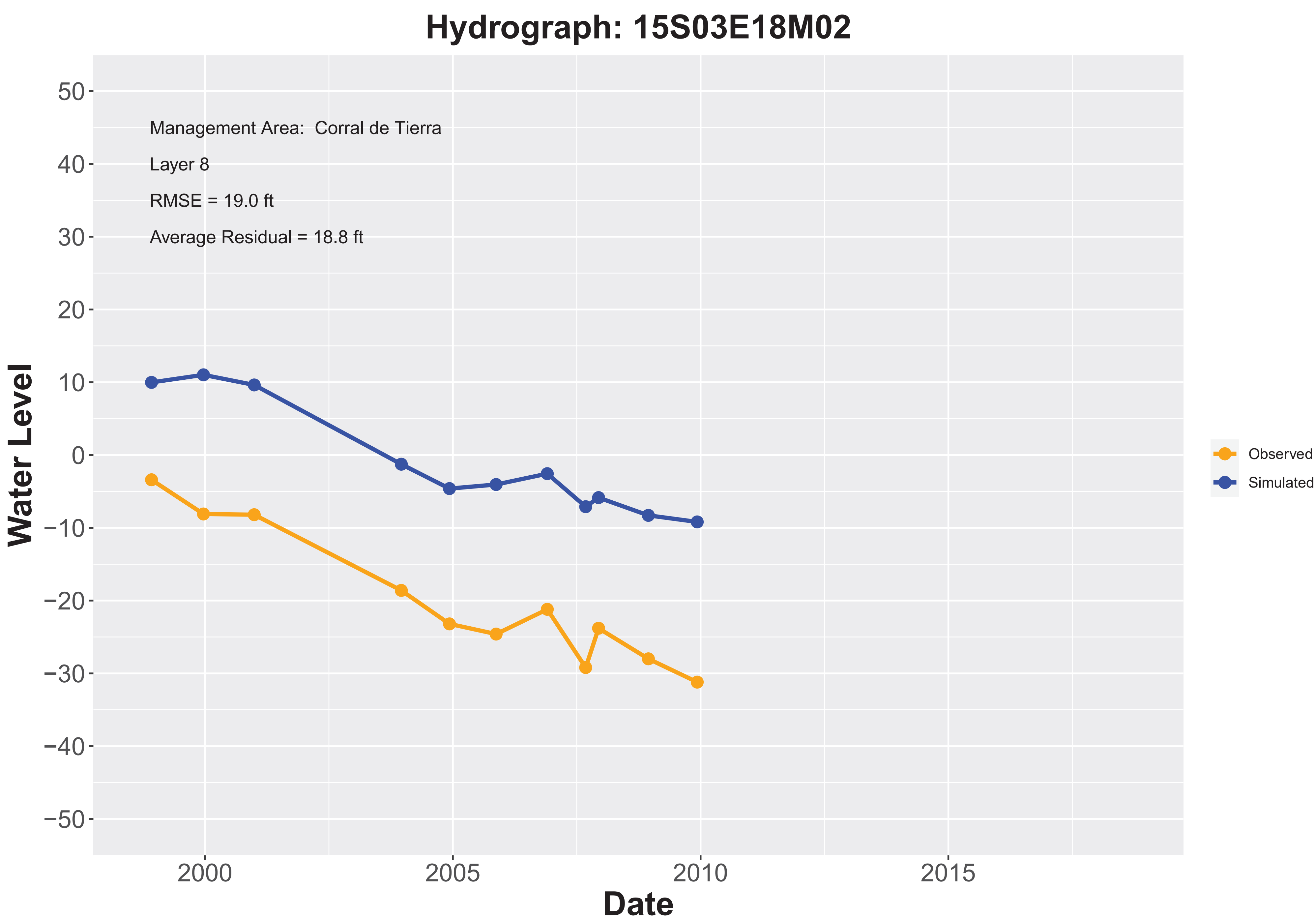


Hydrograph: 14S02E33E02
Management Area: Ord_Airport
Layer 8
RMSE = 2.7 ft
Average Residual = −1.5 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

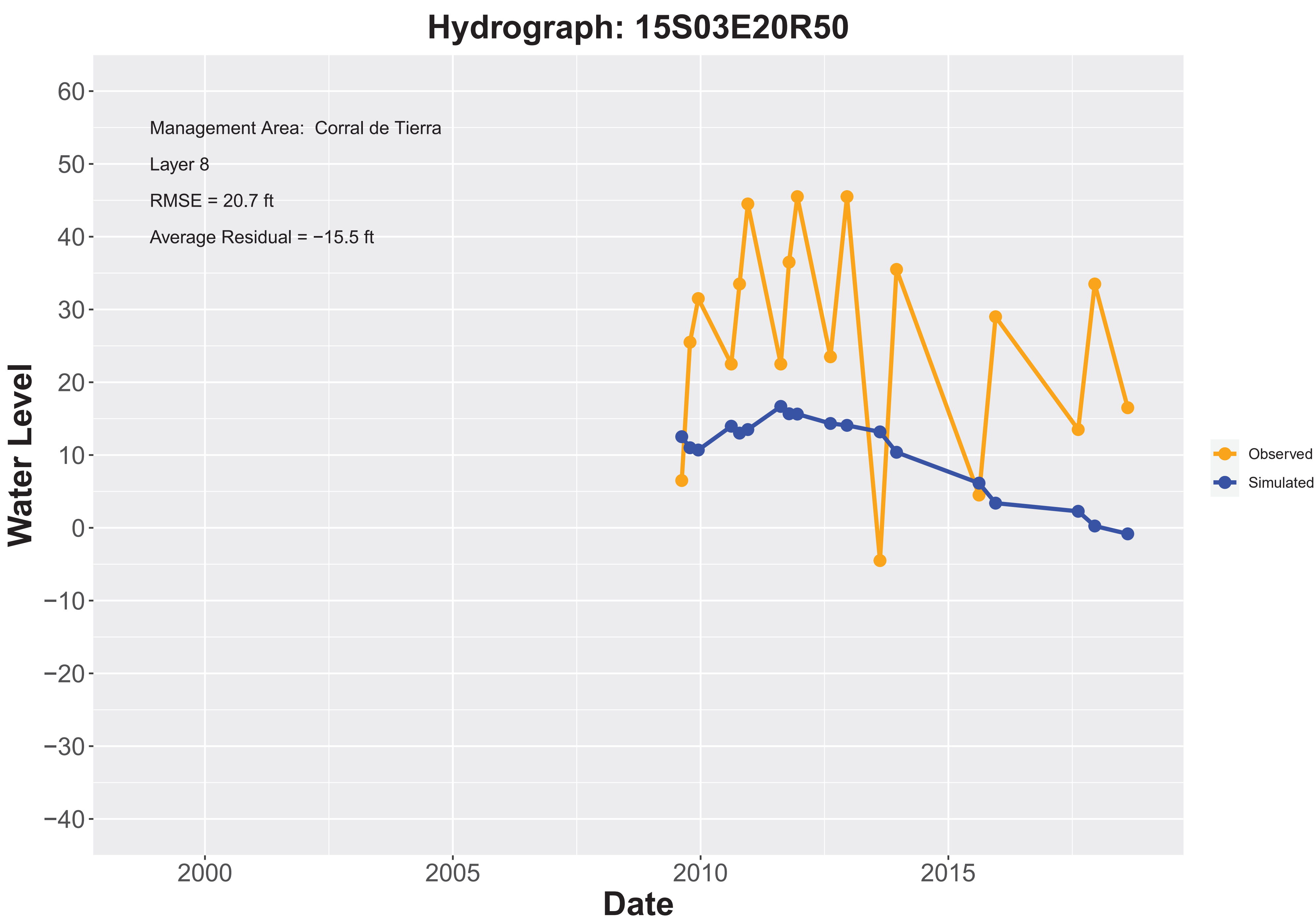

Hydrograph: 15S02E25C01
Management Area: Corral de Tierra
Layer 8
RMSE = 79.3 ft
Average Residual = 78.8 ft
Water Level
160
150
140
130
120
110
100
90
80
70
60
2000
2005
2010
2015
Date
Observed
Simulated

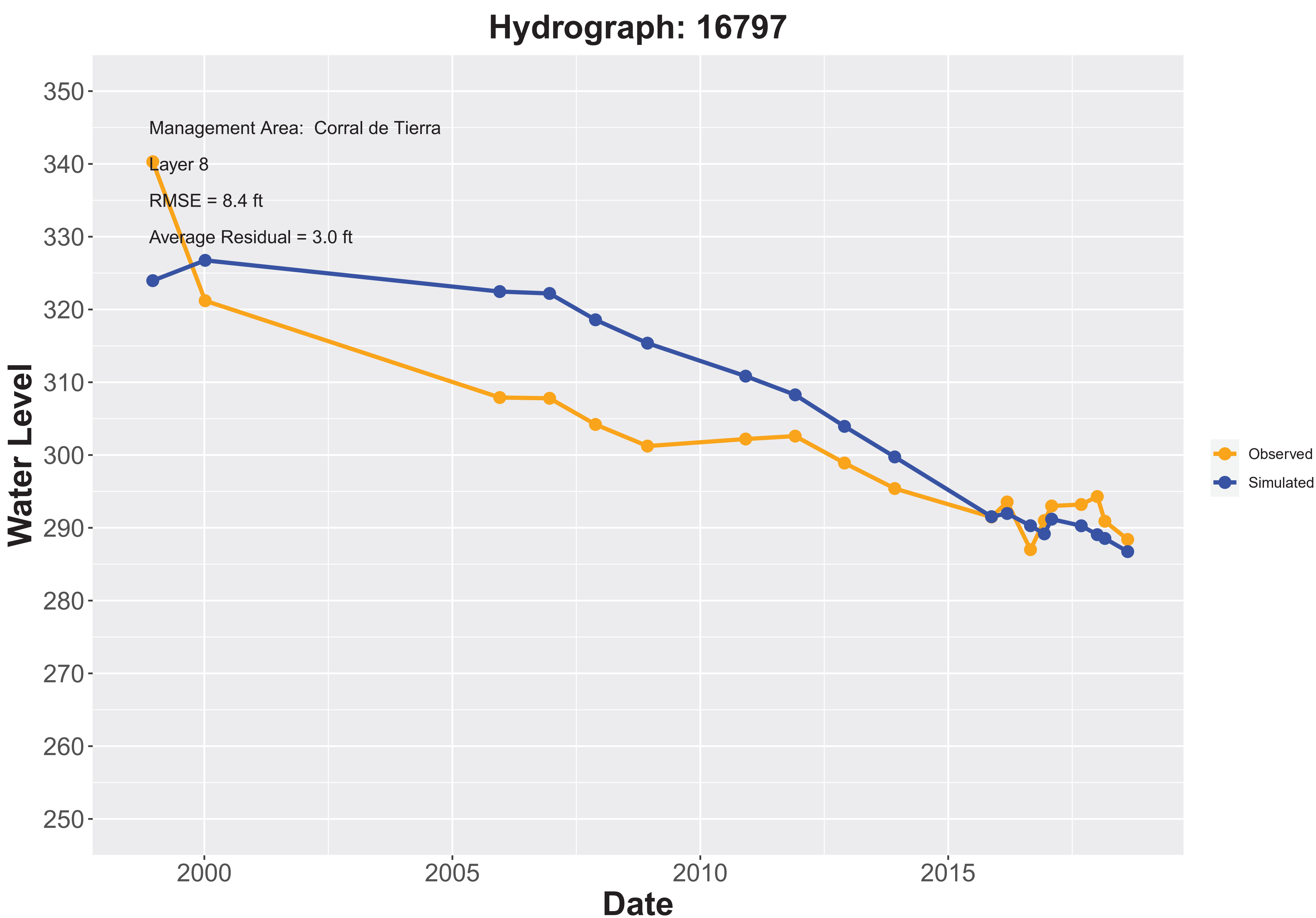


Hydrograph: 15S03E17M01
Management Area: Corral de Tierra
Layer 3
RMSE = 4.0 ft
Average Residual = 0.84 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

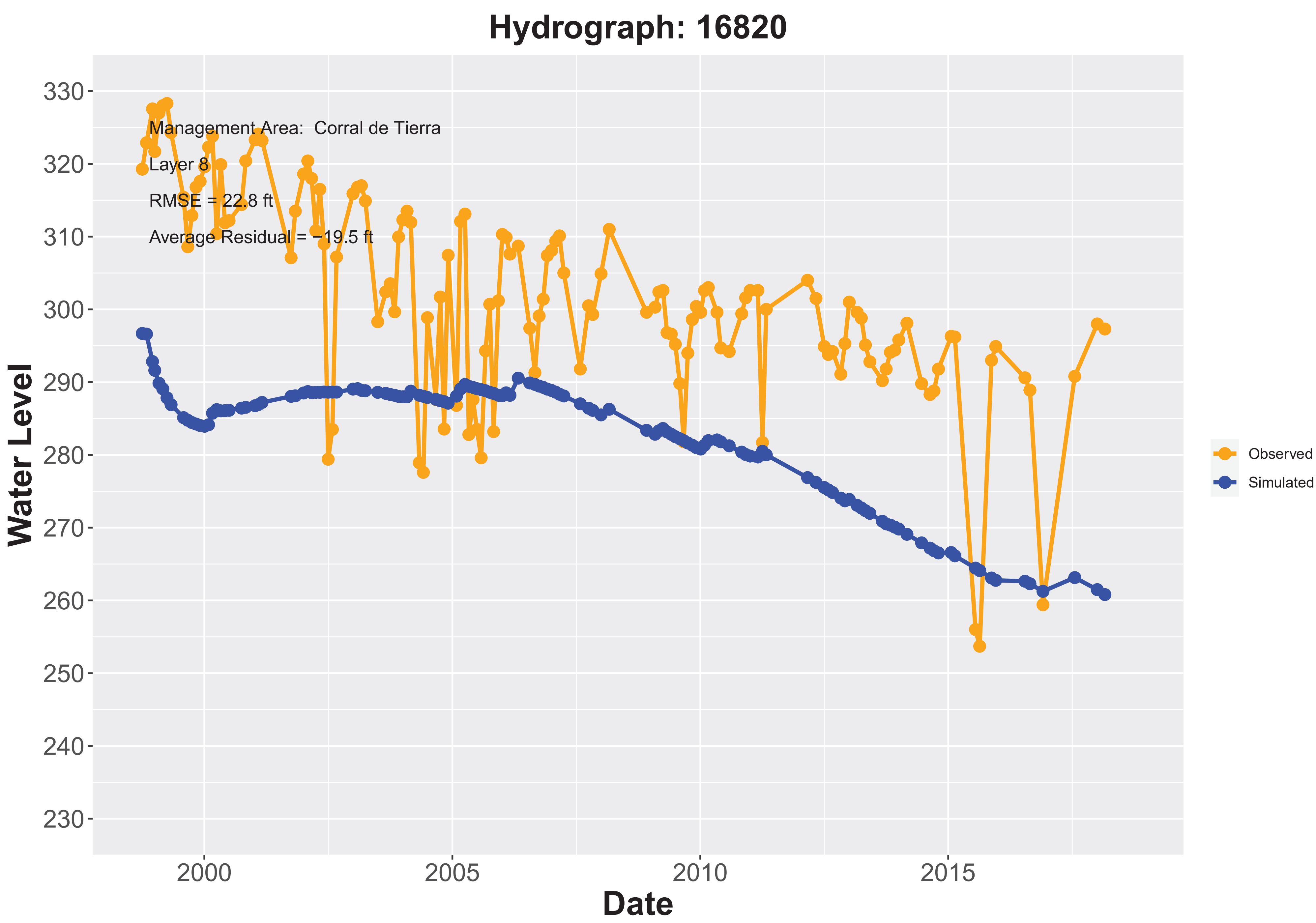


Hydrograph: 15S03E18M02
Management Area: Corral de Tierra
Layer 8
RMSE = 19.0 ft
Average Residual = 18.8 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

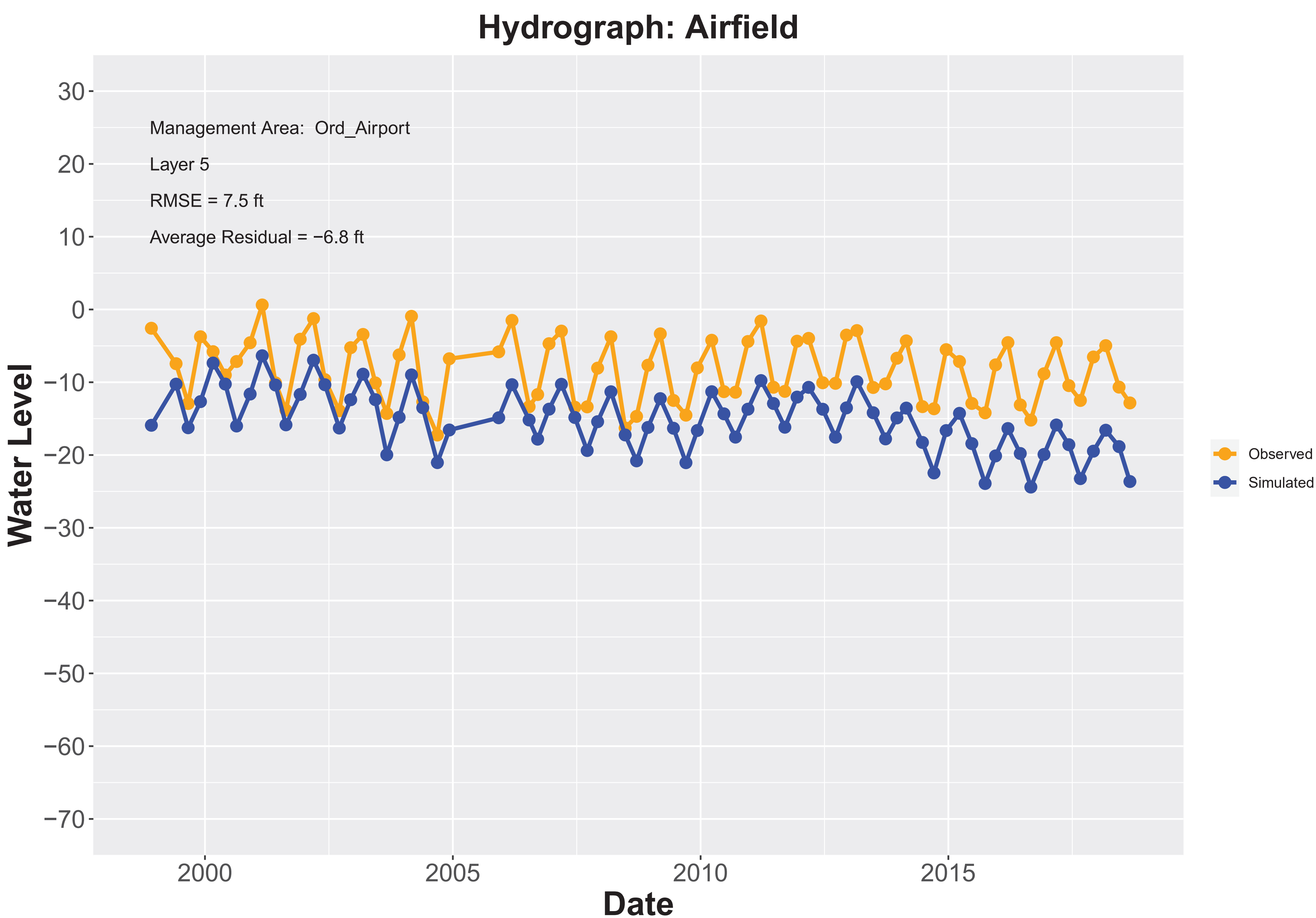

Hydrograph: 15S03E20R50
Management Area: Corral de Tierra
Layer 8
RMSE = 20.7 ft
Average Residual = −15.5 ft
Water Level
60
50
40
30
20
10
0
−10
−20
−30
−40
Date
2000
2005
2010
2015
Observed
Simulated

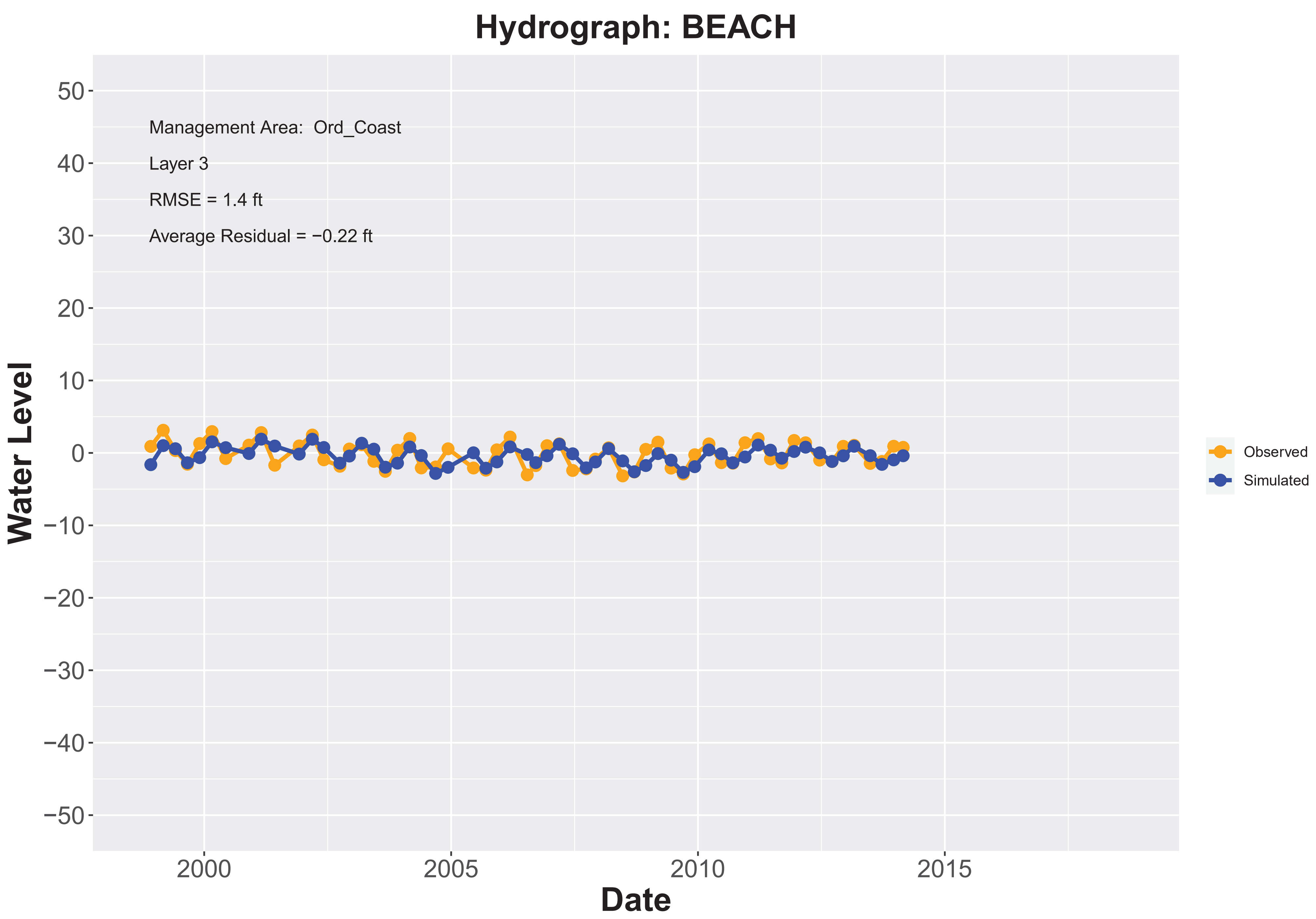


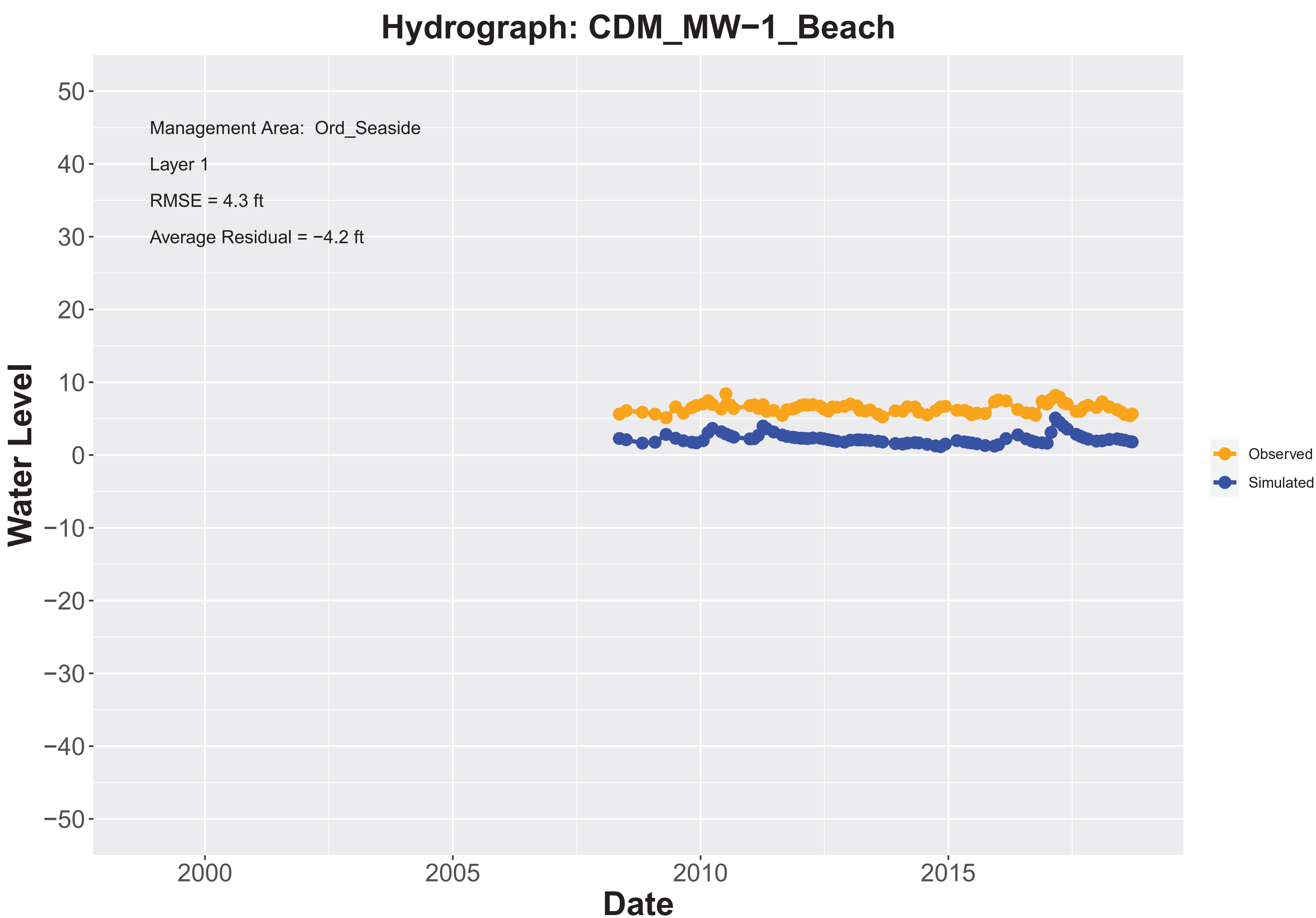
Hydrograph: 16797
Management Area: Corral de Tierra
Layer 8
RMSE = 8.4 ft
Average Residual = 3.0 ft
Water Level
350
340
330
320
310
300
290
280
270
260
250
Date
2000
2005
2010
2015
Observed
Simulated

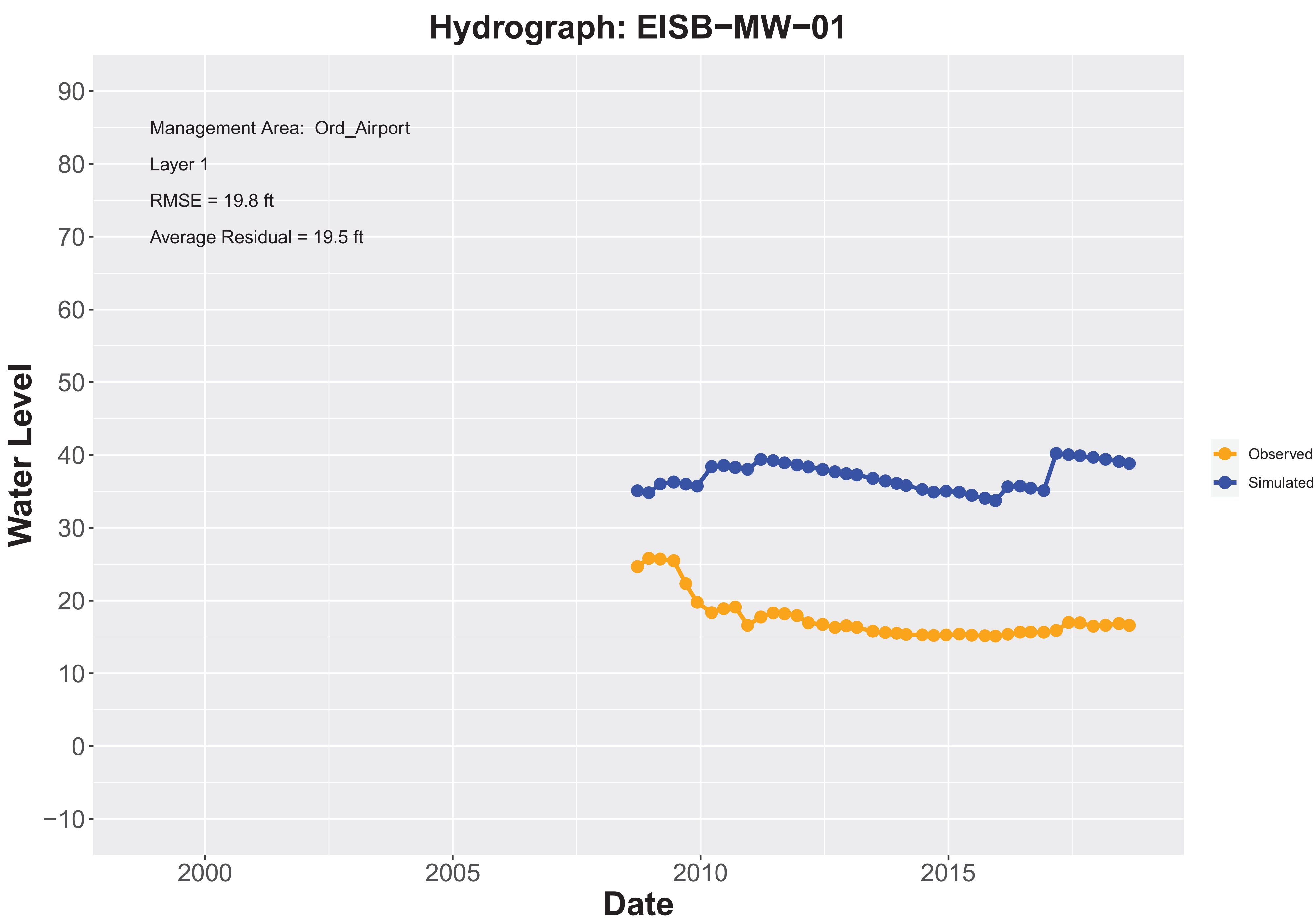


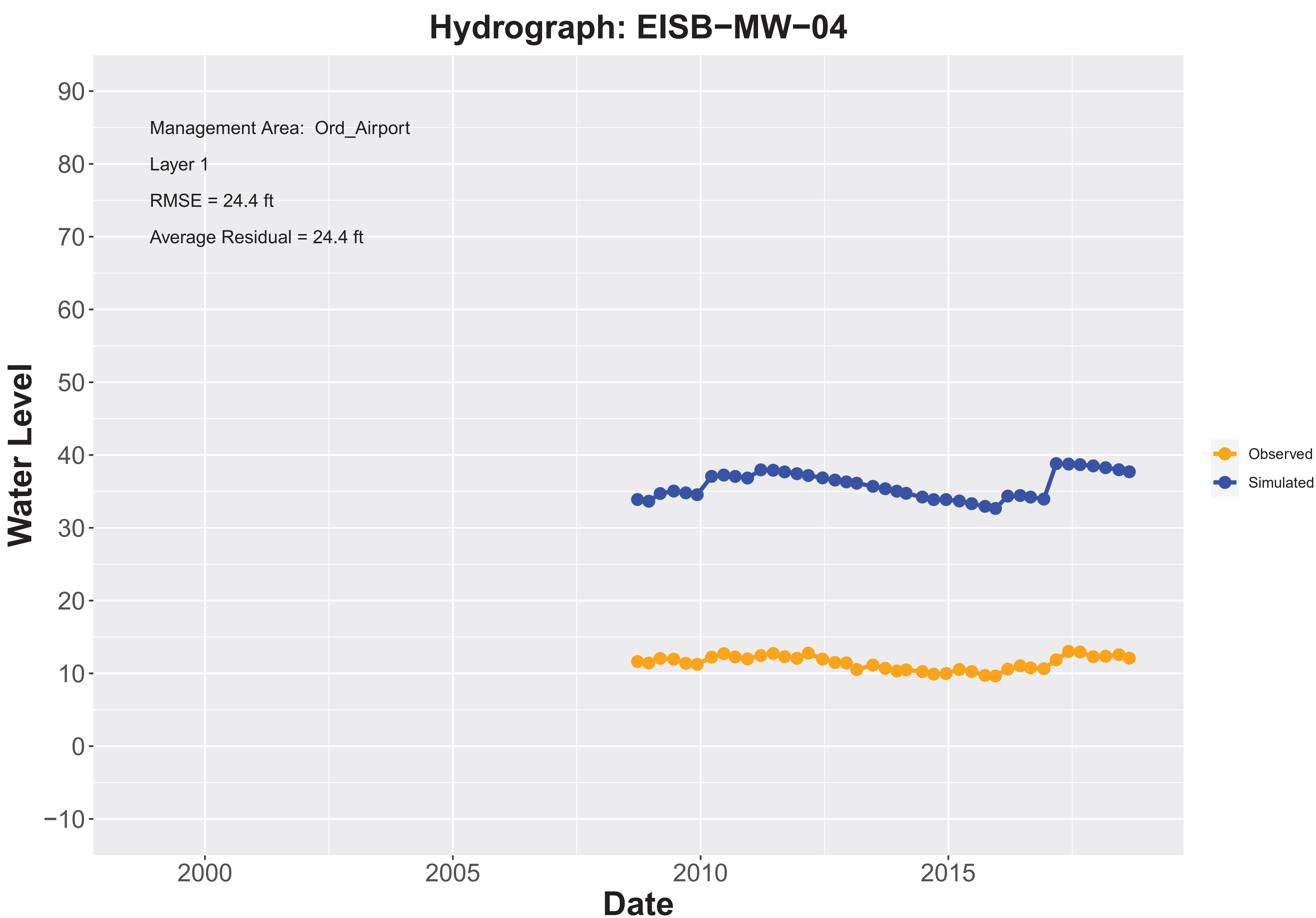
Hydrograph: 16820
Management Area: Corral de Tierra
Layer 8
RMSE = 22.8 ft
Average Residual = −19.5 ft
Water Level
330
320
310
300
290
280
270
260
250
240
230
Date
2000
2005
2010
2015
Observed
Simulated


Hydrograph: Airfield
Management Area: Ord_Airport
Layer 5
RMSE = 7.5 ft
Average Residual = −6.8 ft
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Water Level
2000
2005
2010
2015
Date
Observed
Simulated

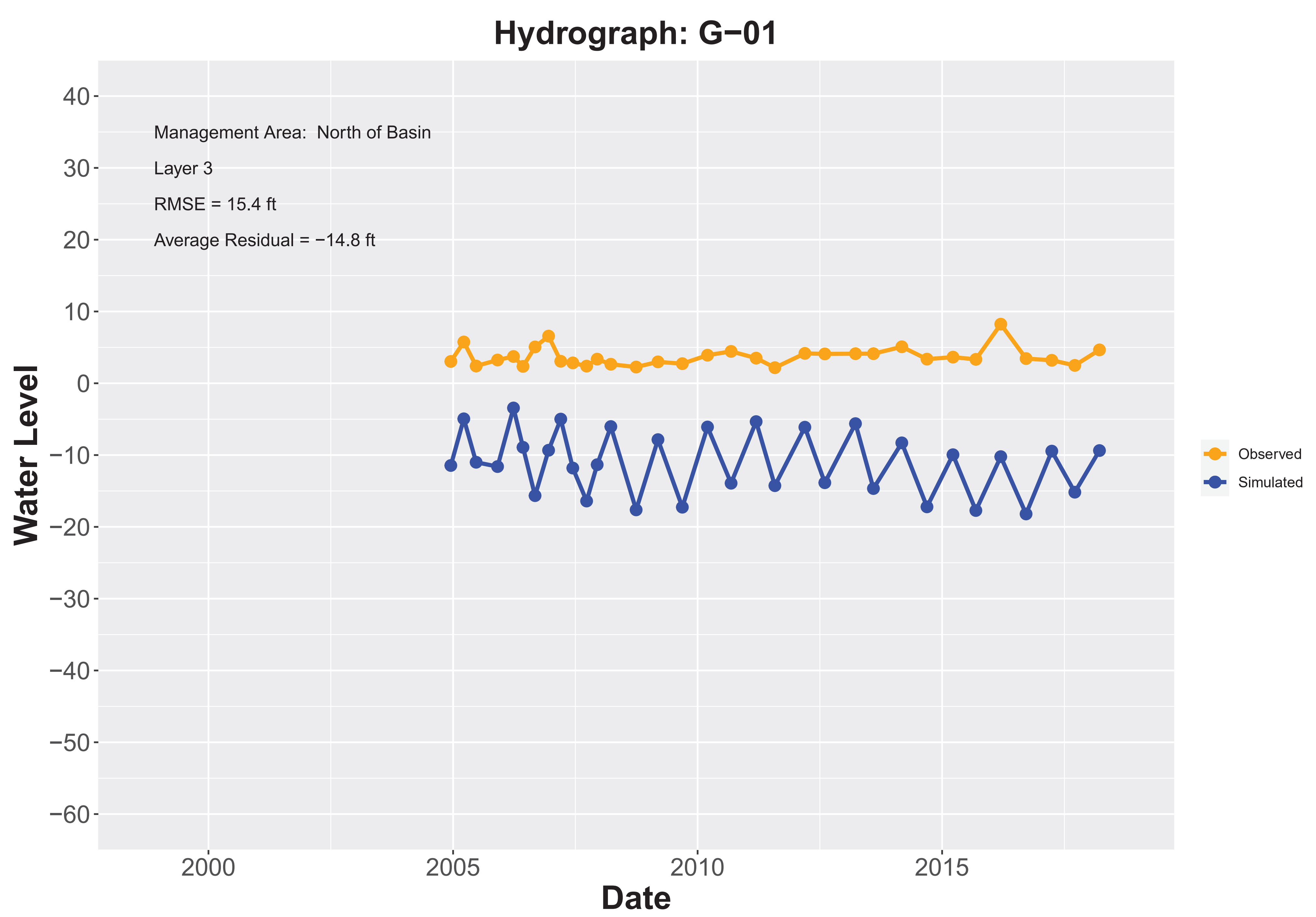

Hydrograph: BEACH
Management Area: Ord_Coast
Layer 3
RMSE = 1.4 ft
Average Residual = −0.22 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

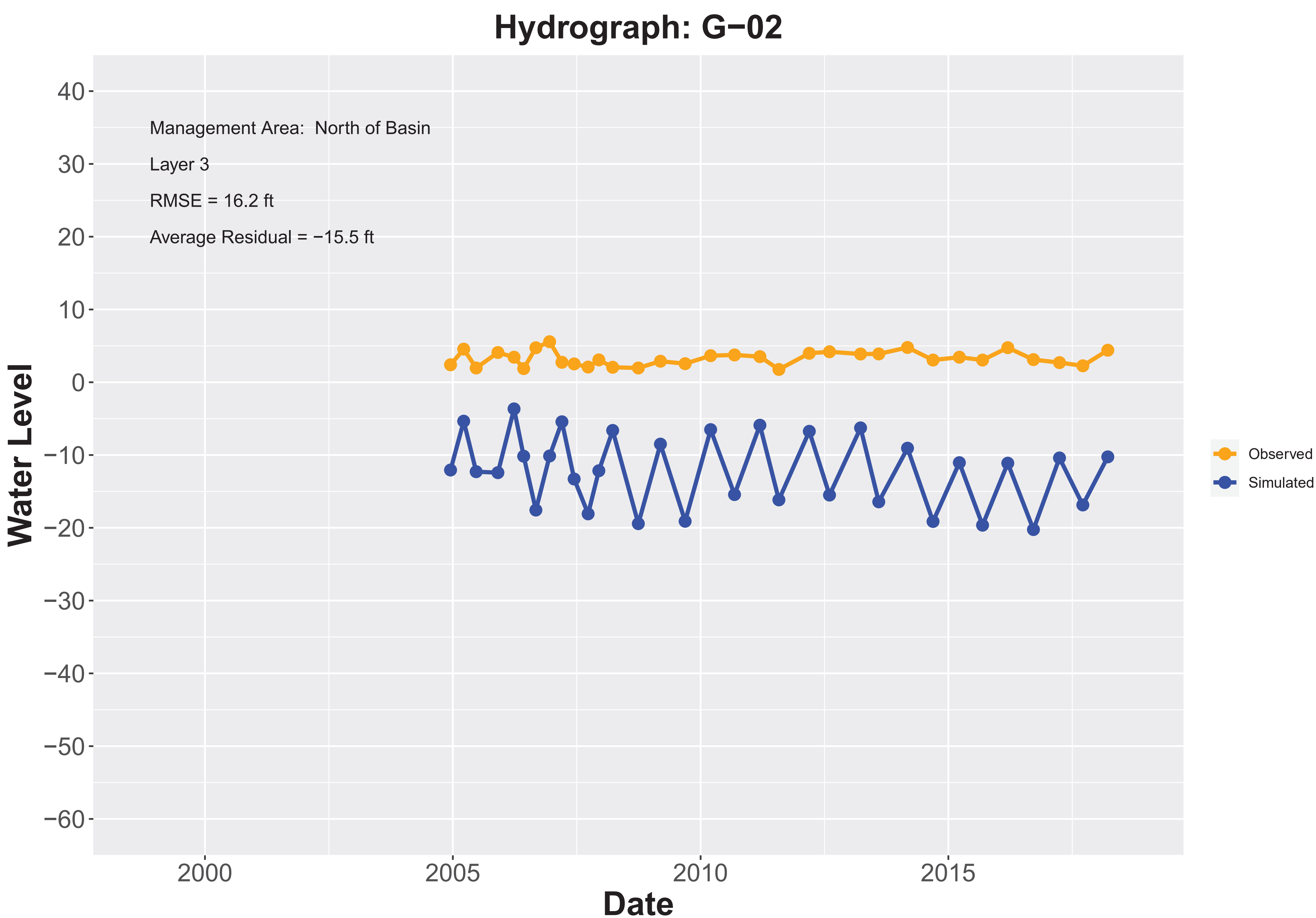

Hydrograph: CDM_MW−1_Beach
Management Area: Ord_Seaside
Layer 1
RMSE = 4.3 ft
Average Residual = −4.2 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: EISB−MW−01
Management Area: Ord_Airport
Layer 1
RMSE = 19.8 ft
Average Residual = 19.5 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

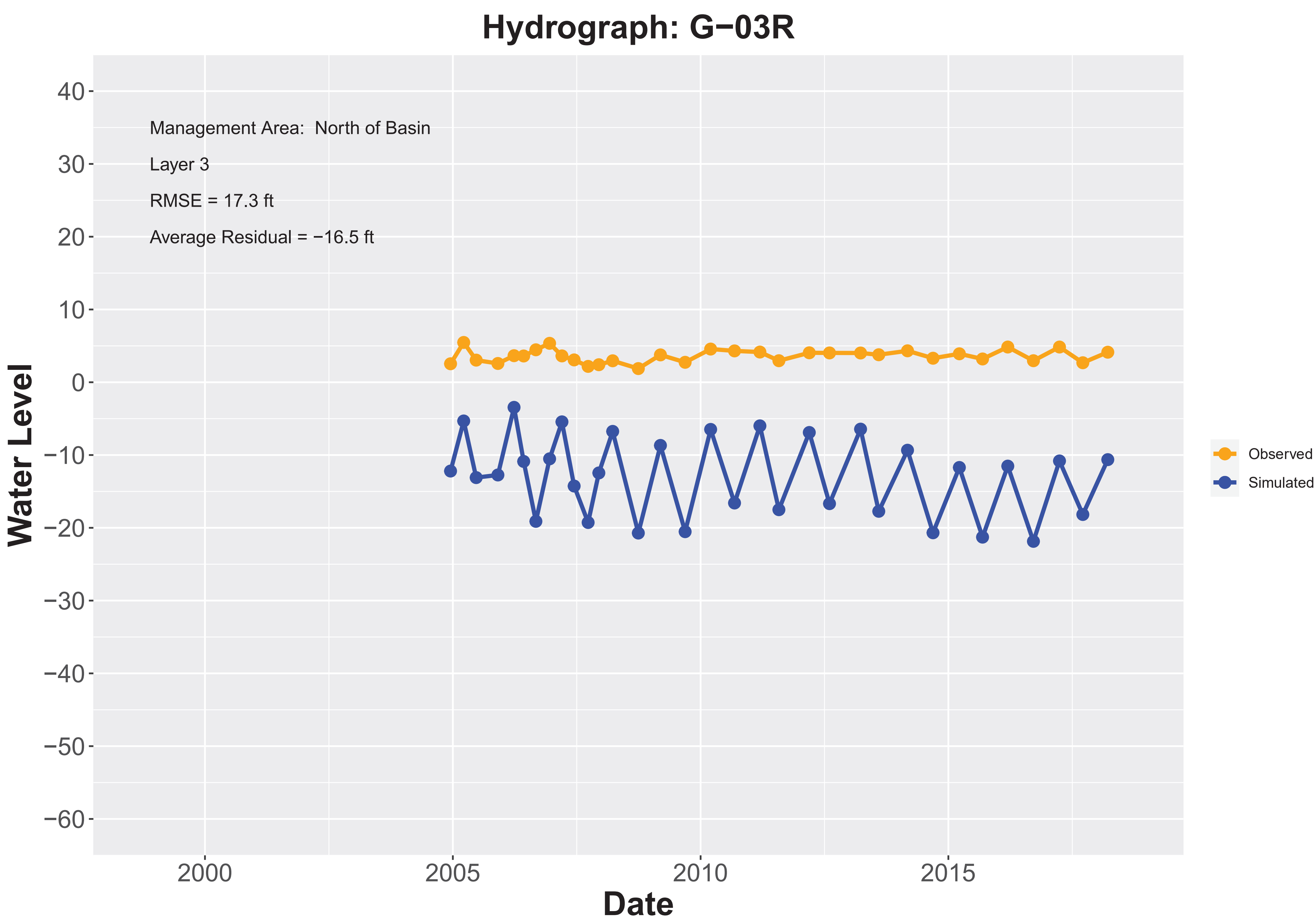


Hydrograph: EISB−MW−04
Management Area: Ord_Airport
Layer 1
RMSE = 24.4 ft
Average Residual = 24.4 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
Date
2000
2005
2010
2015
Observed
Simulated

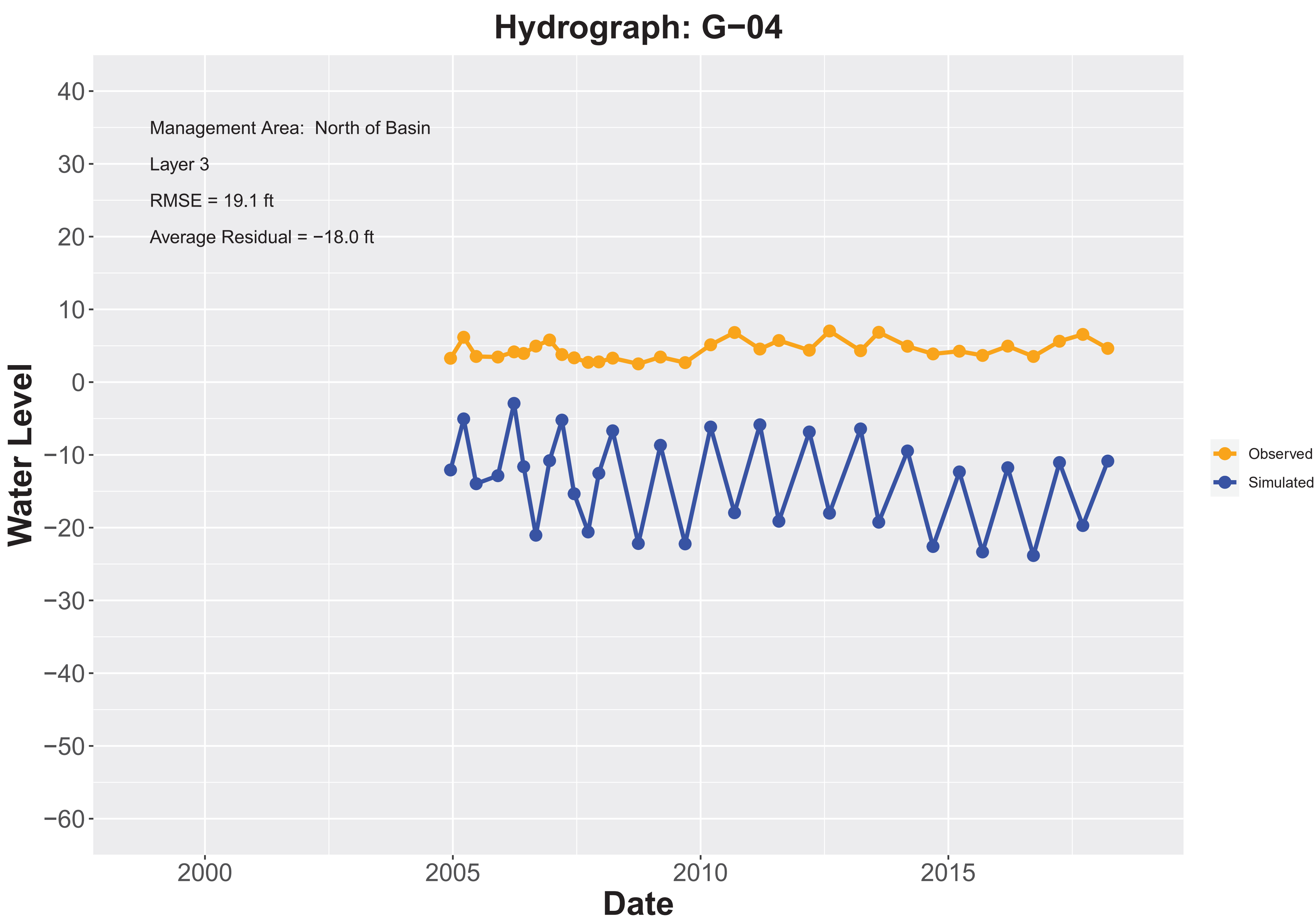

Hydrograph: G−01
Management Area: North of Basin
Layer 3
RMSE = 15.4 ft
Average Residual = −14.8 ft
Water Level
Date
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Observed
Simulated



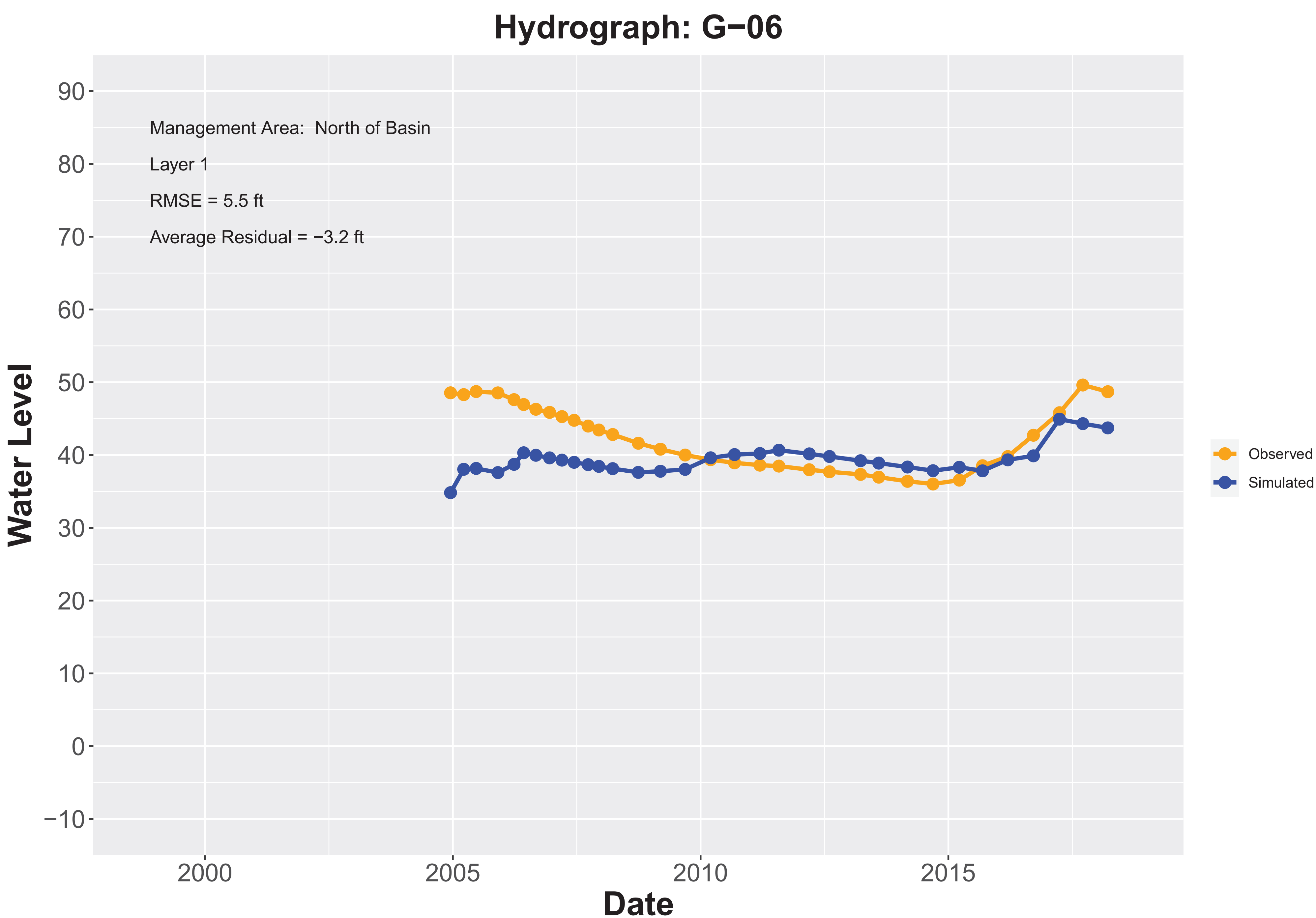
Hydrograph: G−02
Management Area: North of Basin
Layer 3
RMSE = 16.2 ft
Average Residual = −15.5 ft
Water Level
Date
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Observed
Simulated

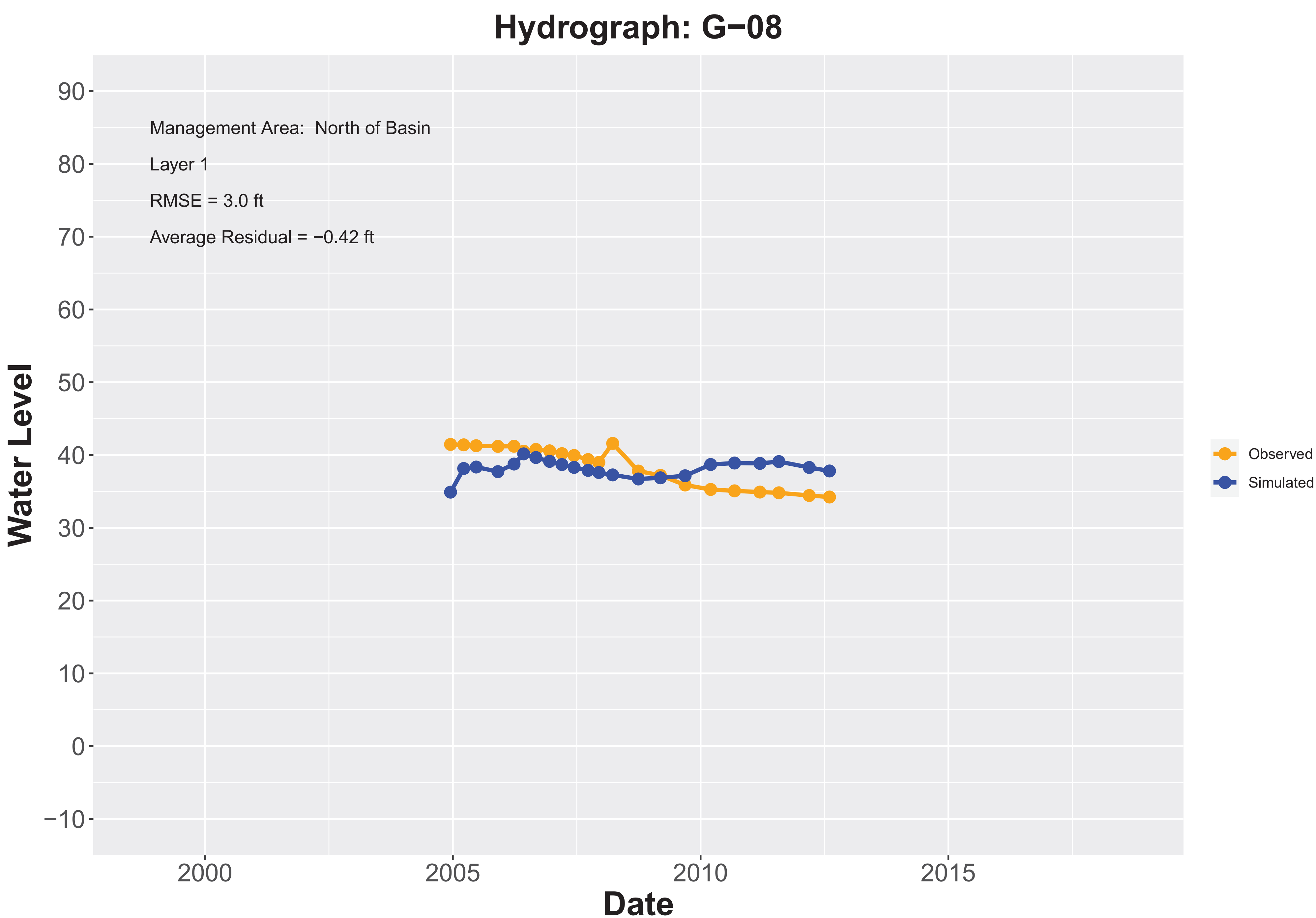


Hydrograph: G−03R
Management Area: North of Basin
Layer 3
RMSE = 17.3 ft
Average Residual = −16.5 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

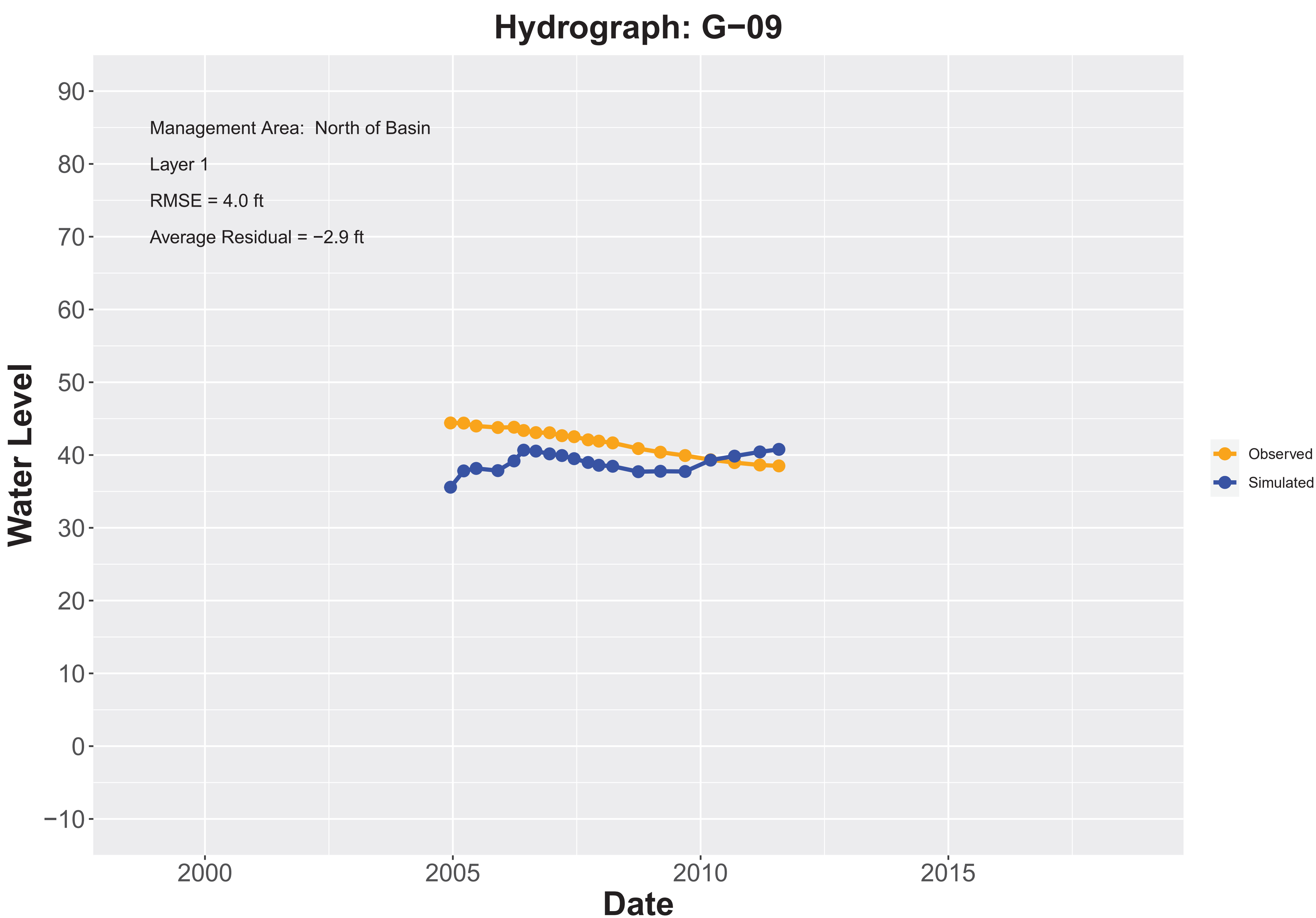


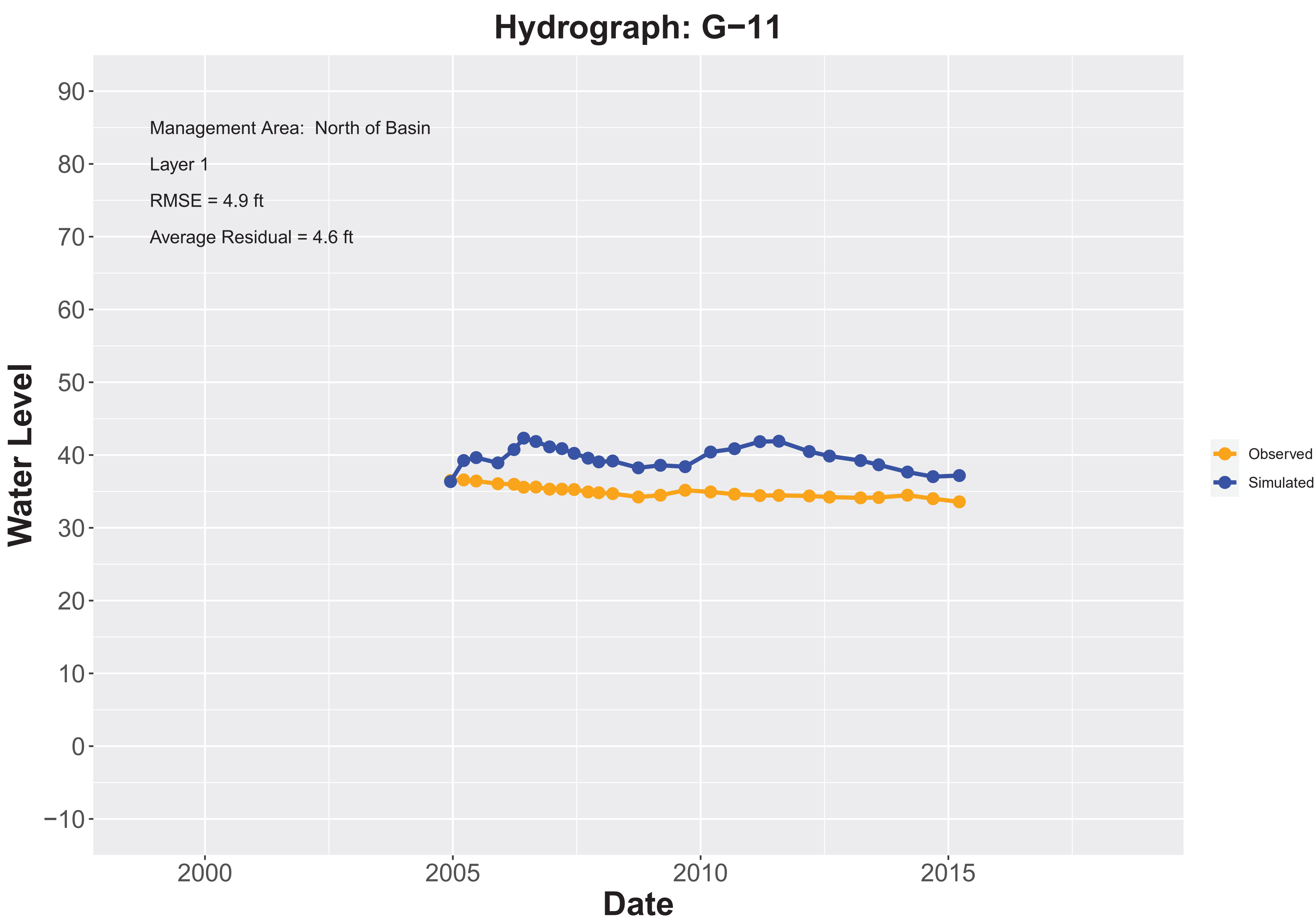
Hydrograph: G−04
Management Area: North of Basin
Layer 3
RMSE = 19.1 ft
Average Residual = −18.0 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: G−06
Management Area: North of Basin
Layer 1
RMSE = 5.5 ft
Average Residual = −3.2 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

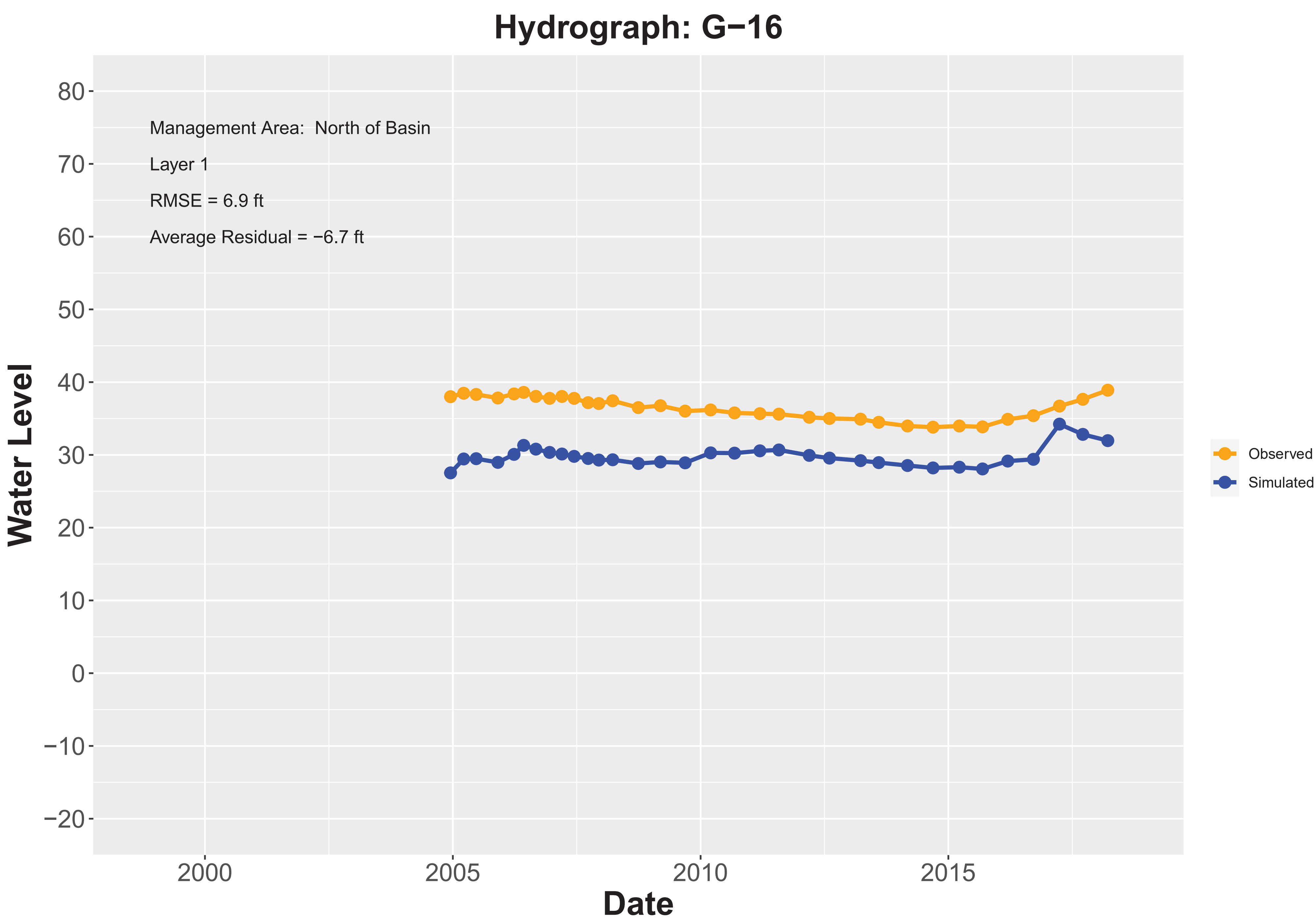


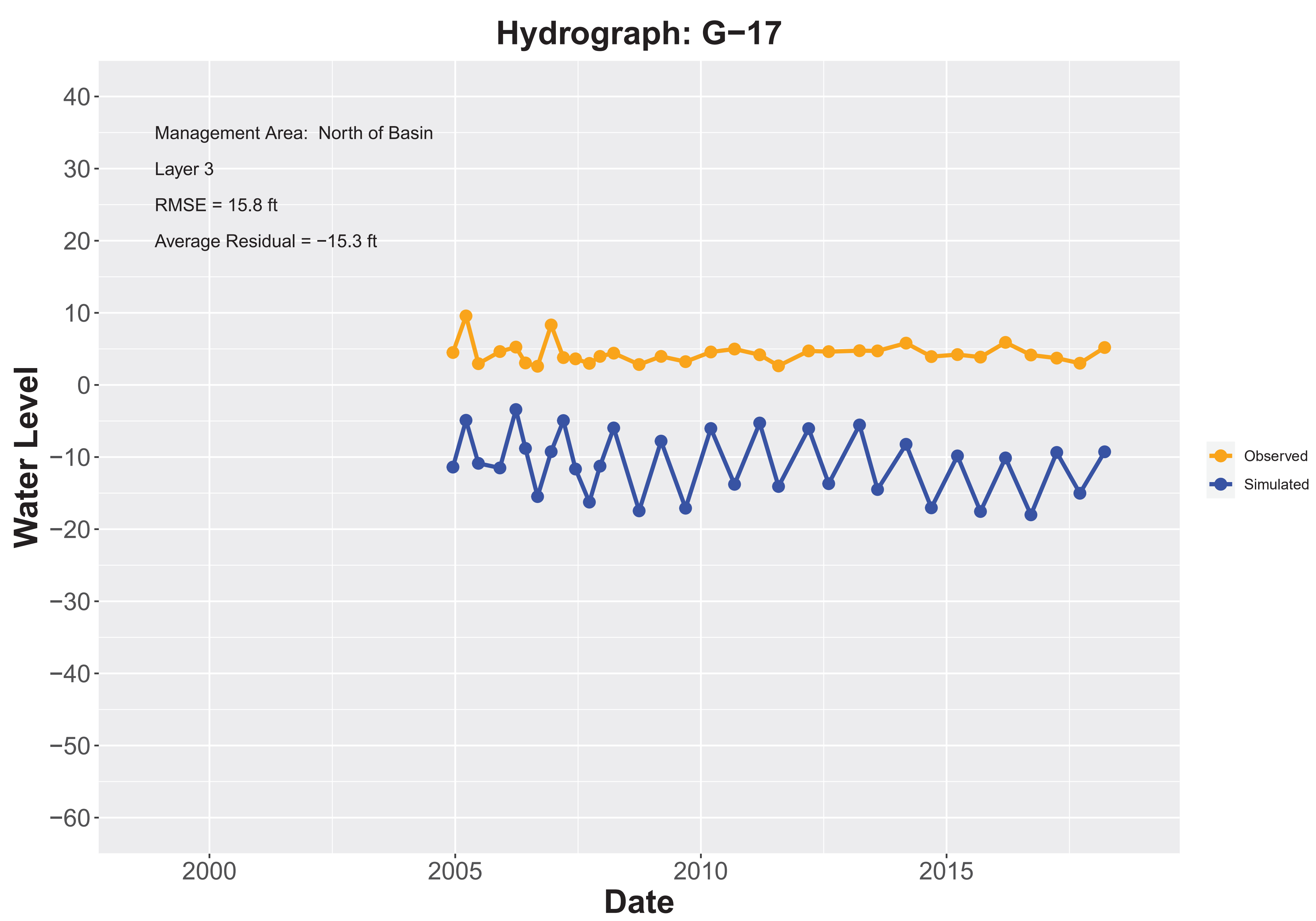
Hydrograph: G−08
Management Area: North of Basin
Layer 1
RMSE = 3.0 ft
Average Residual = −0.42 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: G−09
Management Area: North of Basin
Layer 1
RMSE = 4.0 ft
Average Residual = −2.9 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

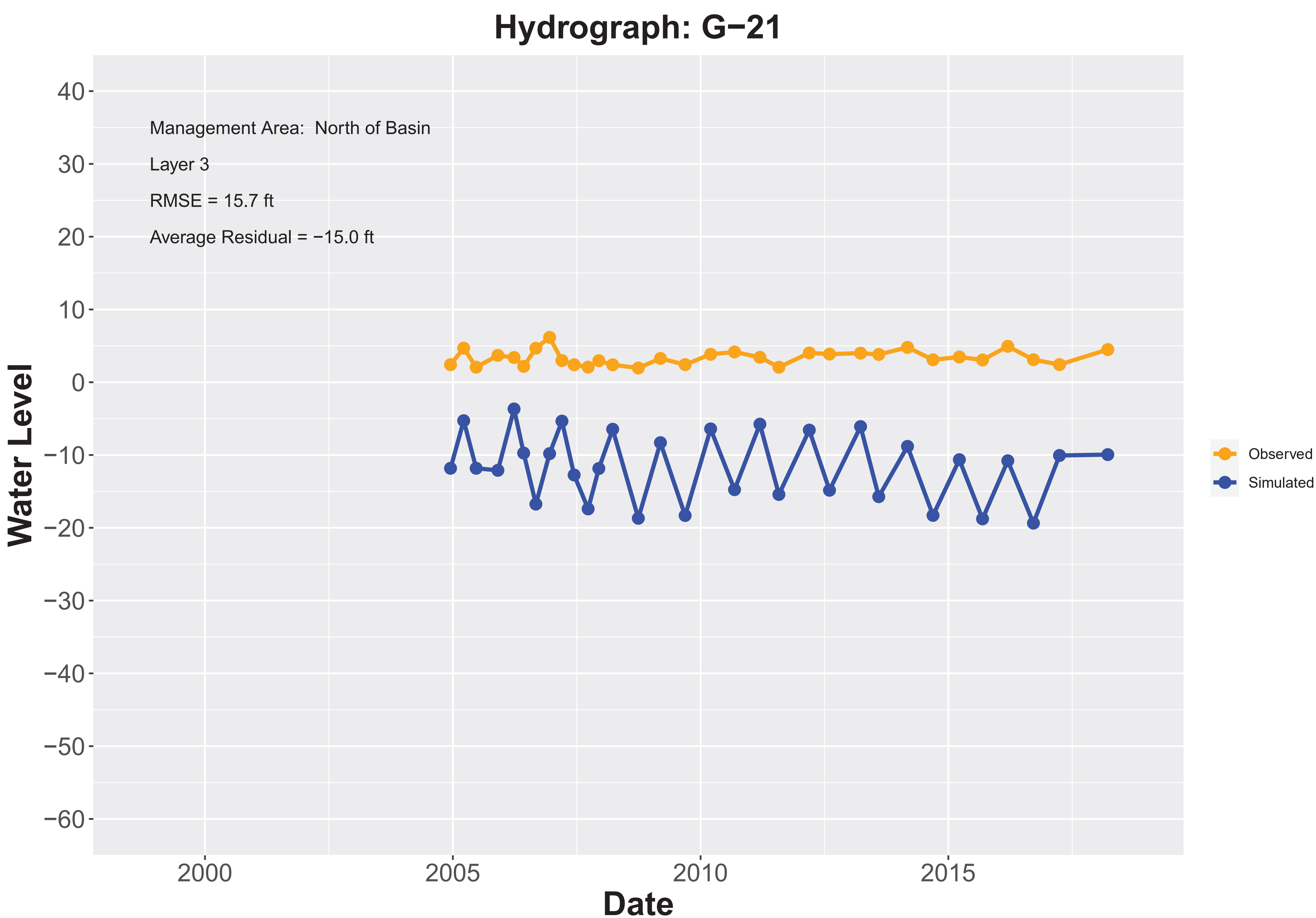


Hydrograph: G−11
Management Area: North of Basin
Layer 1
RMSE = 4.9 ft
Average Residual = 4.6 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

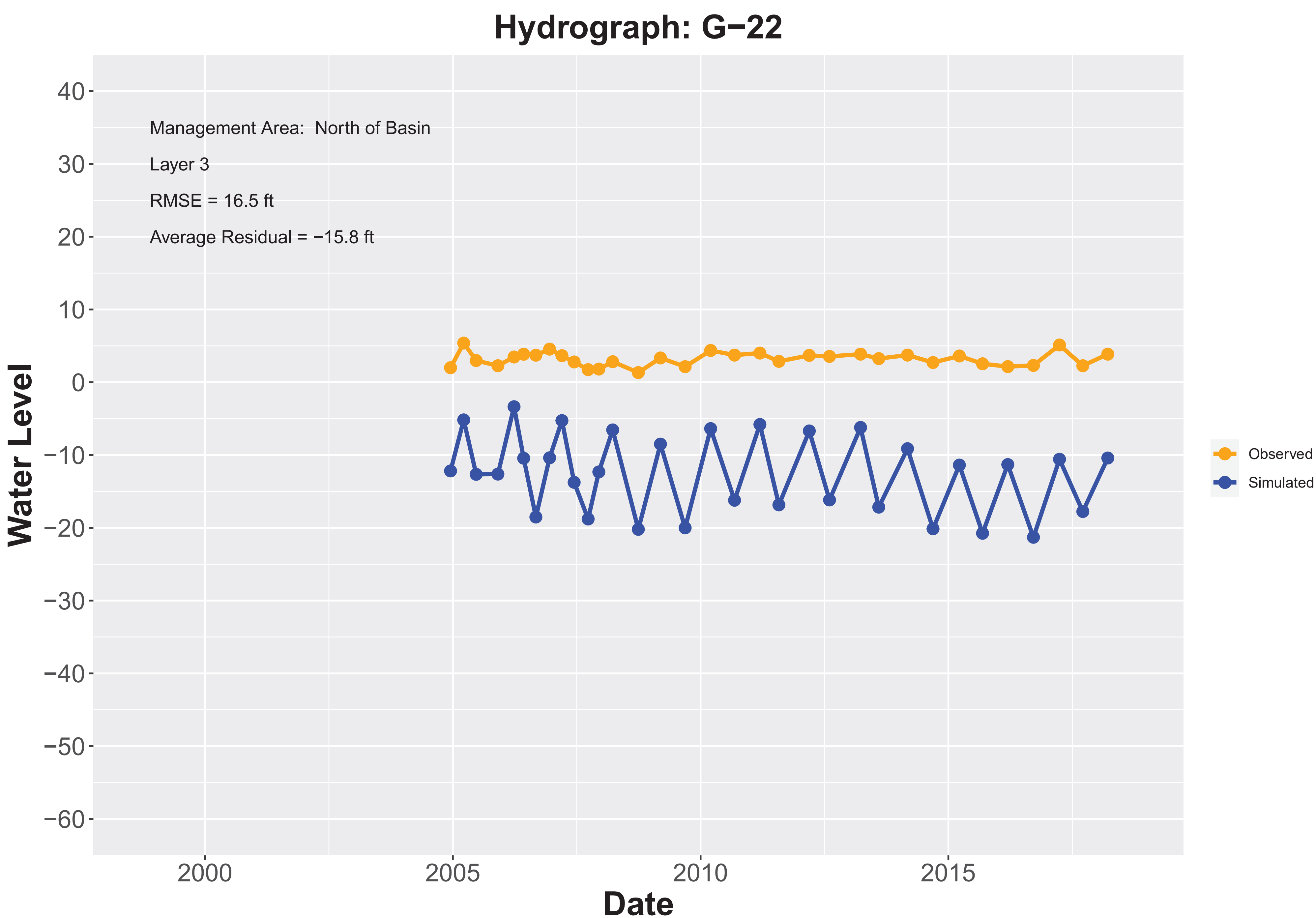

Hydrograph: G−16
Management Area: North of Basin
Layer 1
RMSE = 6.9 ft
Average Residual = −6.7 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated

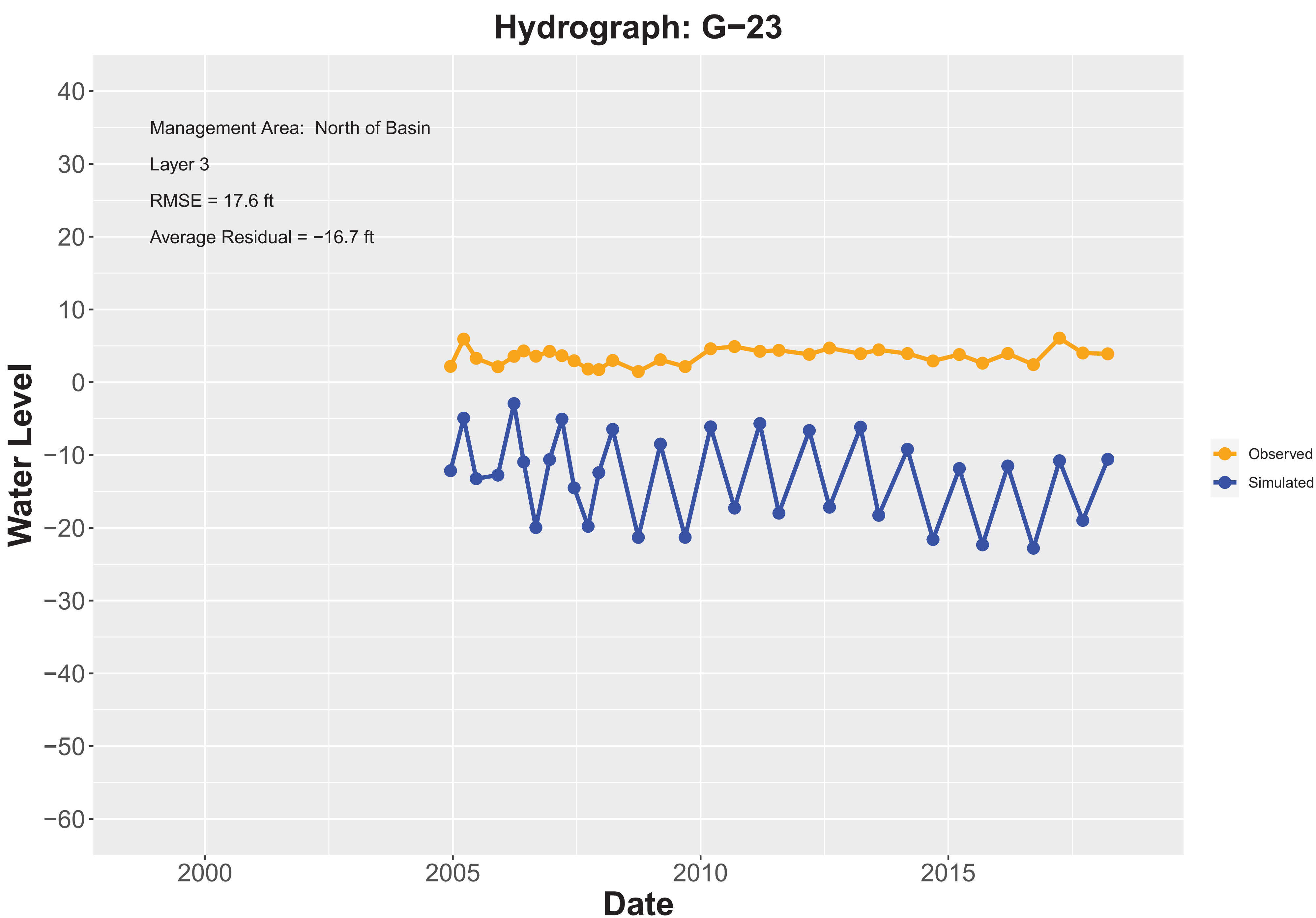


Hydrograph: G−17
Management Area: North of Basin
Layer 3
RMSE = 15.8 ft
Average Residual = −15.3 ft
Water Level
Date
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Observed
Simulated

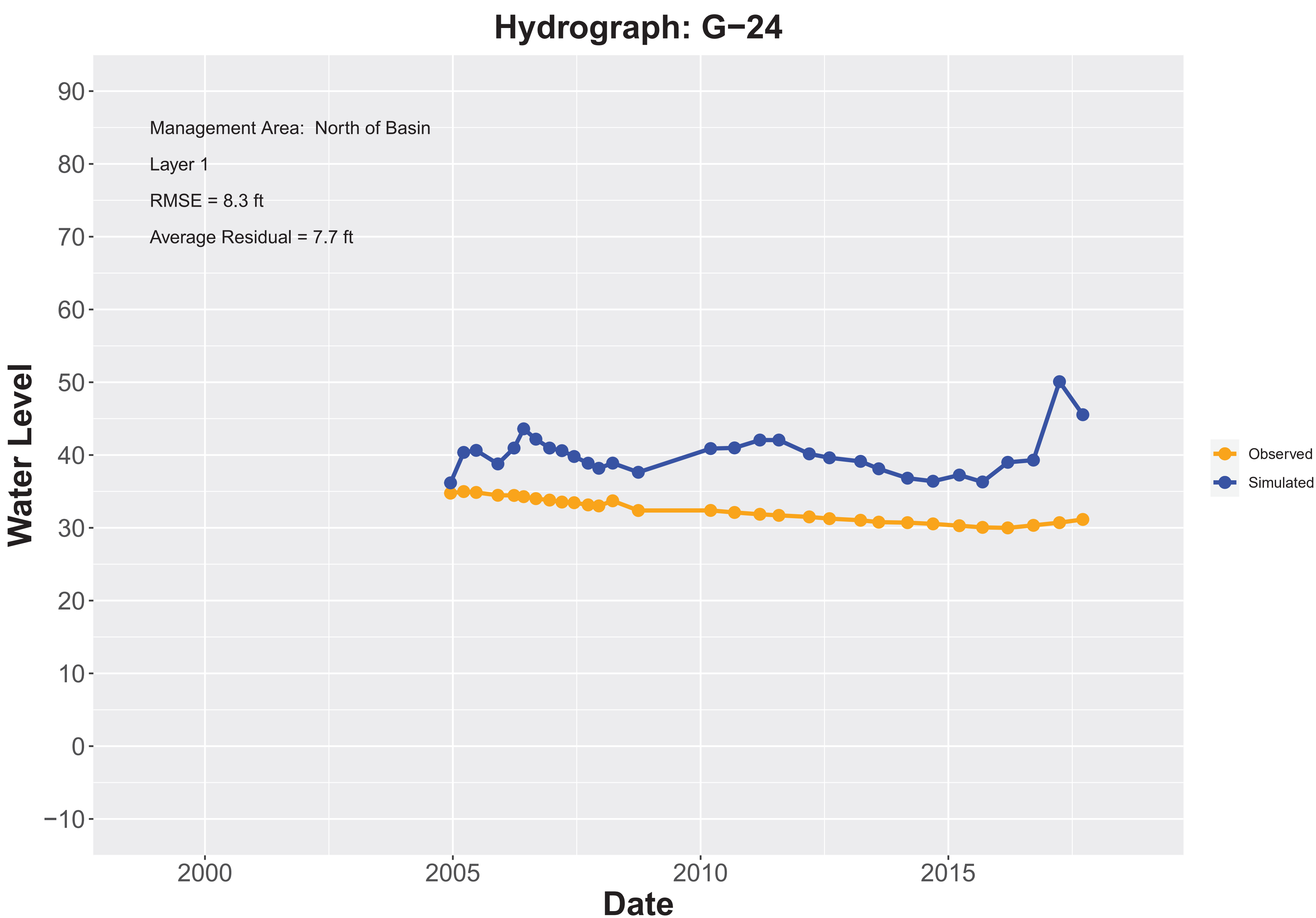


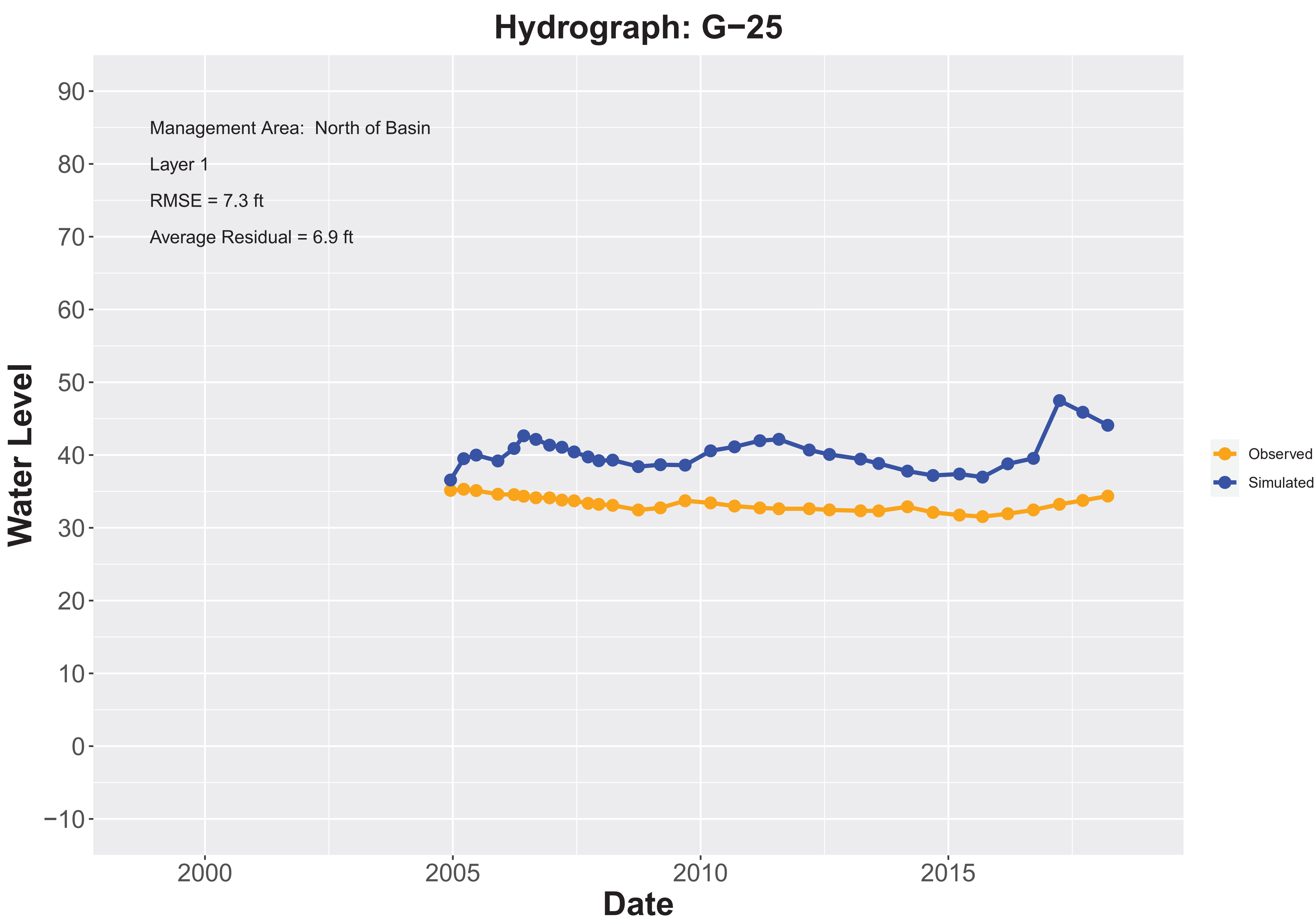
Hydrograph: G−21
Management Area: North of Basin
Layer 3
RMSE = 15.7 ft
Average Residual = −15.0 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

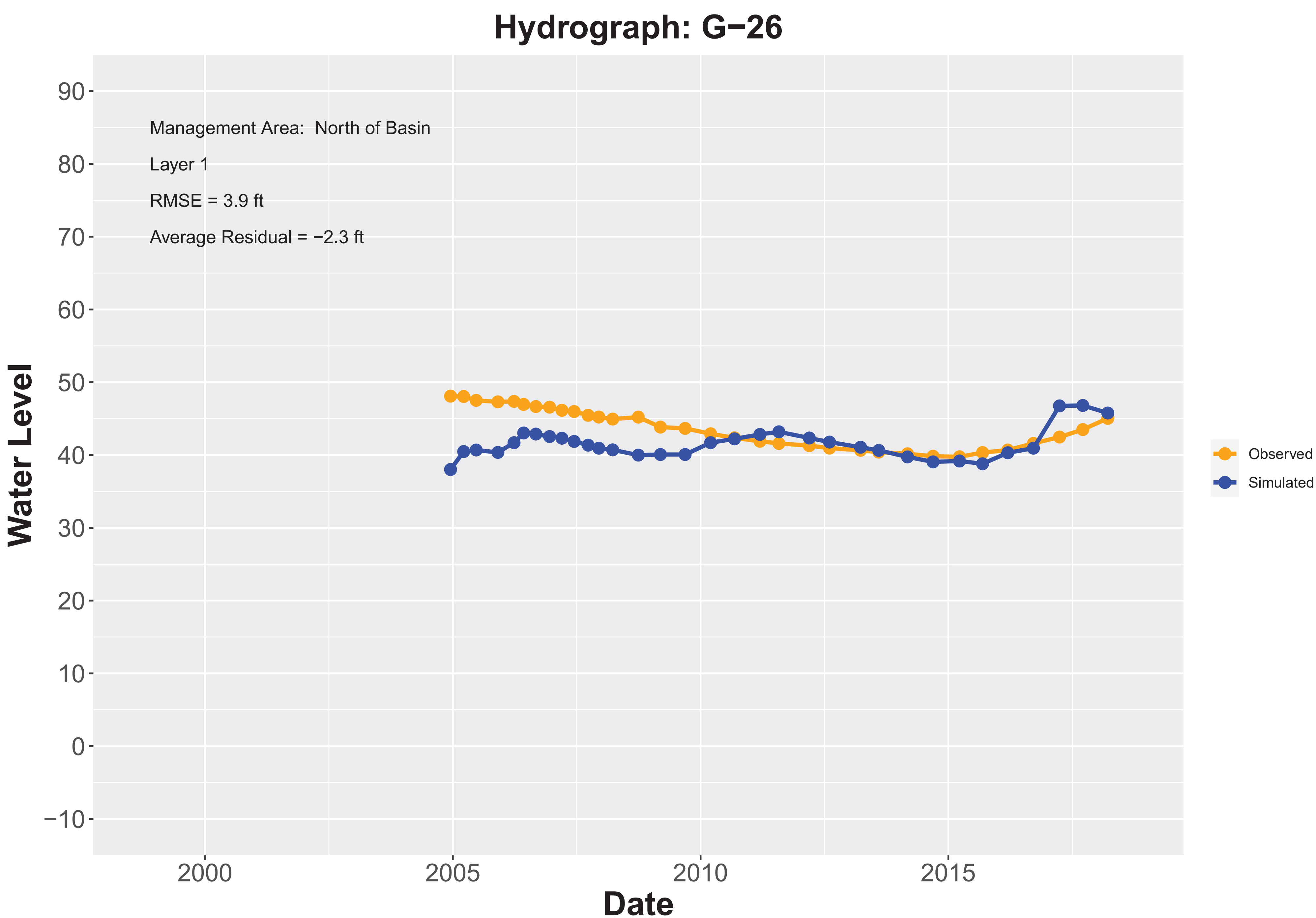

Hydrograph: G−22
Management Area: North of Basin
Layer 3
RMSE = 16.5 ft
Average Residual = −15.8 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated



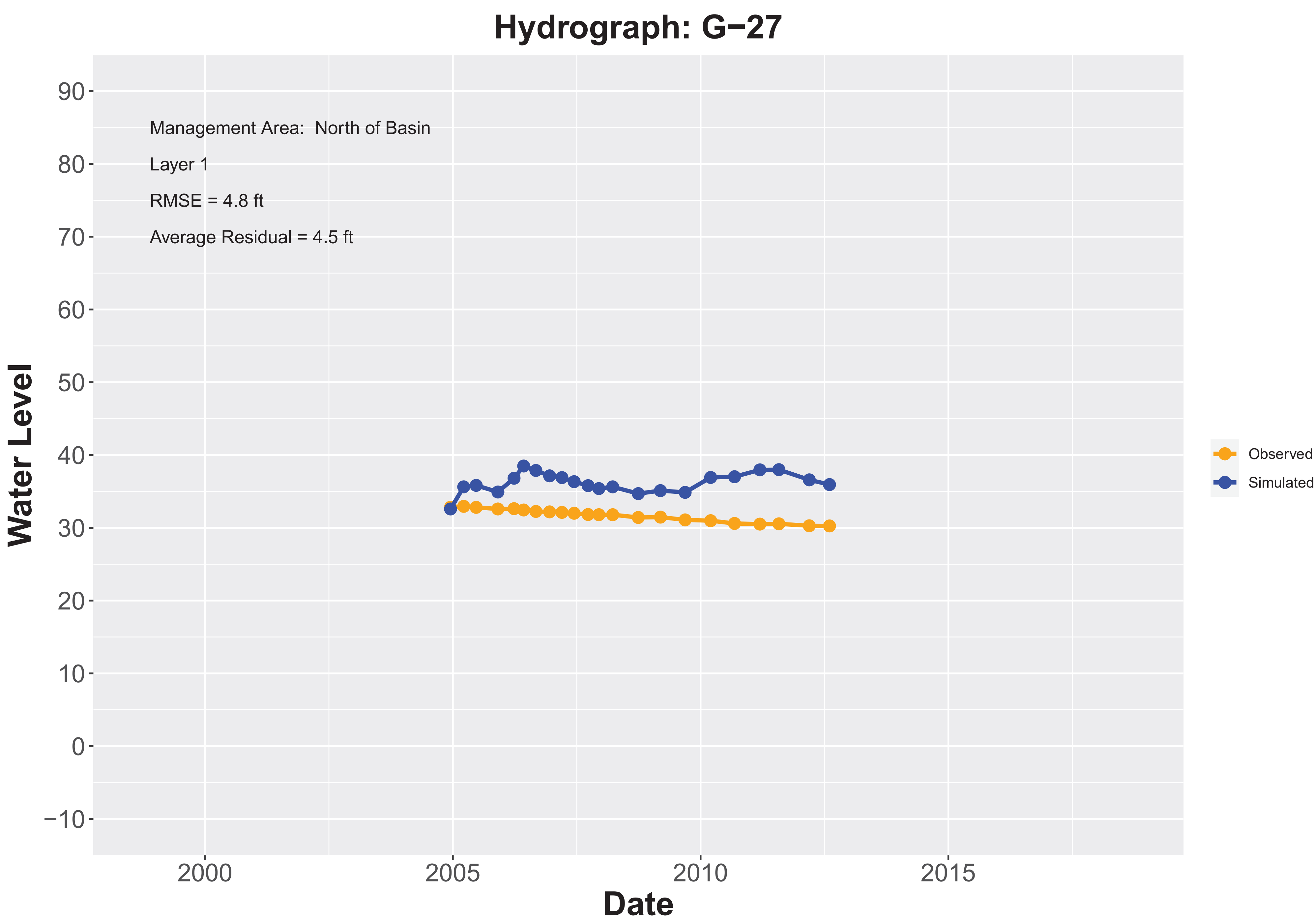
Hydrograph: G−23
Management Area: North of Basin
Layer 3
RMSE = 17.6 ft
Average Residual = −16.7 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: G−24
Management Area: North of Basin
Layer 1
RMSE = 8.3 ft
Average Residual = 7.7 ft
90
80
70
60
50
40
30
20
10
0
−10
Water Level
2000
2005
2010
2015
Date
Observed
Simulated

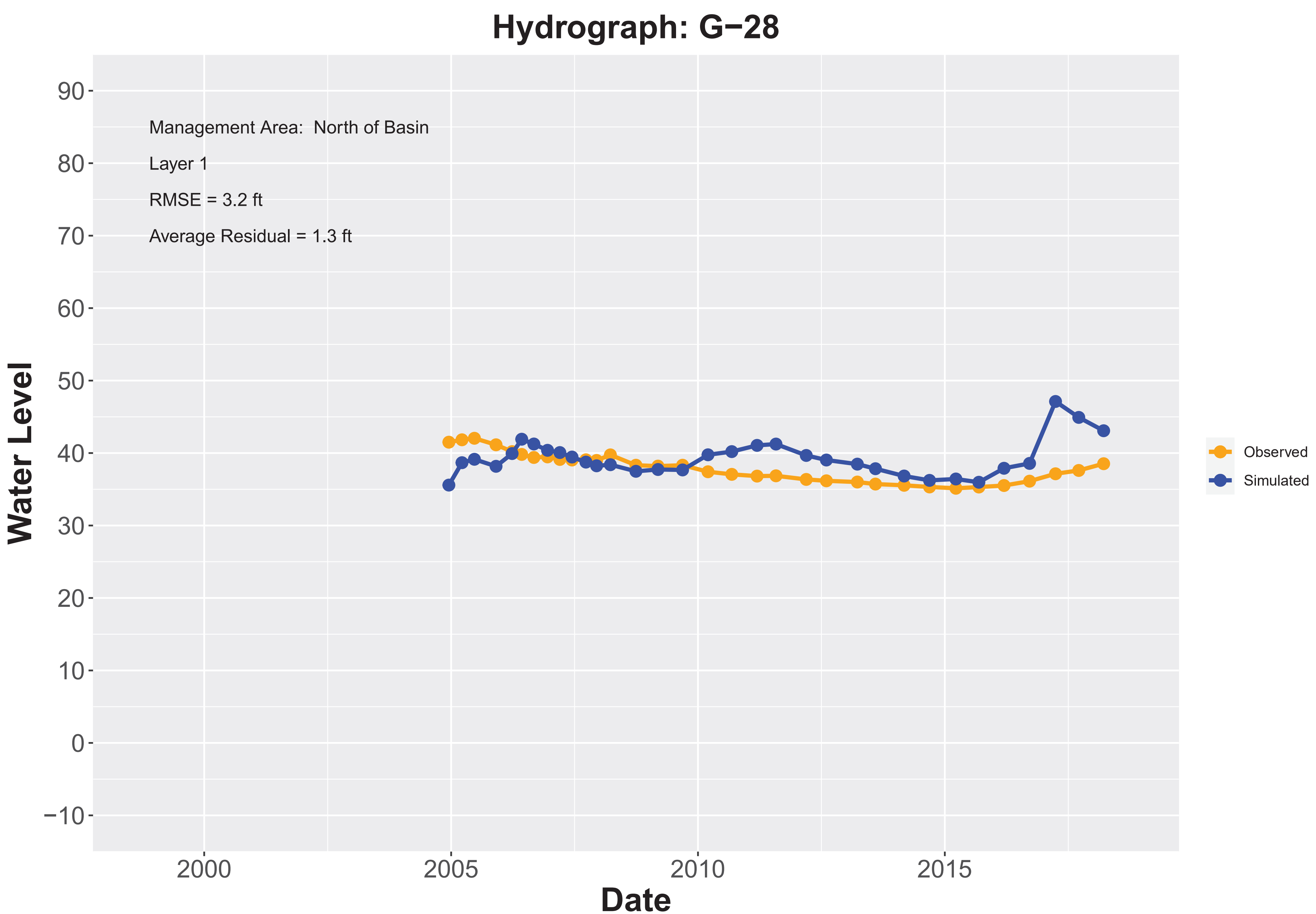

Hydrograph: G−25
Management Area: North of Basin
Layer 1
RMSE = 7.3 ft
Average Residual = 6.9 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated



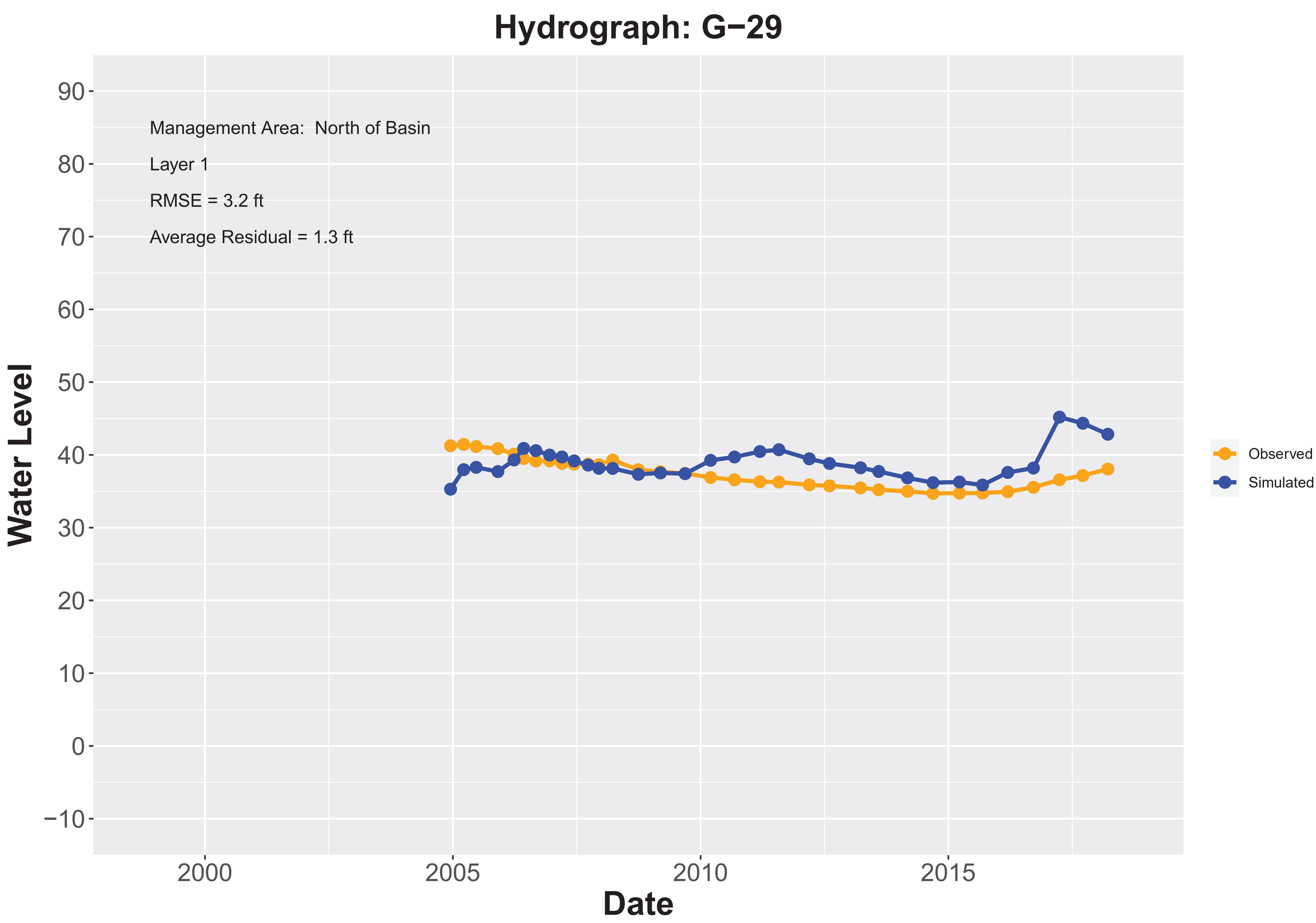
Hydrograph: G−26
Management Area: North of Basin
Layer 1
RMSE = 3.9 ft
Average Residual = −2.3 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
Date
2000
2005
2010
2015
Observed
Simulated

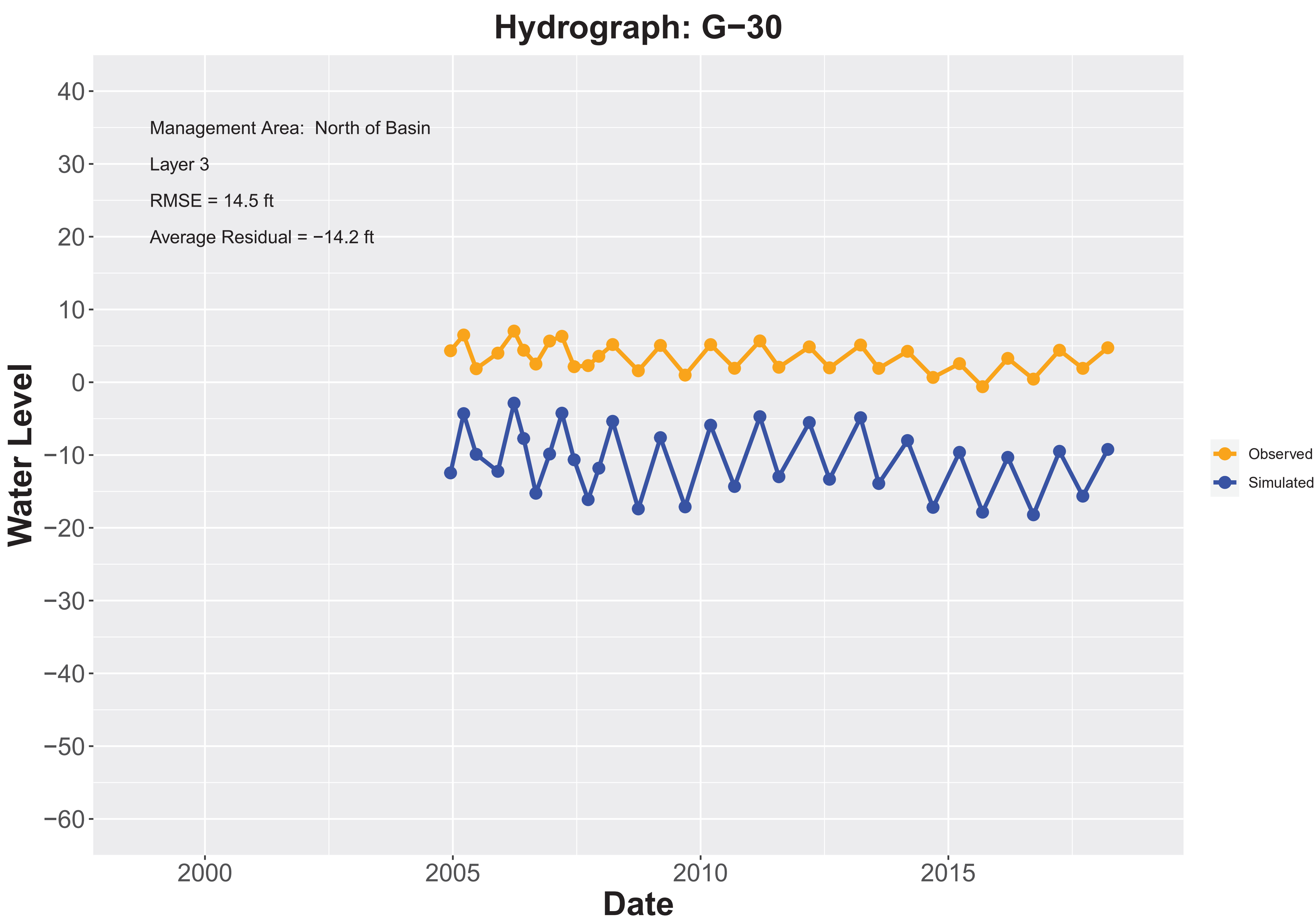


Hydrograph: G−27
Management Area: North of Basin
Layer 1
RMSE = 4.8 ft
Average Residual = 4.5 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

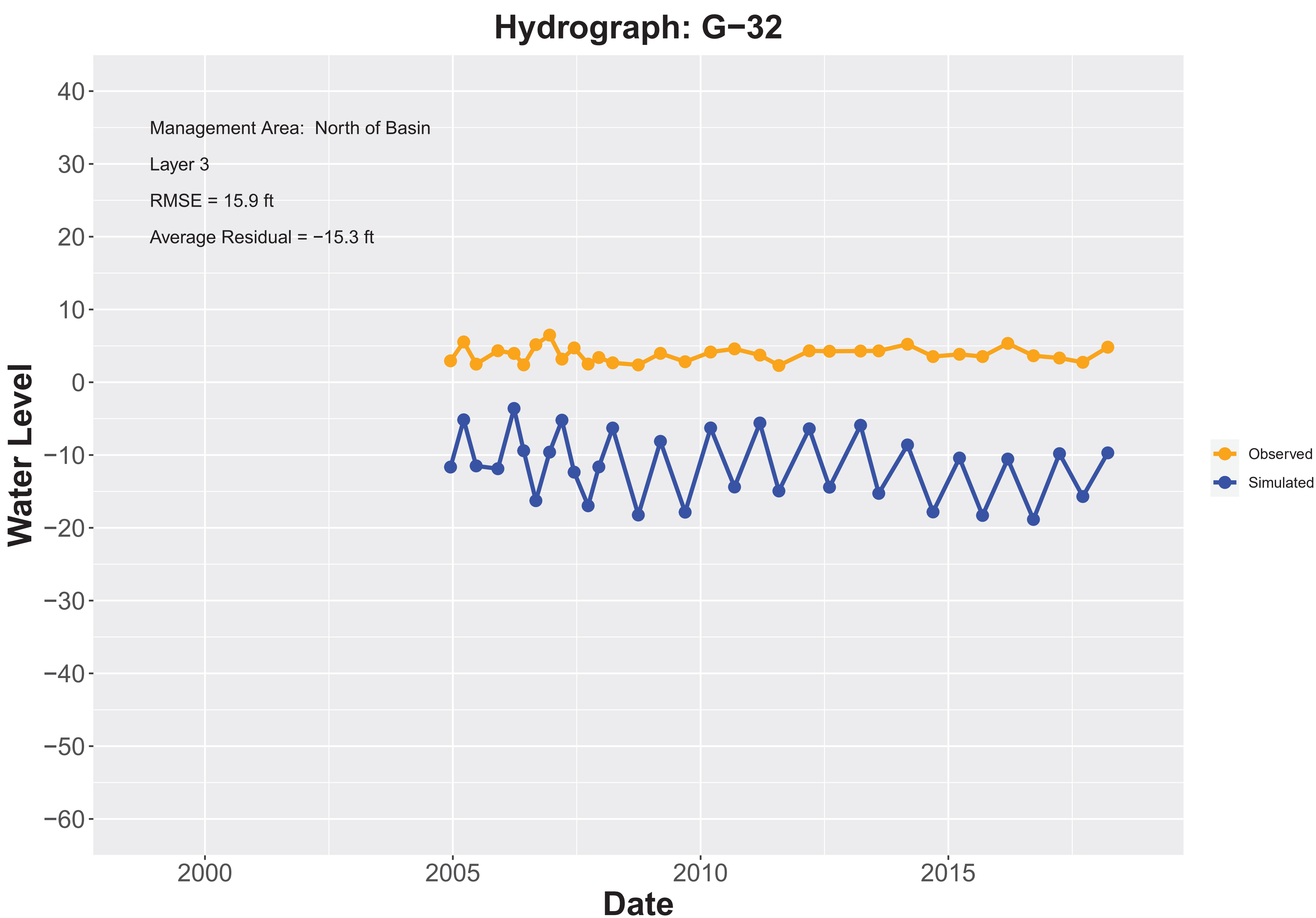


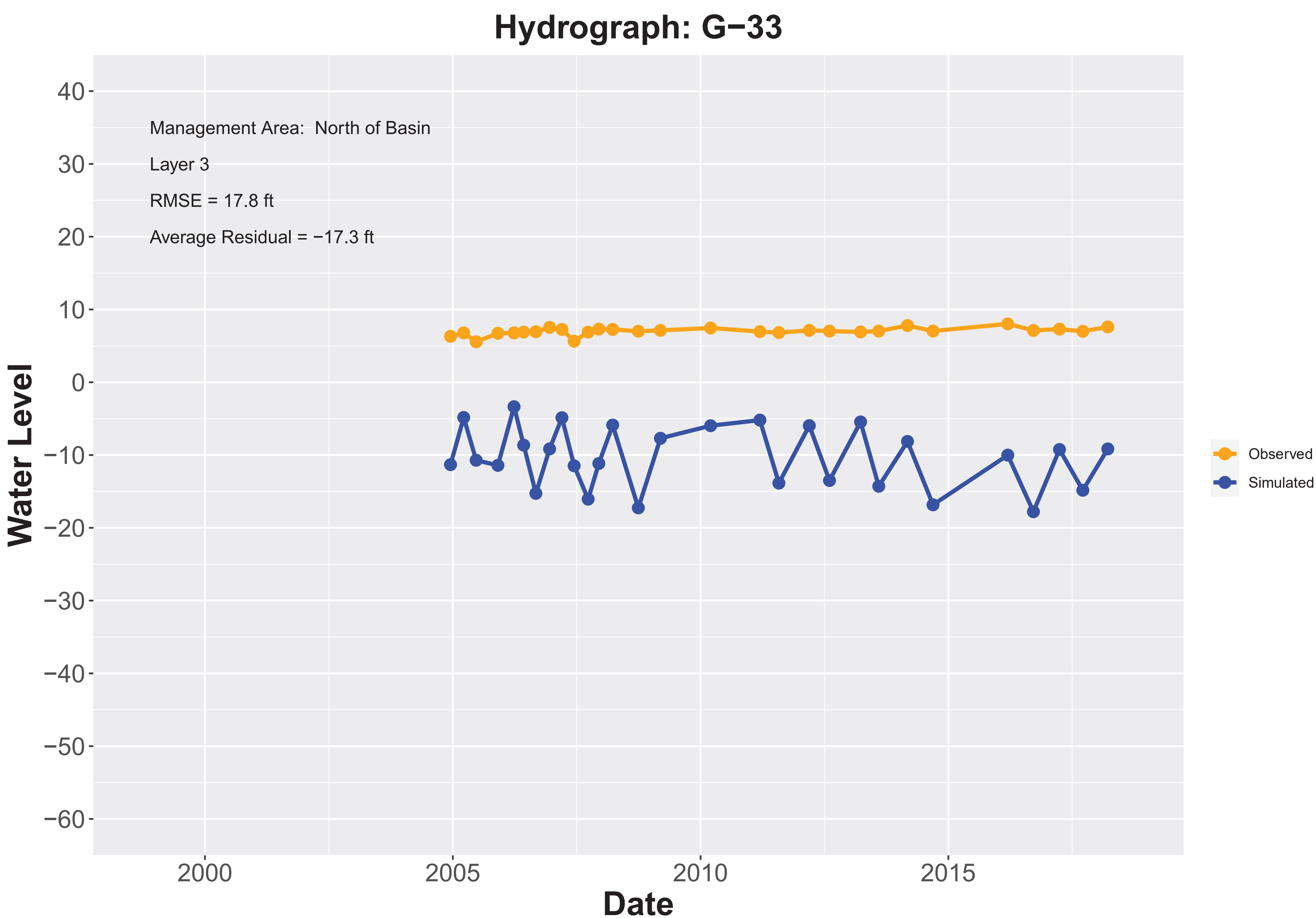
Hydrograph: G−28
Management Area: North of Basin
Layer 1
RMSE = 3.2 ft
Average Residual = 1.3 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: G−29
Management Area: North of Basin
Layer 1
RMSE = 3.2 ft
Average Residual = 1.3 ft
Water Level
Date
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Observed
Simulated

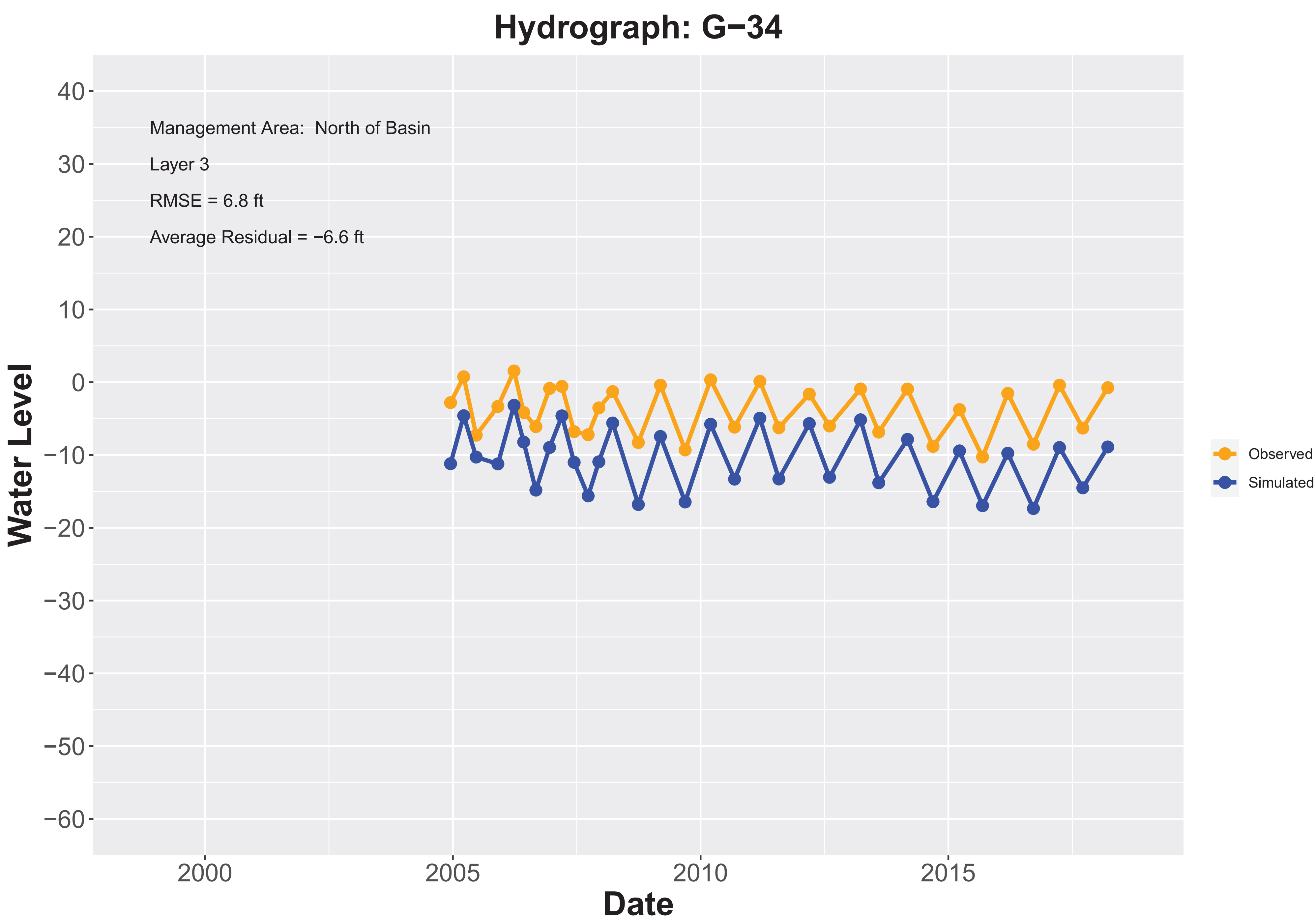


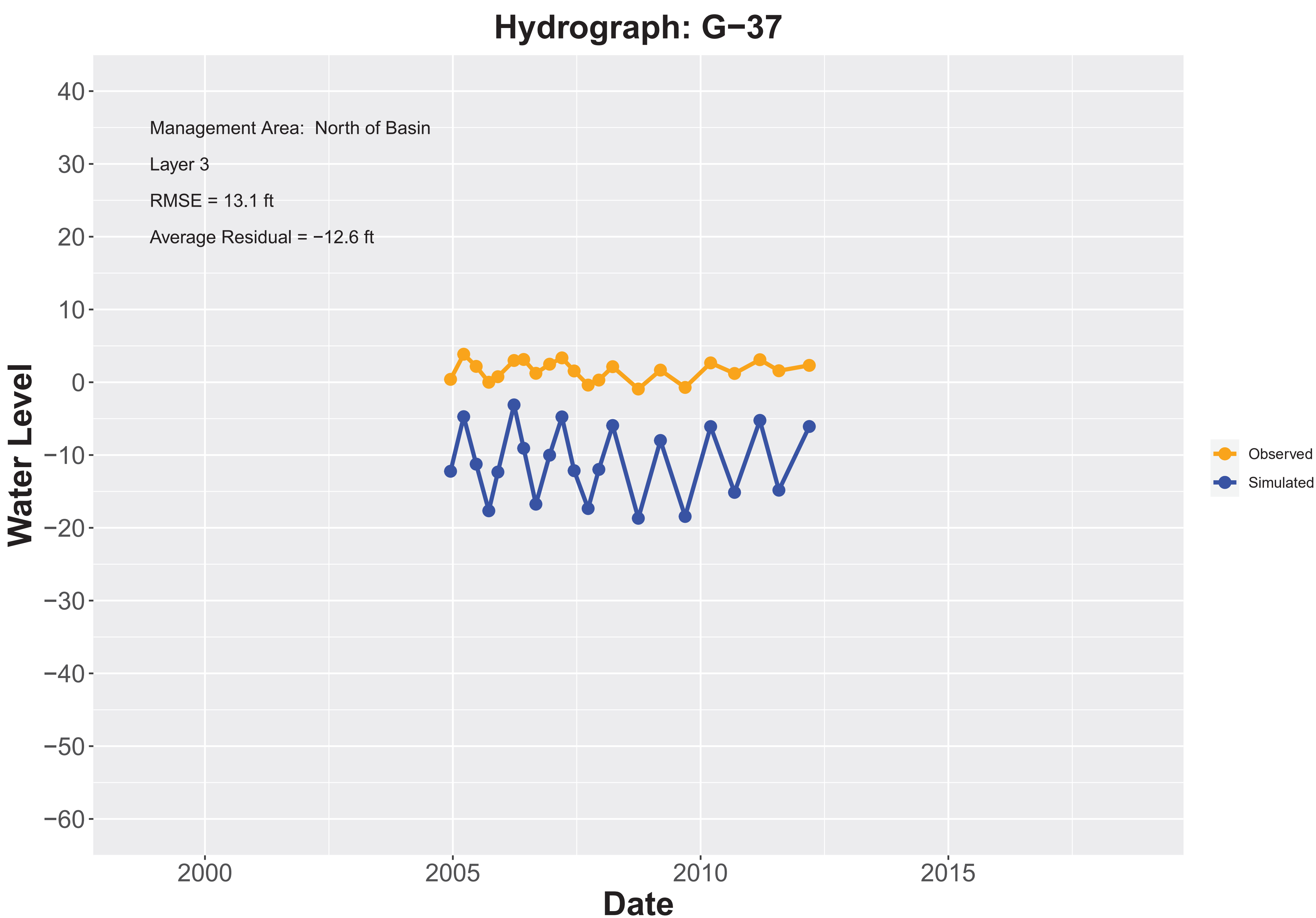
Hydrograph: G−30
Management Area: North of Basin
Layer 3
RMSE = 14.5 ft
Average Residual = −14.2 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

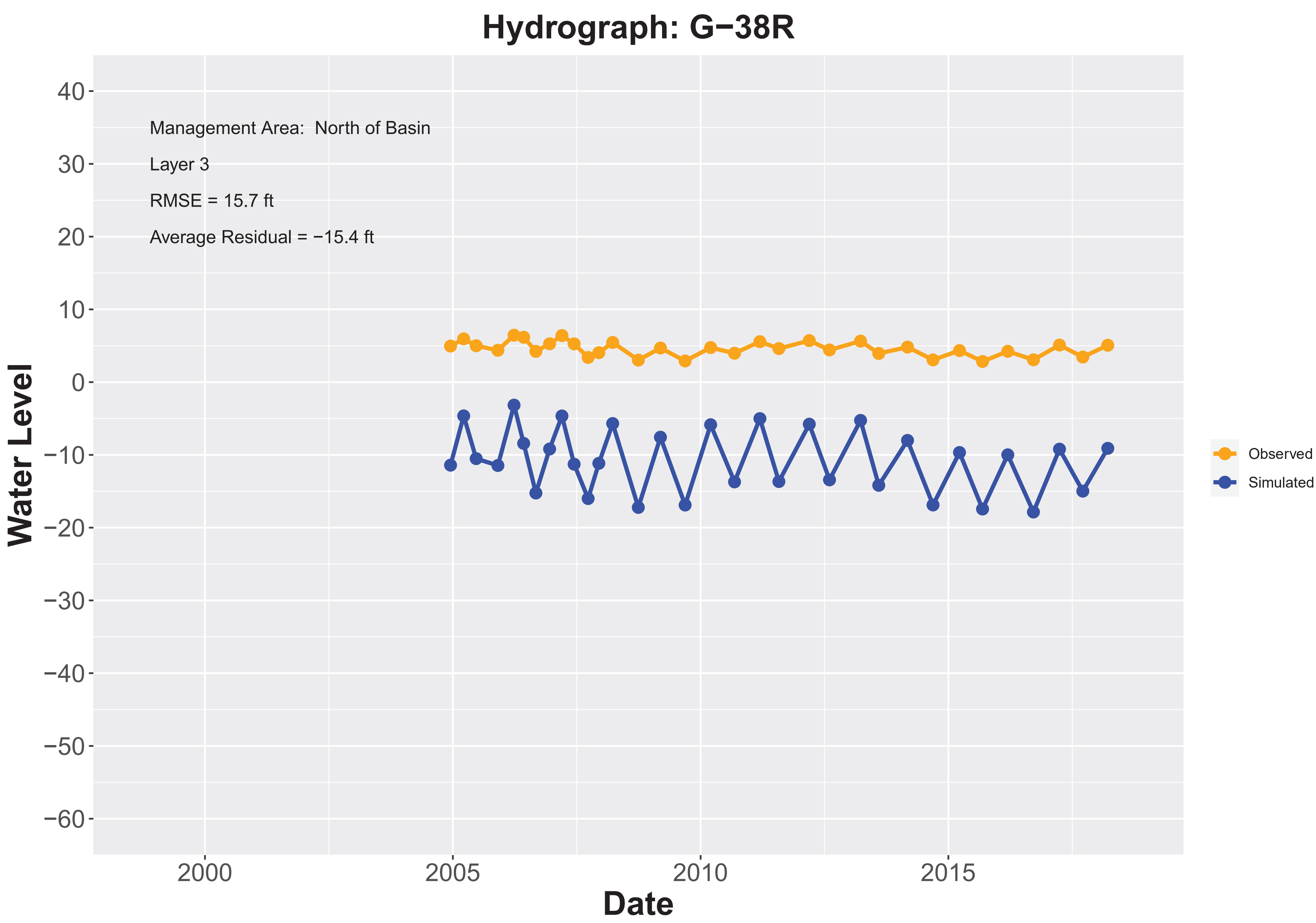

Hydrograph: G−32
Management Area: North of Basin
Layer 3
RMSE = 15.9 ft
Average Residual = −15.3 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

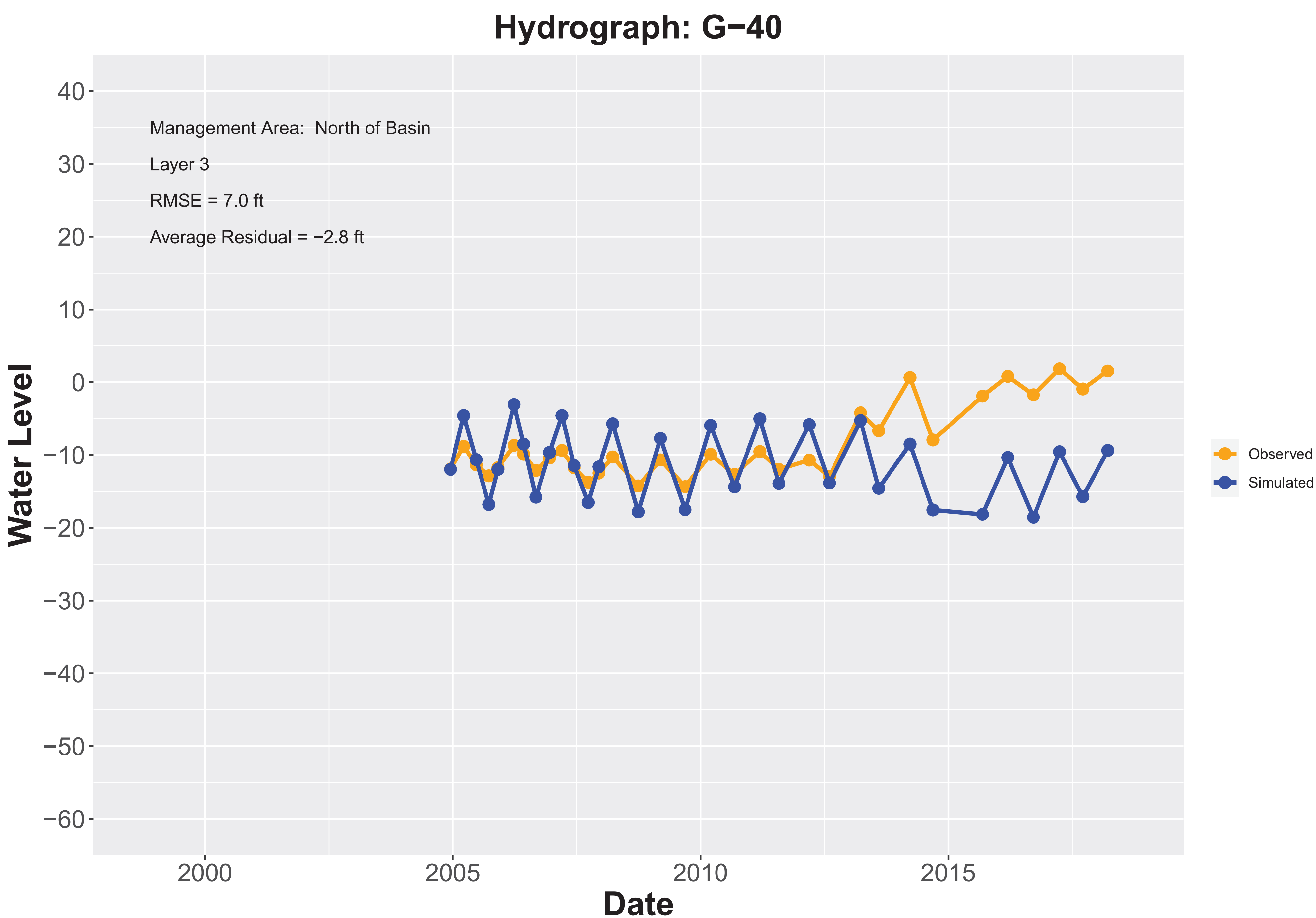


Hydrograph: G−33
Management Area: North of Basin
Layer 3
RMSE = 17.8 ft
Average Residual = −17.3 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

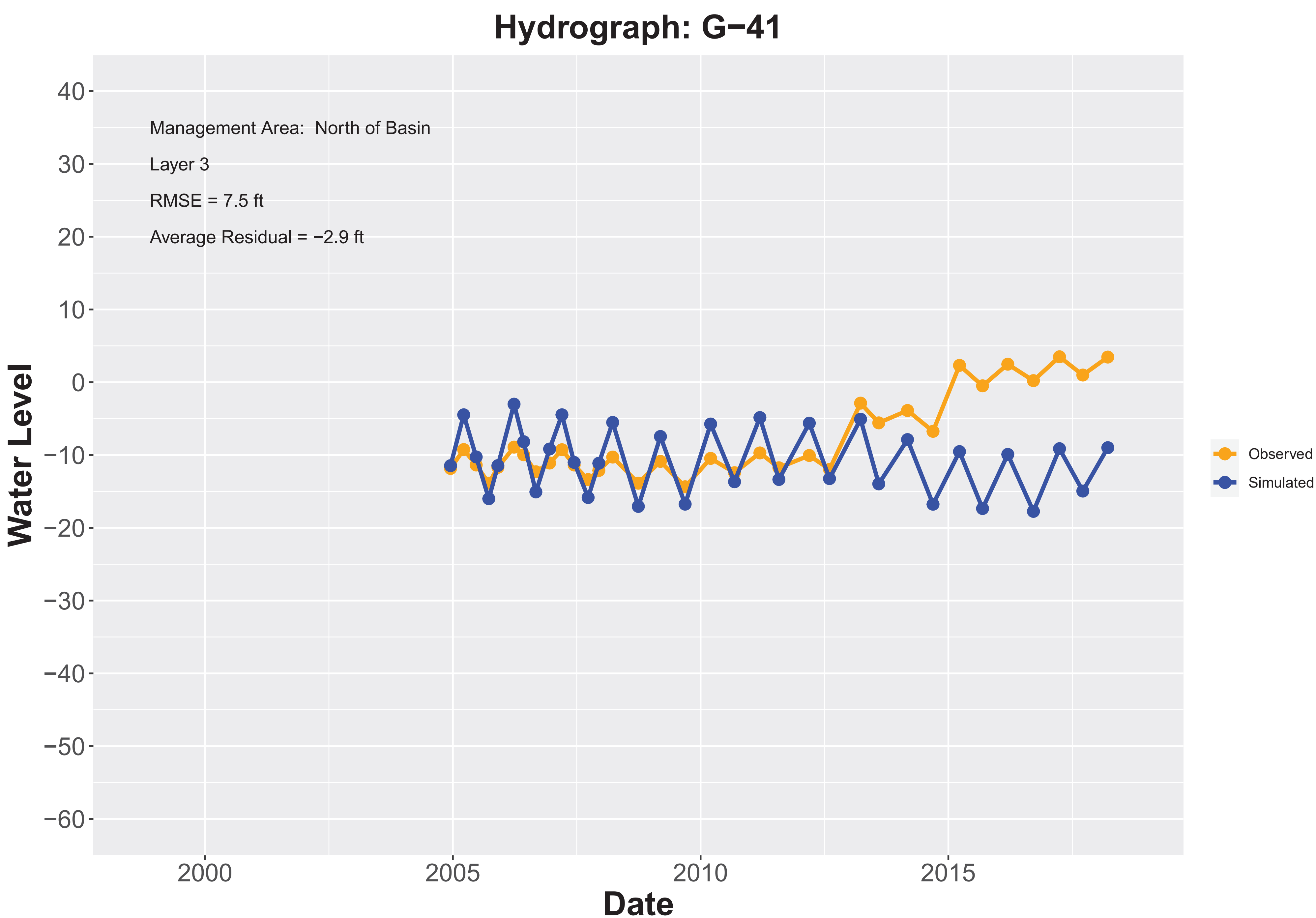

Hydrograph: G−34
Management Area: North of Basin
Layer 3
RMSE = 6.8 ft
Average Residual = −6.6 ft
Water Level
Date
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Observed
Simulated


Hydrograph: G−37
Management Area: North of Basin
Layer 3
RMSE = 13.1 ft
Average Residual = −12.6 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

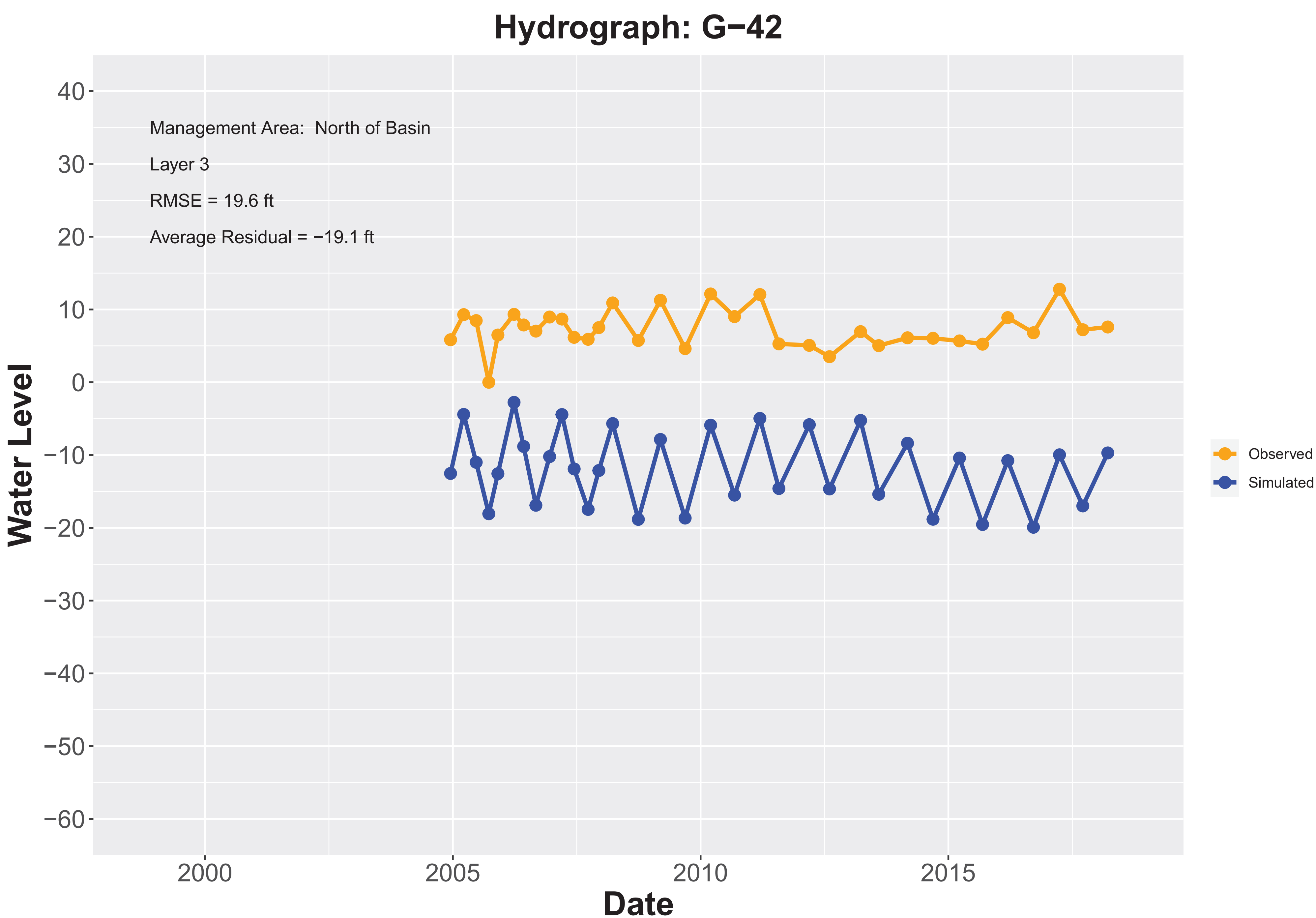

Hydrograph: G−38R
Management Area: North of Basin
Layer 3
RMSE = 15.7 ft
Average Residual = −15.4 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated



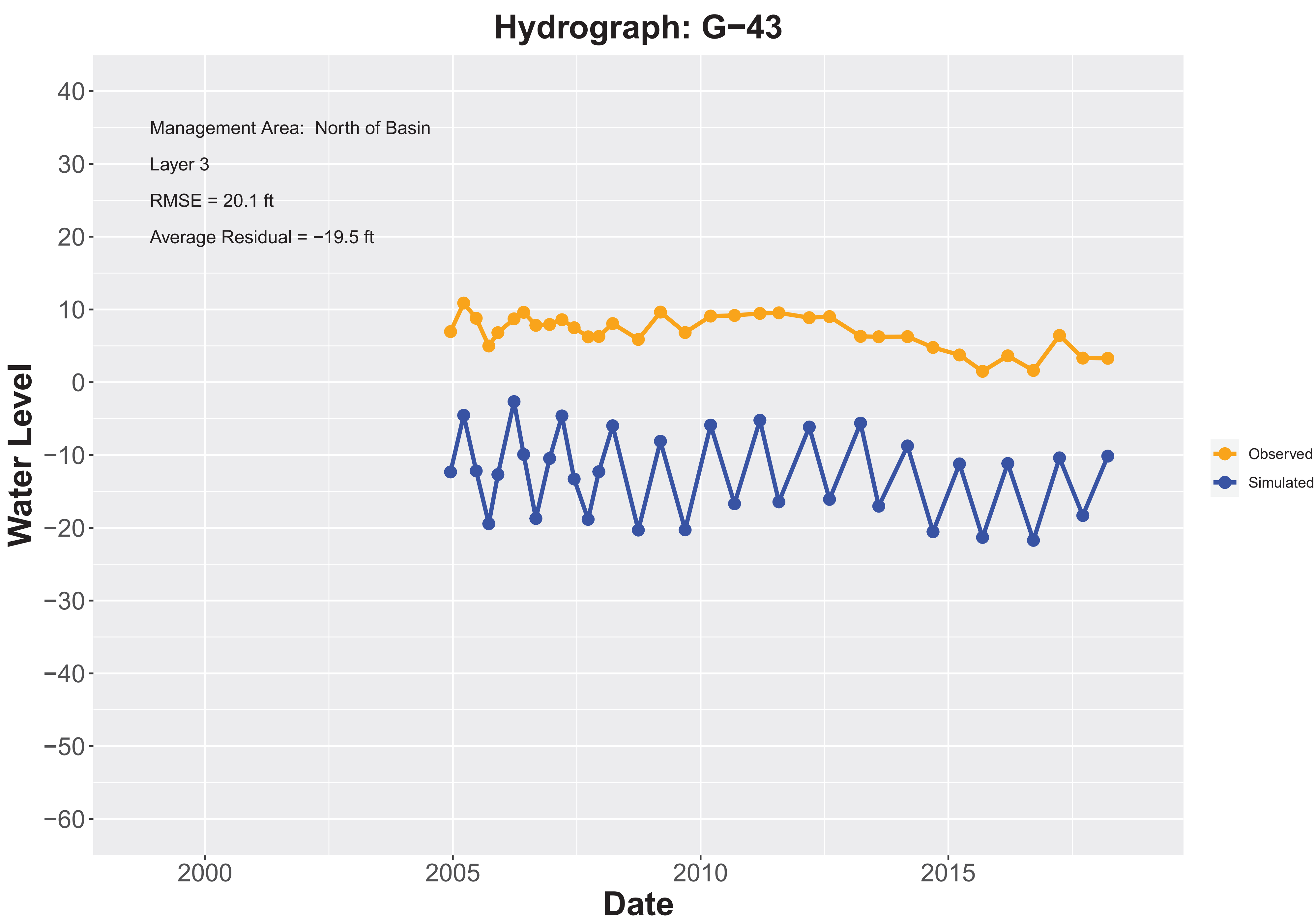
Hydrograph: G−40
Management Area: North of Basin
Layer 3
RMSE = 7.0 ft
Average Residual = −2.8 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

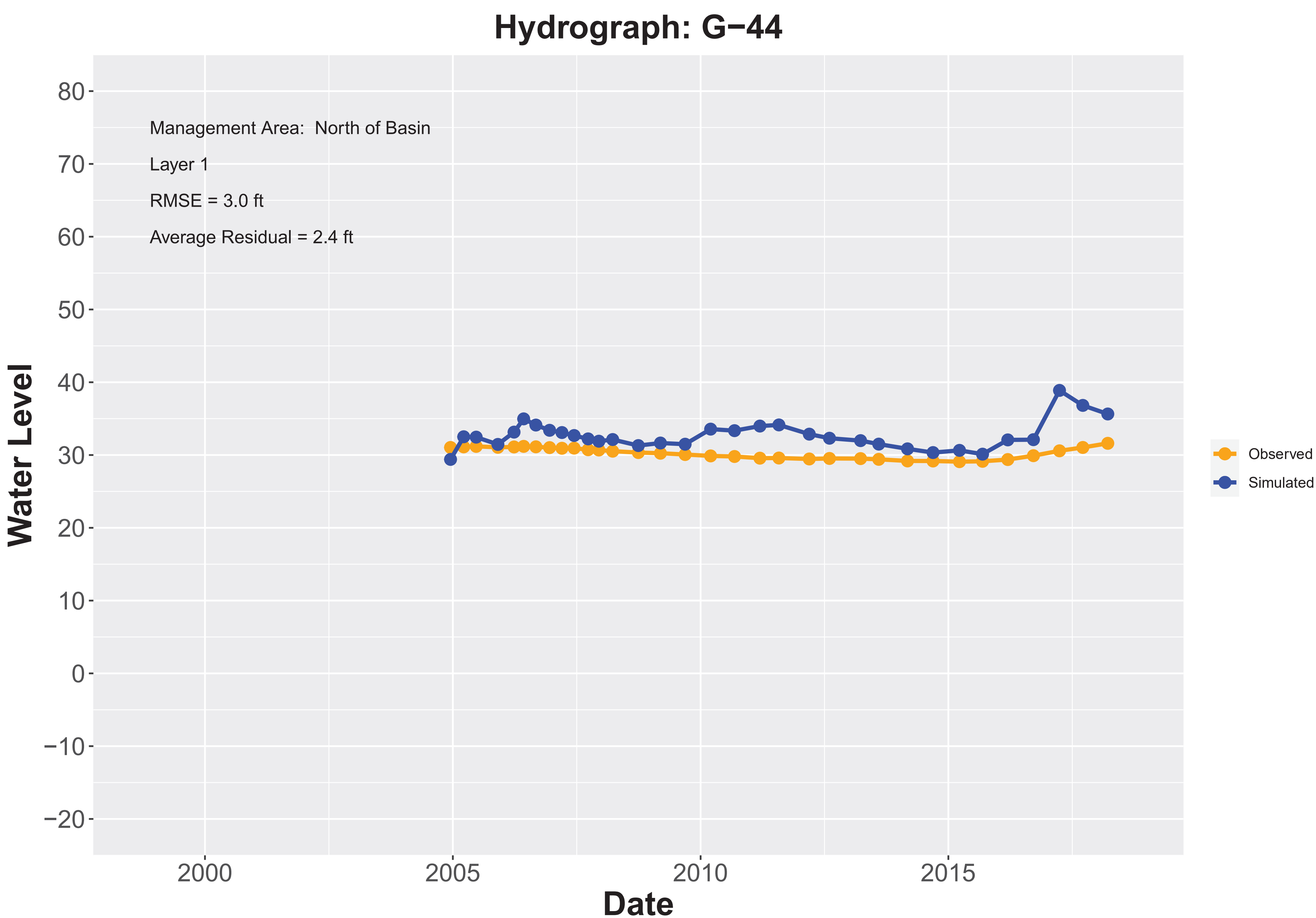


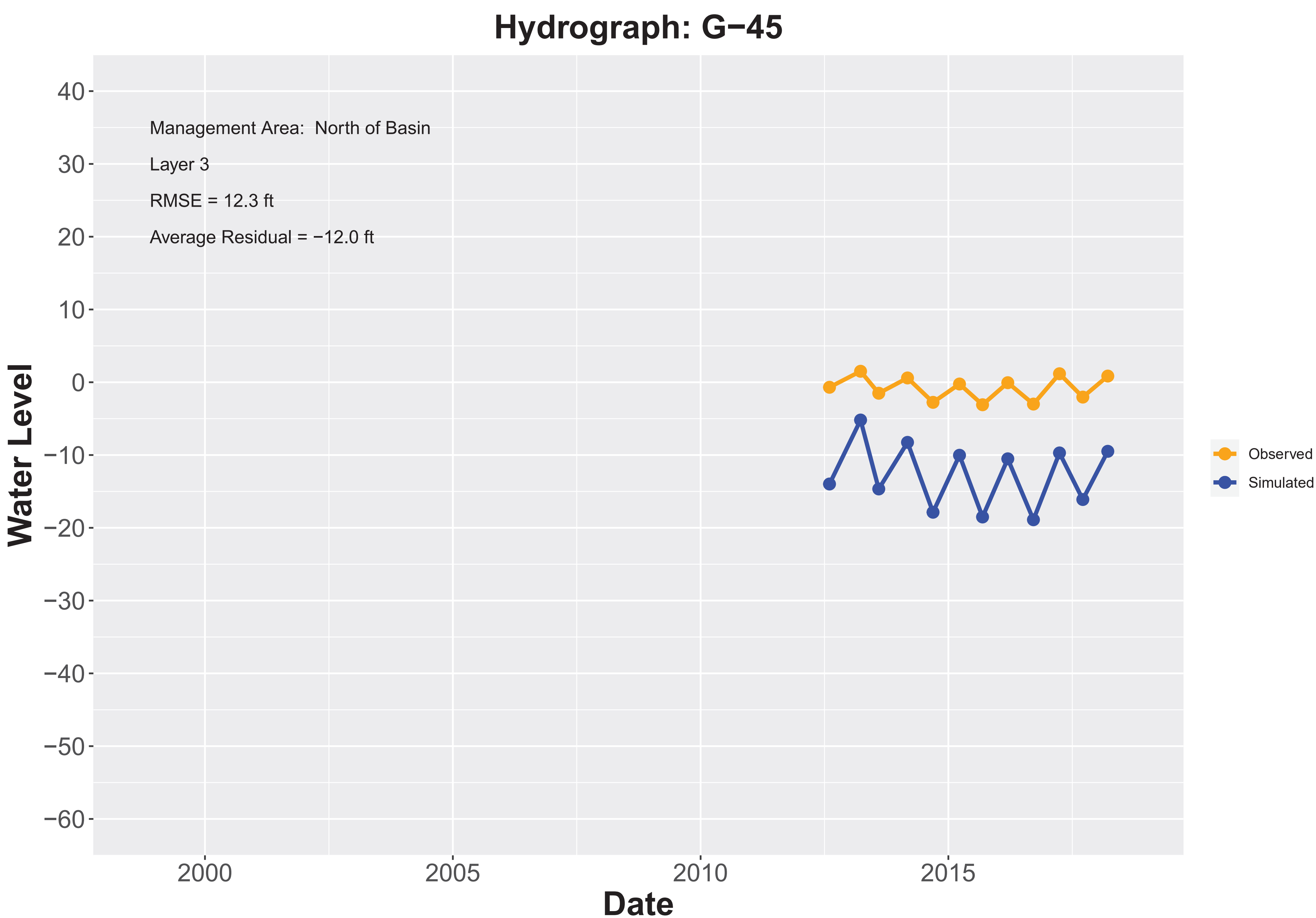
Hydrograph: G−41
Management Area: North of Basin
Layer 3
RMSE = 7.5 ft
Average Residual = −2.9 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

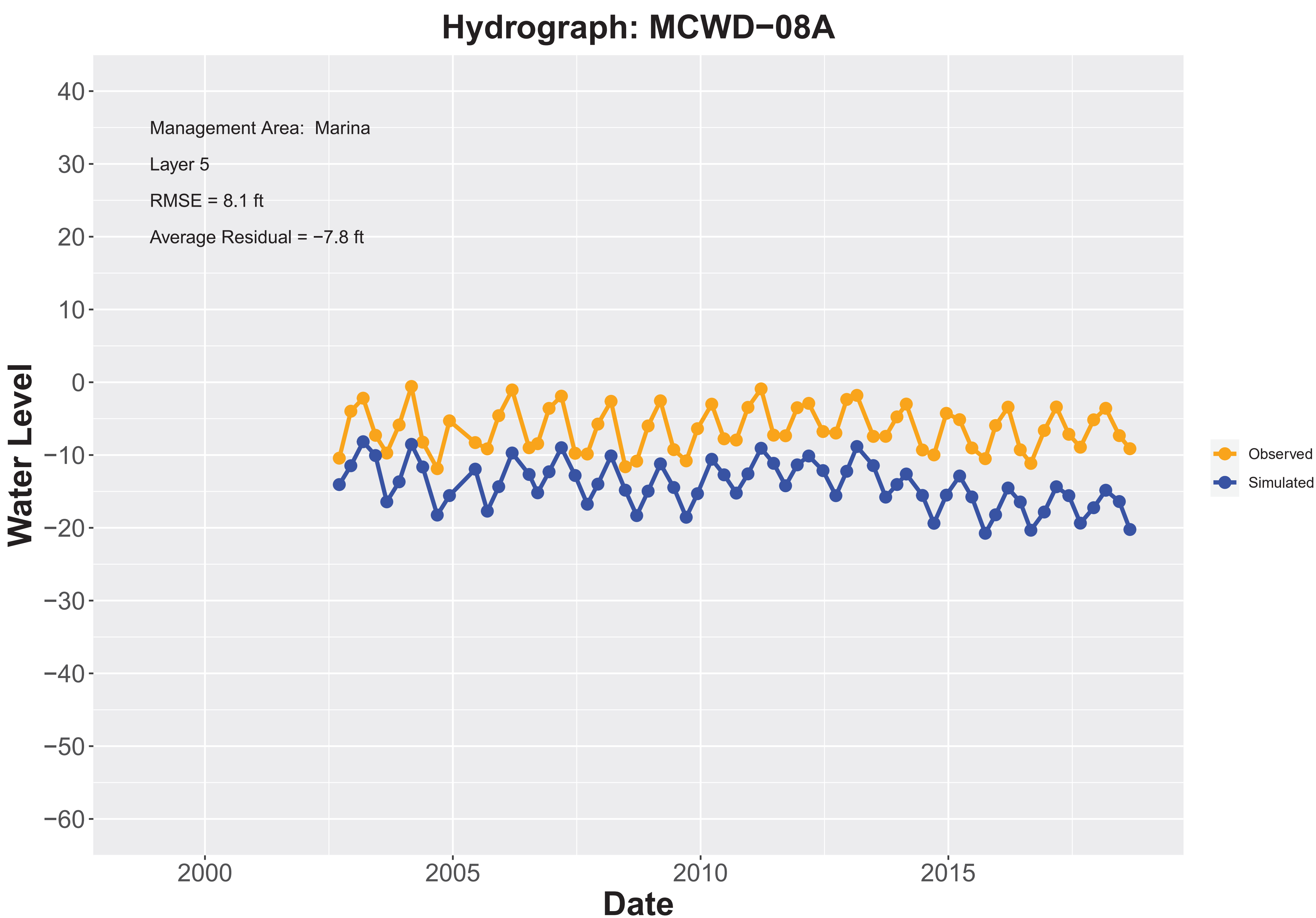


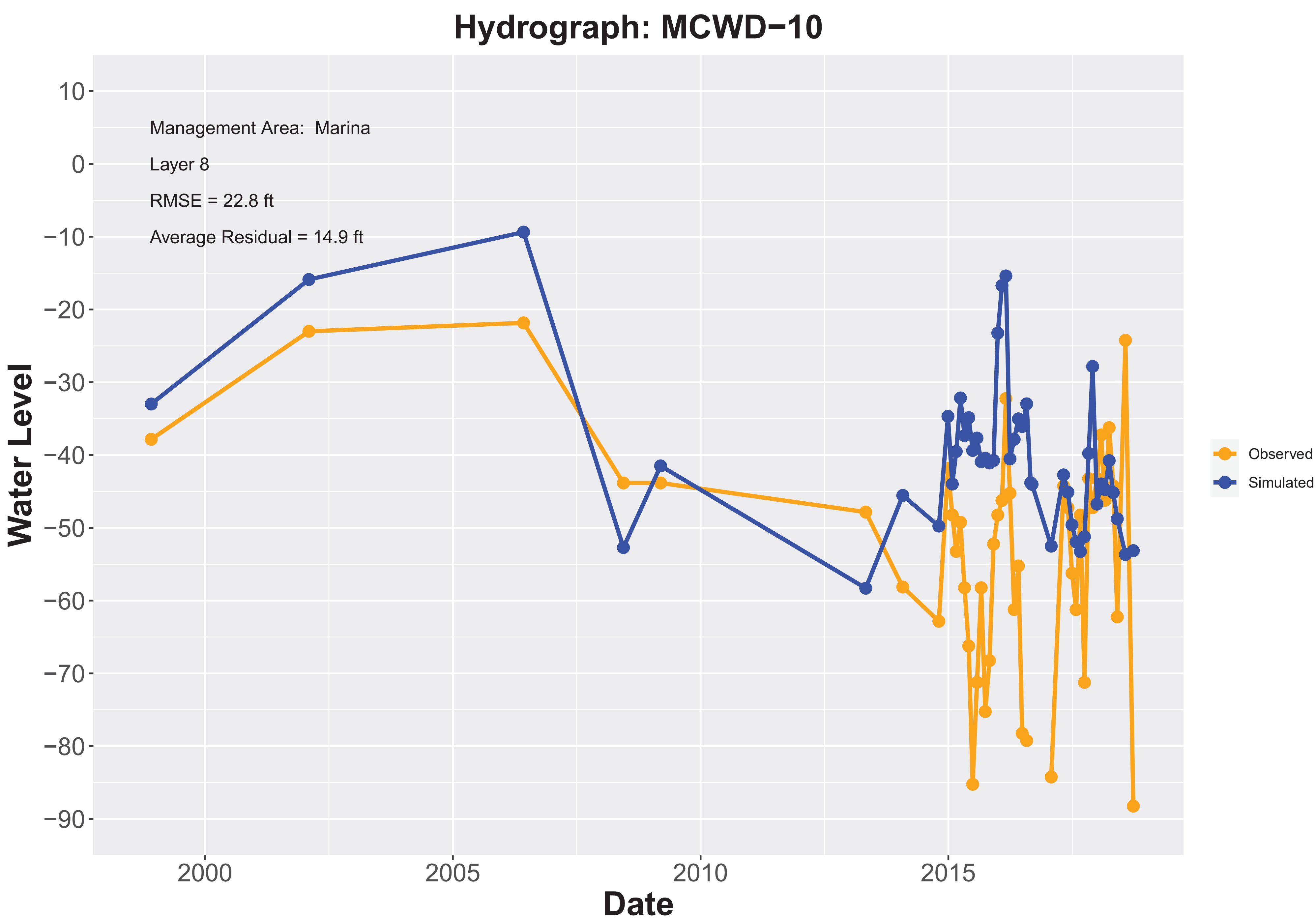
Hydrograph: G−42
Management Area: North of Basin
Layer 3
RMSE = 19.6 ft
Average Residual = −19.1 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: G−43
Management Area: North of Basin
Layer 3
RMSE = 20.1 ft
Average Residual = −19.5 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

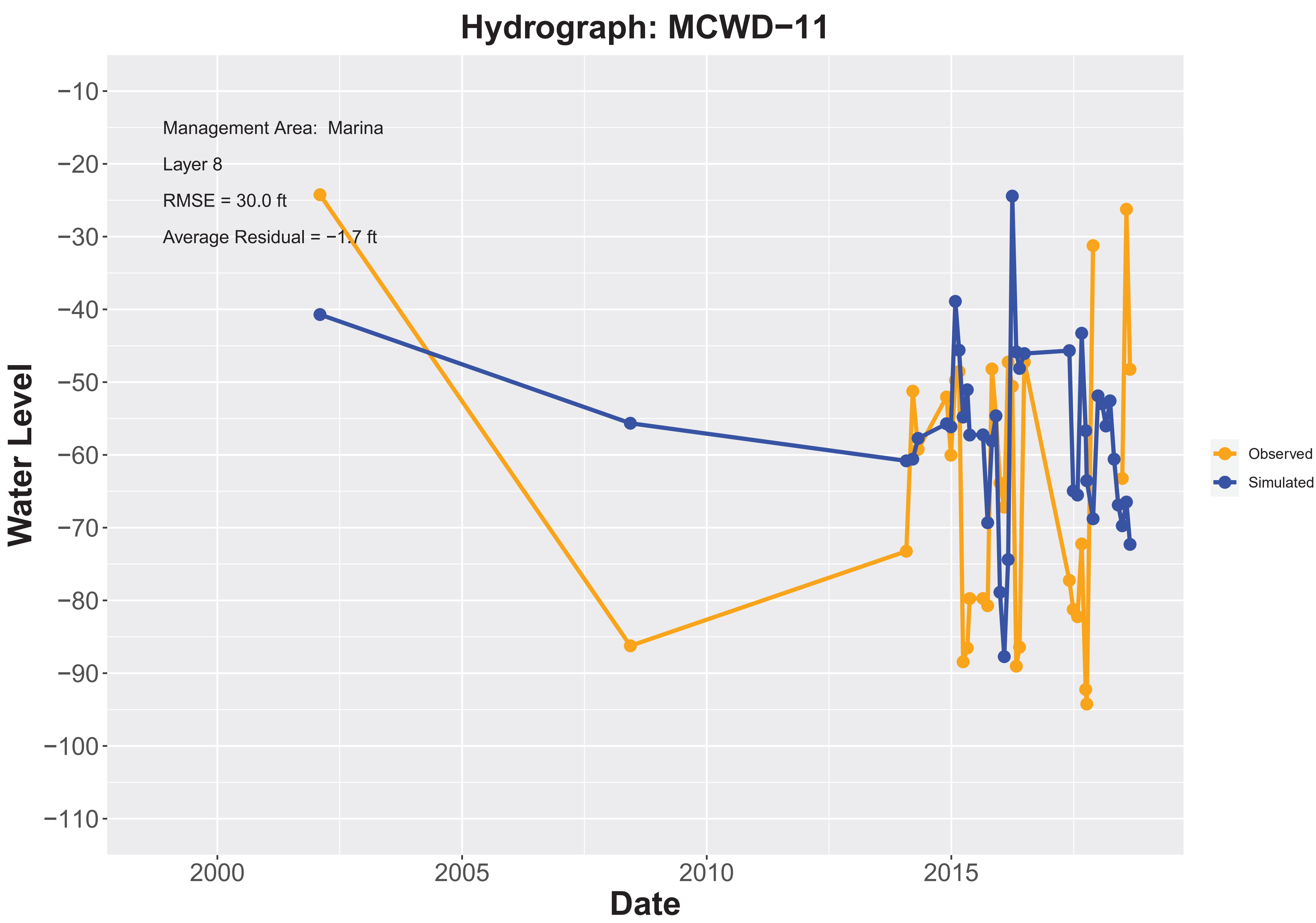

Hydrograph: G−44
Management Area: North of Basin
Layer 1
RMSE = 3.0 ft
Average Residual = 2.4 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: G−45
Management Area: North of Basin
Layer 3
RMSE = 12.3 ft
Average Residual = −12.0 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

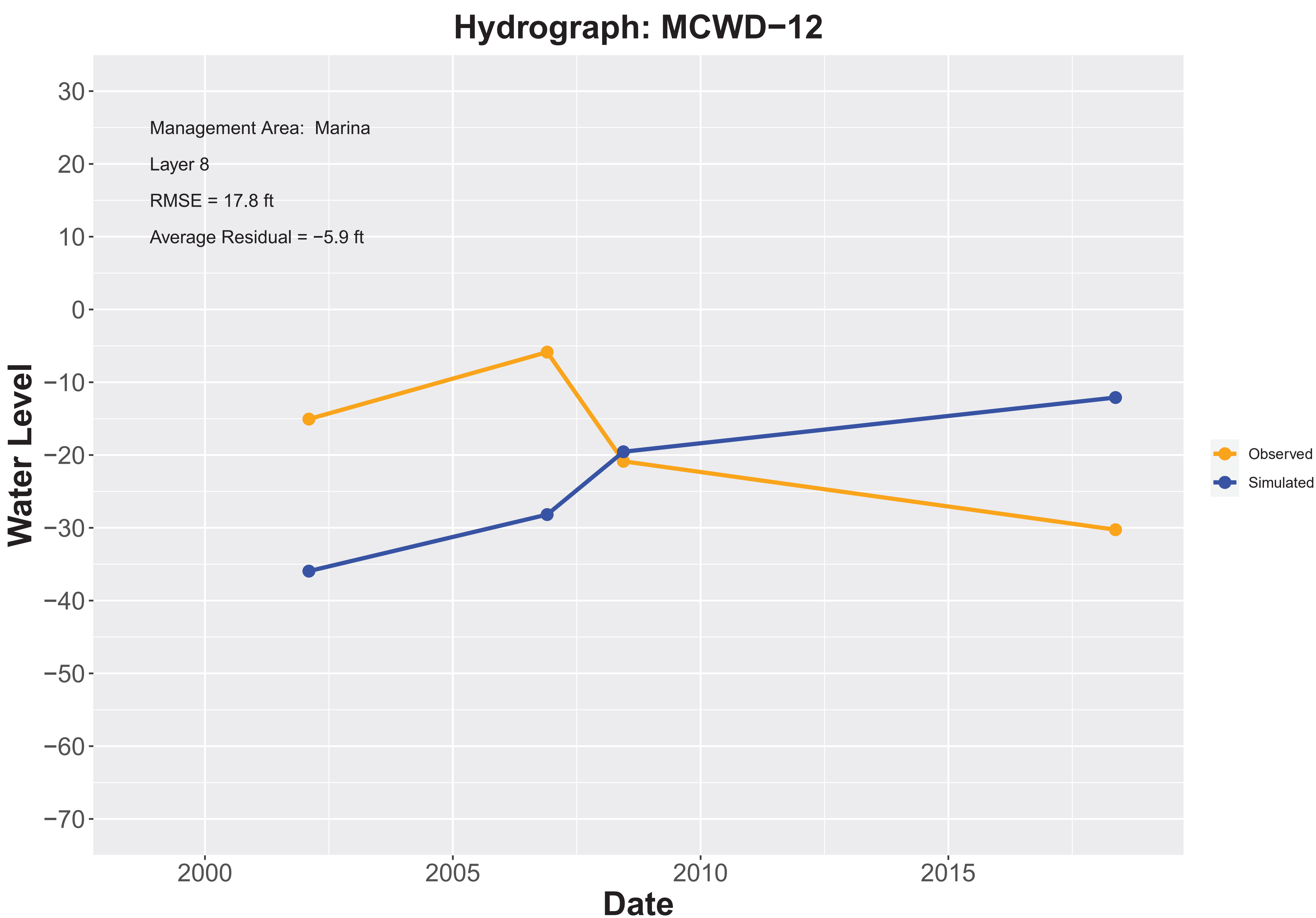

Hydrograph: MCWD−08A
Management Area: Marina
Layer 5
RMSE = 8.1 ft
Average Residual = −7.8 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

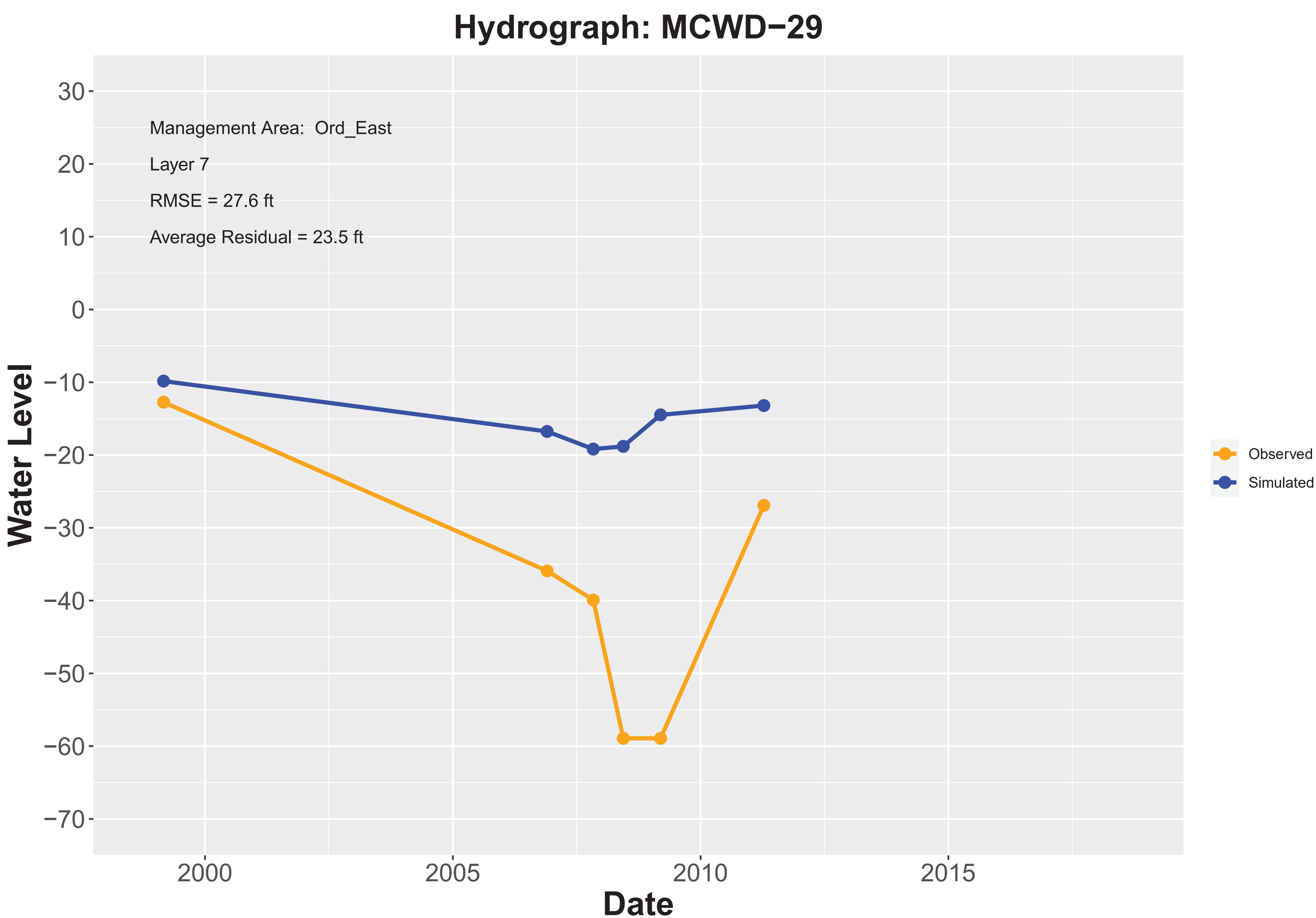


Hydrograph: MCWD−10
Management Area: Marina
Layer 8
RMSE = 22.8 ft
Average Residual = 14.9 ft
Water Level
Date
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
2000
2005
2010
2015
Observed
Simulated

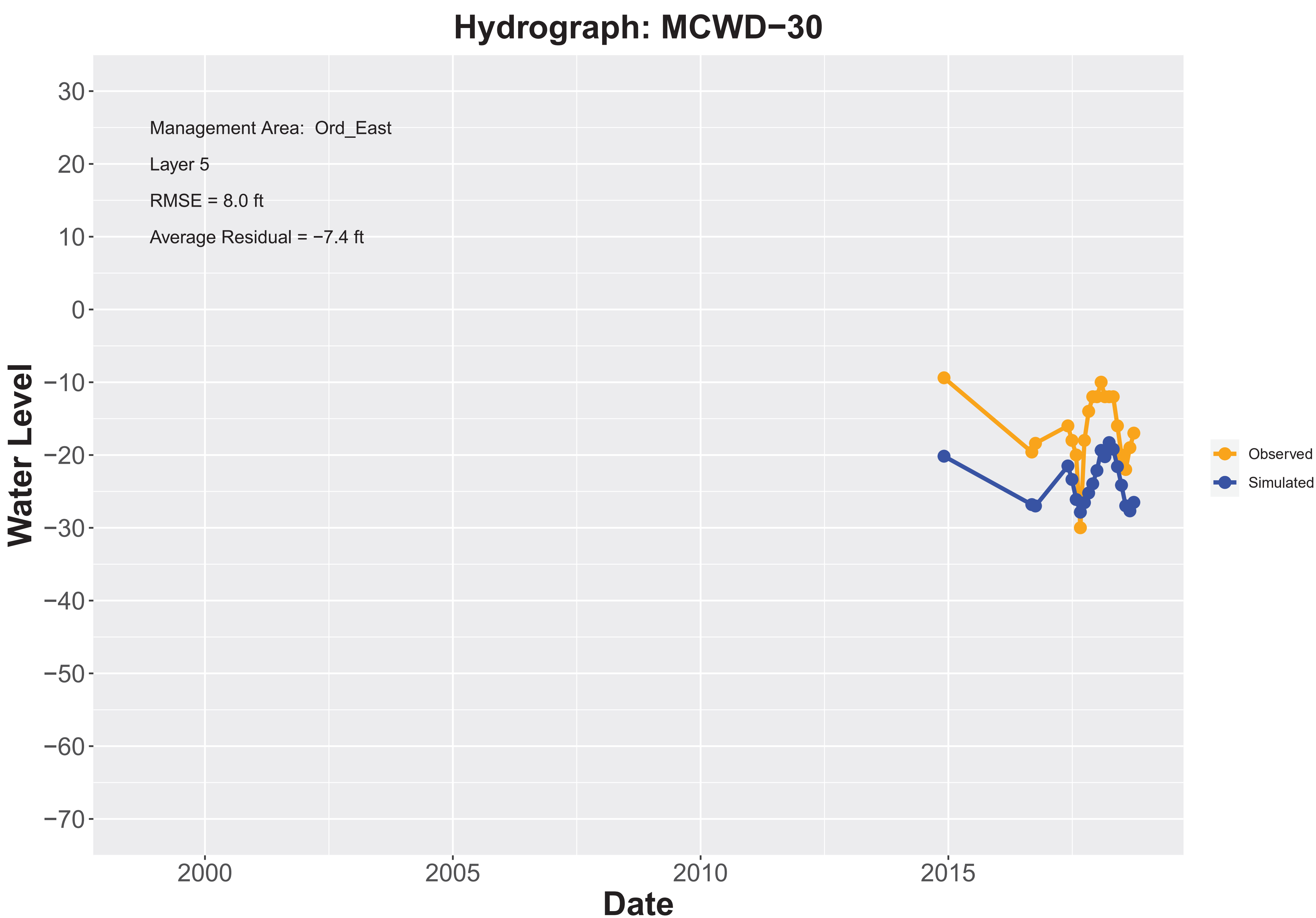


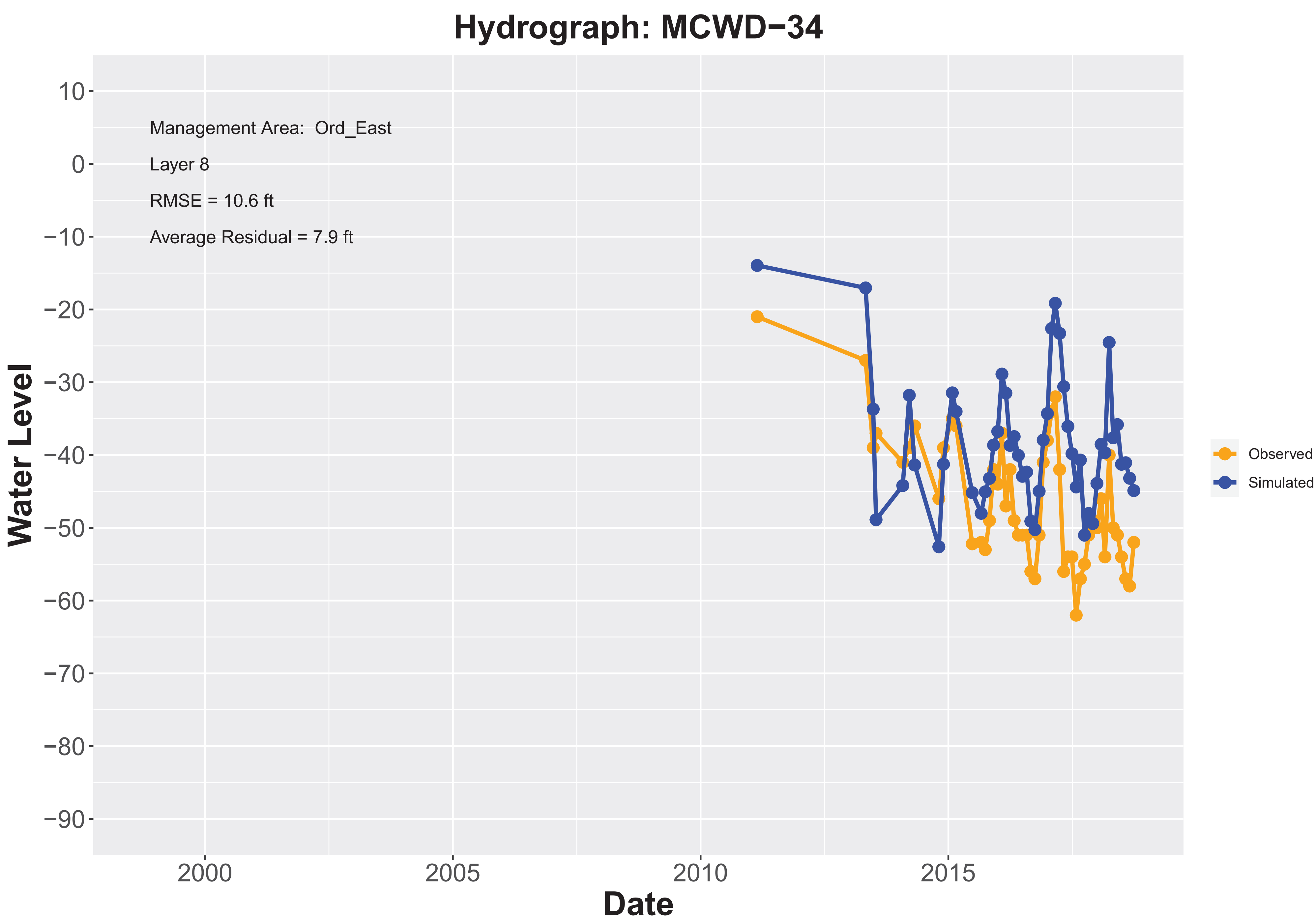
Hydrograph: MCWD−11
Management Area: Marina
Layer 8
RMSE = 30.0 ft
Average Residual = −1.7 ft
Water Level
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
Date
2000
2005
2010
2015
Observed
Simulated

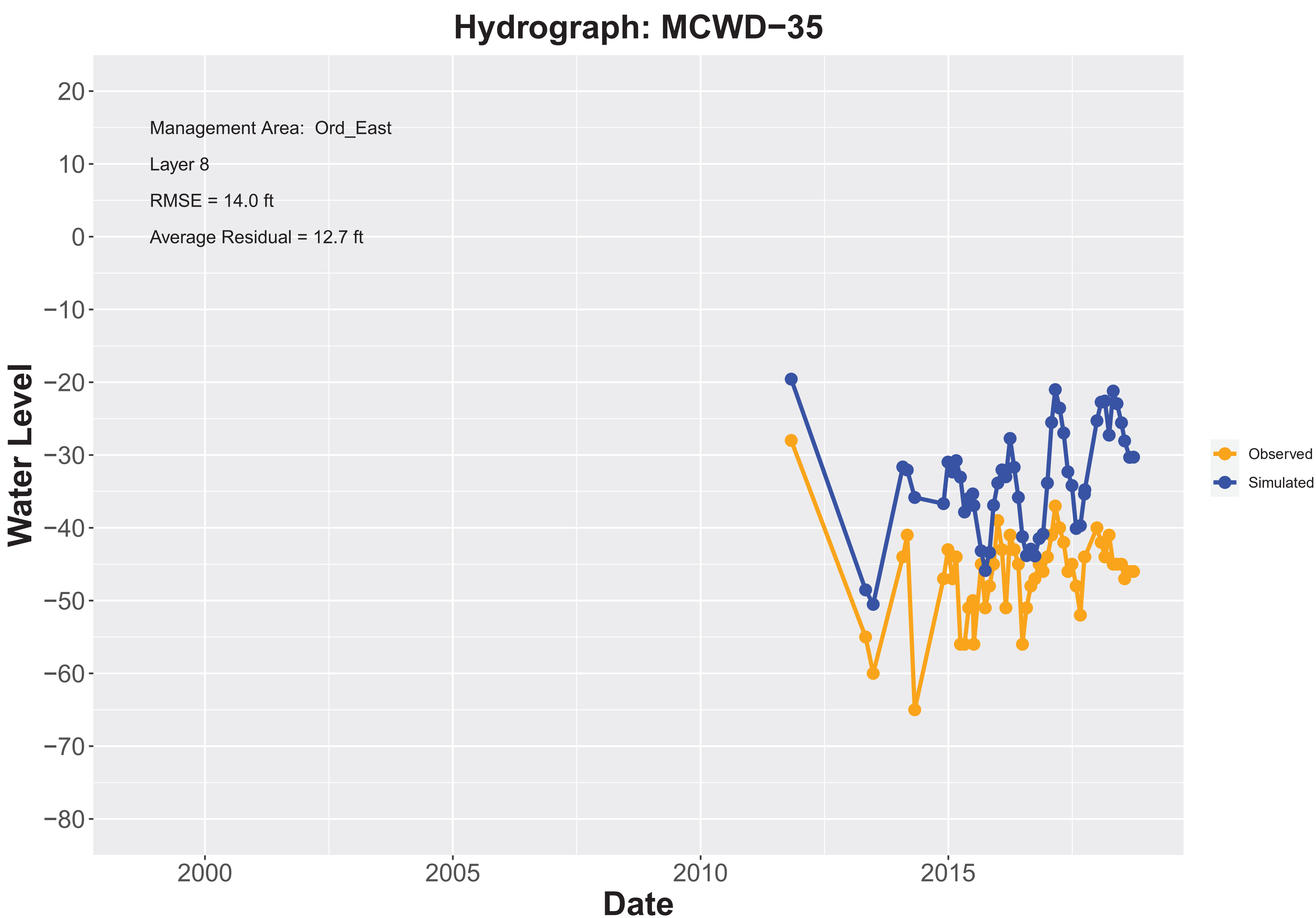

Hydrograph: MCWD−12
Management Area: Marina
Layer 8
RMSE = 17.8 ft
Average Residual = −5.9 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated



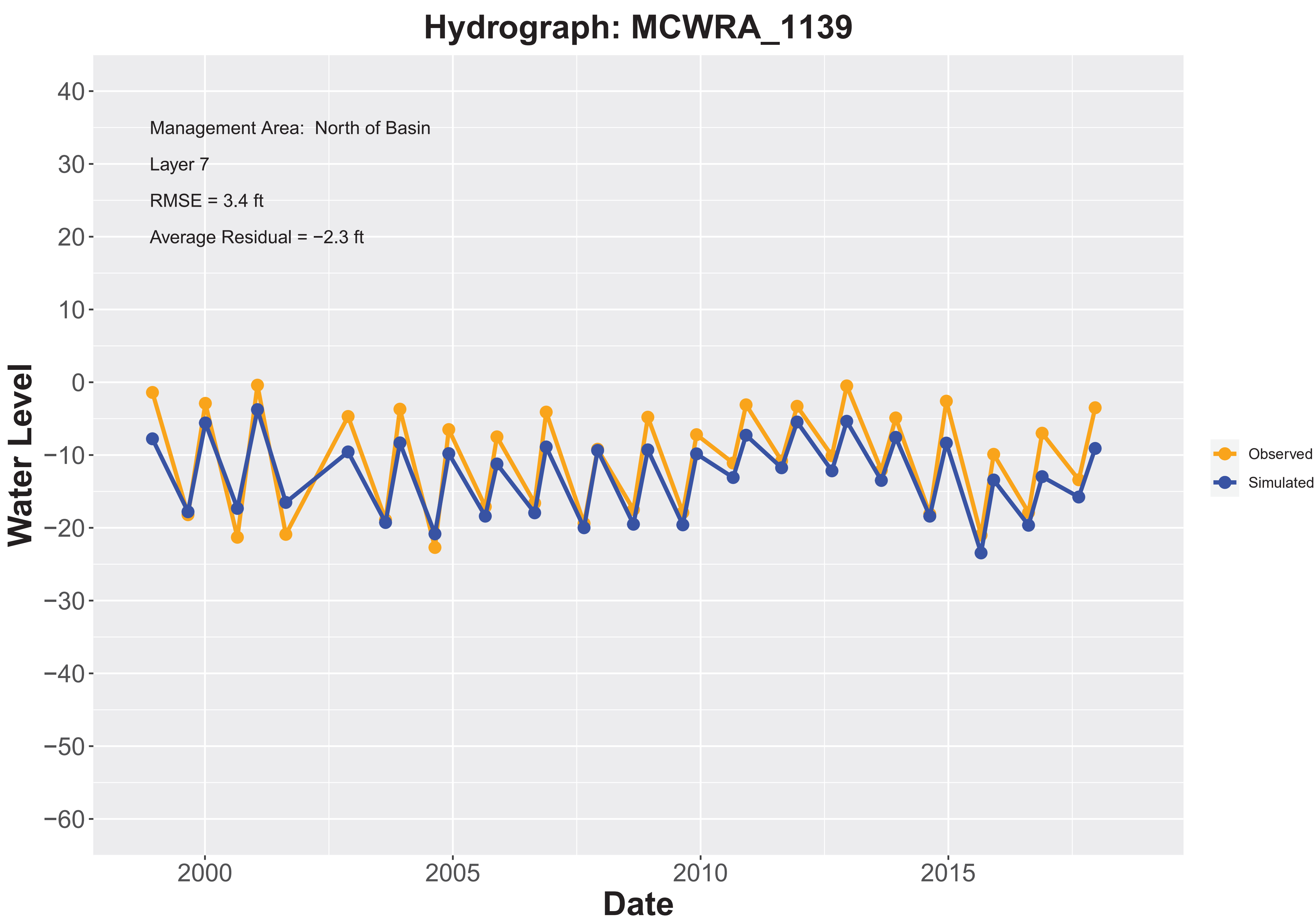
Hydrograph: MCWD−29
Management Area: Ord_East
Layer 7
RMSE = 27.6 ft
Average Residual = 23.5 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MCWD−30
Management Area: Ord_East
Layer 5
RMSE = 8.0 ft
Average Residual = −7.4 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

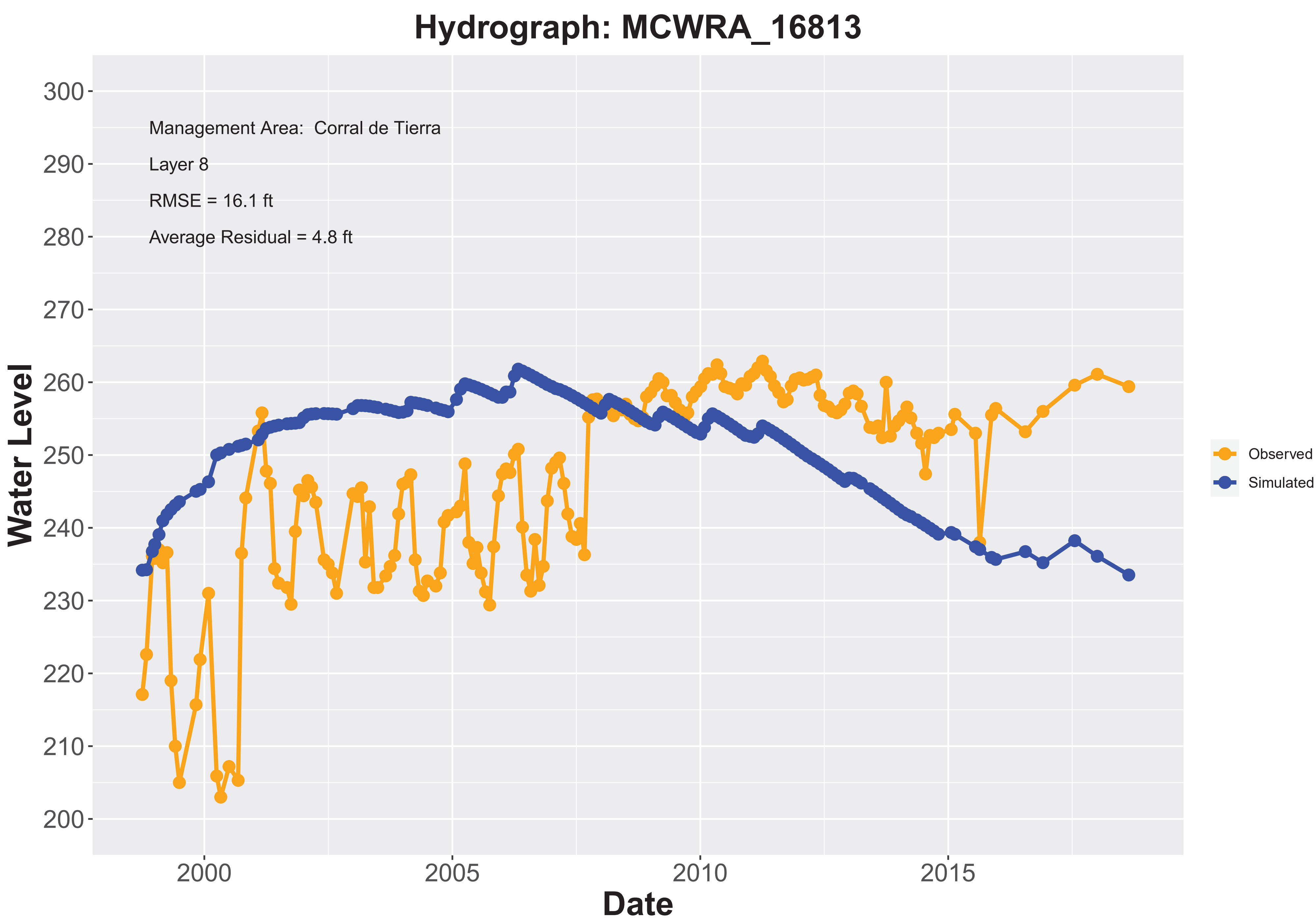

Hydrograph: MCWD−34
Management Area: Ord_East
Layer 8
RMSE = 10.6 ft
Average Residual = 7.9 ft
Water Level
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
2000
2005
2010
2015
Date
Observed
Simulated



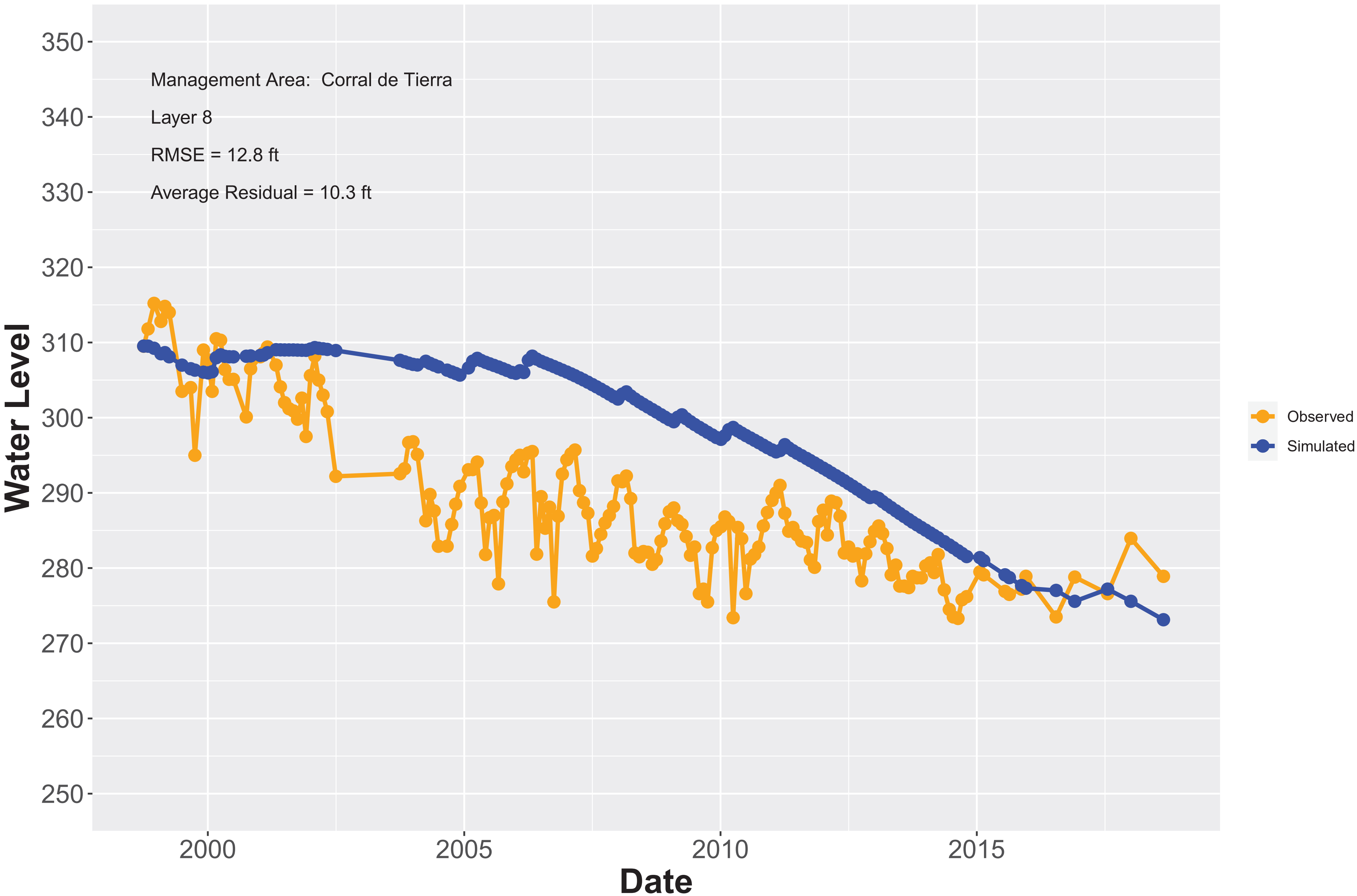
Hydrograph: MCWD−35
Management Area: Ord_East
Layer 8
RMSE = 14.0 ft
Average Residual = 12.7 ft
Water Level
Date
Observed
Simulated
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
2000
2005
2010
2015

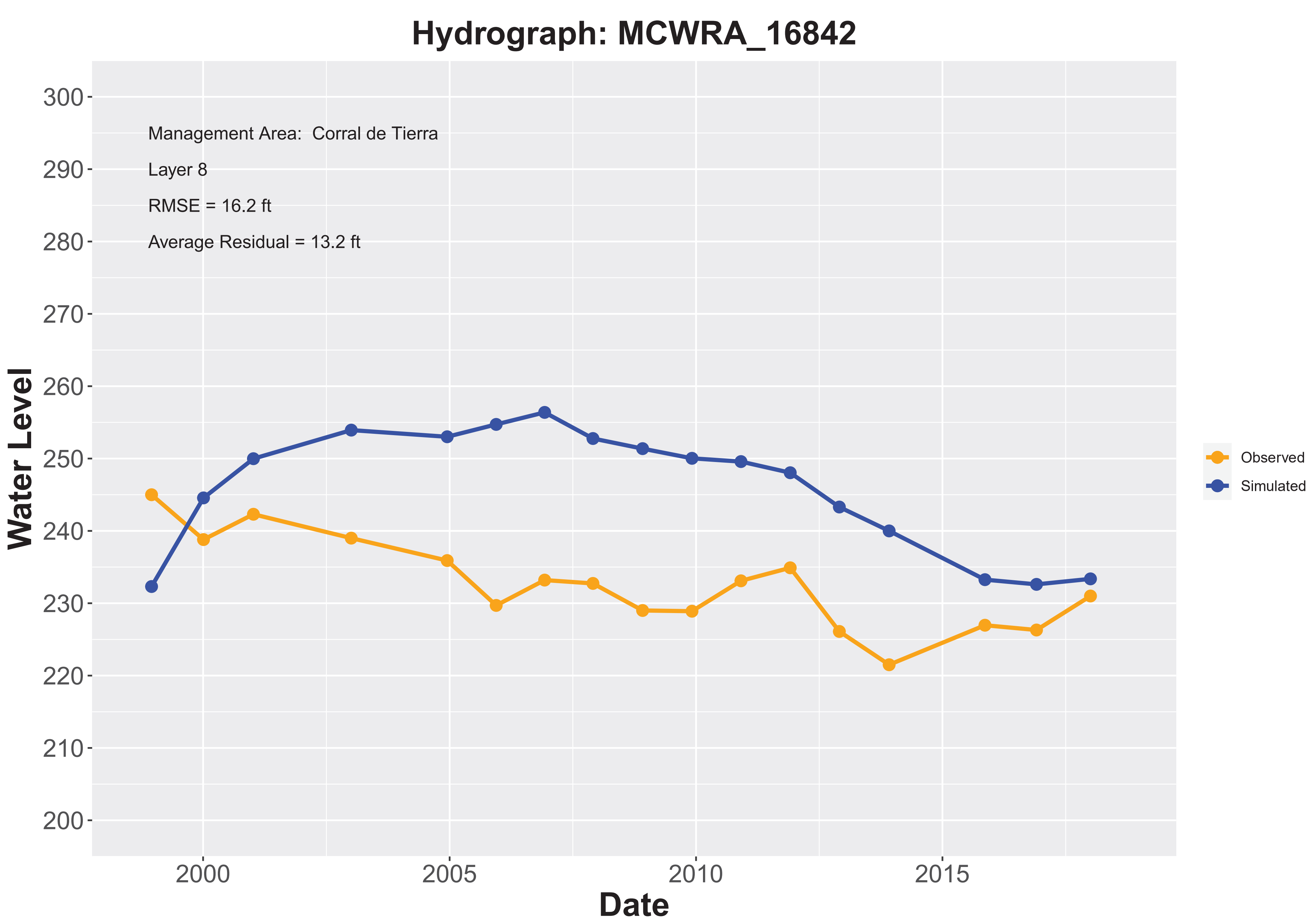


Hydrograph: MCWRA_1139
Management Area: North of Basin
Layer 7
RMSE = 3.4 ft
Average Residual = −2.3 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

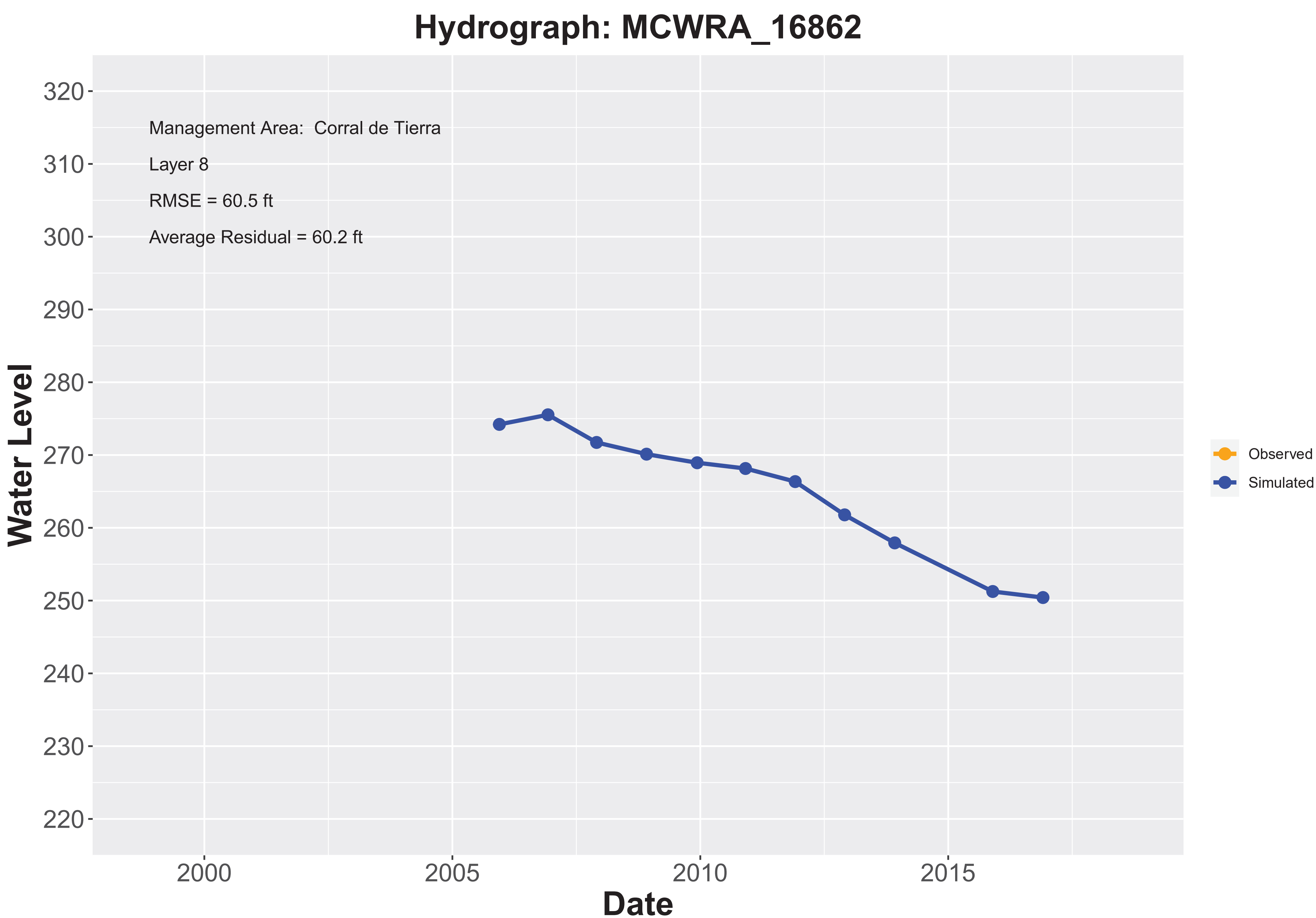

Hydrograph: MCWRA_16813
Management Area: Corral de Tierra
Layer 8
RMSE = 16.1 ft
Average Residual = 4.8 ft
Water Level
300
290
280
270
260
250
240
230
220
210
200
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MCWRA_16823

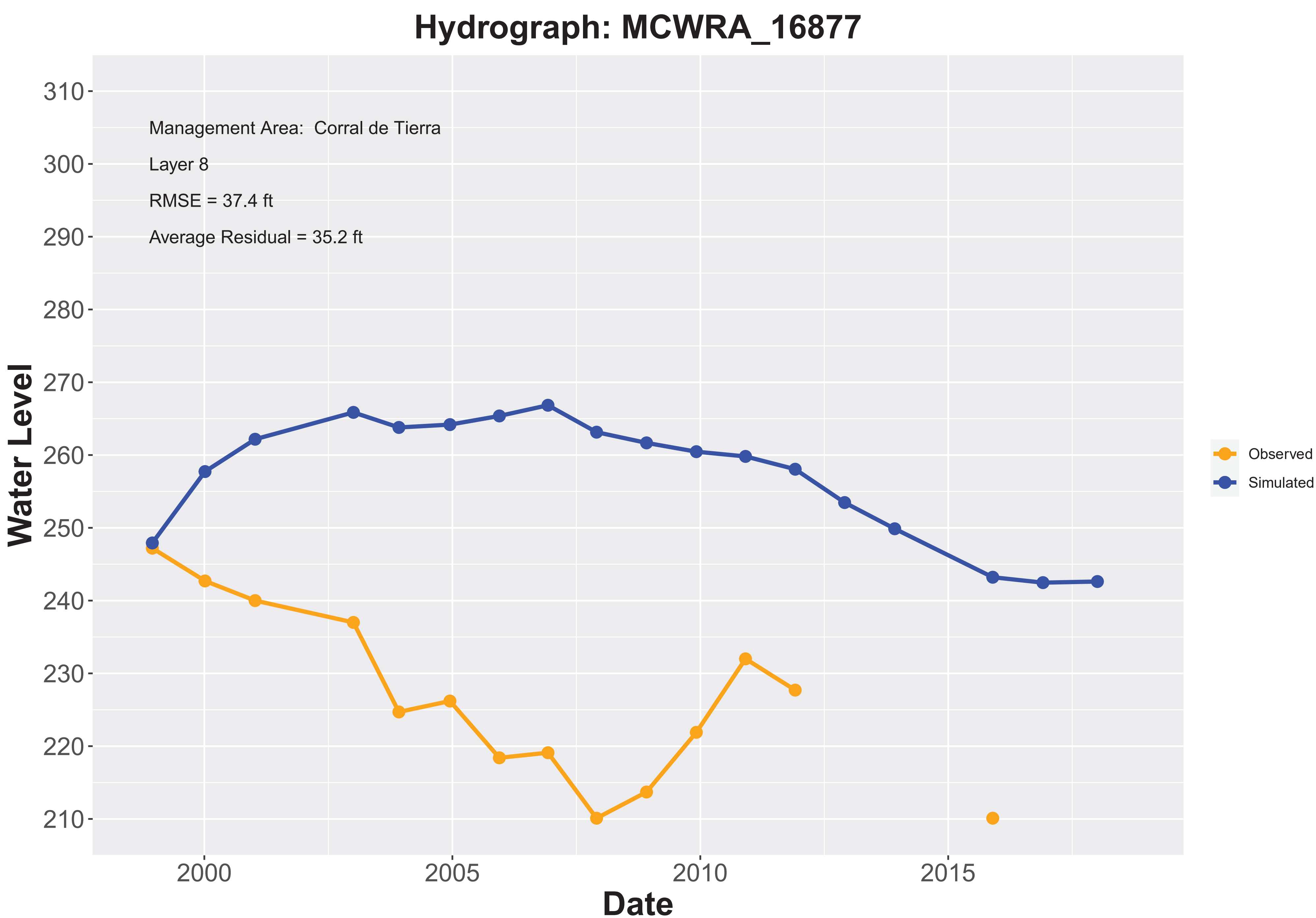


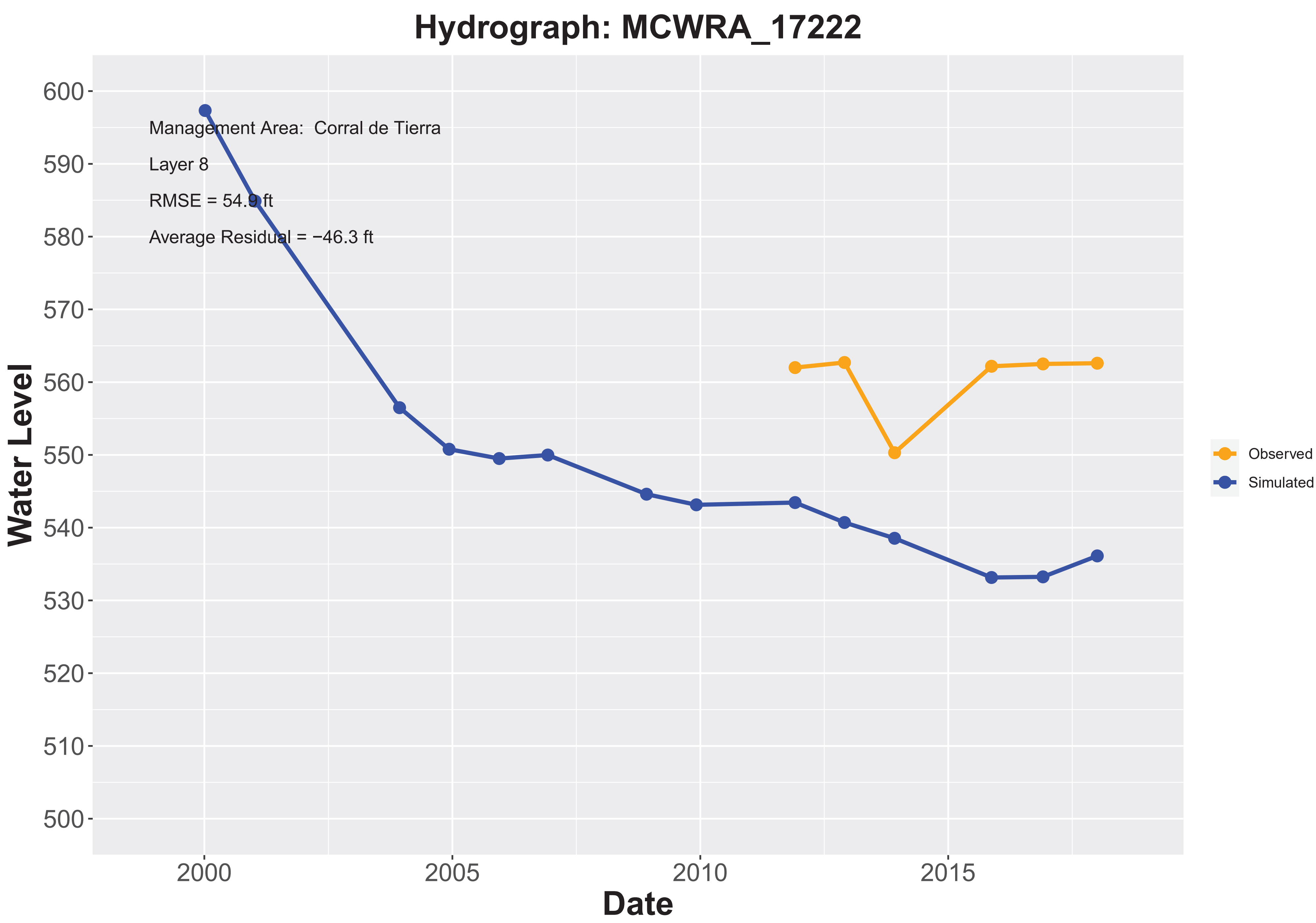


Hydrograph: MCWRA_16842
Management Area: Corral de Tierra
Layer 8
RMSE = 16.2 ft
Average Residual = 13.2 ft
Water Level
300
290
280
270
260
250
240
230
220
210
200
2000
2005
2010
2015
Date
Observed
Simulated

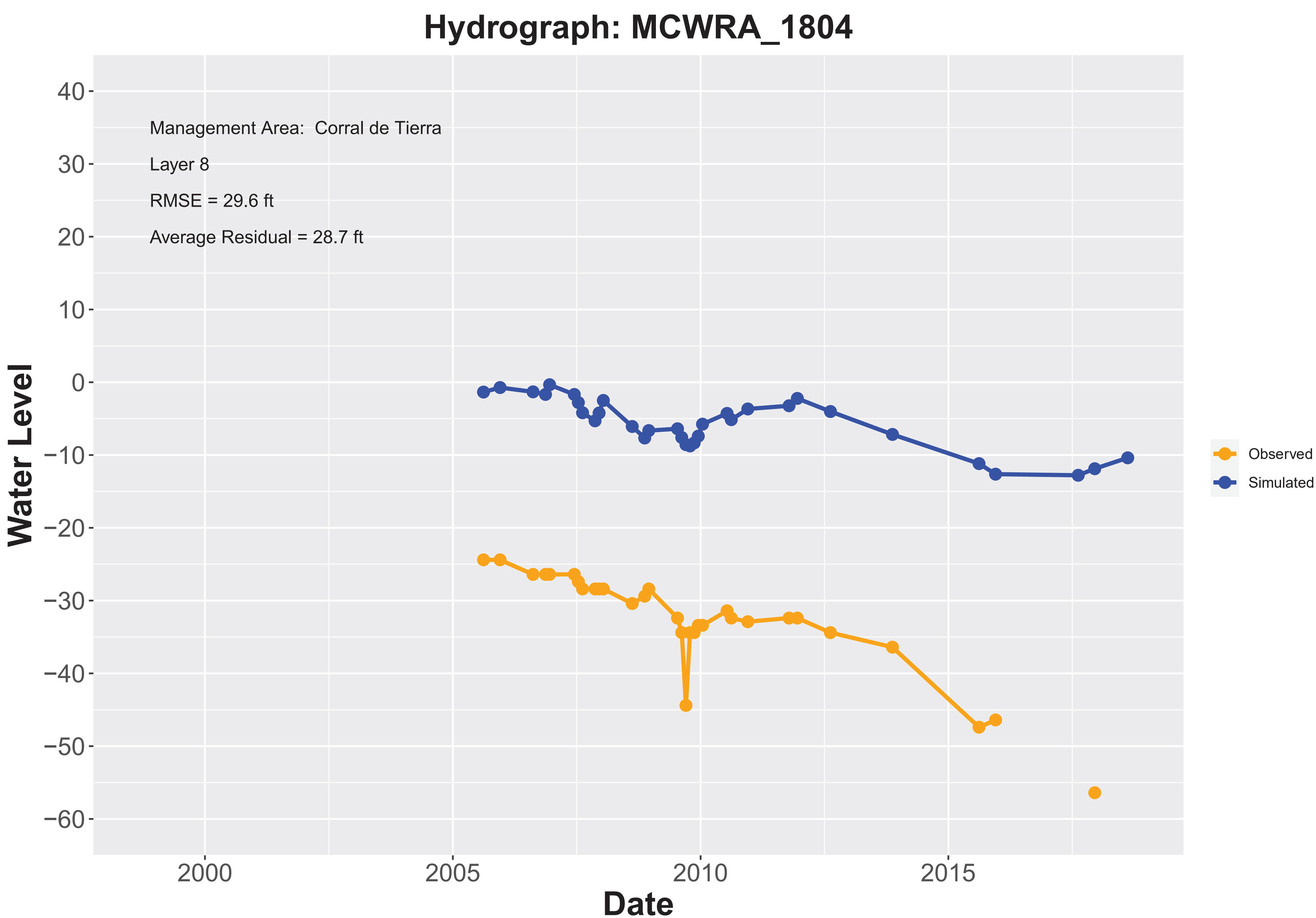


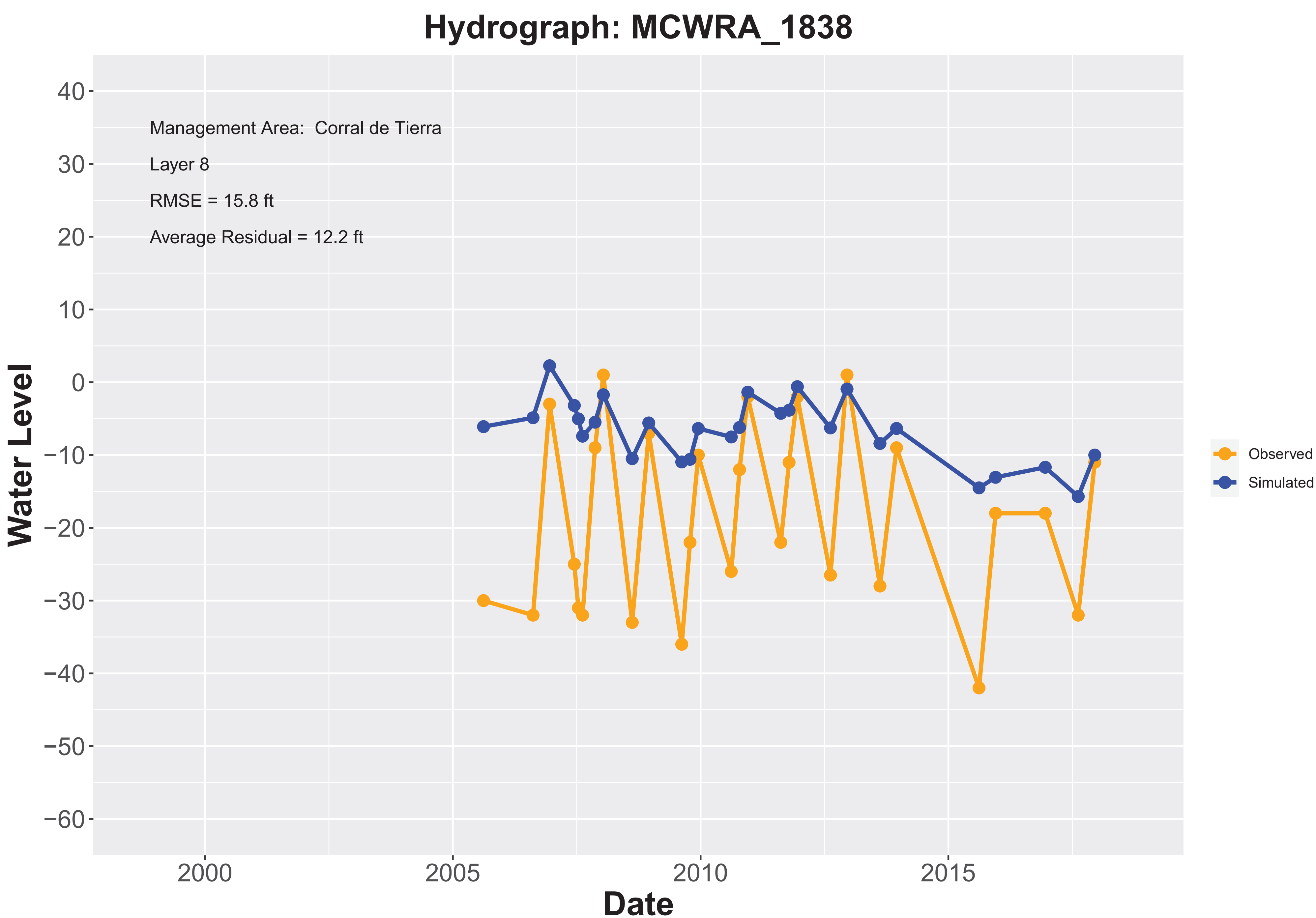
Hydrograph: MCWRA_16862
Management Area: Corral de Tierra
Layer 8
RMSE = 60.5 ft
Average Residual = 60.2 ft
Water Level
320
310
300
290
280
270
260
250
240
230
220
2000
2005
2010
2015
Date
Observed
Simulated

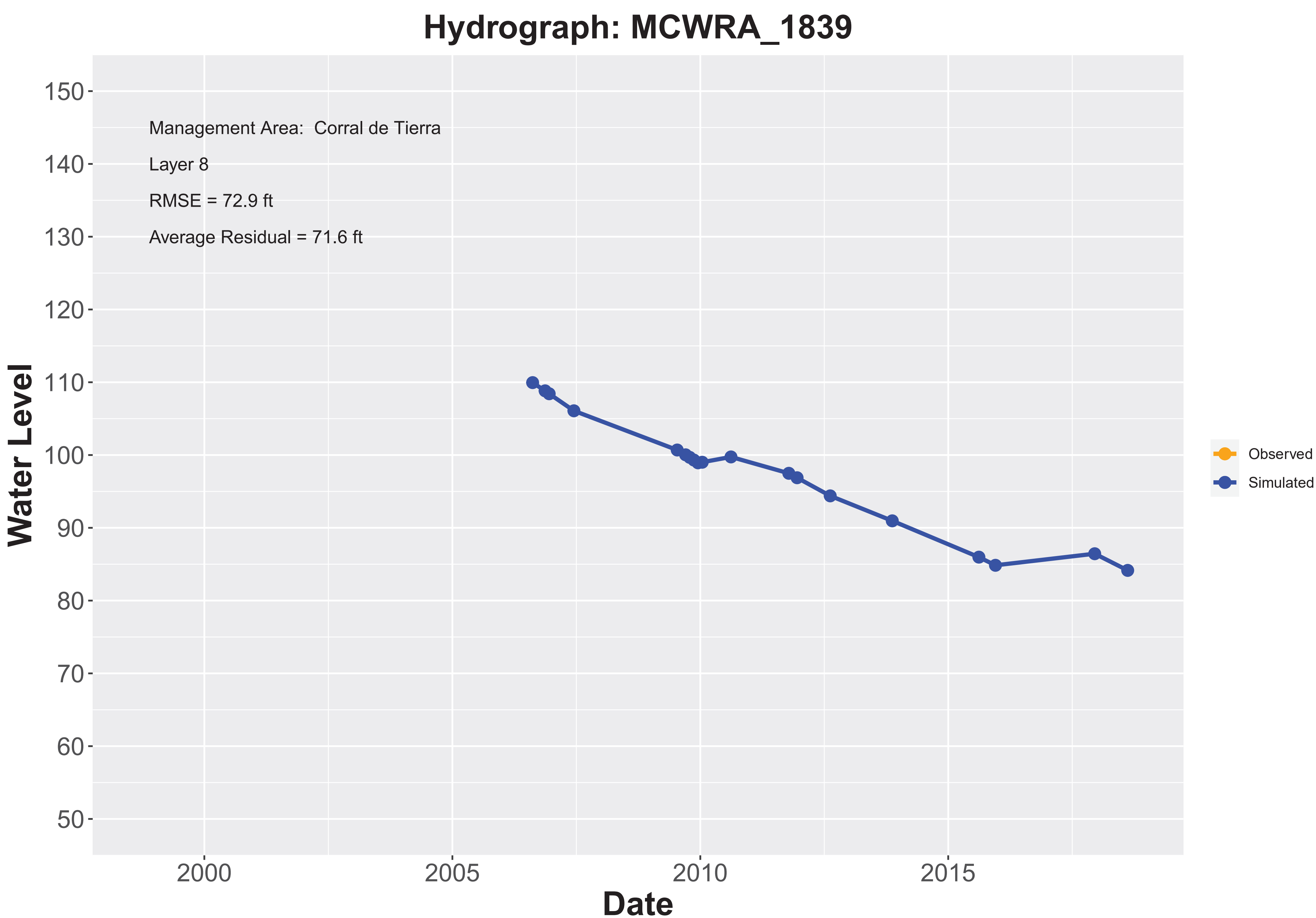

Hydrograph: MCWRA_16877
Management Area: Corral de Tierra
Layer 8
RMSE = 37.4 ft
Average Residual = 35.2 ft
Water Level
310
300
290
280
270
260
250
240
230
220
210
2000
2005
2010
2015
Date
Observed
Simulated

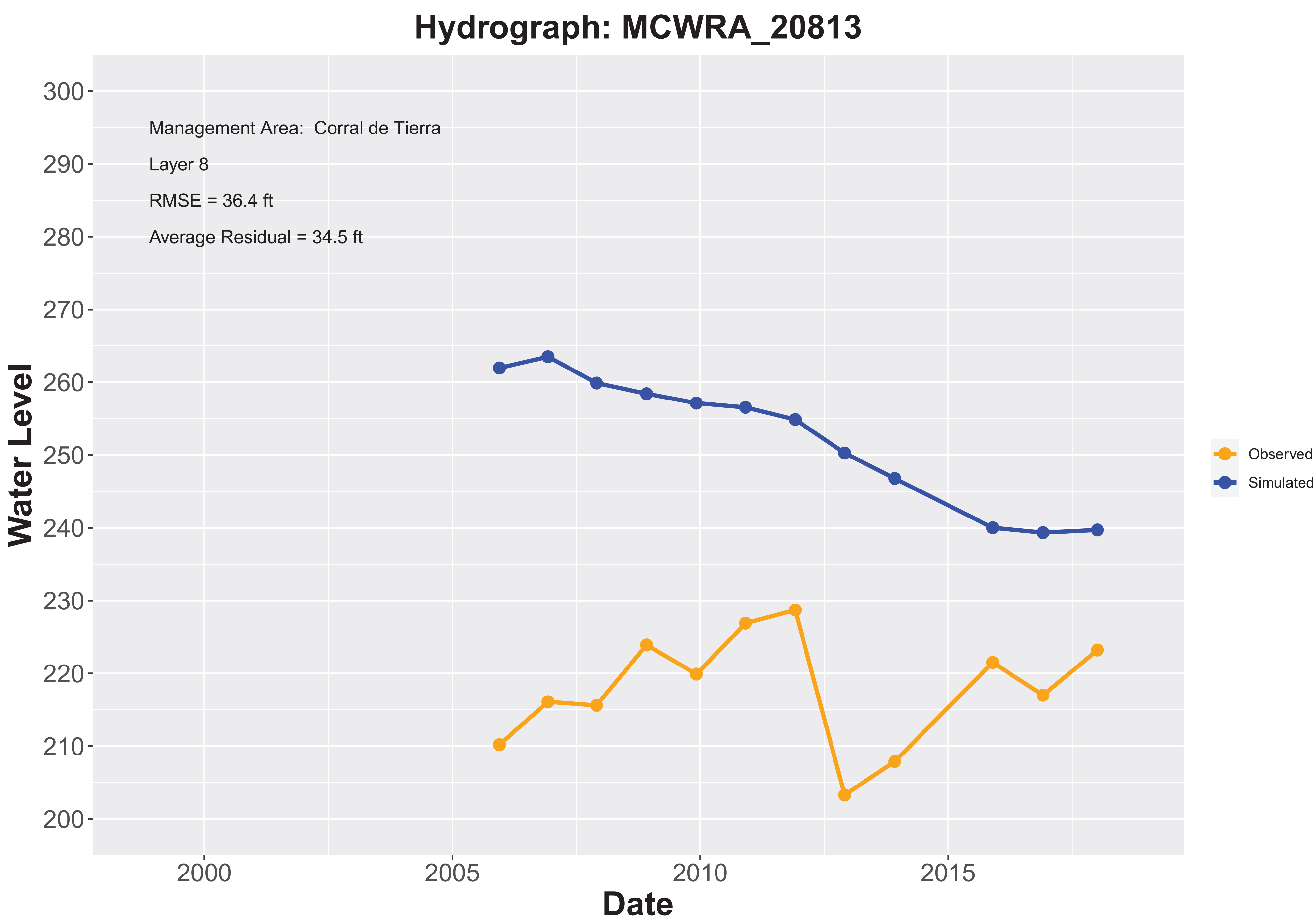


Hydrograph: MCWRA_17222
Management Area: Corral de Tierra
Layer 8
RMSE = 54.9 ft
Average Residual = −46.3 ft
Water Level
600
590
580
570
560
550
540
530
520
510
500
Date
2000
2005
2010
2015
Observed
Simulated

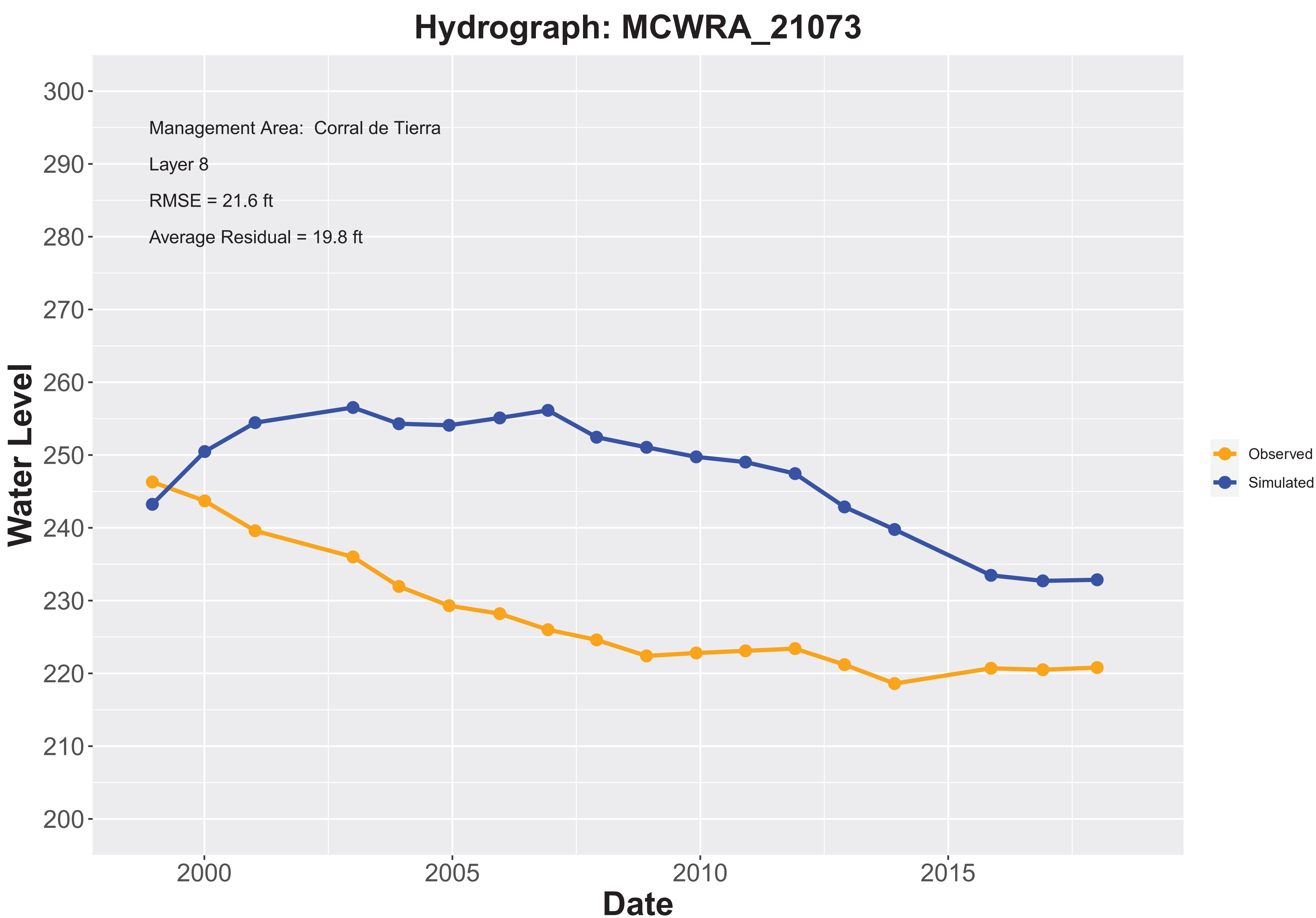

Hydrograph: MCWRA_1804
Management Area: Corral de Tierra
Layer 8
RMSE = 29.6 ft
Average Residual = 28.7 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

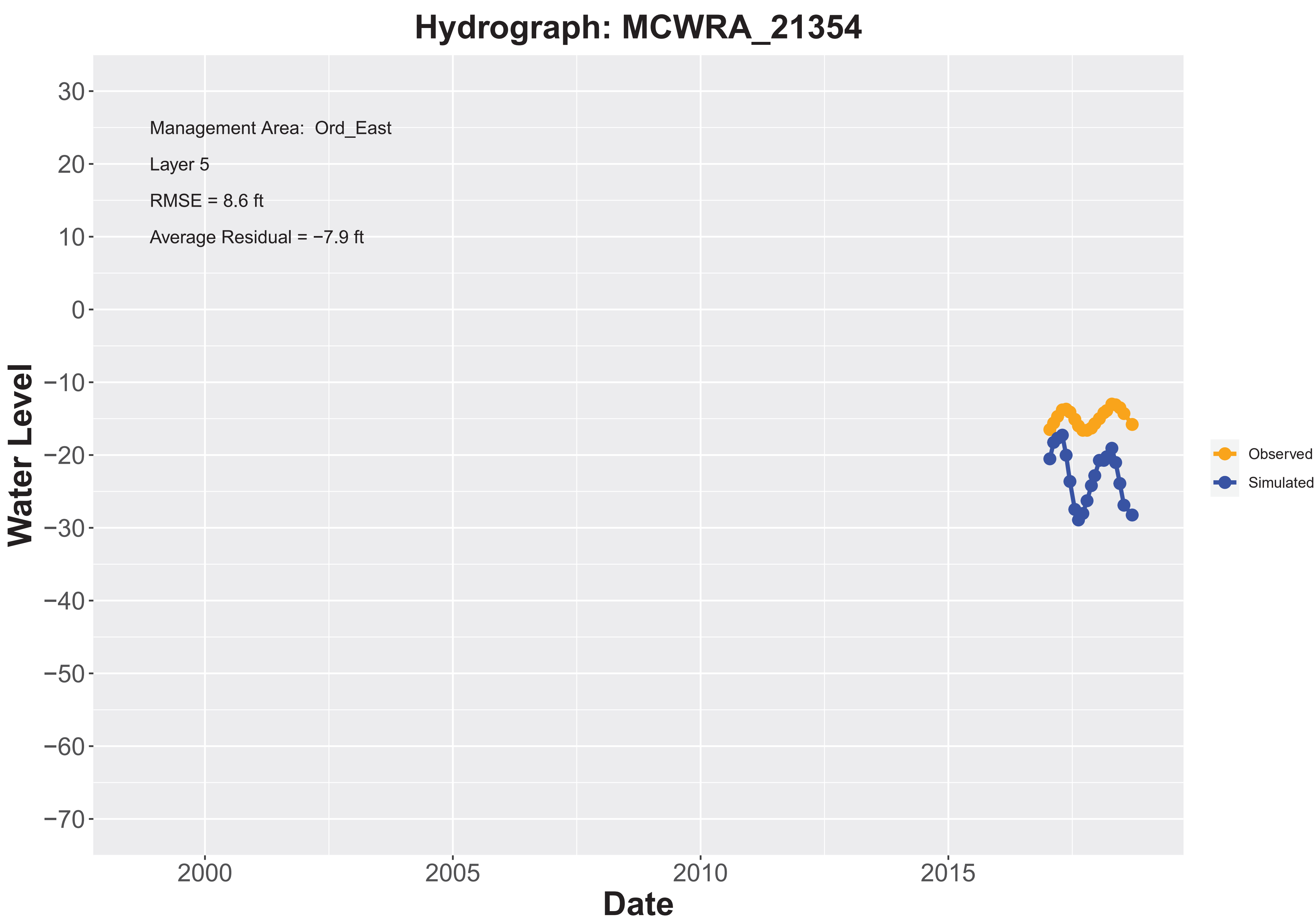

Hydrograph: MCWRA_1838
Management Area: Corral de Tierra
Layer 8
RMSE = 15.8 ft
Average Residual = 12.2 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated


Hydrograph: MCWRA_1839
Management Area: Corral de Tierra
Layer 8
RMSE = 72.9 ft
Average Residual = 71.6 ft
Water Level
150
140
130
120
110
100
90
80
70
60
50
Date
2000
2005
2010
2015
Observed
Simulated

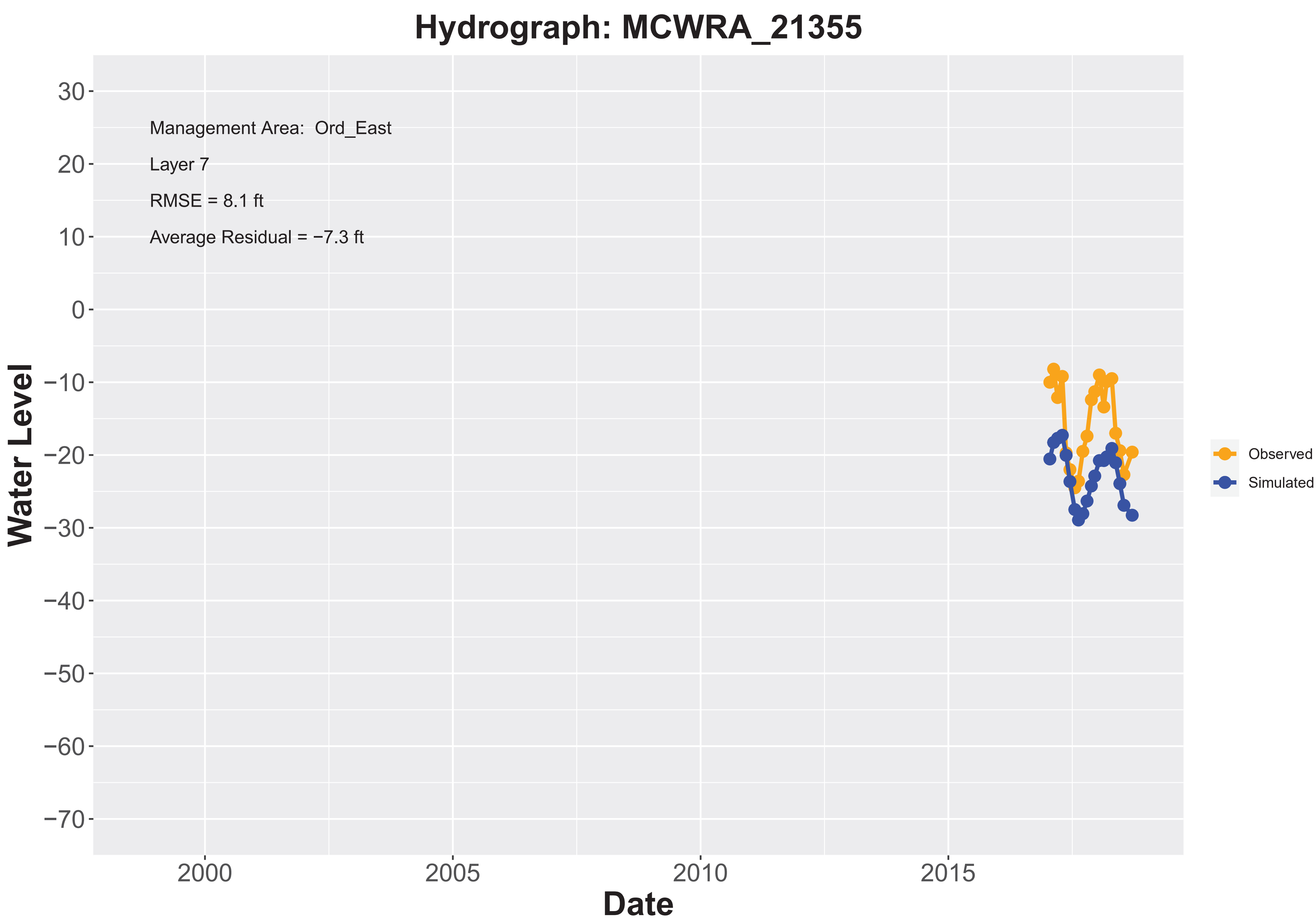


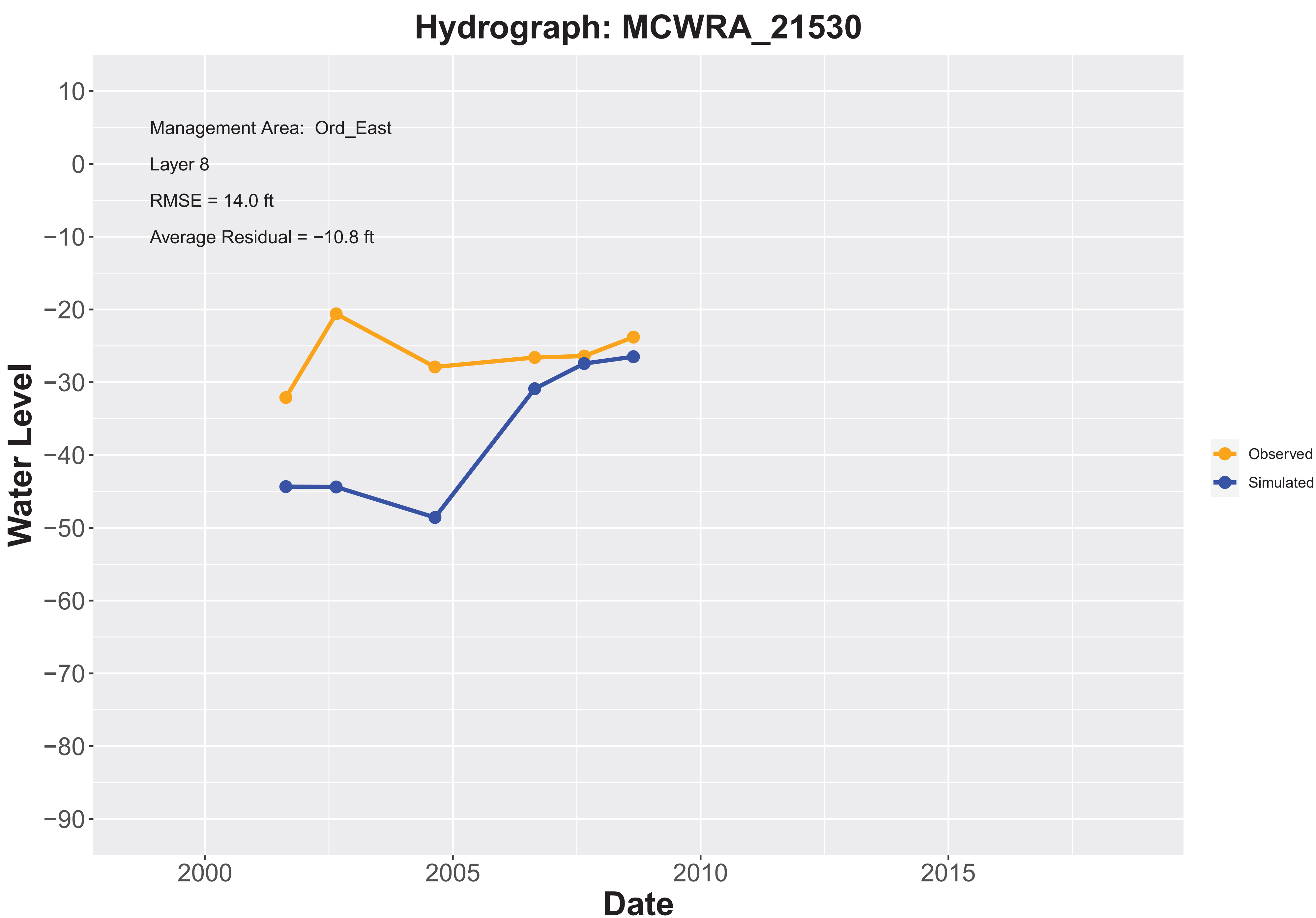
Hydrograph: MCWRA_20813
Management Area: Corral de Tierra
Layer 8
RMSE = 36.4 ft
Average Residual = 34.5 ft
Water Level
300
290
280
270
260
250
240
230
220
210
200
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MCWRA_21073
Management Area: Corral de Tierra
Layer 8
RMSE = 21.6 ft
Average Residual = 19.8 ft
Water Level
300
290
280
270
260
250
240
230
220
210
200
2000
2005
2010
2015
Date
Observed
Simulated

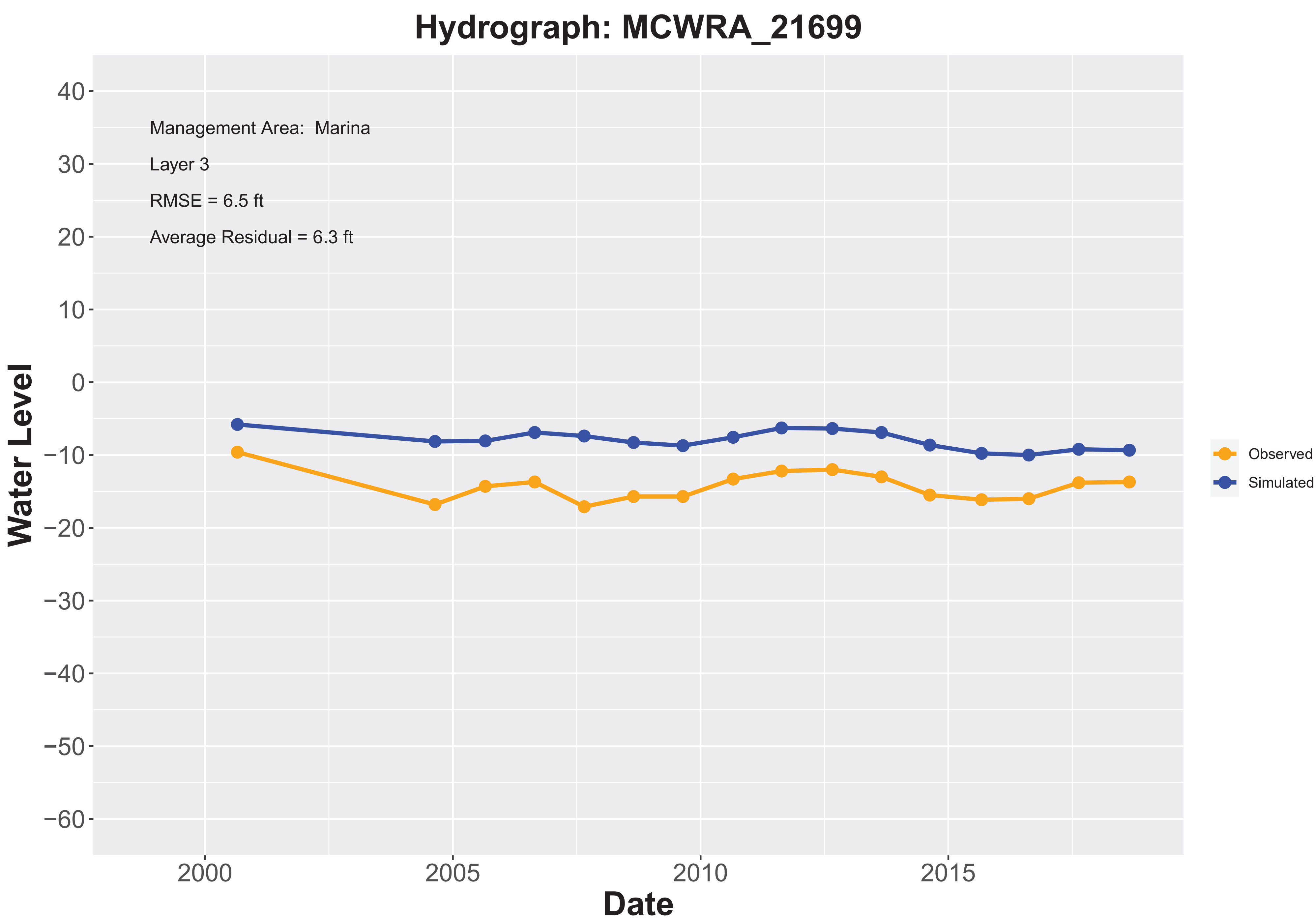


Hydrograph: MCWRA_21354
Management Area: Ord_East
Layer 5
RMSE = 8.6 ft
Average Residual = −7.9 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

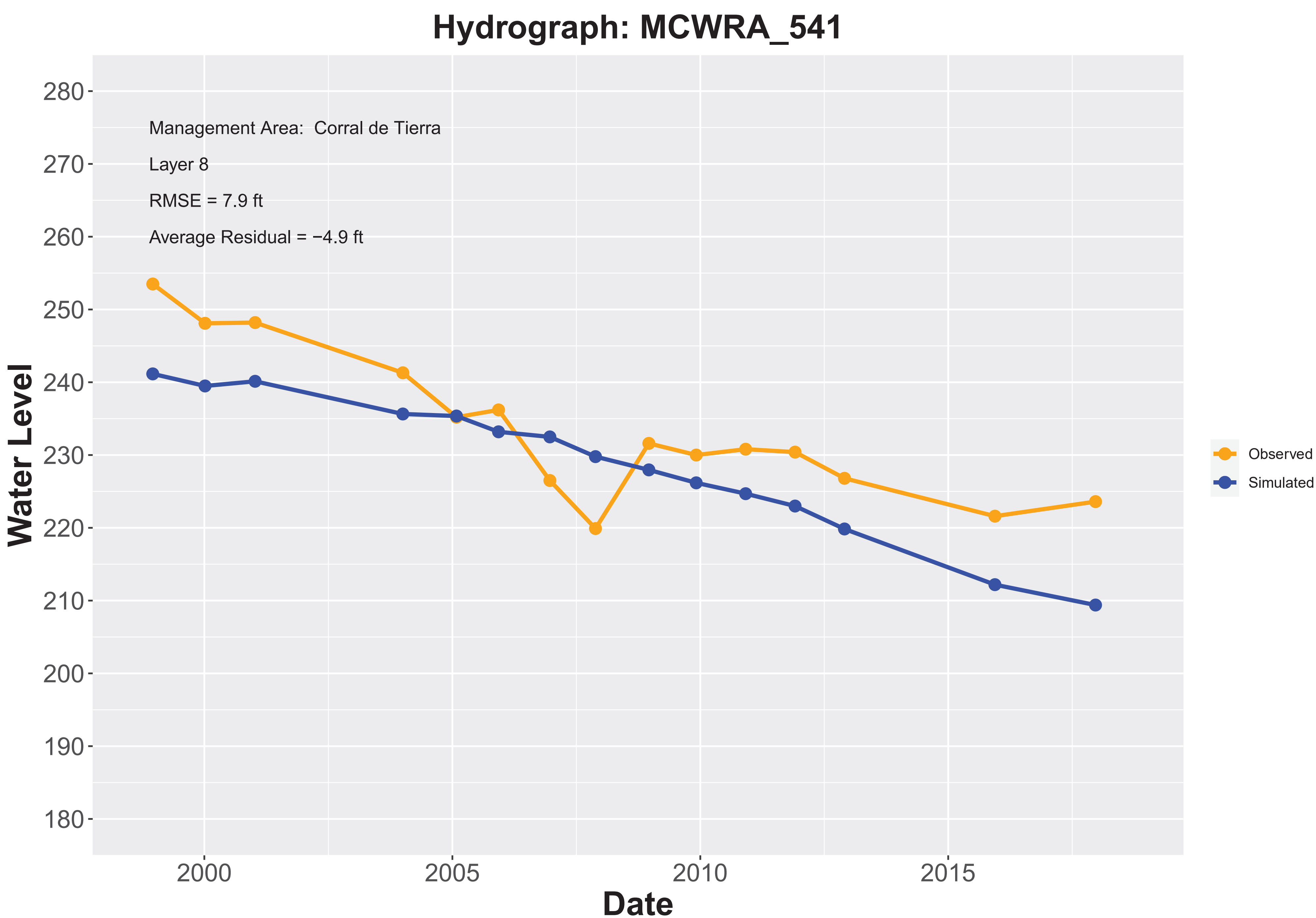

Hydrograph: MCWRA_21355
Management Area: Ord_East
Layer 7
RMSE = 8.1 ft
Average Residual = −7.3 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

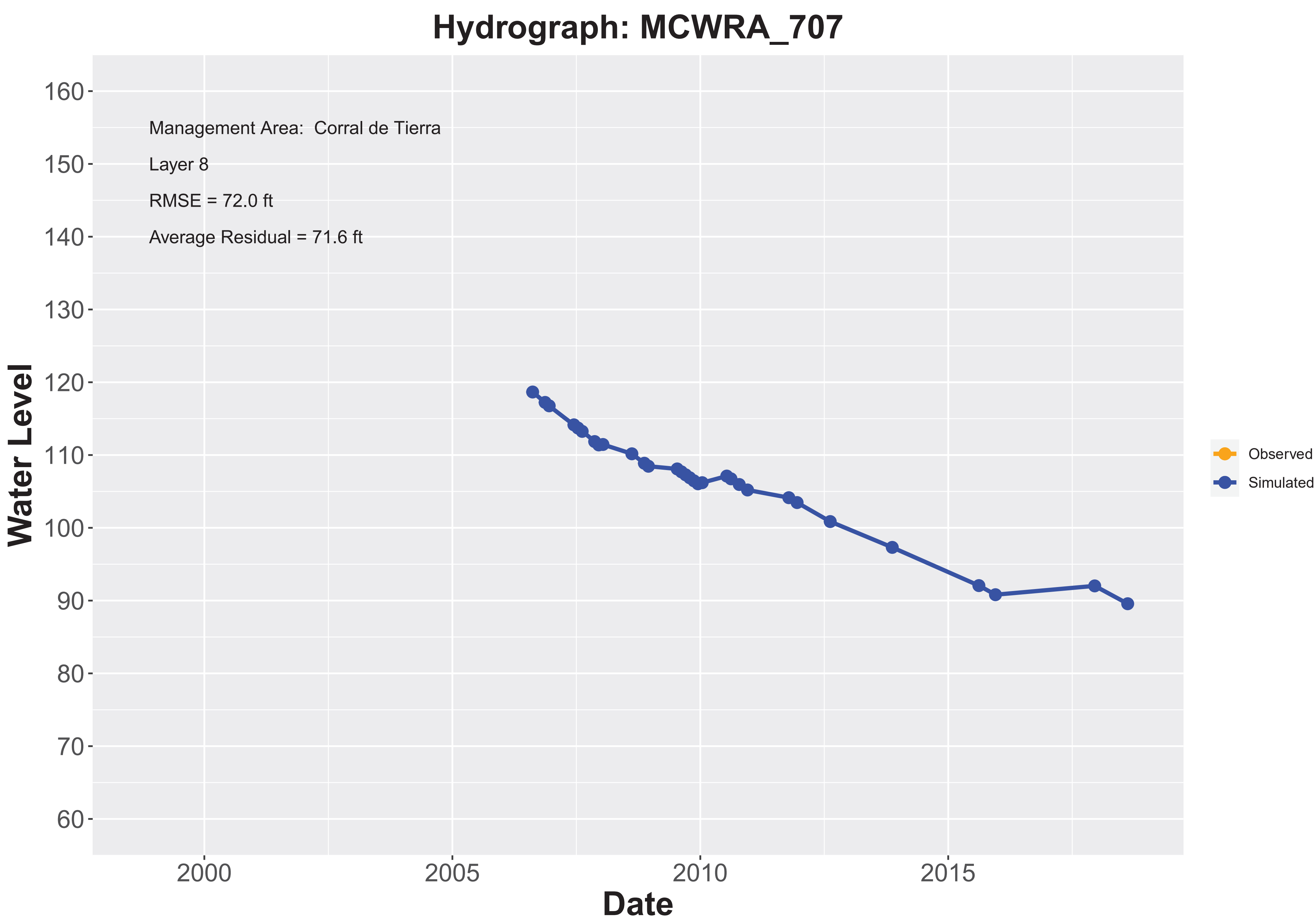


Hydrograph: MCWRA_21530
Management Area: Ord_East
Layer 8
RMSE = 14.0 ft
Average Residual = −10.8 ft
Water Level
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
2000
2005
2010
2015
Date
Observed
Simulated

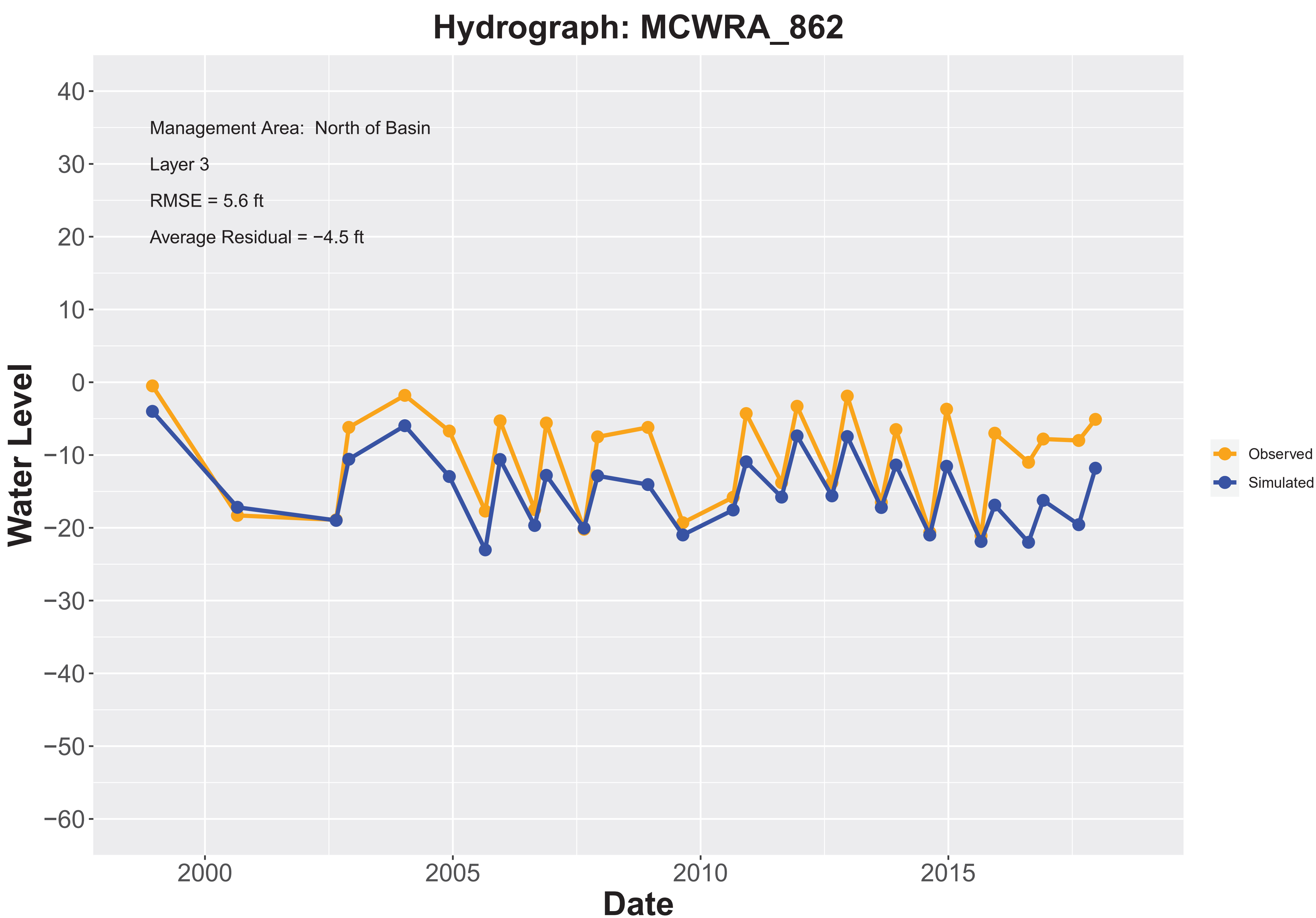


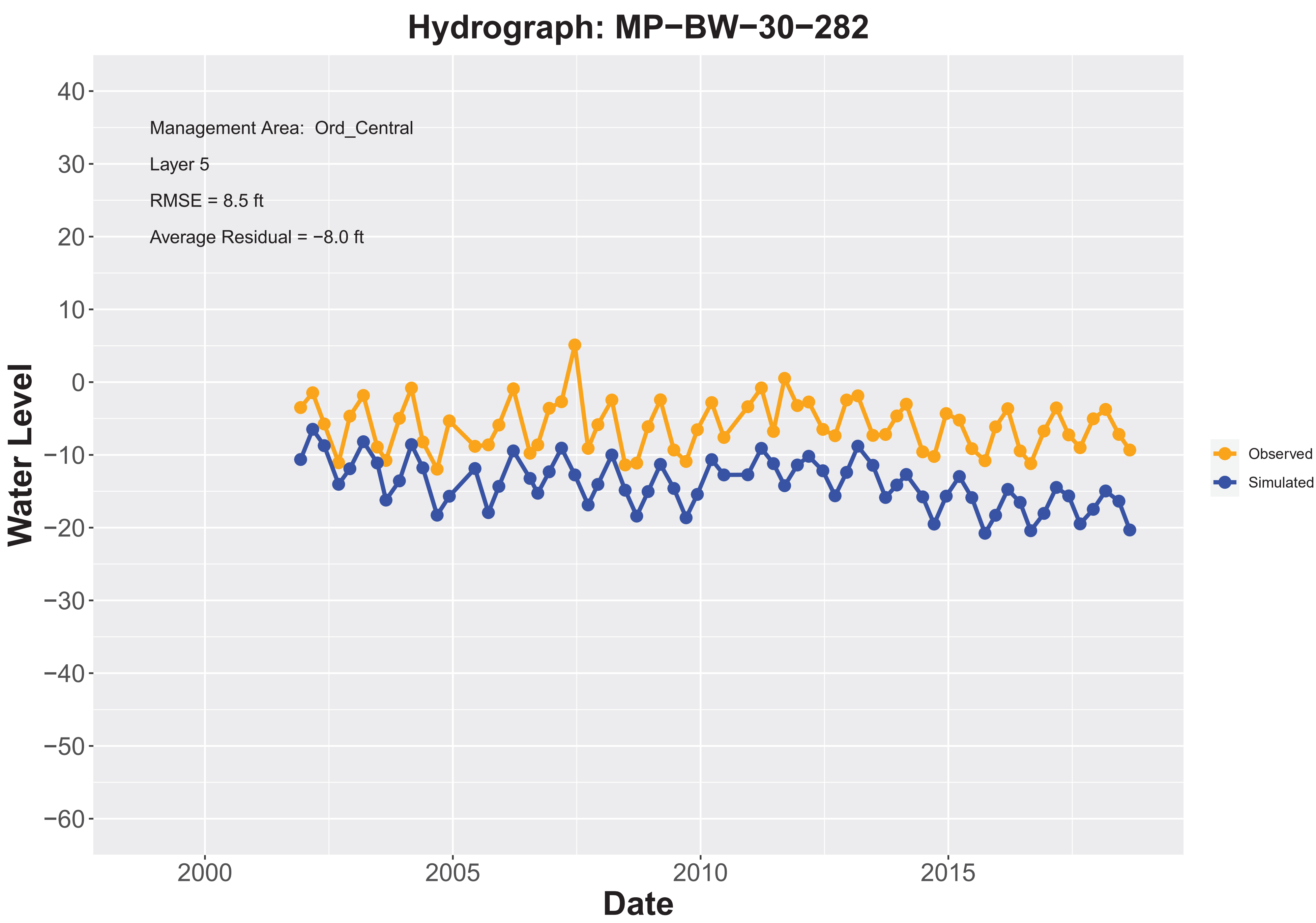
Hydrograph: MCWRA_21699
Management Area: Marina
Layer 3
RMSE = 6.5 ft
Average Residual = 6.3 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MCWRA_541
Management Area: Corral de Tierra
Layer 8
RMSE = 7.9 ft
Average Residual = −4.9 ft
Water Level
280
270
260
250
240
230
220
210
200
190
180
2000
2005
2010
2015
Date
Observed
Simulated

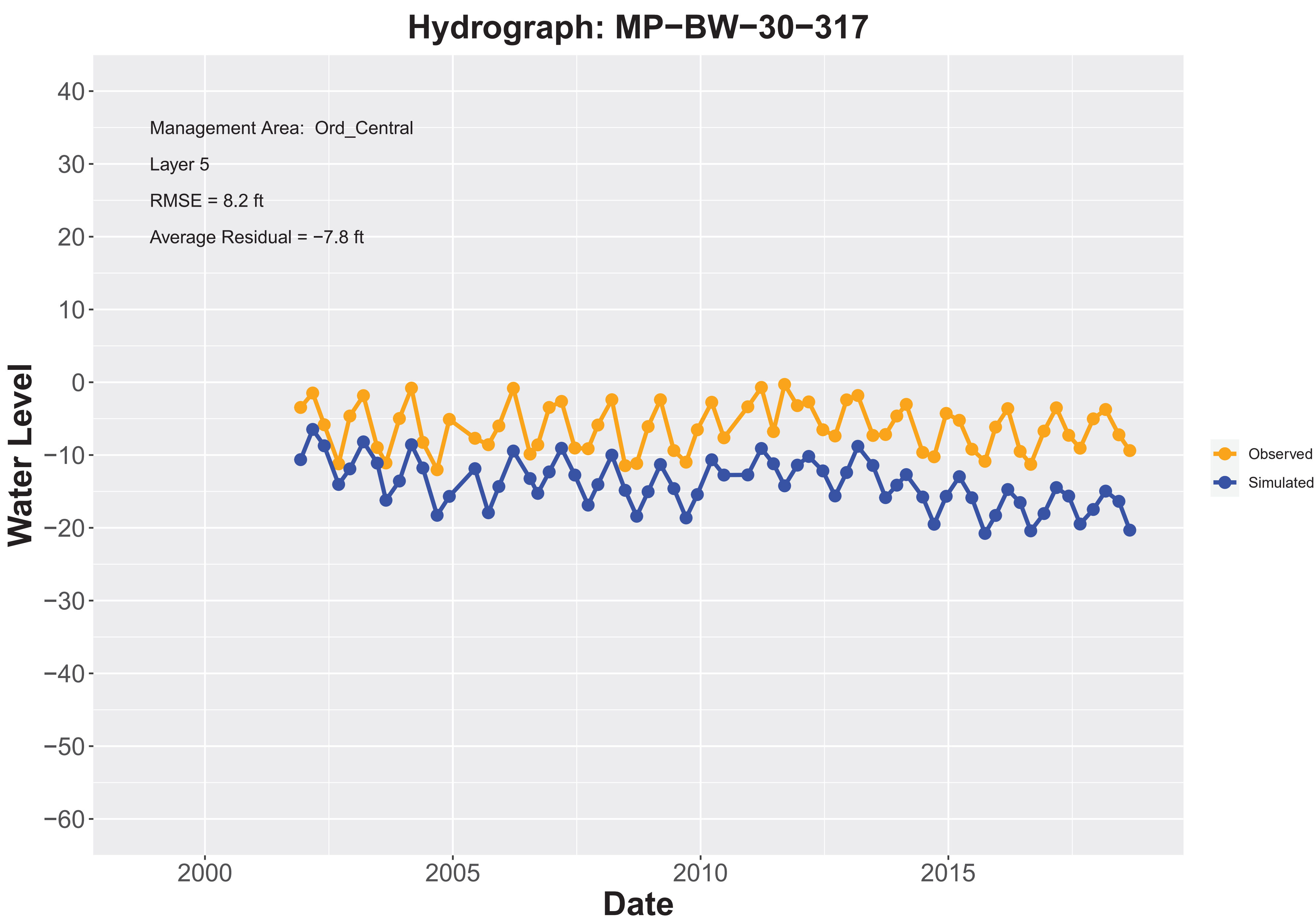


Hydrograph: MCWRA_707
Management Area: Corral de Tierra
Layer 8
RMSE = 72.0 ft
Average Residual = 71.6 ft
Water Level
160
150
140
130
120
110
100
90
80
70
60
2000
2005
2010
2015
Date
Observed
Simulated

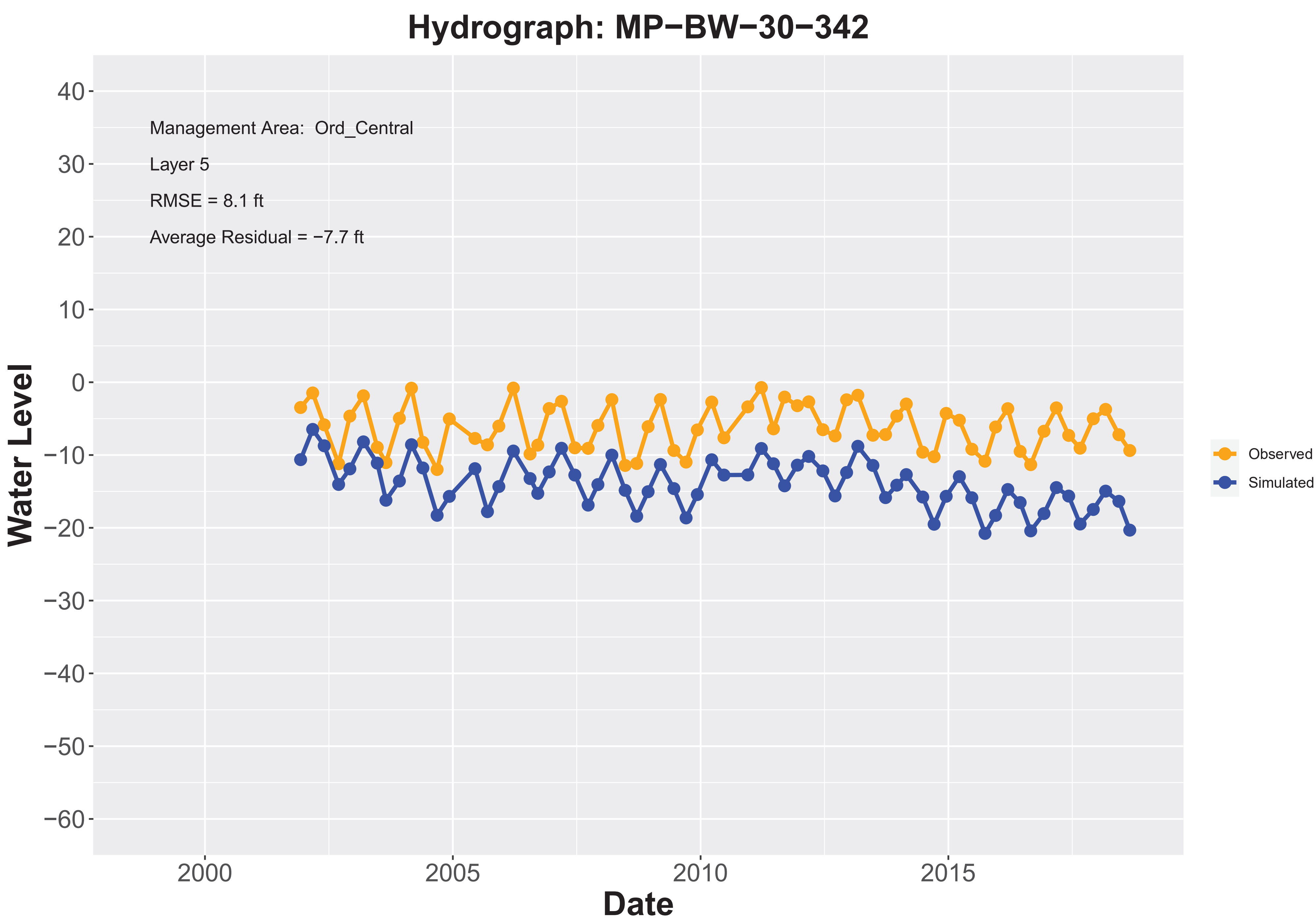

Hydrograph: MCWRA_862
Management Area: North of Basin
Layer 3
RMSE = 5.6 ft
Average Residual = −4.5 ft
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Water Level
2000
2005
2010
2015
Date
Observed
Simulated



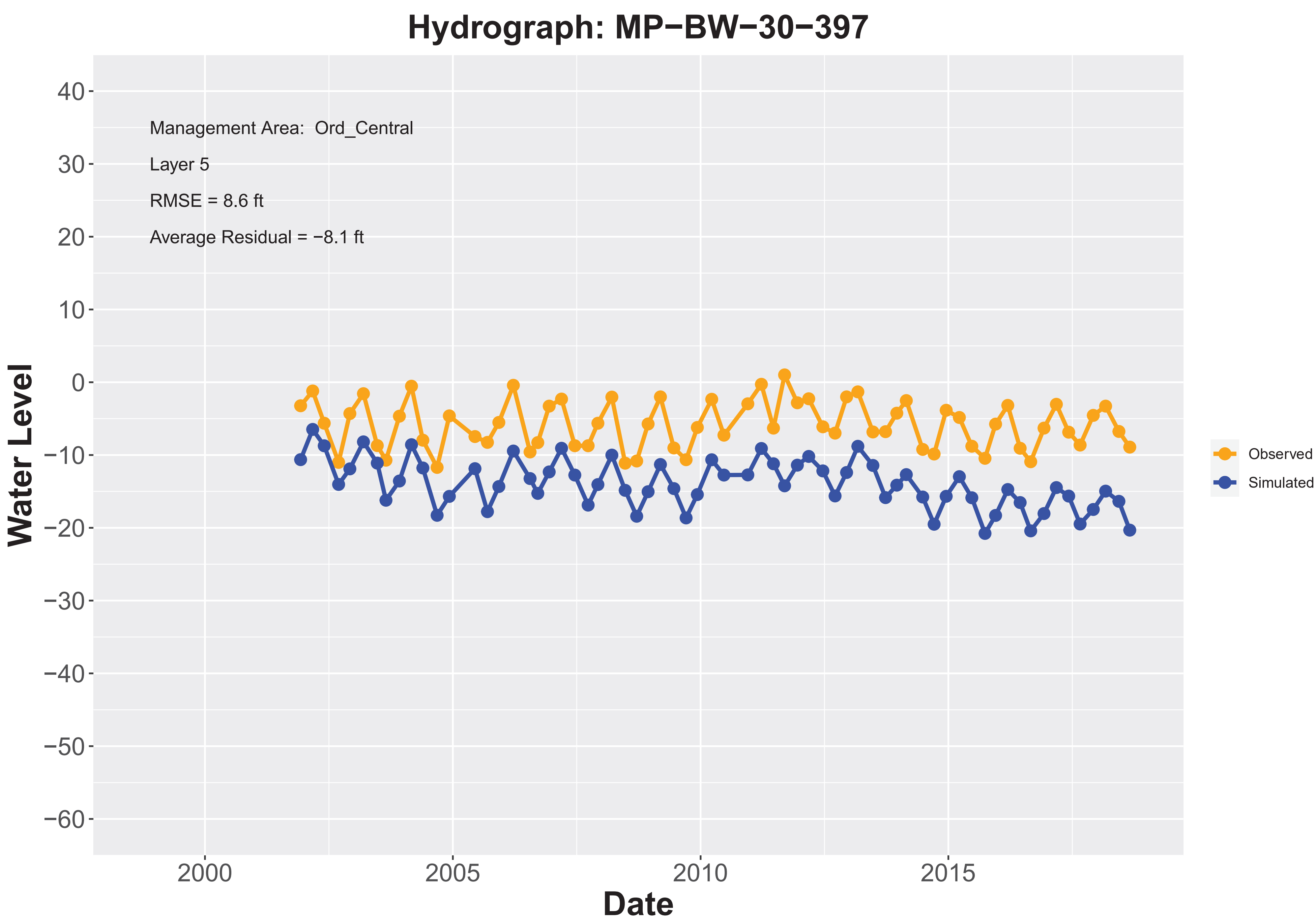
Hydrograph: MP−BW−30−282
Management Area: Ord_Central
Layer 5
RMSE = 8.5 ft
Average Residual = −8.0 ft
Water Level
Date
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Observed
Simulated

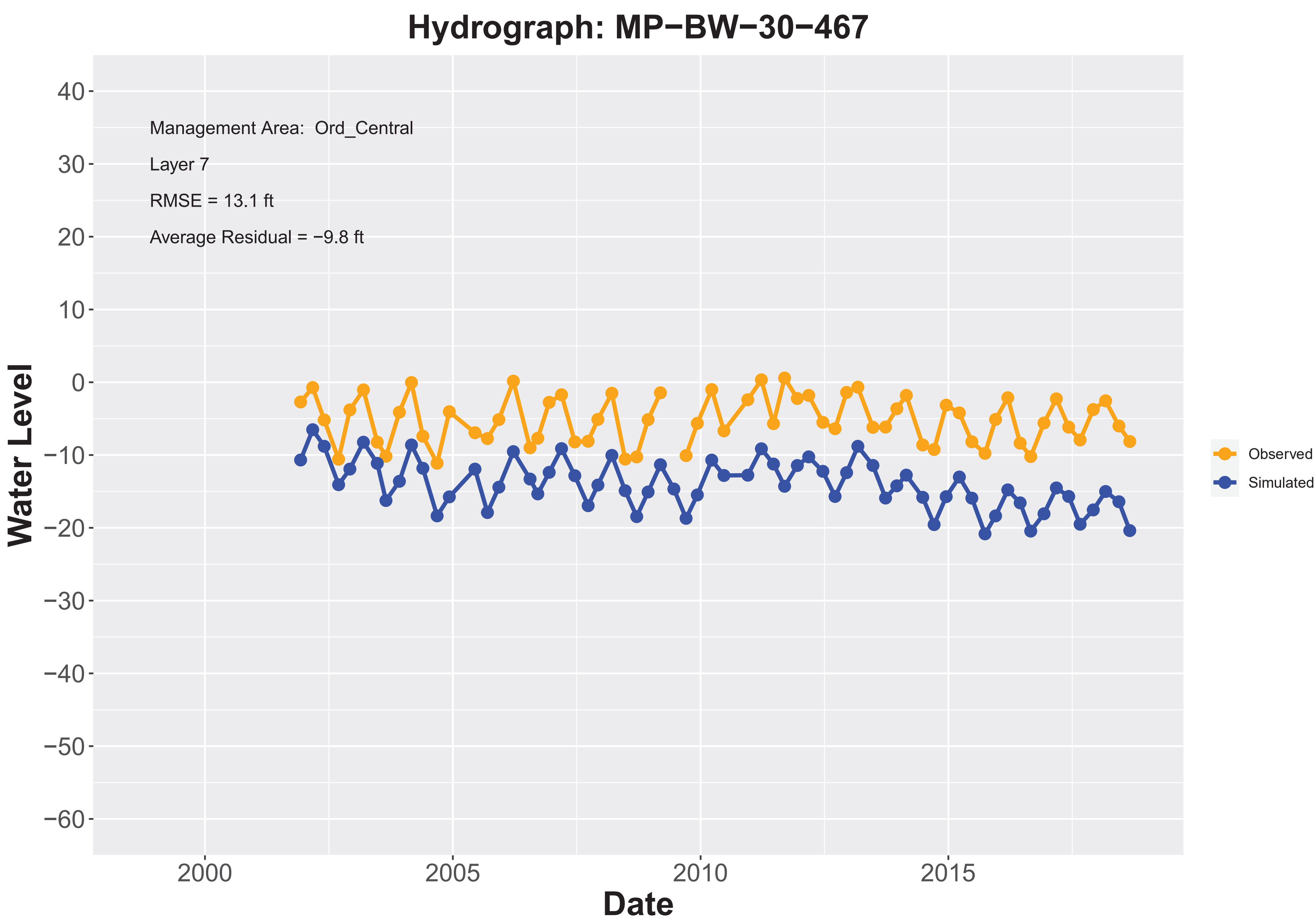


Hydrograph: MP−BW−30−317
Management Area: Ord_Central
Layer 5
RMSE = 8.2 ft
Average Residual = −7.8 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

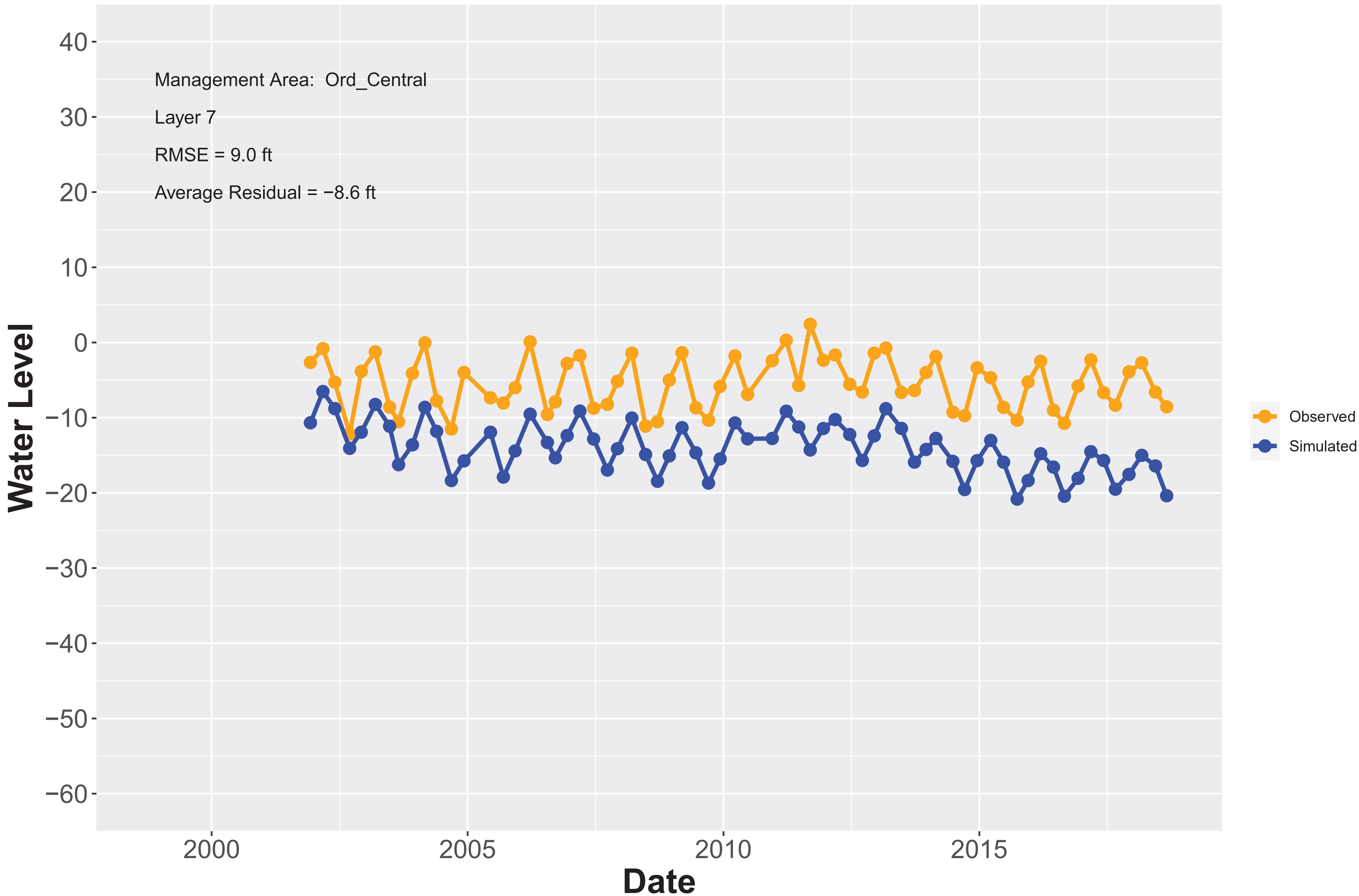


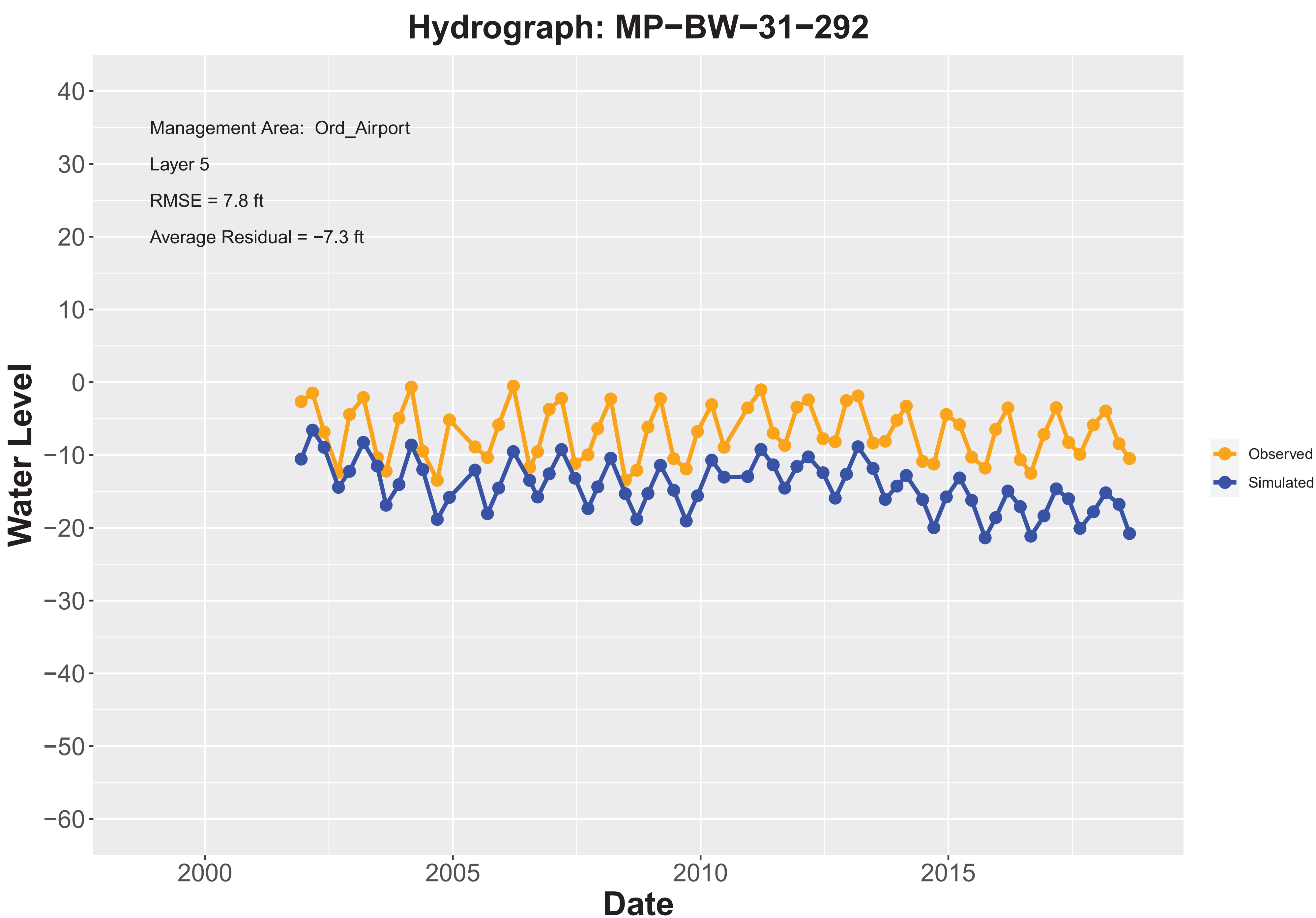
Hydrograph: MP−BW−30−342
Management Area: Ord_Central
Layer 5
RMSE = 8.1 ft
Average Residual = −7.7 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

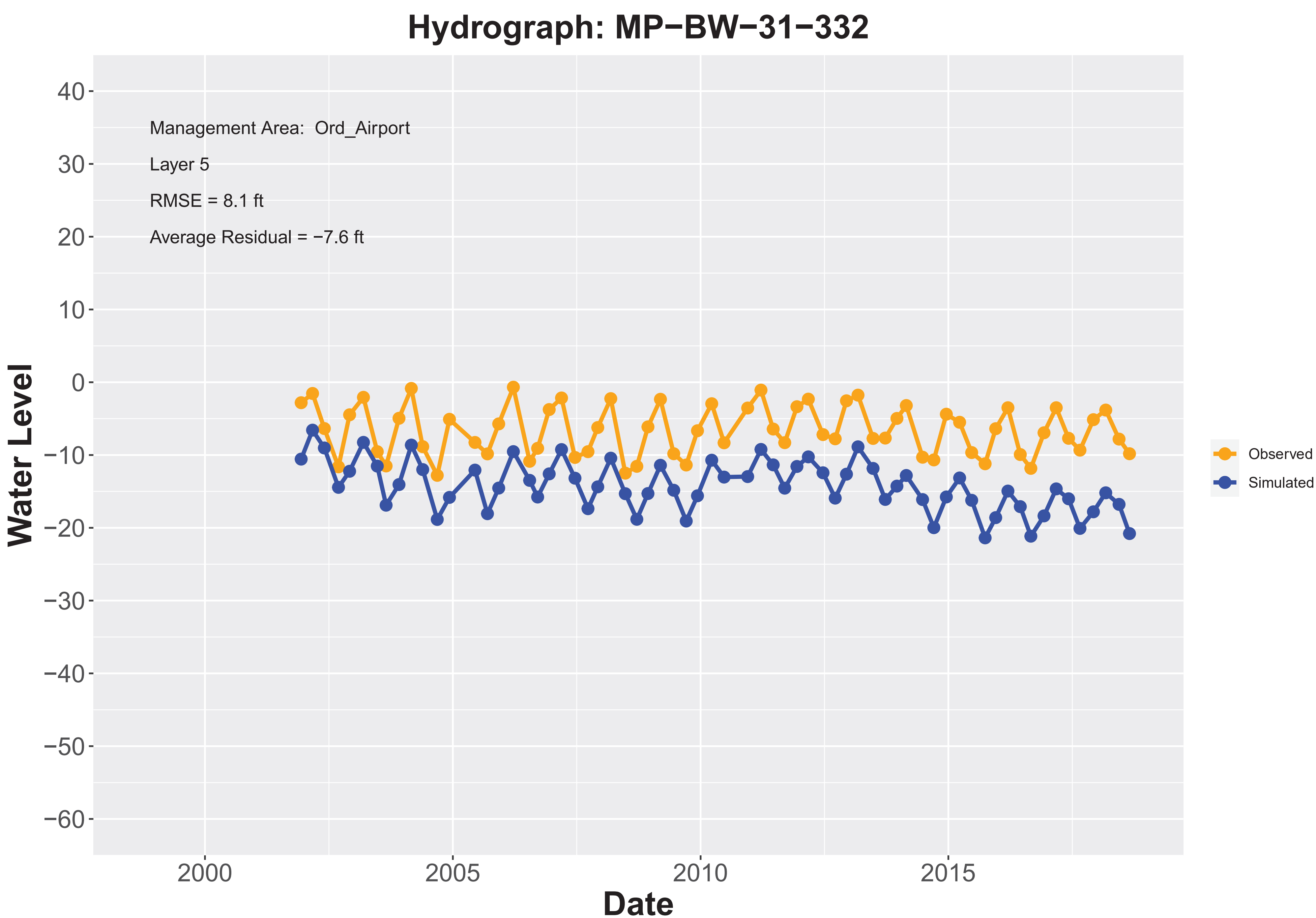

Hydrograph: MP−BW−30−397
Management Area: Ord_Central
Layer 5
RMSE = 8.6 ft
Average Residual = −8.1 ft
Water Level
Date
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Observed
Simulated

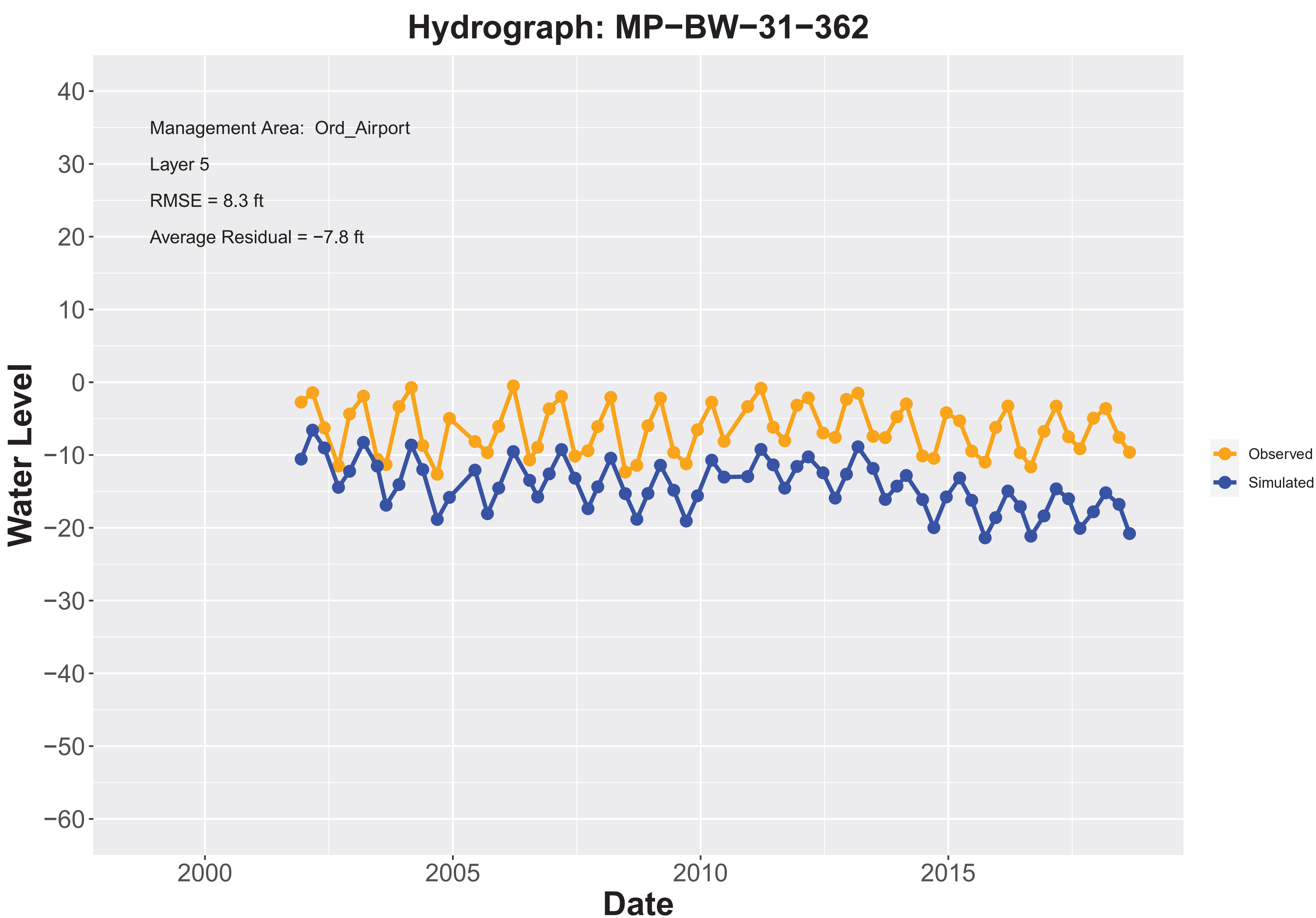

Hydrograph: MP−BW−30−467
Management Area: Ord_Central
Layer 7
RMSE = 13.1 ft
Average Residual = −9.8 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MP−BW−30−537

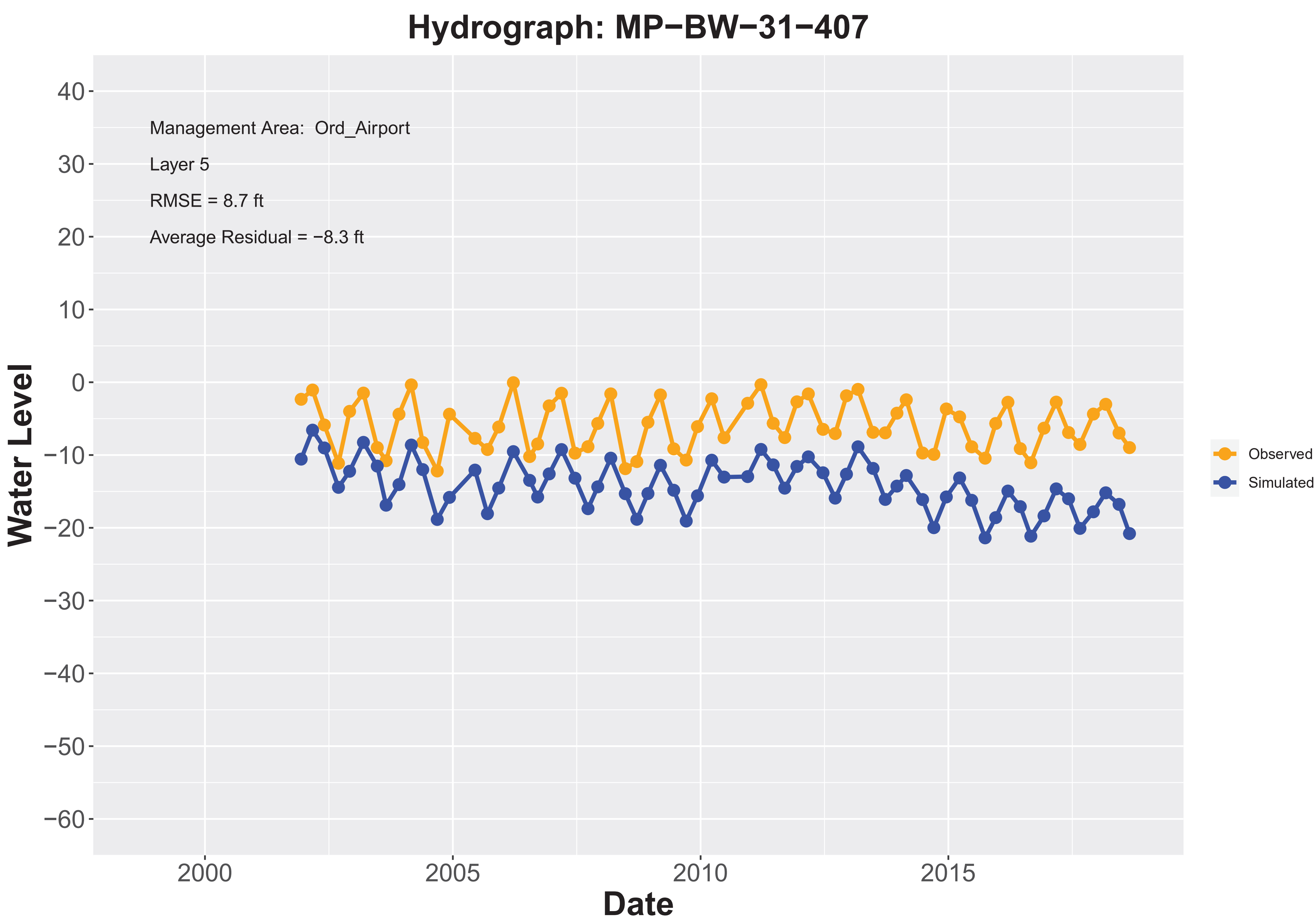


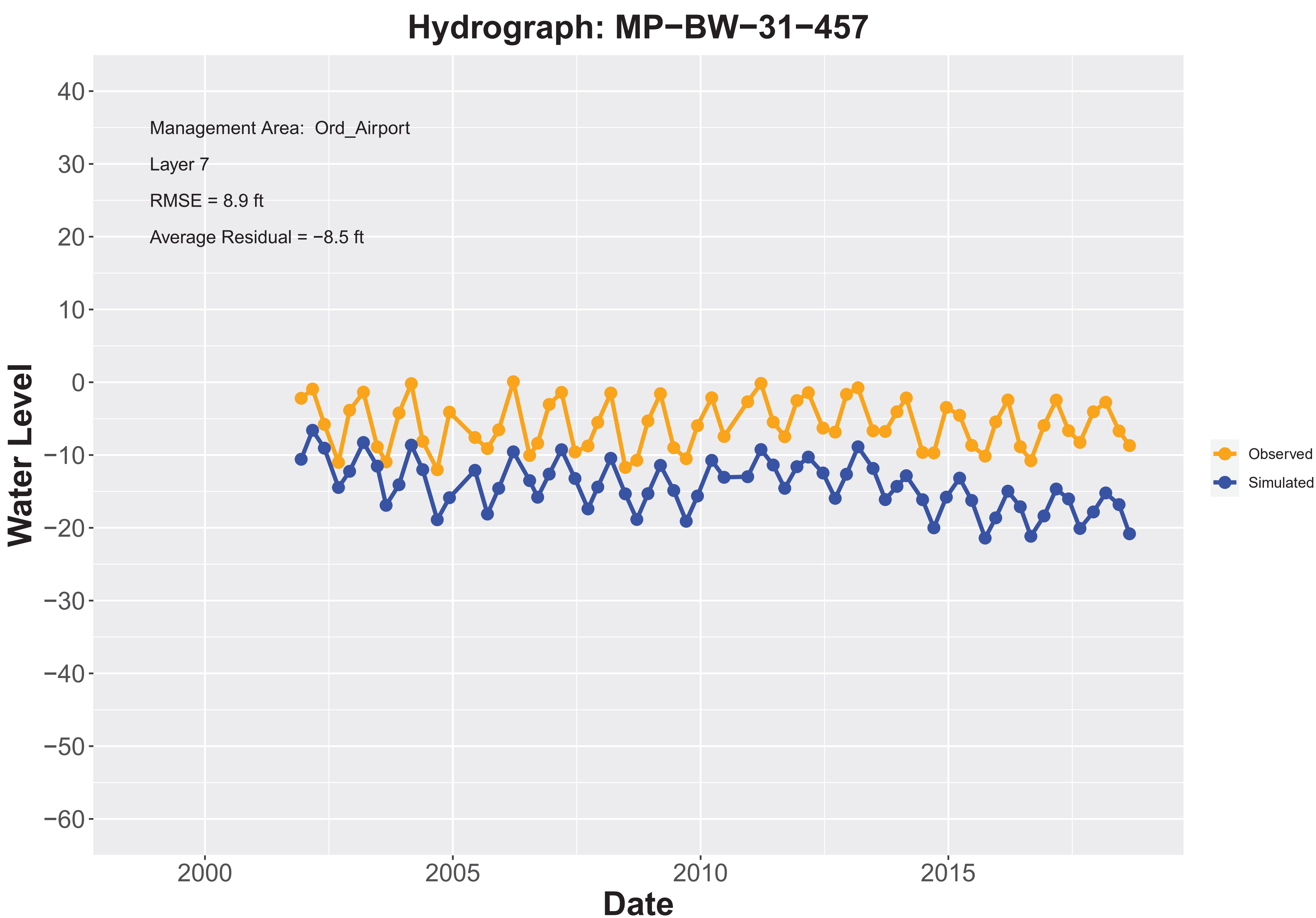

Hydrograph: MP−BW−31−292
Management Area: Ord_Airport
Layer 5
RMSE = 7.8 ft
Average Residual = −7.3 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MP−BW−31−332
Management Area: Ord_Airport
Layer 5
RMSE = 8.1 ft
Average Residual = −7.6 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

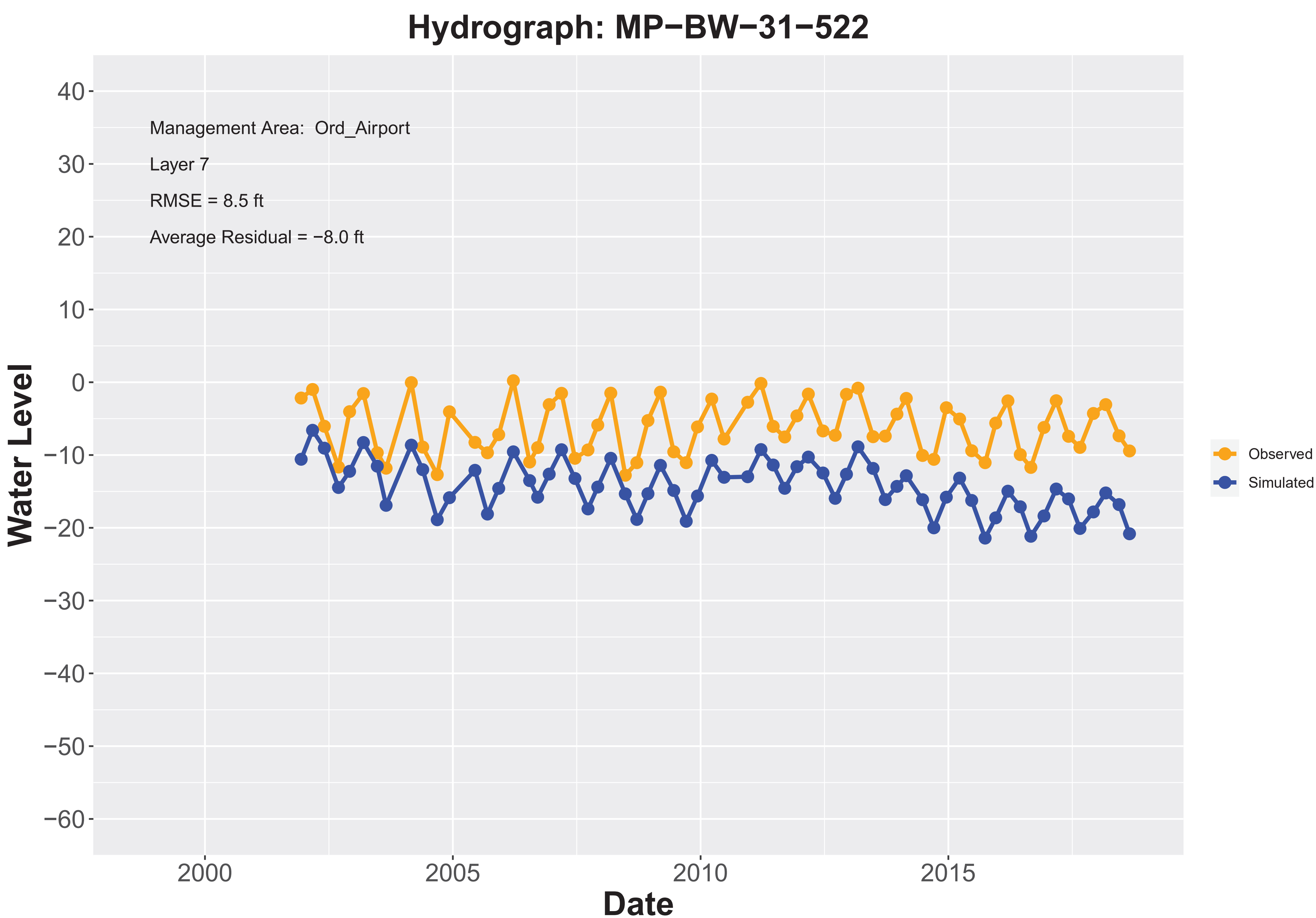


Hydrograph: MP−BW−31−362
Management Area: Ord_Airport
Layer 5
RMSE = 8.3 ft
Average Residual = −7.8 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

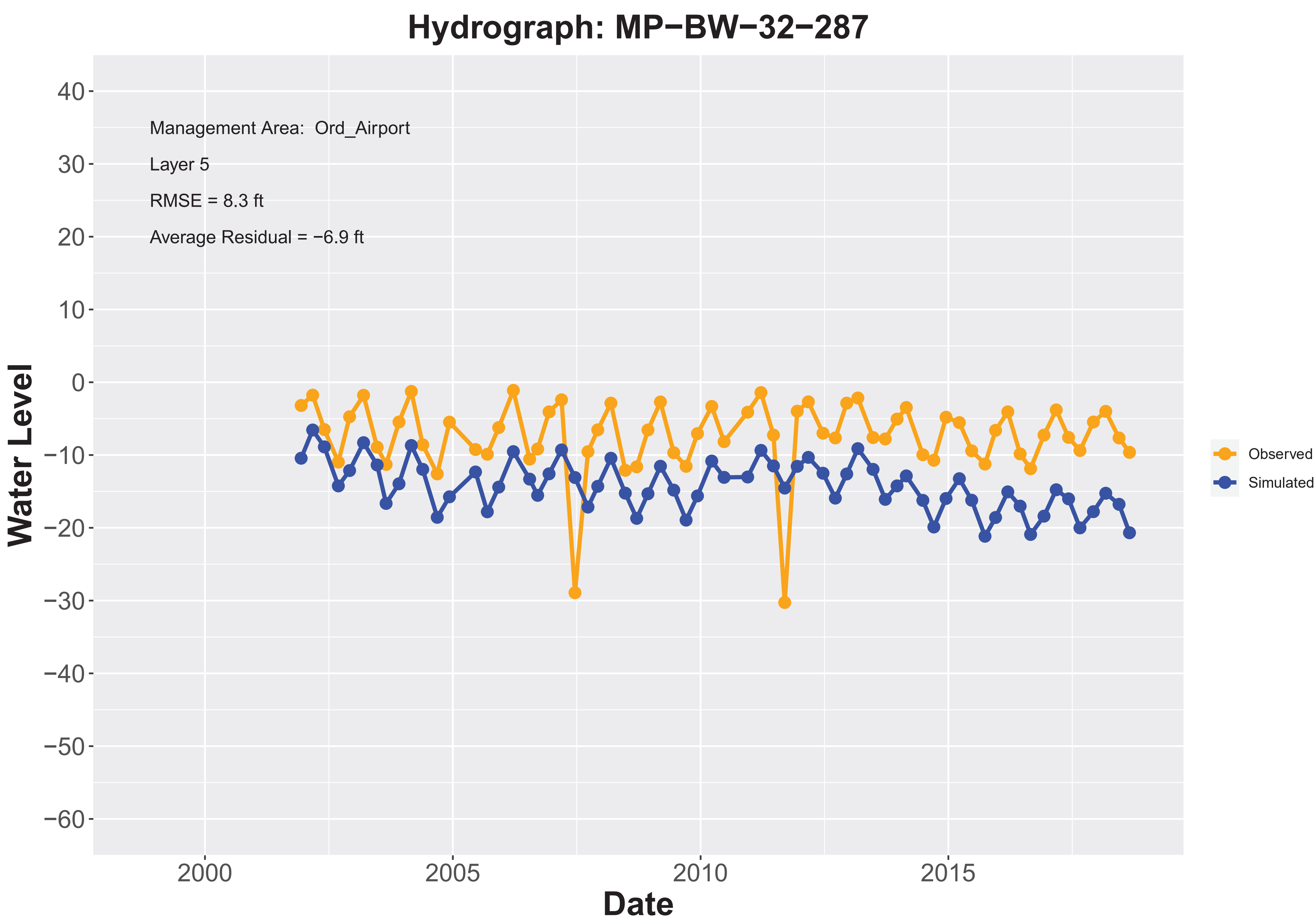

Hydrograph: MP−BW−31−407
Management Area: Ord_Airport
Layer 5
RMSE = 8.7 ft
Average Residual = −8.3 ft
Water Level
Date
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Observed
Simulated



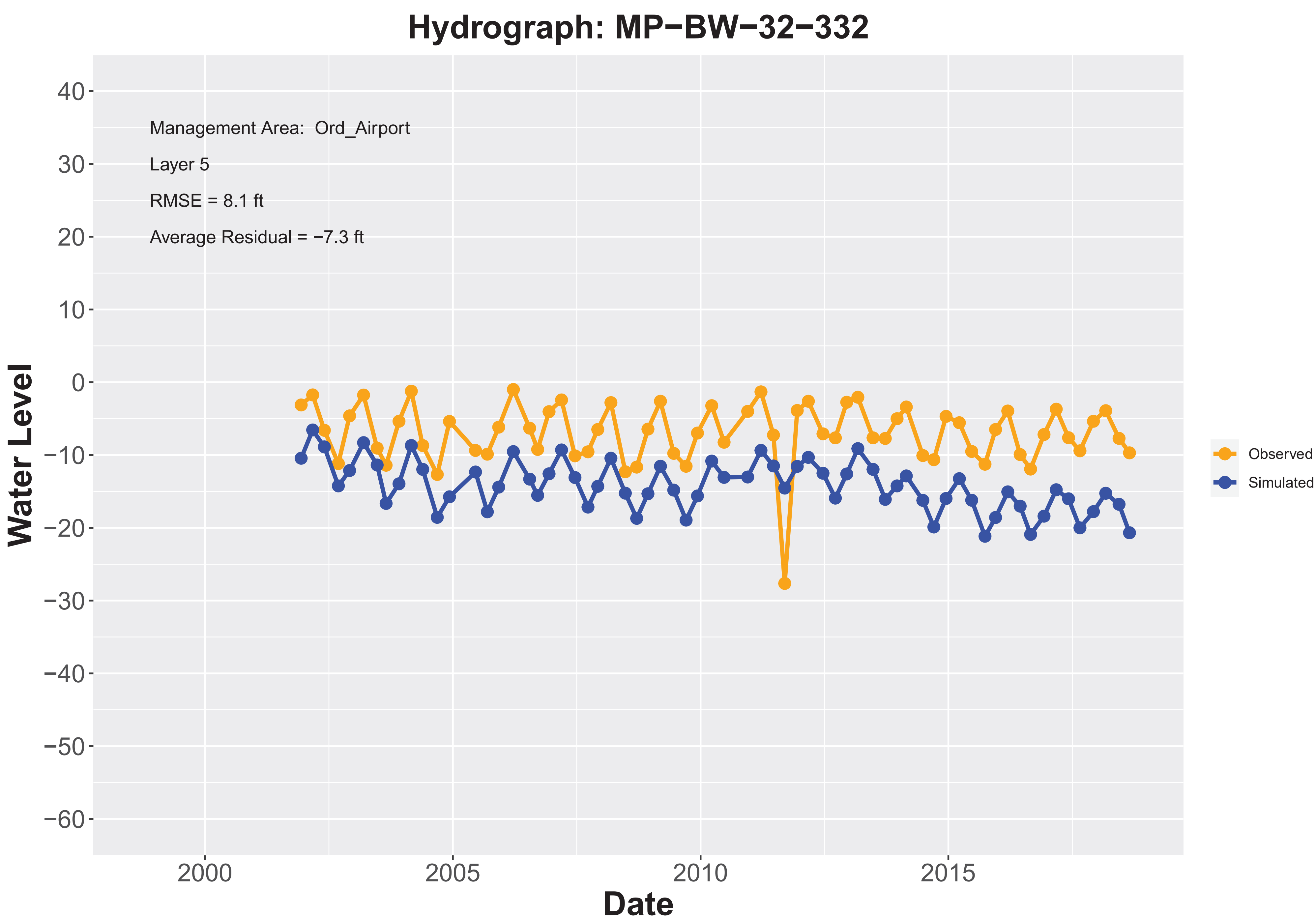
Hydrograph: MP−BW−31−457
Management Area: Ord_Airport
Layer 7
RMSE = 8.9 ft
Average Residual = −8.5 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated



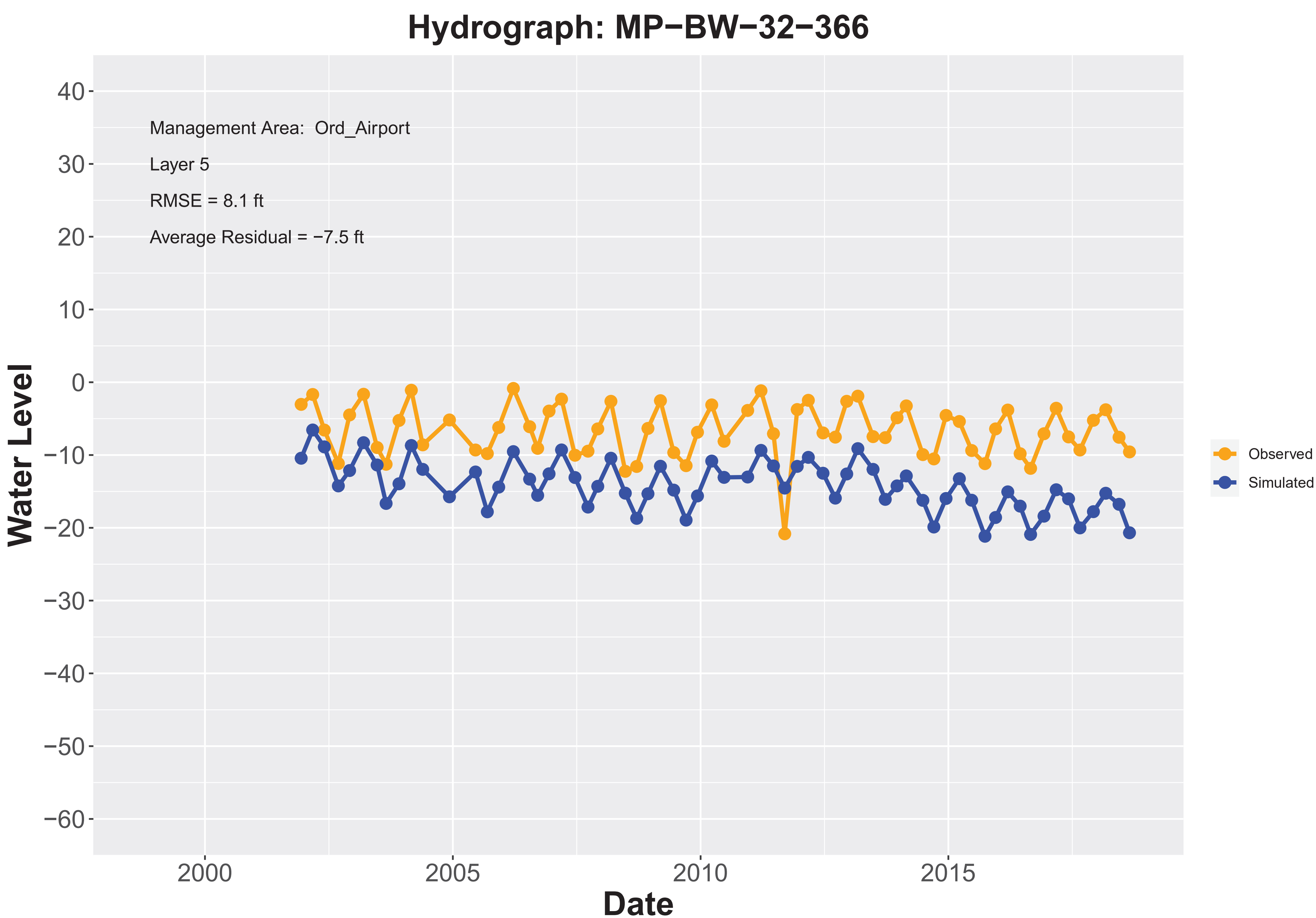
Hydrograph: MP−BW−31−522
Management Area: Ord_Airport
Layer 7
RMSE = 8.5 ft
Average Residual = −8.0 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

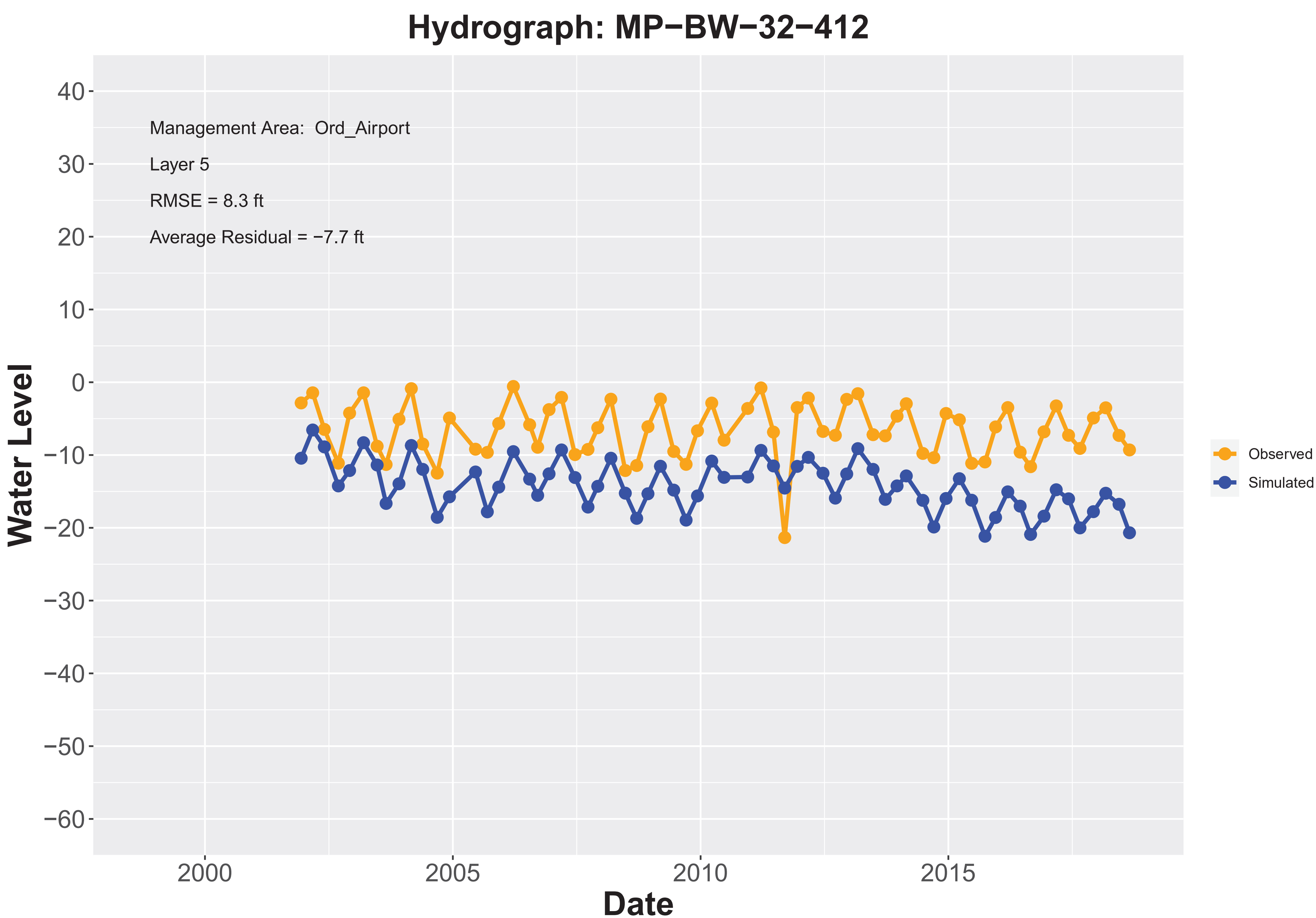


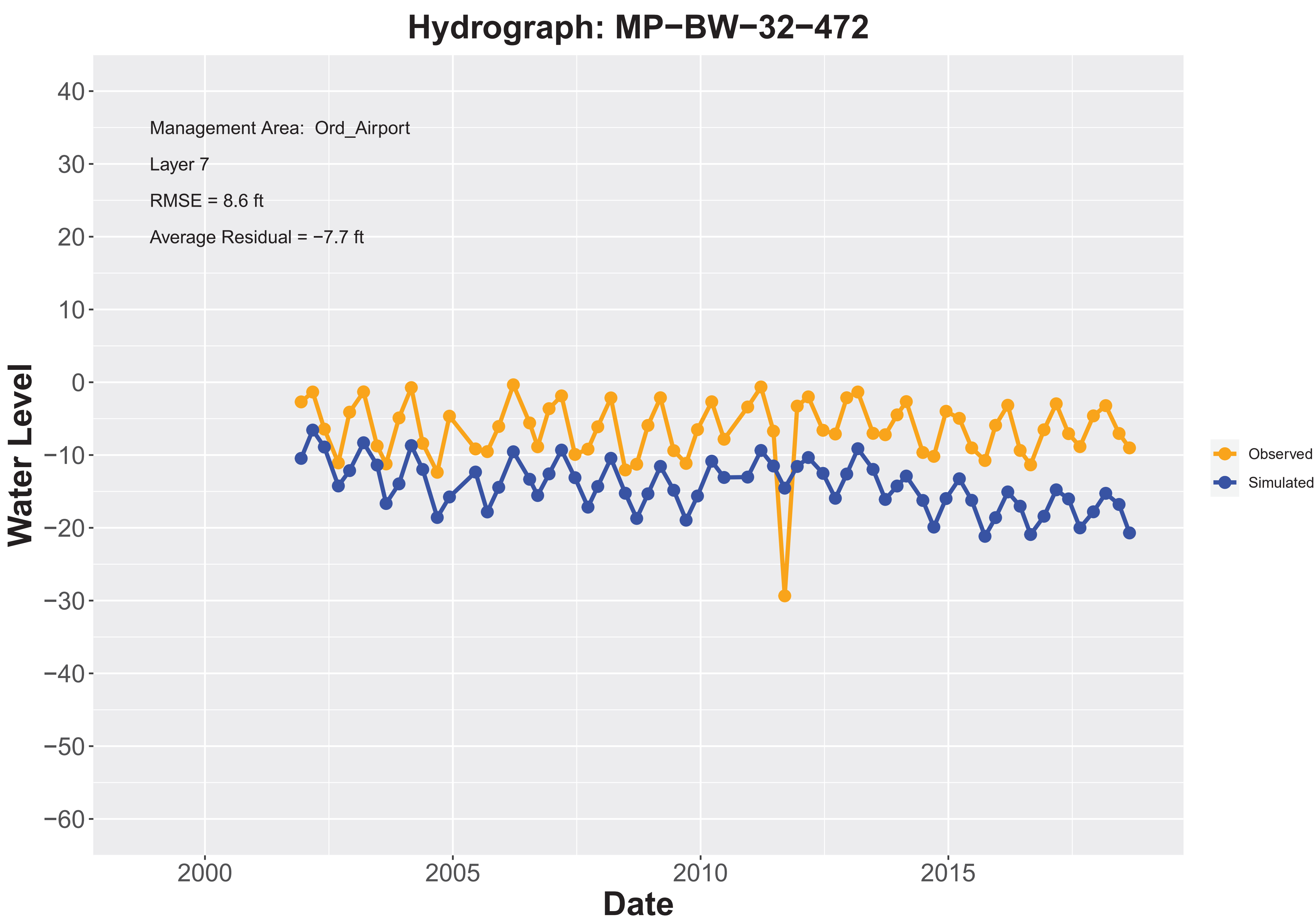
Hydrograph: MP−BW−32−287
Management Area: Ord_Airport
Layer 5
RMSE = 8.3 ft
Average Residual = −6.9 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

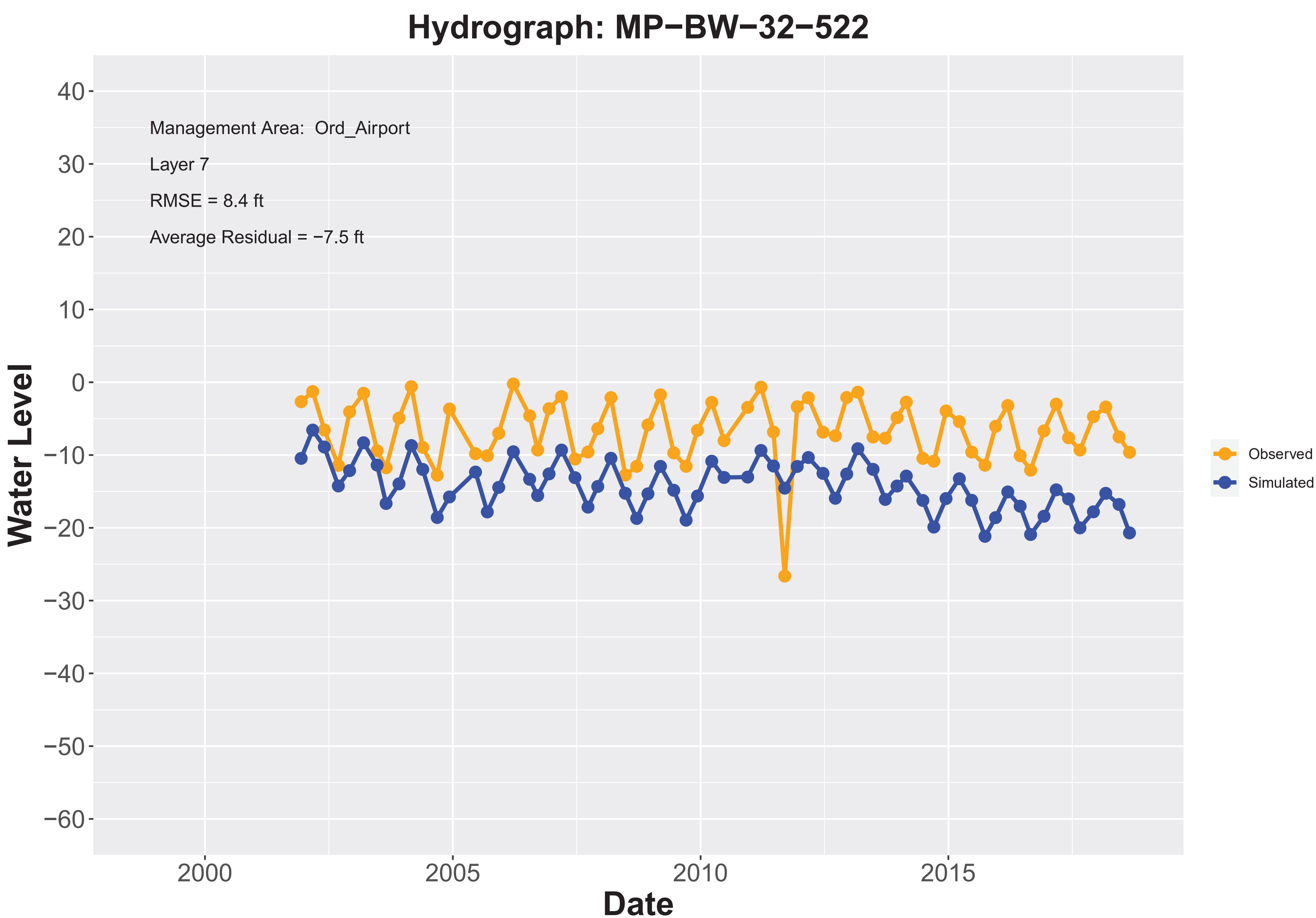


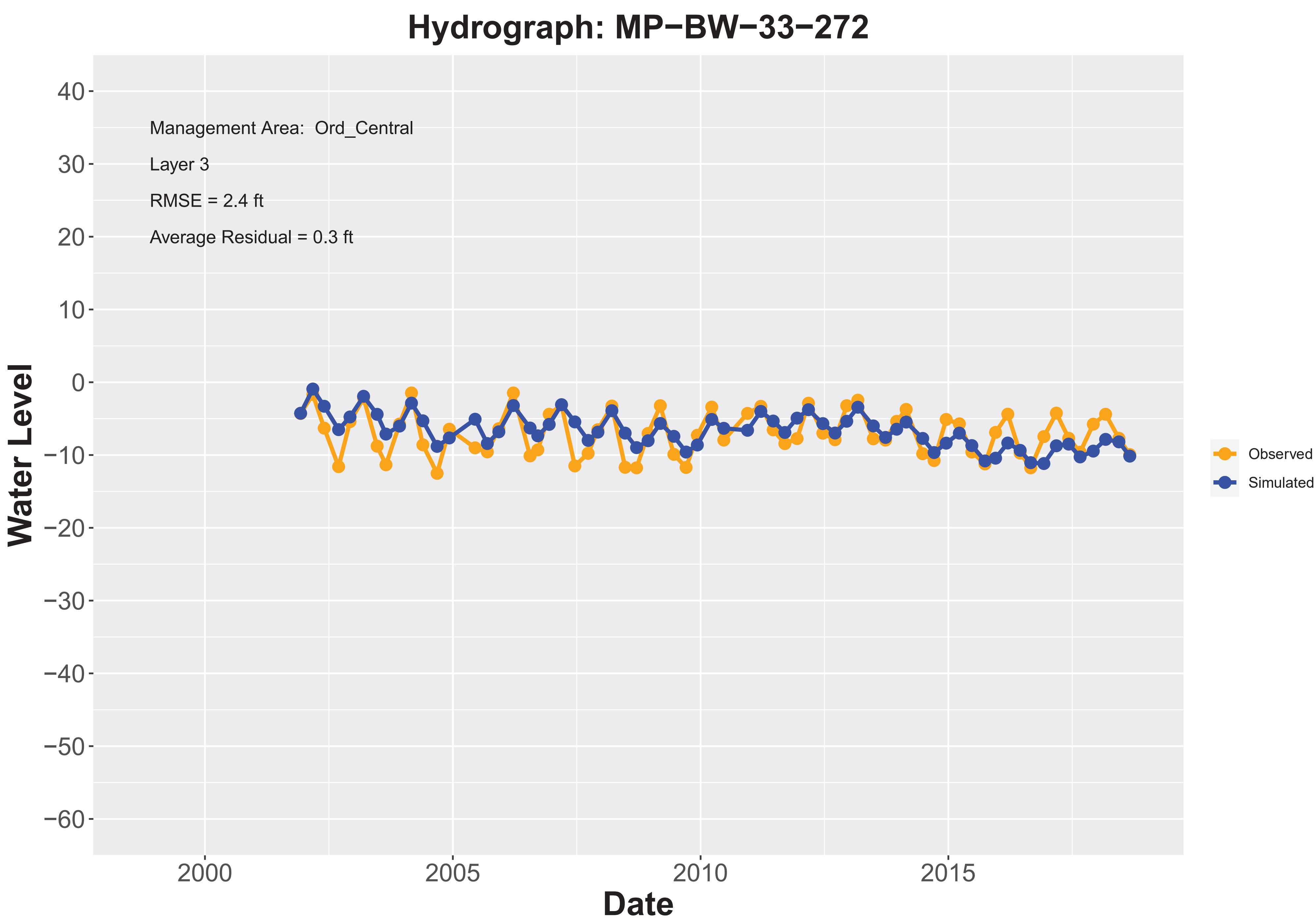
Hydrograph: MP−BW−32−332
Management Area: Ord_Airport
Layer 5
RMSE = 8.1 ft
Average Residual = −7.3 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

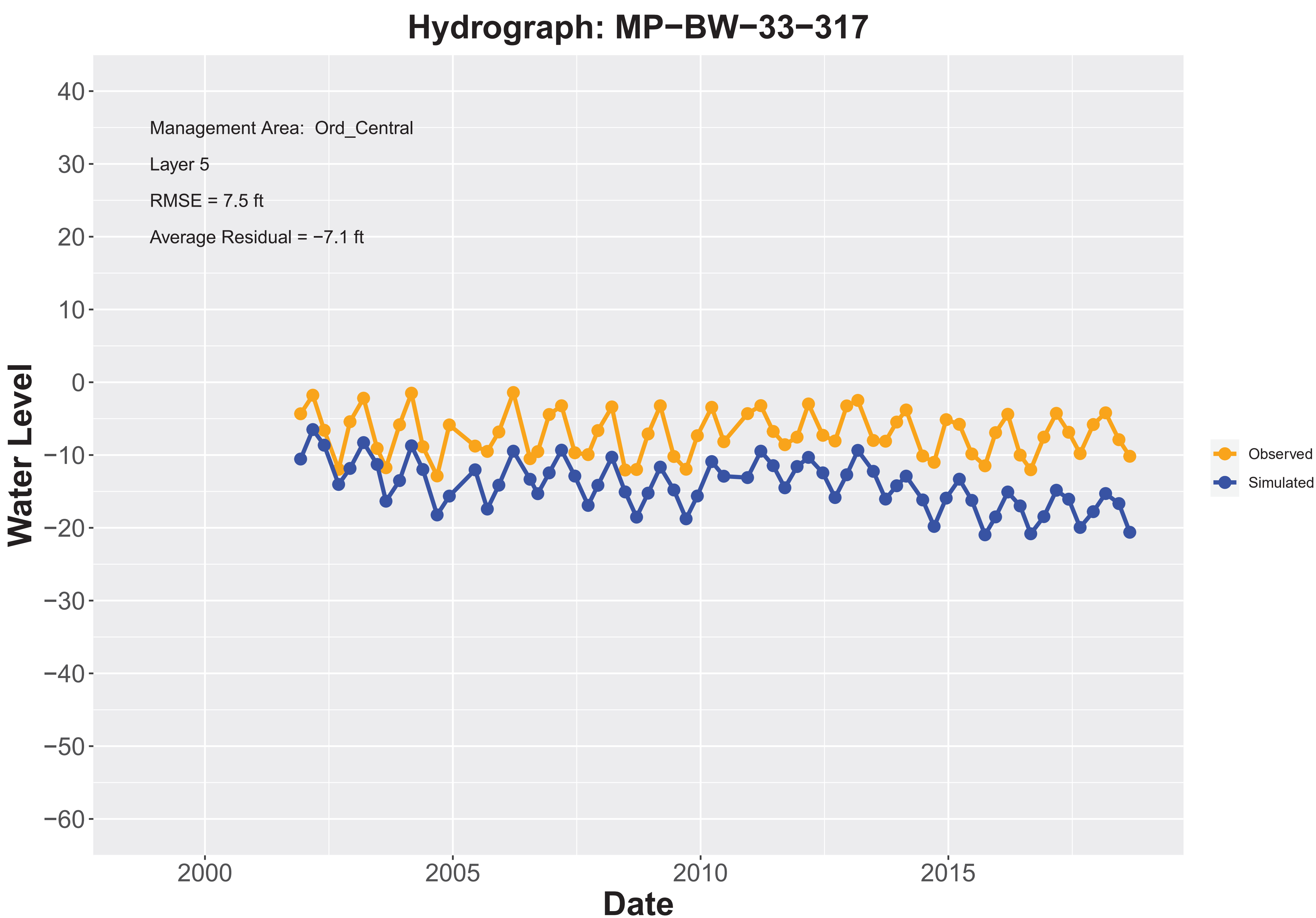

Hydrograph: MP−BW−32−366
Management Area: Ord_Airport
Layer 5
RMSE = 8.1 ft
Average Residual = −7.5 ft
Water Level
Date
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Observed
Simulated


Hydrograph: MP−BW−32−412
Management Area: Ord_Airport
Layer 5
RMSE = 8.3 ft
Average Residual = −7.7 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

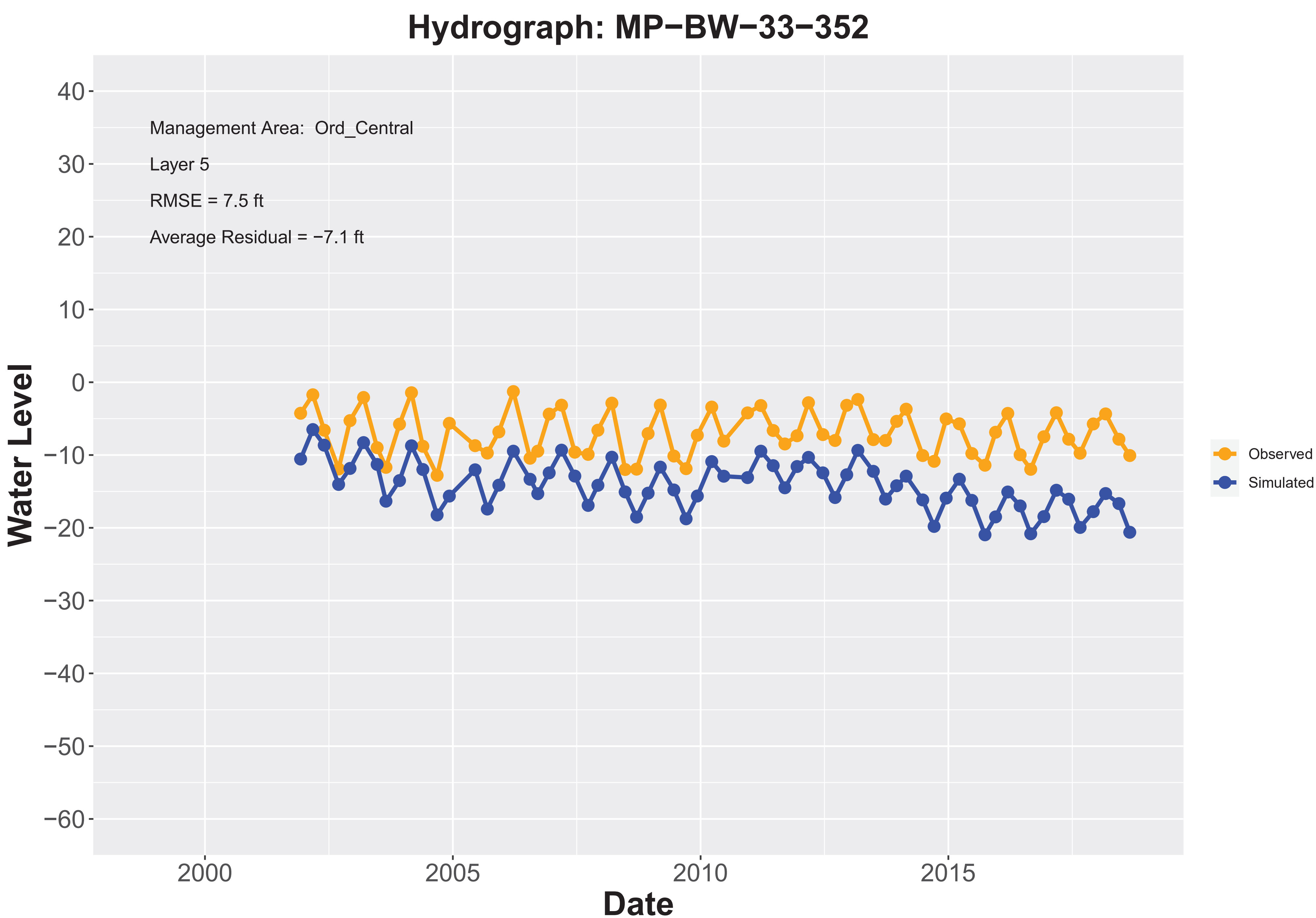

Hydrograph: MP−BW−32−472
Management Area: Ord_Airport
Layer 7
RMSE = 8.6 ft
Average Residual = −7.7 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated


Hydrograph: MP−BW−32−522
Management Area: Ord_Airport
Layer 7
RMSE = 8.4 ft
Average Residual = −7.5 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

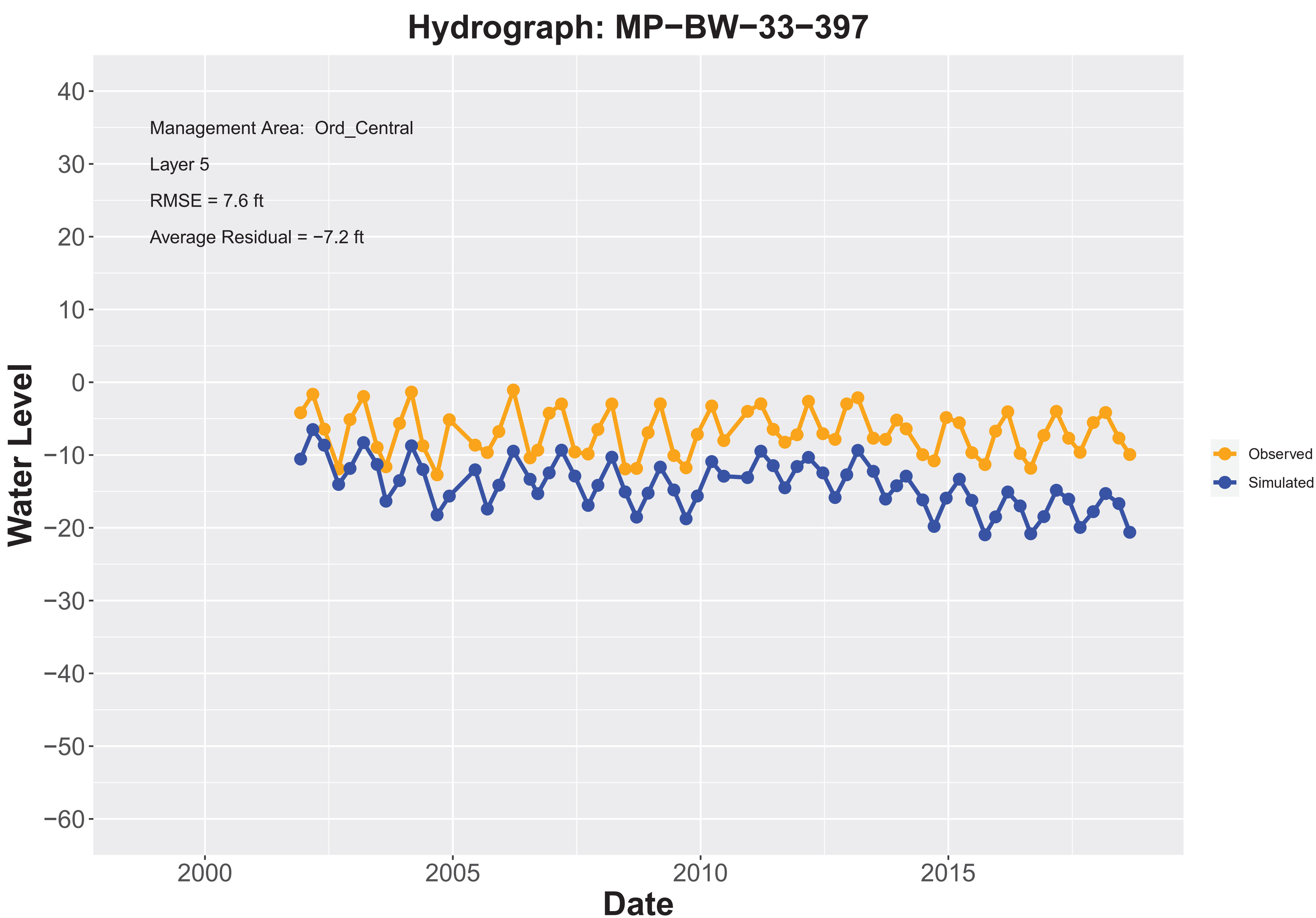

Hydrograph: MP−BW−33−272
Management Area: Ord_Central
Layer 3
RMSE = 2.4 ft
Average Residual = 0.3 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

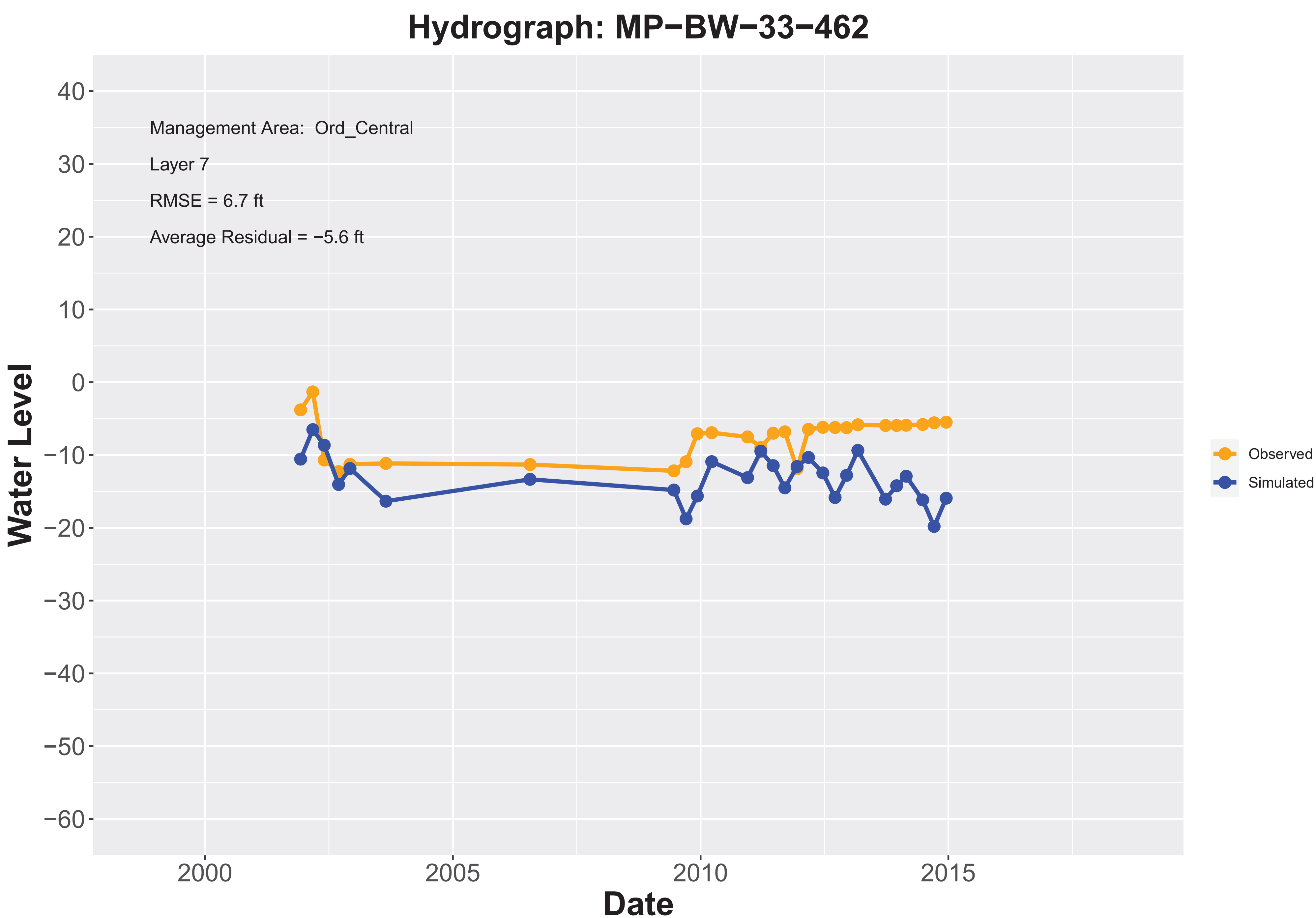


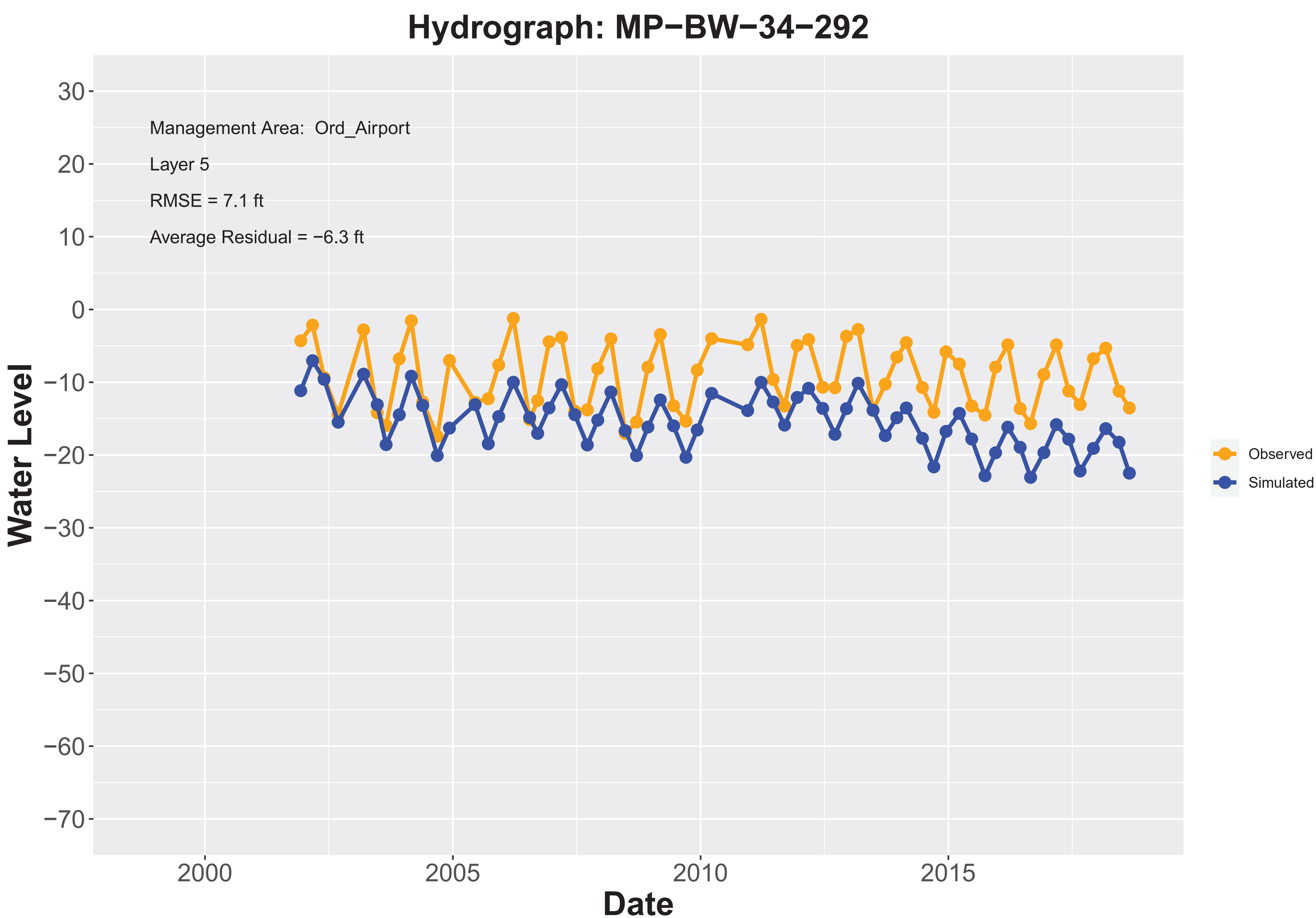
Hydrograph: MP−BW−33−317
Management Area: Ord_Central
Layer 5
RMSE = 7.5 ft
Average Residual = −7.1 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated



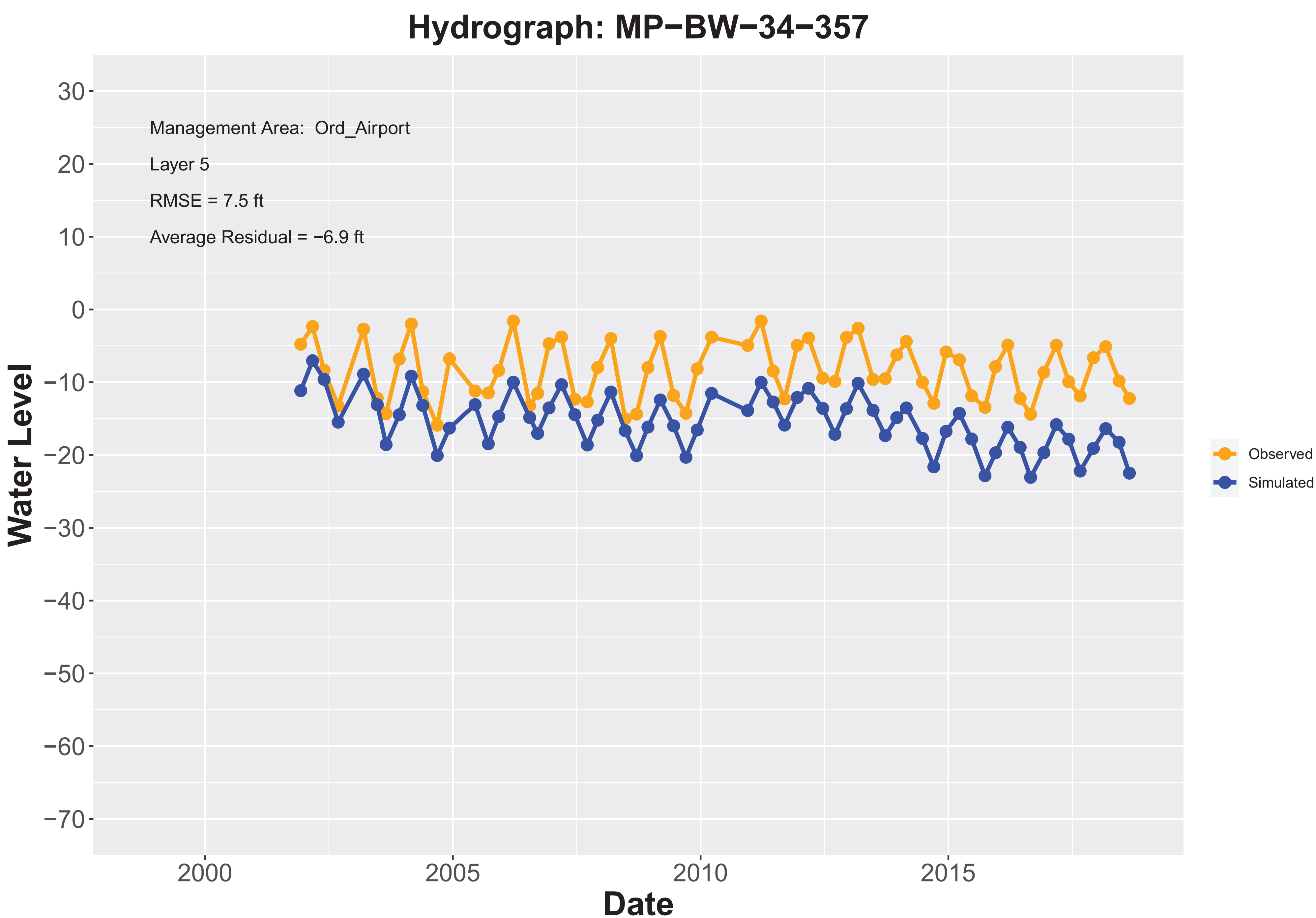
Hydrograph: MP−BW−33−352
Management Area: Ord_Central
Layer 5
RMSE = 7.5 ft
Average Residual = −7.1 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

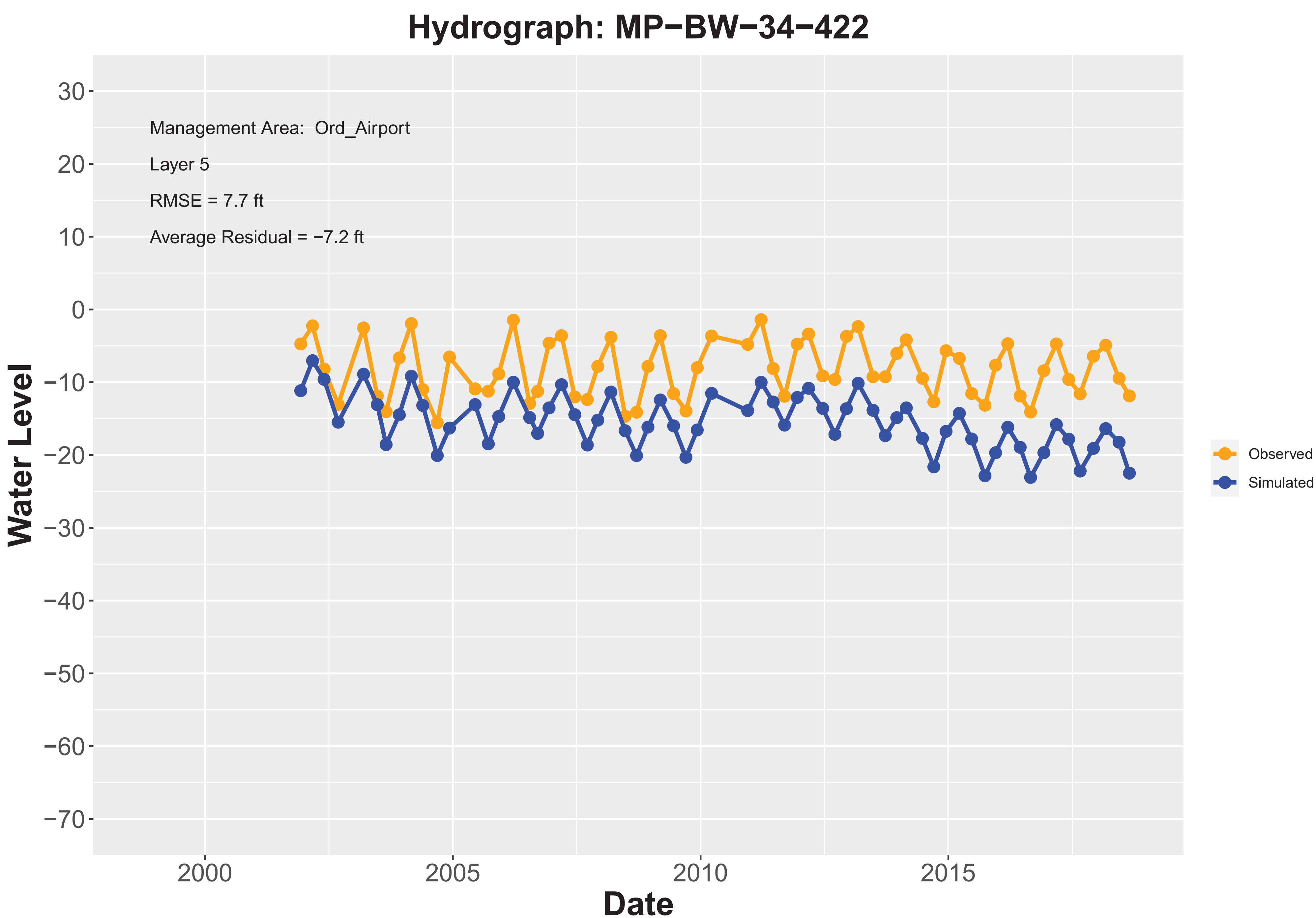

Hydrograph: MP−BW−33−397
Management Area: Ord_Central
Layer 5
RMSE = 7.6 ft
Average Residual = −7.2 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MP−BW−33−462
Management Area: Ord_Central
Layer 7
RMSE = 6.7 ft
Average Residual = −5.6 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

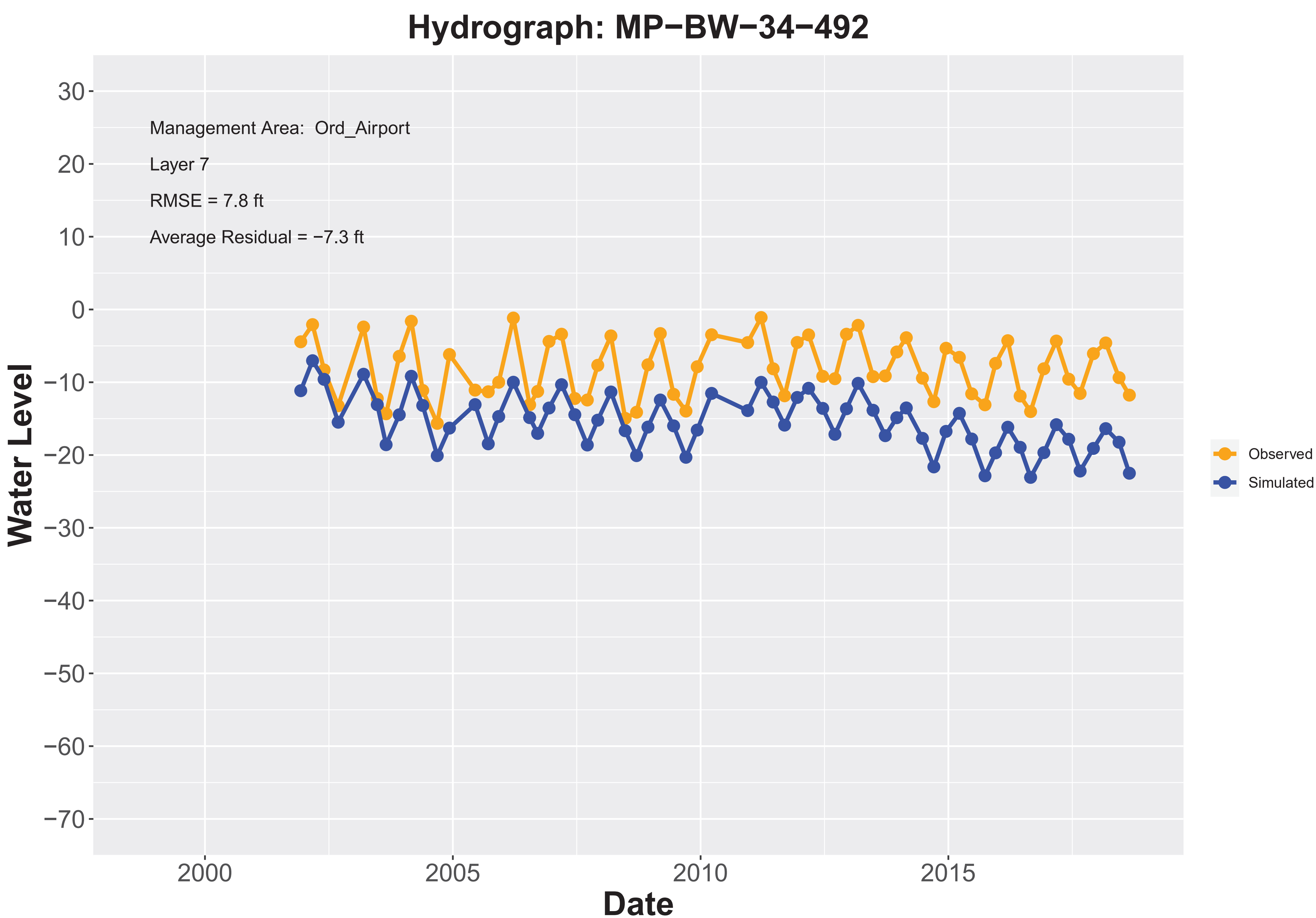


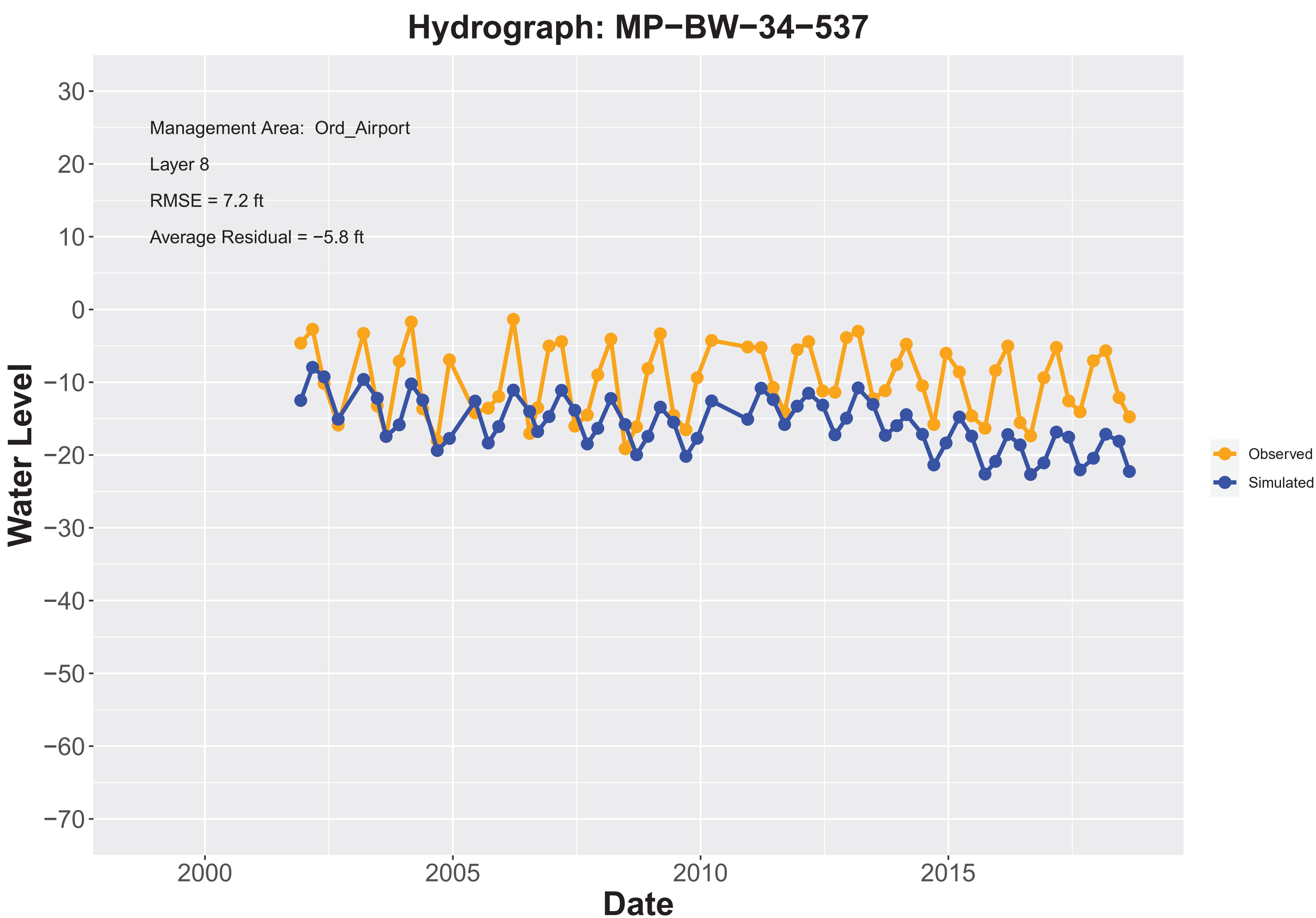
Hydrograph: MP−BW−34−292
Management Area: Ord_Airport
Layer 5
RMSE = 7.1 ft
Average Residual = −6.3 ft
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Water Level
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MP−BW−34−357
Management Area: Ord_Airport
Layer 5
RMSE = 7.5 ft
Average Residual = −6.9 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

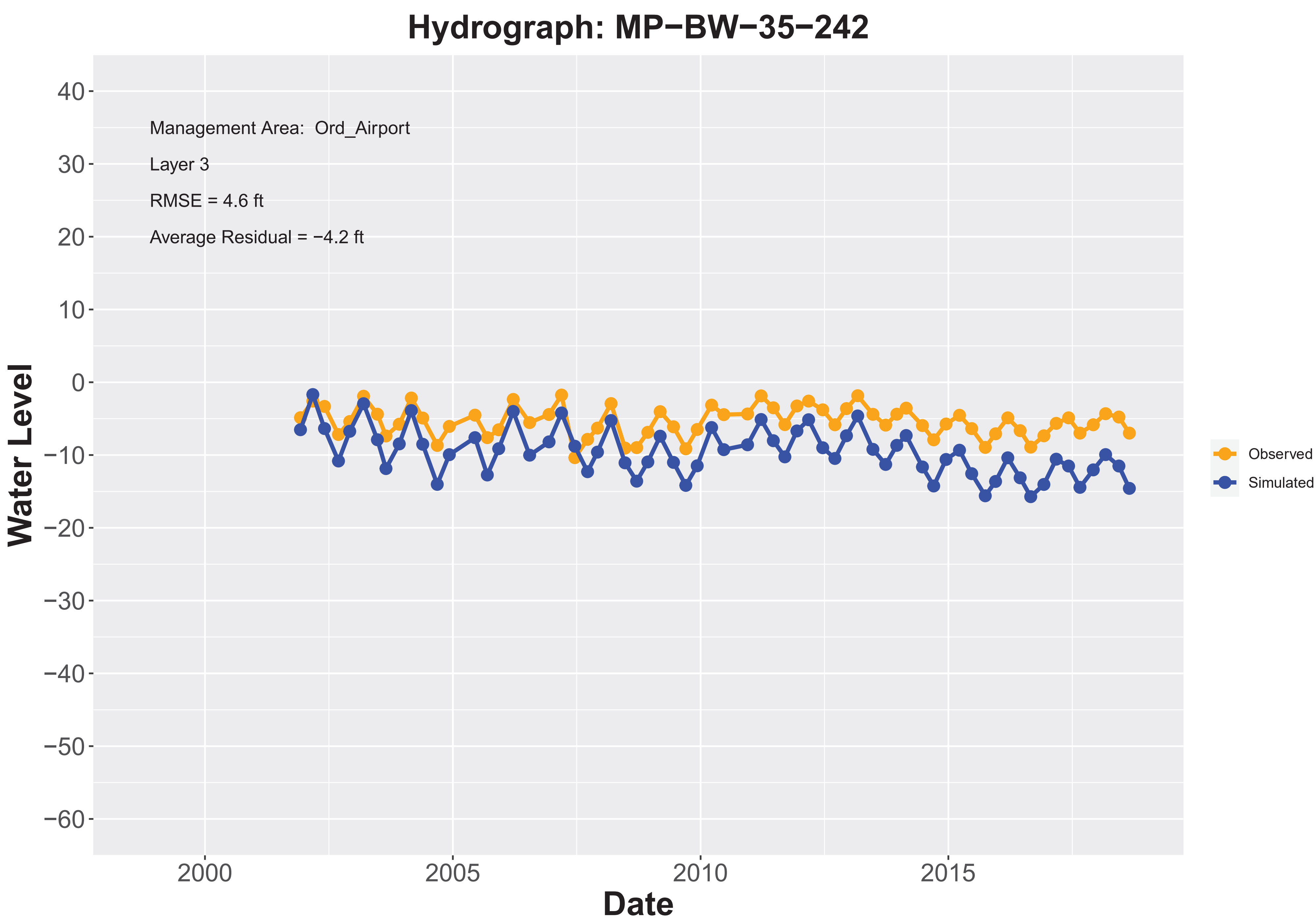


Hydrograph: MP−BW−34−422
Management Area: Ord_Airport
Layer 5
RMSE = 7.7 ft
Average Residual = −7.2 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated


Hydrograph: MP−BW−34−492
Management Area: Ord_Airport
Layer 7
RMSE = 7.8 ft
Average Residual = −7.3 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

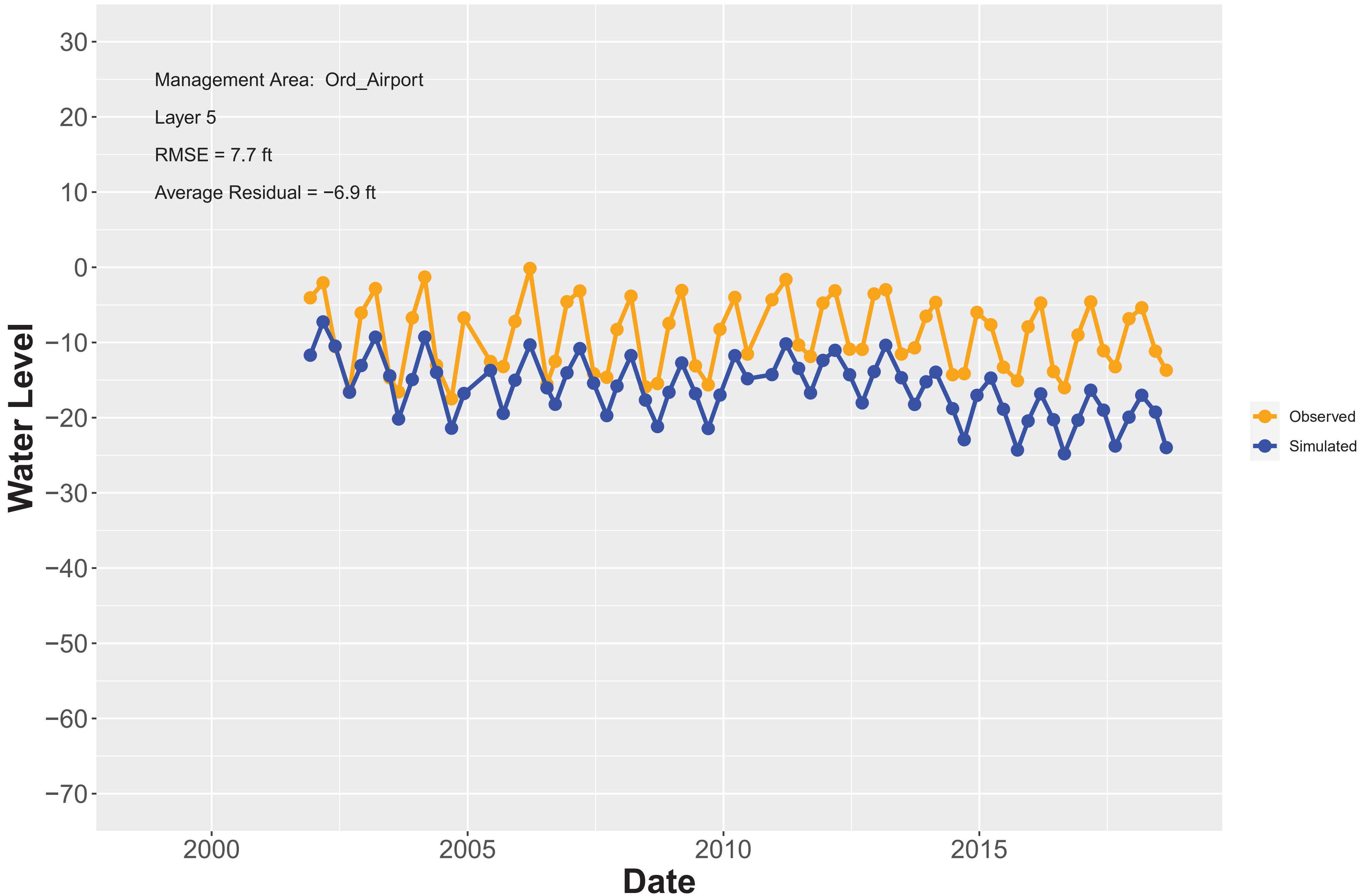


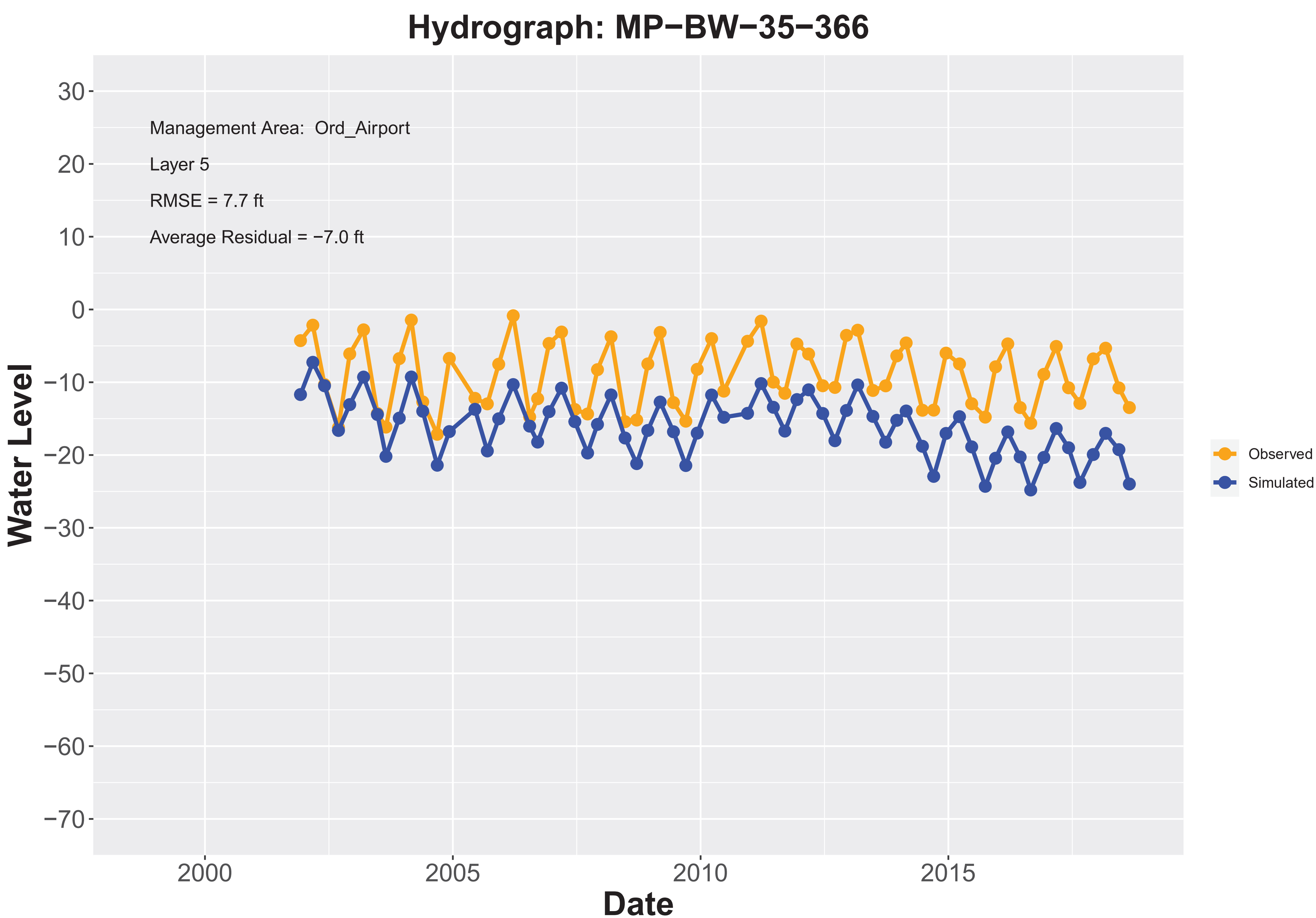
Hydrograph: MP−BW−34−537
Management Area: Ord_Airport
Layer 8
RMSE = 7.2 ft
Average Residual = −5.8 ft
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Water Level
2000
2005
2010
2015
Date
Observed
Simulated

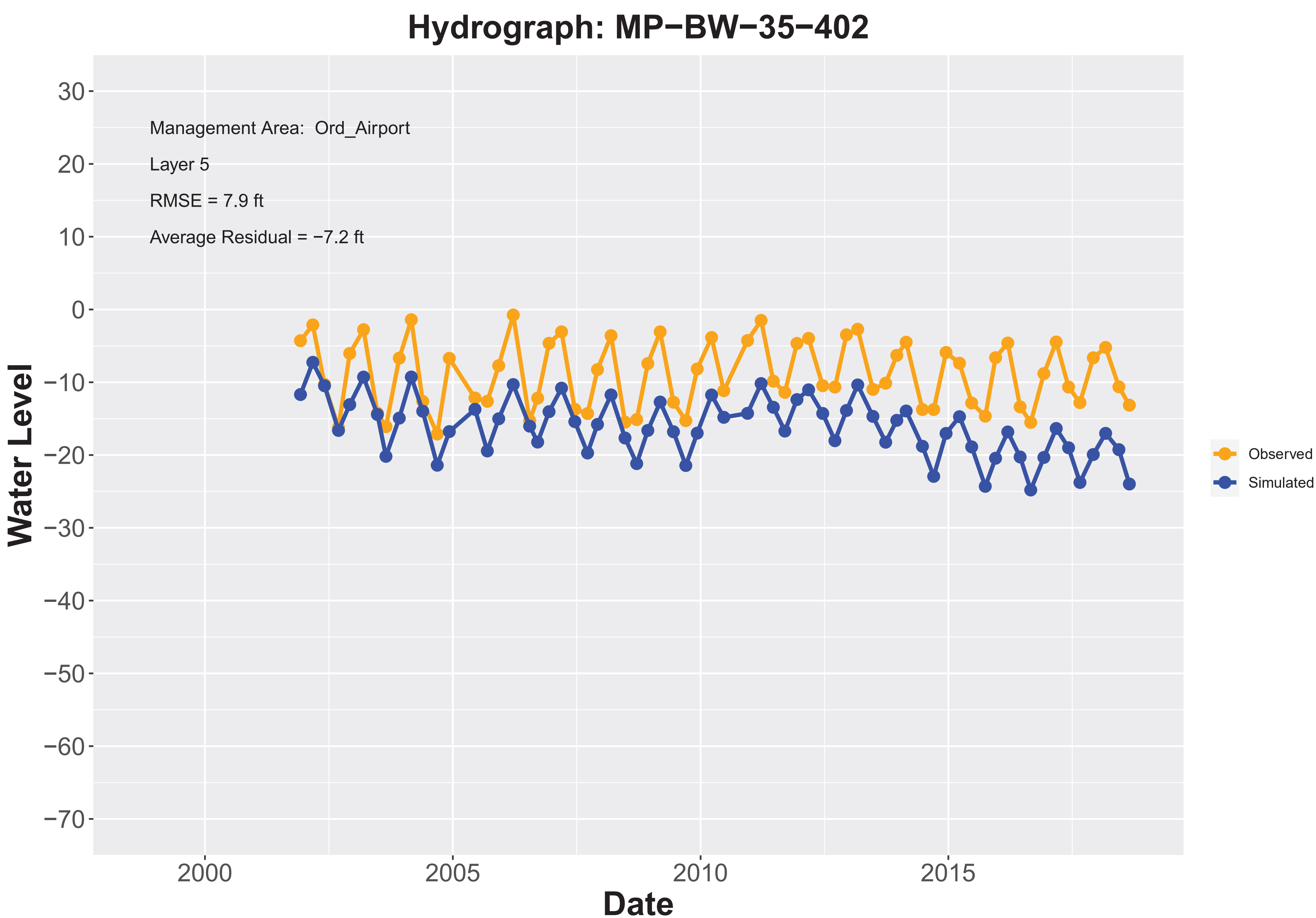


Hydrograph: MP−BW−35−242
Management Area: Ord_Airport
Layer 3
RMSE = 4.6 ft
Average Residual = −4.2 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

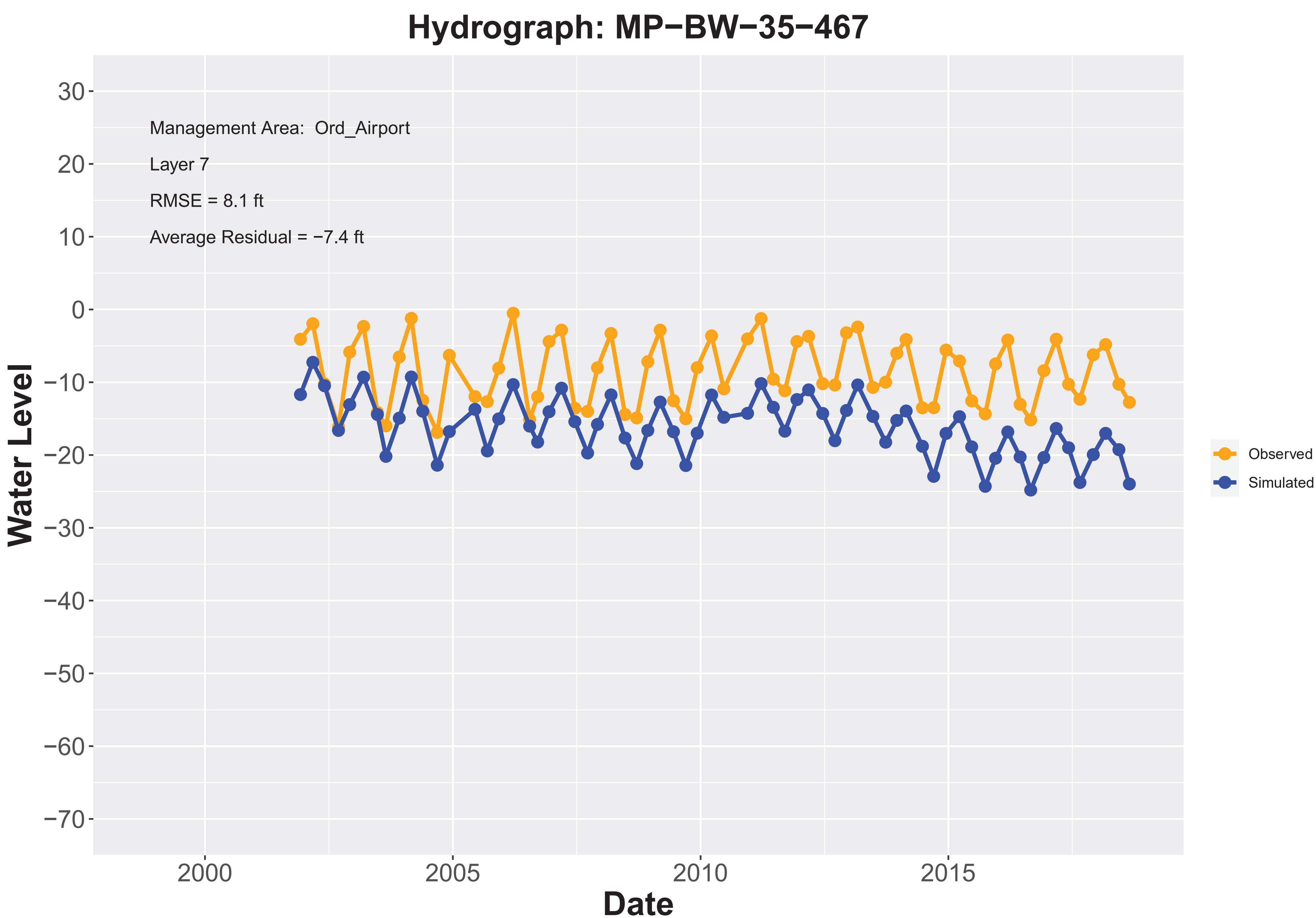
Hydrograph: MP−BW−35−312



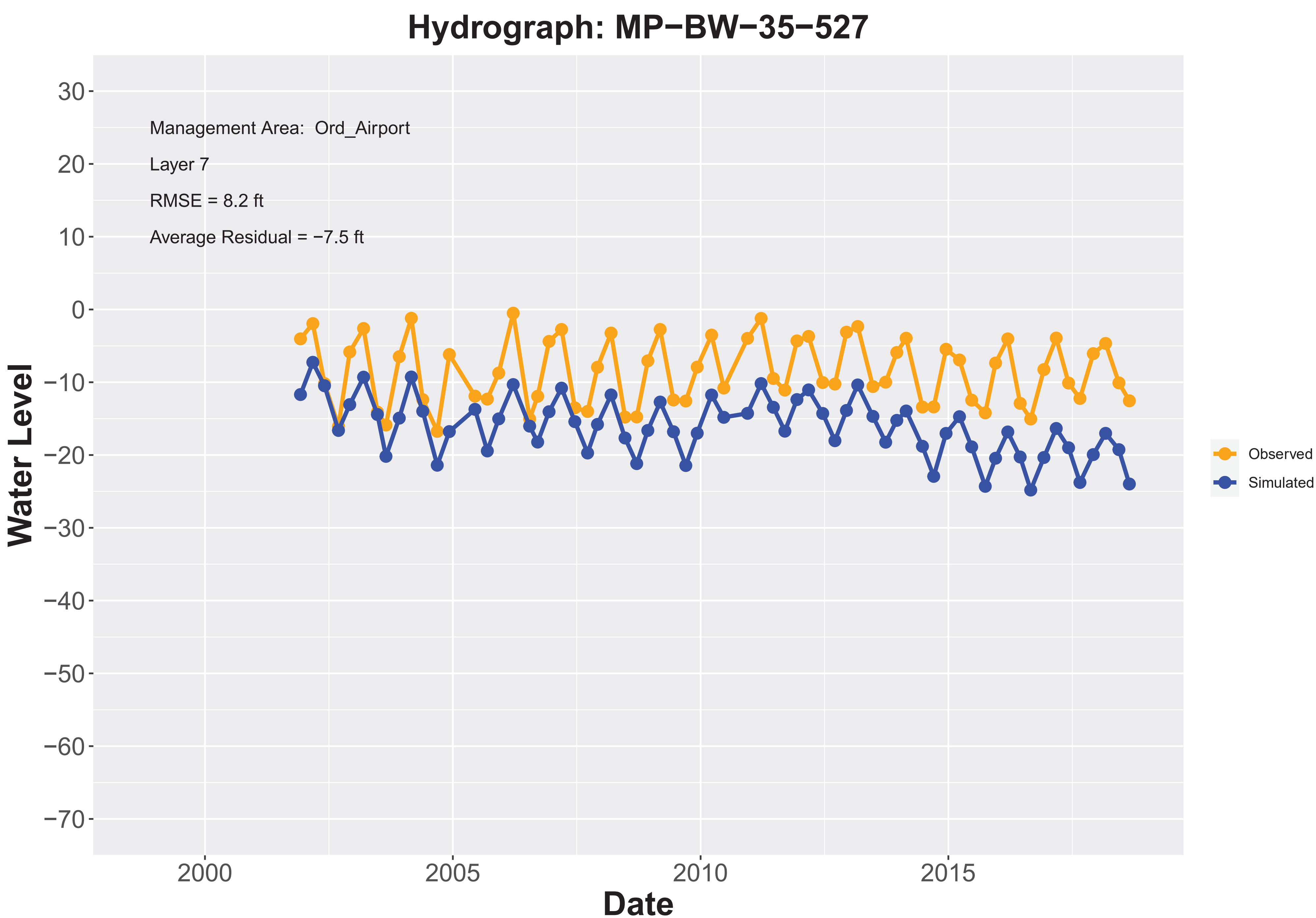

Hydrograph: MP−BW−35−366
Management Area: Ord_Airport
Layer 5
RMSE = 7.7 ft
Average Residual = −7.0 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated

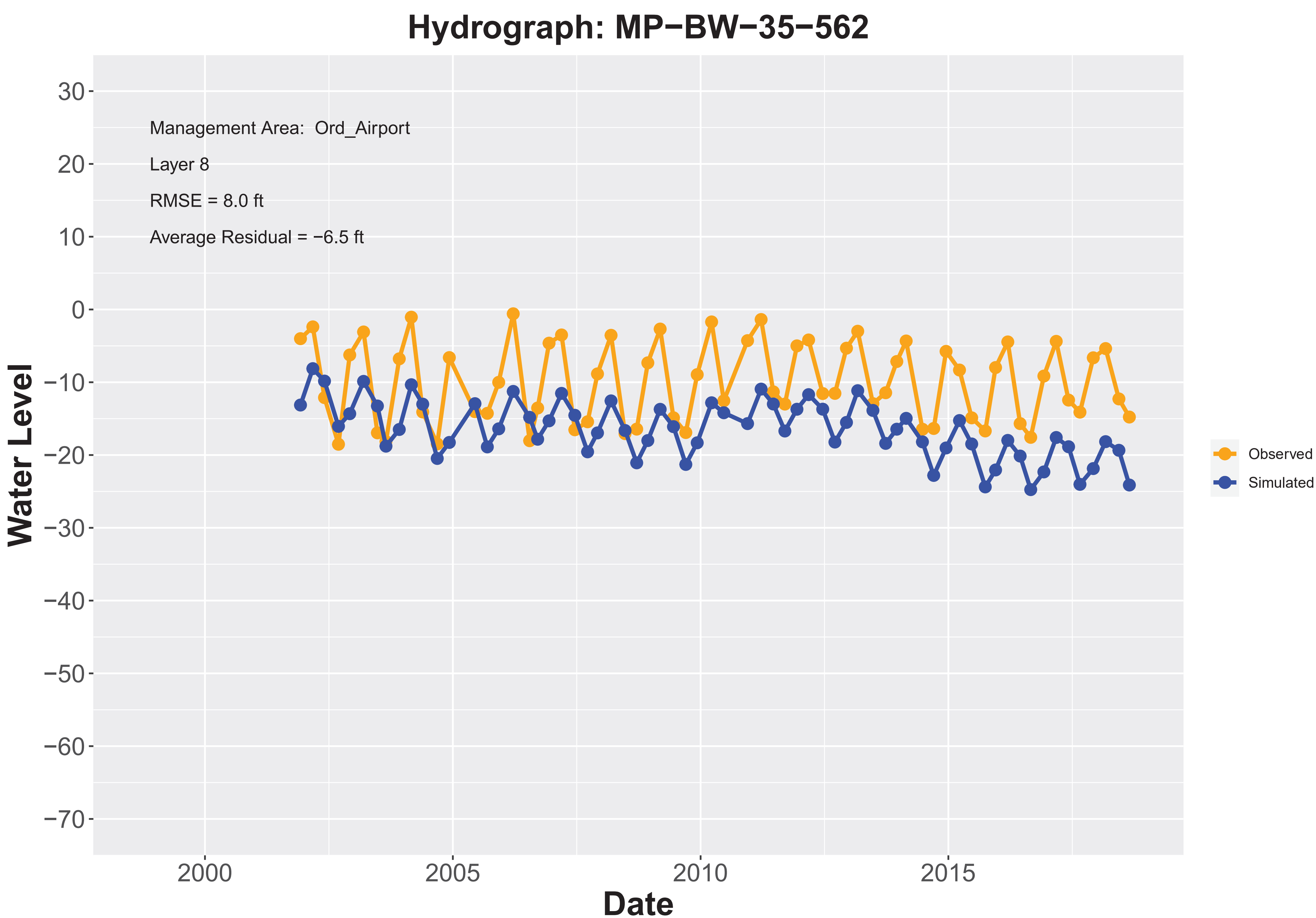


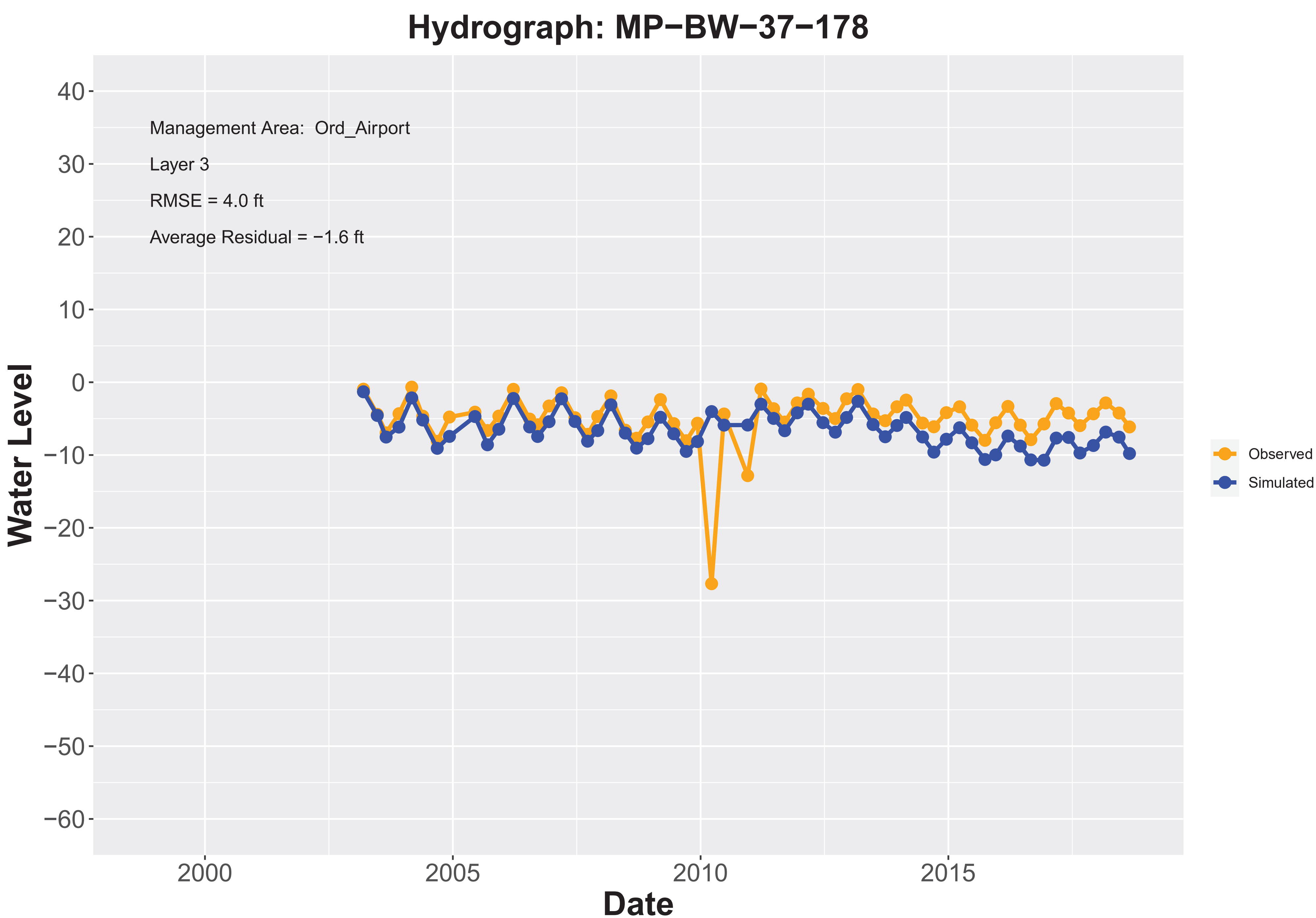
Hydrograph: MP−BW−35−402
Management Area: Ord_Airport
Layer 5
RMSE = 7.9 ft
Average Residual = −7.2 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated



Hydrograph: MP−BW−35−467
Management Area: Ord_Airport
Layer 7
RMSE = 8.1 ft
Average Residual = −7.4 ft
Water Level
Date
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Observed
Simulated

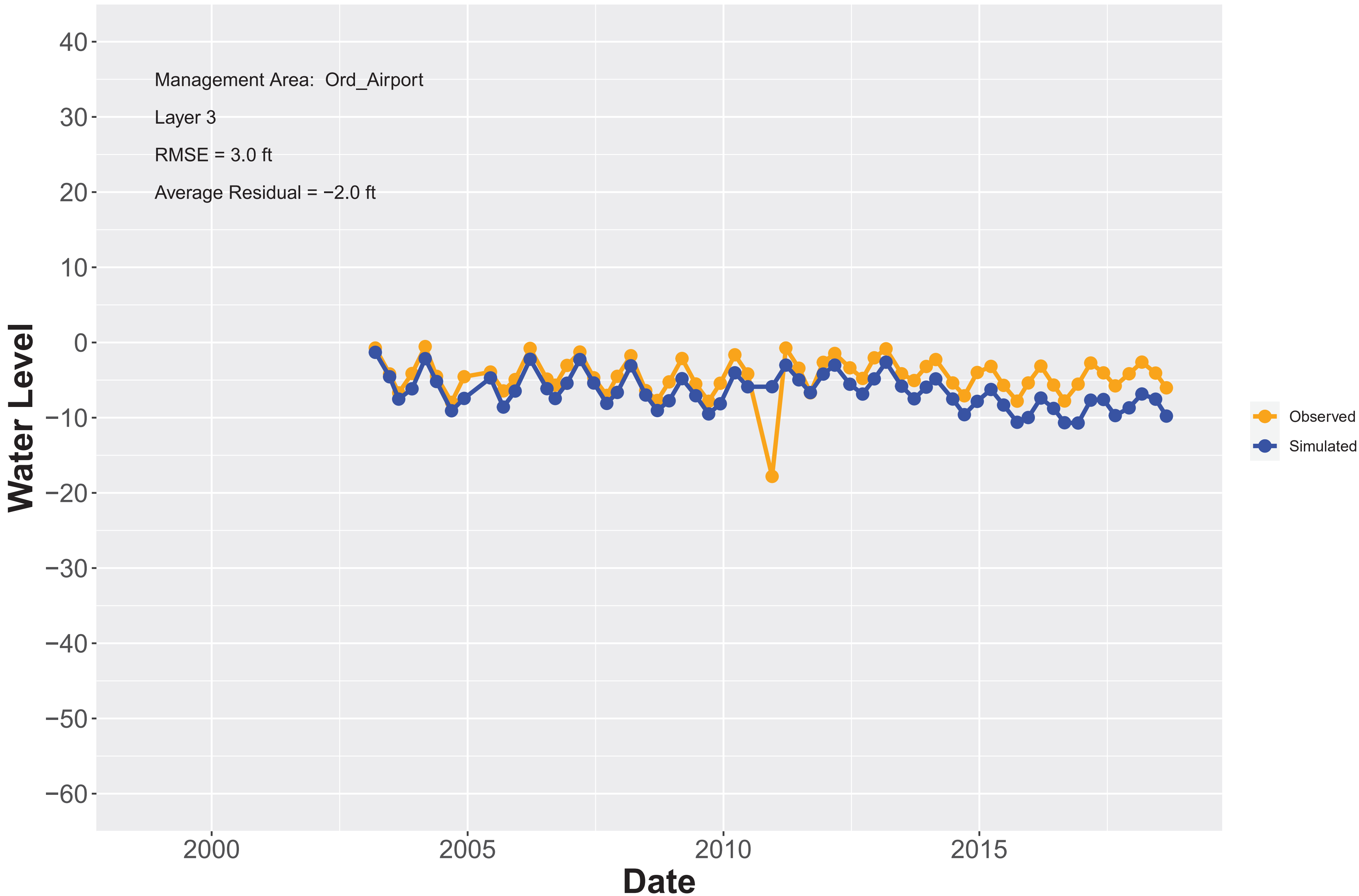

Hydrograph: MP−BW−35−527
Management Area: Ord_Airport
Layer 7
RMSE = 8.2 ft
Average Residual = −7.5 ft
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Water Level
2000
2005
2010
2015
Date
Observed
Simulated

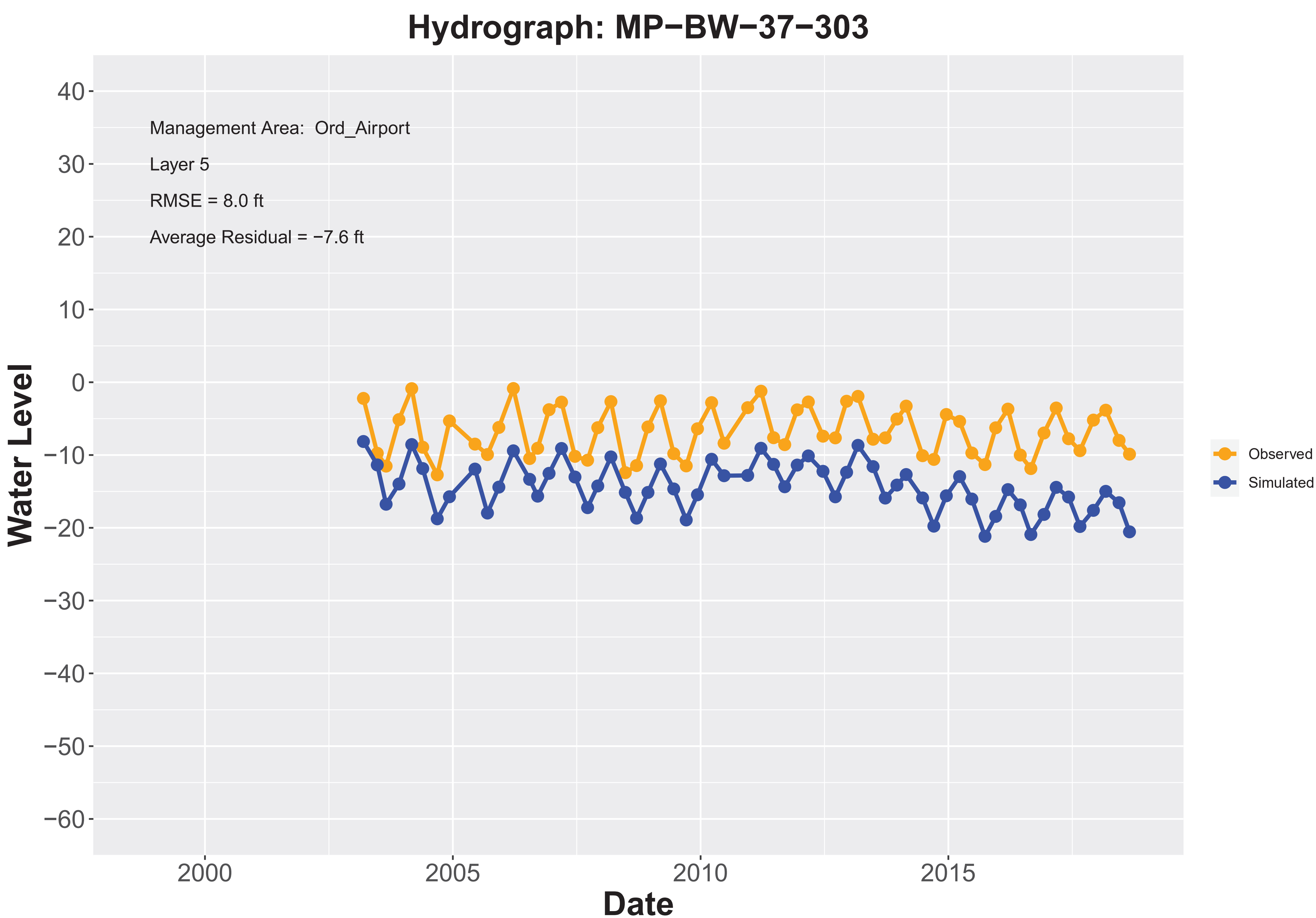

Hydrograph: MP−BW−35−562
Management Area: Ord_Airport
Layer 8
RMSE = 8.0 ft
Average Residual = −6.5 ft
Water Level
Date
Observed
Simulated
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015



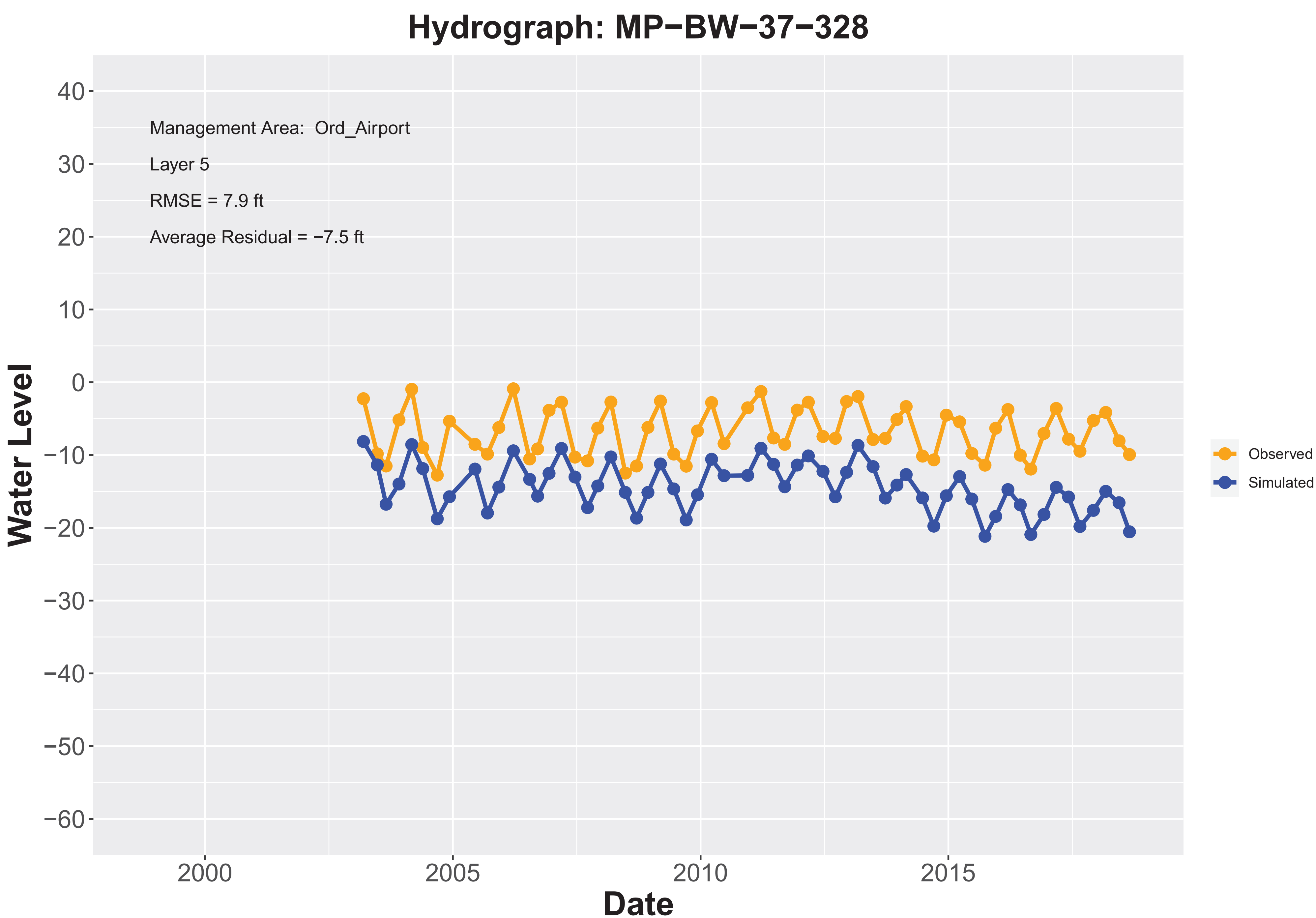
Hydrograph: MP−BW−37−178
Management Area: Ord_Airport
Layer 3
RMSE = 4.0 ft
Average Residual = −1.6 ft
Water Level
Date
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Observed
Simulated

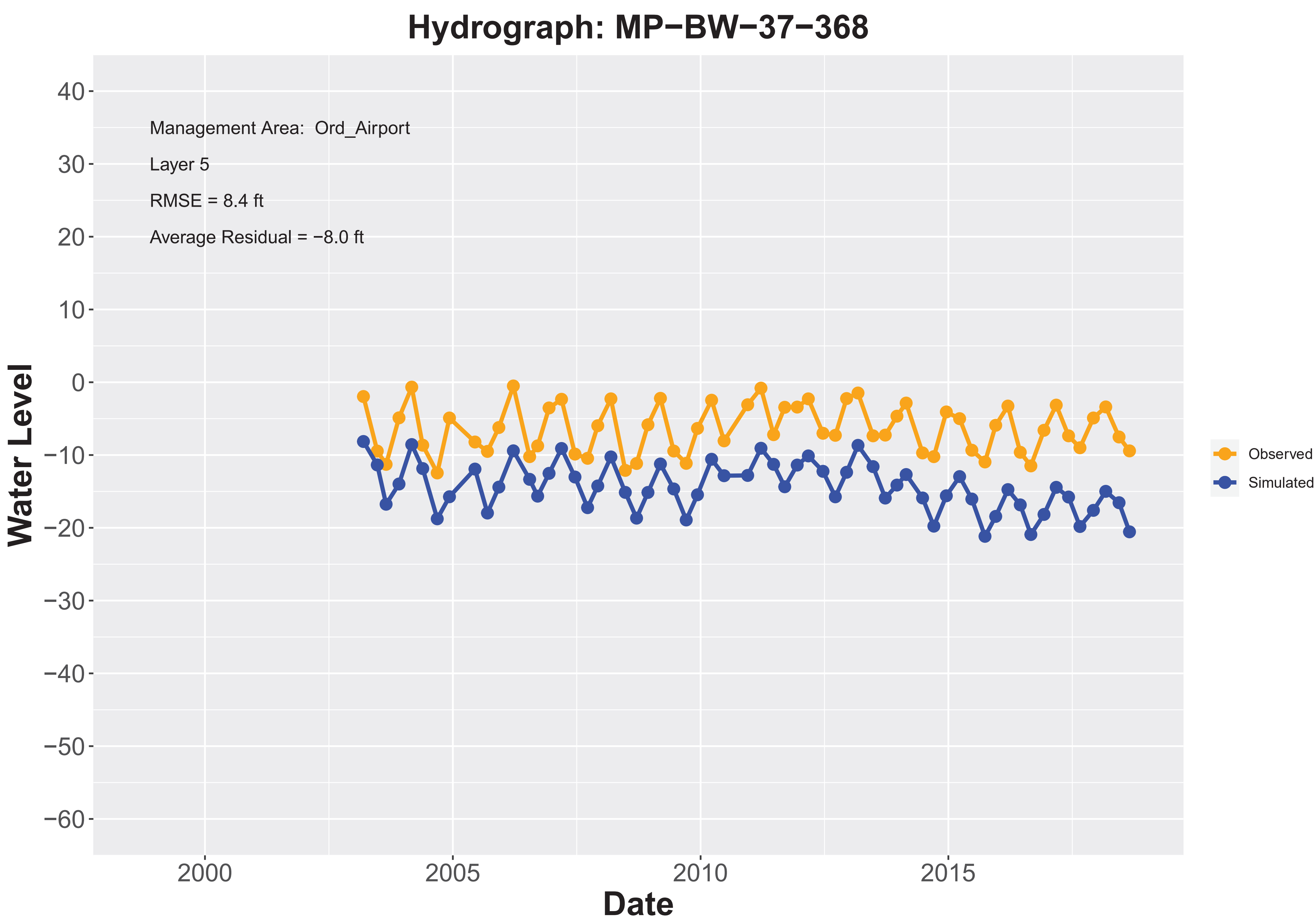
Hydrograph: MP−BW−37−193



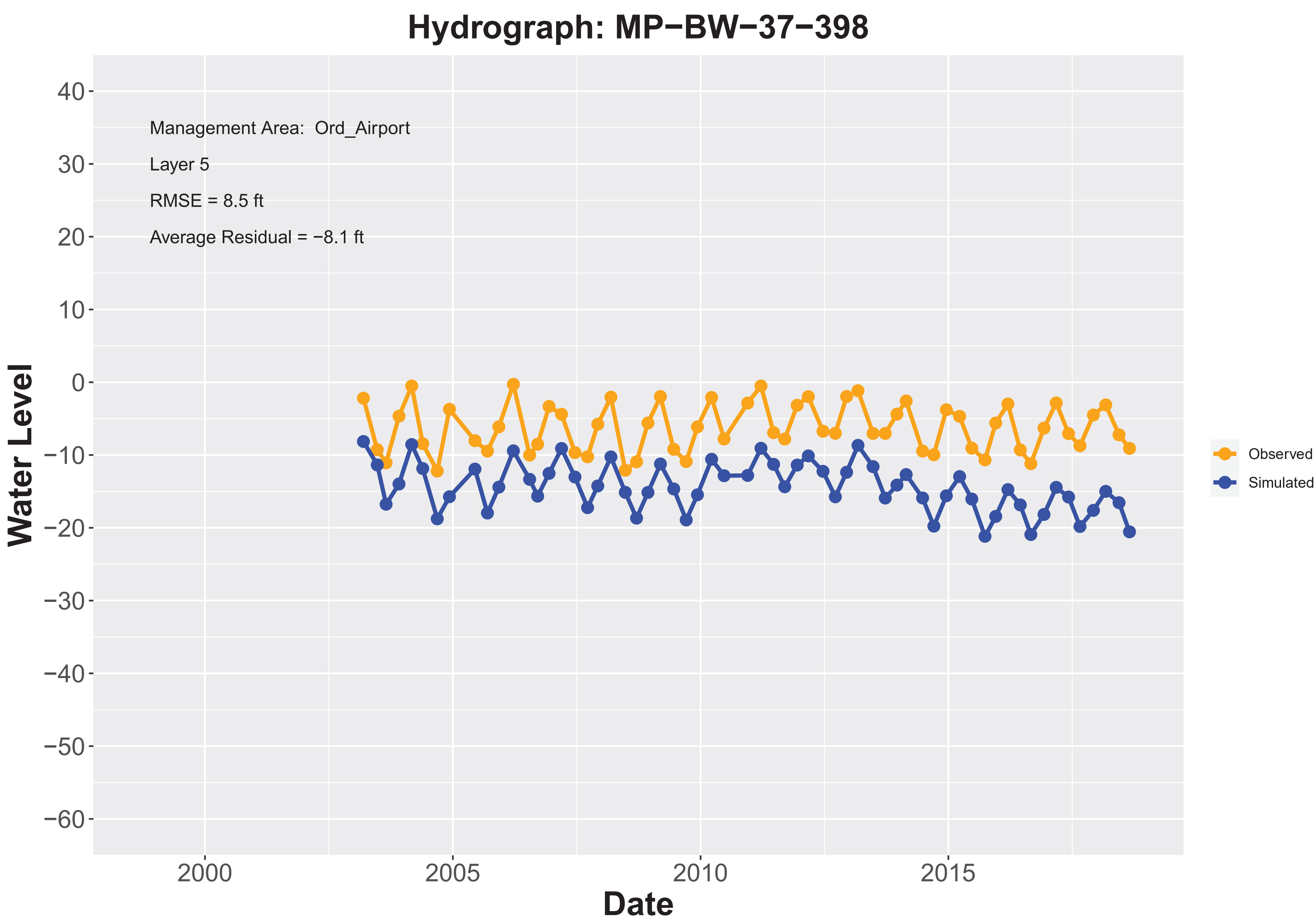


Hydrograph: MP−BW−37−303
Management Area: Ord_Airport
Layer 5
RMSE = 8.0 ft
Average Residual = −7.6 ft
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Water Level
2000
2005
2010
2015
Date
Observed
Simulated

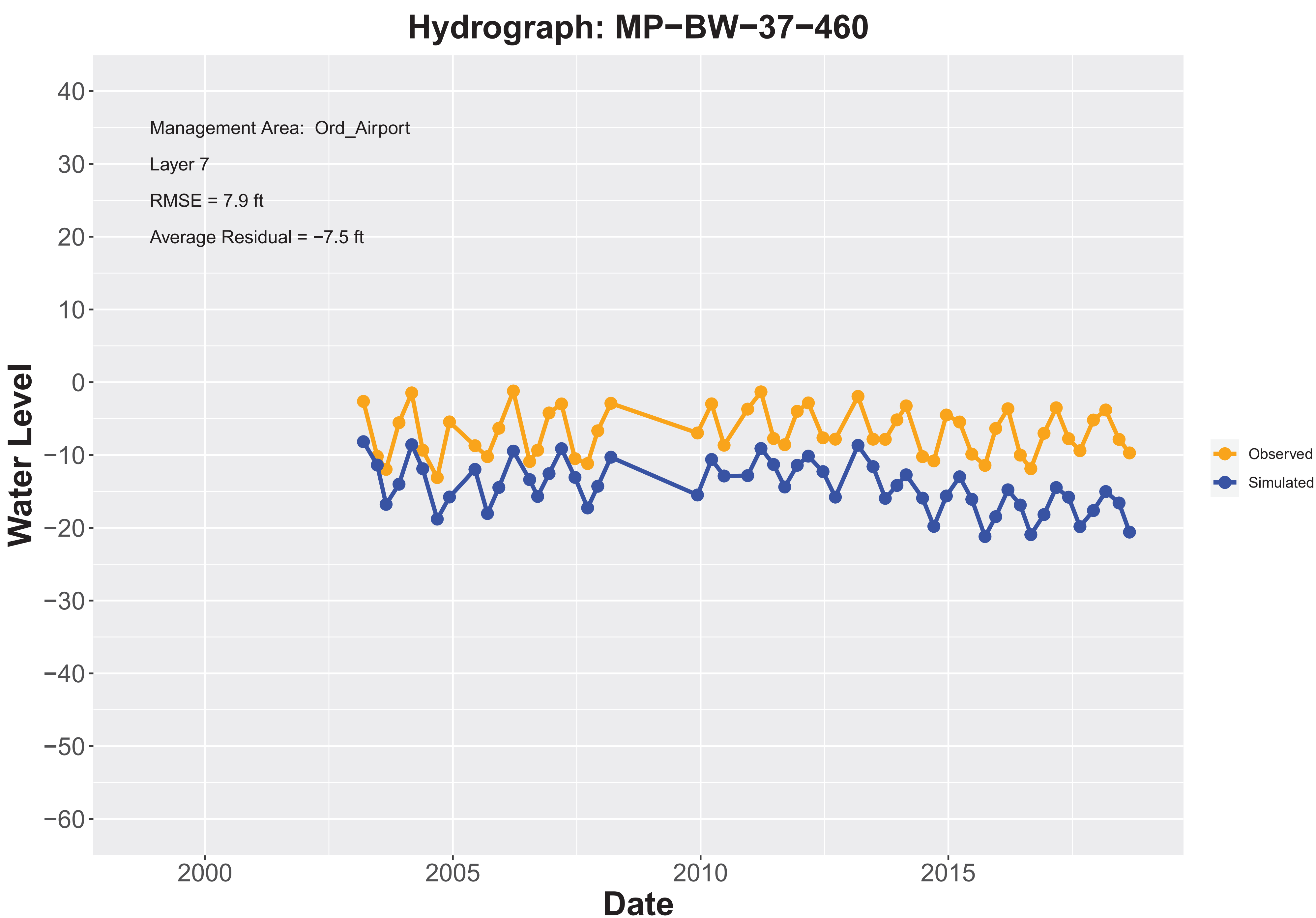

Hydrograph: MP−BW−37−328
Management Area: Ord_Airport
Layer 5
RMSE = 7.9 ft
Average Residual = −7.5 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated



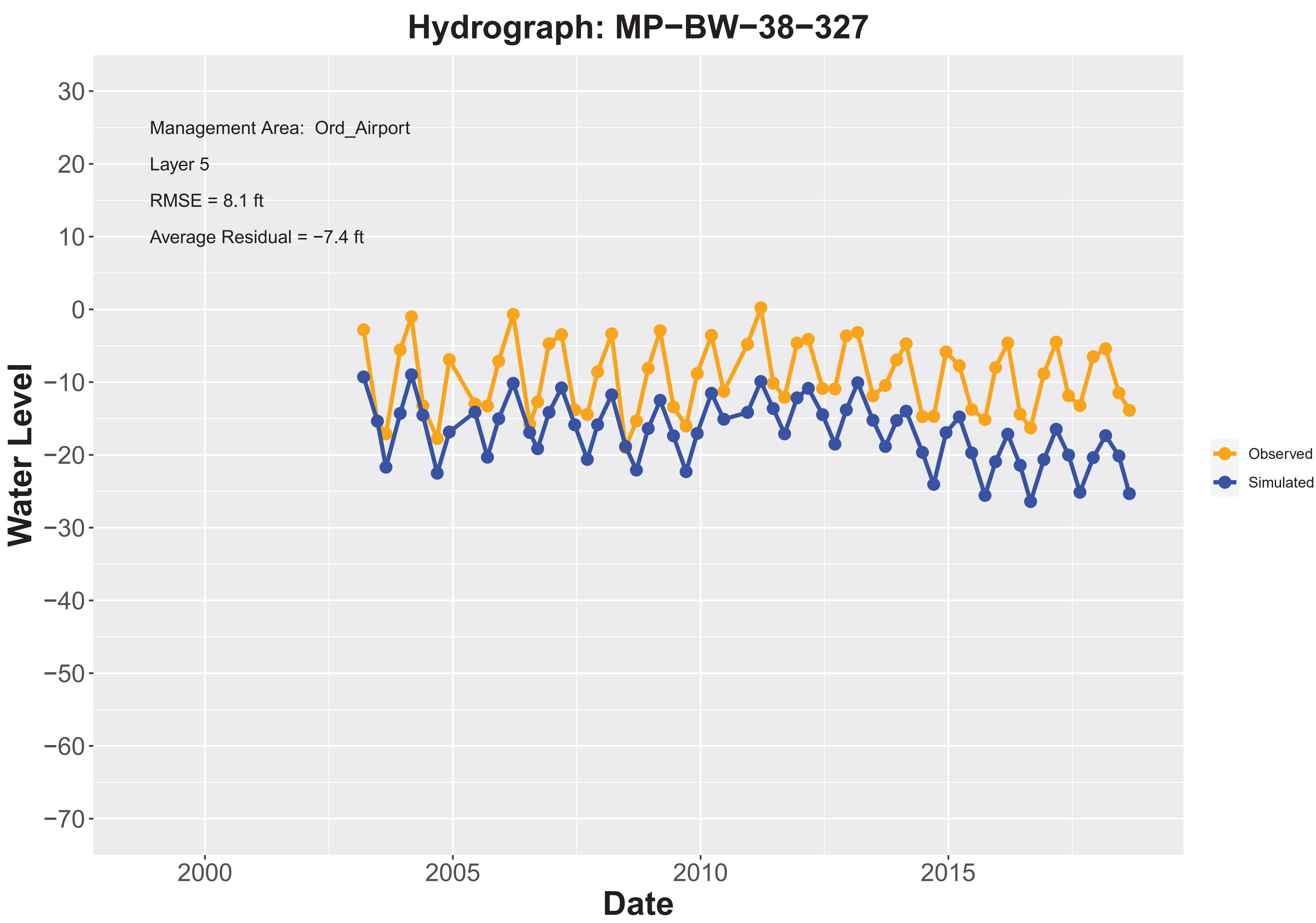
Hydrograph: MP−BW−37−368
Management Area: Ord_Airport
Layer 5
RMSE = 8.4 ft
Average Residual = −8.0 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

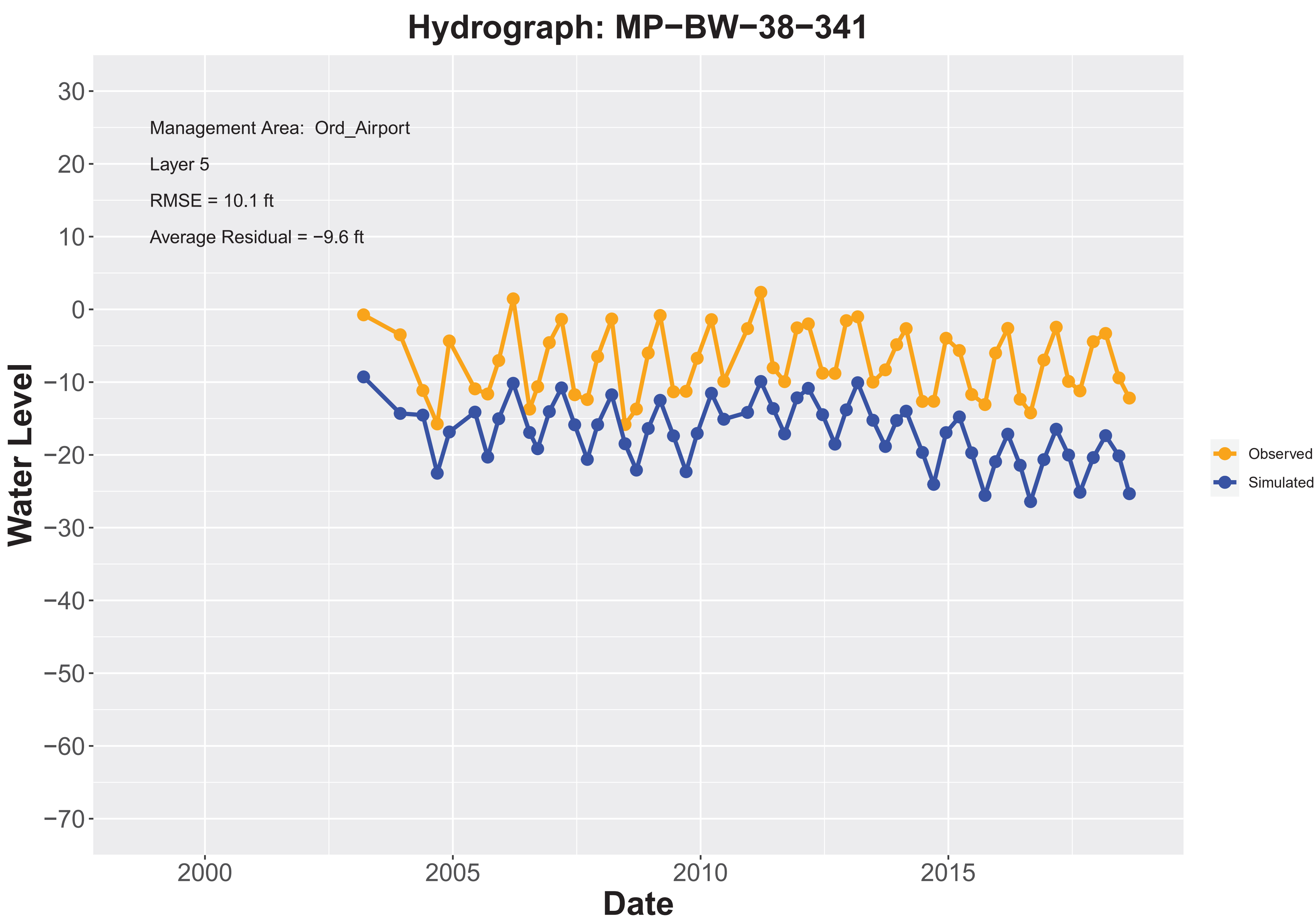


Hydrograph: MP−BW−37−398
Management Area: Ord_Airport
Layer 5
RMSE = 8.5 ft
Average Residual = −8.1 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

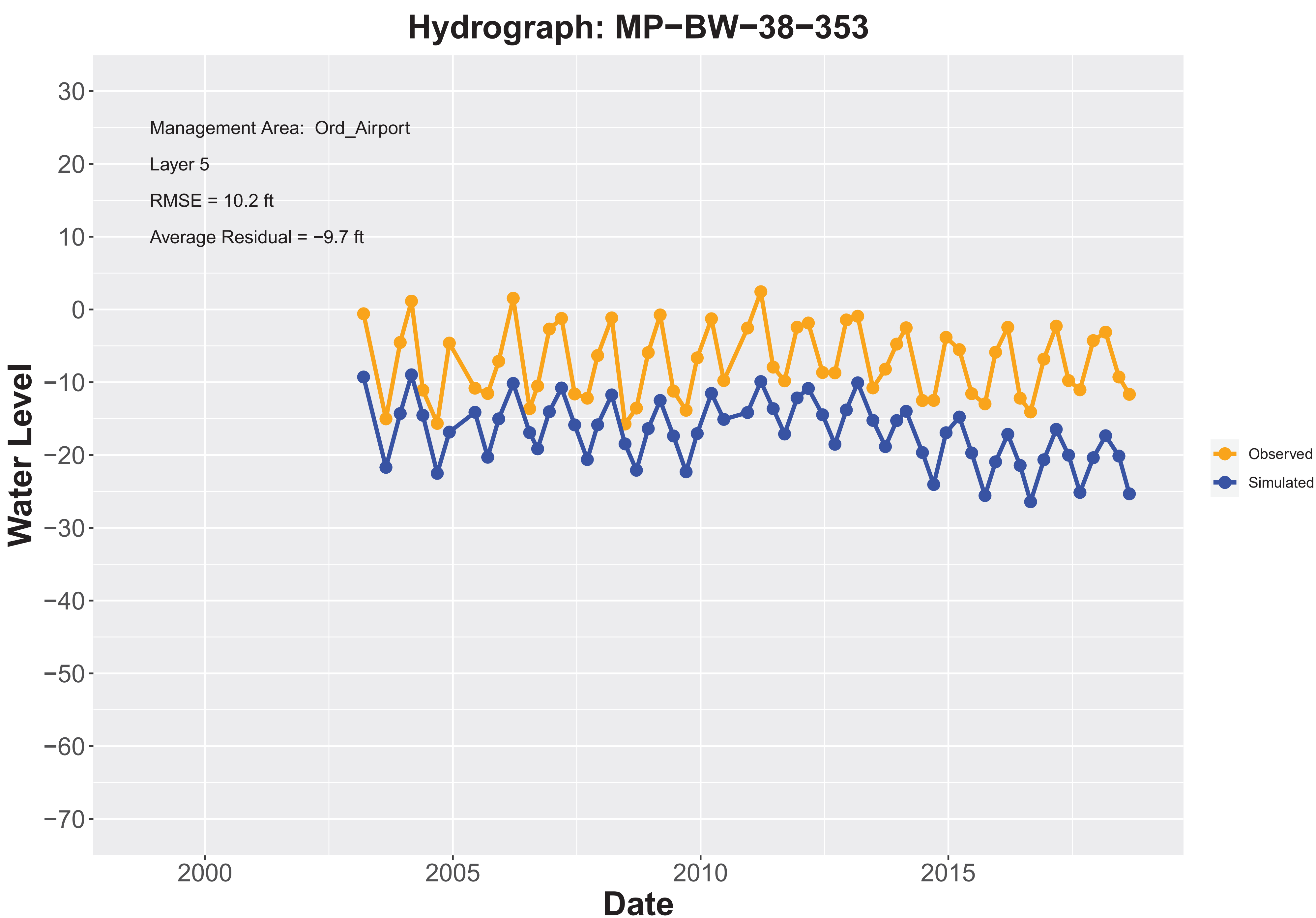


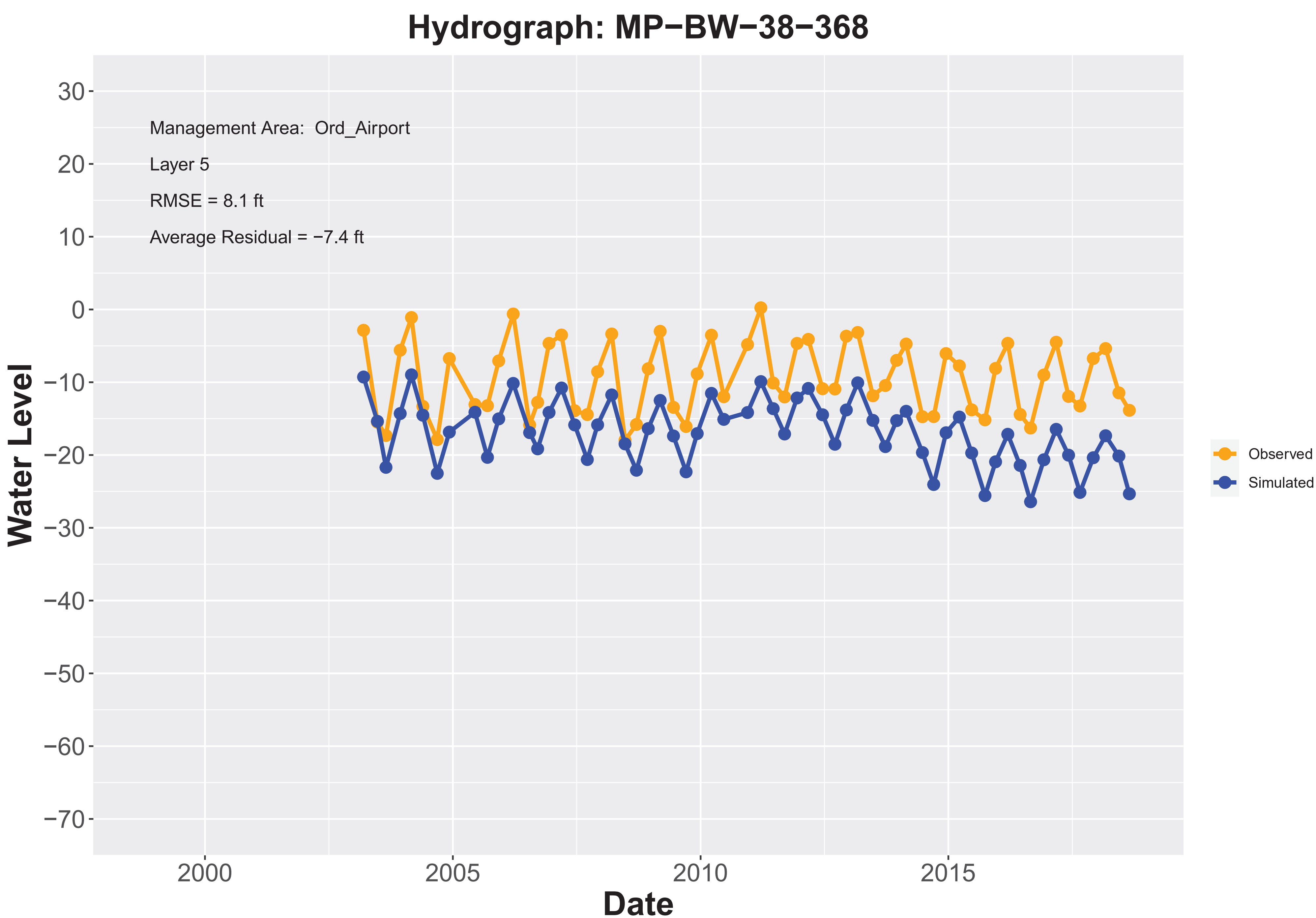
Hydrograph: MP−BW−37−460
Management Area: Ord_Airport
Layer 7
RMSE = 7.9 ft
Average Residual = −7.5 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

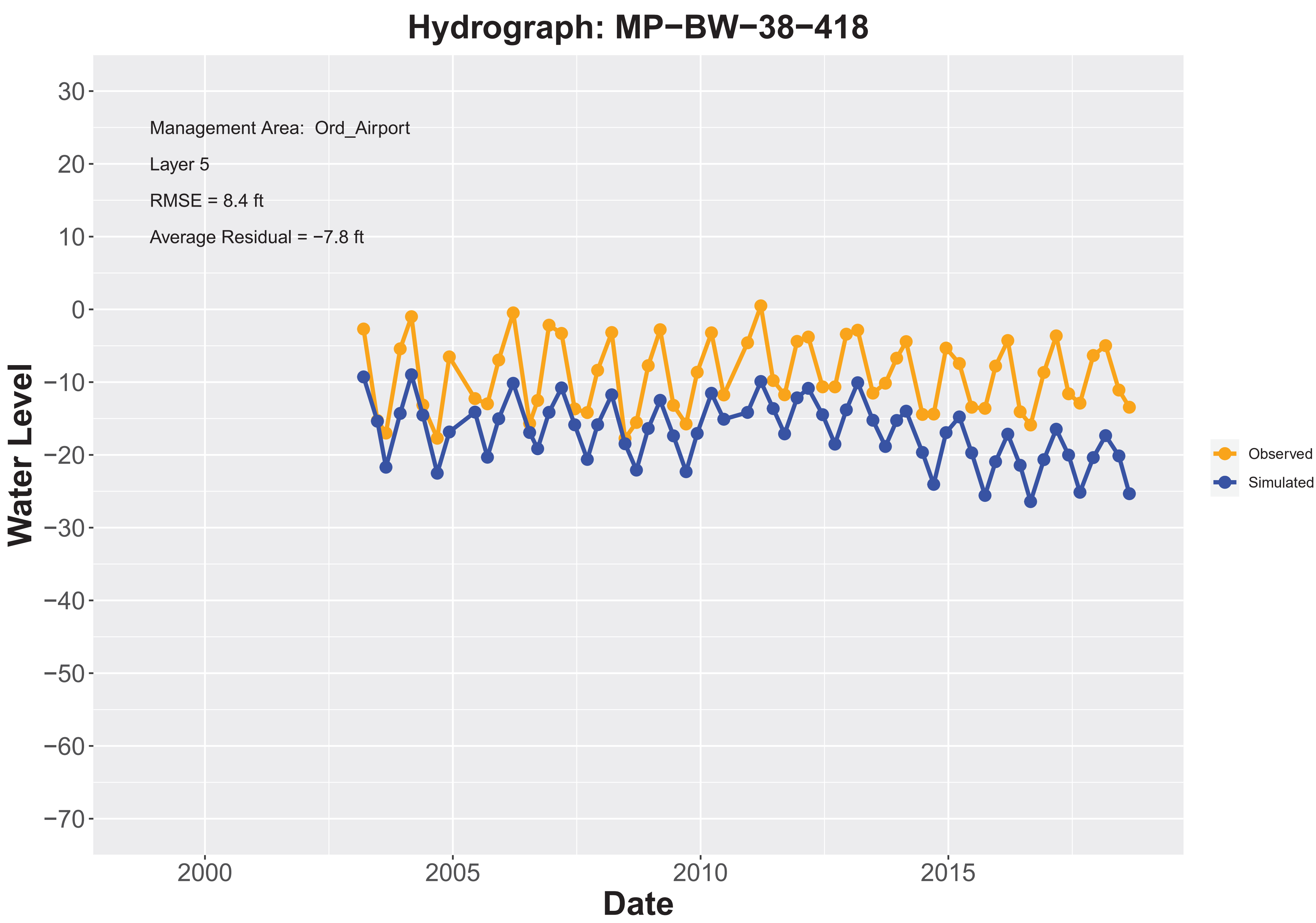

Hydrograph: MP−BW−38−327
Management Area: Ord_Airport
Layer 5
RMSE = 8.1 ft
Average Residual = −7.4 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

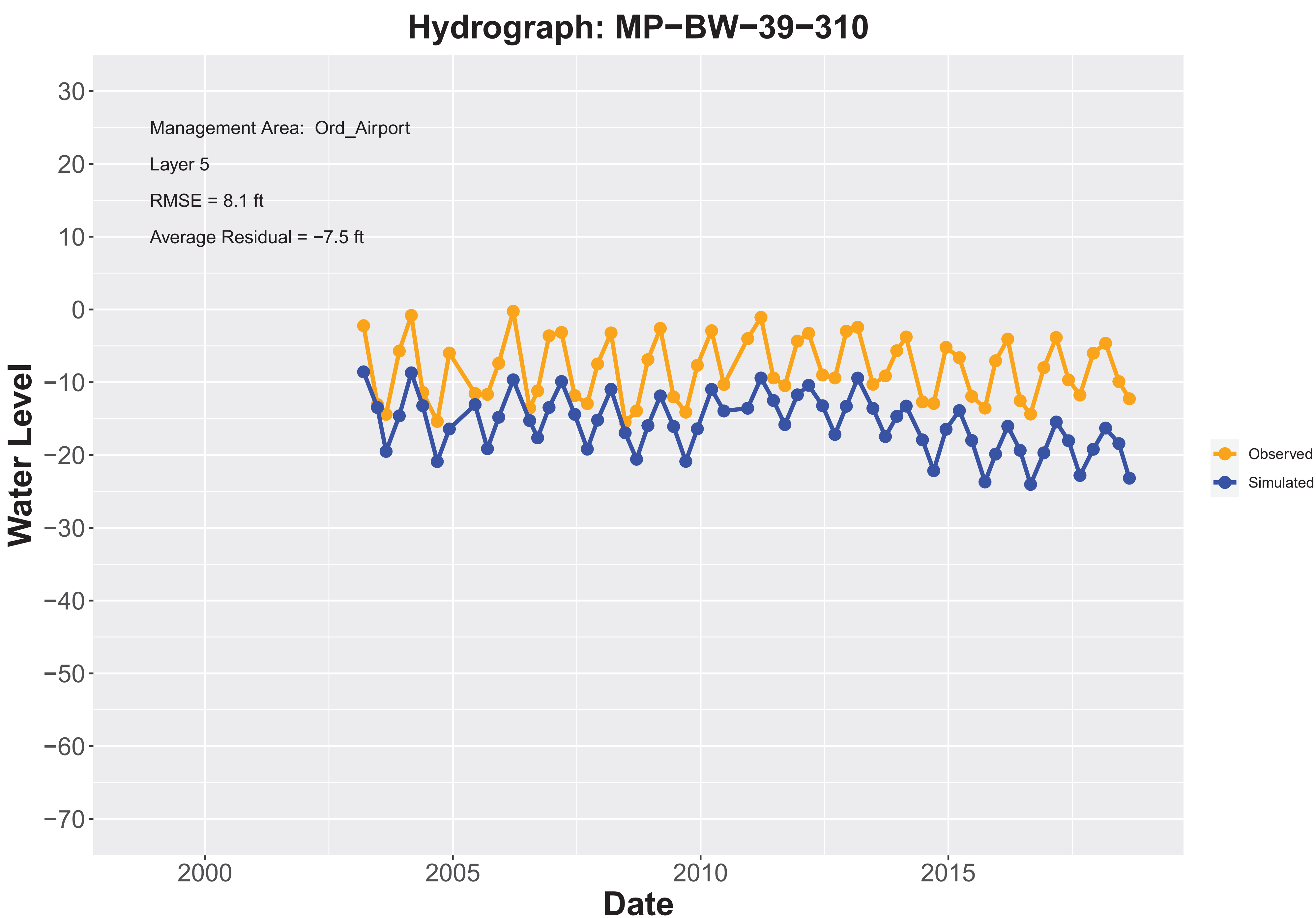


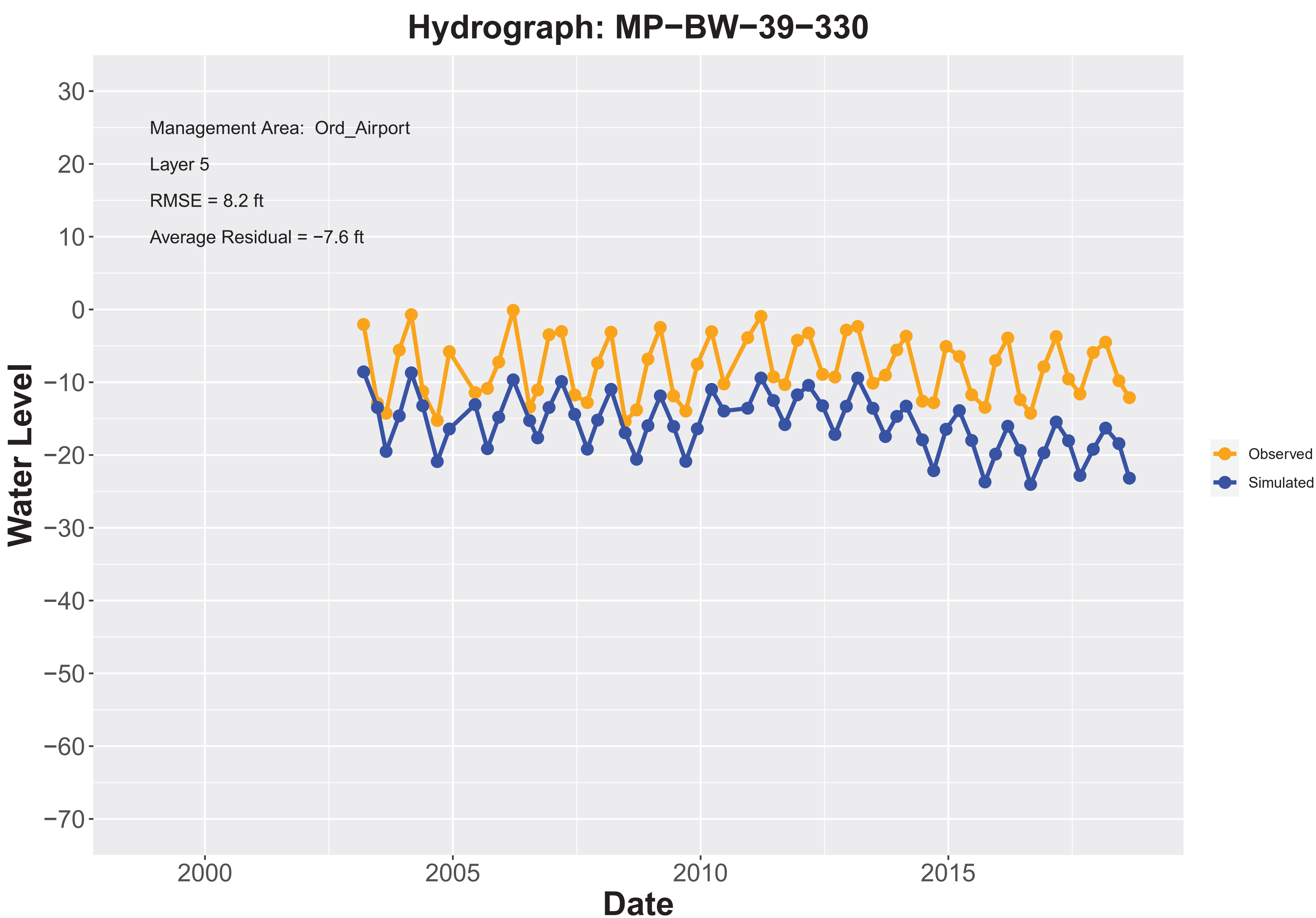
Hydrograph: MP−BW−38−341
Management Area: Ord_Airport
Layer 5
RMSE = 10.1 ft
Average Residual = −9.6 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MP−BW−38−353
Management Area: Ord_Airport
Layer 5
RMSE = 10.2 ft
Average Residual = −9.7 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated

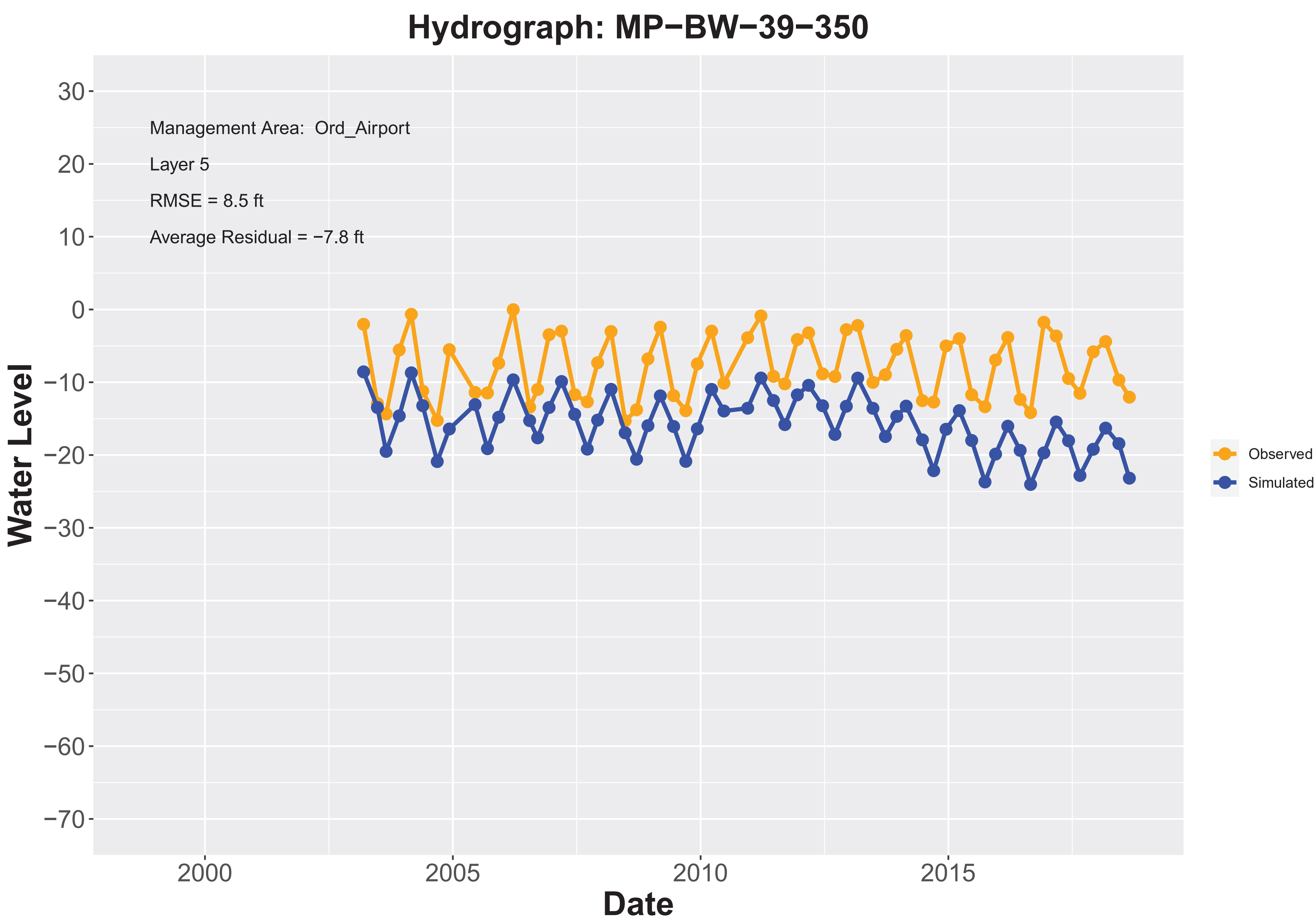

Hydrograph: MP−BW−38−368
Management Area: Ord_Airport
Layer 5
RMSE = 8.1 ft
Average Residual = −7.4 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

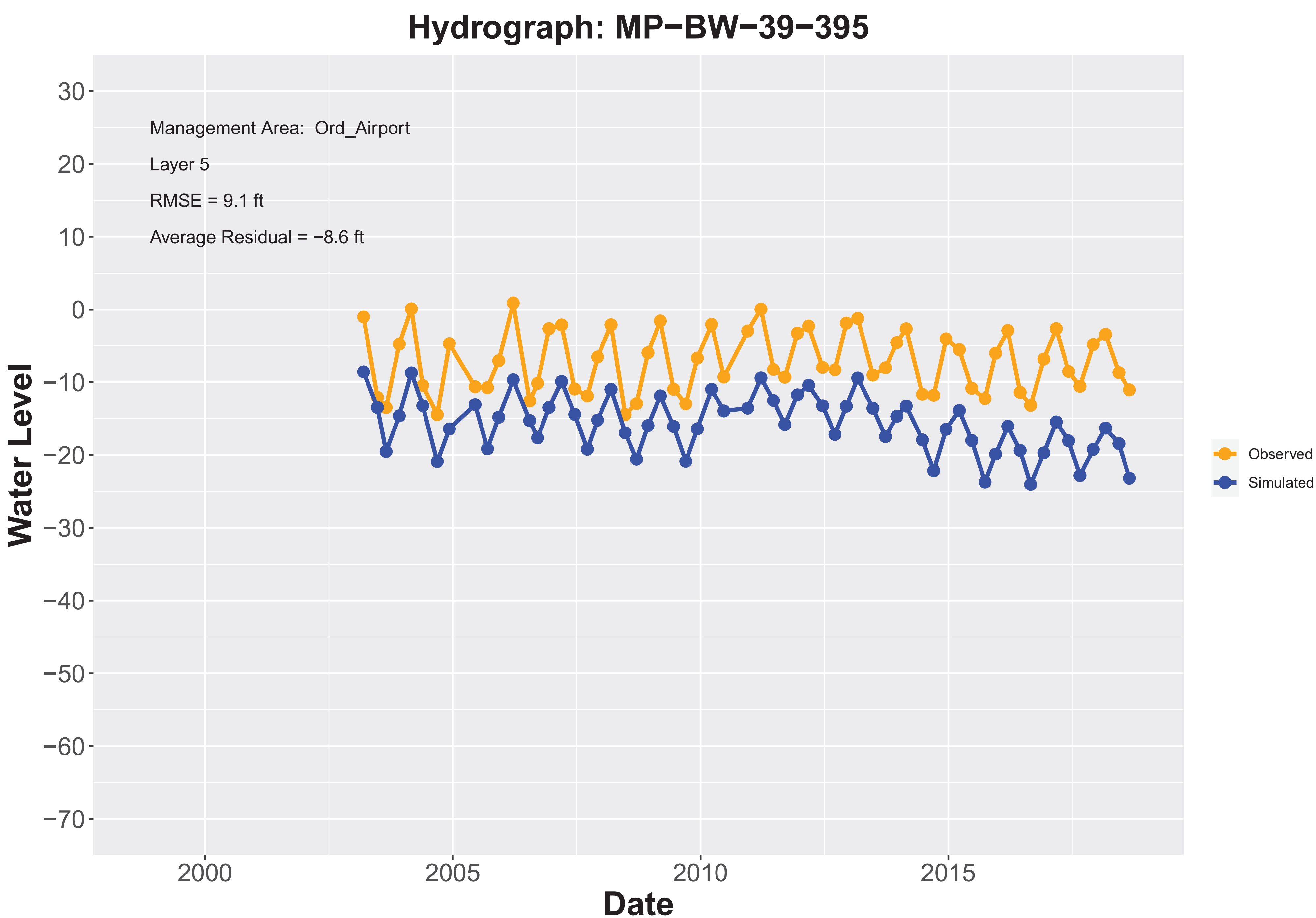

Hydrograph: MP−BW−38−418
Management Area: Ord_Airport
Layer 5
RMSE = 8.4 ft
Average Residual = −7.8 ft
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Water Level
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MP−BW−39−310
Management Area: Ord_Airport
Layer 5
RMSE = 8.1 ft
Average Residual = −7.5 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated

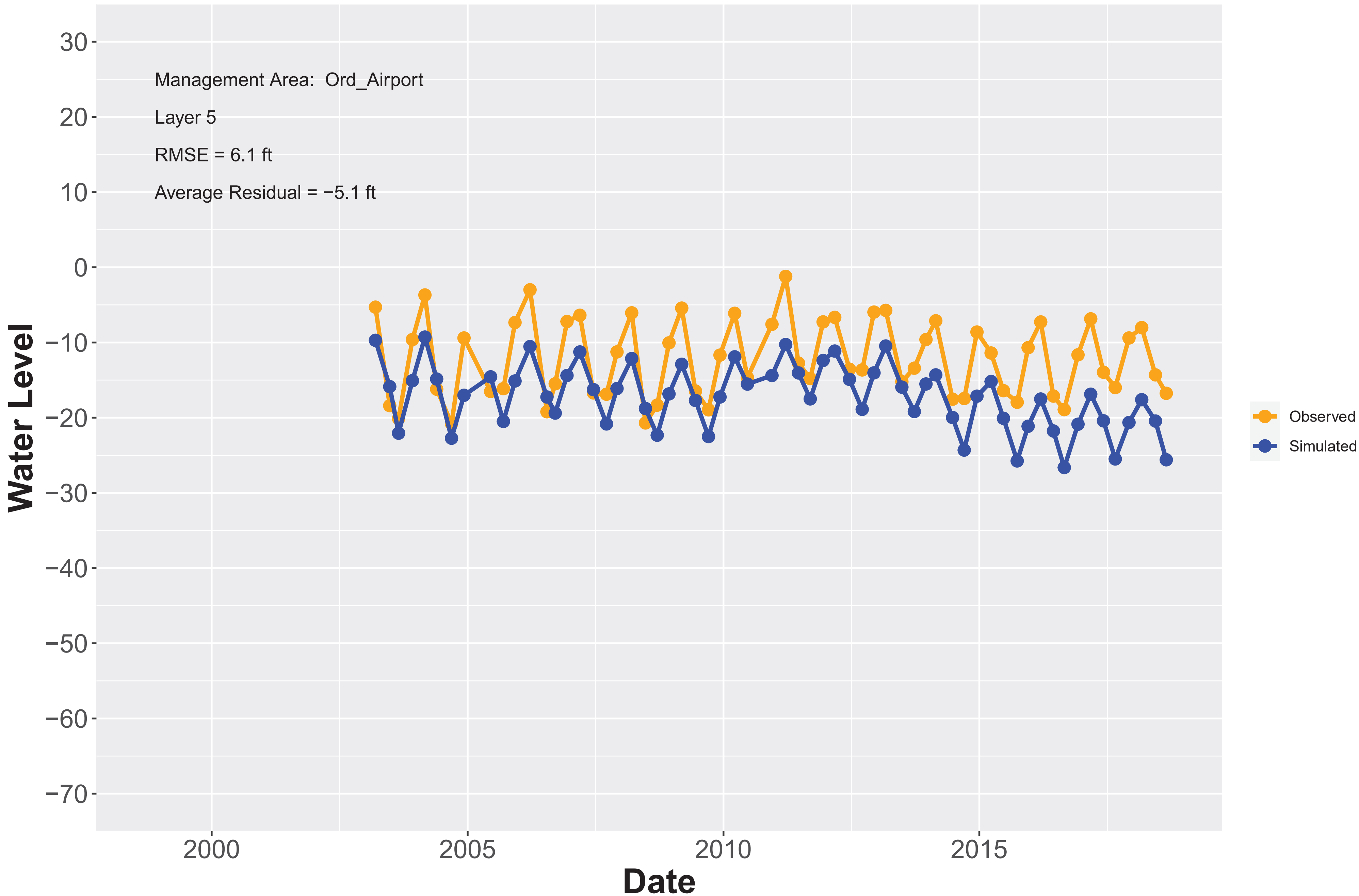


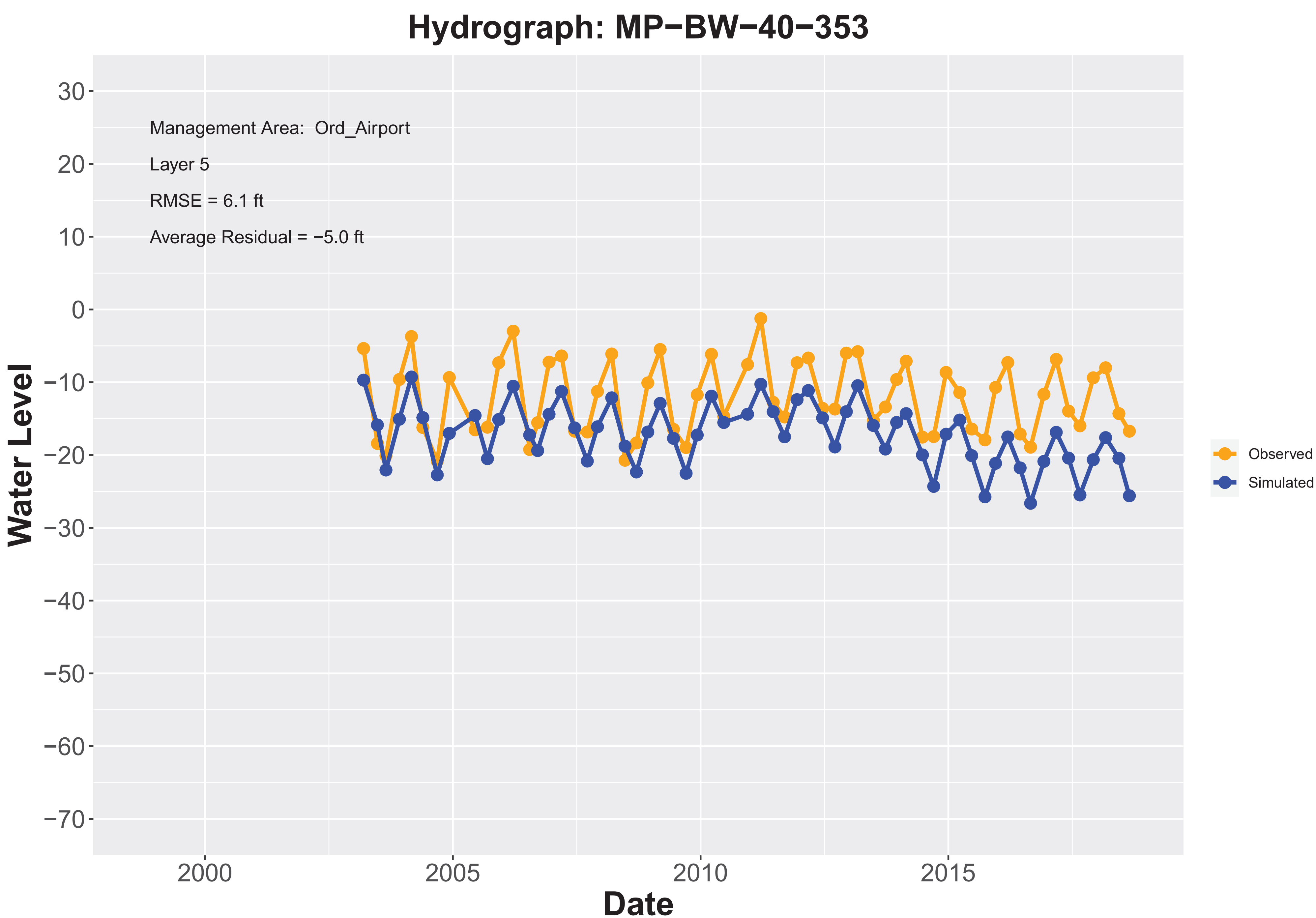
Hydrograph: MP−BW−39−330
Management Area: Ord_Airport
Layer 5
RMSE = 8.2 ft
Average Residual = −7.6 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

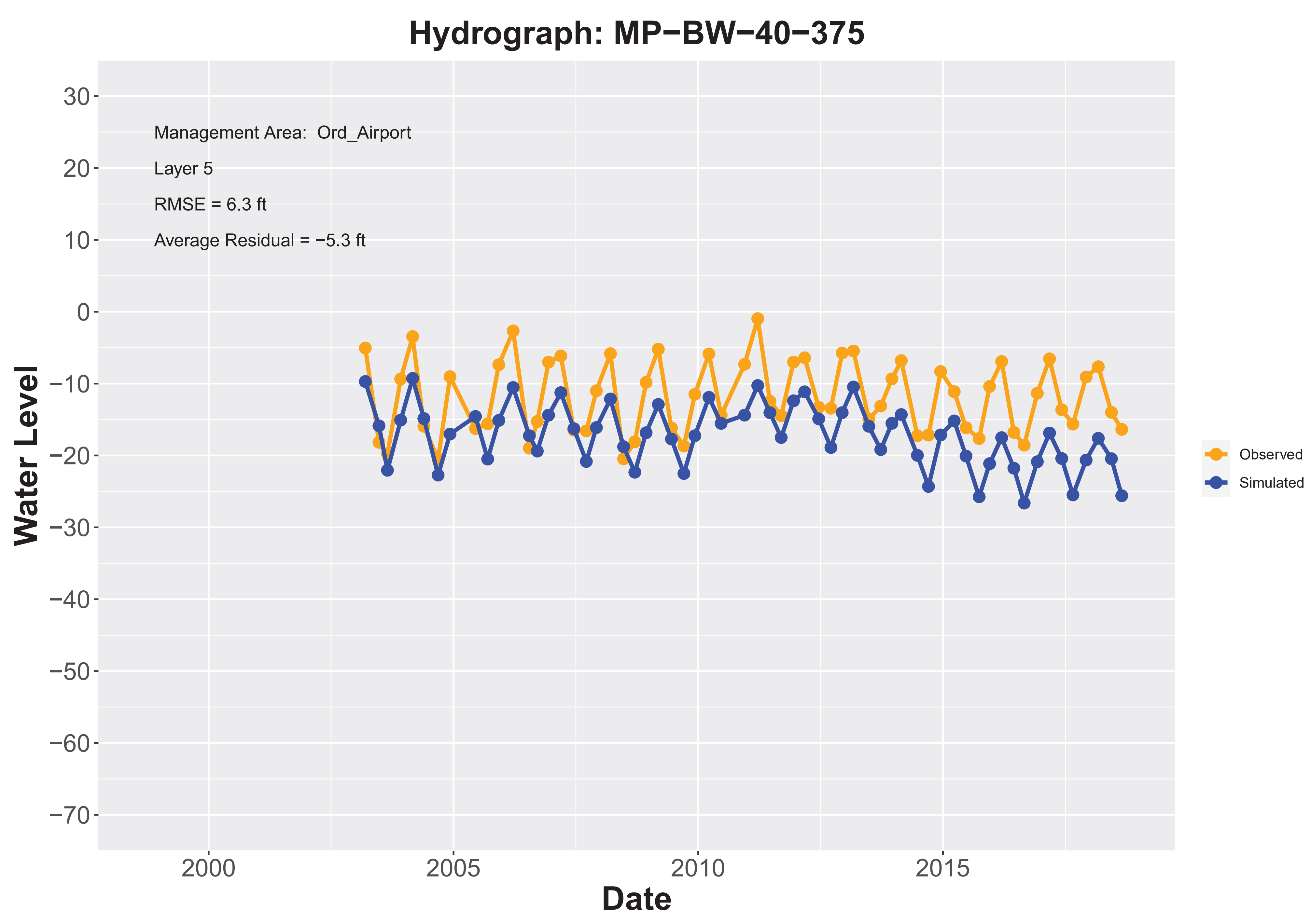

Hydrograph: MP−BW−39−350
Management Area: Ord_Airport
Layer 5
RMSE = 8.5 ft
Average Residual = −7.8 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

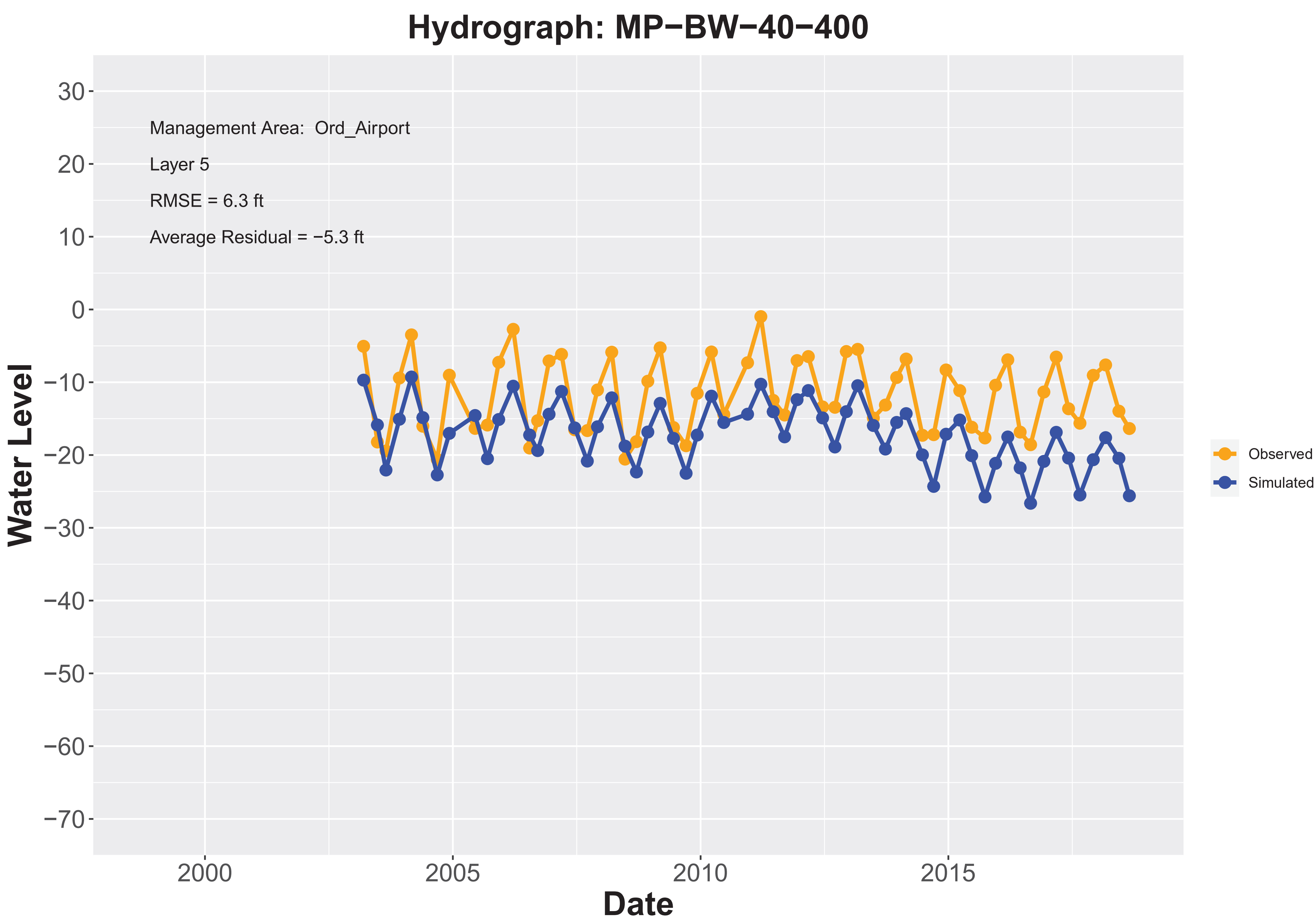

Hydrograph: MP−BW−39−395
Management Area: Ord_Airport
Layer 5
RMSE = 9.1 ft
Average Residual = −8.6 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated

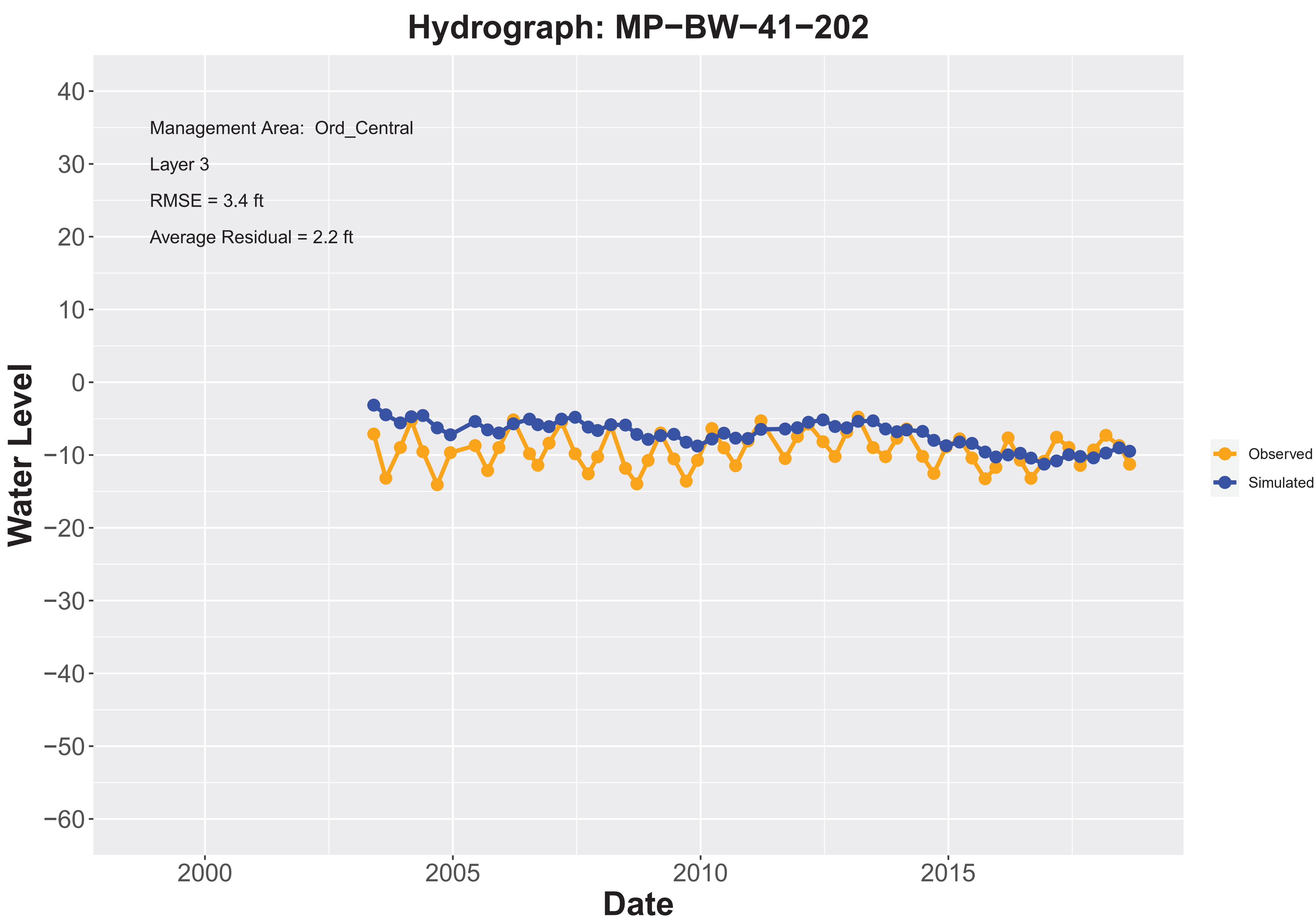
Hydrograph: MP−BW−40−333



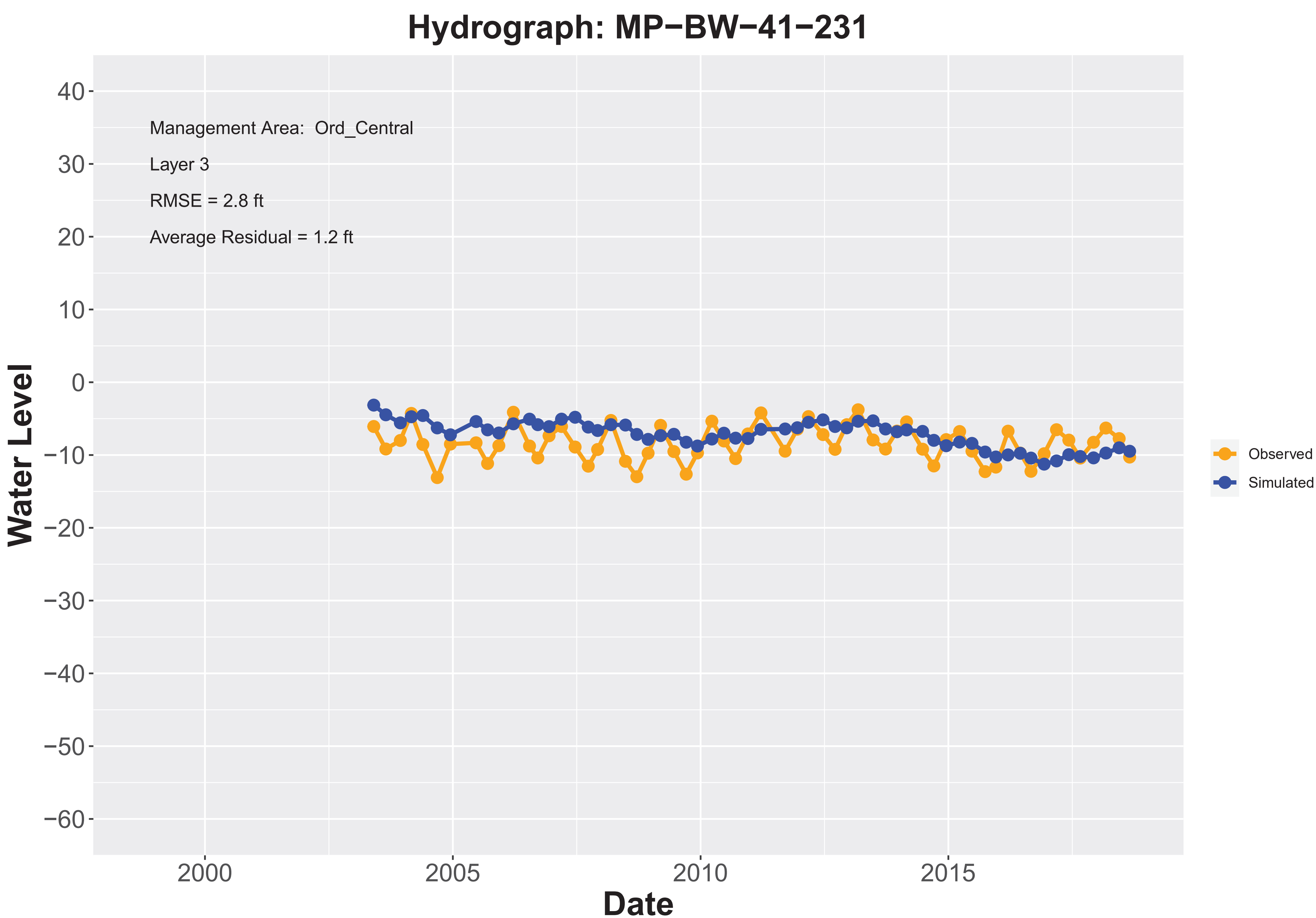

Hydrograph: MP−BW−40−353
Management Area: Ord_Airport
Layer 5
RMSE = 6.1 ft
Average Residual = −5.0 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated


Hydrograph: MP−BW−40−375
Management Area: Ord_Airport
Layer 5
RMSE = 6.3 ft
Average Residual = −5.3 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated

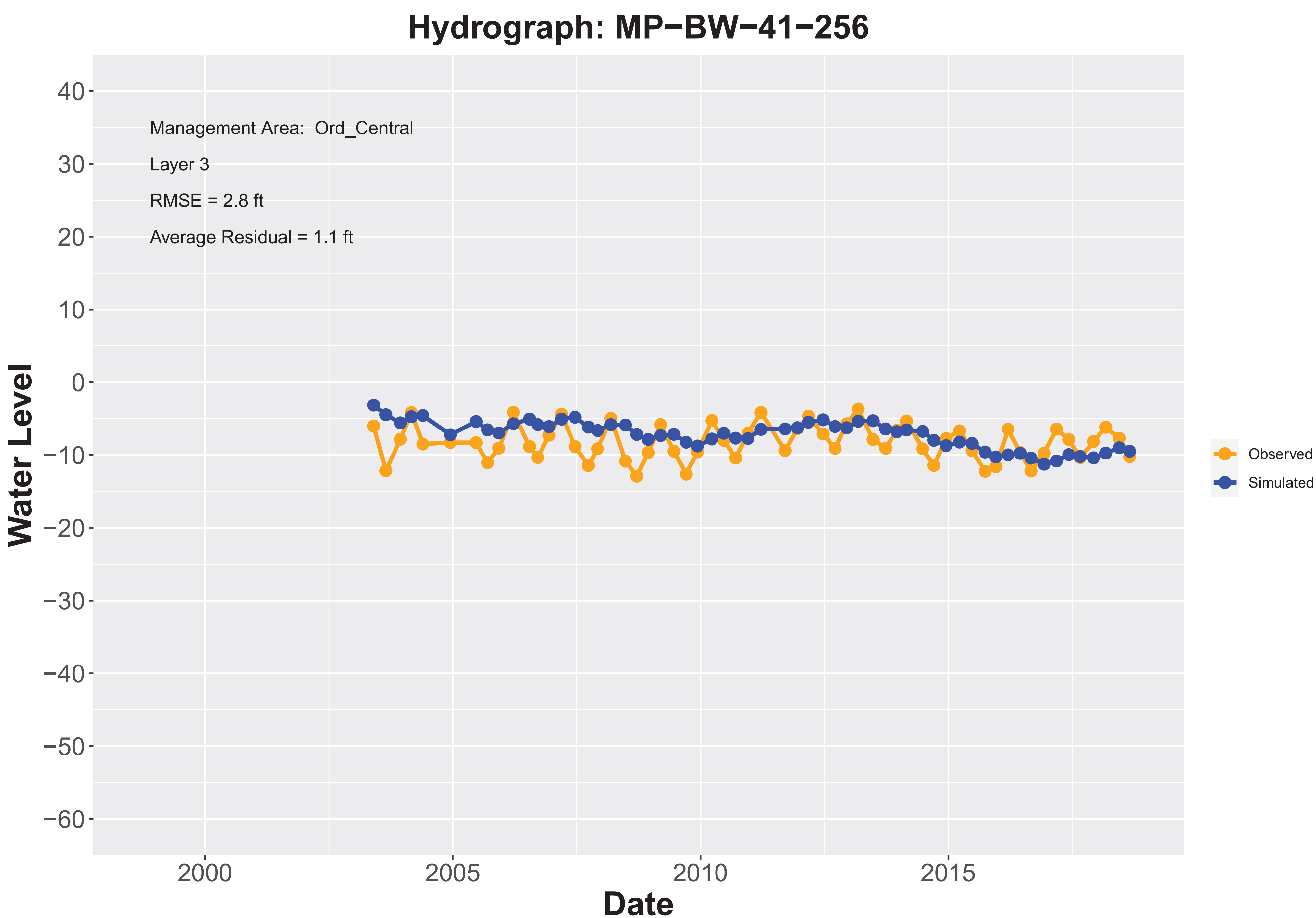

Hydrograph: MP−BW−40−400
Management Area: Ord_Airport
Layer 5
RMSE = 6.3 ft
Average Residual = −5.3 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated



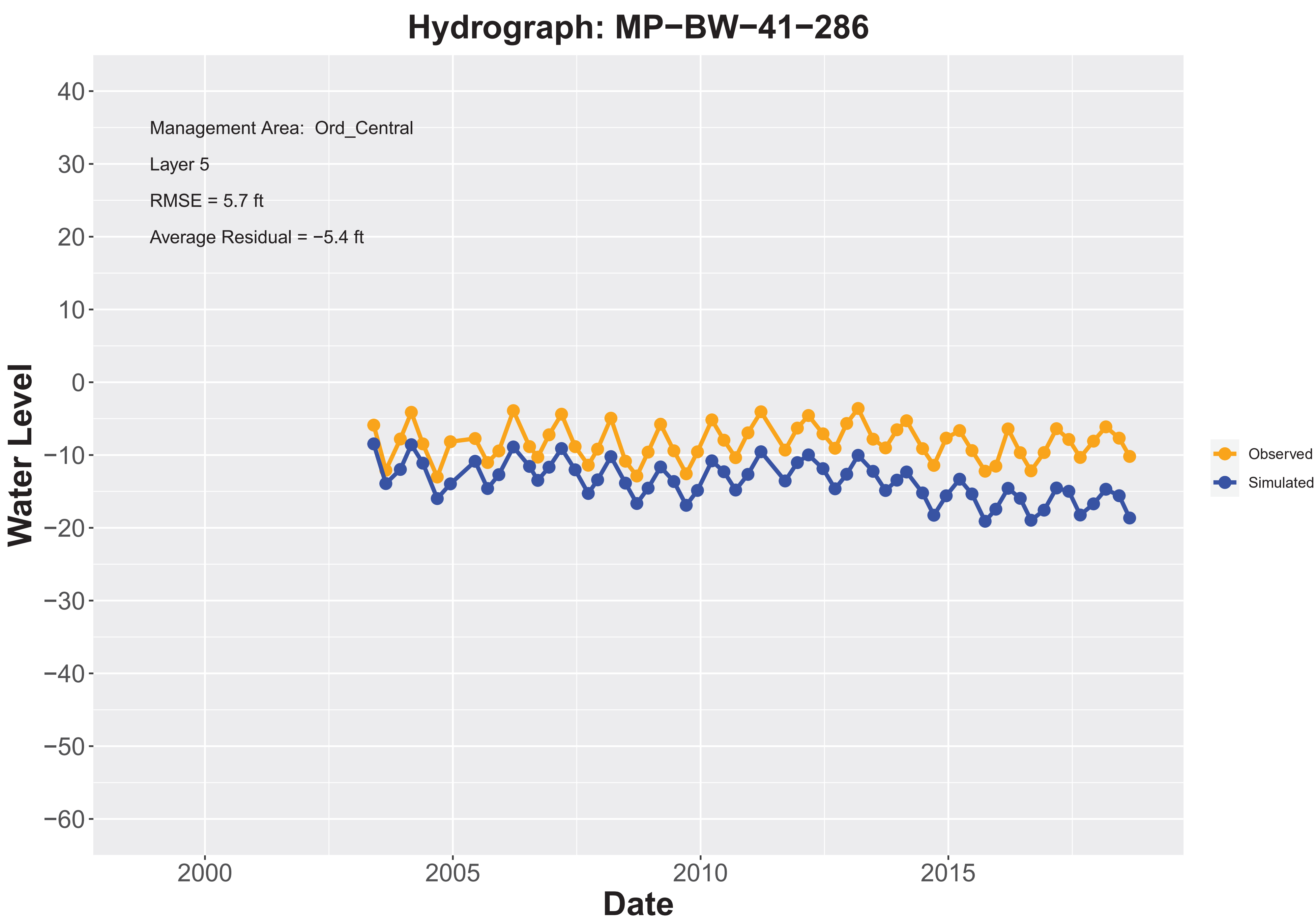
Hydrograph: MP−BW−41−202
Management Area: Ord_Central
Layer 3
RMSE = 3.4 ft
Average Residual = 2.2 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated



Hydrograph: MP−BW−41−231
Management Area: Ord_Central
Layer 3
RMSE = 2.8 ft
Average Residual = 1.2 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

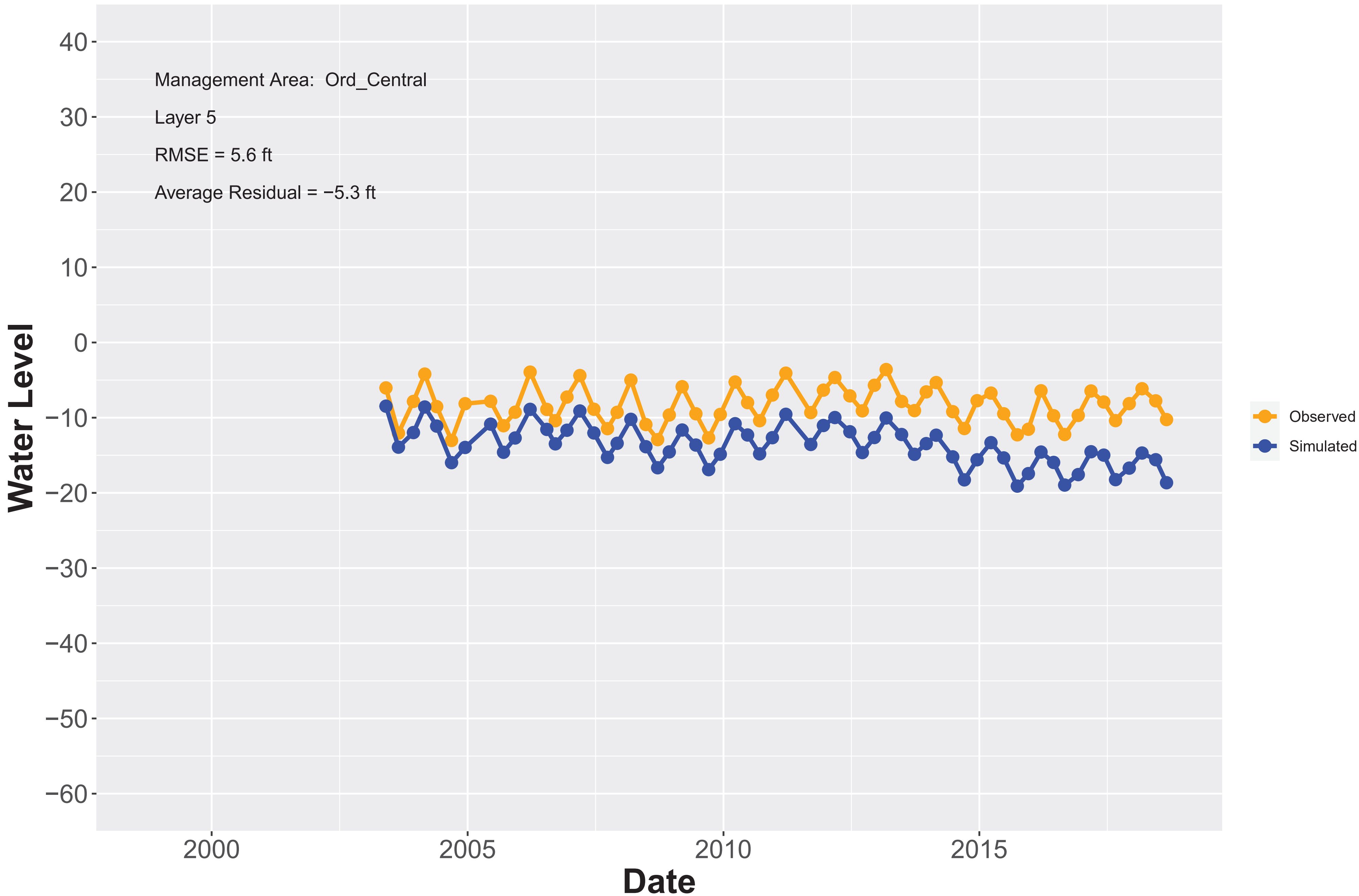


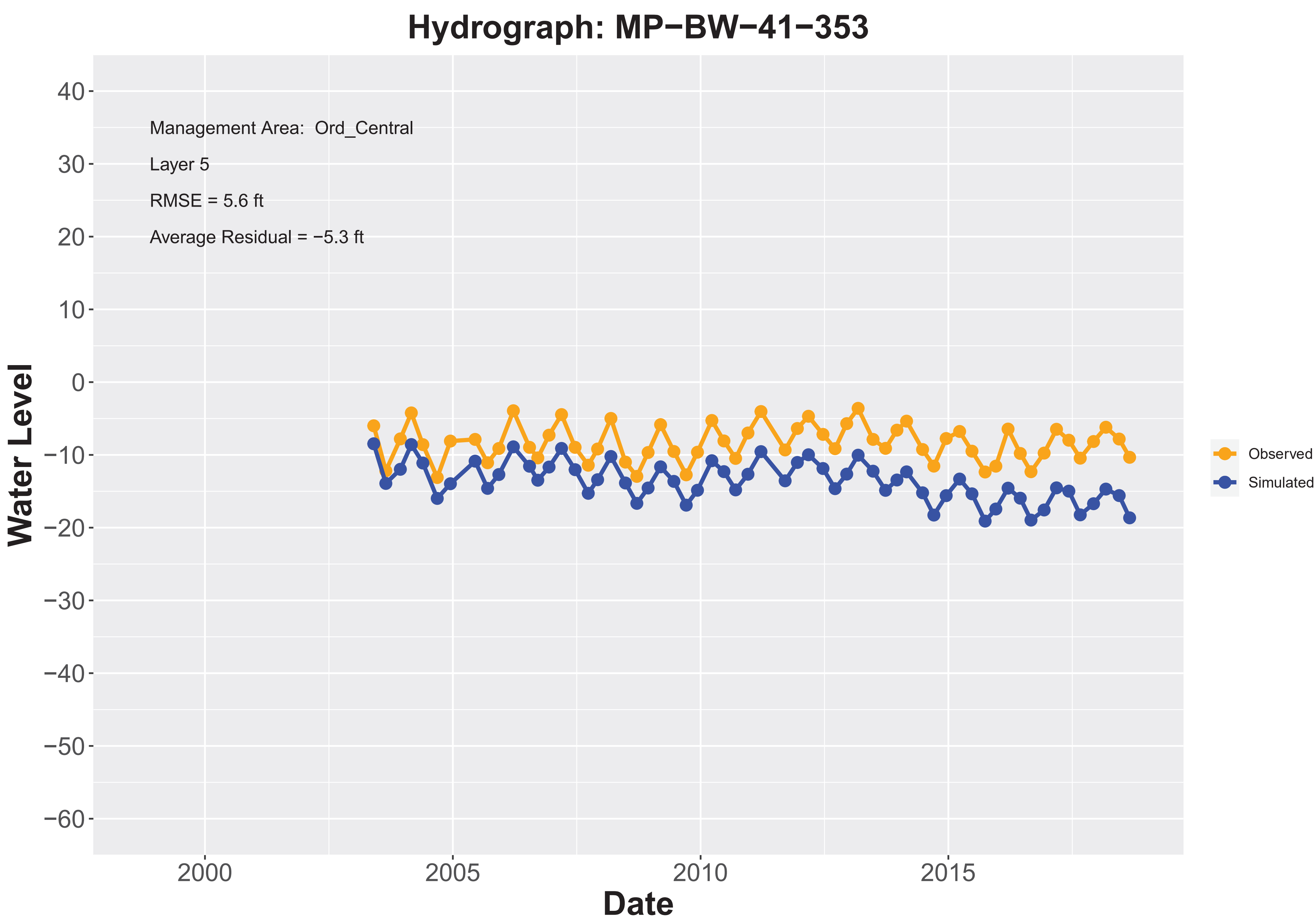
Hydrograph: MP−BW−41−256
Management Area: Ord_Central
Layer 3
RMSE = 2.8 ft
Average Residual = 1.1 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated



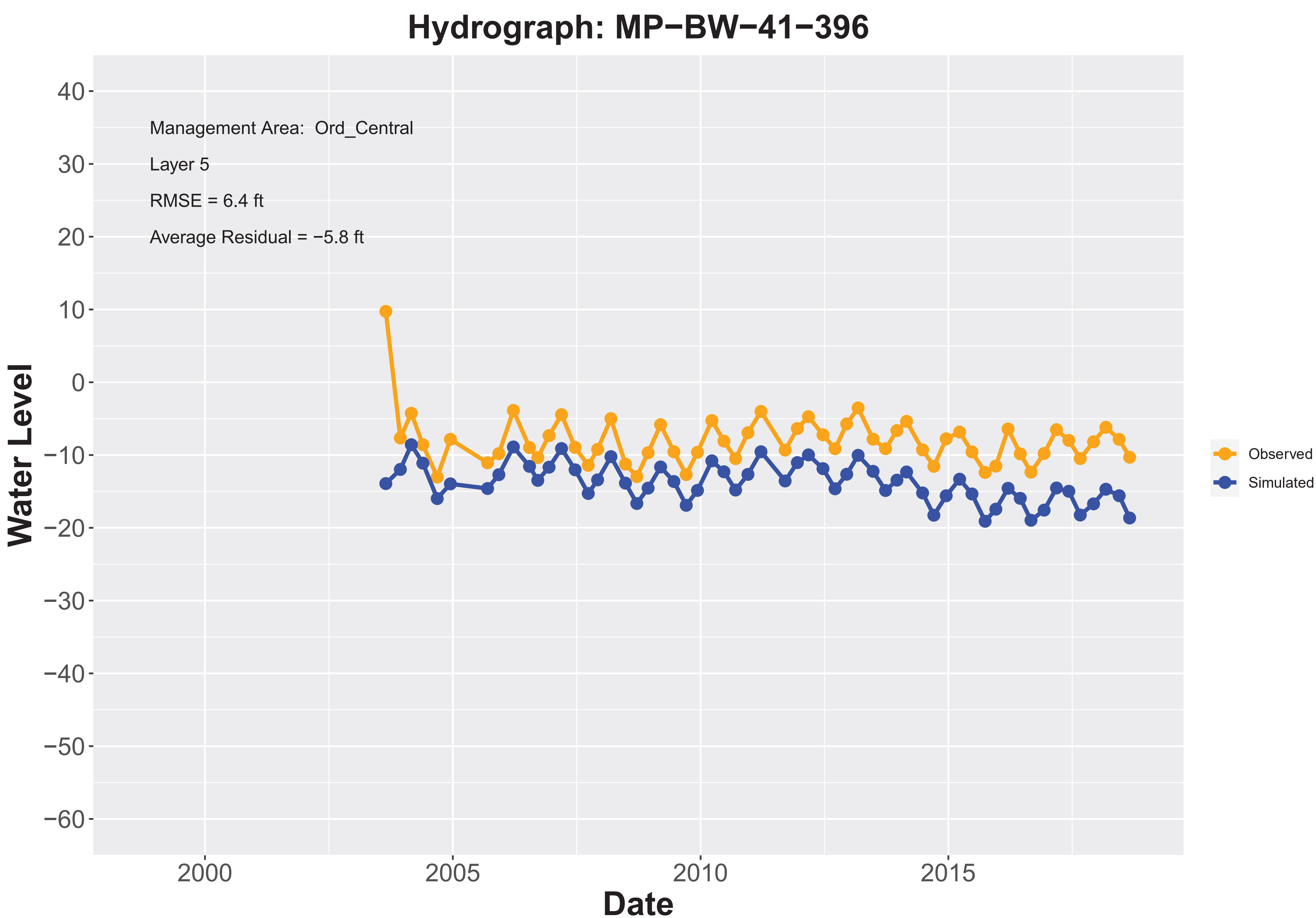
Hydrograph: MP−BW−41−286
Management Area: Ord_Central
Layer 5
RMSE = 5.7 ft
Average Residual = −5.4 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MP−BW−41−318

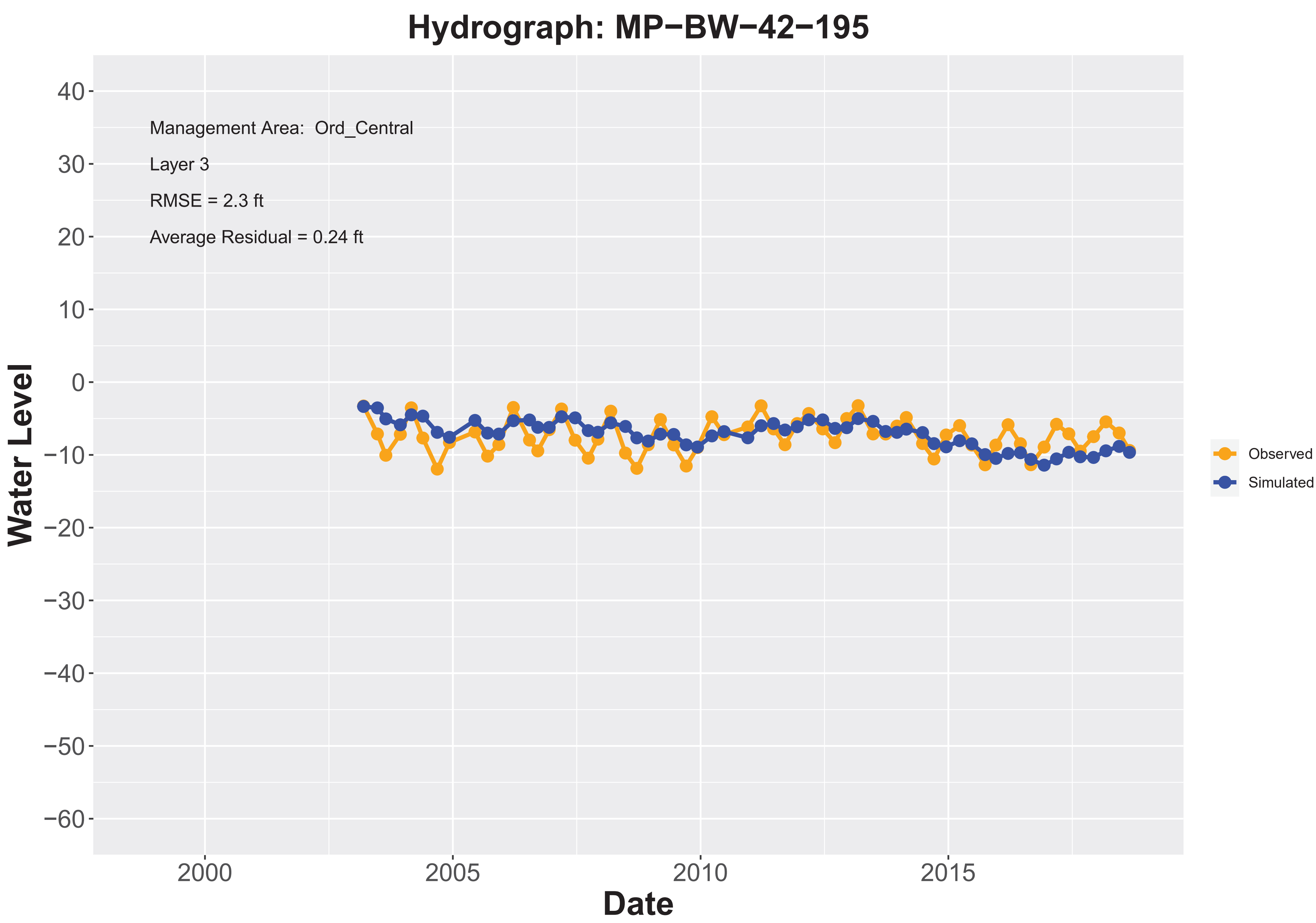




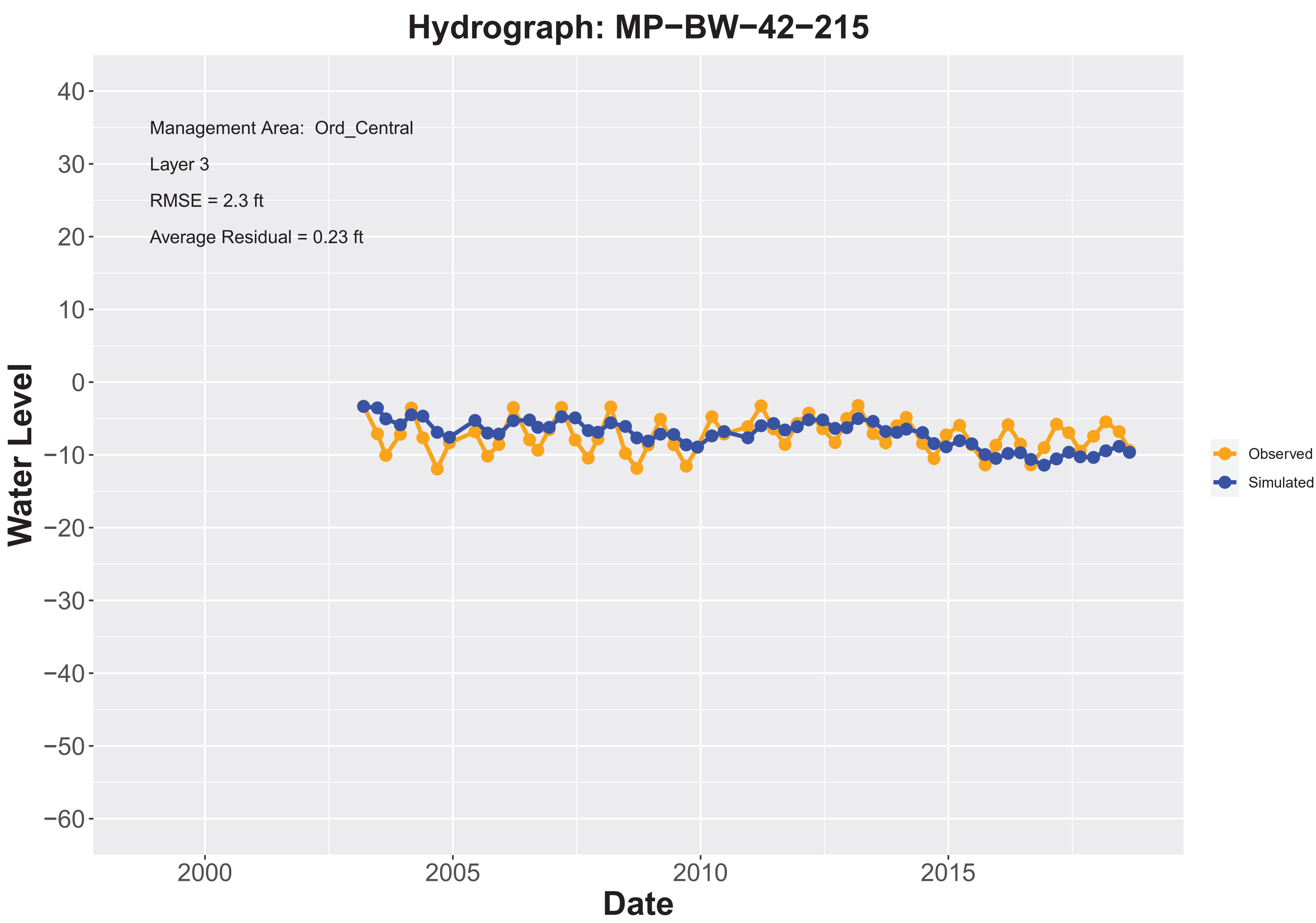
Hydrograph: MP−BW−41−353
Management Area: Ord_Central
Layer 5
RMSE = 5.6 ft
Average Residual = −5.3 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

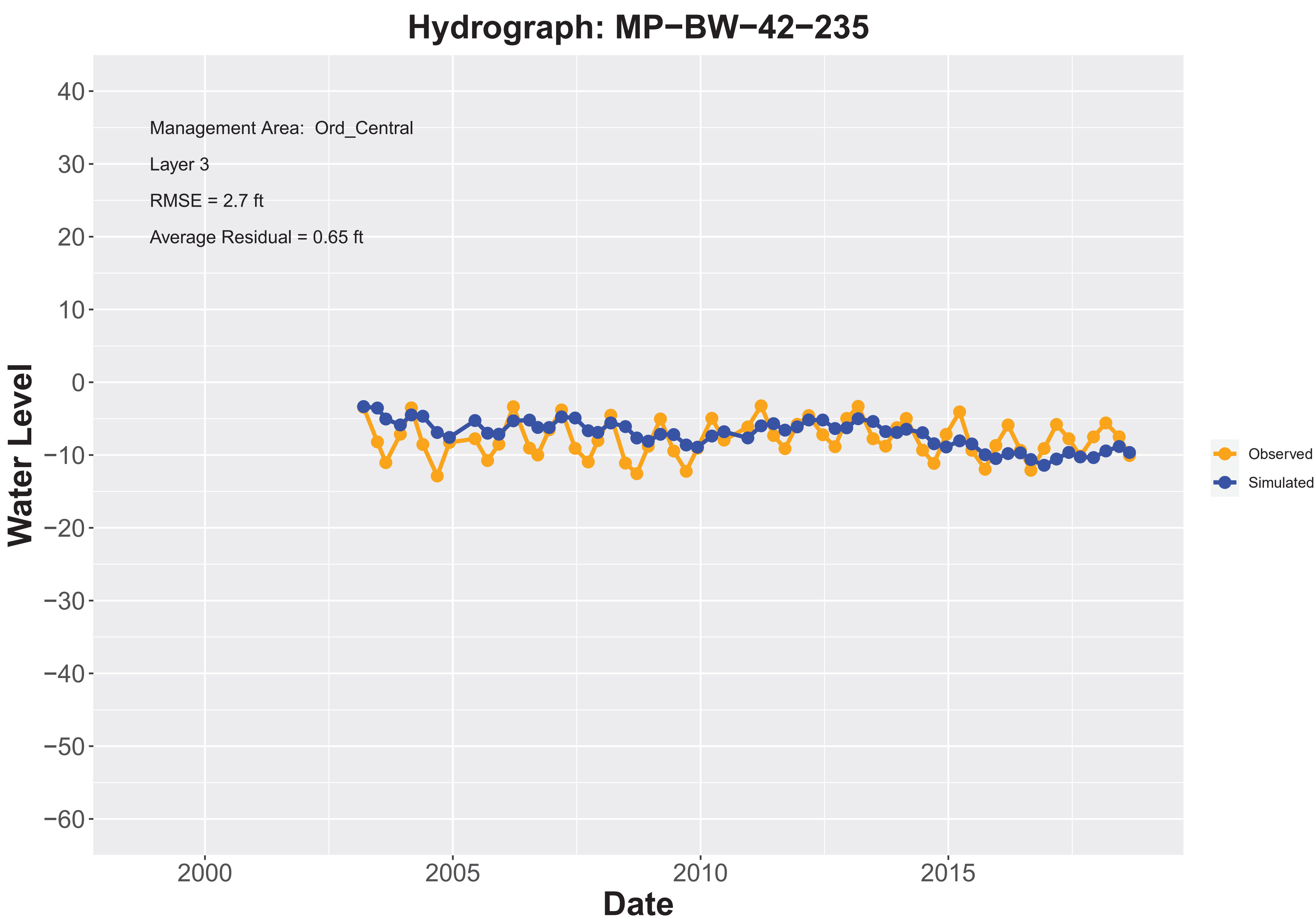


Hydrograph: MP−BW−41−396
Management Area: Ord_Central
Layer 5
RMSE = 6.4 ft
Average Residual = −5.8 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

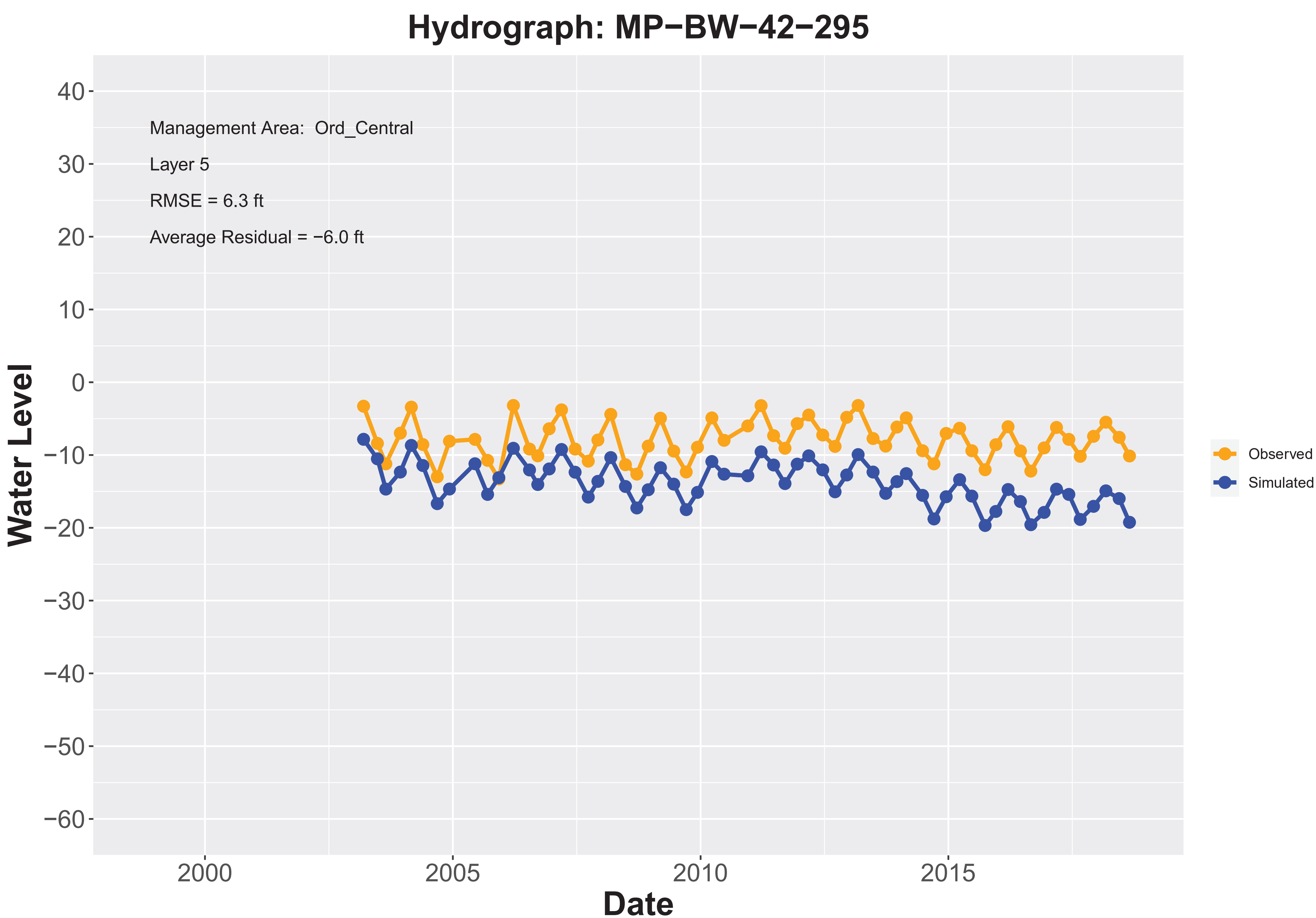


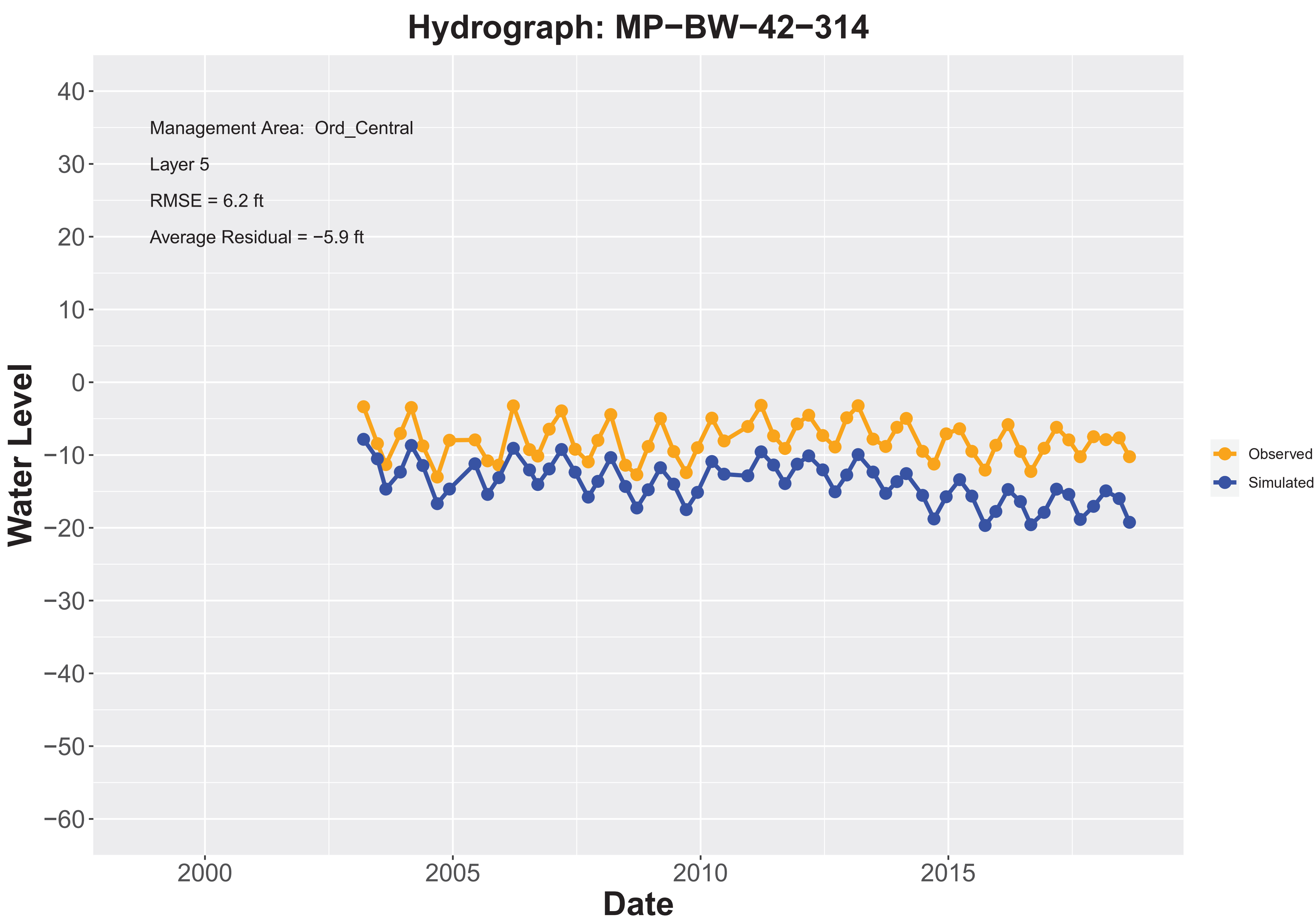
Hydrograph: MP−BW−42−195
Management Area: Ord_Central
Layer 3
RMSE = 2.3 ft
Average Residual = 0.24 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

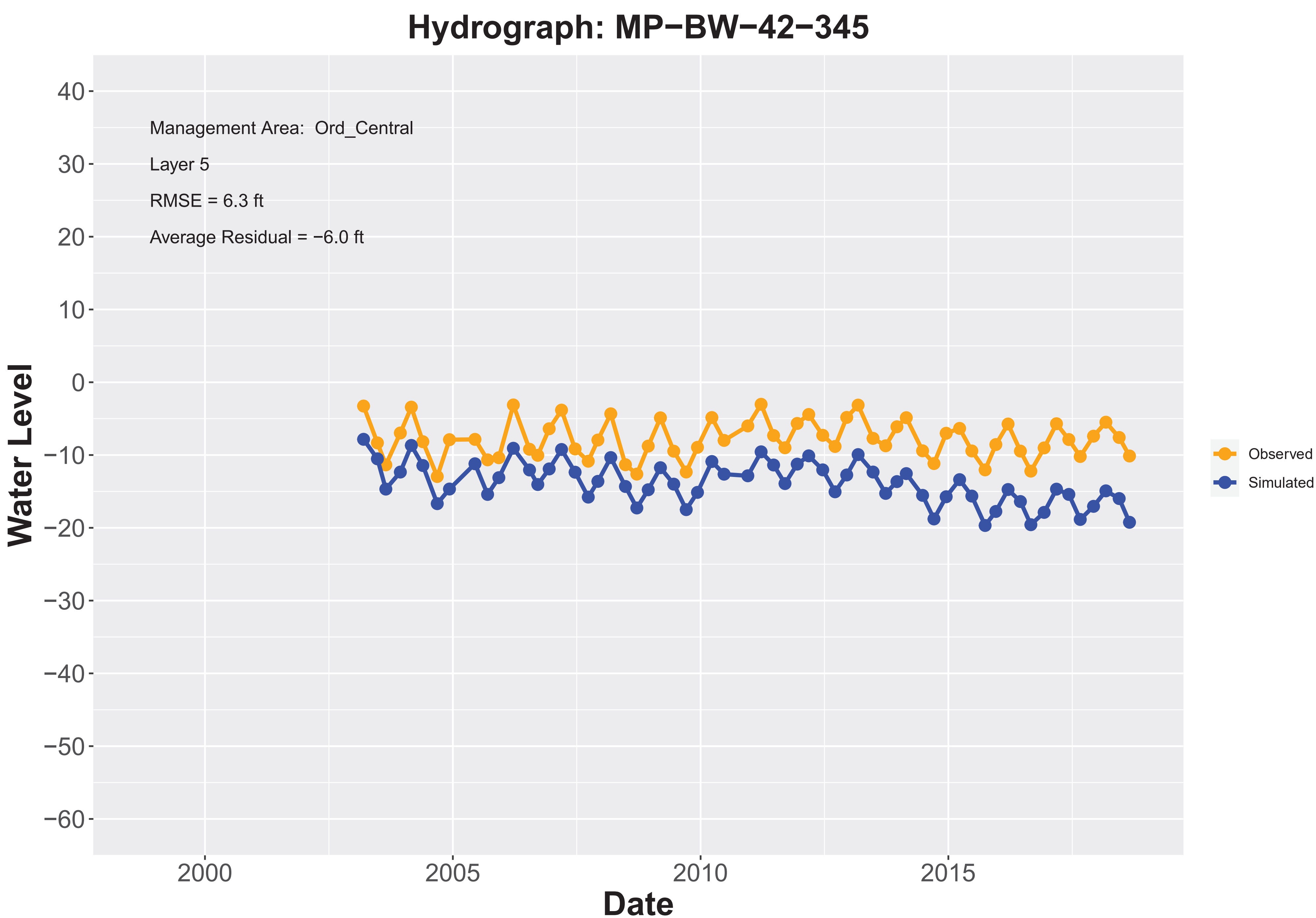

Hydrograph: MP−BW−42−215
Management Area: Ord_Central
Layer 3
RMSE = 2.3 ft
Average Residual = 0.23 ft
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Water Level
2000
2005
2010
2015
Date
Observed
Simulated



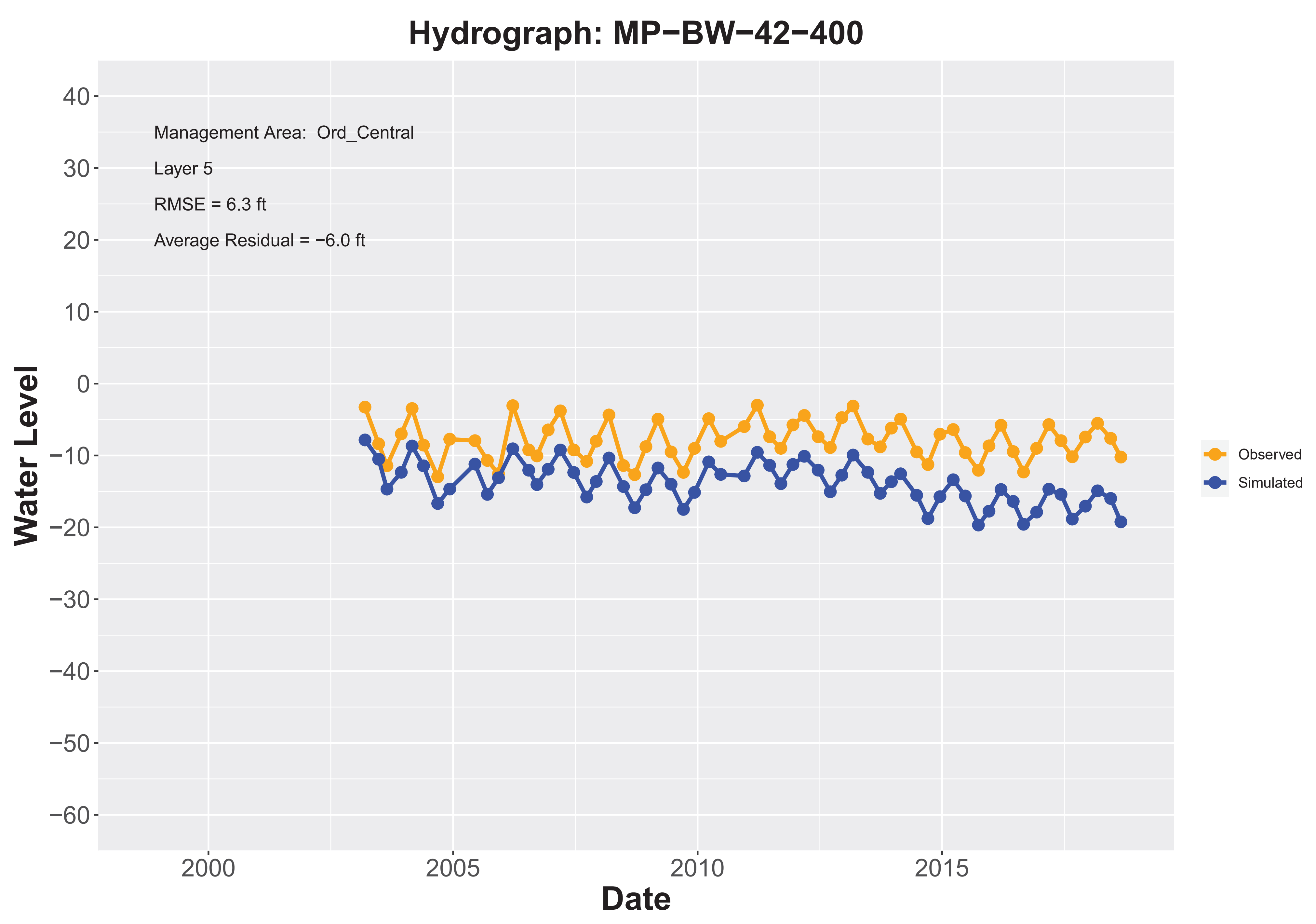
Hydrograph: MP−BW−42−235
Management Area: Ord_Central
Layer 3
RMSE = 2.7 ft
Average Residual = 0.65 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MP−BW−42−295
Management Area: Ord_Central
Layer 5
RMSE = 6.3 ft
Average Residual = −6.0 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

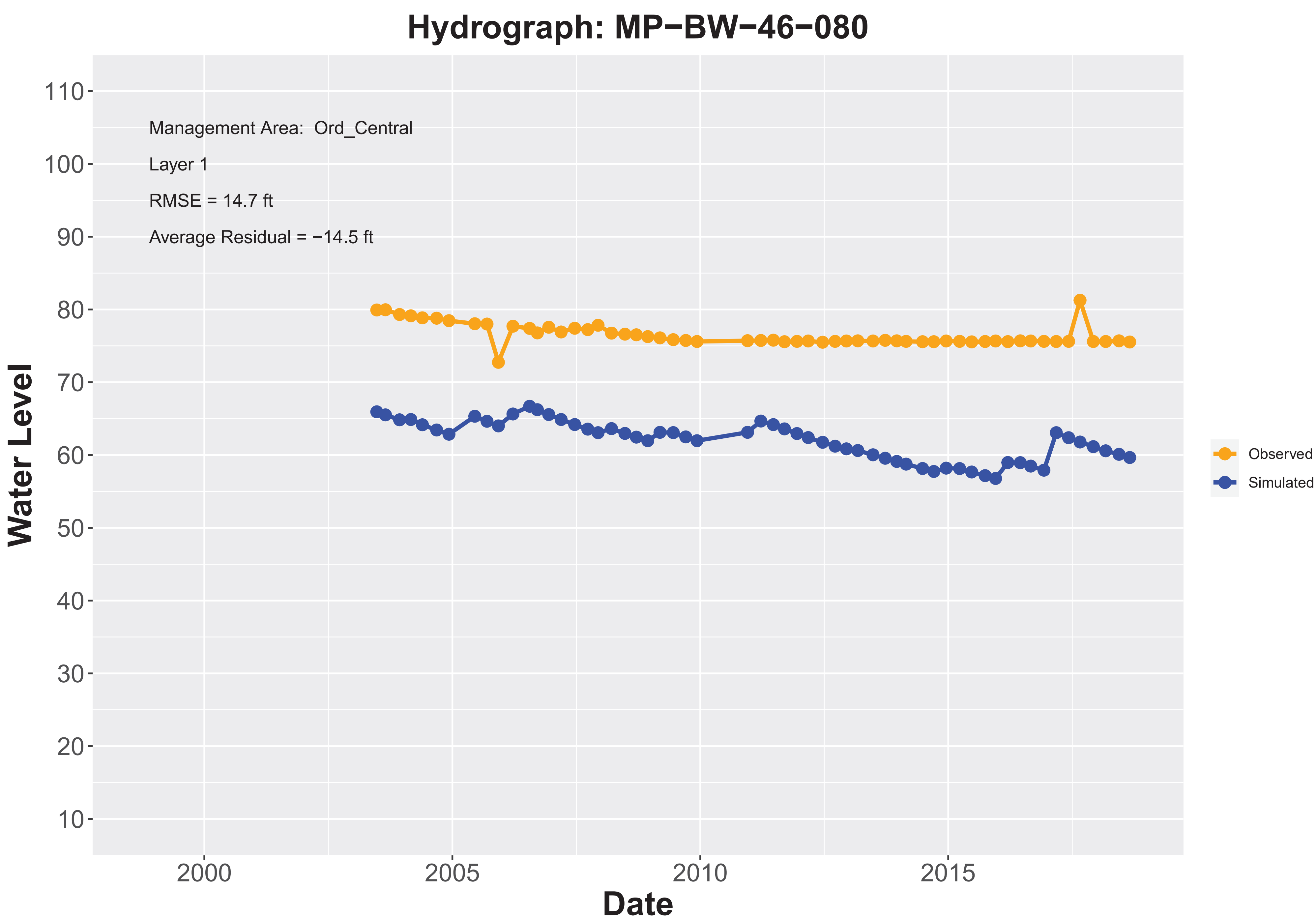

Hydrograph: MP−BW−42−314
Management Area: Ord_Central
Layer 5
RMSE = 6.2 ft
Average Residual = −5.9 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated



Hydrograph: MP−BW−42−345
Management Area: Ord_Central
Layer 5
RMSE = 6.3 ft
Average Residual = −6.0 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

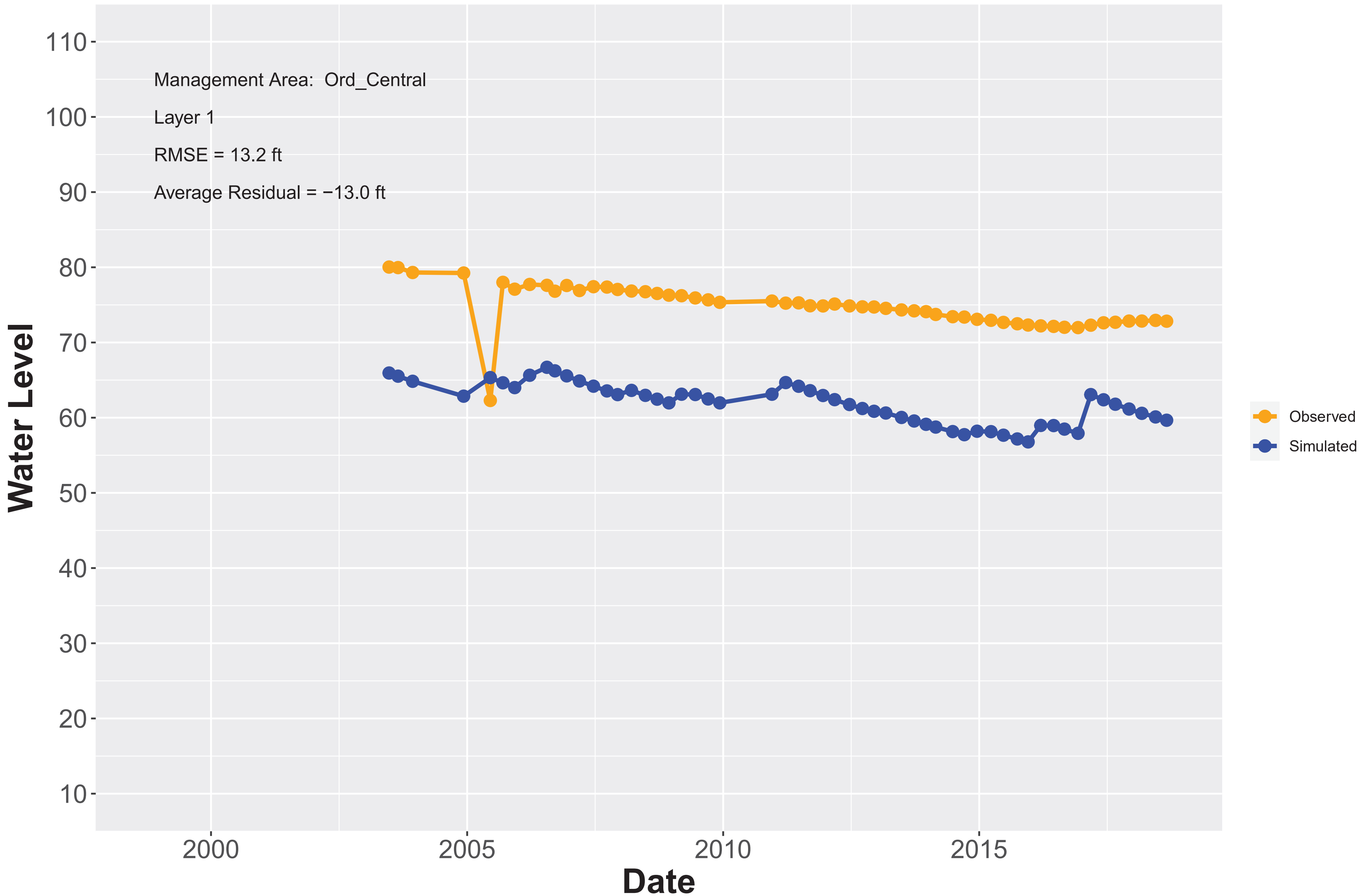


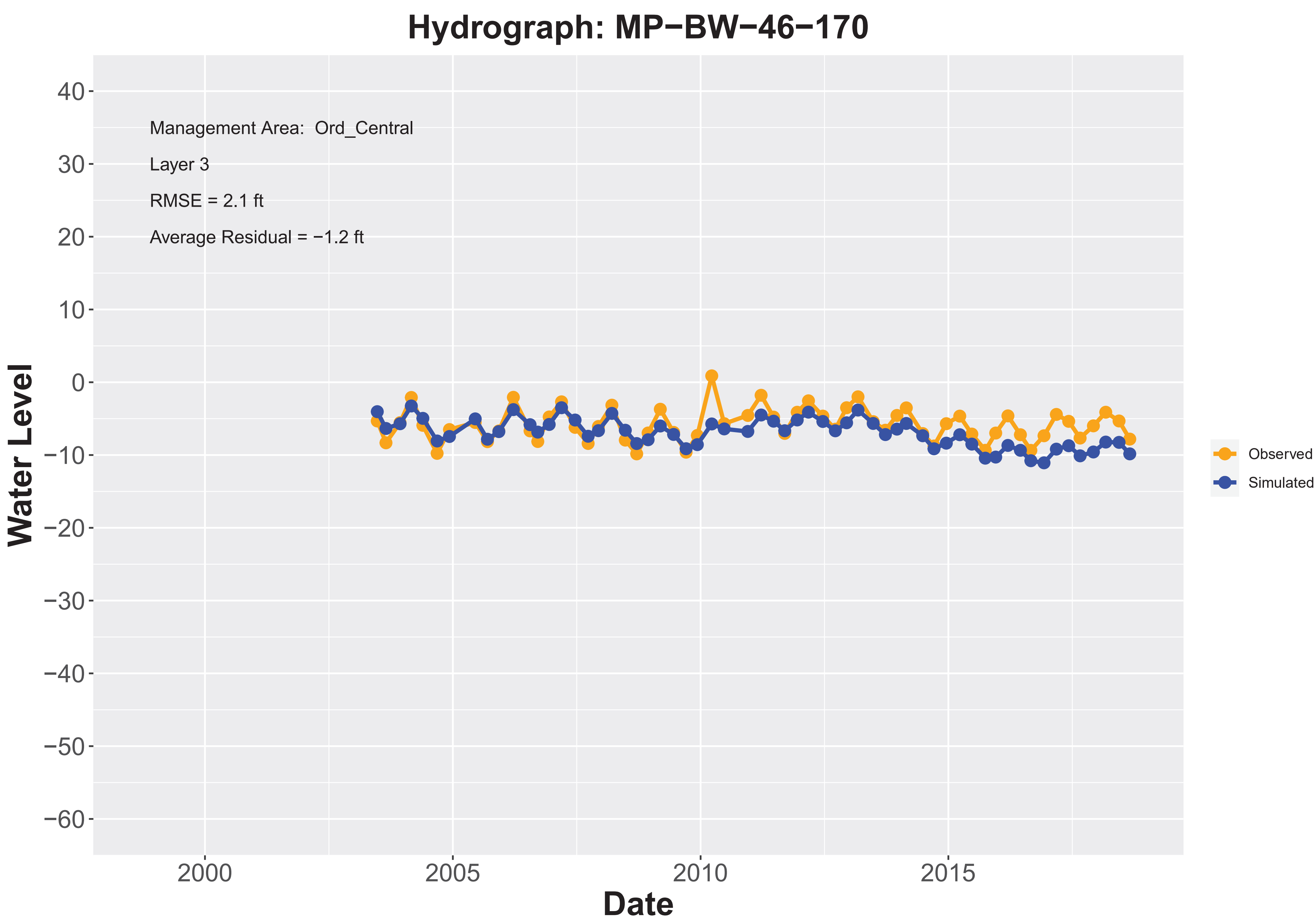
Hydrograph: MP−BW−42−400
Management Area: Ord_Central
Layer 5
RMSE = 6.3 ft
Average Residual = −6.0 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated



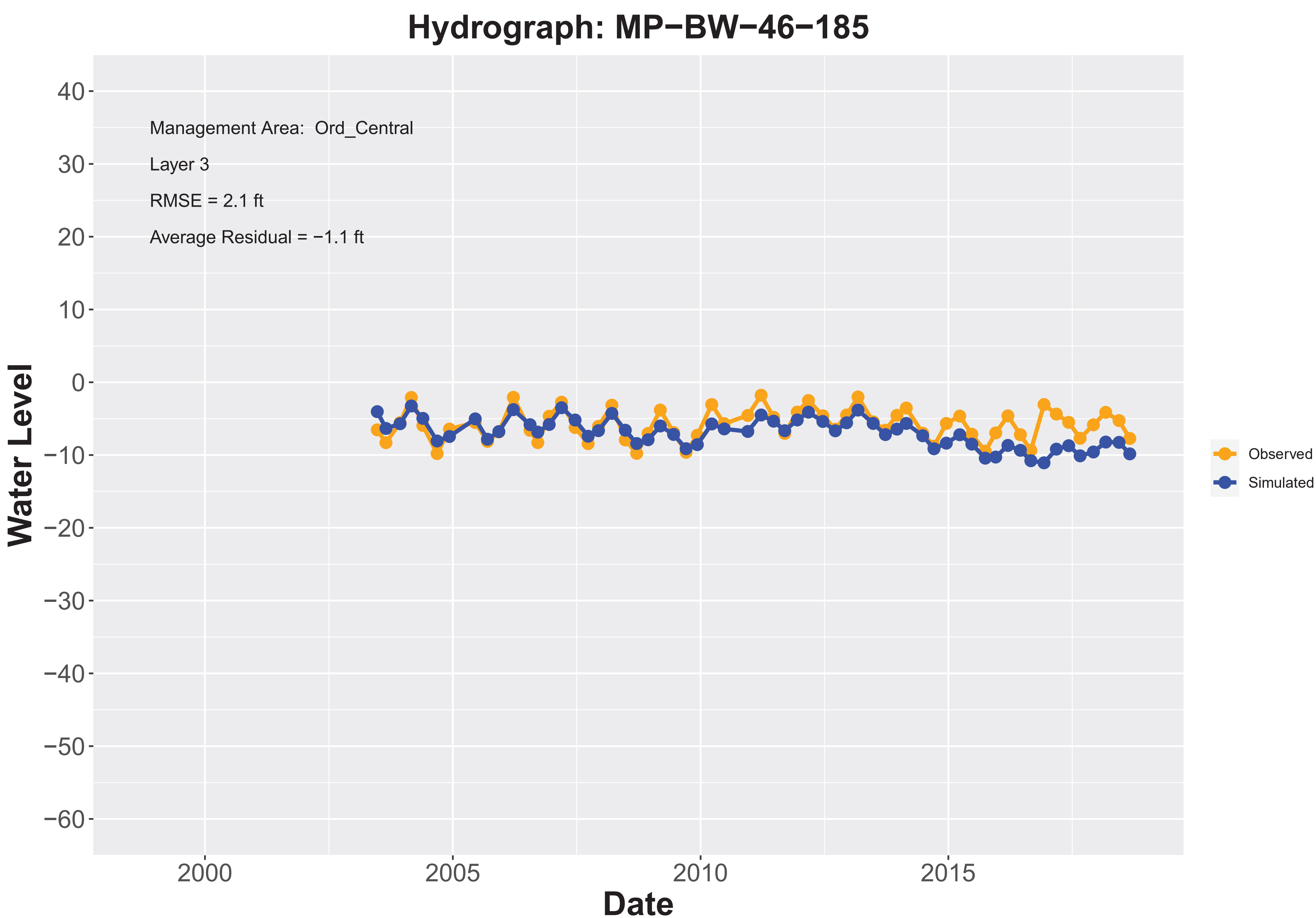
Hydrograph: MP−BW−46−080
Management Area: Ord_Central
Layer 1
RMSE = 14.7 ft
Average Residual = −14.5 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MP−BW−46−095





Hydrograph: MP−BW−46−170
Management Area: Ord_Central
Layer 3
RMSE = 2.1 ft
Average Residual = −1.2 ft
Water Level
Date
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Observed
Simulated



Hydrograph: MP−BW−46−185
Management Area: Ord_Central
Layer 3
RMSE = 2.1 ft
Average Residual = −1.1 ft
Water Level
40
30
20
10
0
−10
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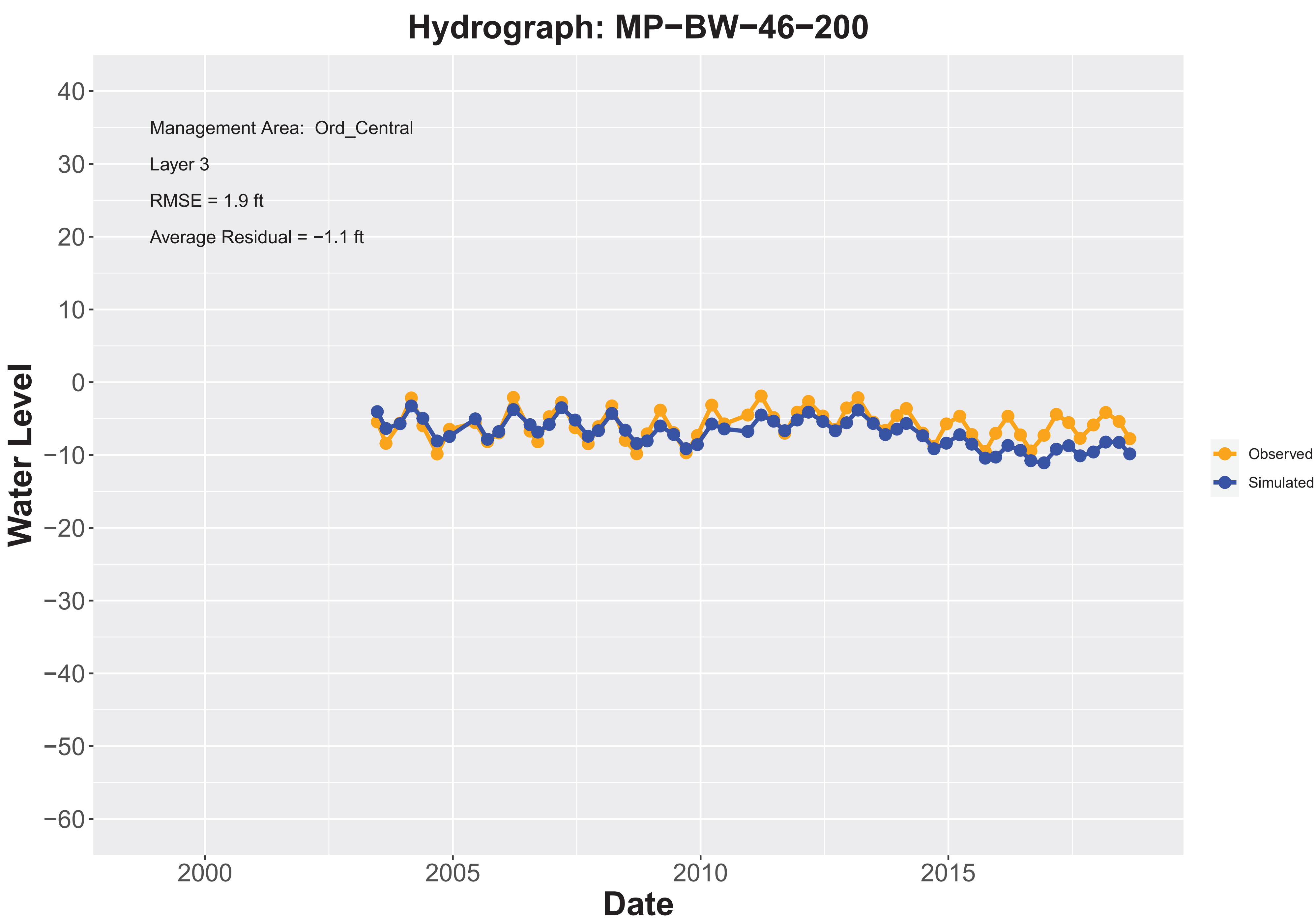
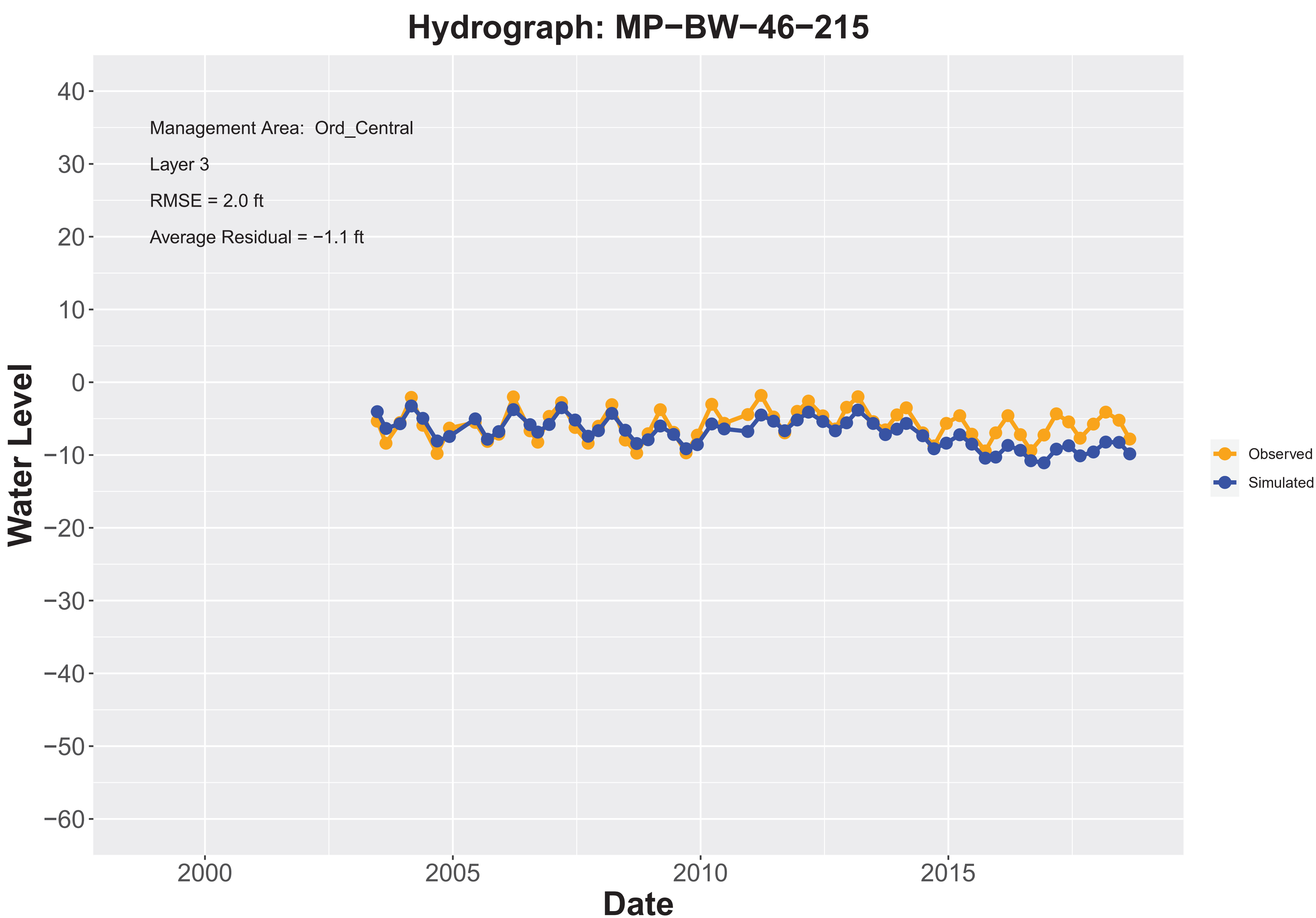
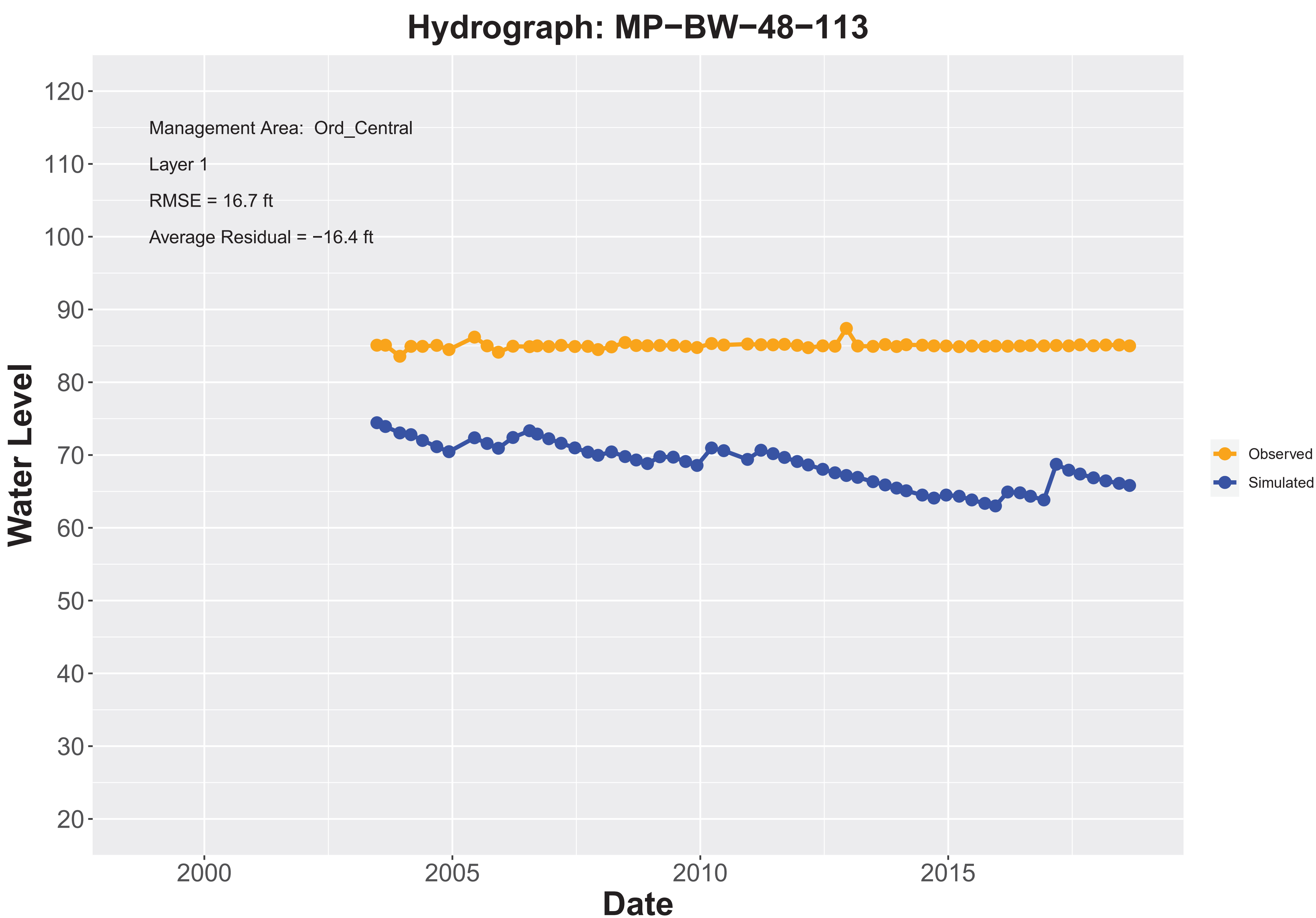
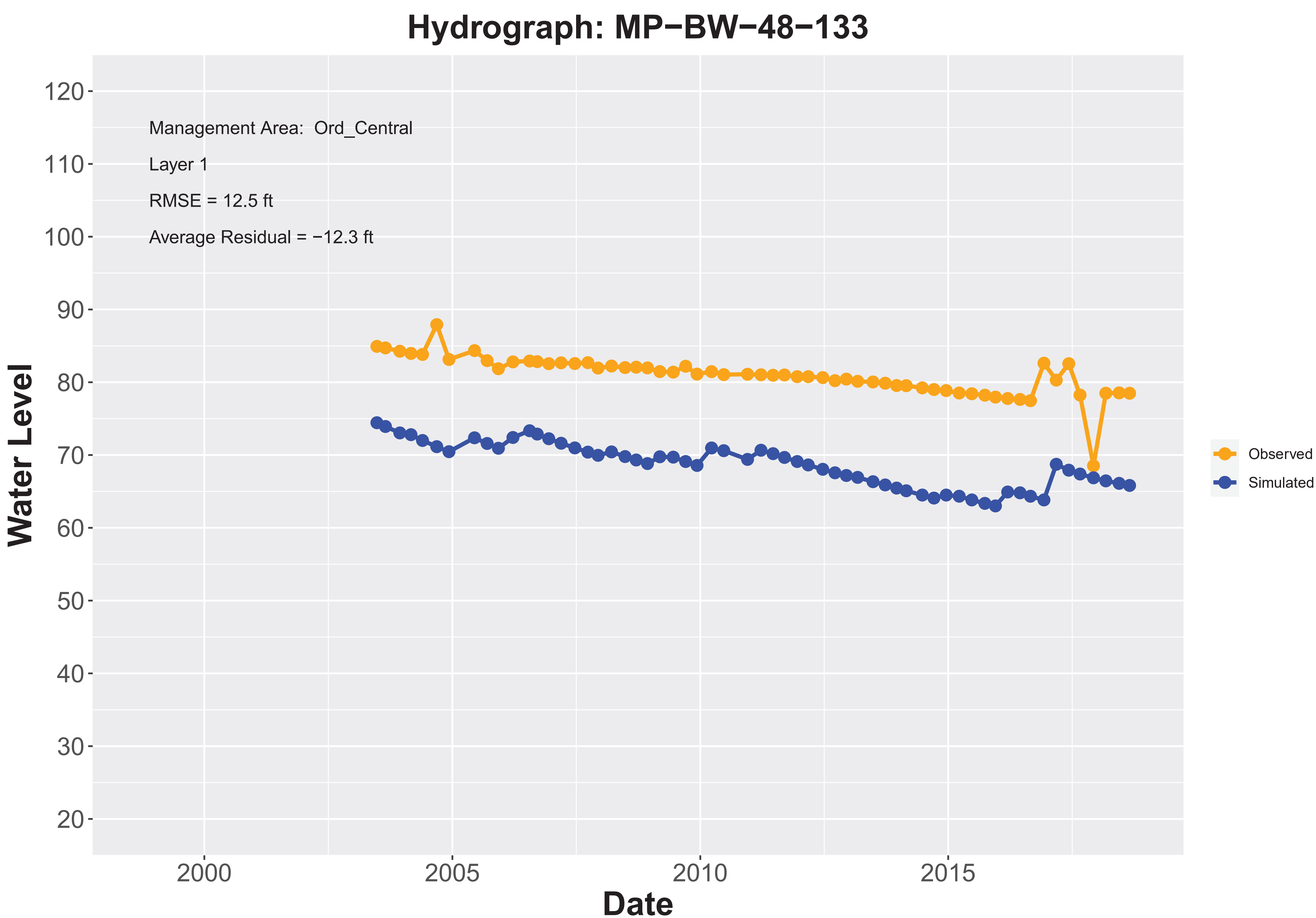
2000
2005
2010
2015
Date
Observed
Simulated

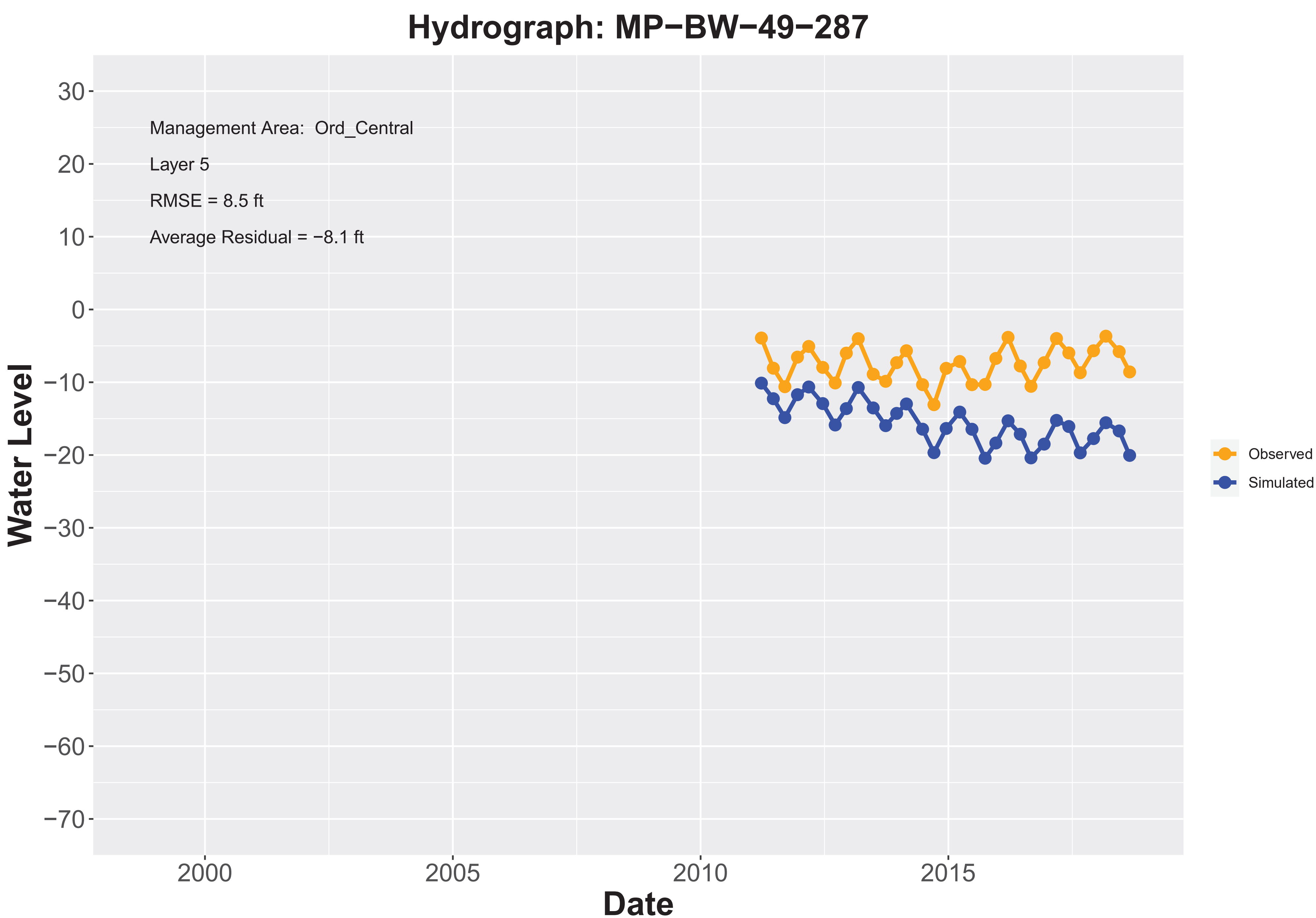

Hydrograph: MP−BW−46−200
Management Area: Ord_Central
Layer 3
RMSE = 1.9 ft
Average Residual = −1.1 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

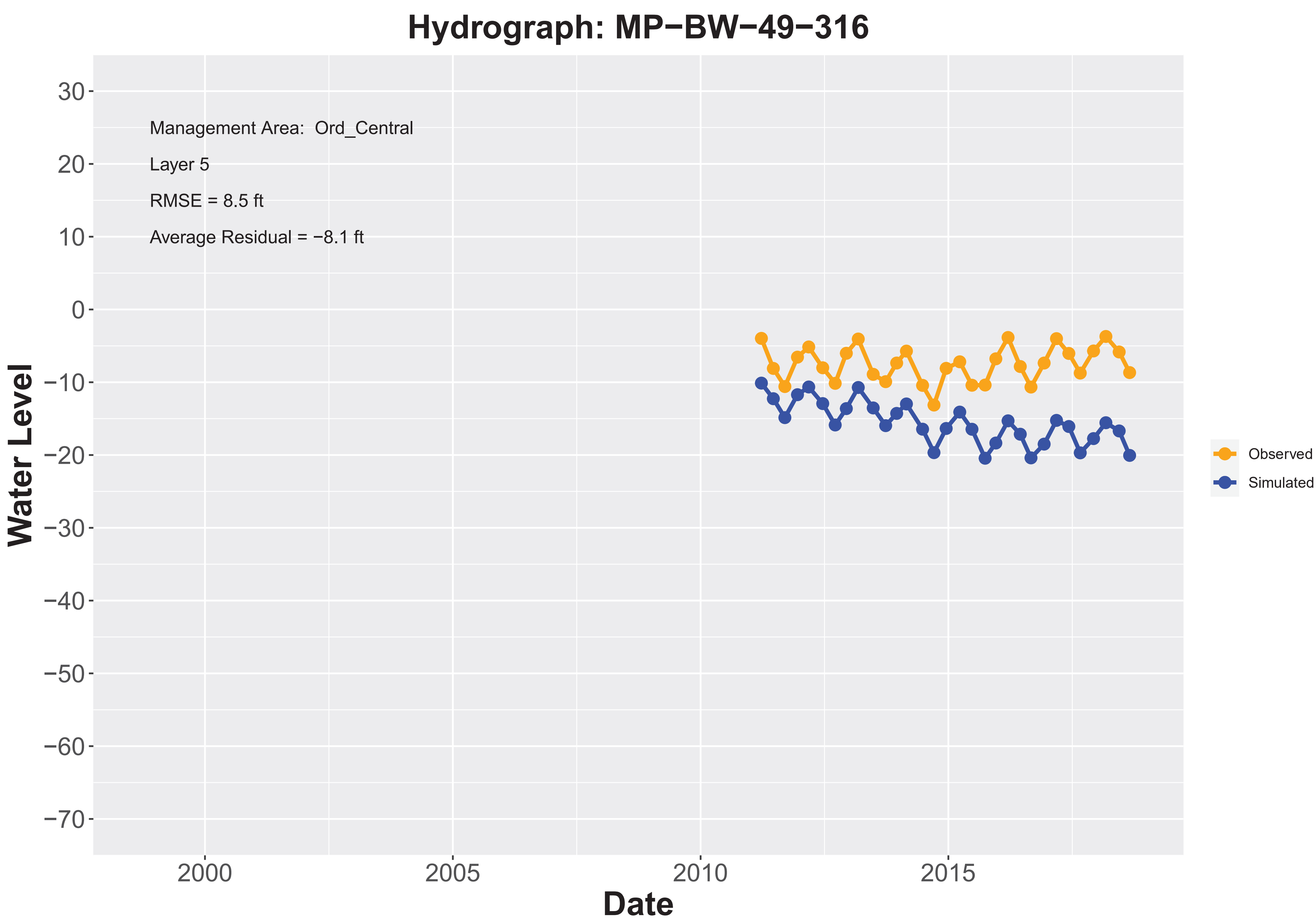

Hydrograph: MP−BW−46−215
Management Area: Ord_Central
Layer 3
RMSE = 2.0 ft
Average Residual = −1.1 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

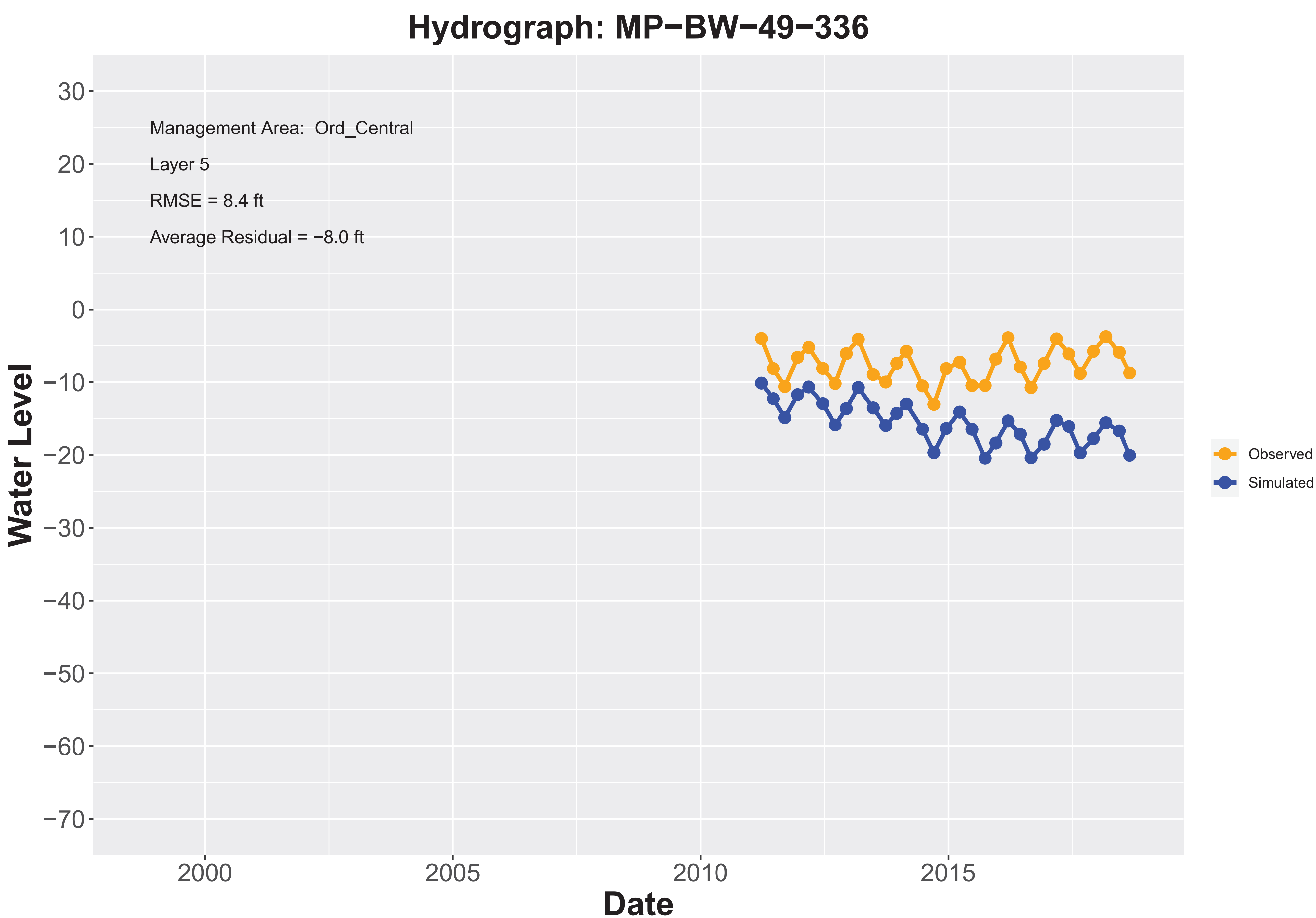


Hydrograph: MP−BW−48−113
Management Area: Ord_Central
Layer 1
RMSE = 16.7 ft
Average Residual = −16.4 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated

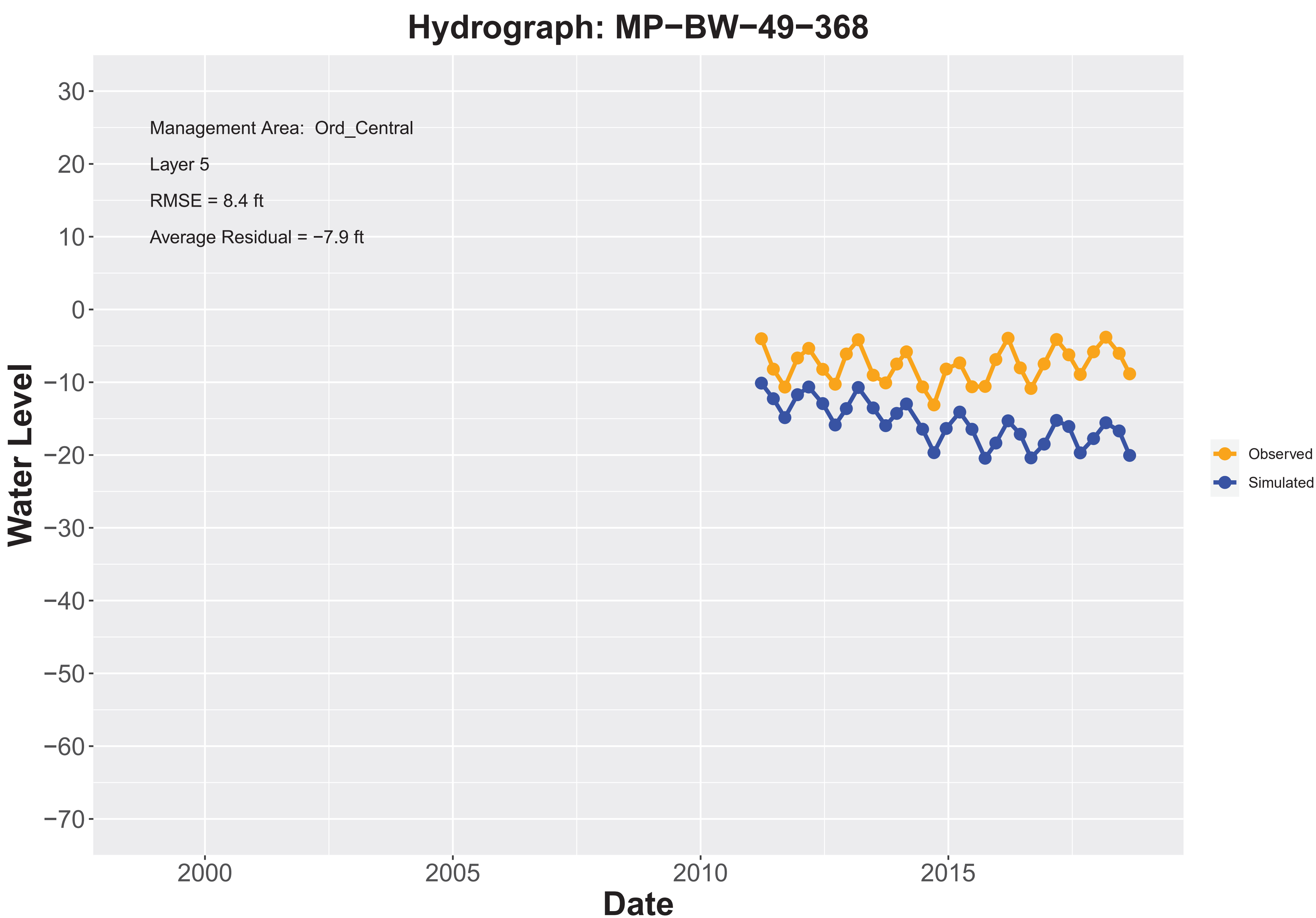

Hydrograph: MP−BW−48−133
Management Area: Ord_Central
Layer 1
RMSE = 12.5 ft
Average Residual = −12.3 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MP−BW−49−287
Management Area: Ord_Central
Layer 5
RMSE = 8.5 ft
Average Residual = −8.1 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated

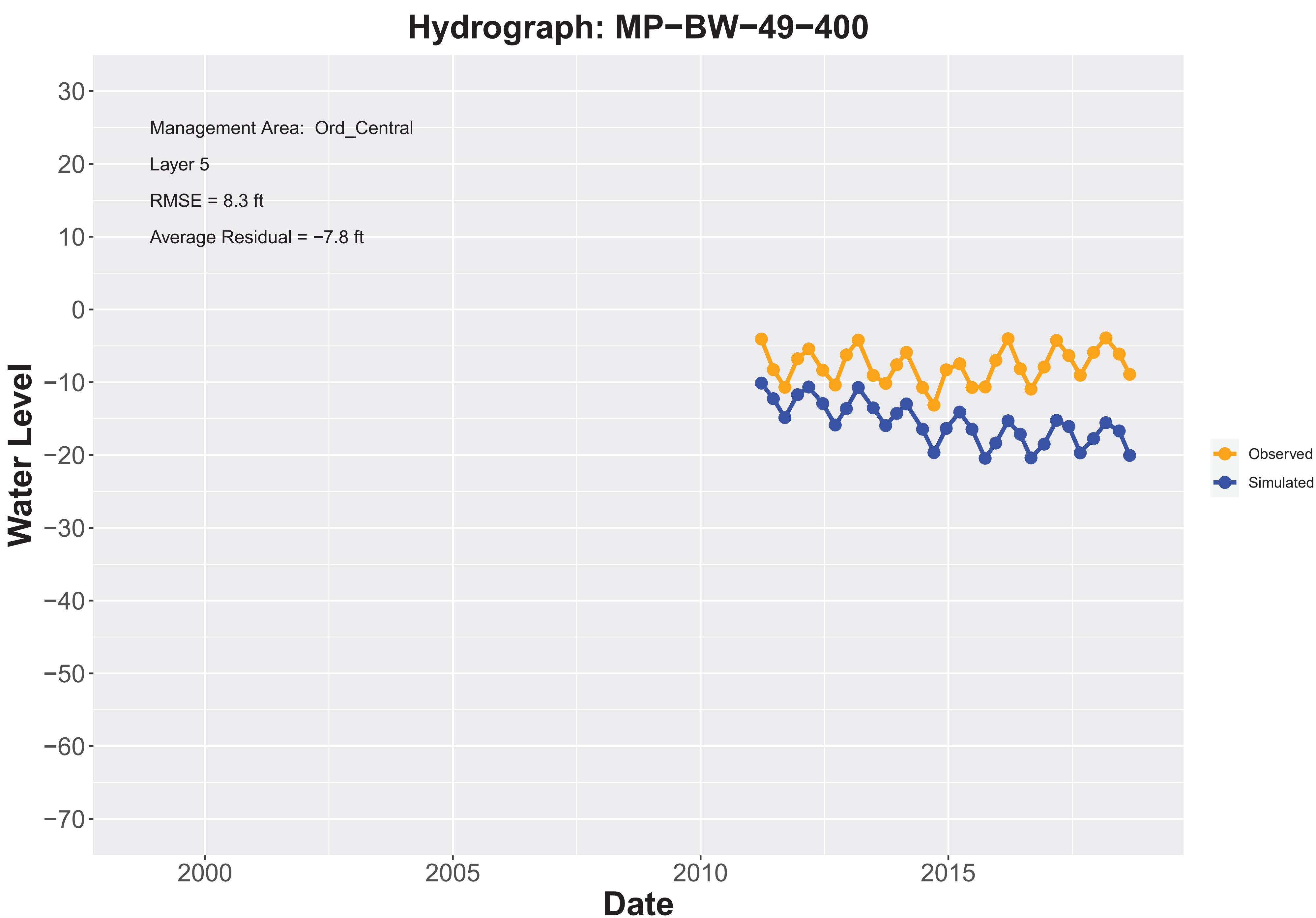

Hydrograph: MP−BW−49−316
Management Area: Ord_Central
Layer 5
RMSE = 8.5 ft
Average Residual = −8.1 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated



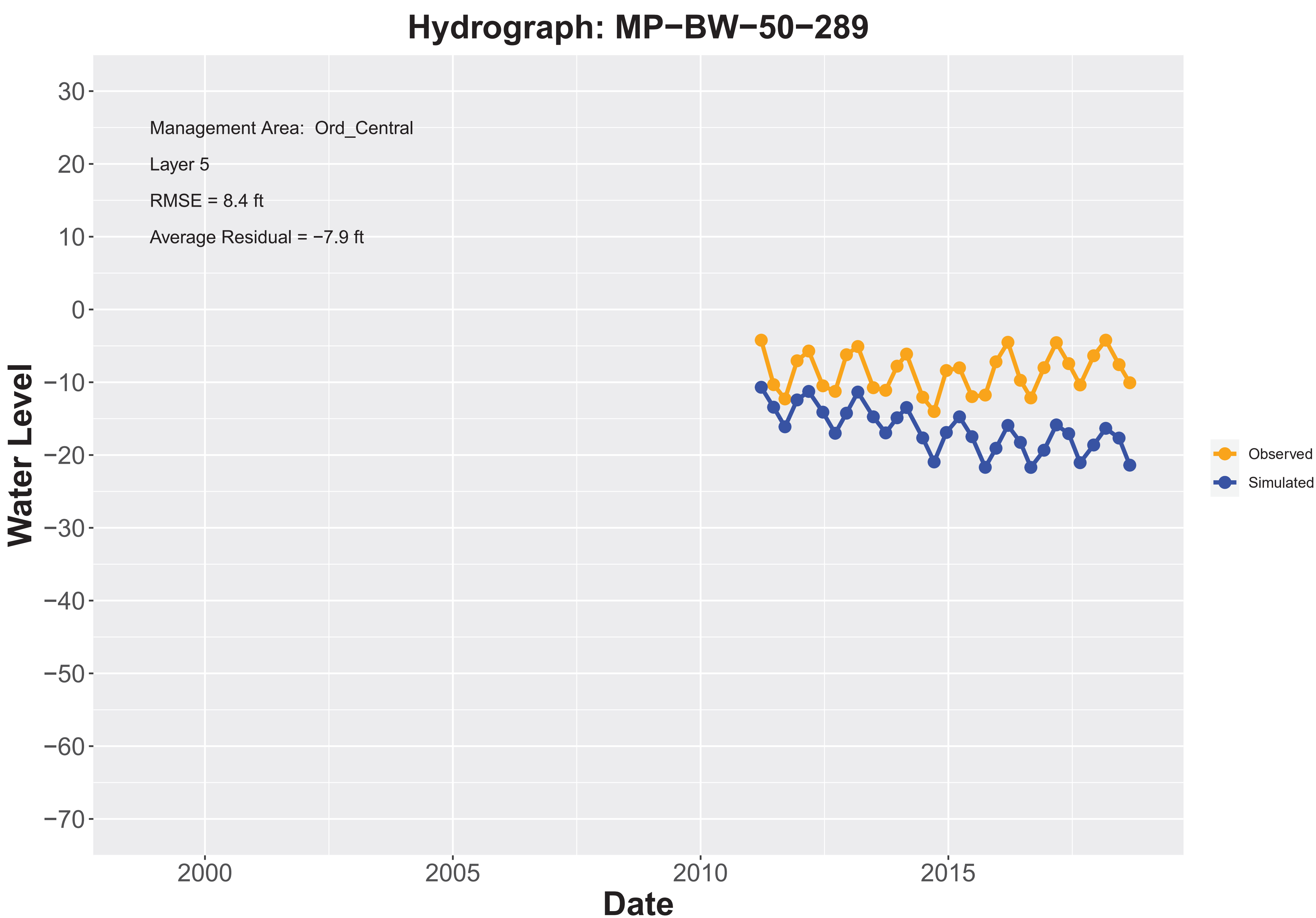
Hydrograph: MP−BW−49−336
Management Area: Ord_Central
Layer 5
RMSE = 8.4 ft
Average Residual = −8.0 ft
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Water Level
2000
2005
2010
2015
Date
Observed
Simulated

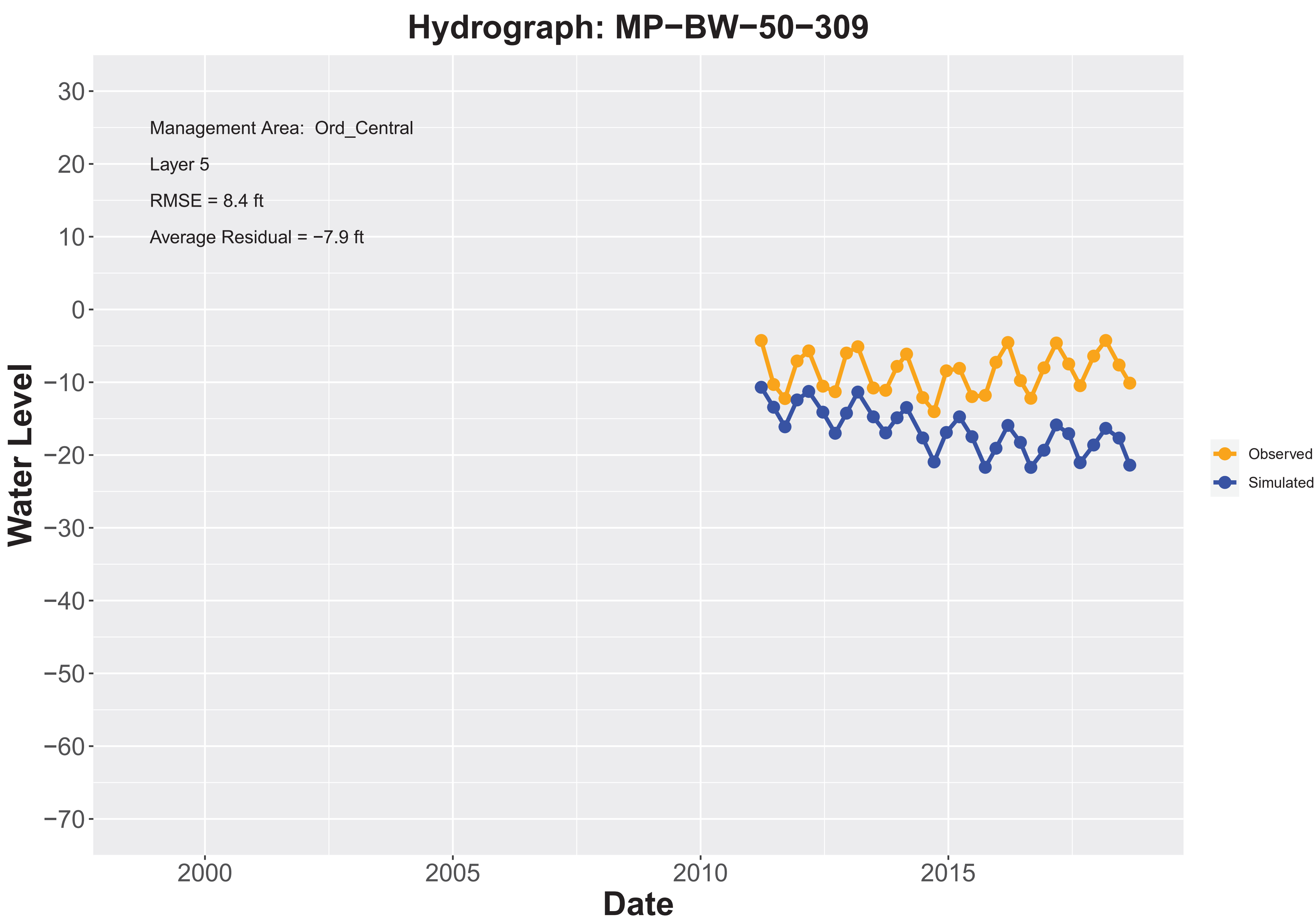


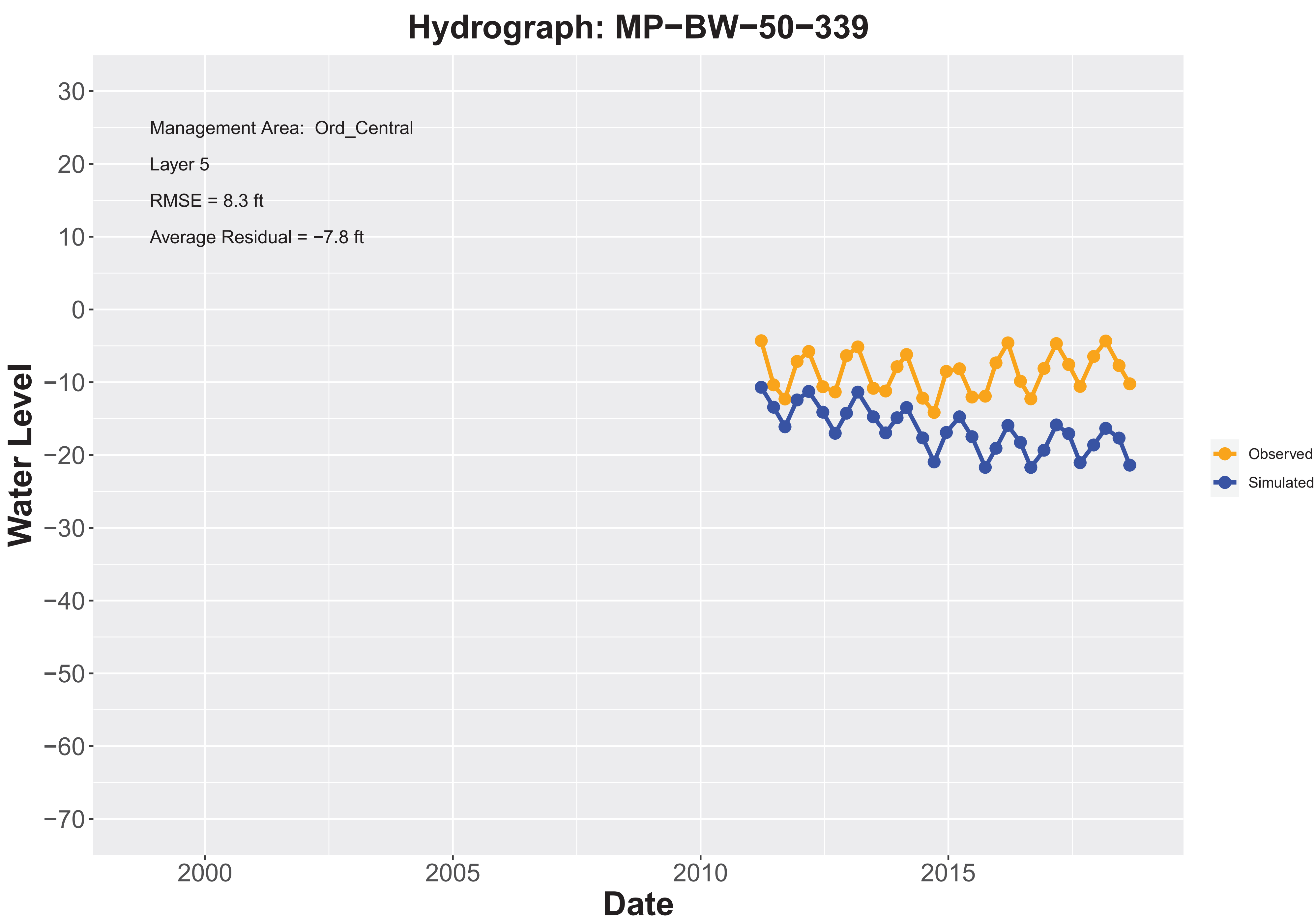
Hydrograph: MP−BW−49−368
Management Area: Ord_Central
Layer 5
RMSE = 8.4 ft
Average Residual = −7.9 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated



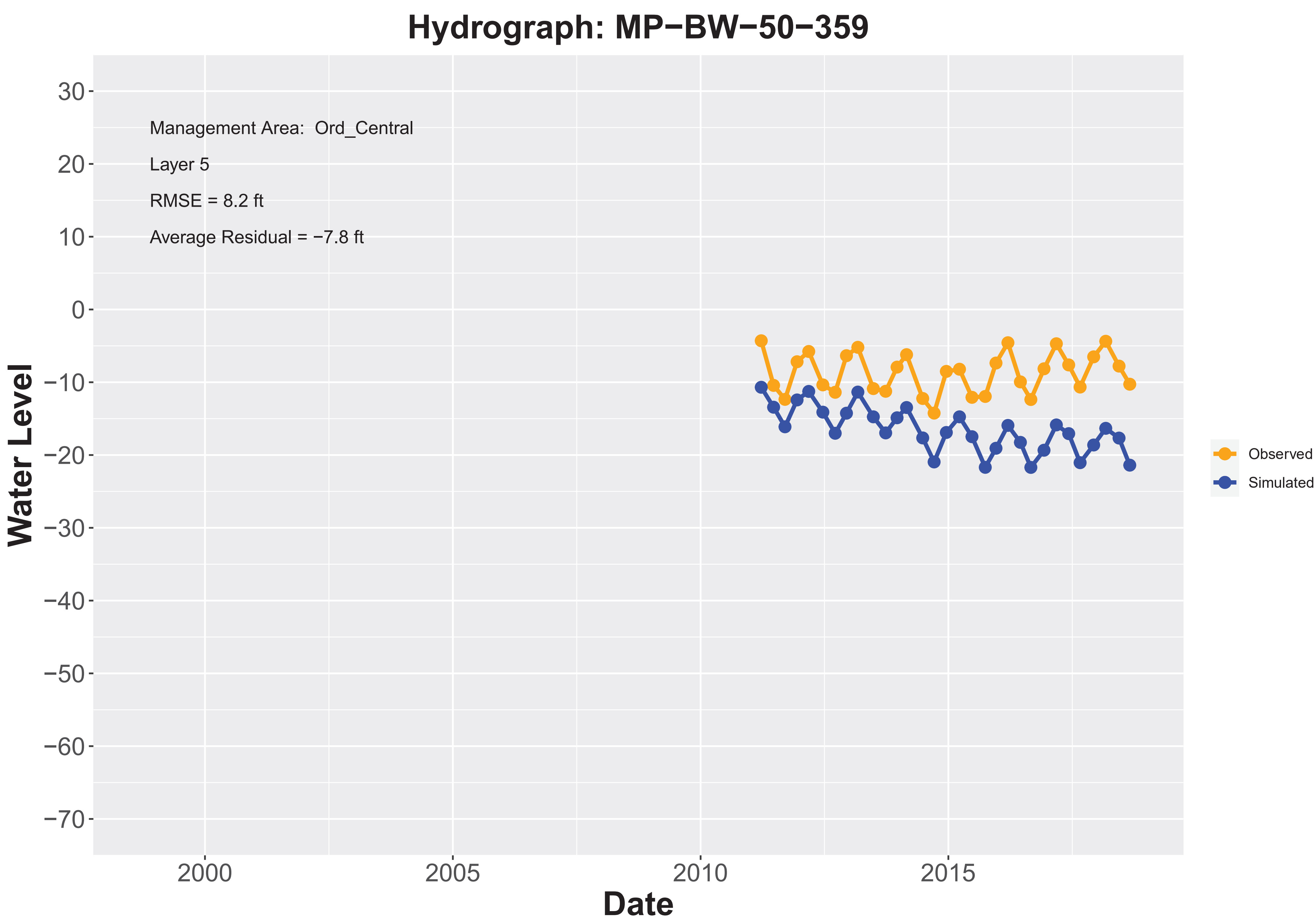
Hydrograph: MP−BW−49−400
Management Area: Ord_Central
Layer 5
RMSE = 8.3 ft
Average Residual = −7.8 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MP−BW−50−289
Management Area: Ord_Central
Layer 5
RMSE = 8.4 ft
Average Residual = −7.9 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated

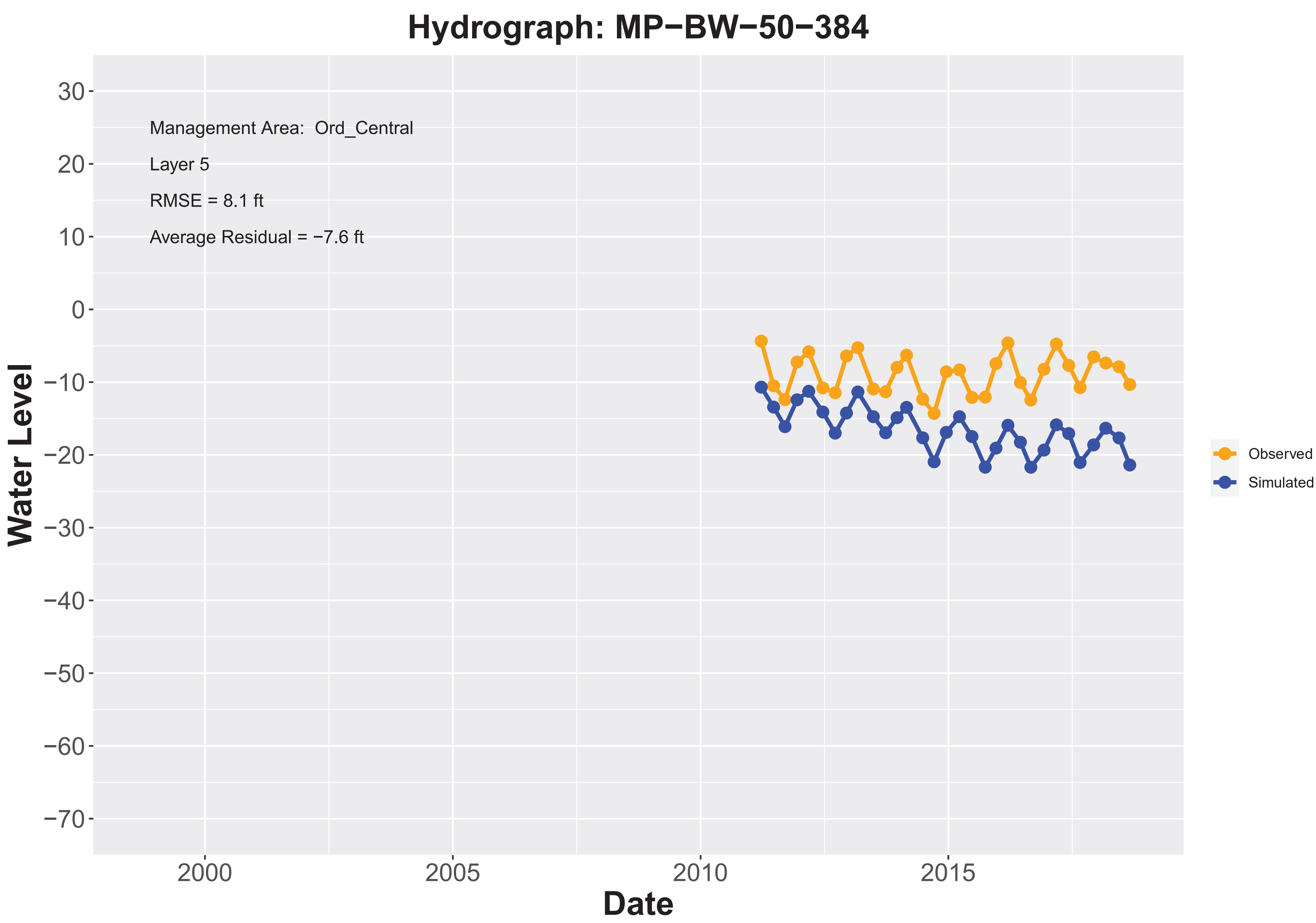

Hydrograph: MP−BW−50−309
Management Area: Ord_Central
Layer 5
RMSE = 8.4 ft
Average Residual = −7.9 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated



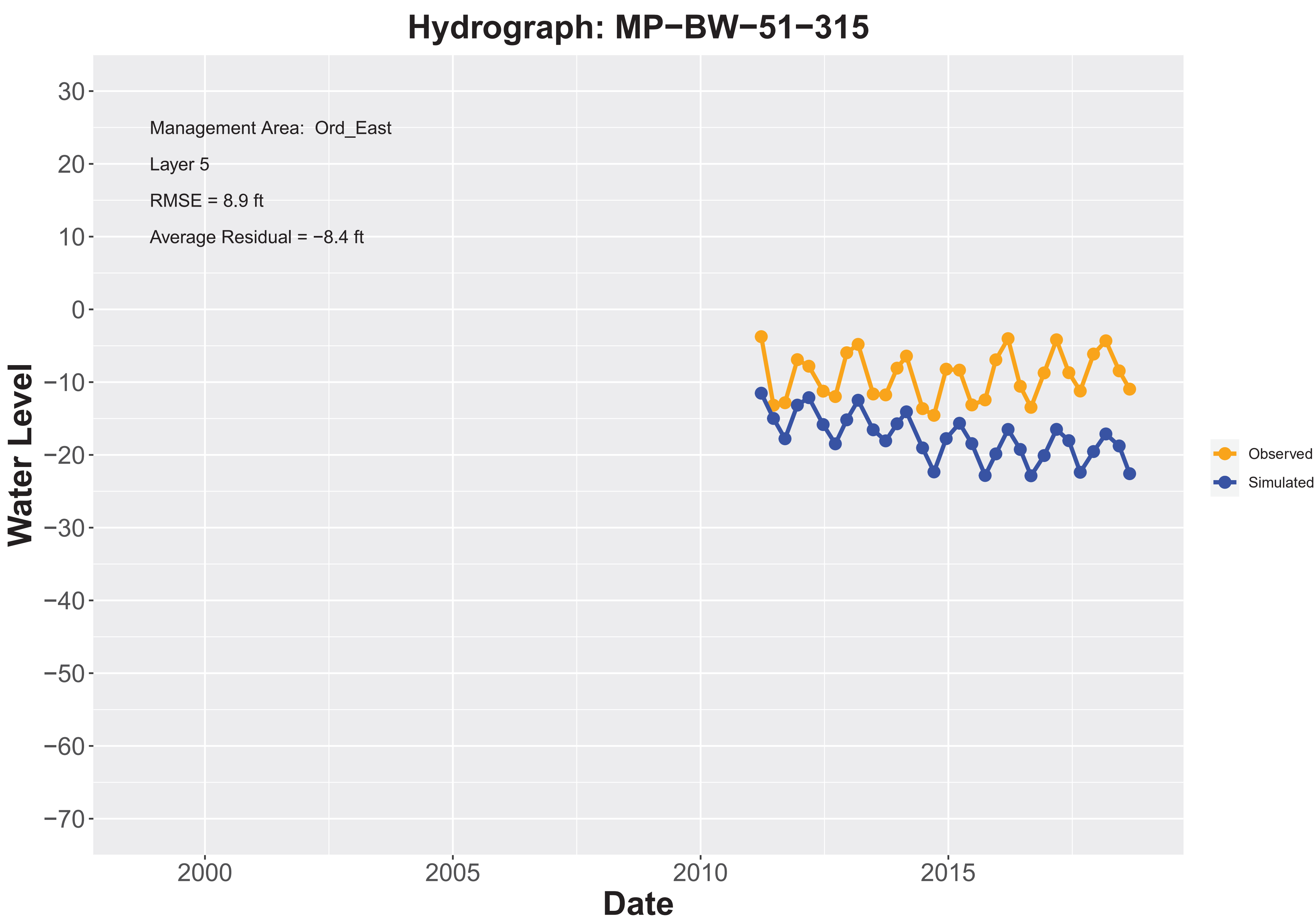
Hydrograph: MP−BW−50−339
Management Area: Ord_Central
Layer 5
RMSE = 8.3 ft
Average Residual = −7.8 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated

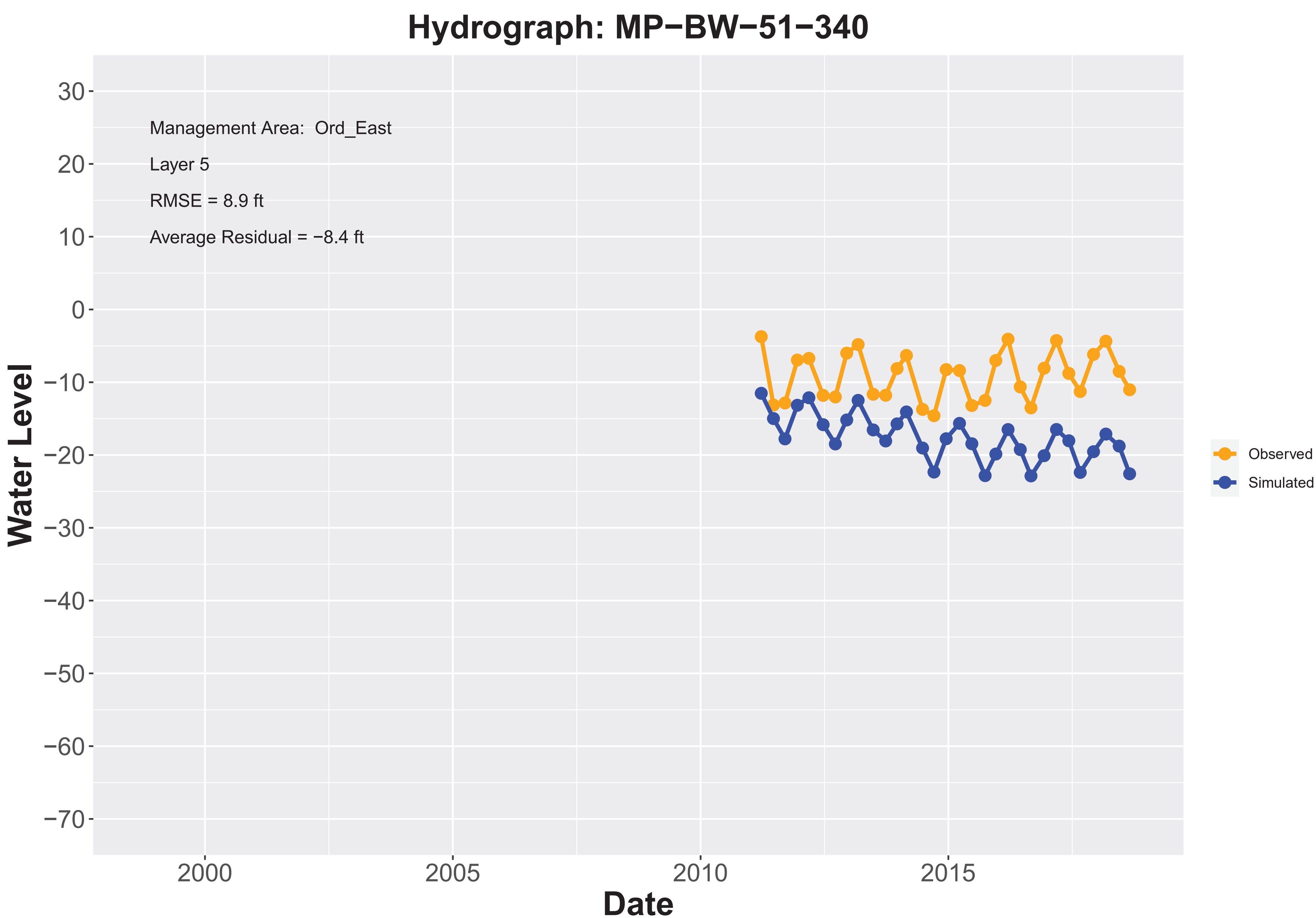


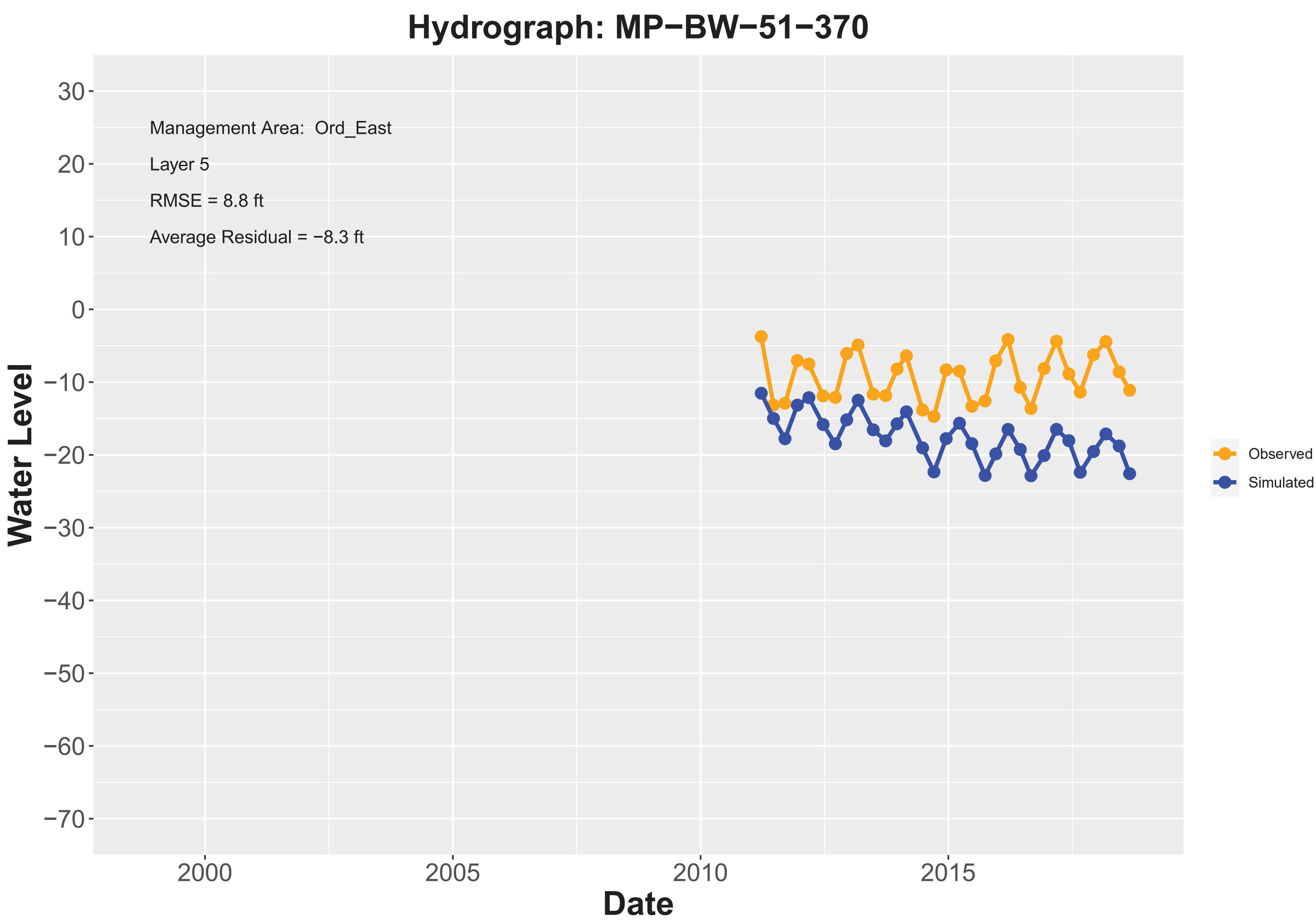
Hydrograph: MP−BW−50−359
Management Area: Ord_Central
Layer 5
RMSE = 8.2 ft
Average Residual = −7.8 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated

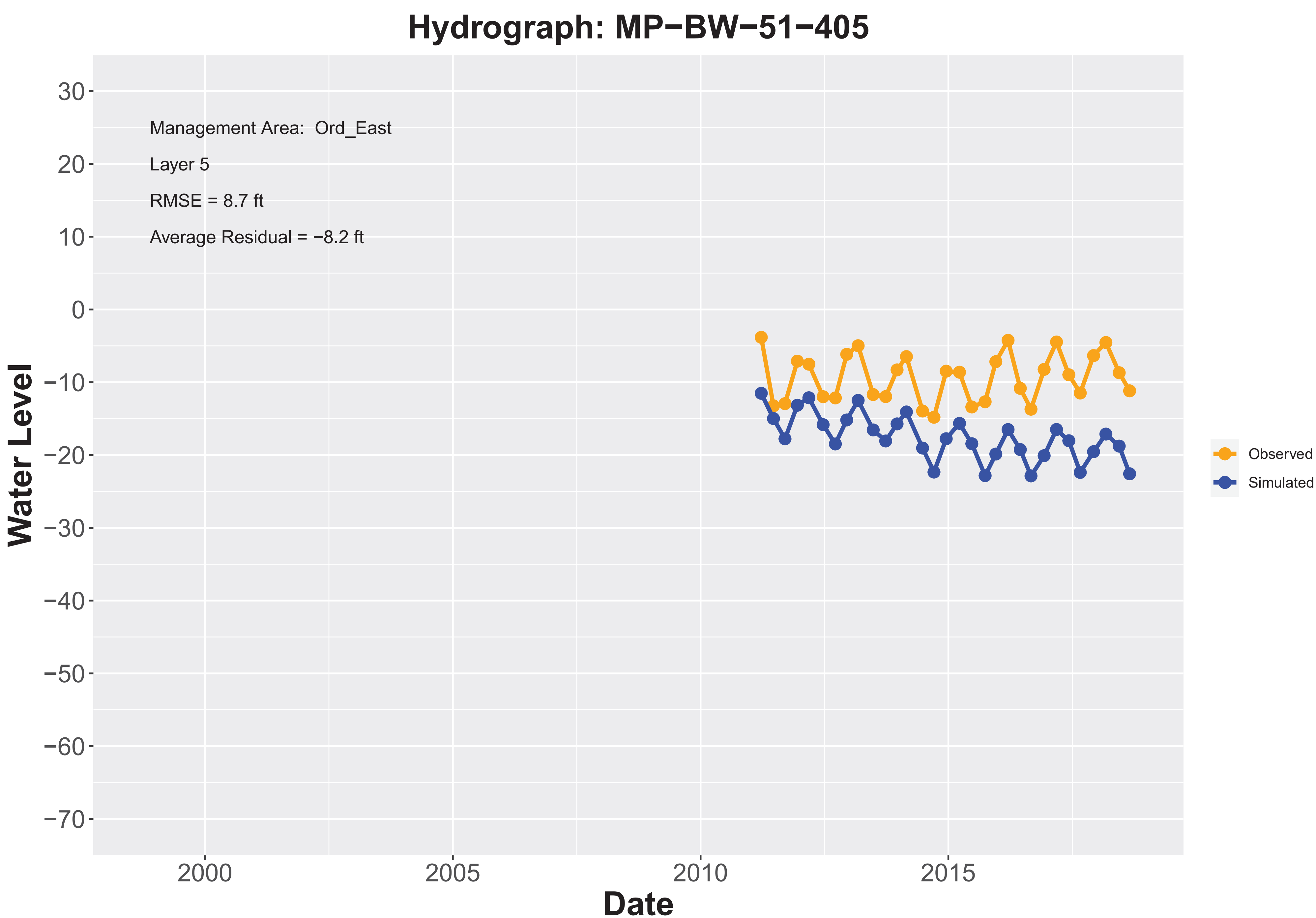


Hydrograph: MP−BW−50−384
Management Area: Ord_Central
Layer 5
RMSE = 8.1 ft
Average Residual = −7.6 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MP−BW−51−315
Management Area: Ord_East
Layer 5
RMSE = 8.9 ft
Average Residual = −8.4 ft
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Water Level
2000
2005
2010
2015
Date
Observed
Simulated

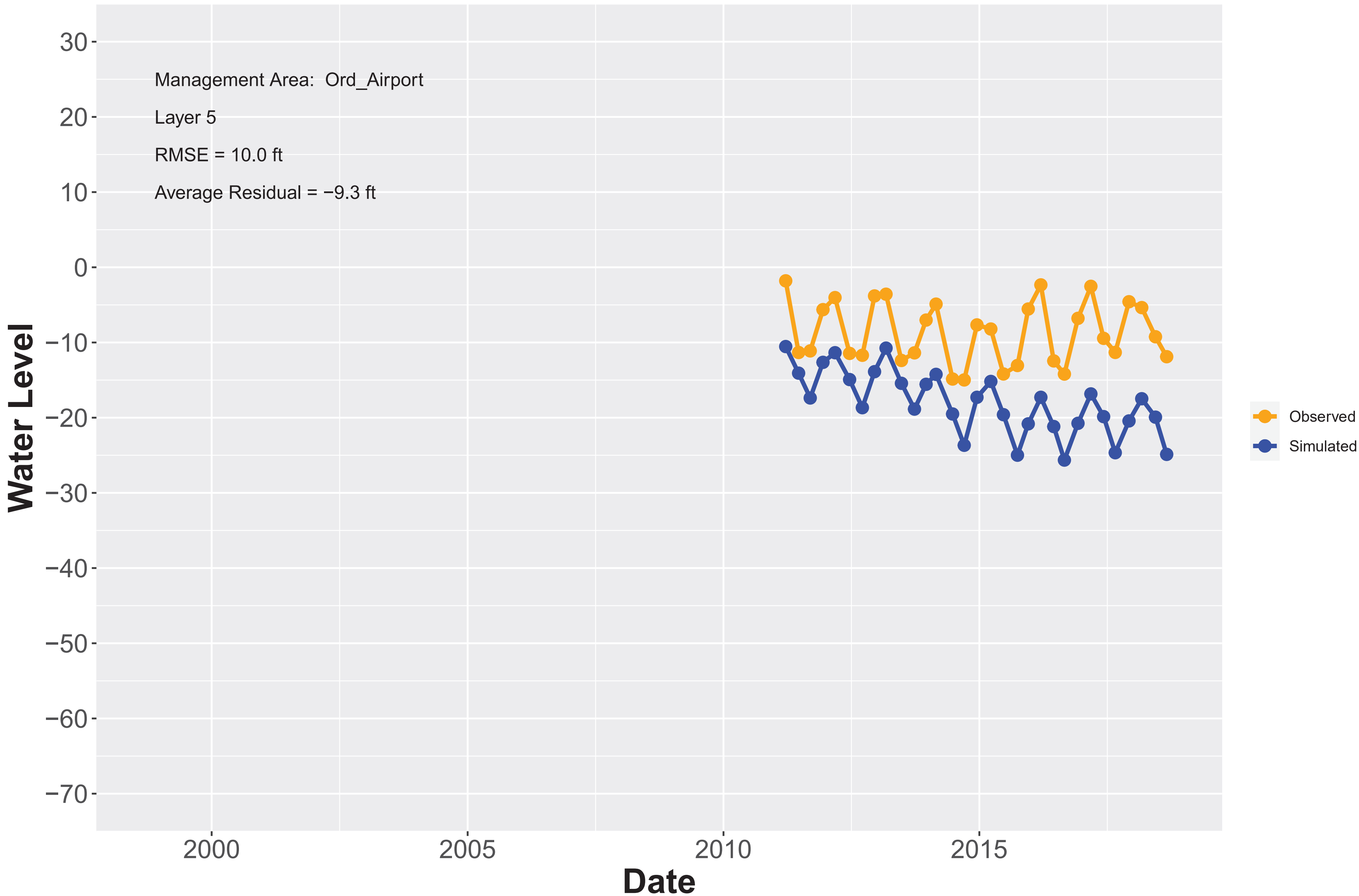

Hydrograph: MP−BW−51−340
Management Area: Ord_East
Layer 5
RMSE = 8.9 ft
Average Residual = −8.4 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

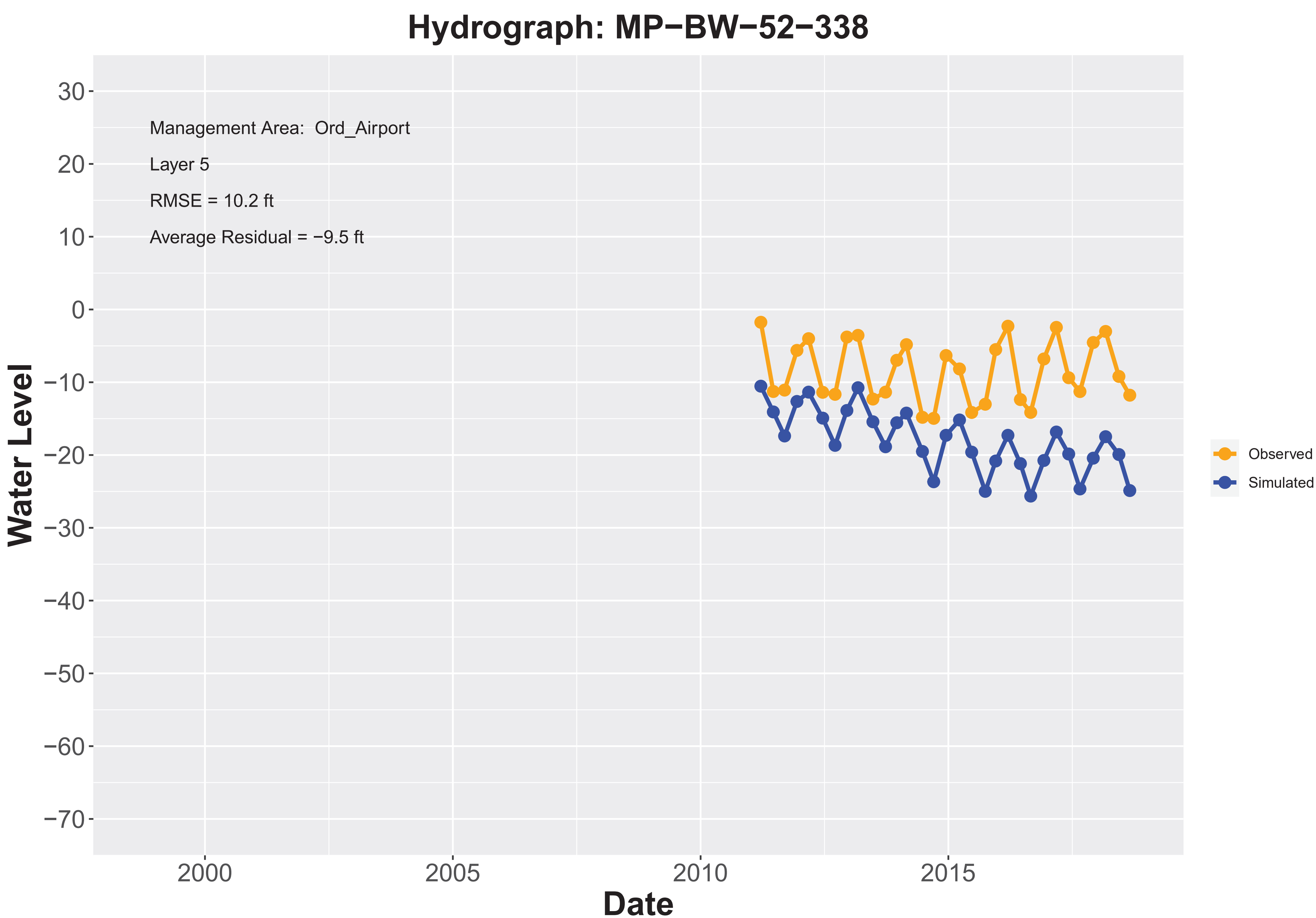

Hydrograph: MP−BW−51−370
Management Area: Ord_East
Layer 5
RMSE = 8.8 ft
Average Residual = −8.3 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated



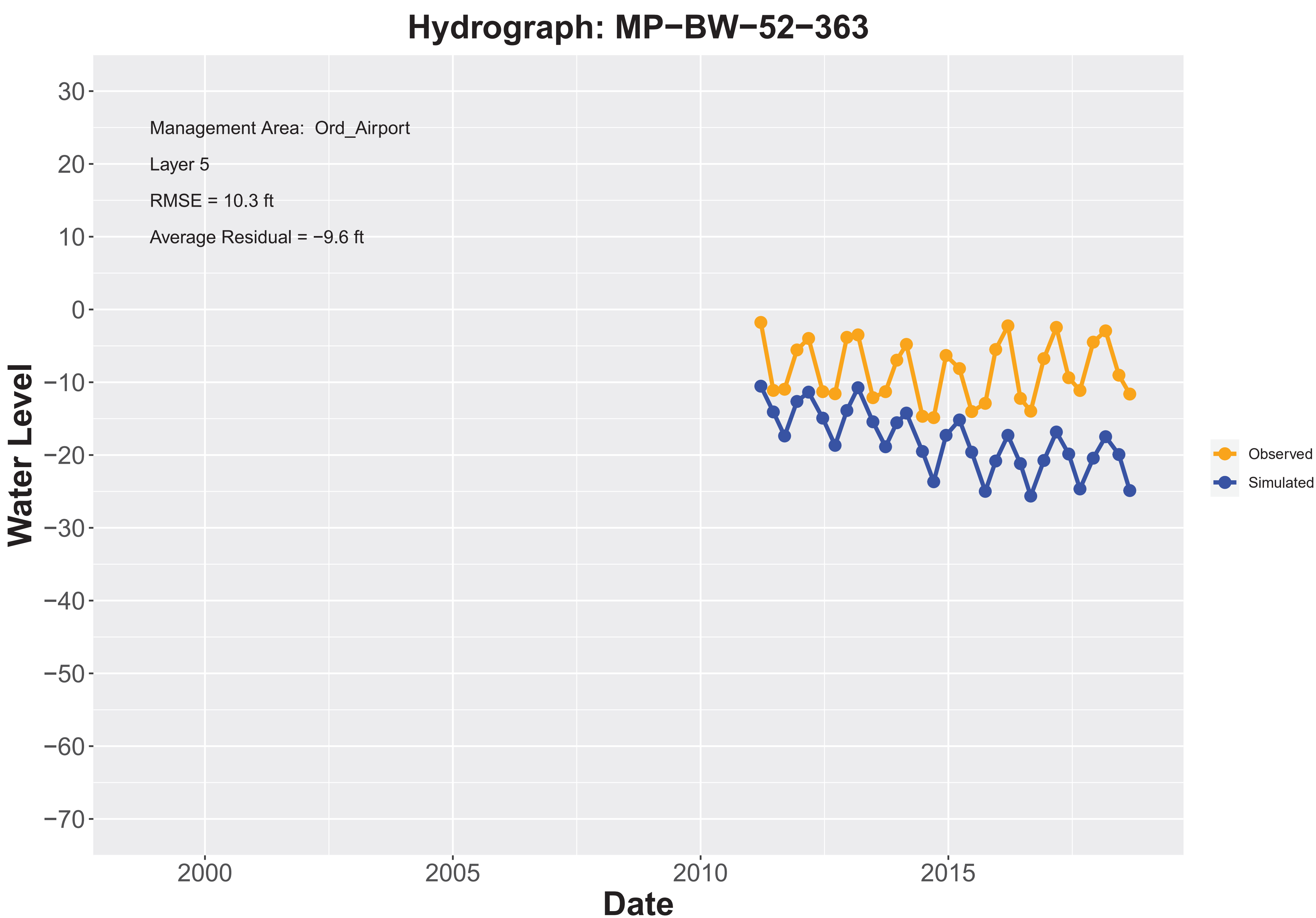
Hydrograph: MP−BW−51−405
Management Area: Ord_East
Layer 5
RMSE = 8.7 ft
Average Residual = −8.2 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
Date
2000
2005
2010
2015
Observed
Simulated

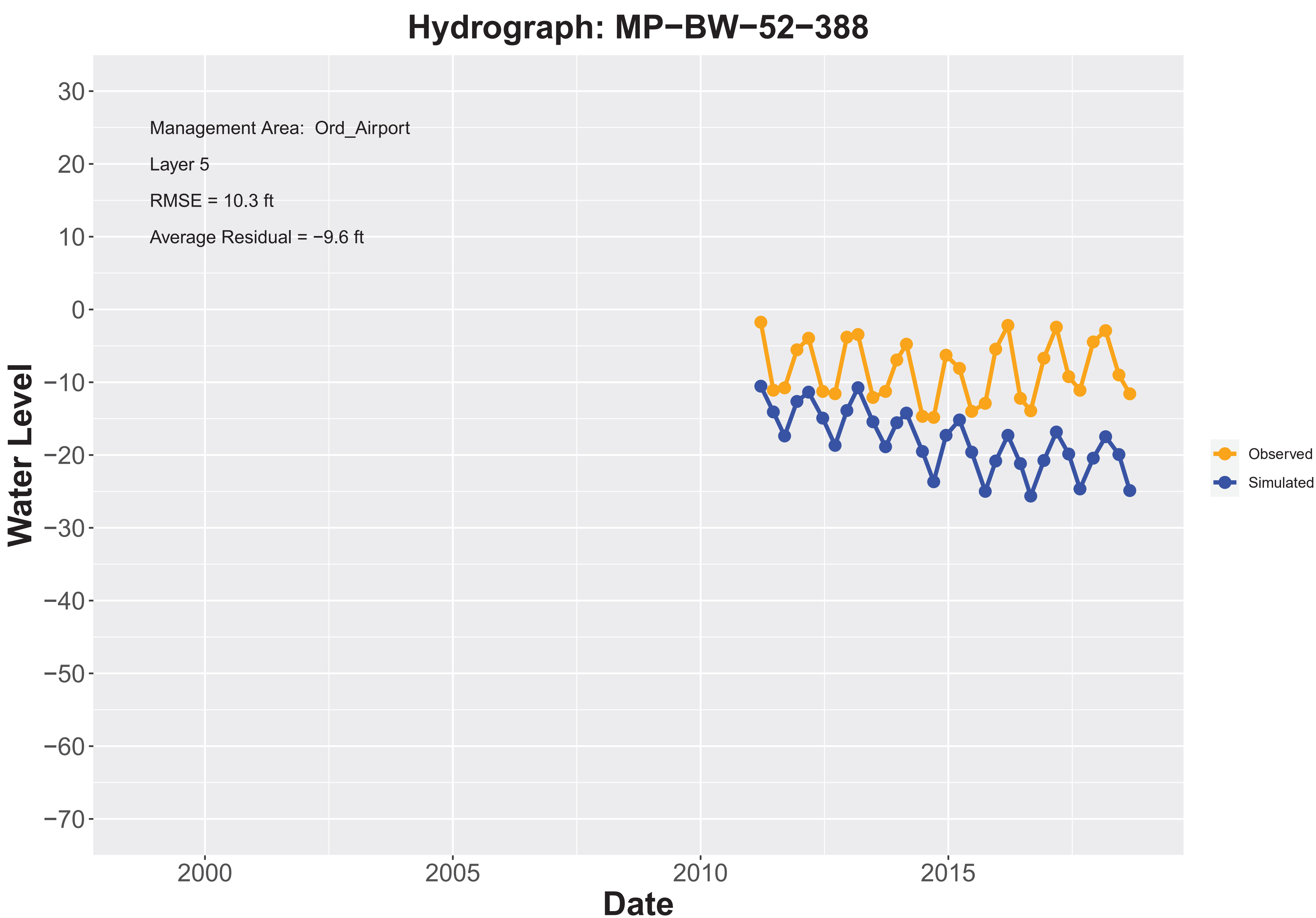
Hydrograph: MP−BW−52−323



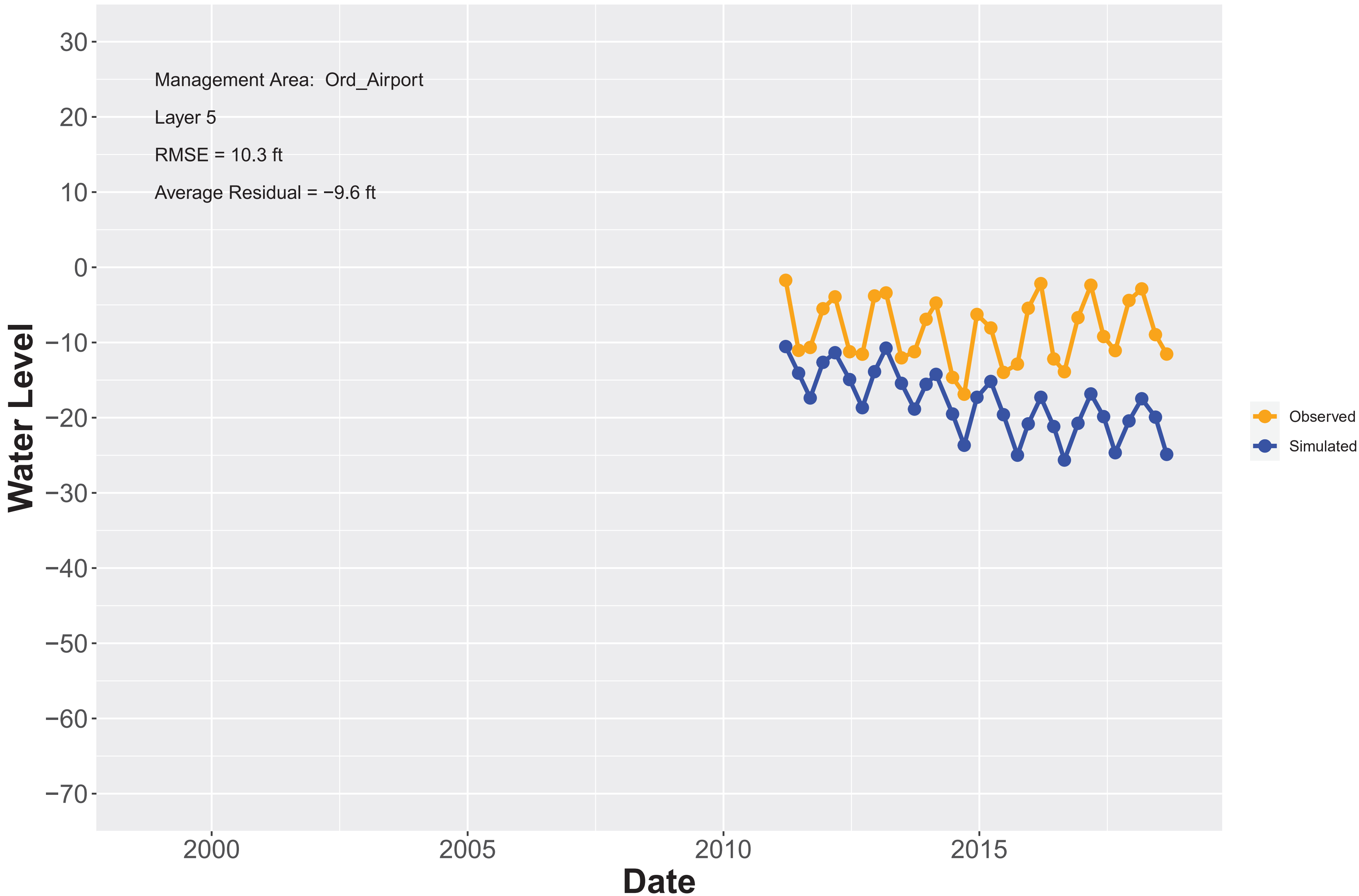


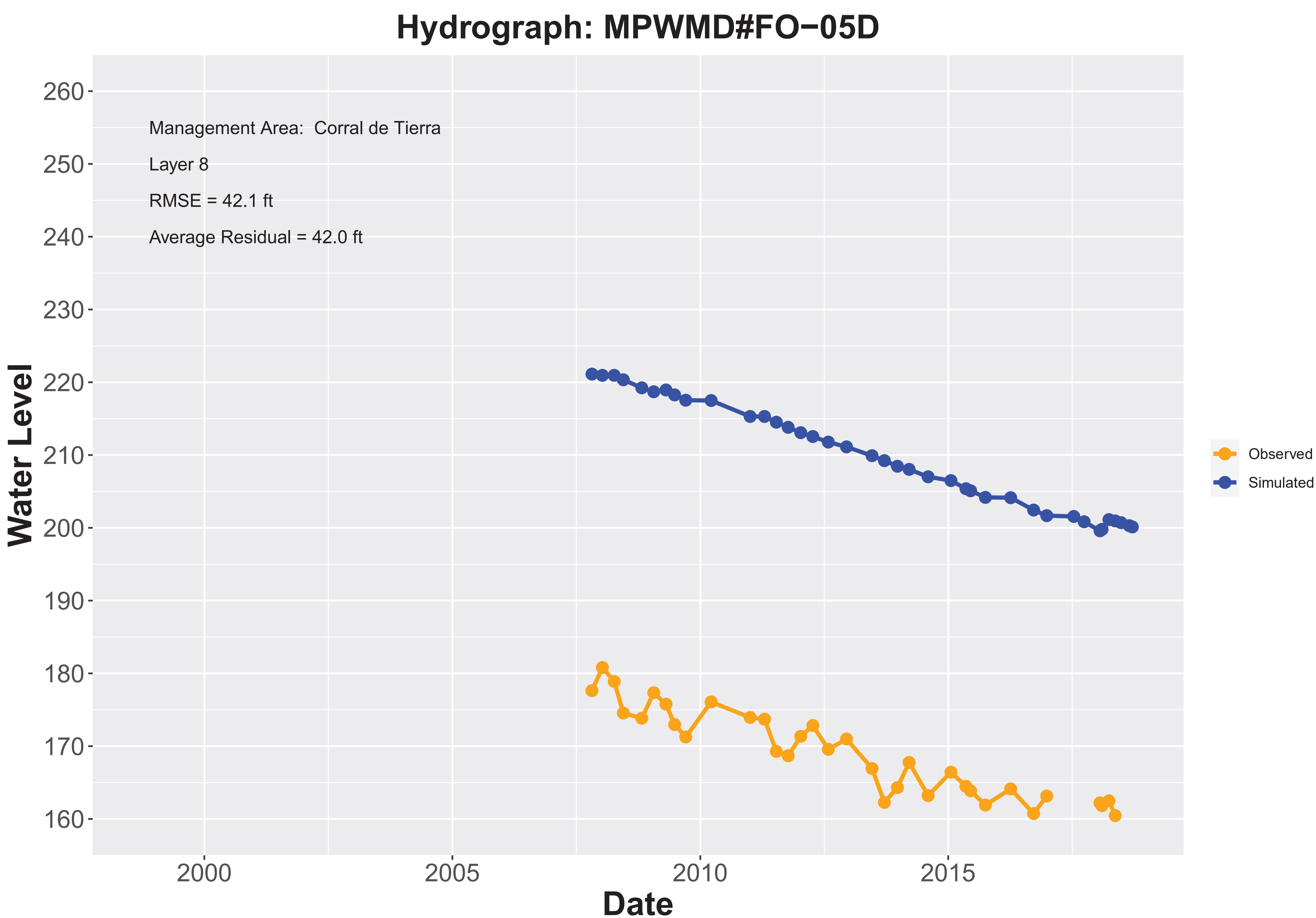
Hydrograph: MP−BW−52−338
Management Area: Ord_Airport
Layer 5
RMSE = 10.2 ft
Average Residual = −9.5 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MP−BW−52−363
Management Area: Ord_Airport
Layer 5
RMSE = 10.3 ft
Average Residual = −9.6 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

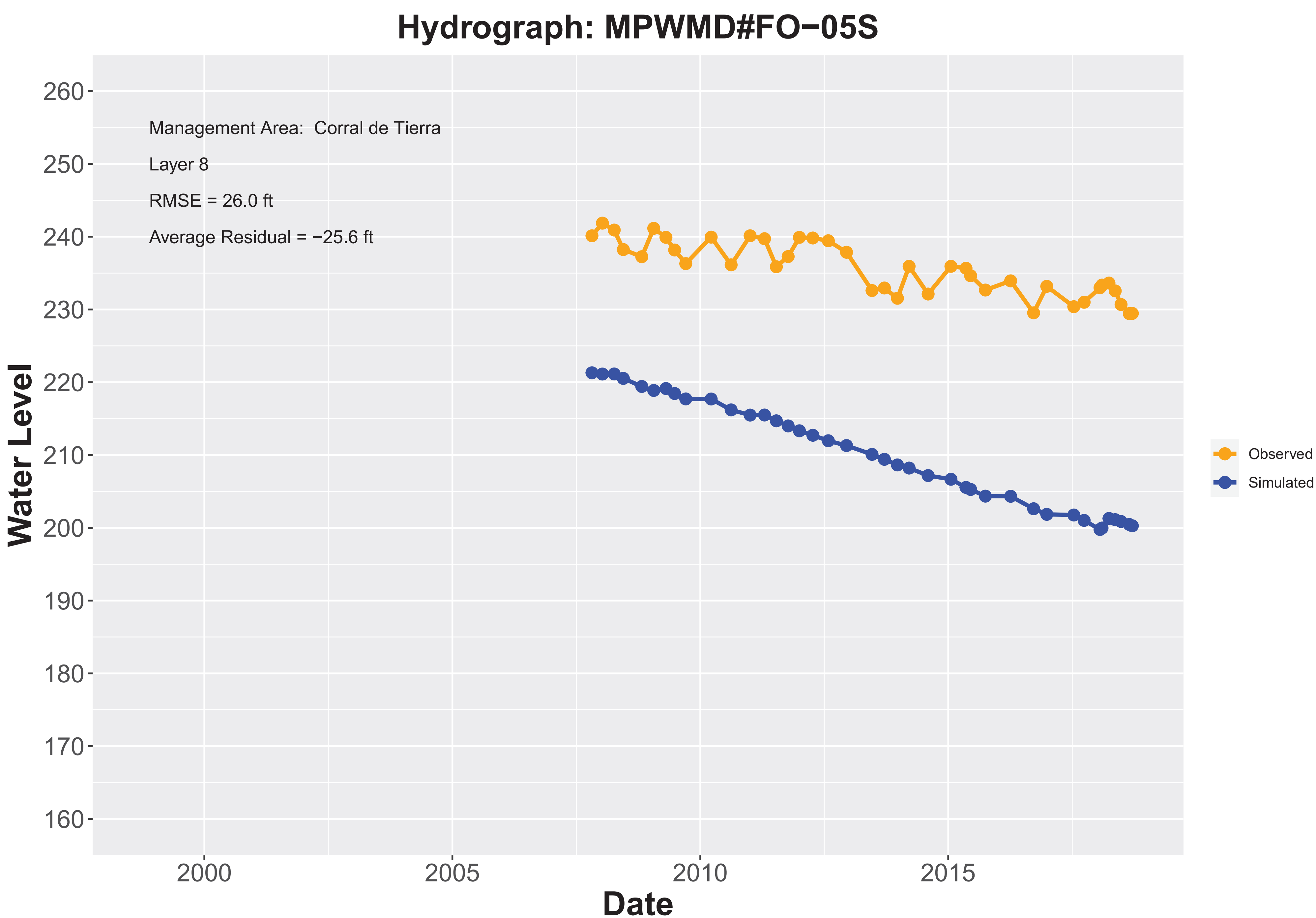

Hydrograph: MP−BW−52−388
Management Area: Ord_Airport
Layer 5
RMSE = 10.3 ft
Average Residual = −9.6 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MP−BW−52−408

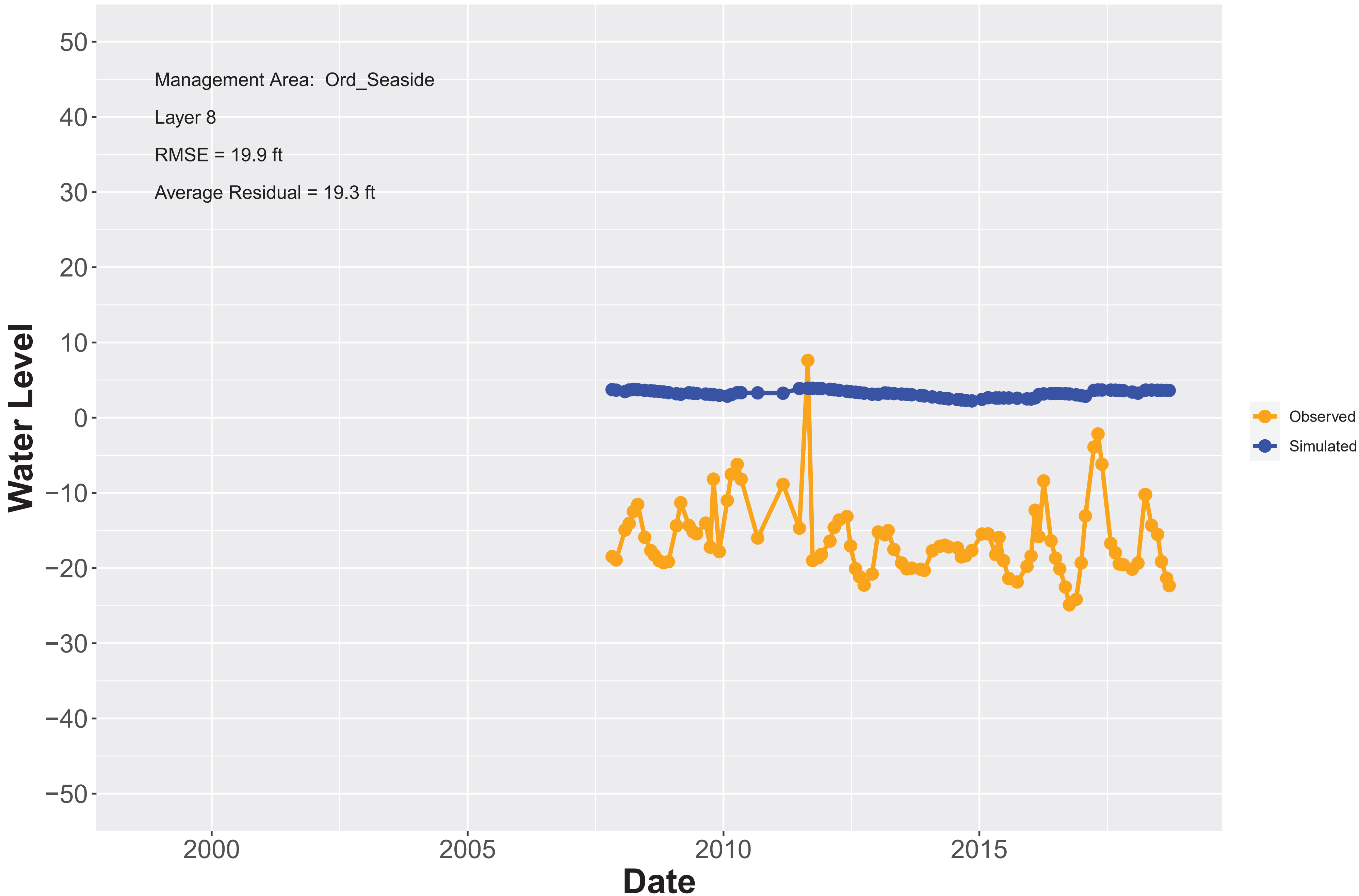


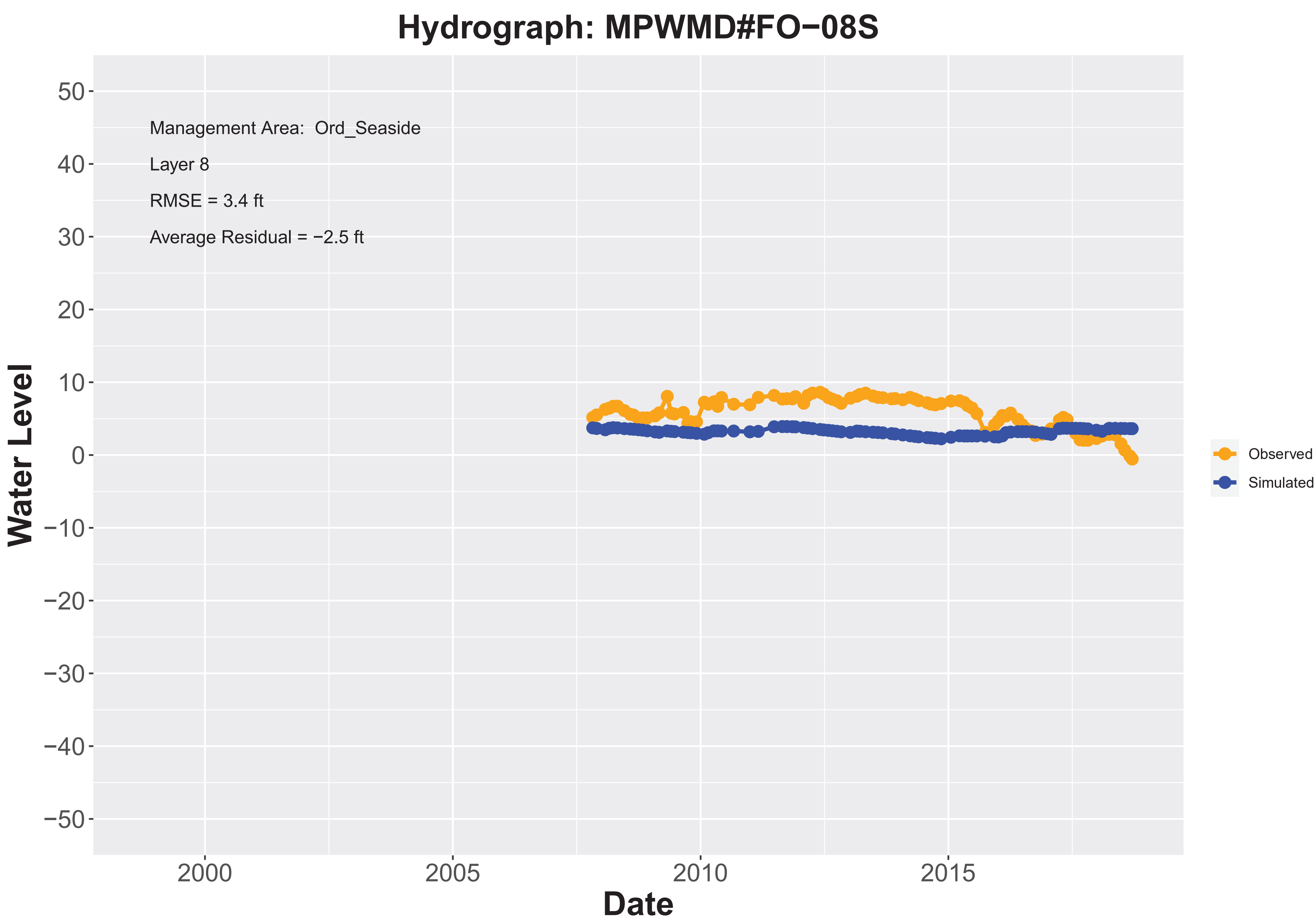


Hydrograph: MPWMD#FO−05D
Management Area: Corral de Tierra
Layer 8
RMSE = 42.1 ft
Average Residual = 42.0 ft
Water Level
260
250
240
230
220
210
200
190
180
170
160
2000
2005
2010
2015
Date
Observed
Simulated

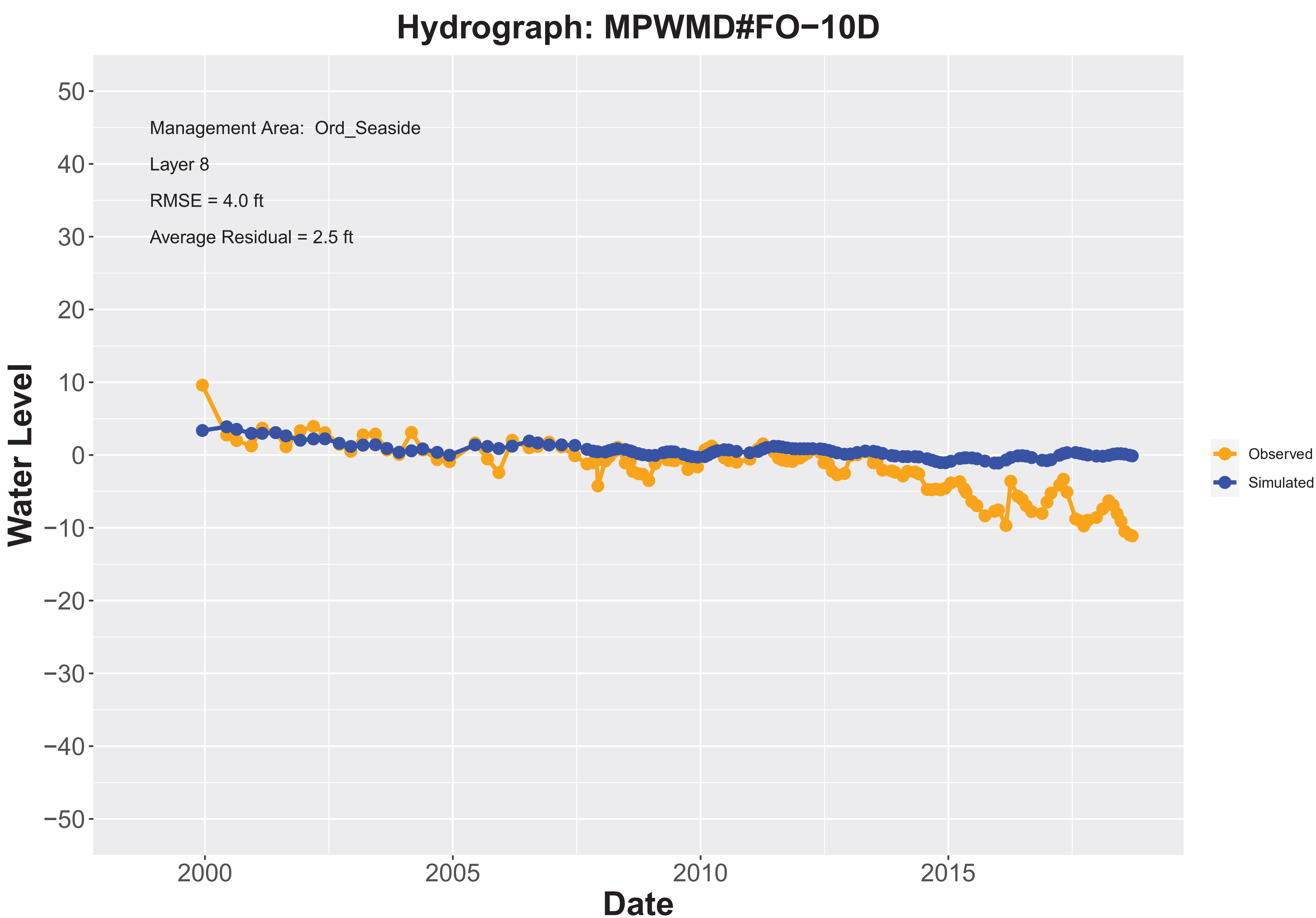

Hydrograph: MPWMD#FO−05S
Management Area: Corral de Tierra
Layer 8
RMSE = 26.0 ft
Average Residual = −25.6 ft
Water Level
260
250
240
230
220
210
200
190
180
170
160
2000
2005
2010
2015
Date
Observed
Simulated

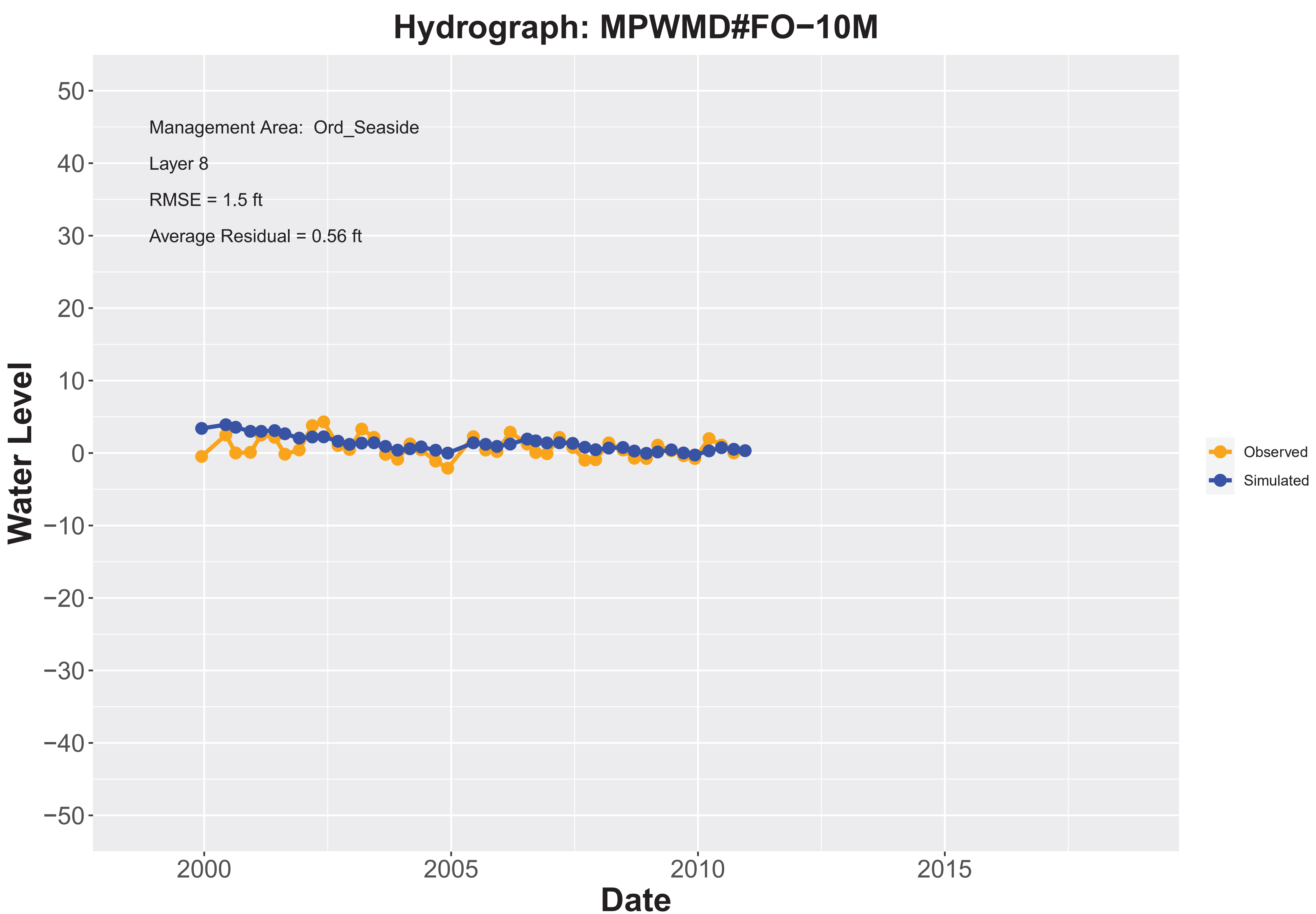
Hydrograph: MPWMD#FO−08D



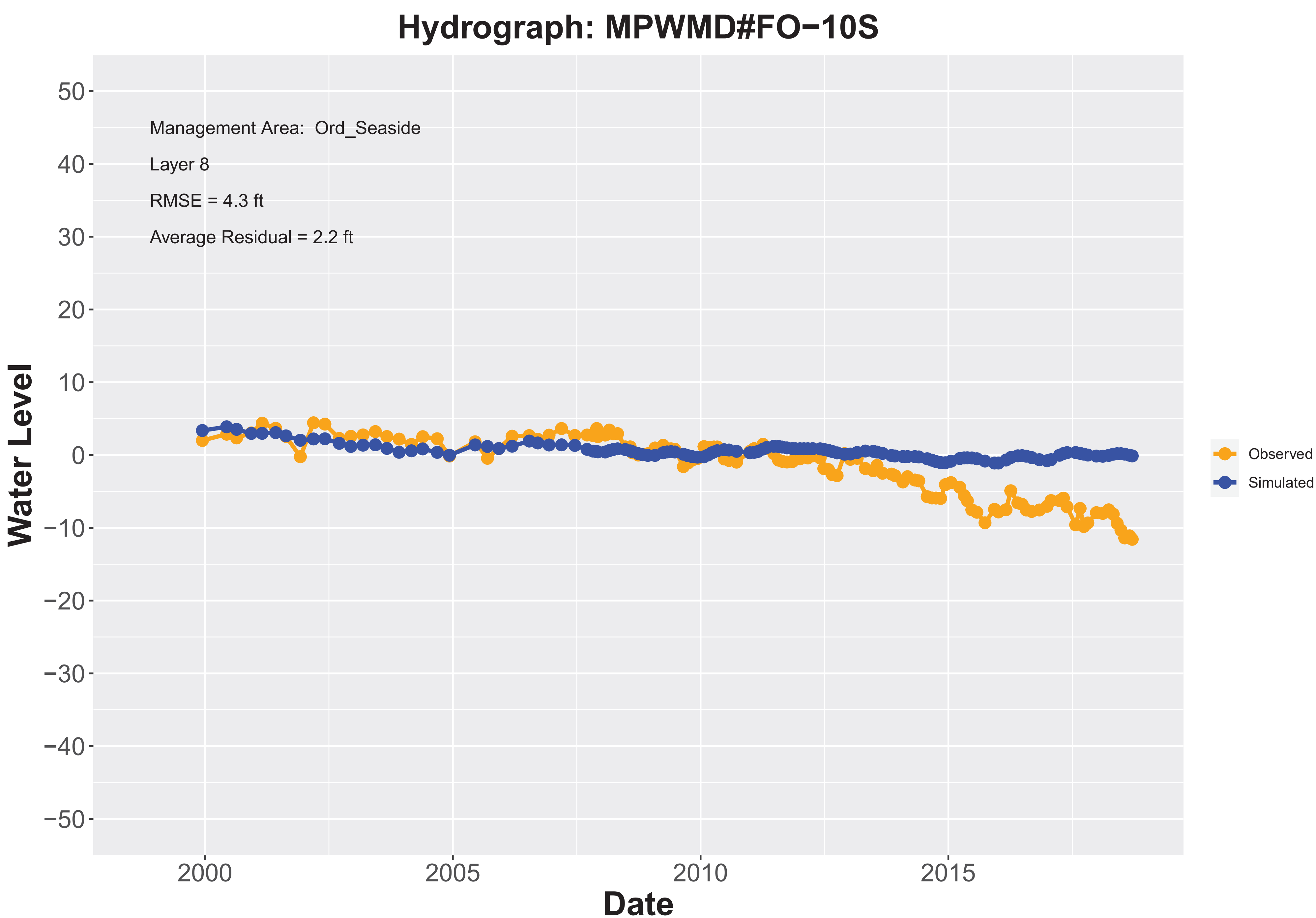


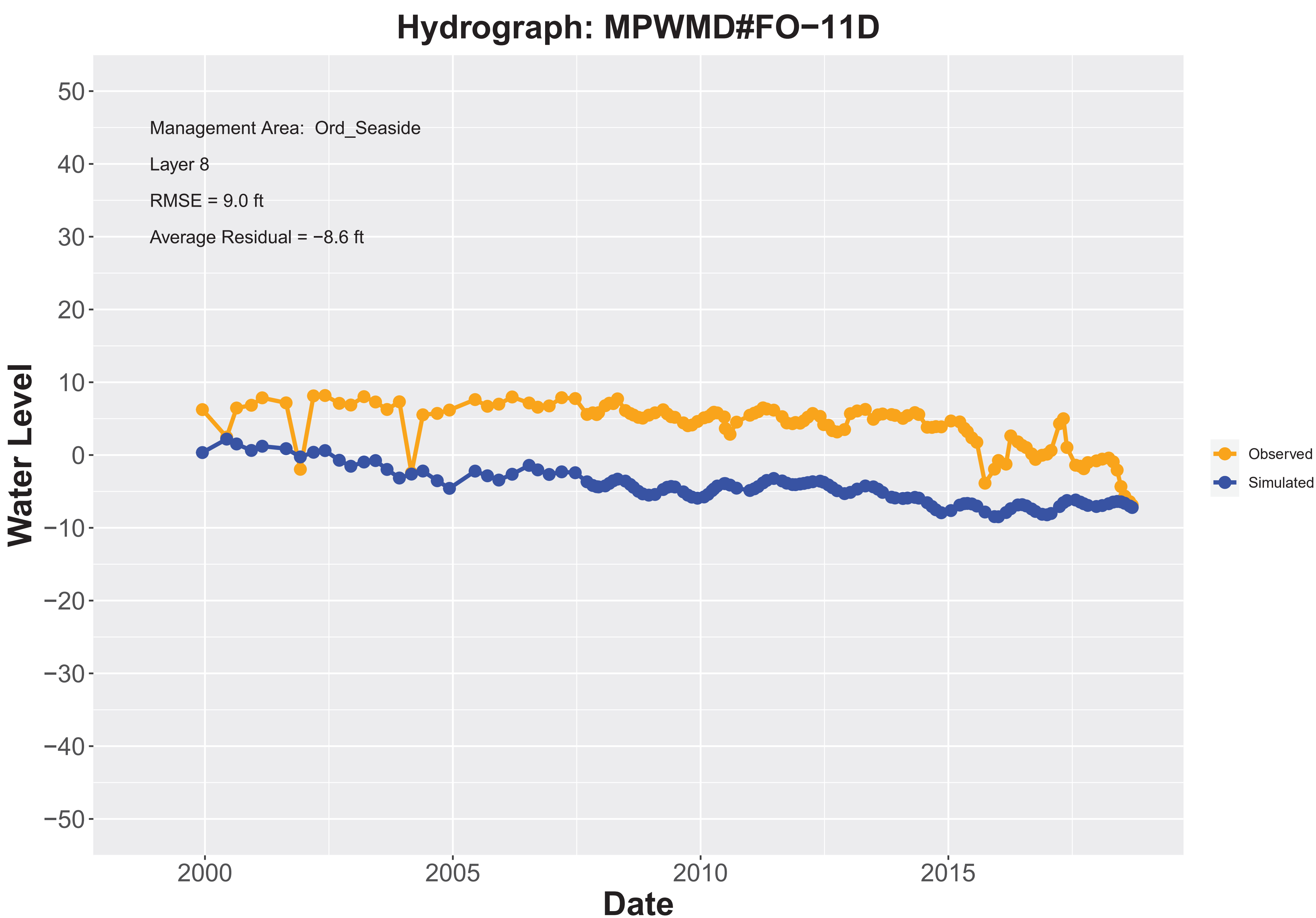
Hydrograph: MPWMD#FO−08S
Management Area: Ord_Seaside
Layer 8
RMSE = 3.4 ft
Average Residual = −2.5 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MPWMD#FO−10D
Management Area: Ord_Seaside
Layer 8
RMSE = 4.0 ft
Average Residual = 2.5 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

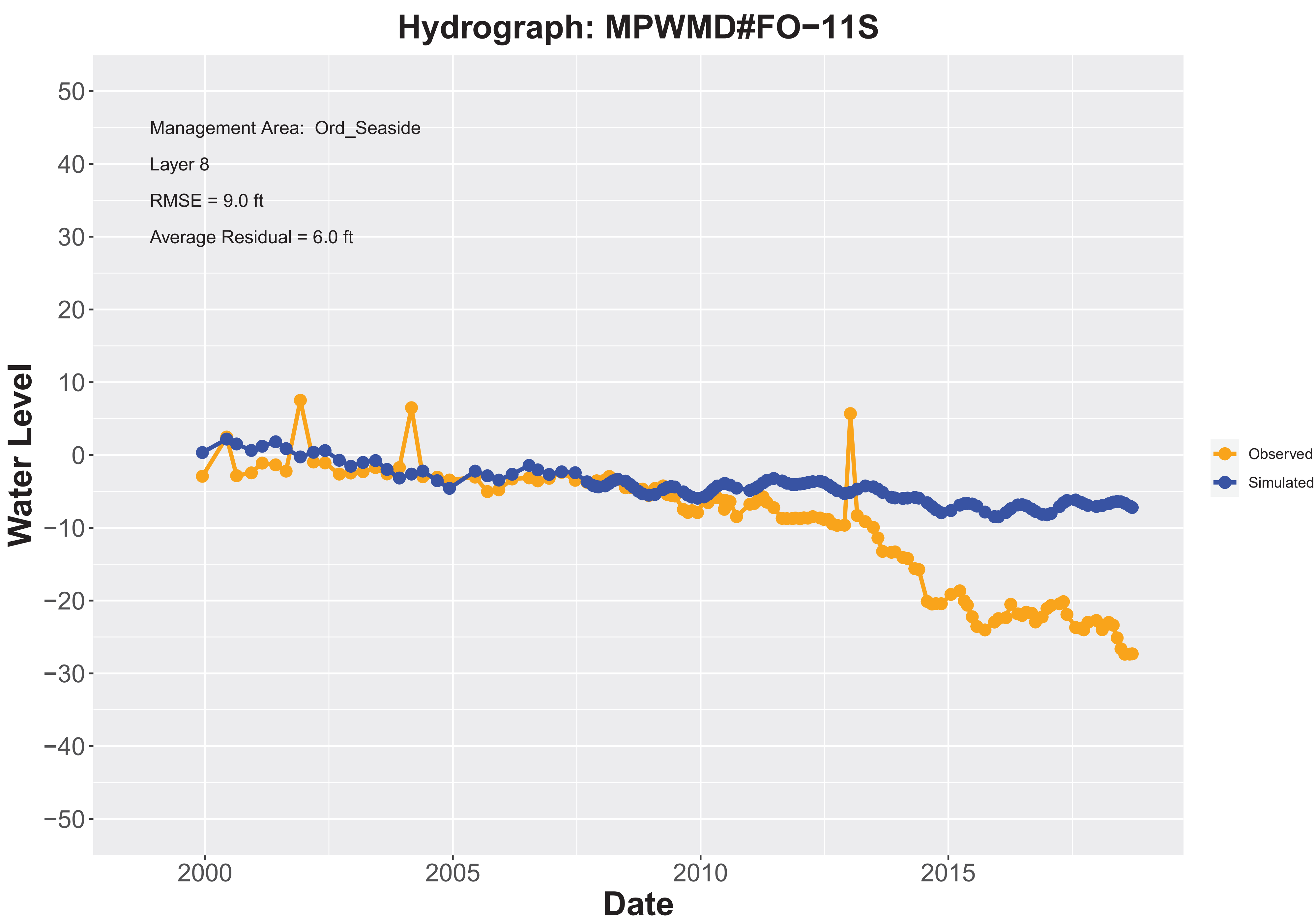


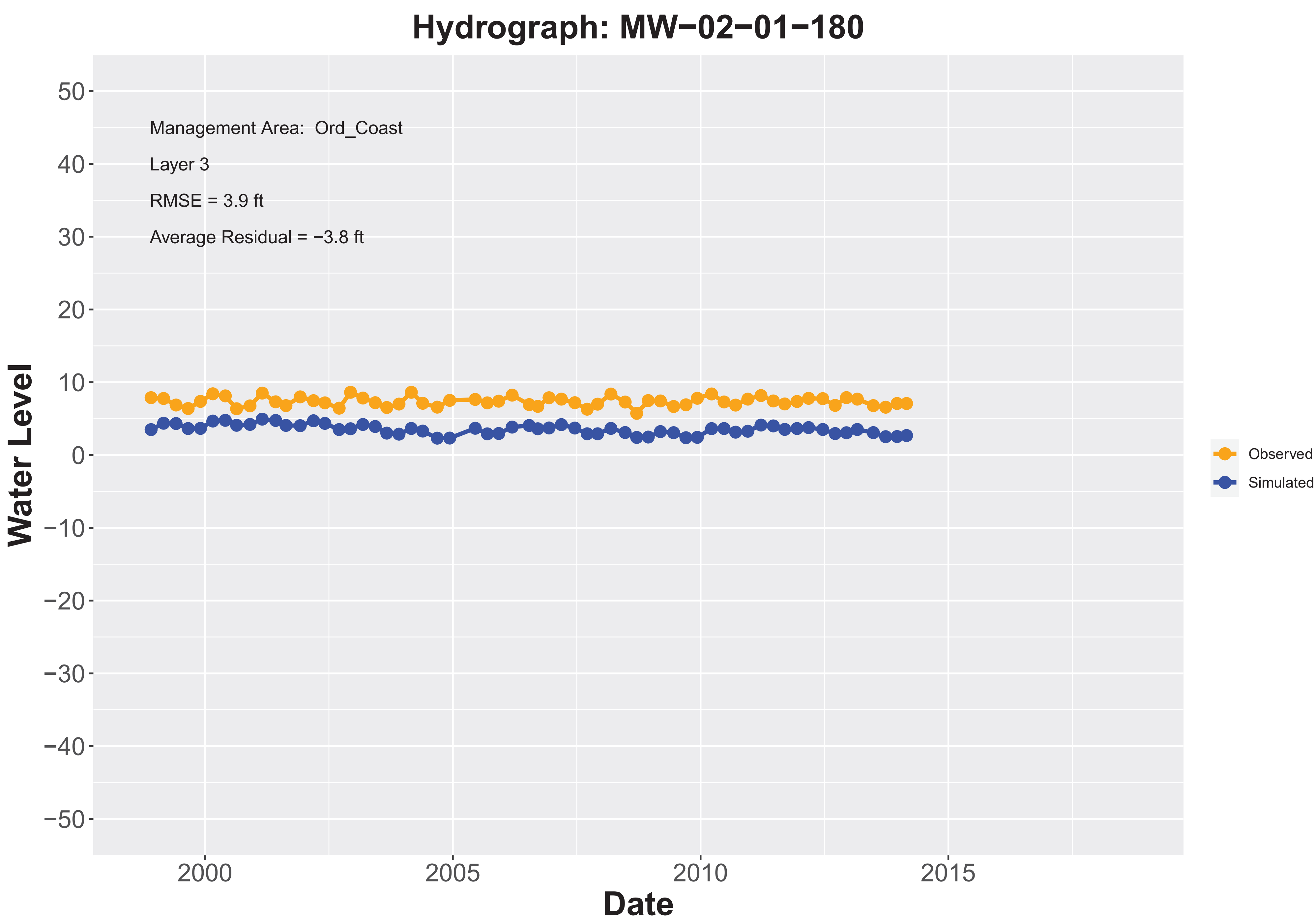
Hydrograph: MPWMD#FO−10M
Management Area: Ord_Seaside
Layer 8
RMSE = 1.5 ft
Average Residual = 0.56 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

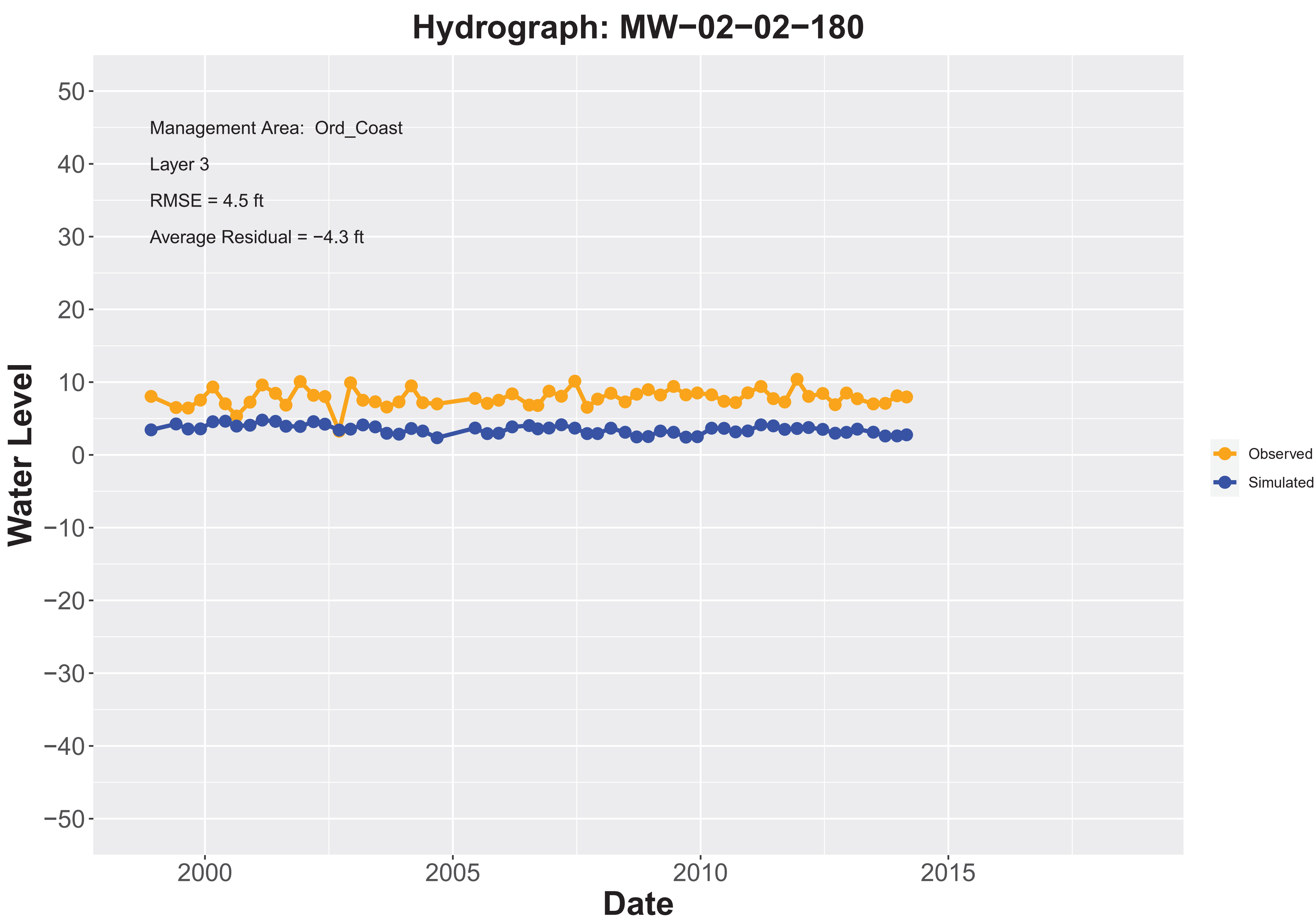

Hydrograph: MPWMD#FO−10S
Management Area: Ord_Seaside
Layer 8
RMSE = 4.3 ft
Average Residual = 2.2 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



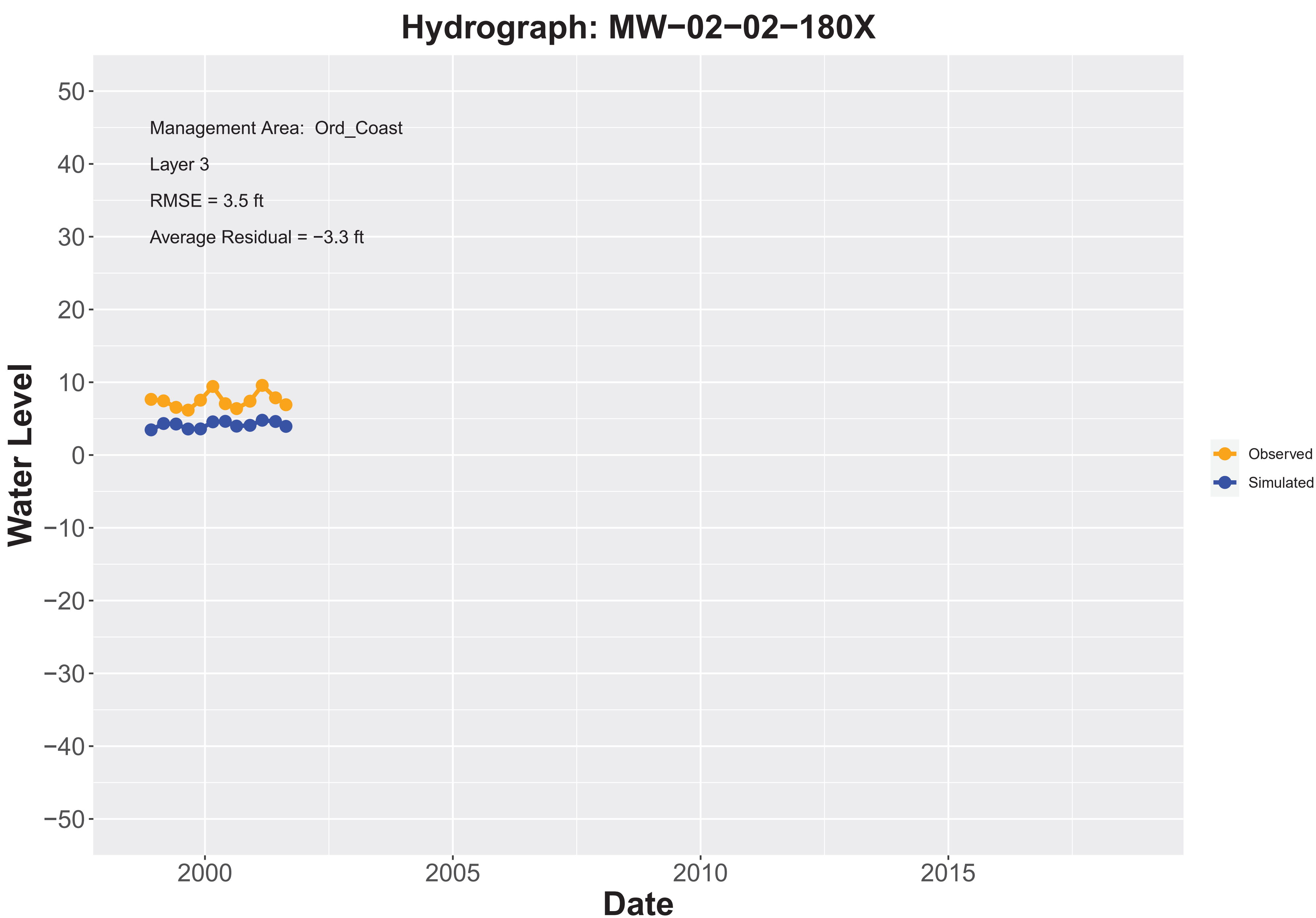
Hydrograph: MPWMD#FO−11D
Management Area: Ord_Seaside
Layer 8
RMSE = 9.0 ft
Average Residual = −8.6 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

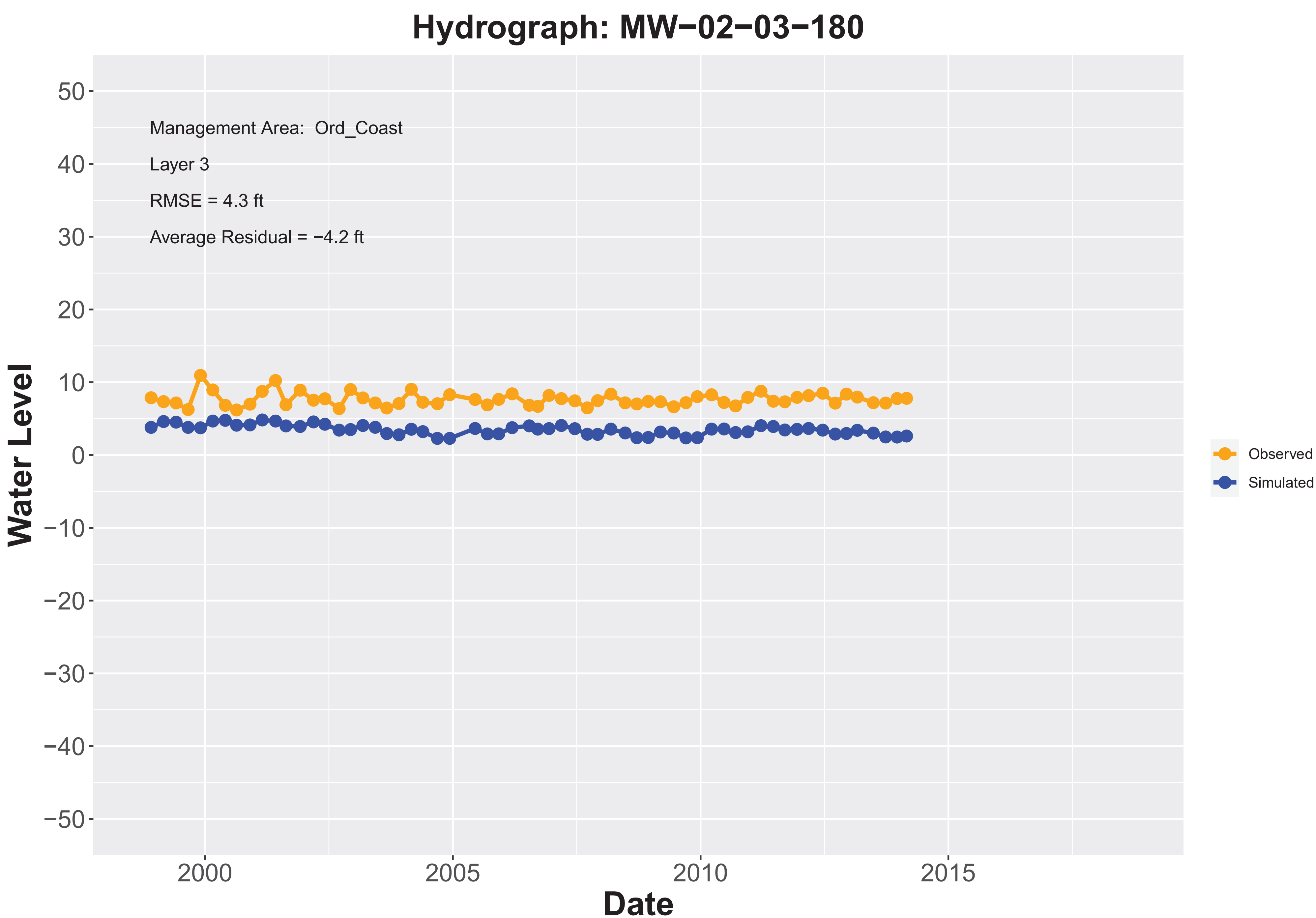

Hydrograph: MPWMD#FO−11S
Management Area: Ord_Seaside
Layer 8
RMSE = 9.0 ft
Average Residual = 6.0 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

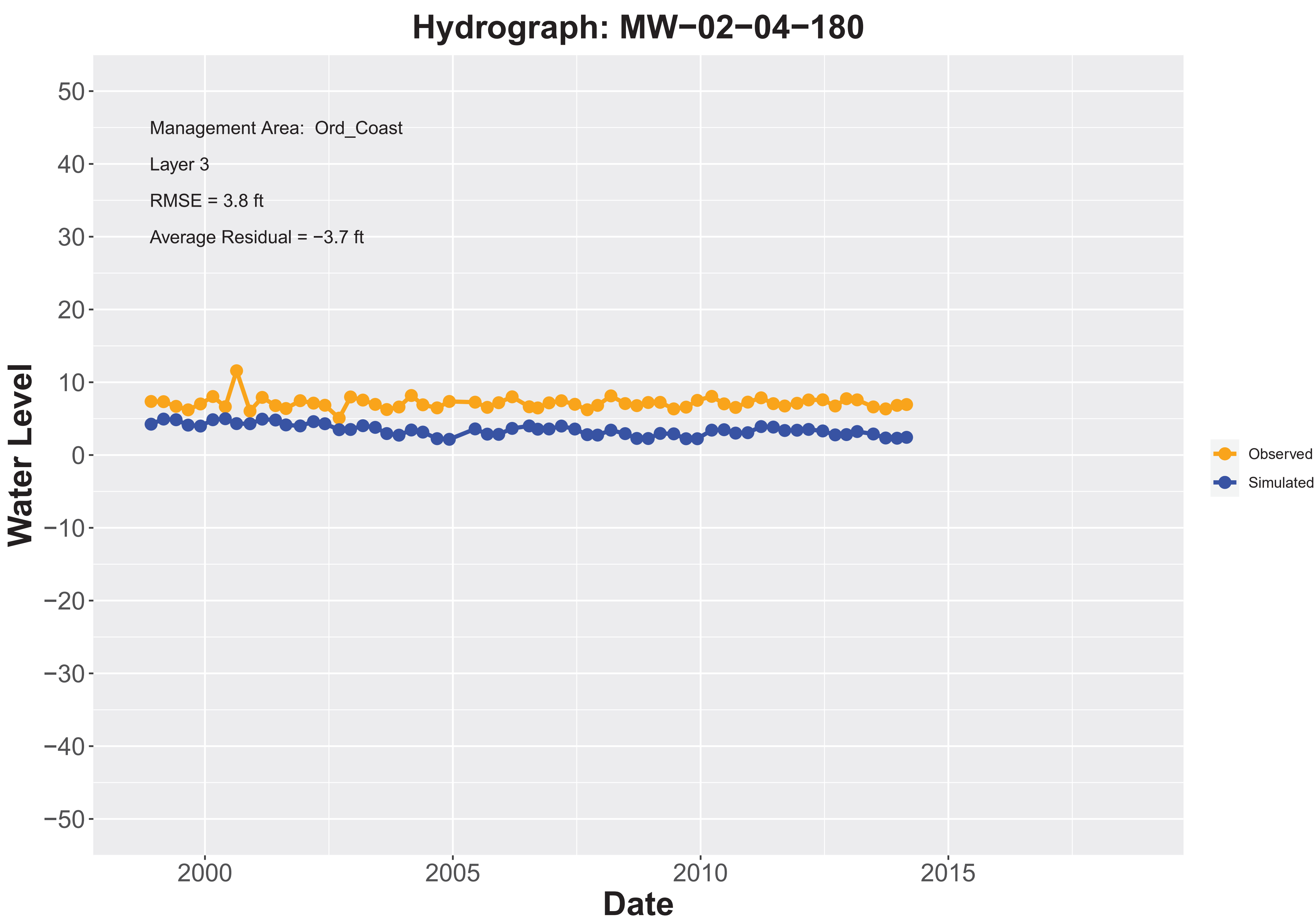

Hydrograph: MW−02−01−180
Management Area: Ord_Coast
Layer 3
RMSE = 3.9 ft
Average Residual = −3.8 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



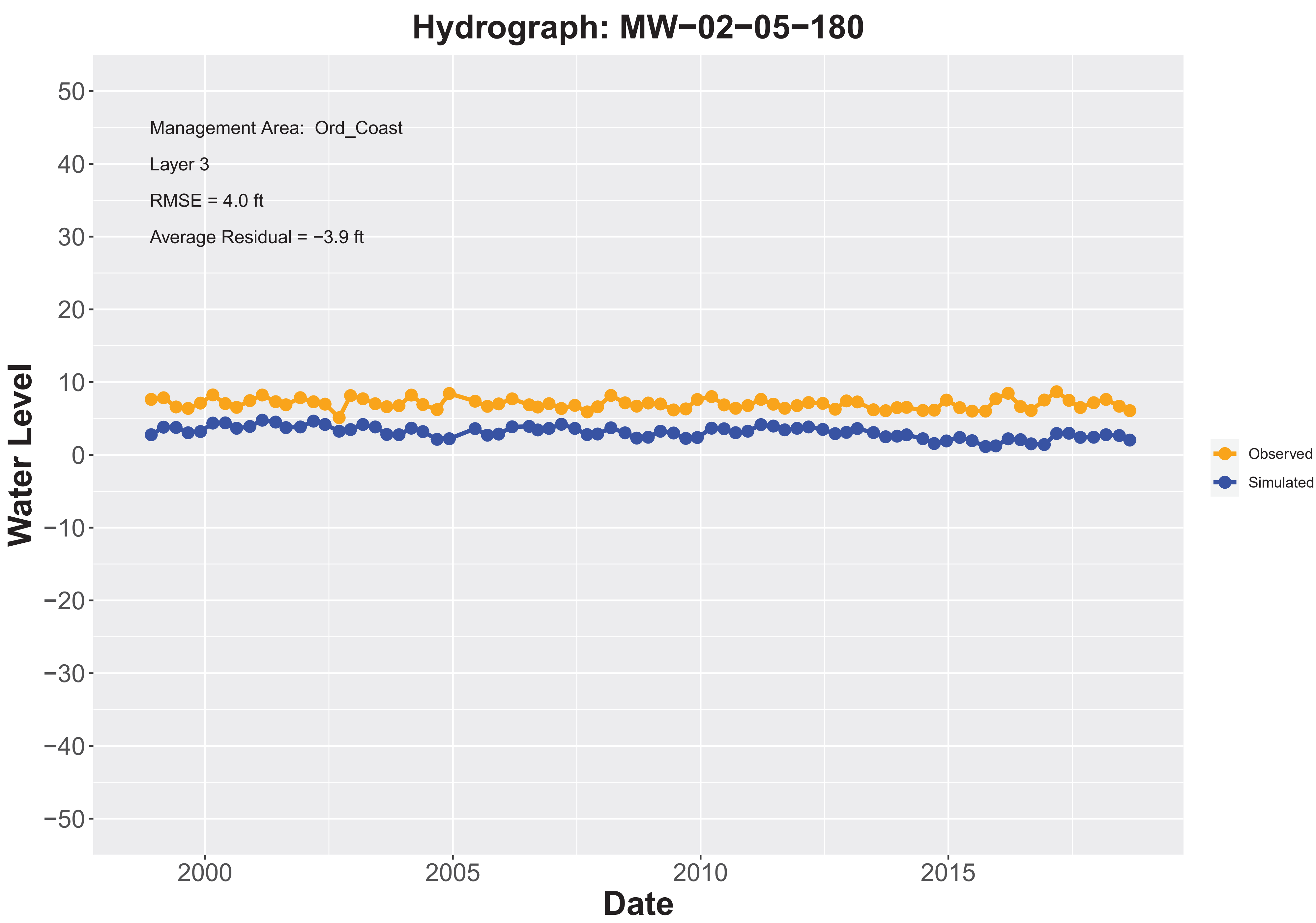
Hydrograph: MW−02−02−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.5 ft
Average Residual = −4.3 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−02−02−180X
Management Area: Ord_Coast
Layer 3
RMSE = 3.5 ft
Average Residual = −3.3 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−02−03−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.3 ft
Average Residual = −4.2 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

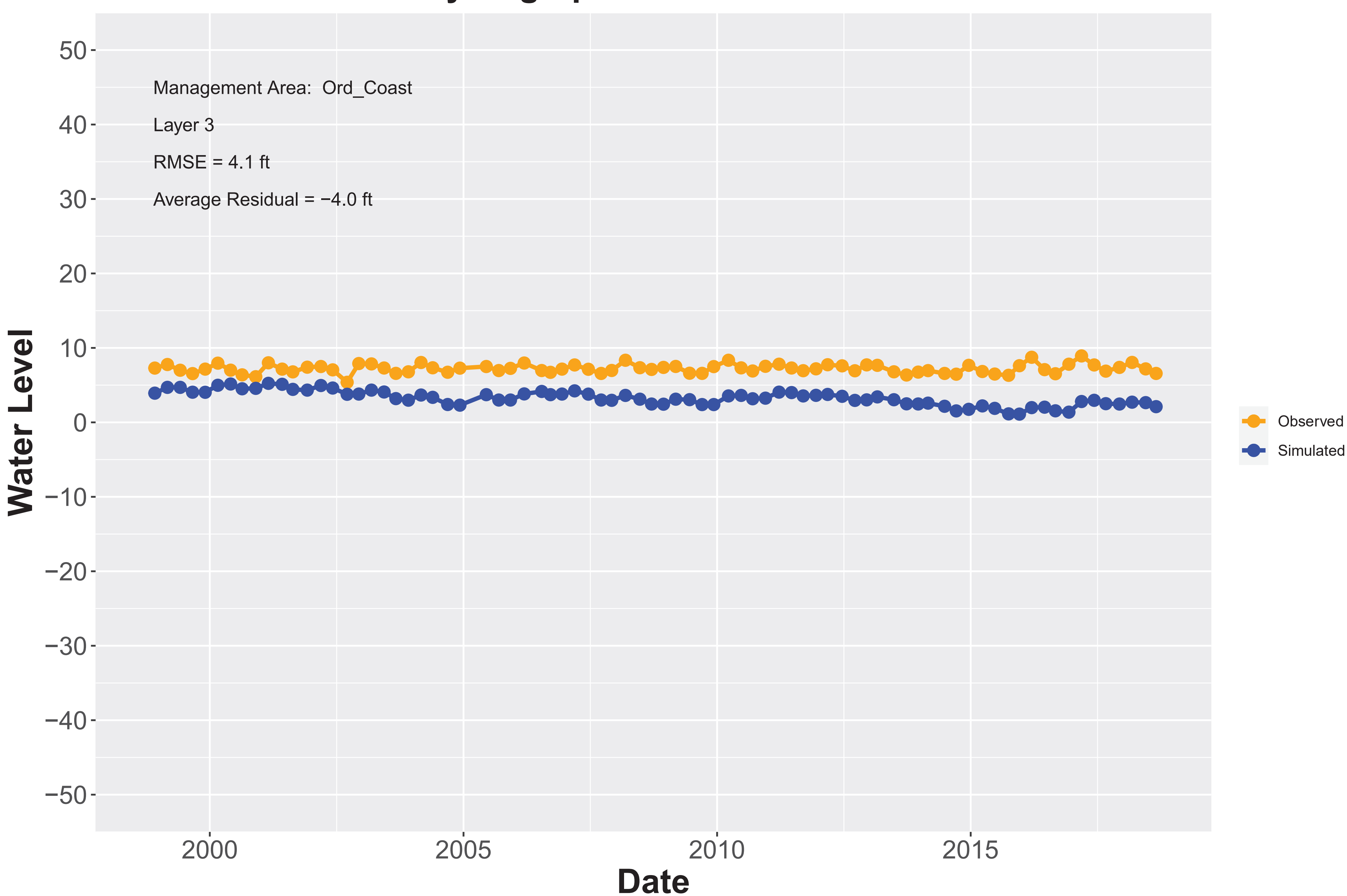


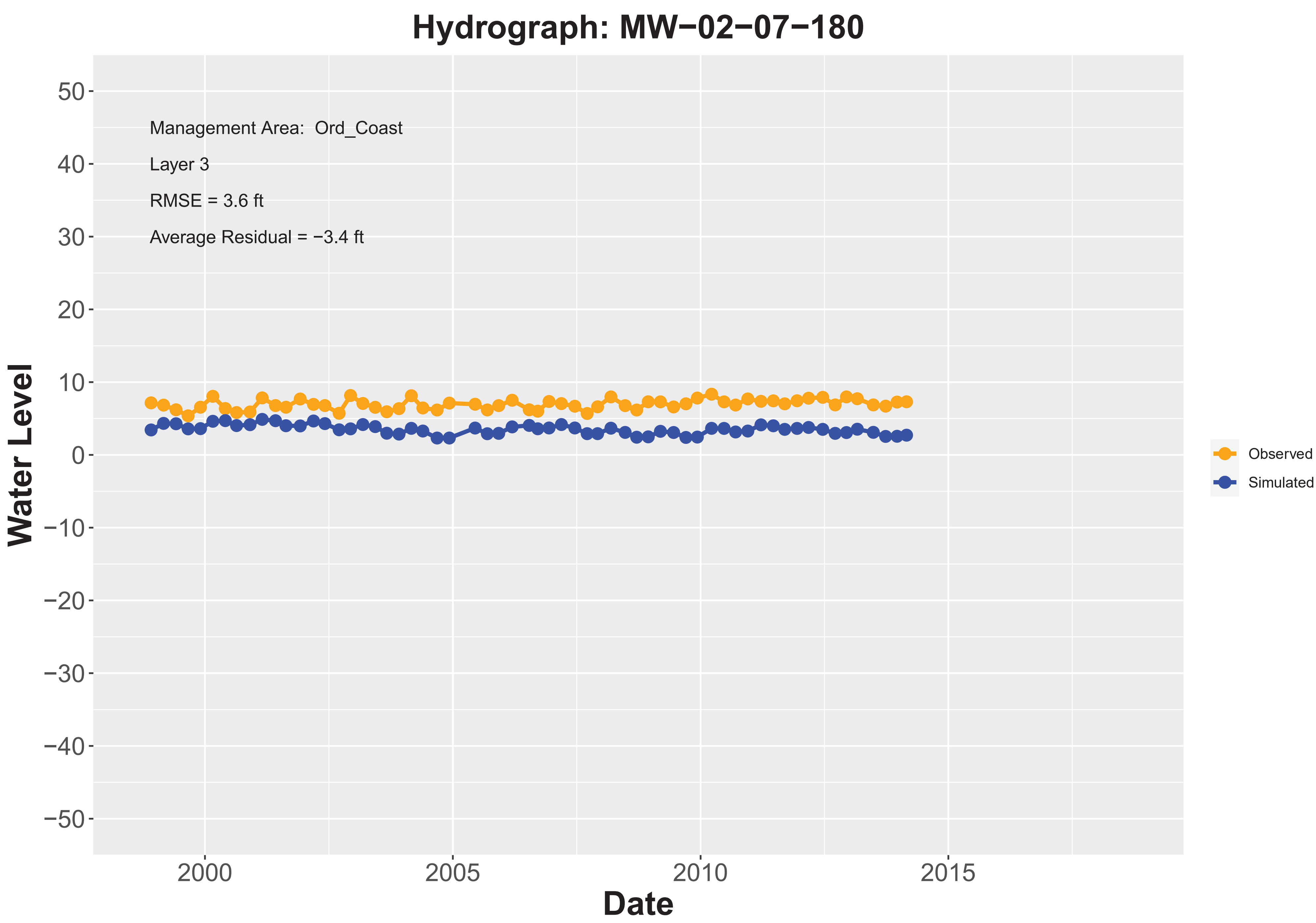
Hydrograph: MW−02−04−180
Management Area: Ord_Coast
Layer 3
RMSE = 3.8 ft
Average Residual = −3.7 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−02−05−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.0 ft
Average Residual = −3.9 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−02−06−180




Hydrograph: MW−02−07−180
Management Area: Ord_Coast
Layer 3
RMSE = 3.6 ft
Average Residual = −3.4 ft
Water Level
50
40
30
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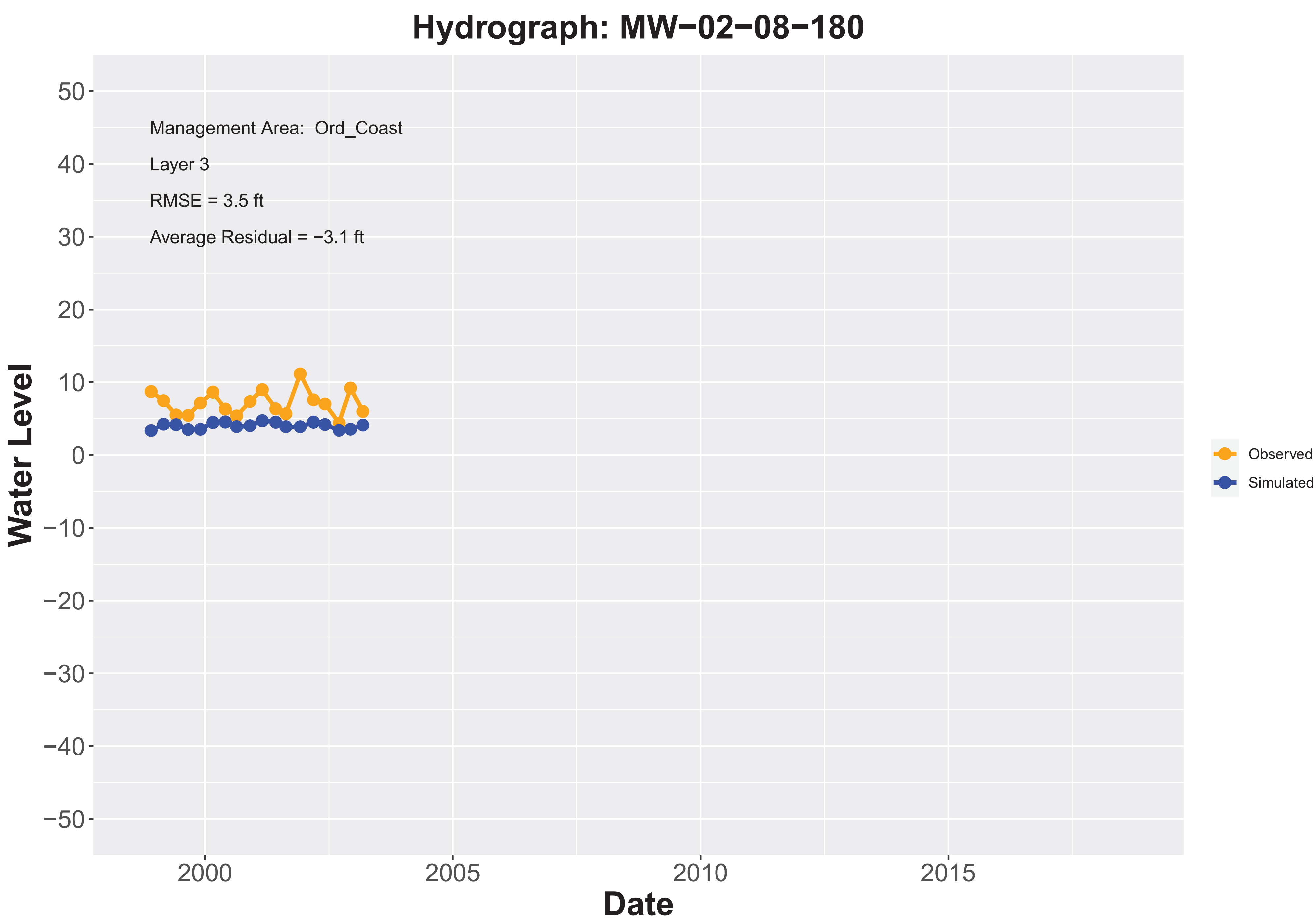
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−02−08−180
Management Area: Ord_Coast
Layer 3
RMSE = 3.5 ft
Average Residual = −3.1 ft
Water Level
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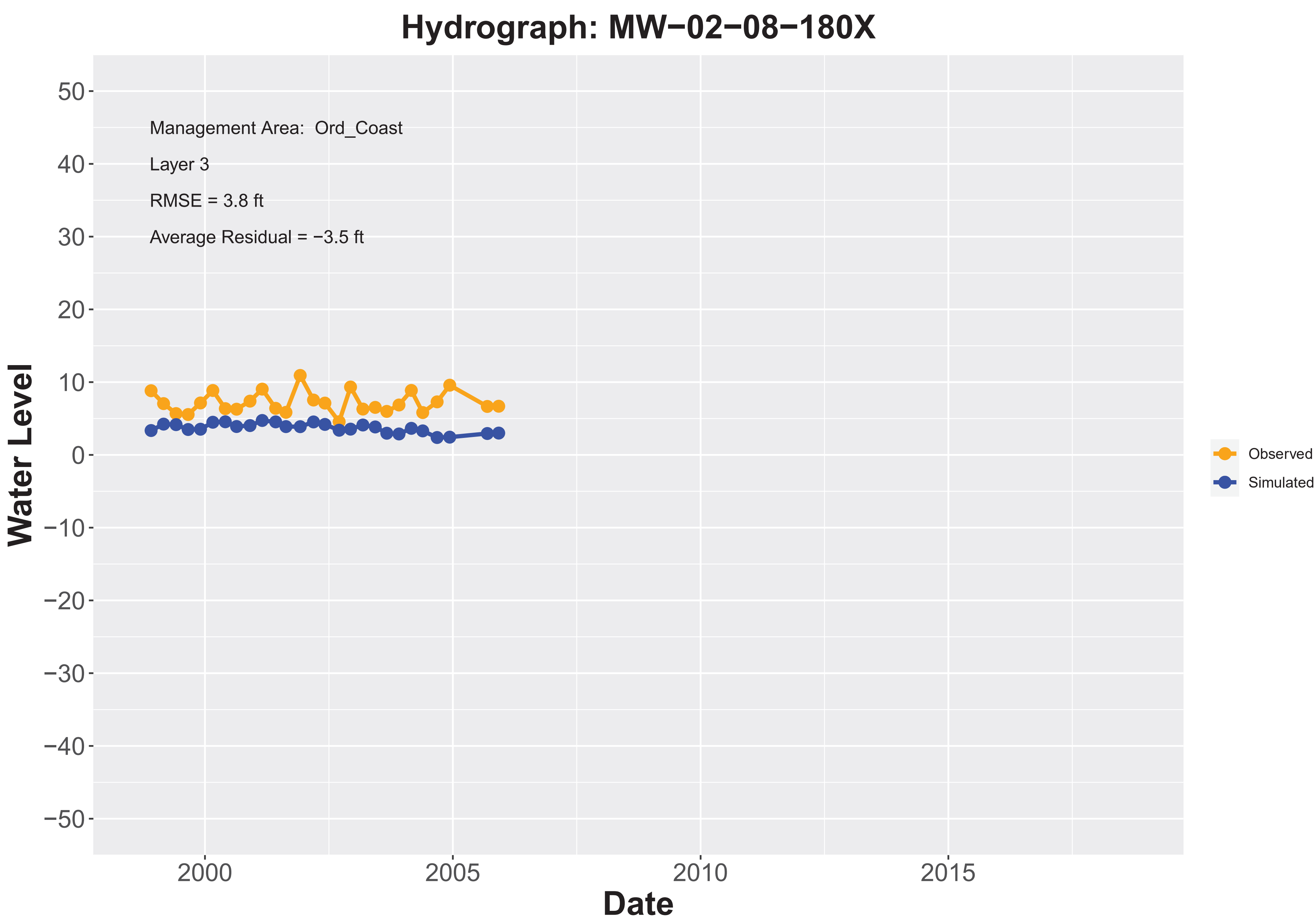
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−02−08−180X
Management Area: Ord_Coast
Layer 3
RMSE = 3.8 ft
Average Residual = −3.5 ft
Water Level
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40
30
20
10
0
−10
−20
−30
−40
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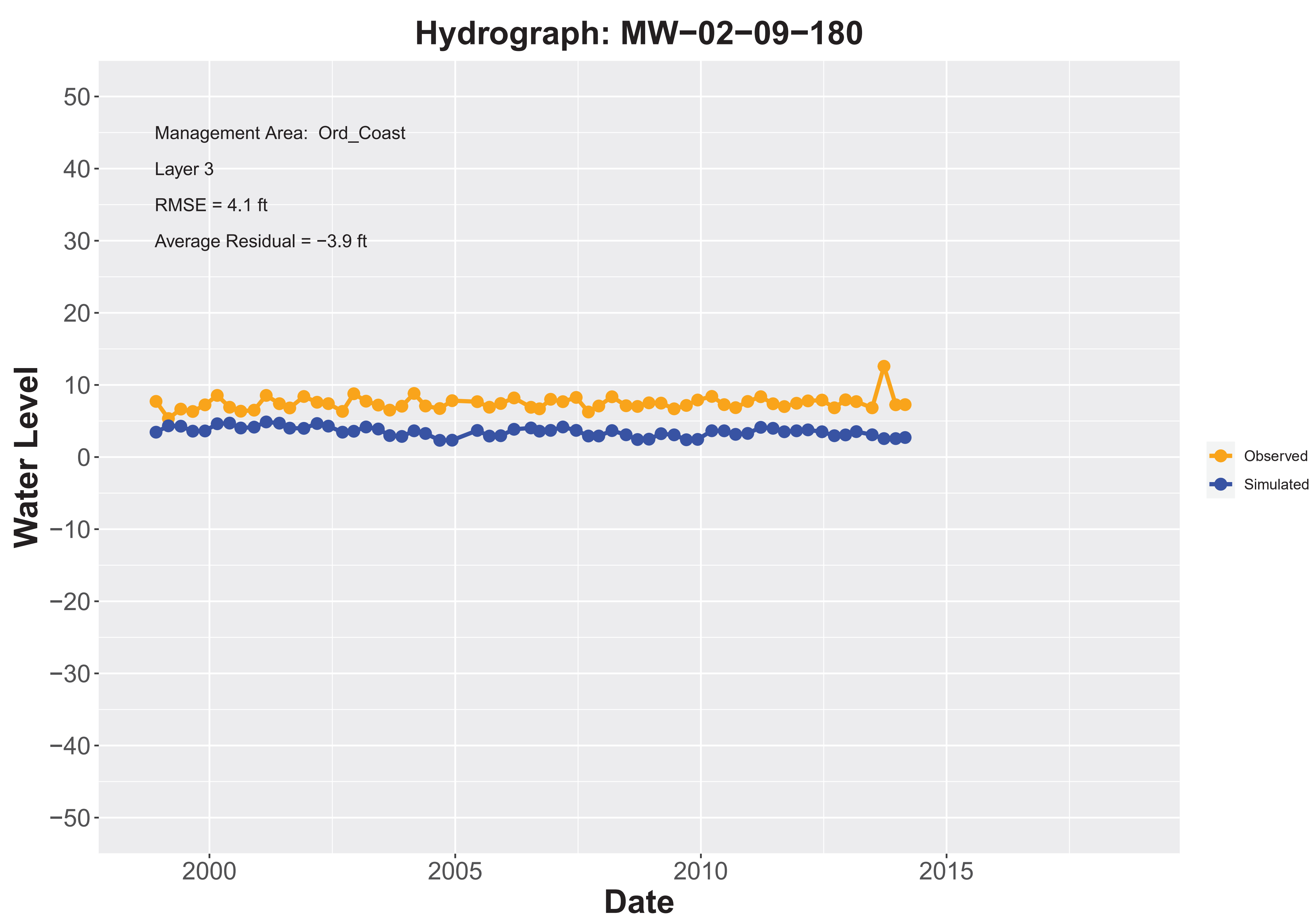
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−02−09−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.1 ft
Average Residual = −3.9 ft
Water Level
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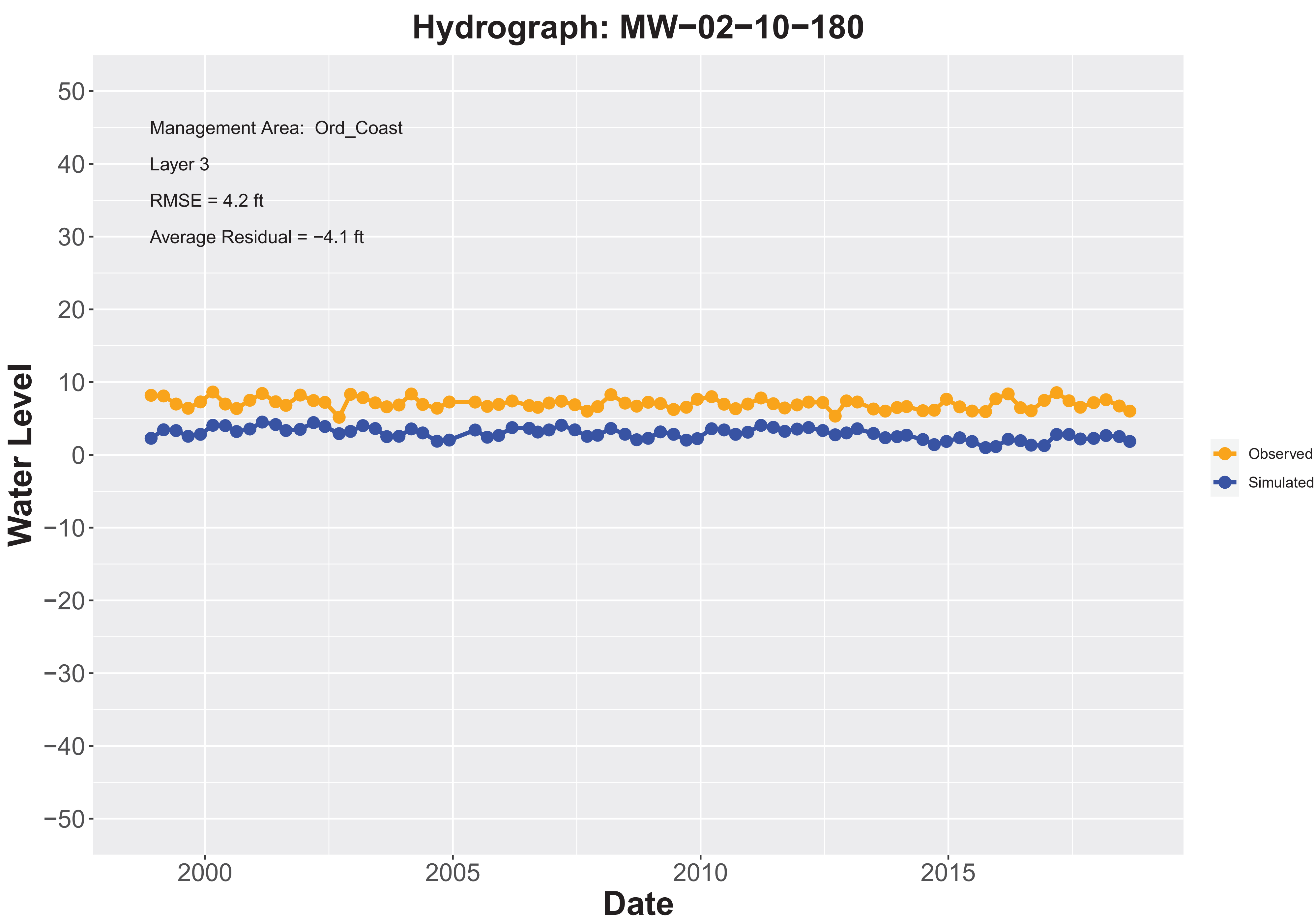
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−02−10−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.2 ft
Average Residual = −4.1 ft
Water Level
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40
30
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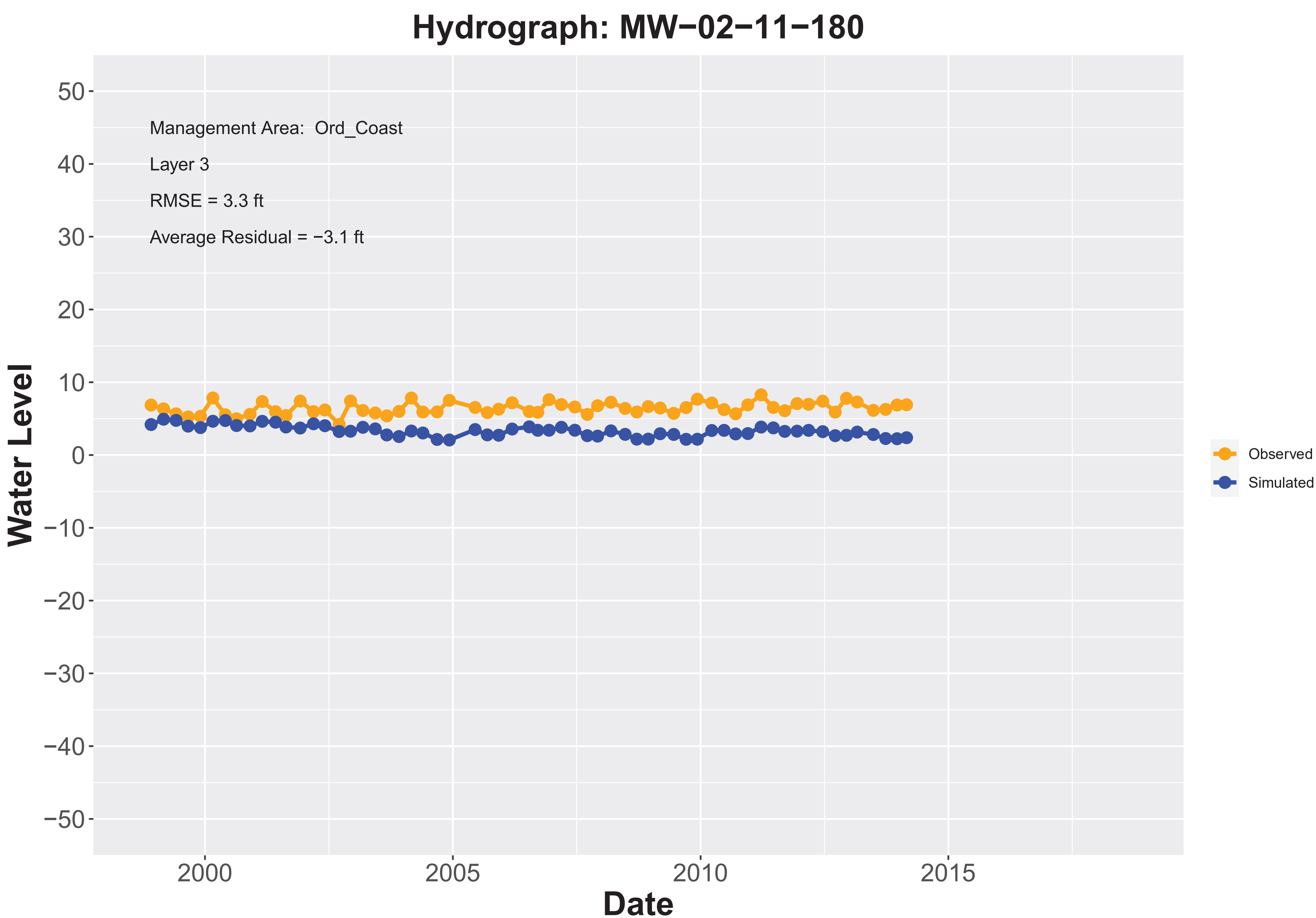
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−02−11−180
Management Area: Ord_Coast
Layer 3
RMSE = 3.3 ft
Average Residual = −3.1 ft
Water Level
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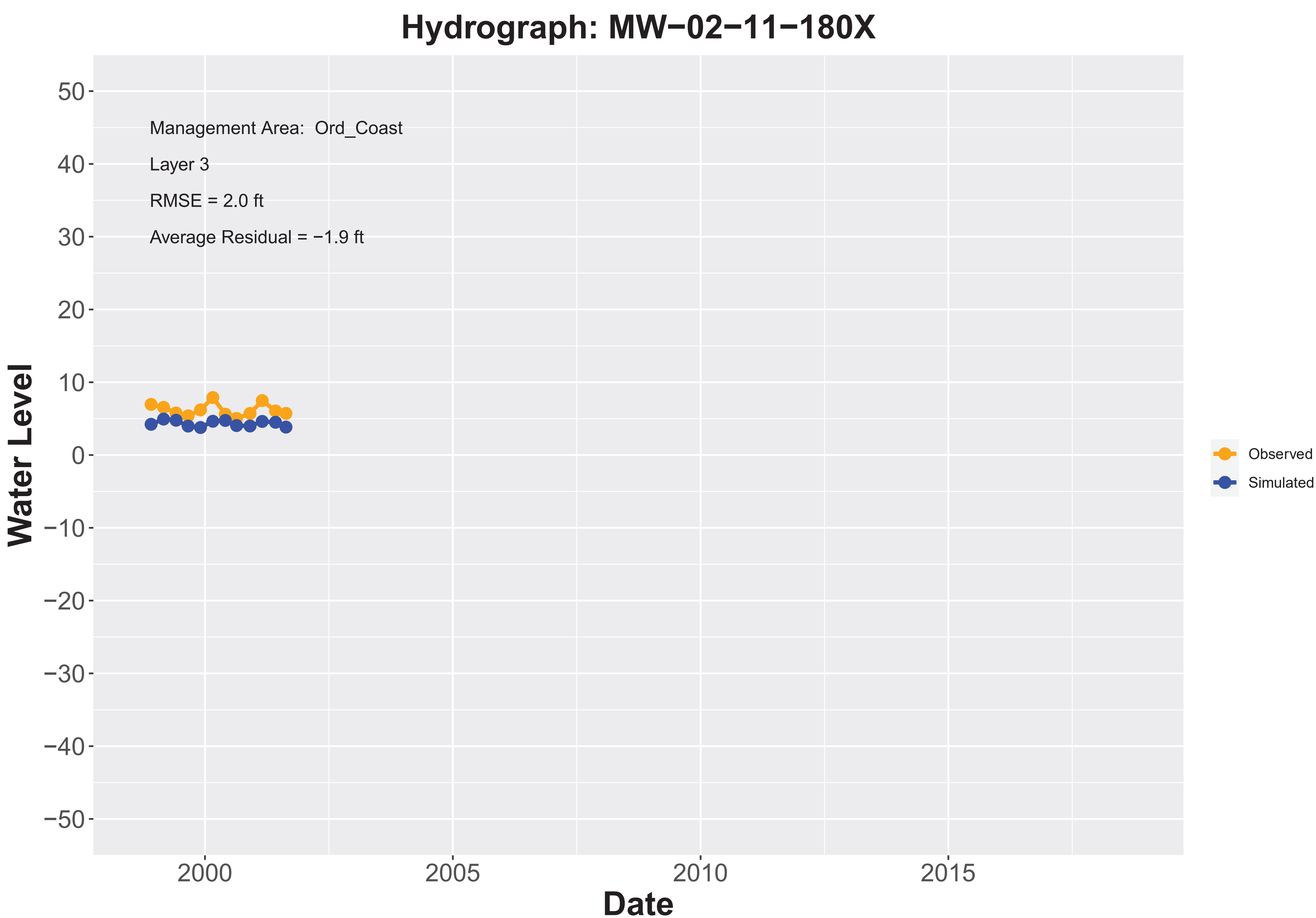
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−02−11−180X
Management Area: Ord_Coast
Layer 3
RMSE = 2.0 ft
Average Residual = −1.9 ft
Water Level
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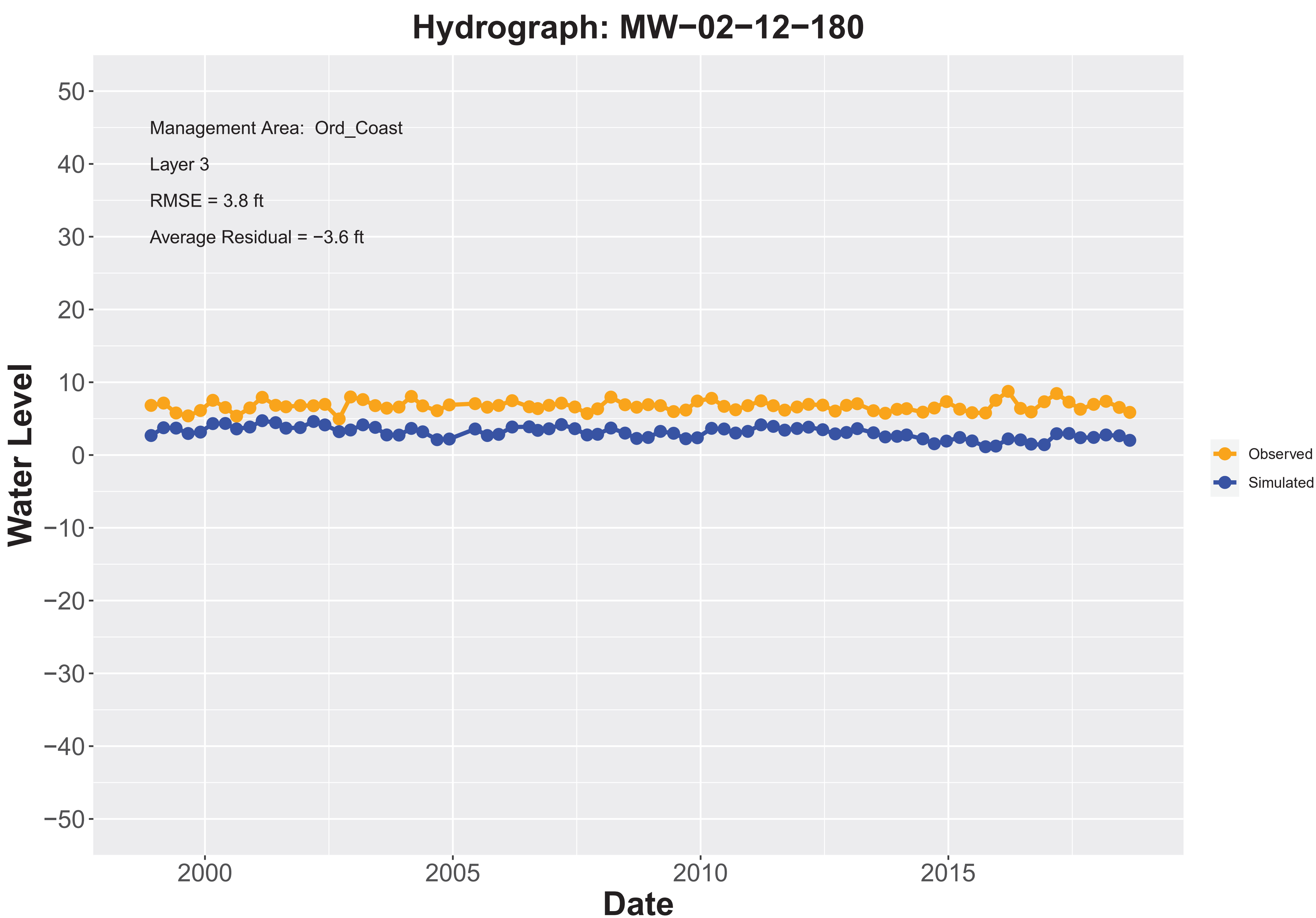
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−02−12−180
Management Area: Ord_Coast
Layer 3
RMSE = 3.8 ft
Average Residual = −3.6 ft
Water Level
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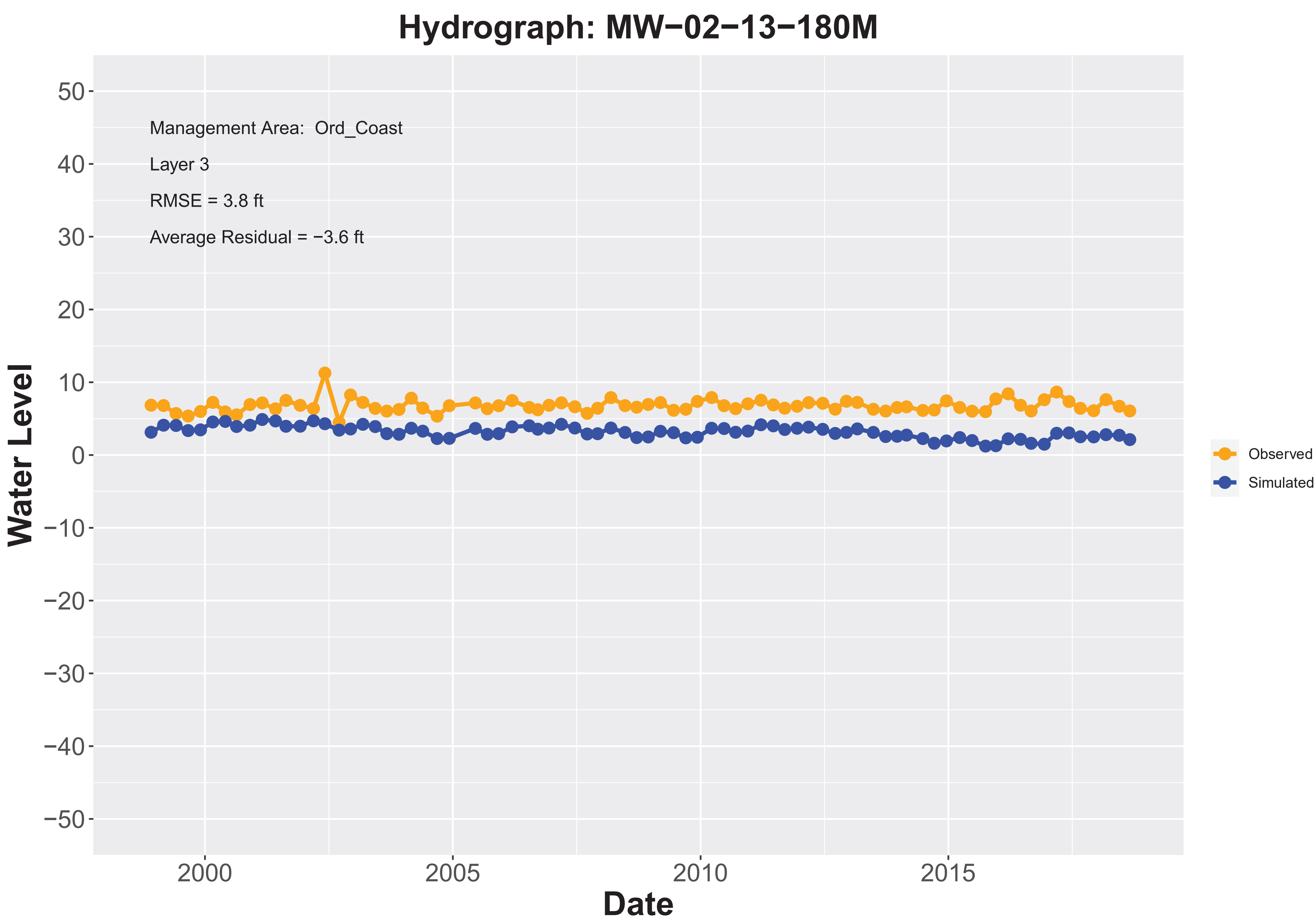
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−02−13−180M
Management Area: Ord_Coast
Layer 3
RMSE = 3.8 ft
Average Residual = −3.6 ft
Water Level
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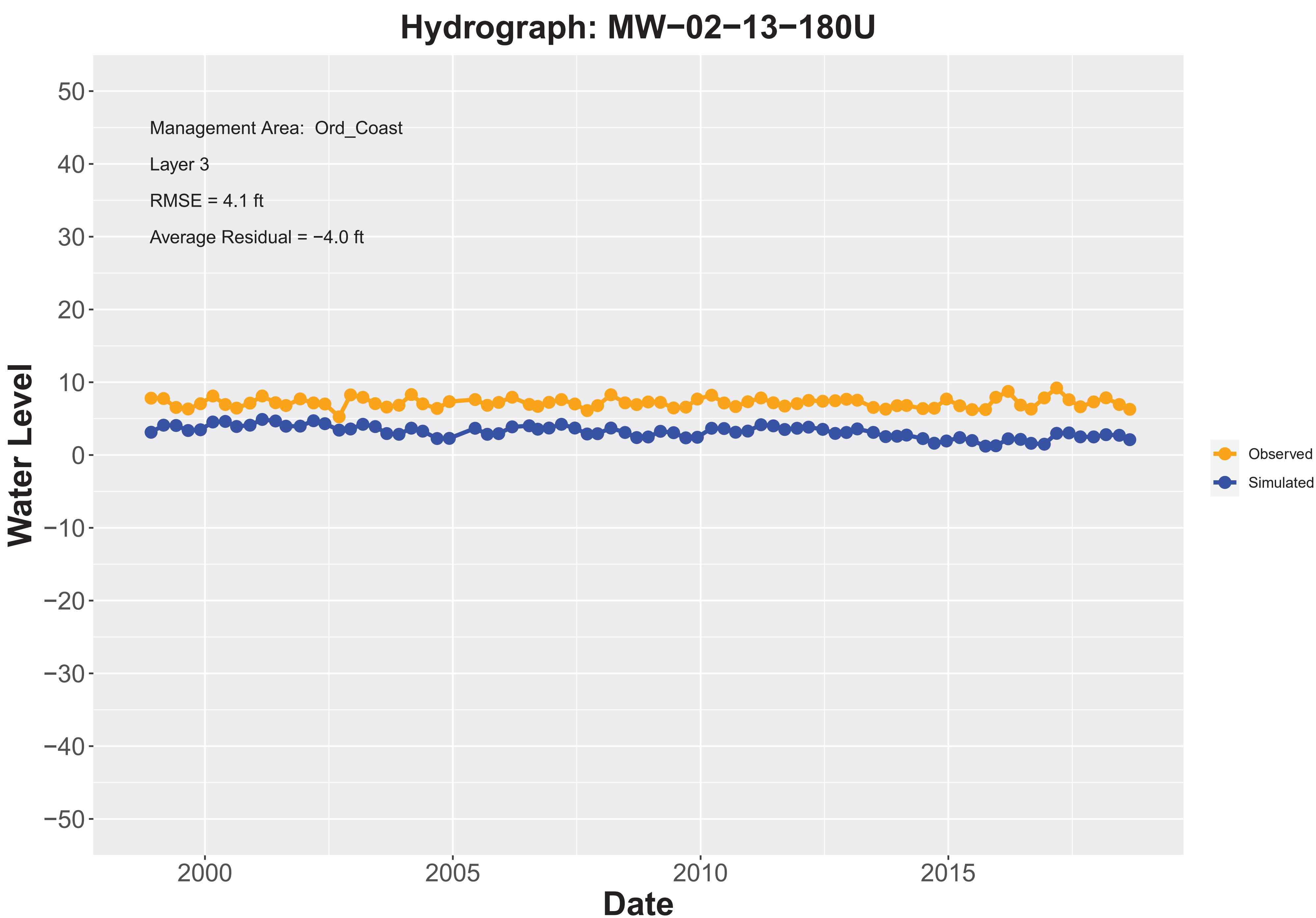
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−02−13−180U
Management Area: Ord_Coast
Layer 3
RMSE = 4.1 ft
Average Residual = −4.0 ft
Water Level
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40
30
20
10
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−10
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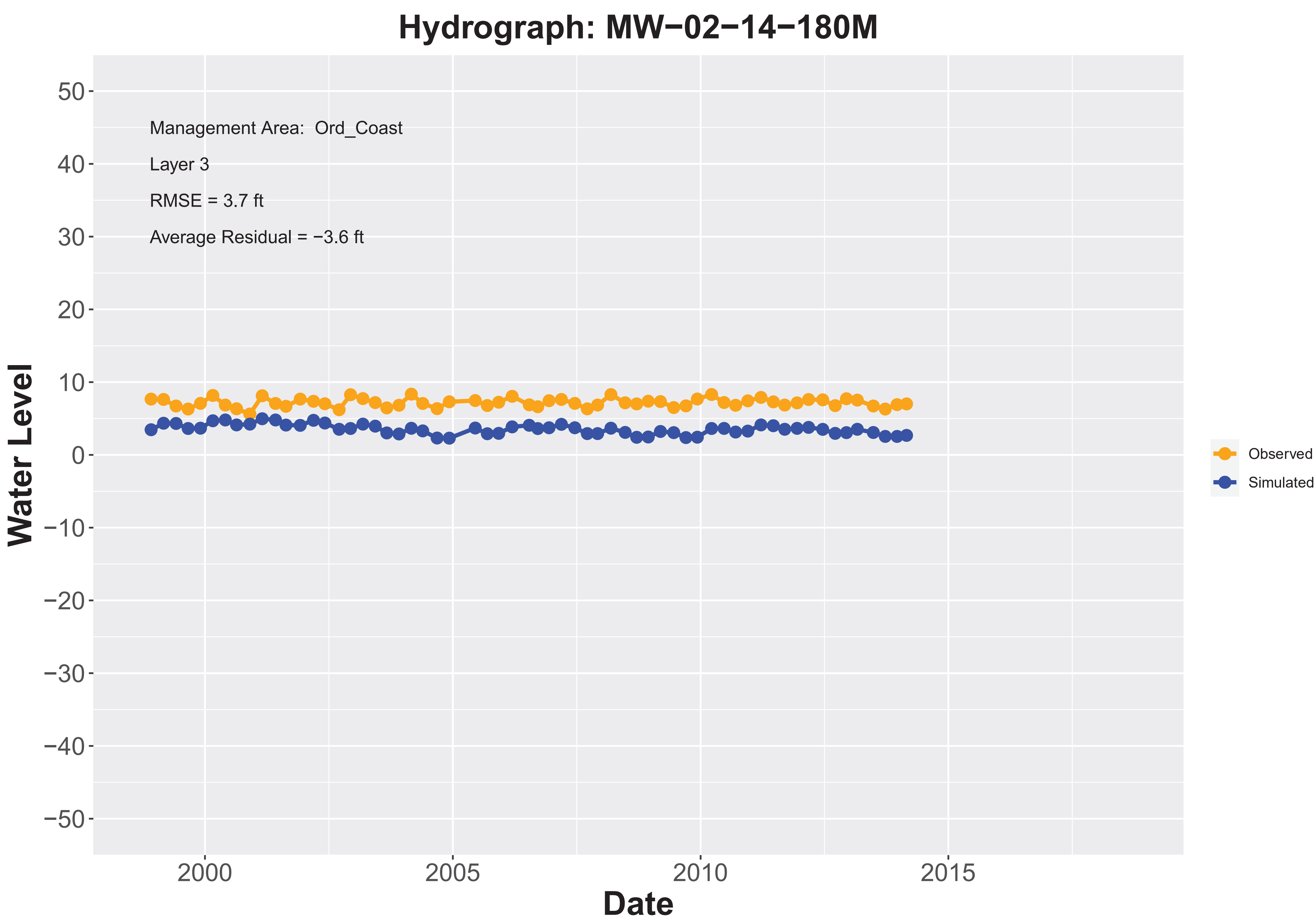
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−02−14−180M
Management Area: Ord_Coast
Layer 3
RMSE = 3.7 ft
Average Residual = −3.6 ft
Water Level
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30
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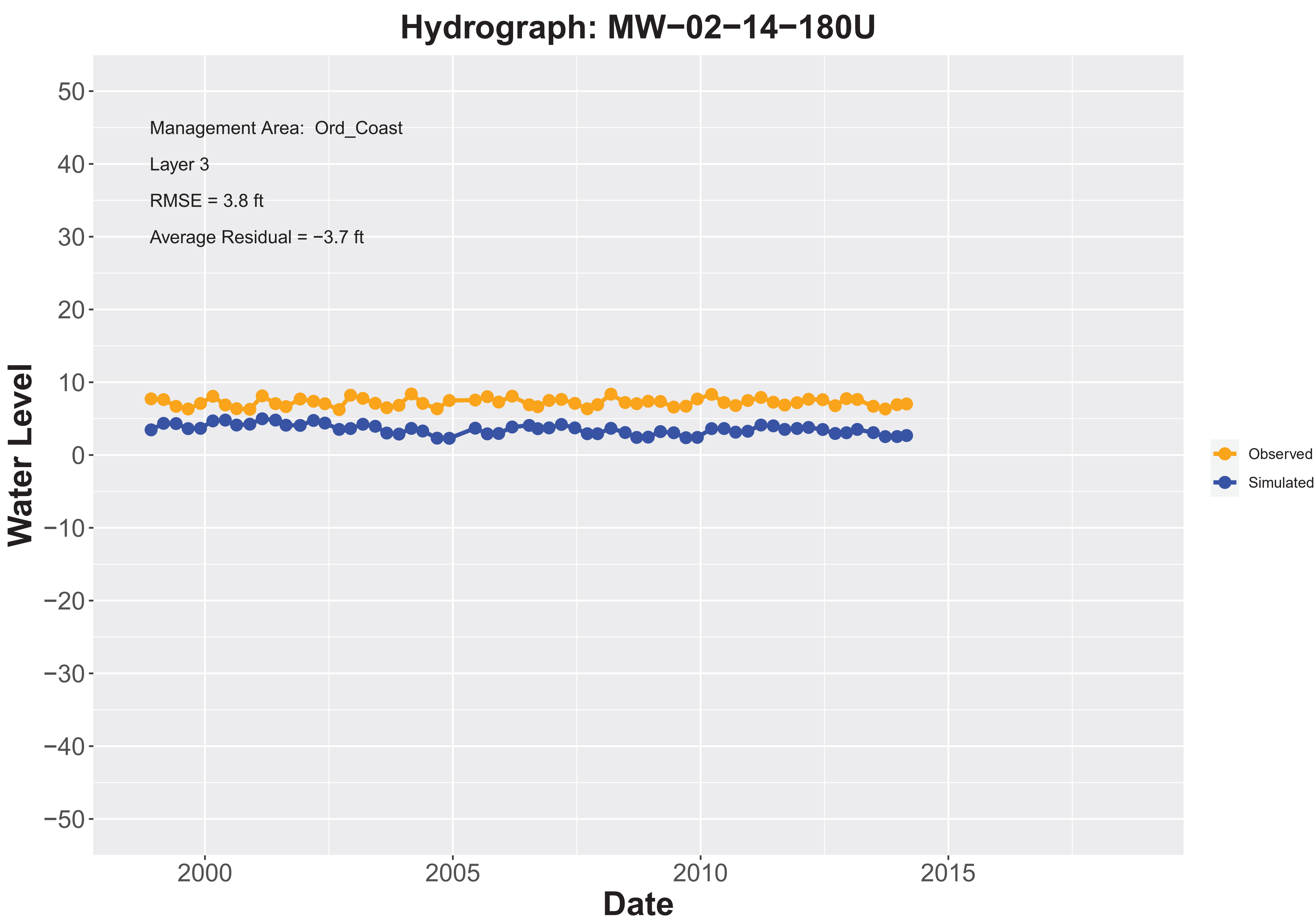
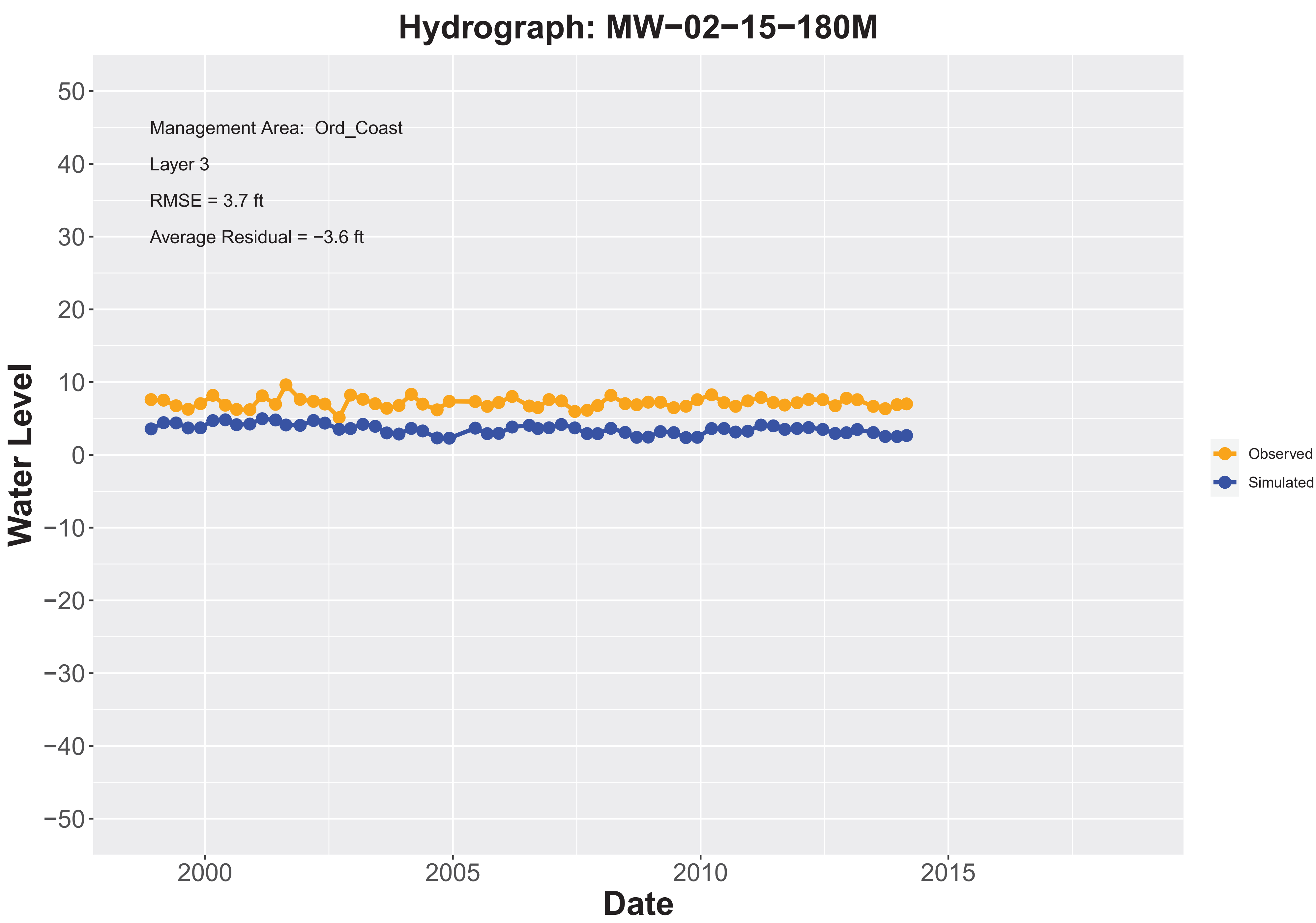
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−02−14−180U
Management Area: Ord_Coast
Layer 3
RMSE = 3.8 ft
Average Residual = −3.7 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−02−15−180M
Management Area: Ord_Coast
Layer 3
RMSE = 3.7 ft
Average Residual = −3.6 ft
Water Level
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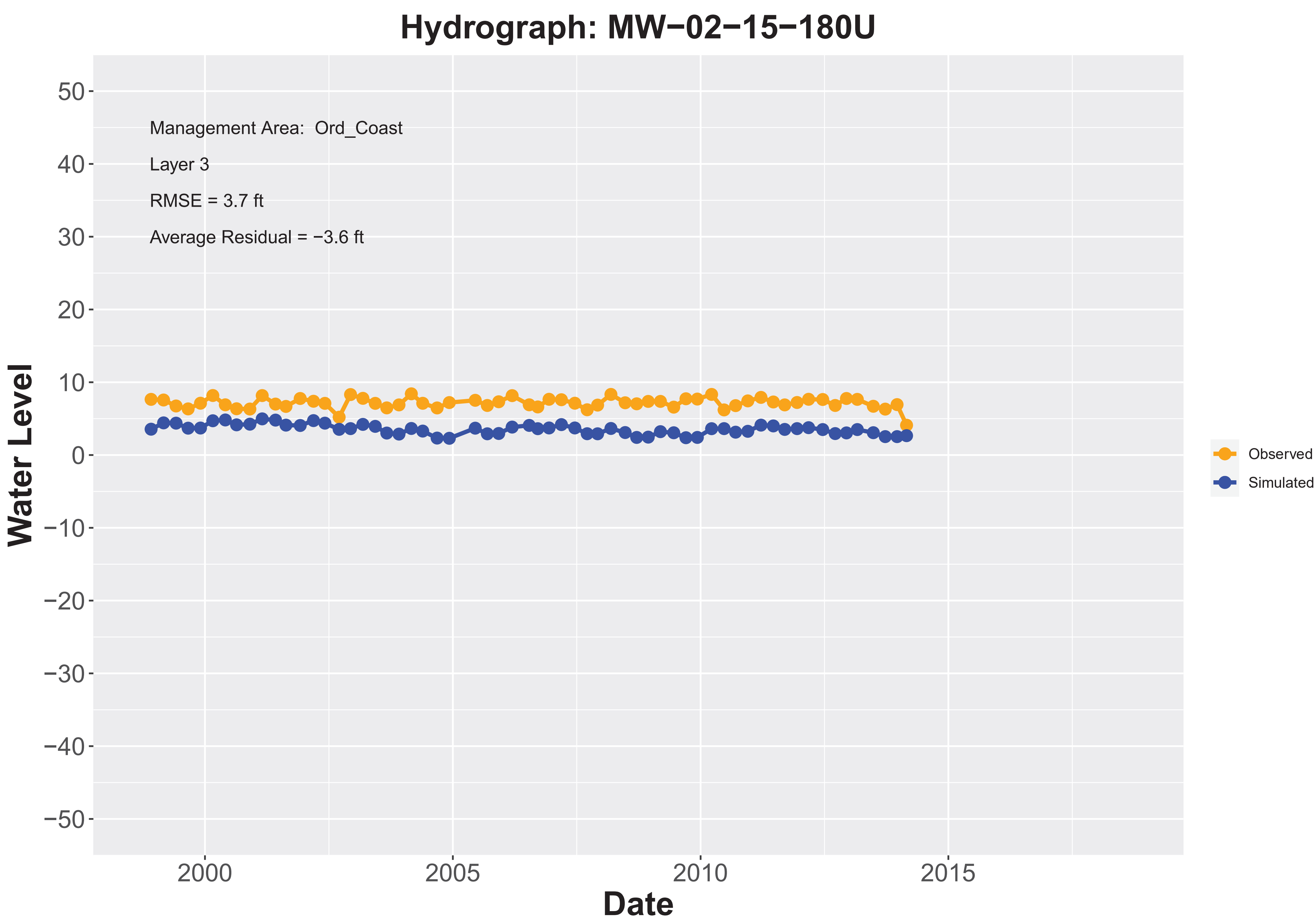
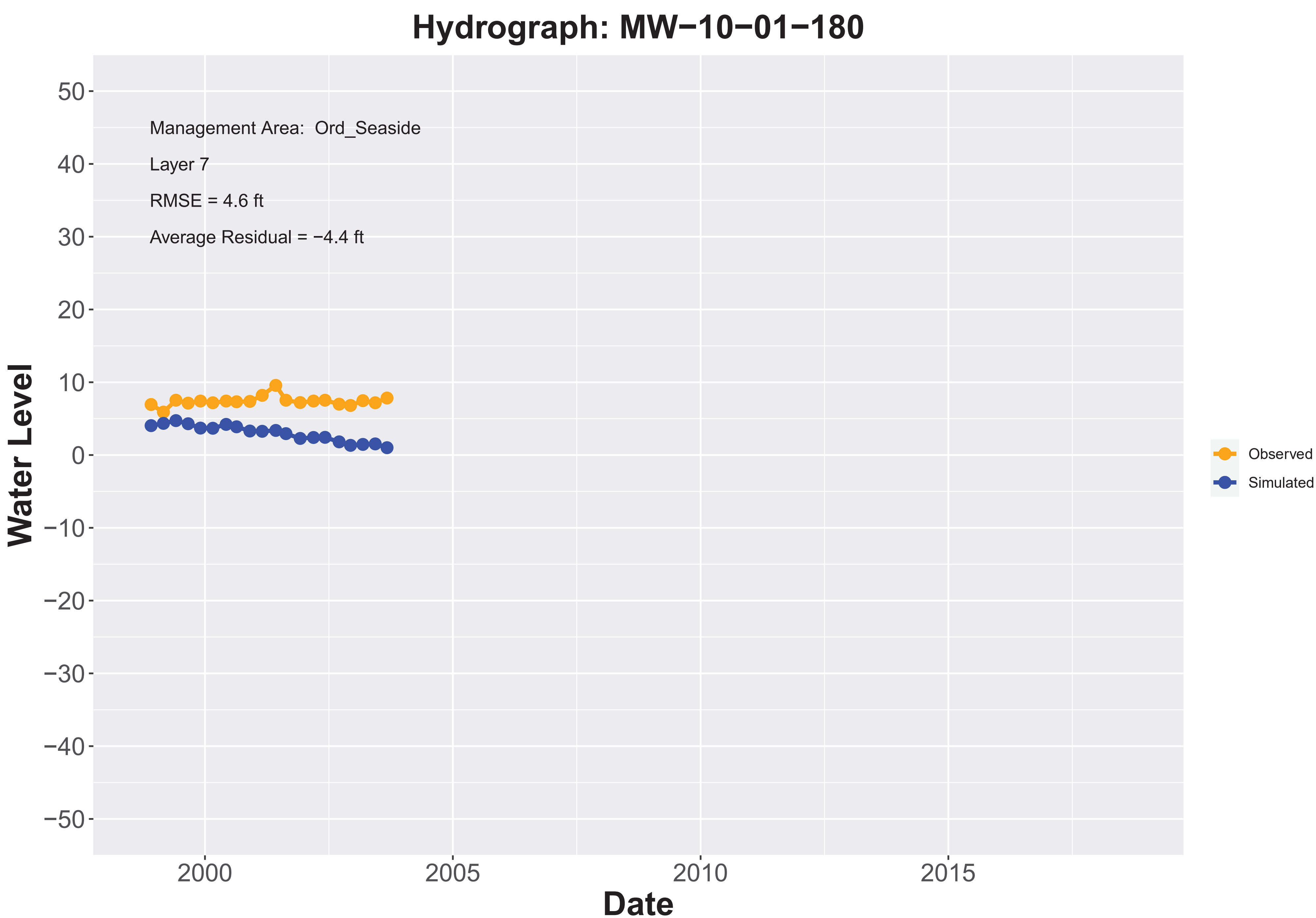
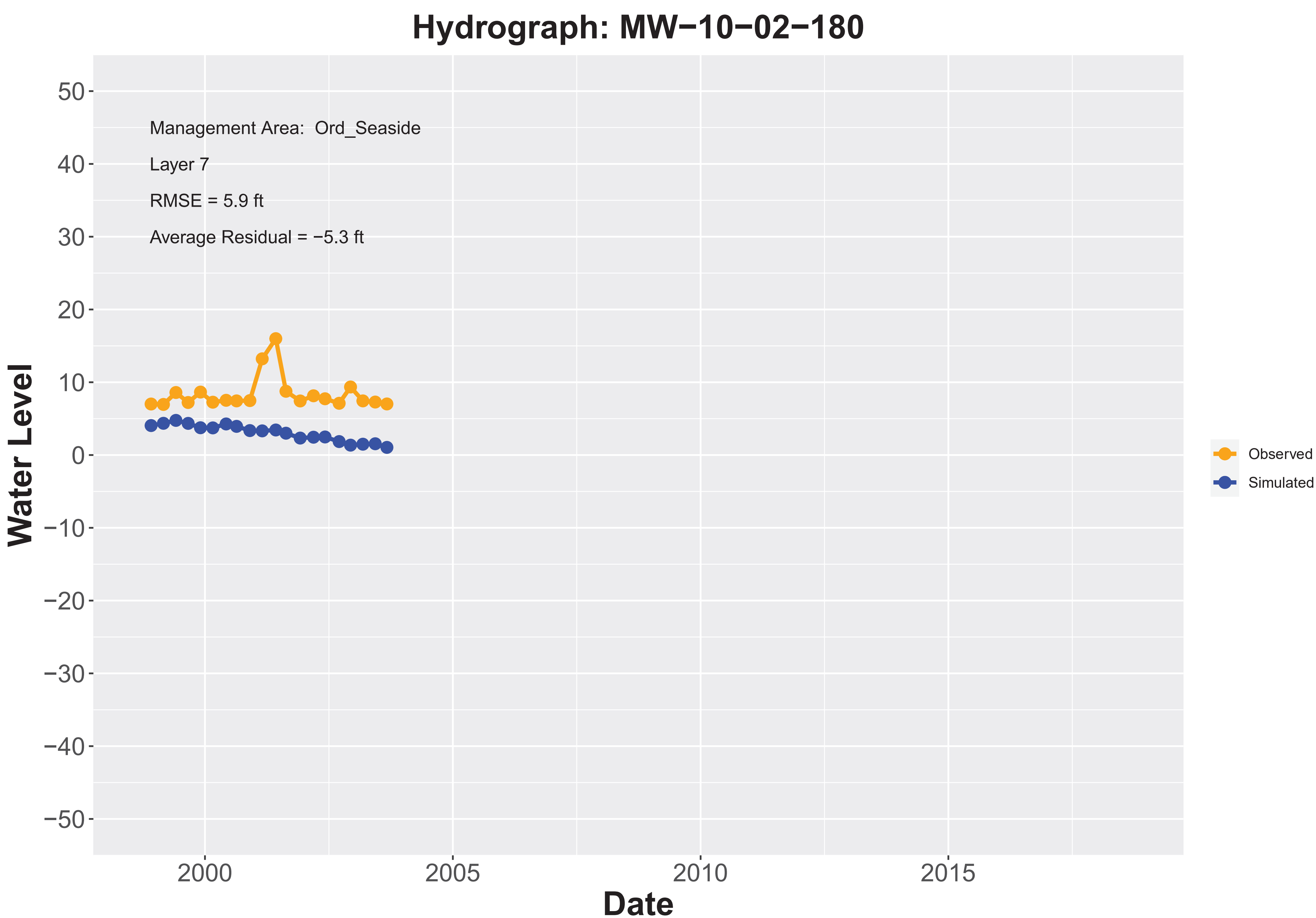
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

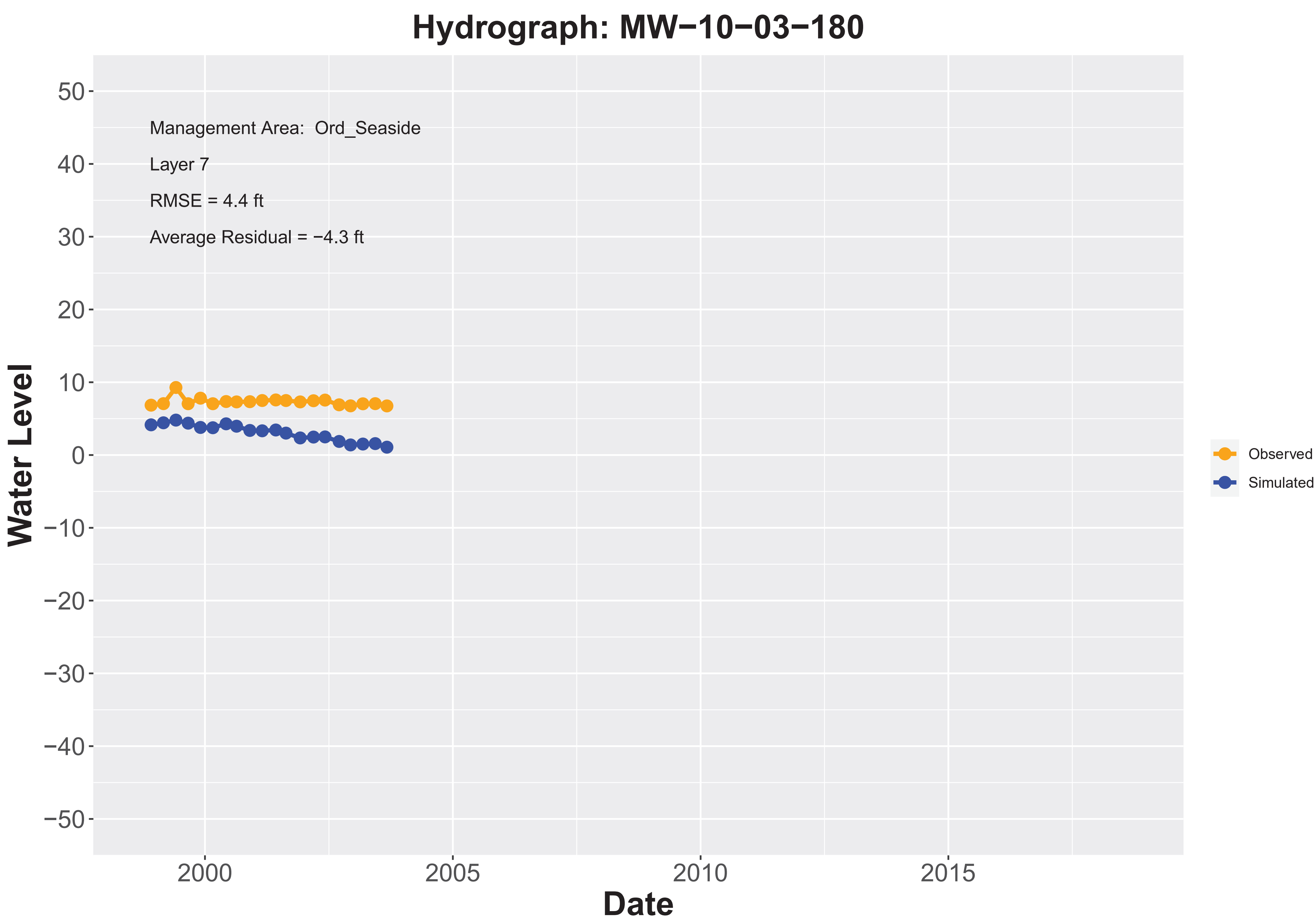

Hydrograph: MW−02−15−180U
Management Area: Ord_Coast
Layer 3
RMSE = 3.7 ft
Average Residual = −3.6 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



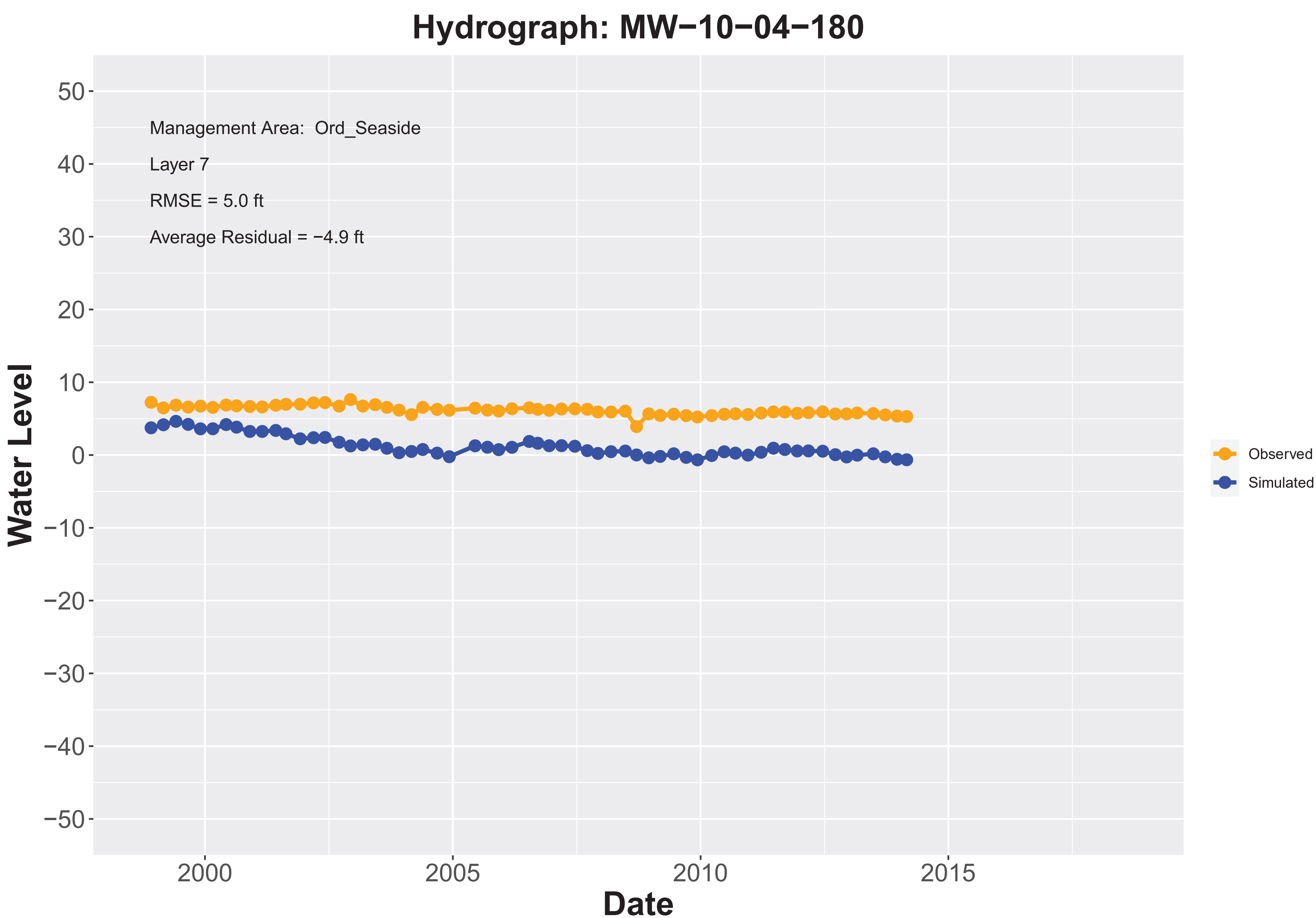
Hydrograph: MW−10−01−180
Management Area: Ord_Seaside
Layer 7
RMSE = 4.6 ft
Average Residual = −4.4 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

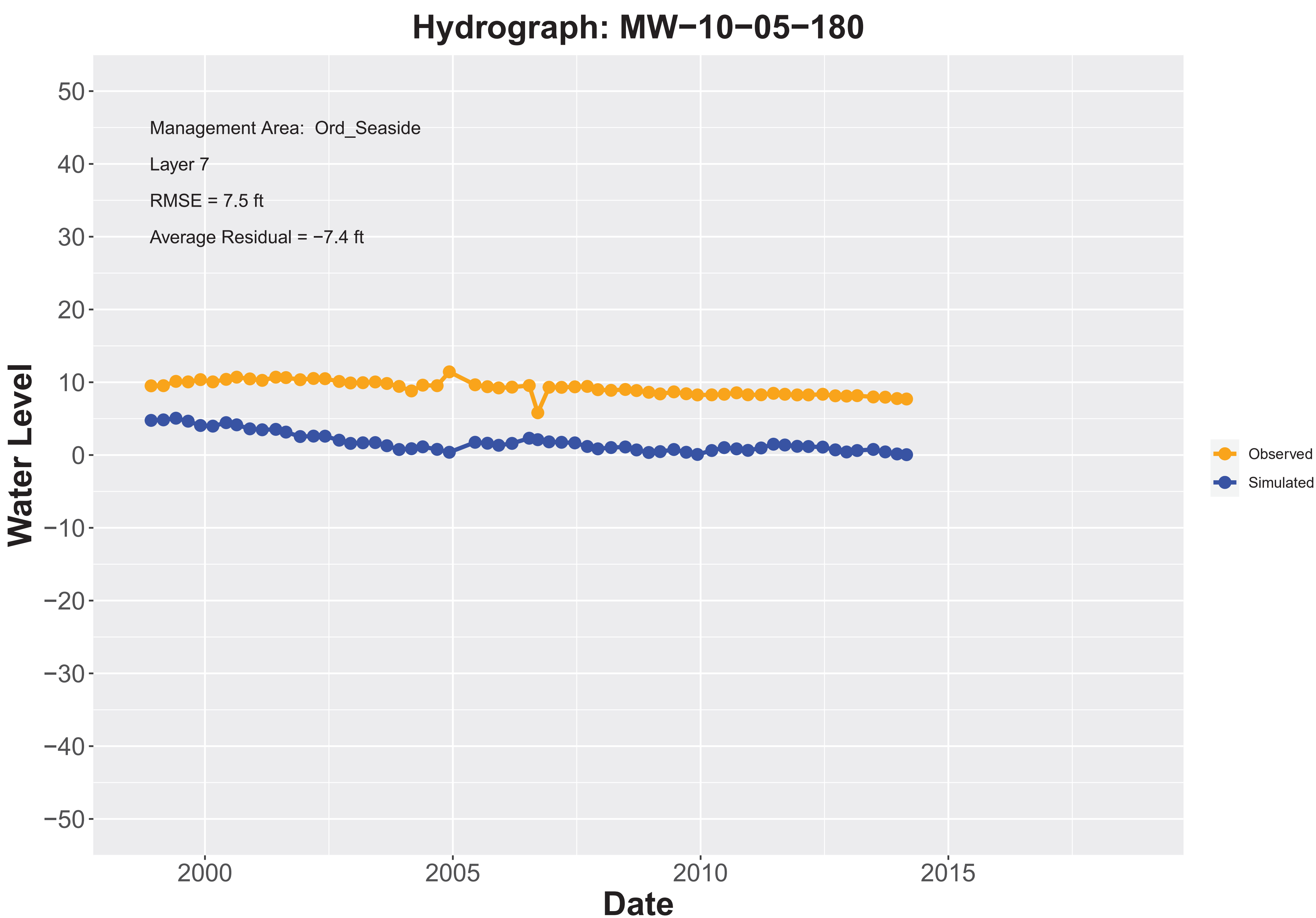


Hydrograph: MW−10−02−180
Management Area: Ord_Seaside
Layer 7
RMSE = 5.9 ft
Average Residual = −5.3 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−10−03−180
Management Area: Ord_Seaside
Layer 7
RMSE = 4.4 ft
Average Residual = −4.3 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−10−04−180
Management Area: Ord_Seaside
Layer 7
RMSE = 5.0 ft
Average Residual = −4.9 ft
Water Level
Date
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Observed
Simulated



Hydrograph: MW−10−05−180
Management Area: Ord_Seaside
Layer 7
RMSE = 7.5 ft
Average Residual = −7.4 ft
Water Level
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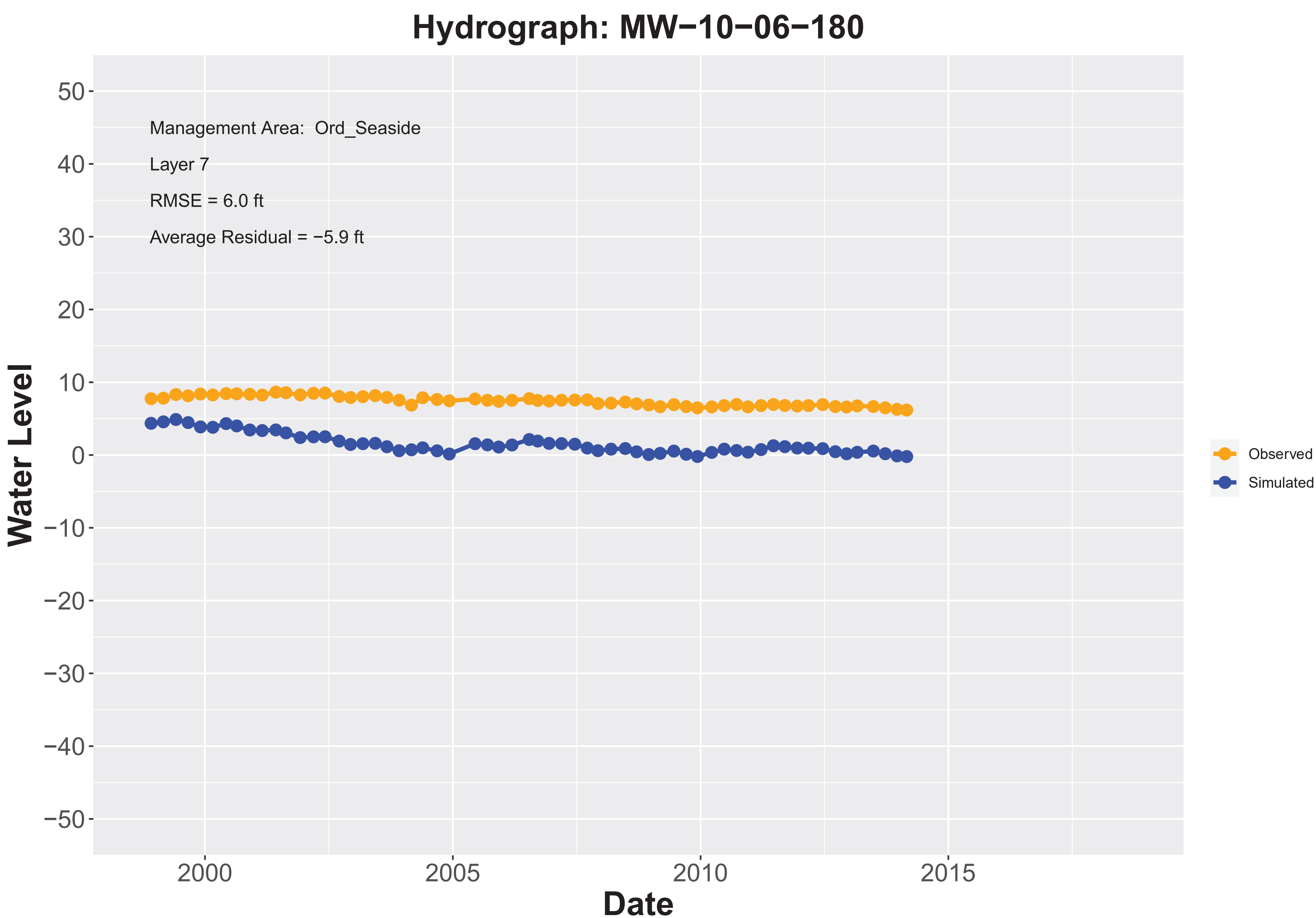
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−10−06−180
Management Area: Ord_Seaside
Layer 7
RMSE = 6.0 ft
Average Residual = −5.9 ft
Water Level
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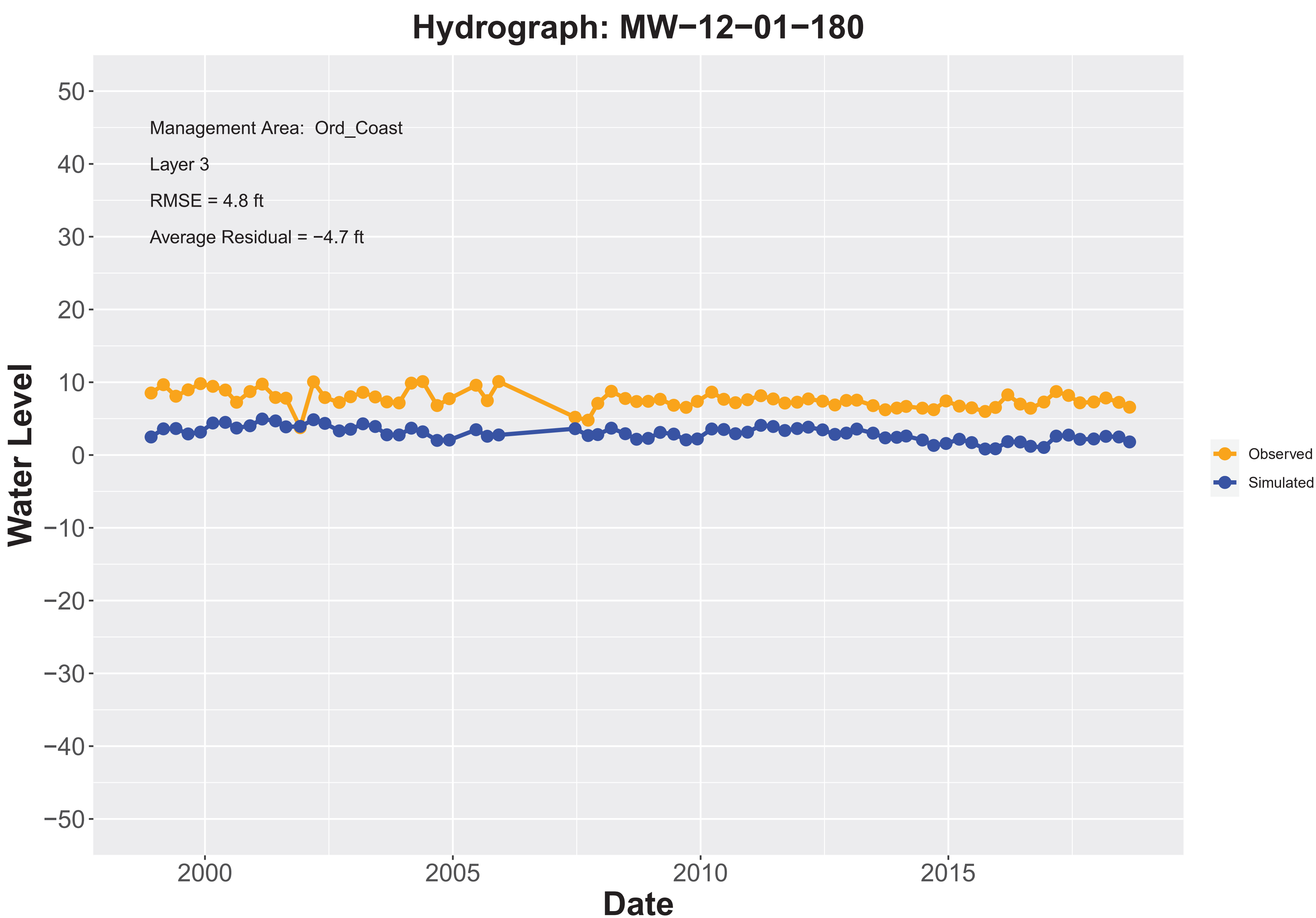
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−12−01−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.8 ft
Average Residual = −4.7 ft
Water Level
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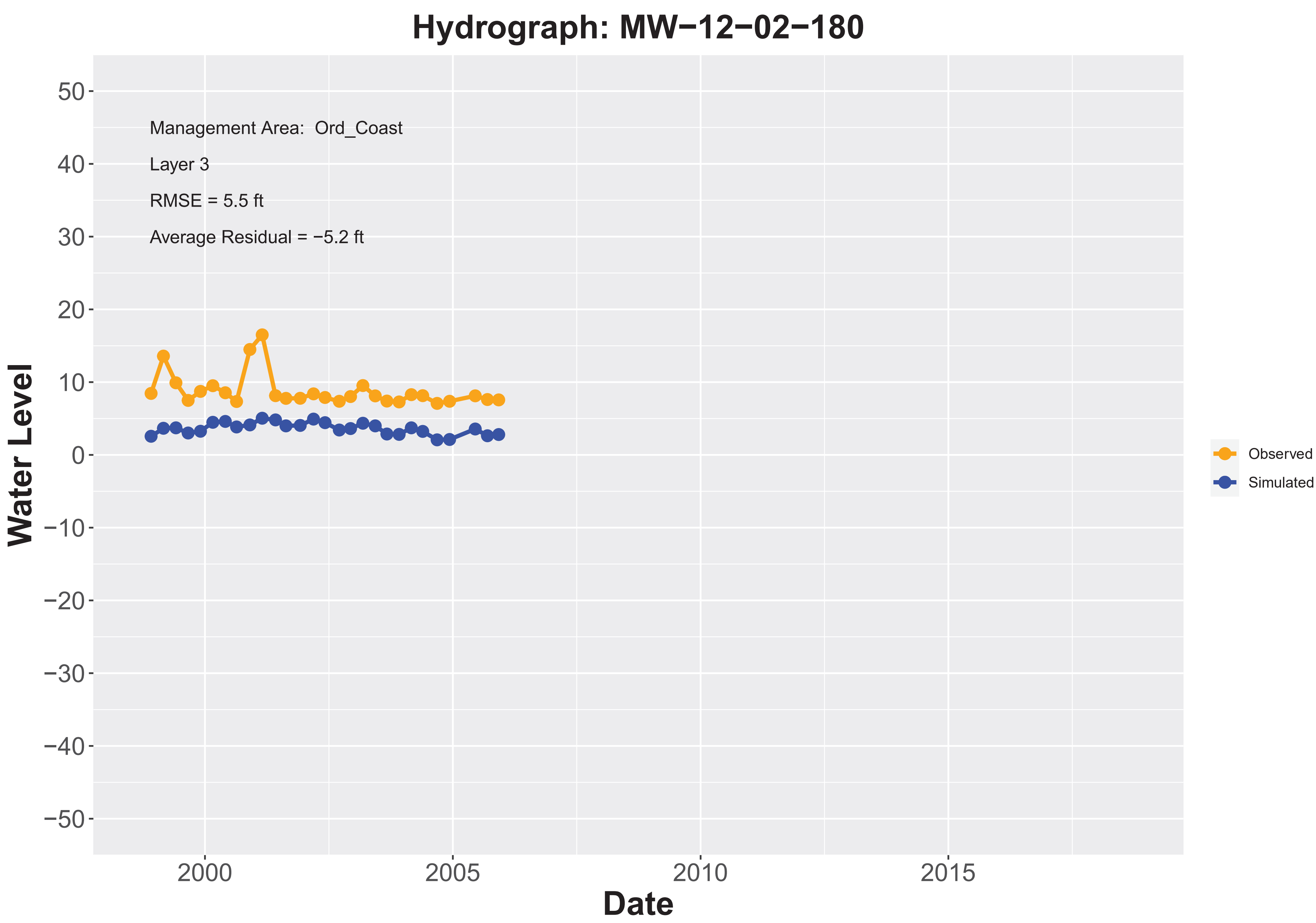
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−12−02−180
Management Area: Ord_Coast
Layer 3
RMSE = 5.5 ft
Average Residual = −5.2 ft
Water Level
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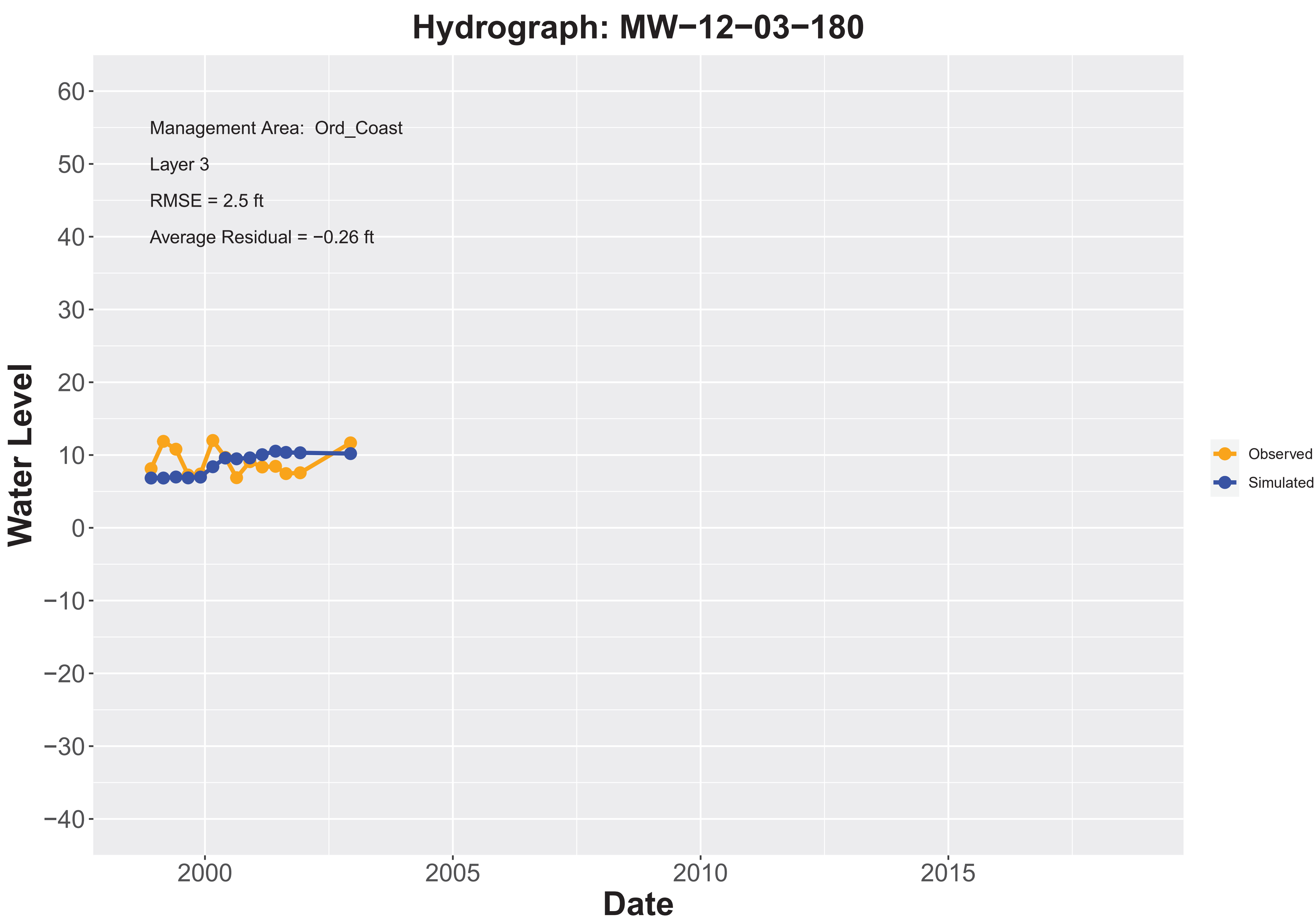
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−12−03−180
Management Area: Ord_Coast
Layer 3
RMSE = 2.5 ft
Average Residual = −0.26 ft
Water Level
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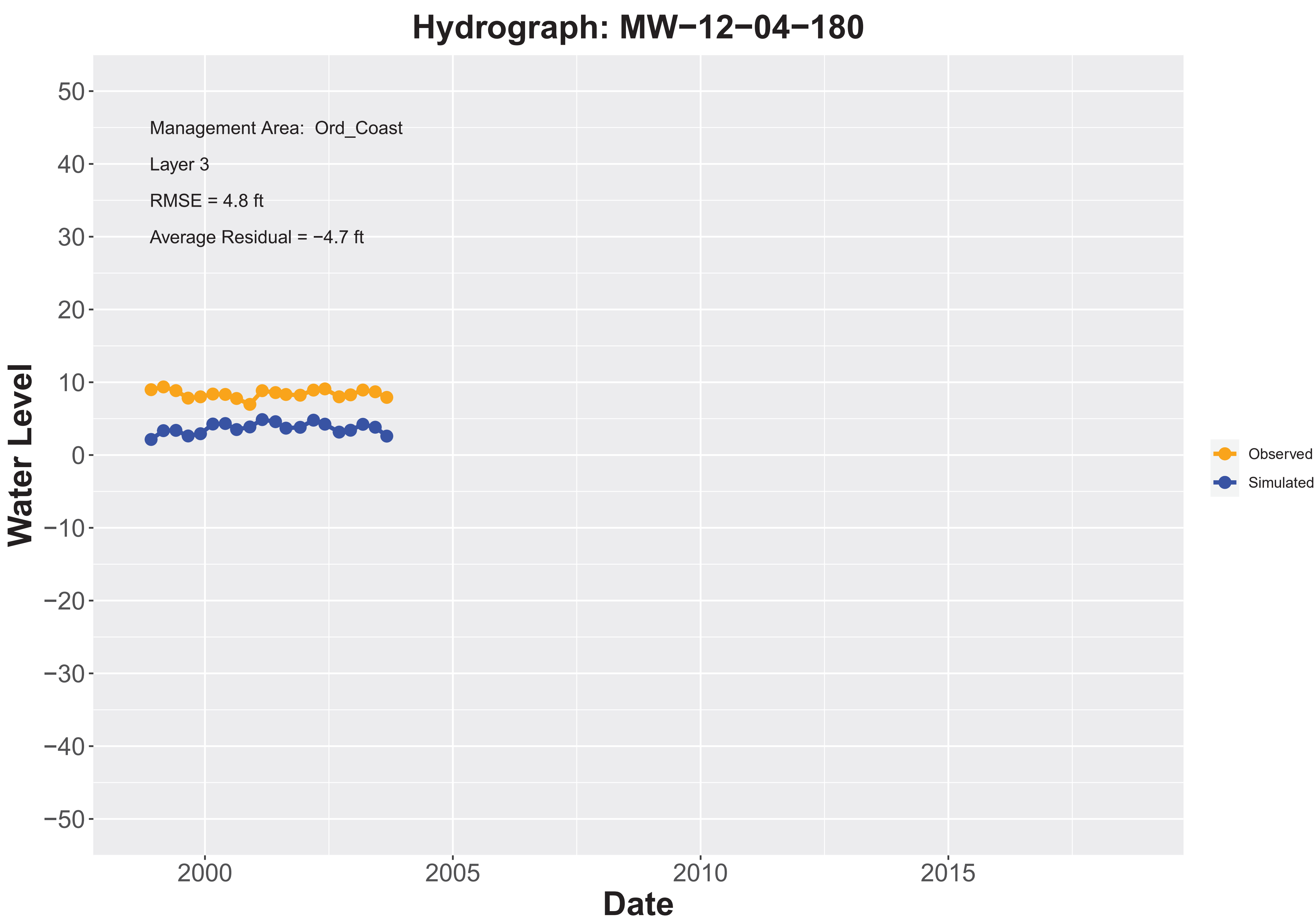
20
10
0
−10
−20
−30
−40
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−12−04−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.8 ft
Average Residual = −4.7 ft
Water Level
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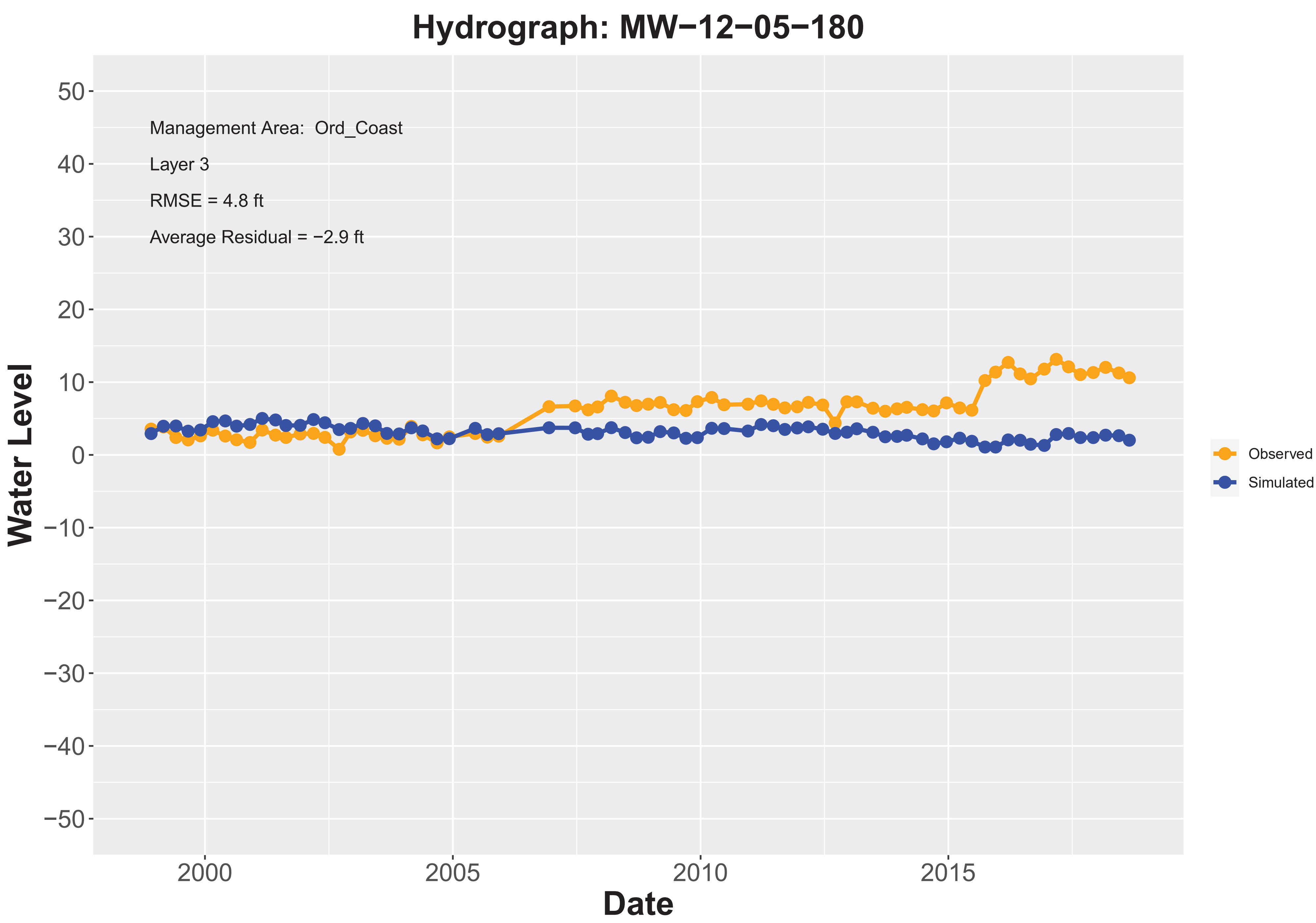
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−12−05−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.8 ft
Average Residual = −2.9 ft
Water Level
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40
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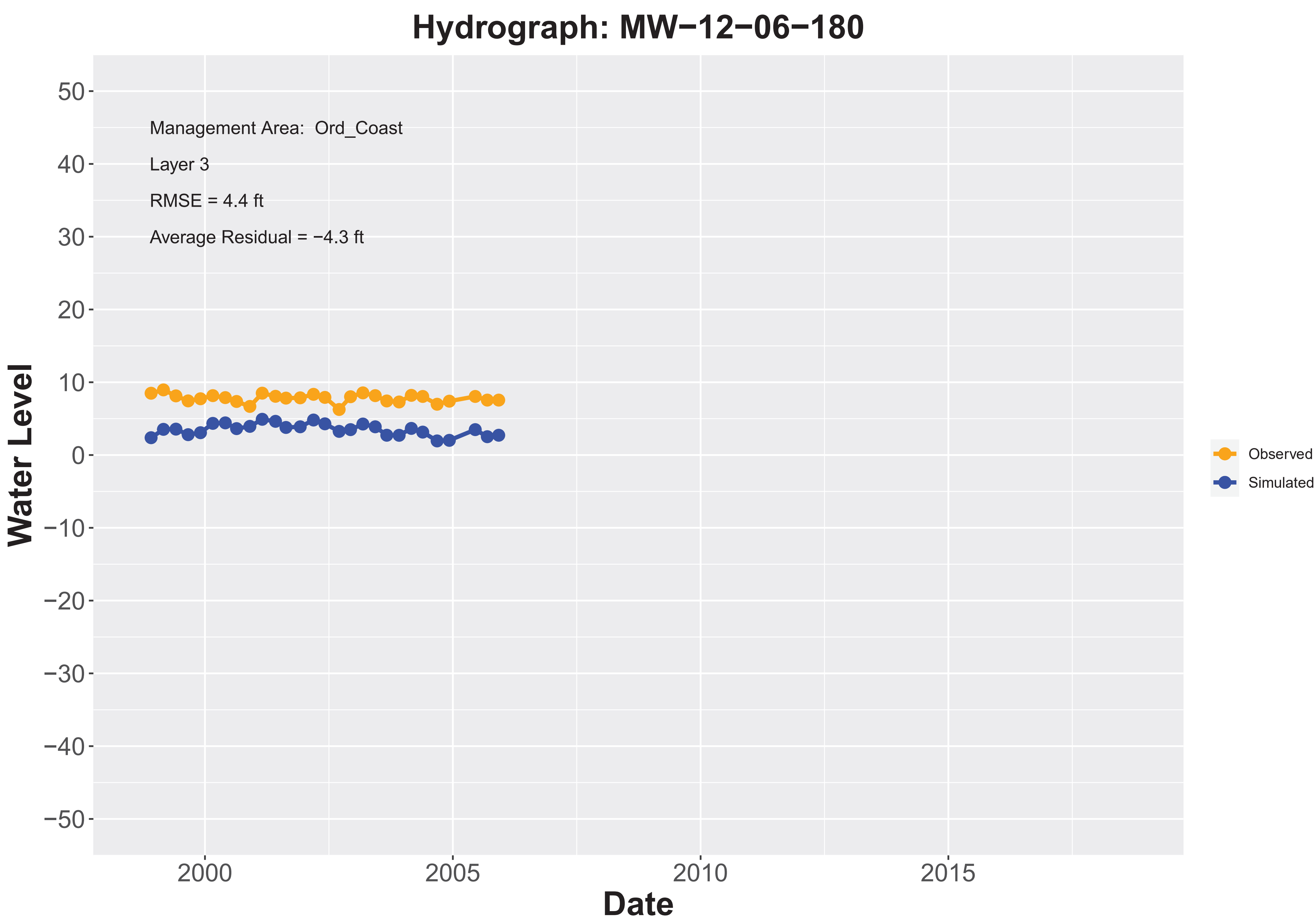
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−12−06−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.4 ft
Average Residual = −4.3 ft
Water Level
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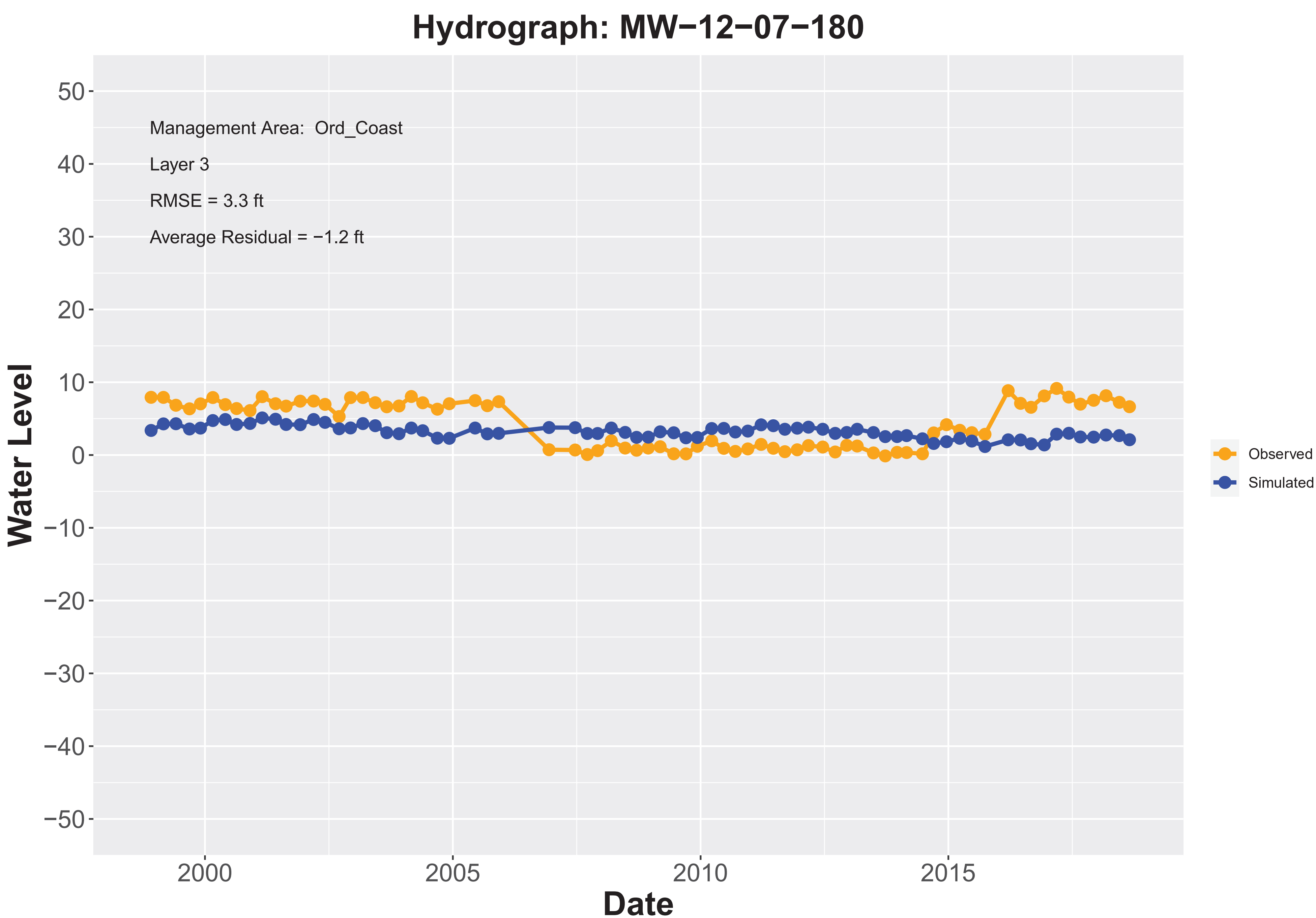
30
20
10
0
−10
−20
−30
−40
−50
Date
2000
2005
2010
2015
Observed
Simulated


Hydrograph: MW−12−07−180
Management Area: Ord_Coast
Layer 3
RMSE = 3.3 ft
Average Residual = −1.2 ft
Water Level
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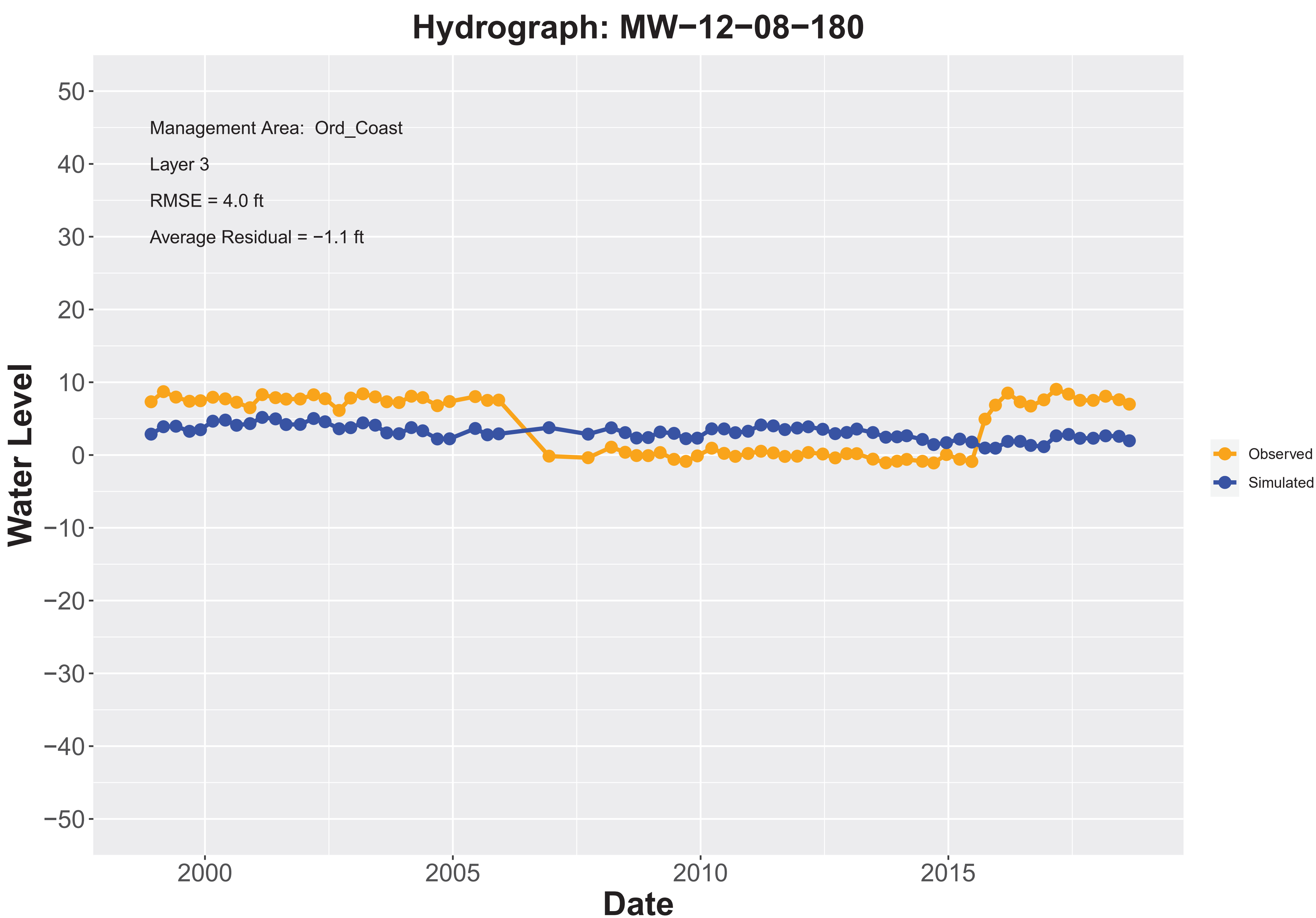
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−12−08−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.0 ft
Average Residual = −1.1 ft
Water Level
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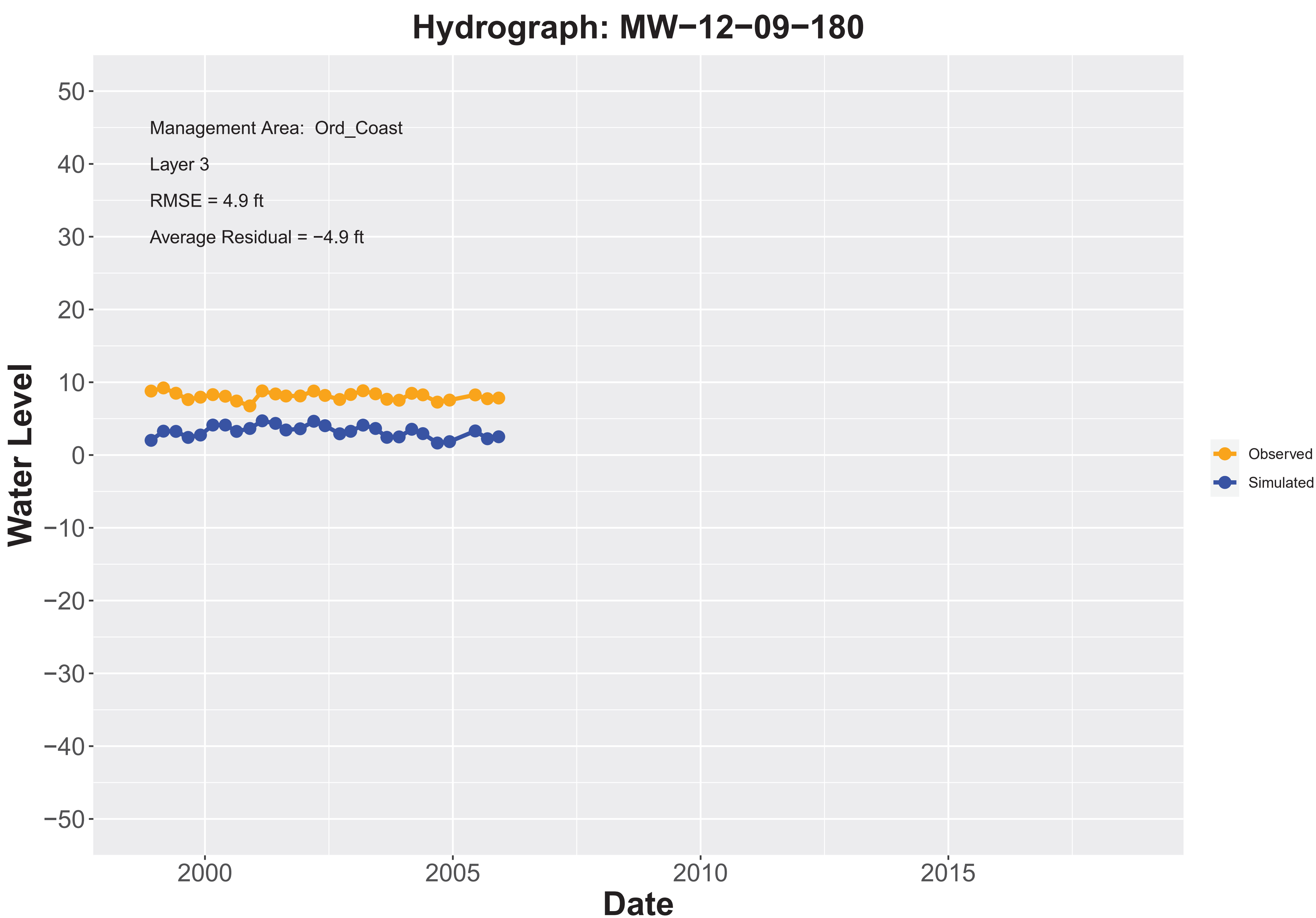
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−12−09−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.9 ft
Average Residual = −4.9 ft
Water Level
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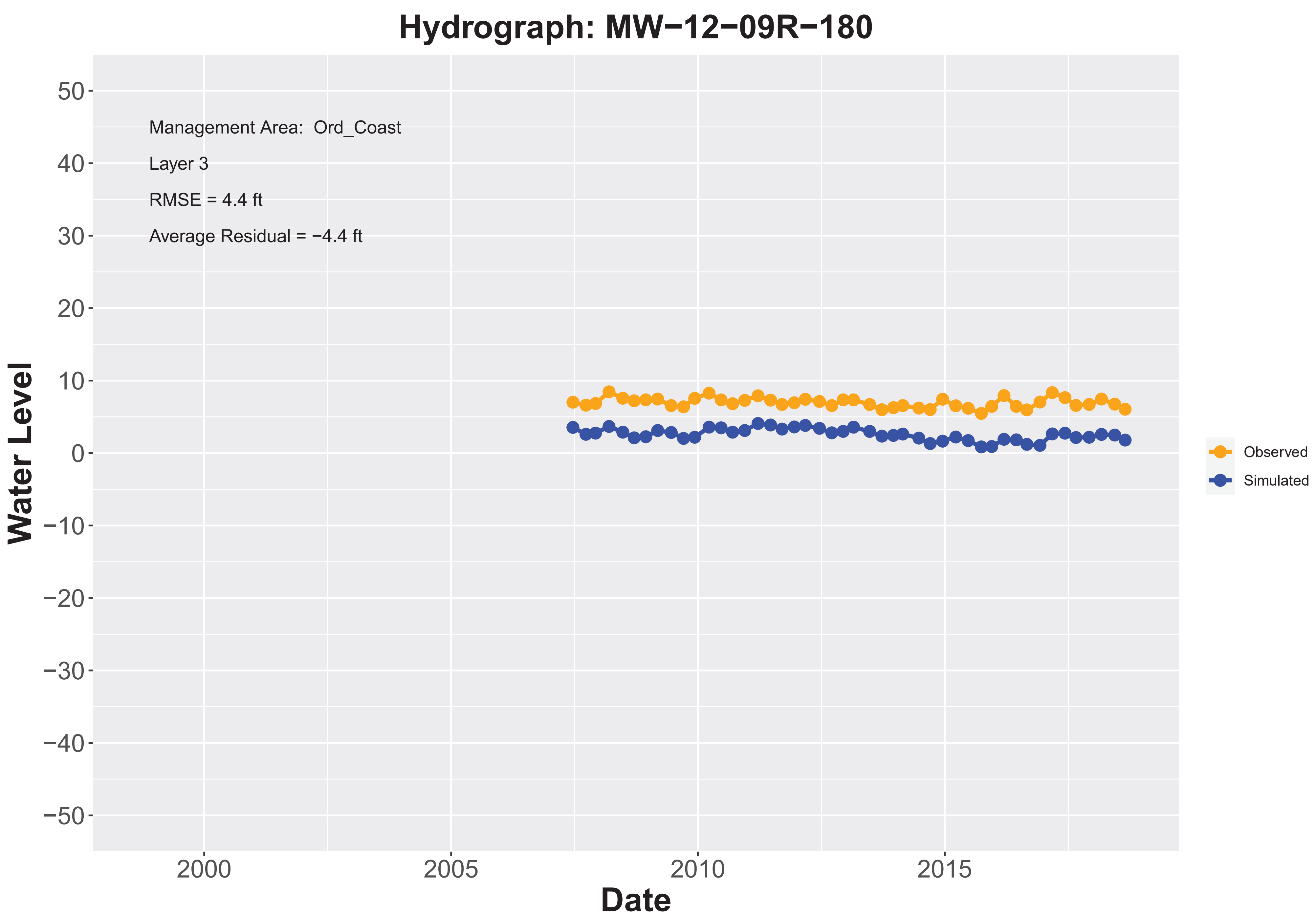
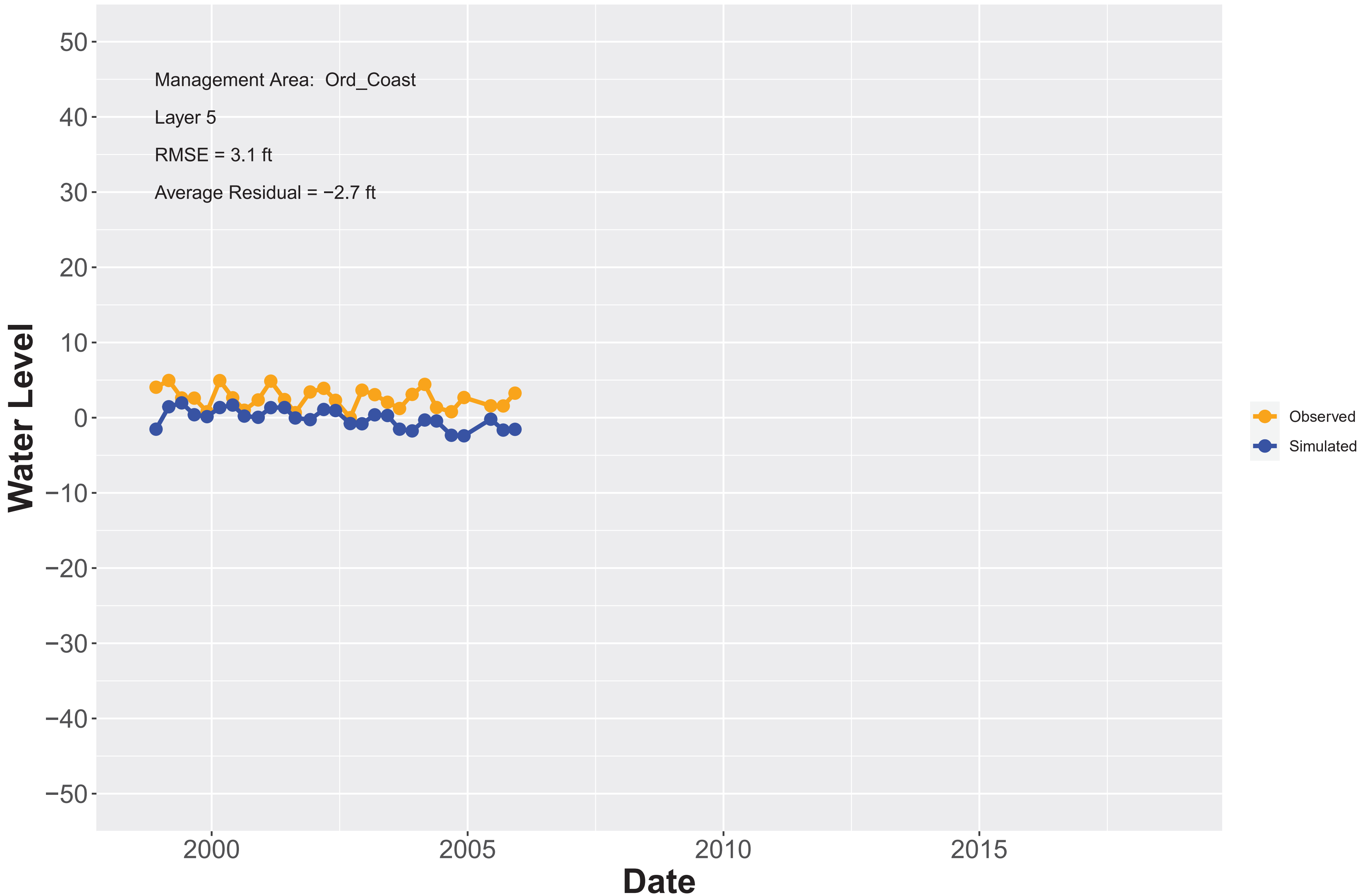
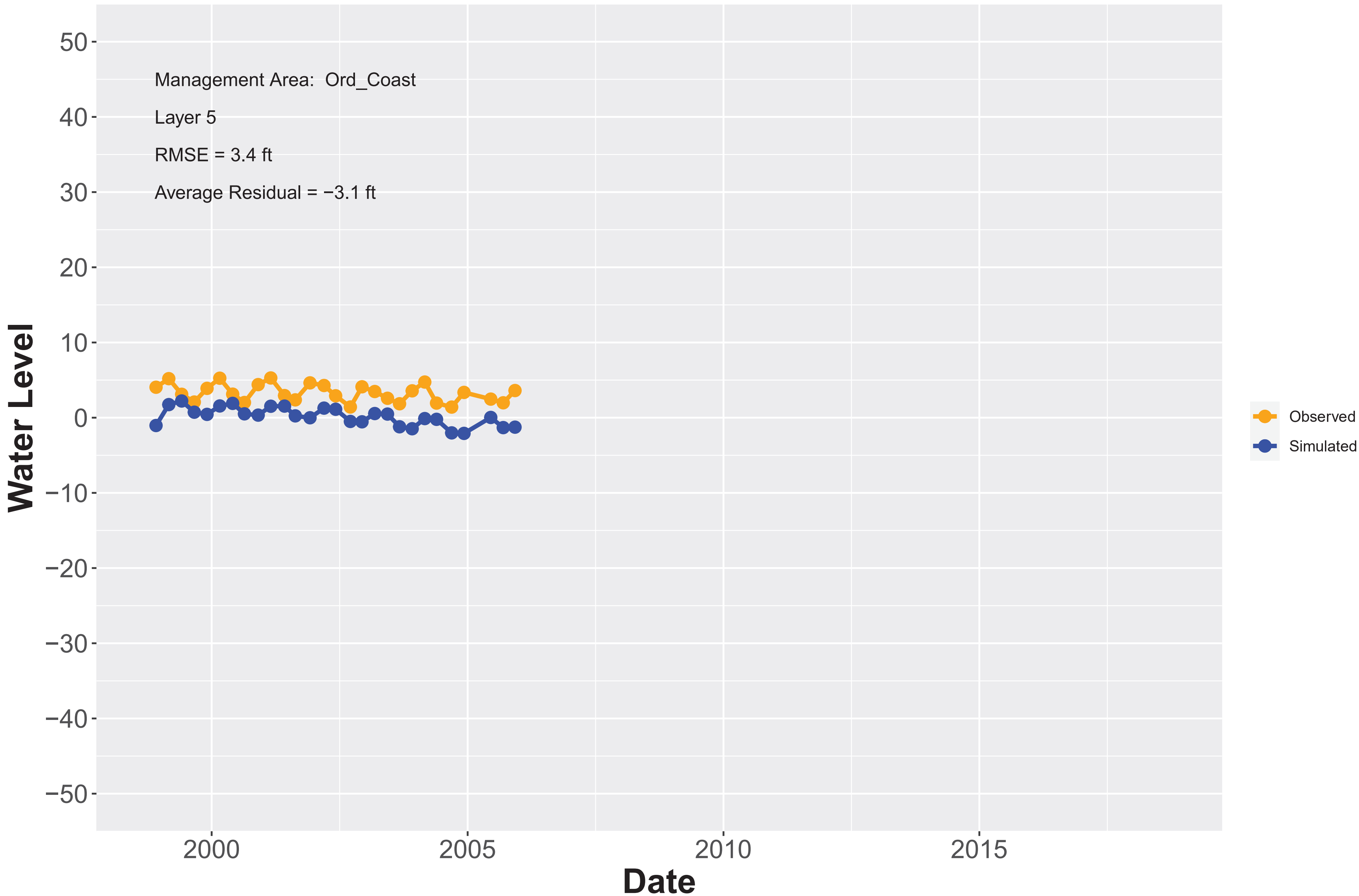
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−12−09R−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.4 ft
Average Residual = −4.4 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

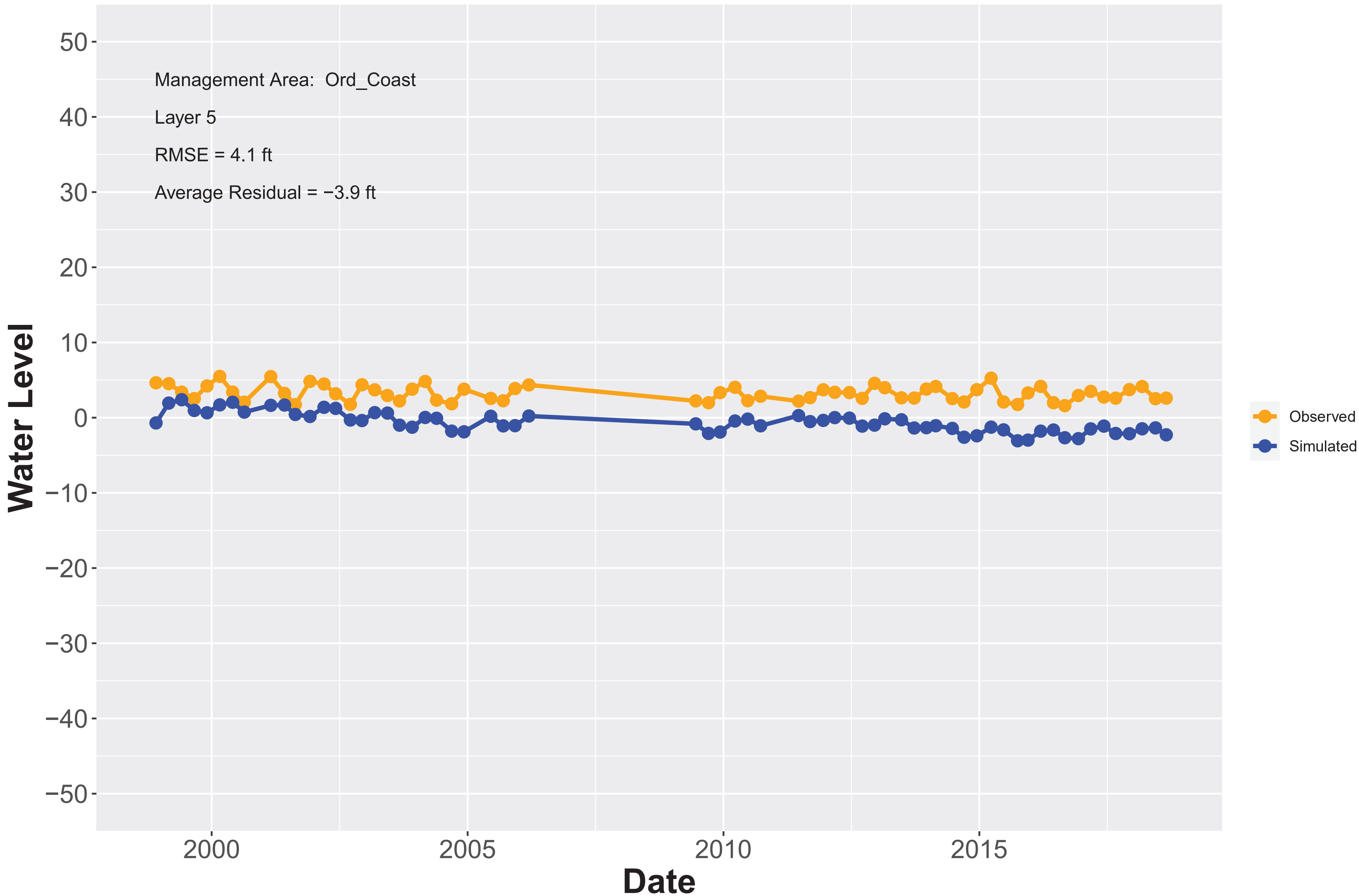
Hydrograph: MW−12−10−180L

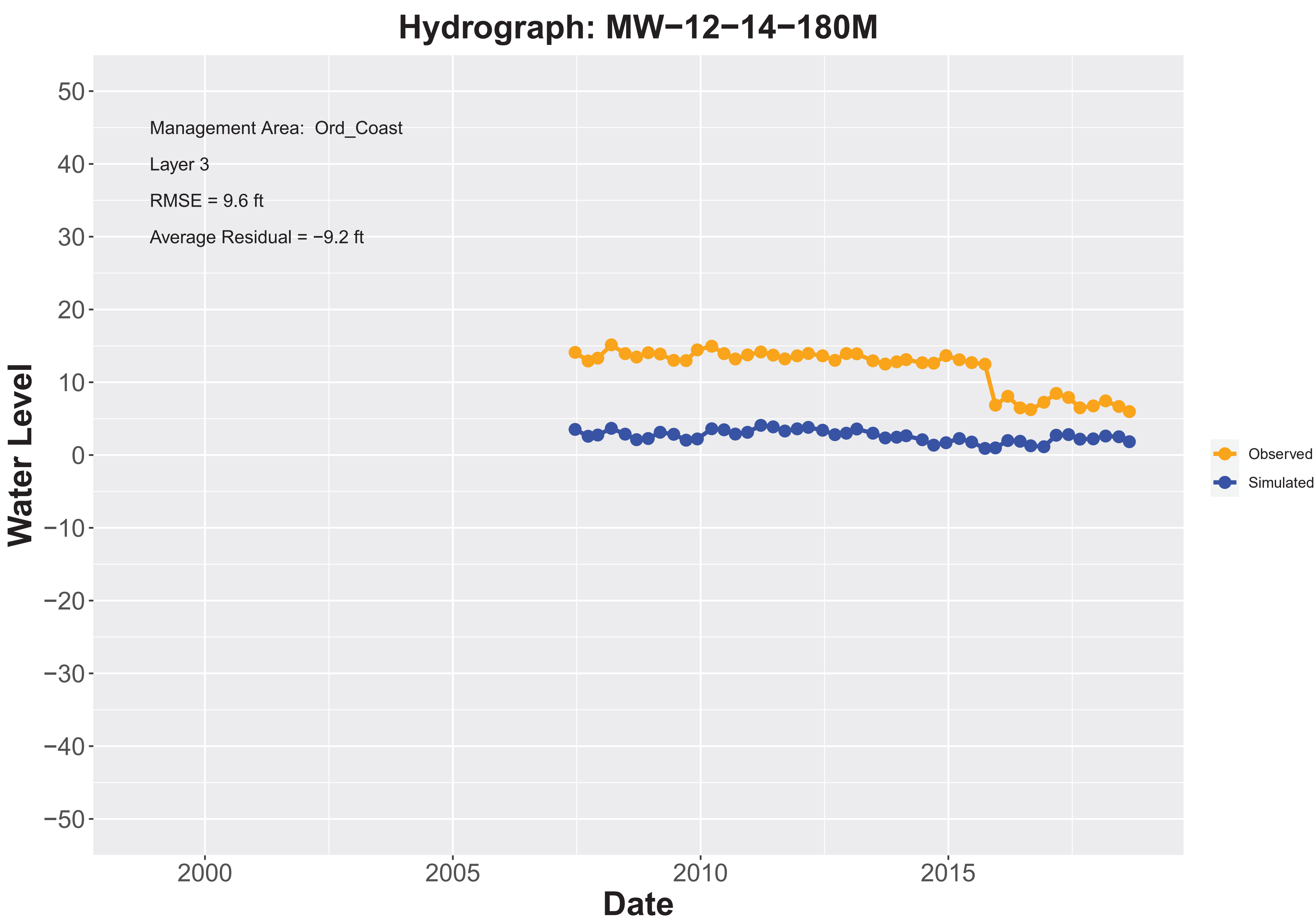


Hydrograph: MW−12−11−180L



Hydrograph: MW−12−12−180L




Hydrograph: MW−12−14−180M
Management Area: Ord_Coast
Layer 3
RMSE = 9.6 ft
Average Residual = −9.2 ft
Water Level
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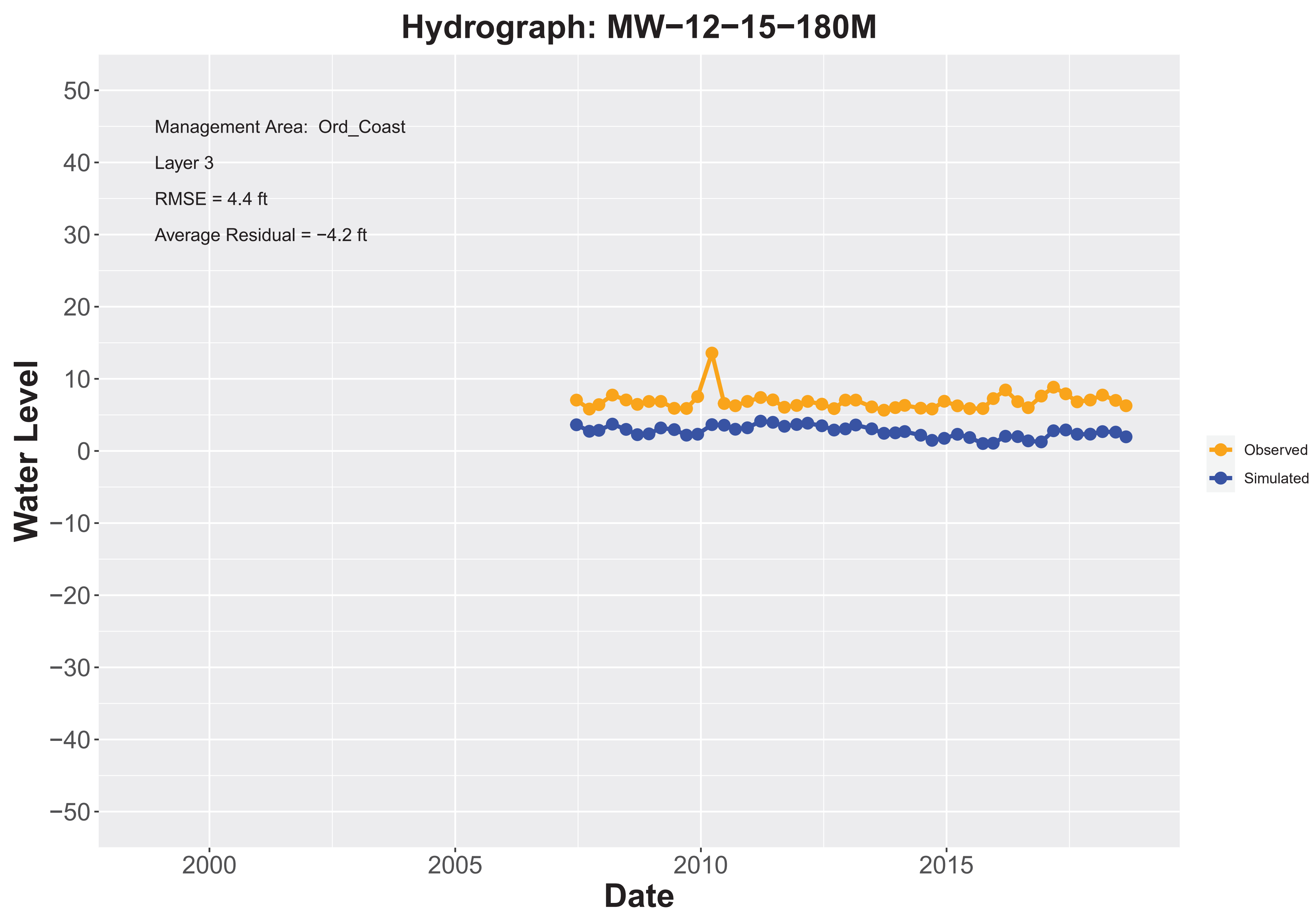
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−12−15−180M
Management Area: Ord_Coast
Layer 3
RMSE = 4.4 ft
Average Residual = −4.2 ft
Water Level
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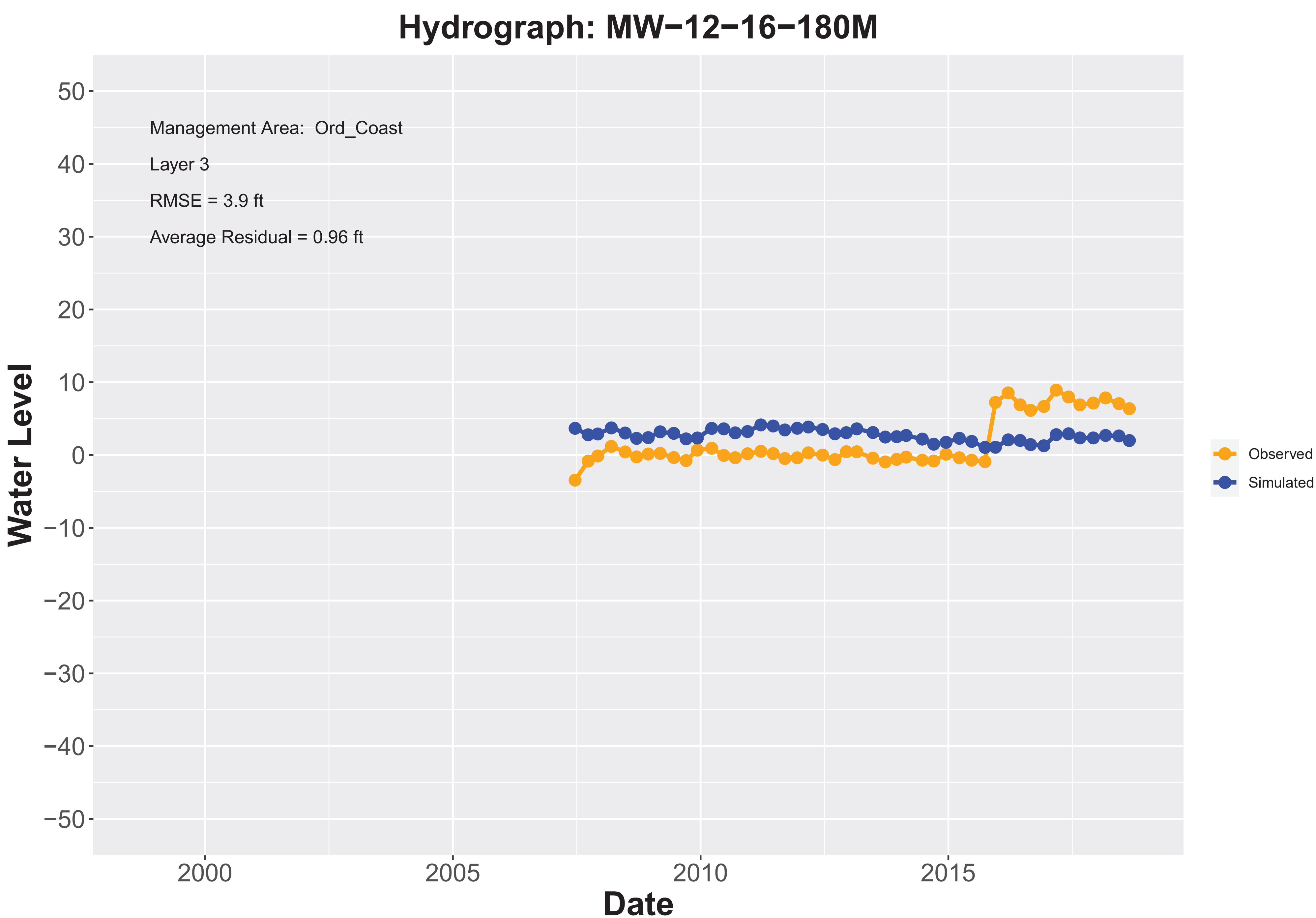
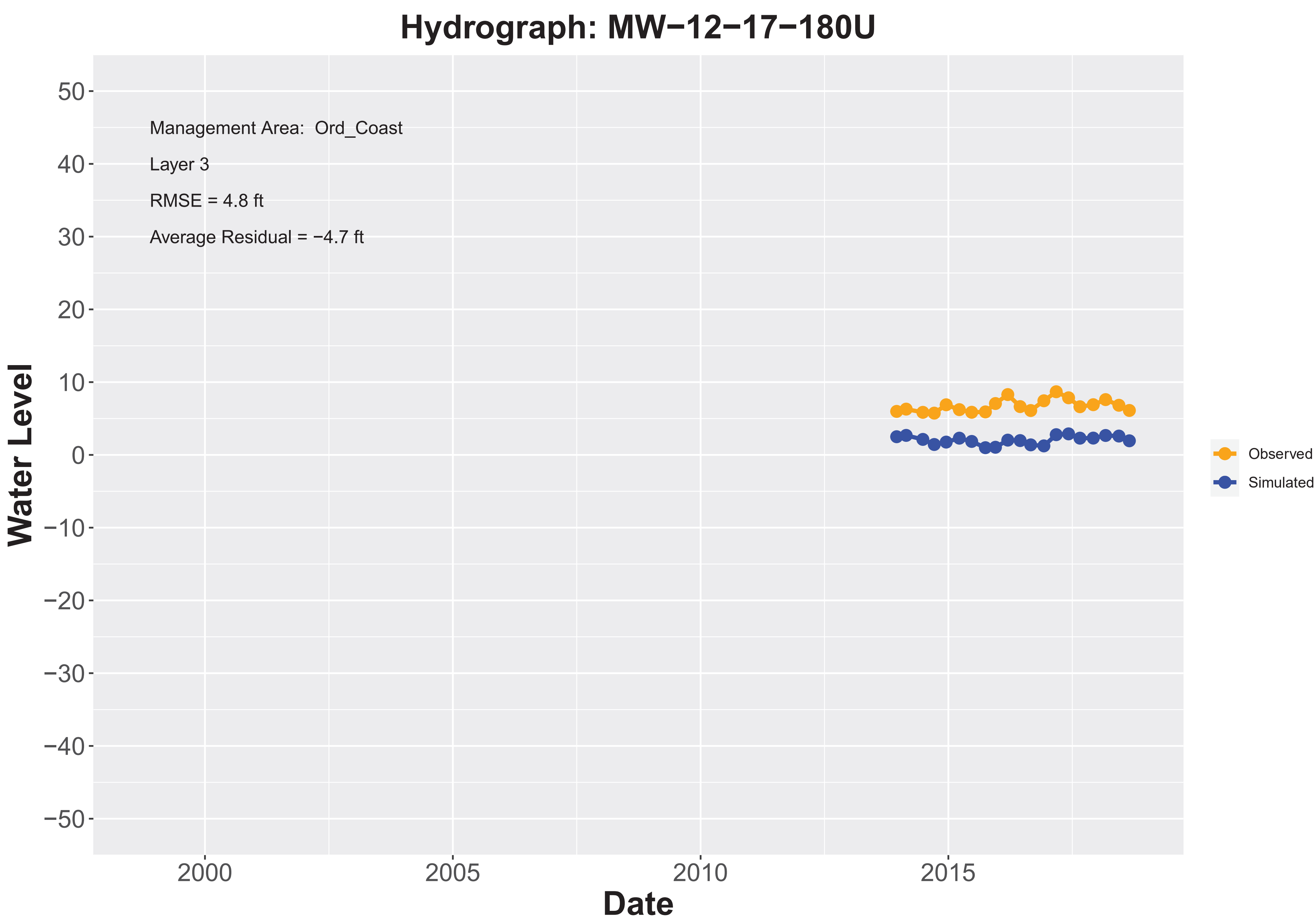
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−12−16−180M
Management Area: Ord_Coast
Layer 3
RMSE = 3.9 ft
Average Residual = 0.96 ft
50
40
30
20
10
0
−10
−20
−30
−40
−50
Water Level
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−12−17−180U
Management Area: Ord_Coast
Layer 3
RMSE = 4.8 ft
Average Residual = −4.7 ft
Water Level
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30
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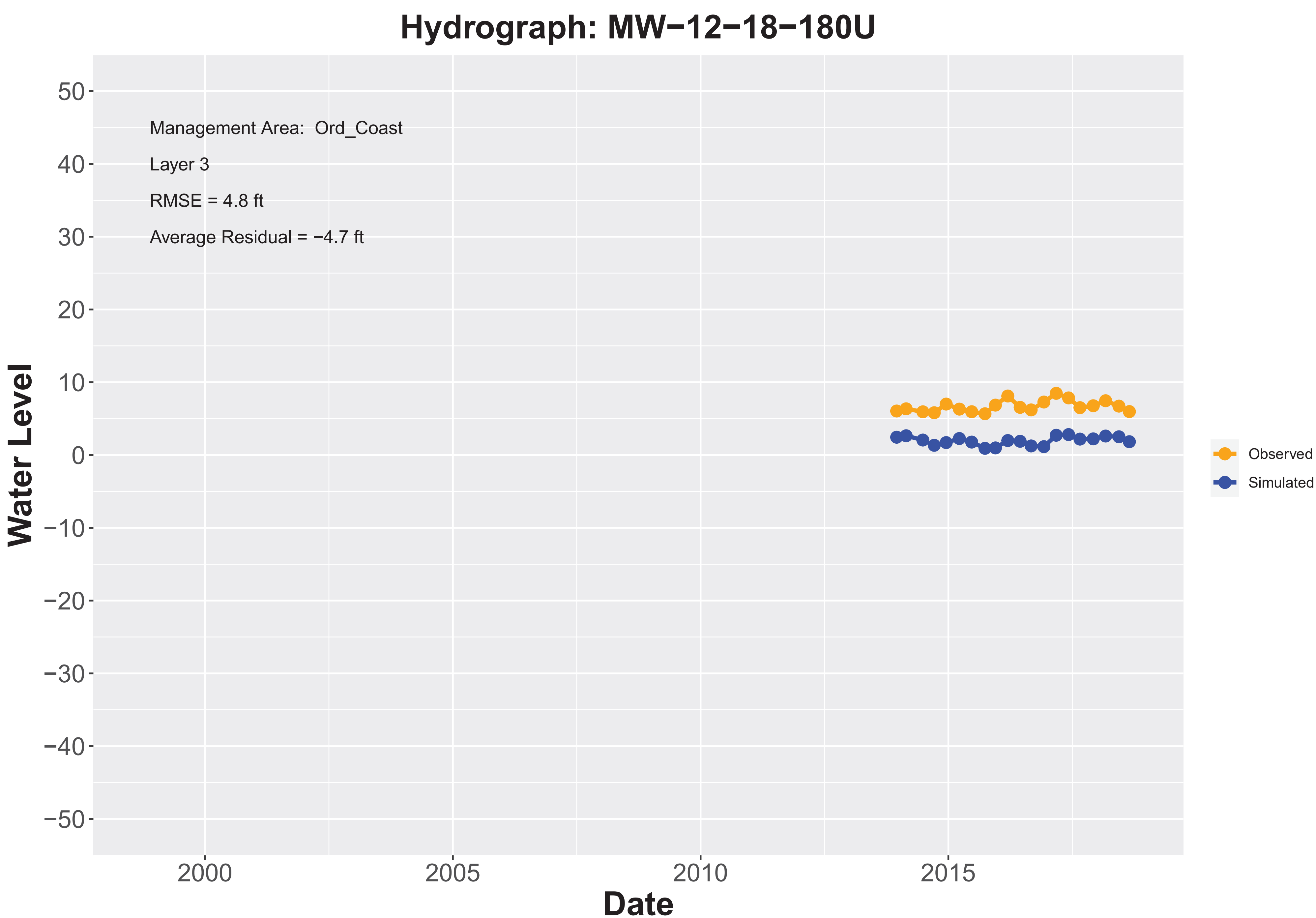
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−12−18−180U
Management Area: Ord_Coast
Layer 3
RMSE = 4.8 ft
Average Residual = −4.7 ft
Water Level
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30
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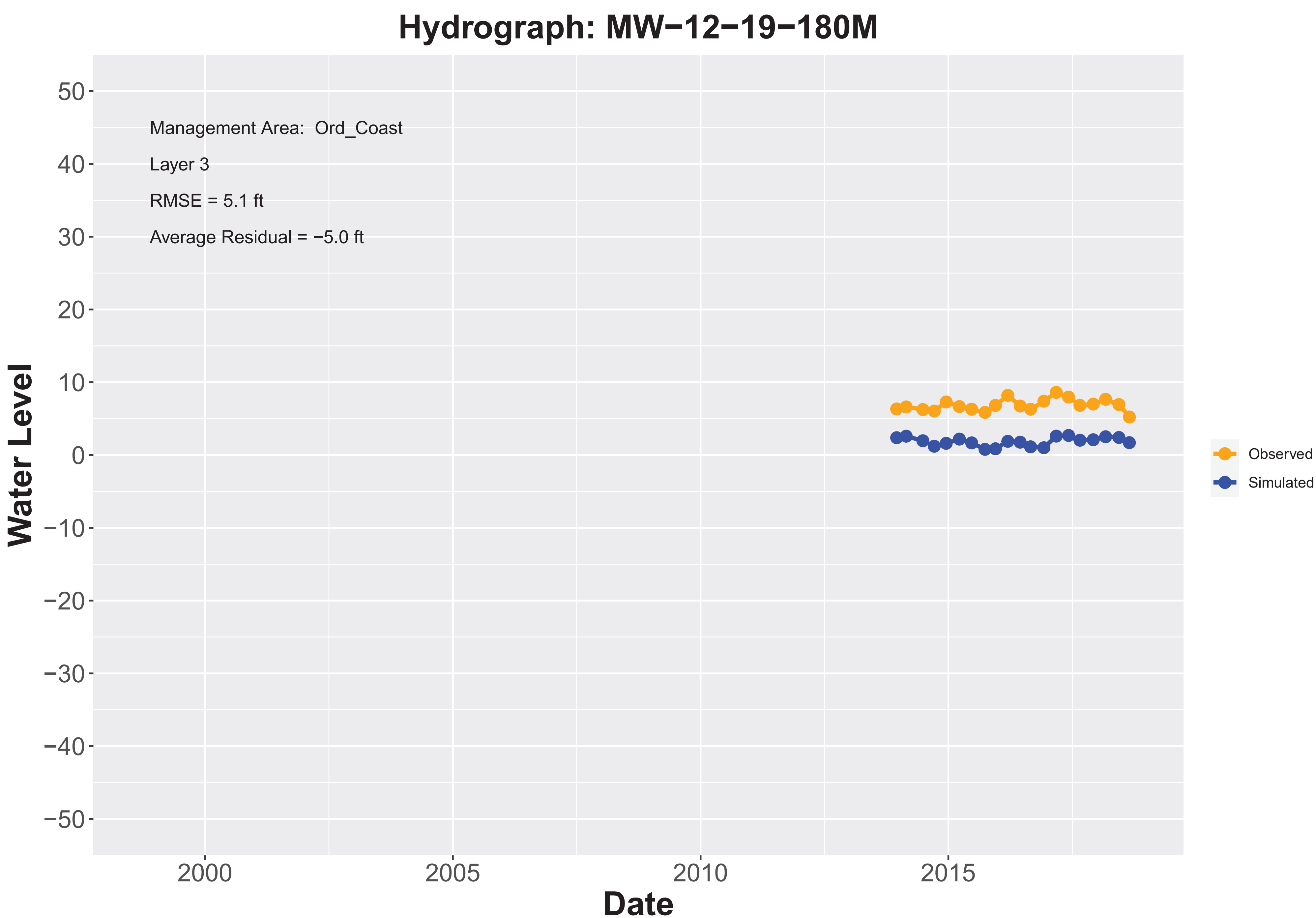
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−12−19−180M
Management Area: Ord_Coast
Layer 3
RMSE = 5.1 ft
Average Residual = −5.0 ft
Water Level
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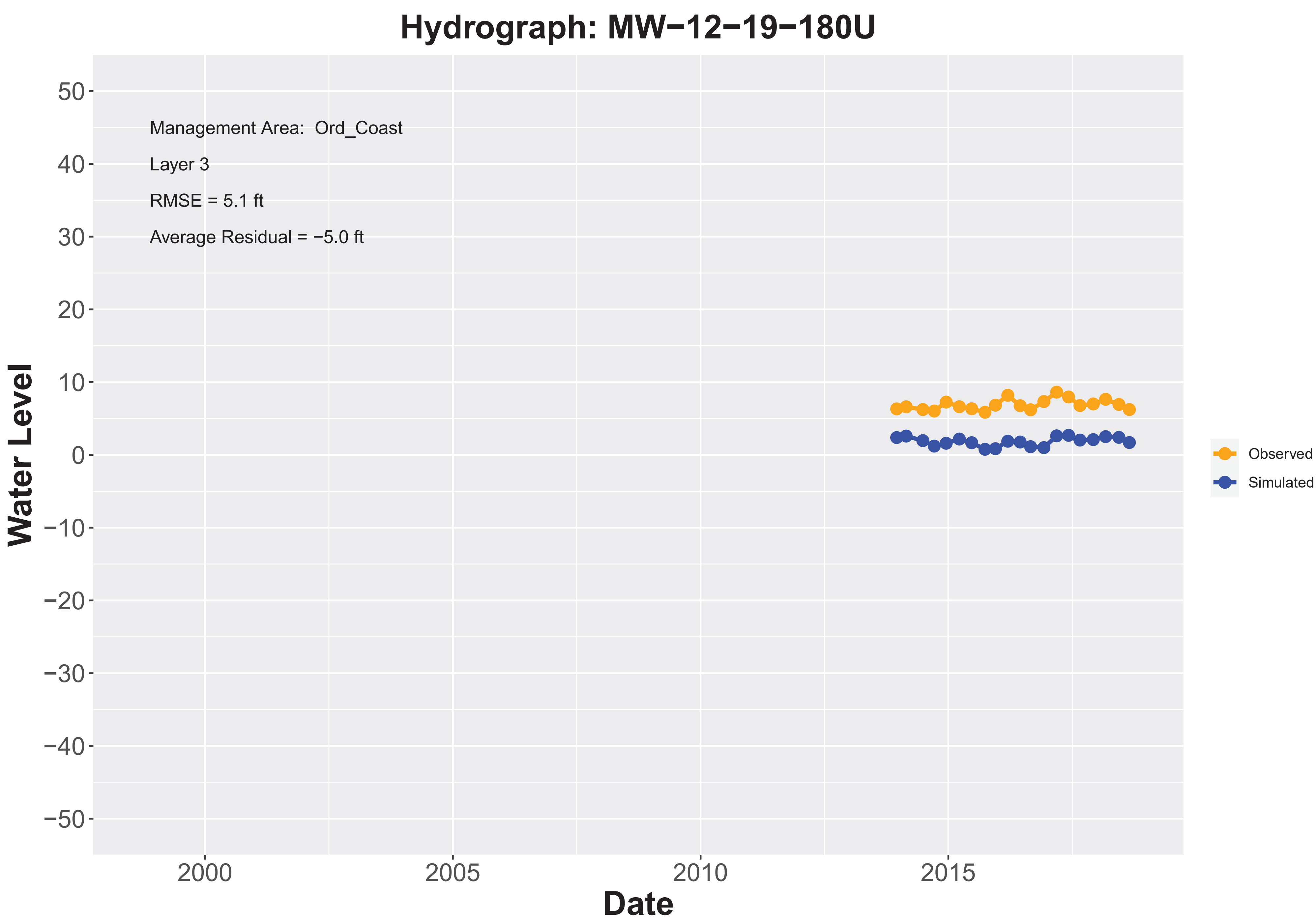
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−12−19−180U
Management Area: Ord_Coast
Layer 3
RMSE = 5.1 ft
Average Residual = −5.0 ft
Water Level
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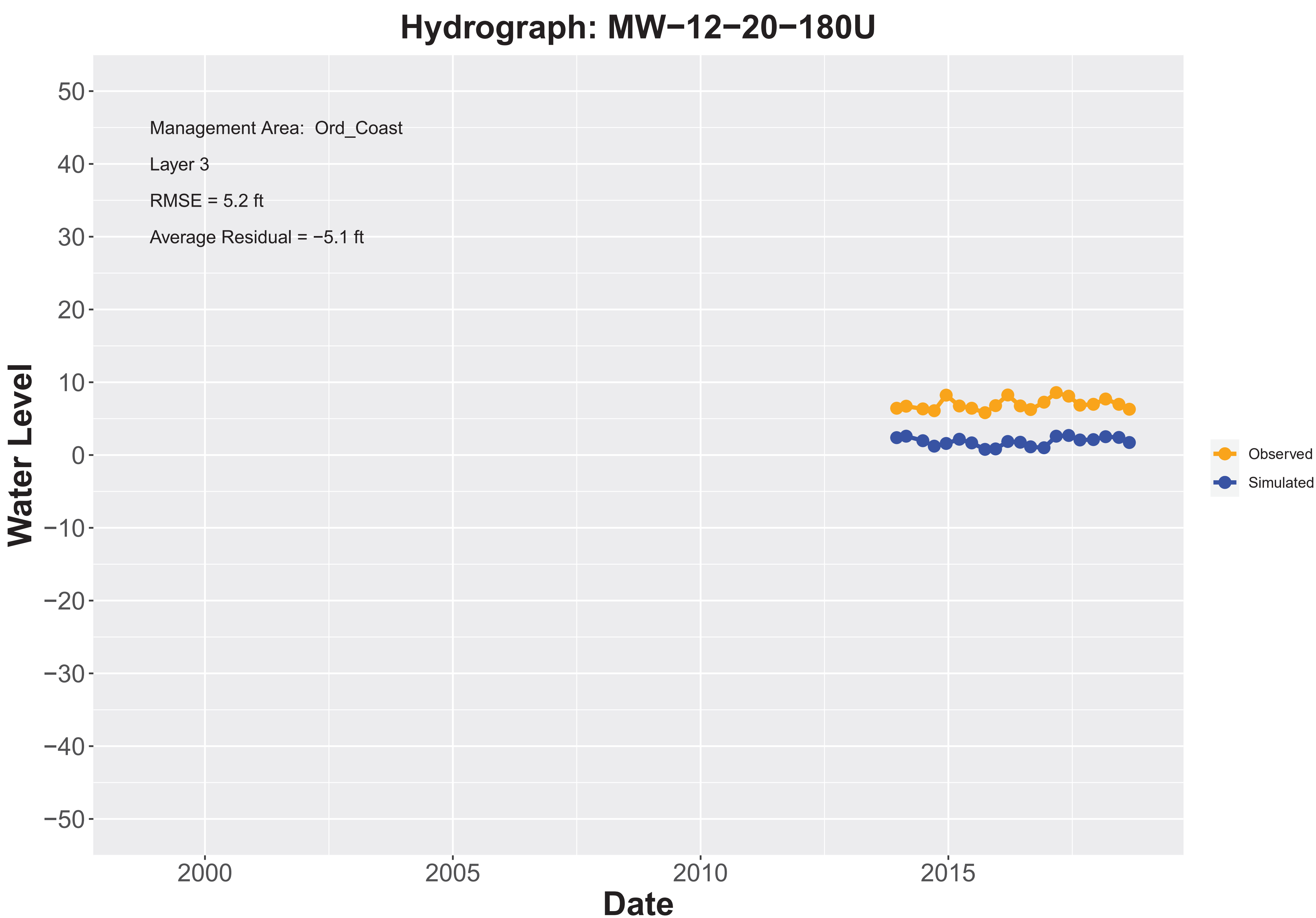
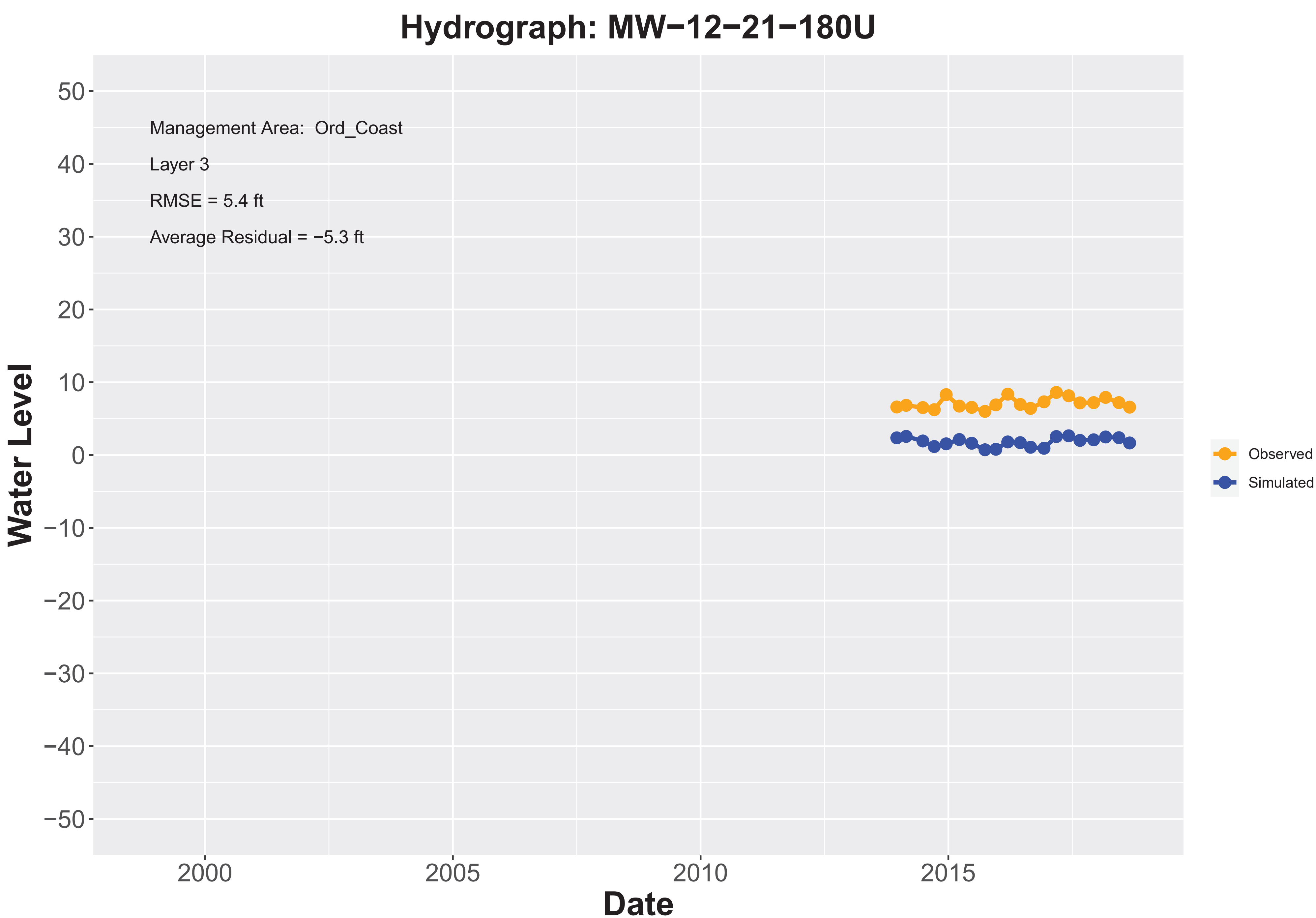
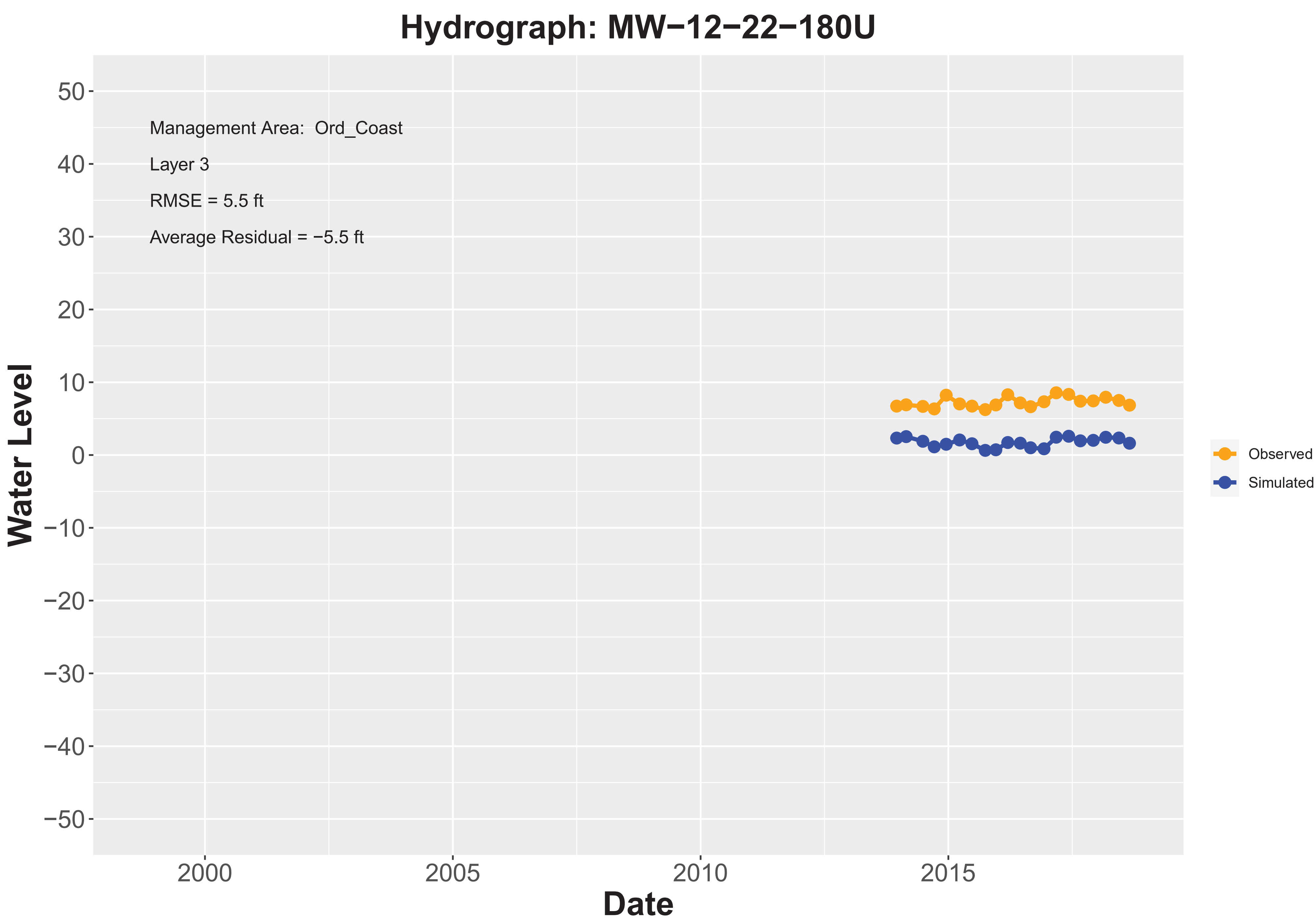
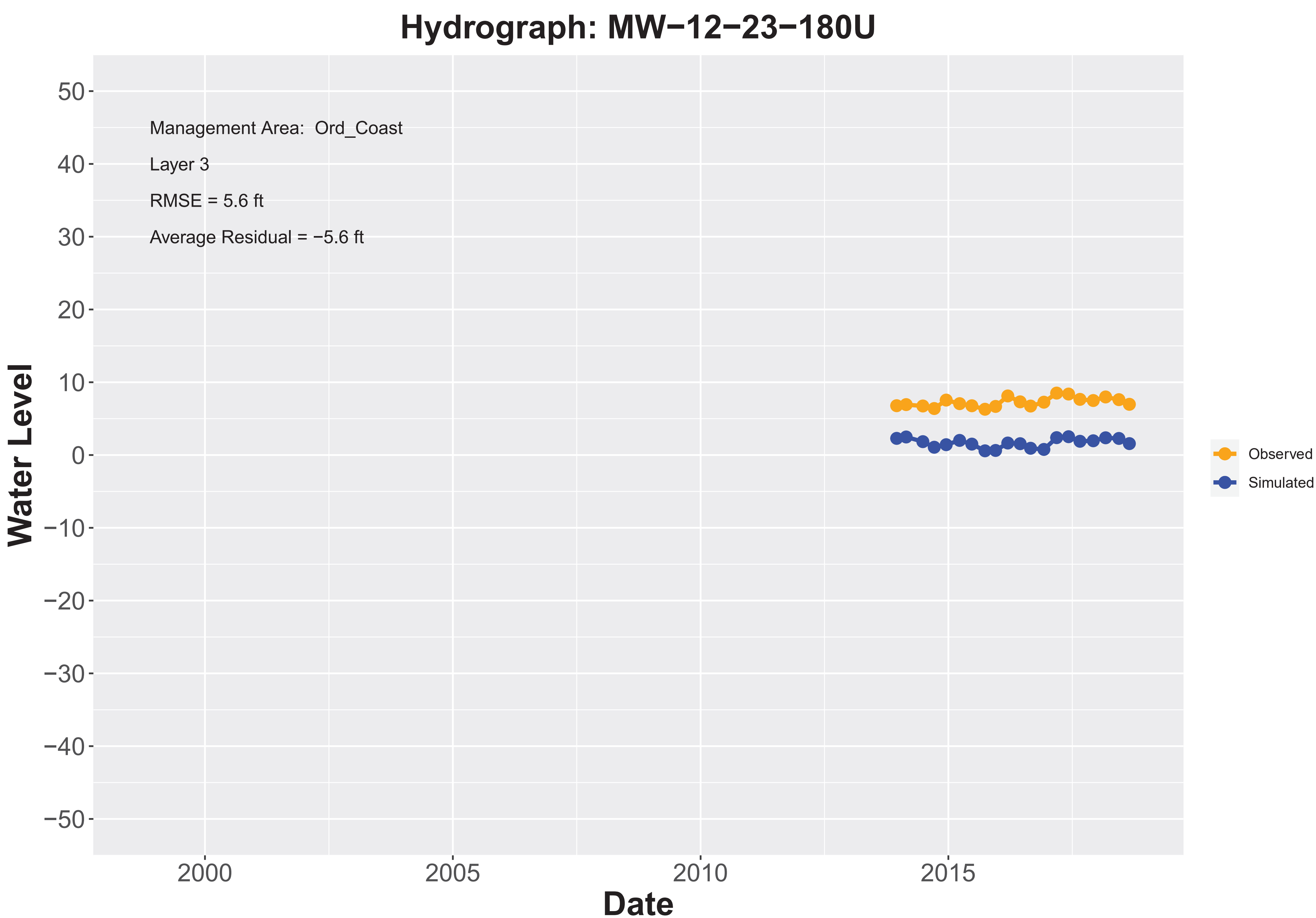
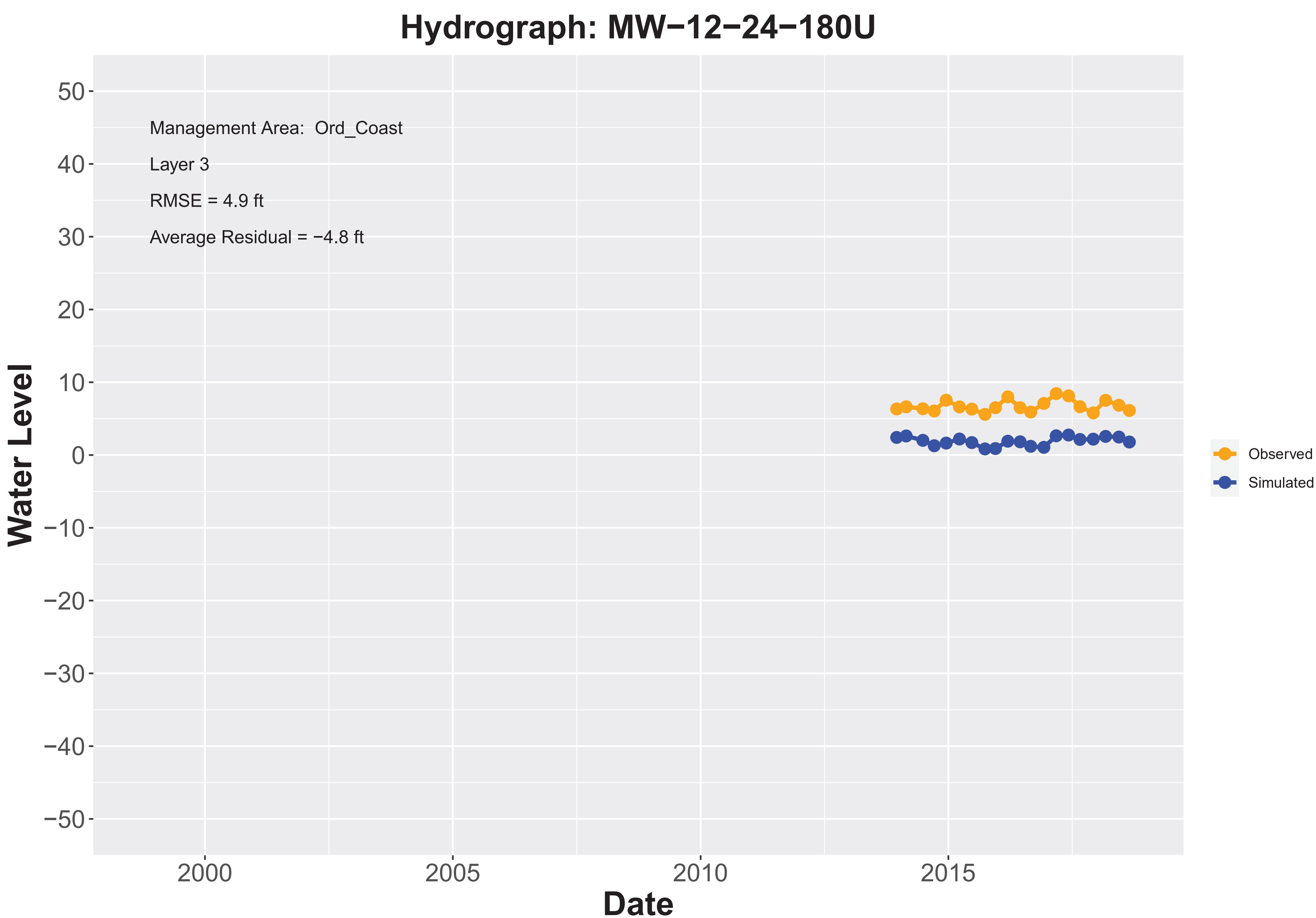
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

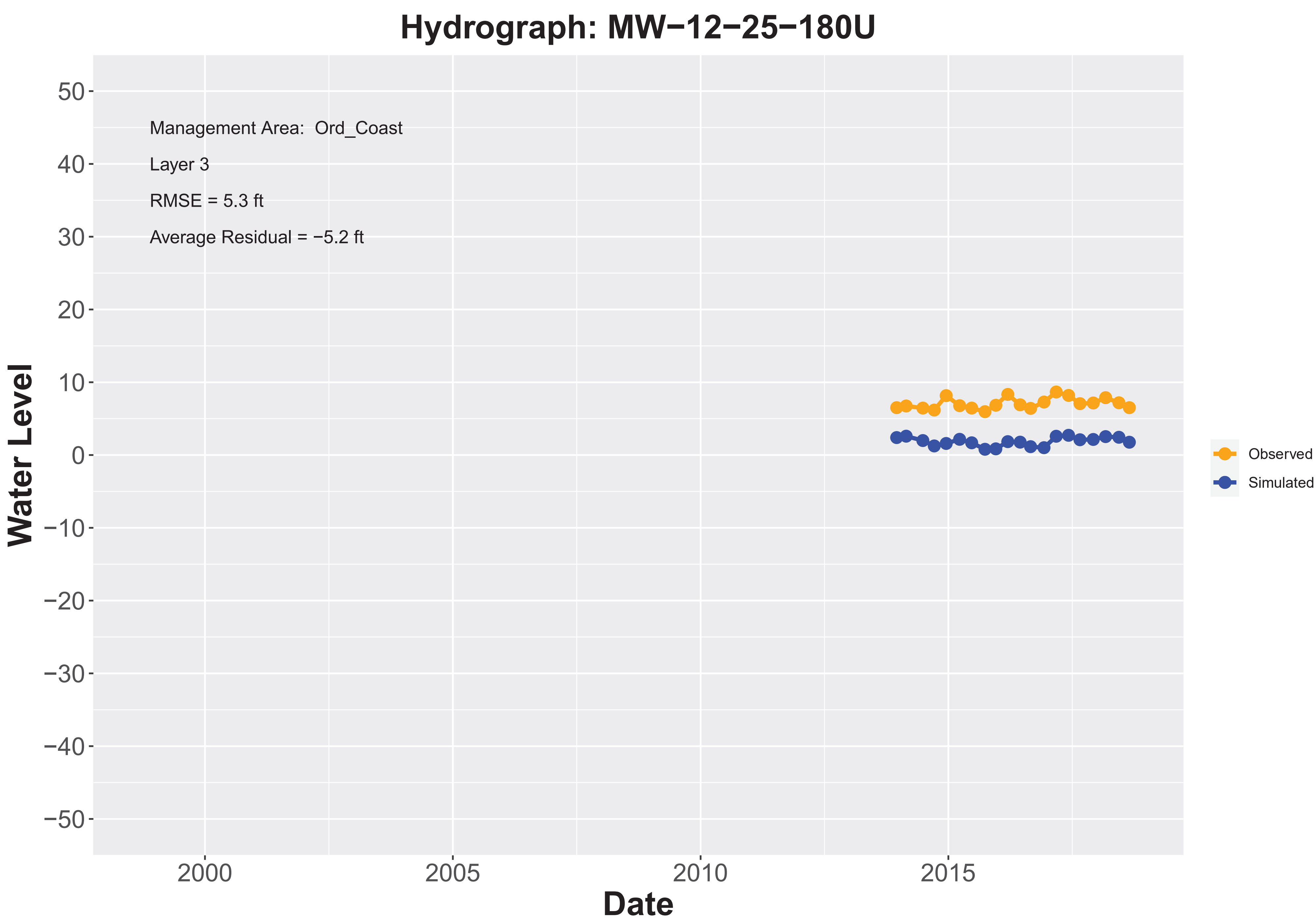

Hydrograph: MW−12−20−180U
Management Area: Ord_Coast
Layer 3
RMSE = 5.2 ft
Average Residual = −5.1 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

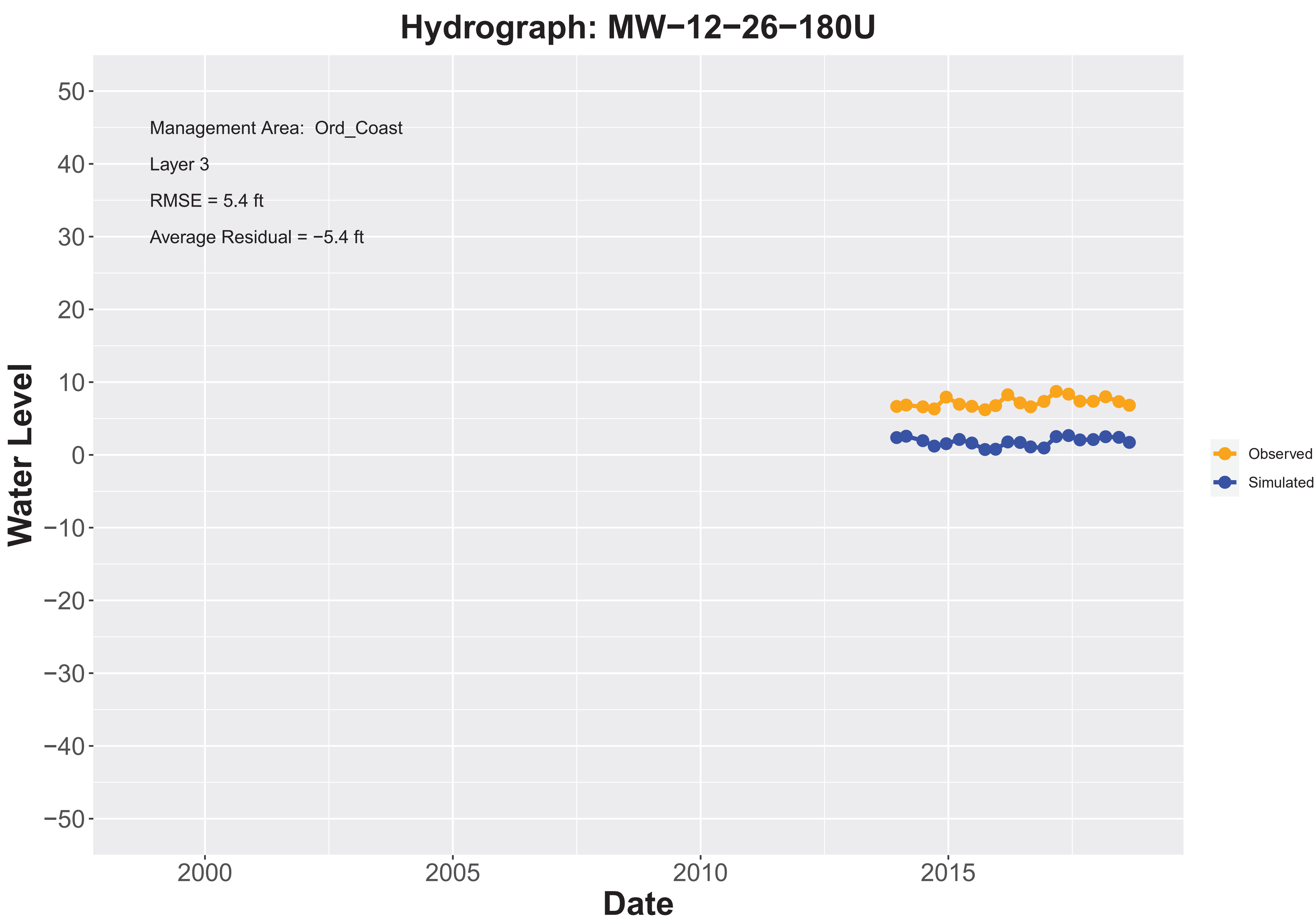

Hydrograph: MW−12−21−180U
Management Area: Ord_Coast
Layer 3
RMSE = 5.4 ft
Average Residual = −5.3 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

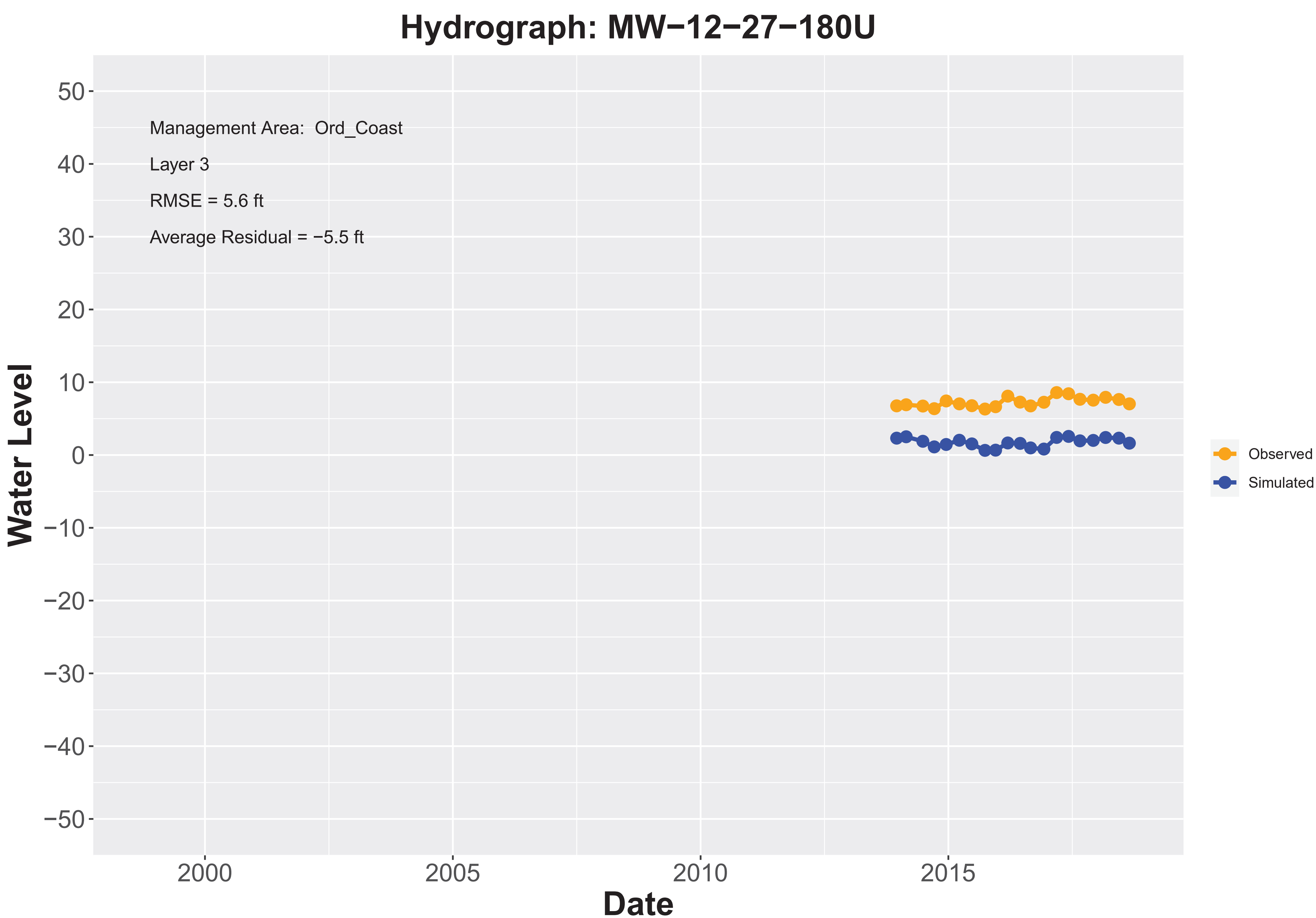

Hydrograph: MW−12−22−180U
Management Area: Ord_Coast
Layer 3
RMSE = 5.5 ft
Average Residual = −5.5 ft
Water Level
Date
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Observed
Simulated

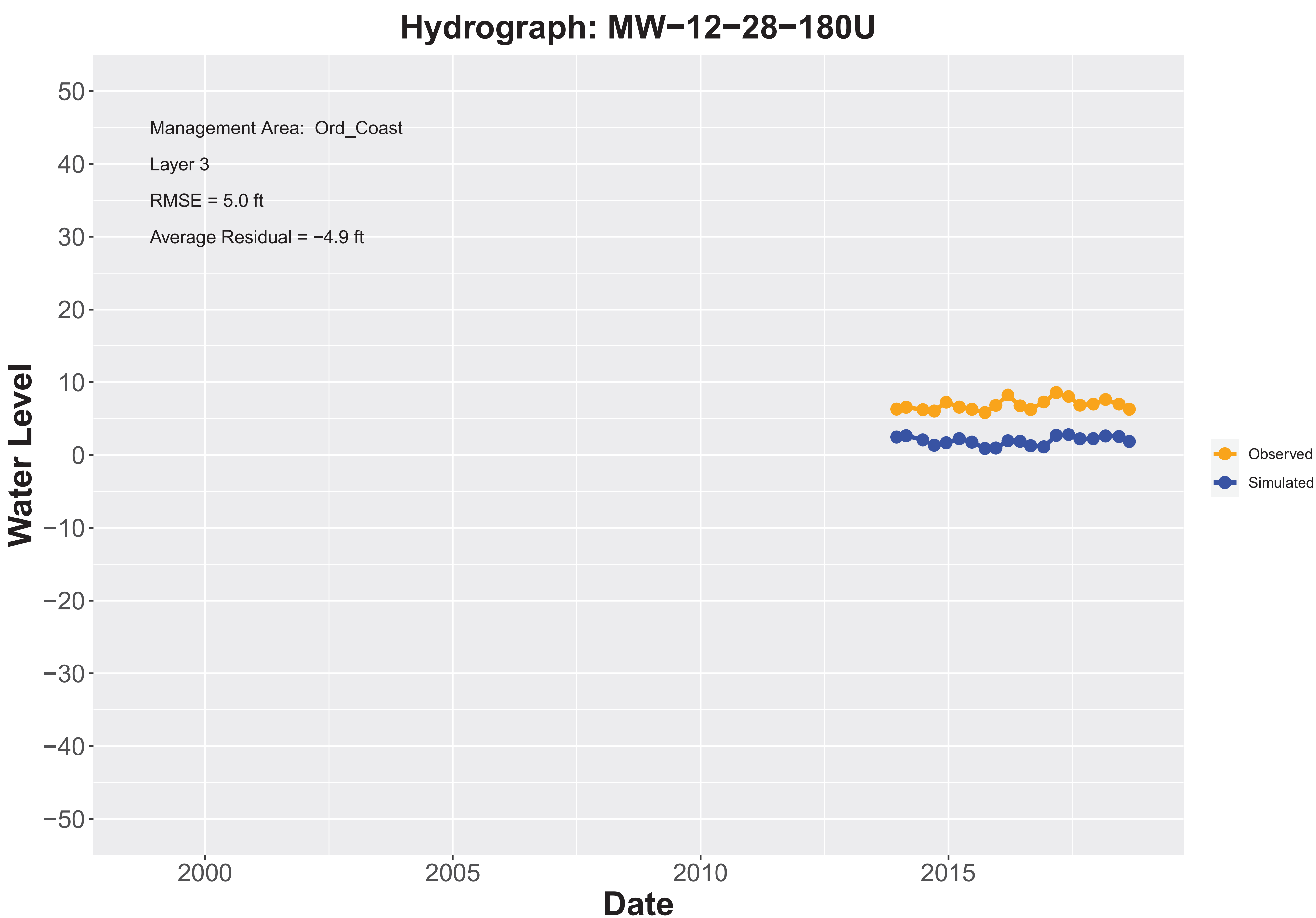

Hydrograph: MW−12−23−180U
Management Area: Ord_Coast
Layer 3
RMSE = 5.6 ft
Average Residual = −5.6 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

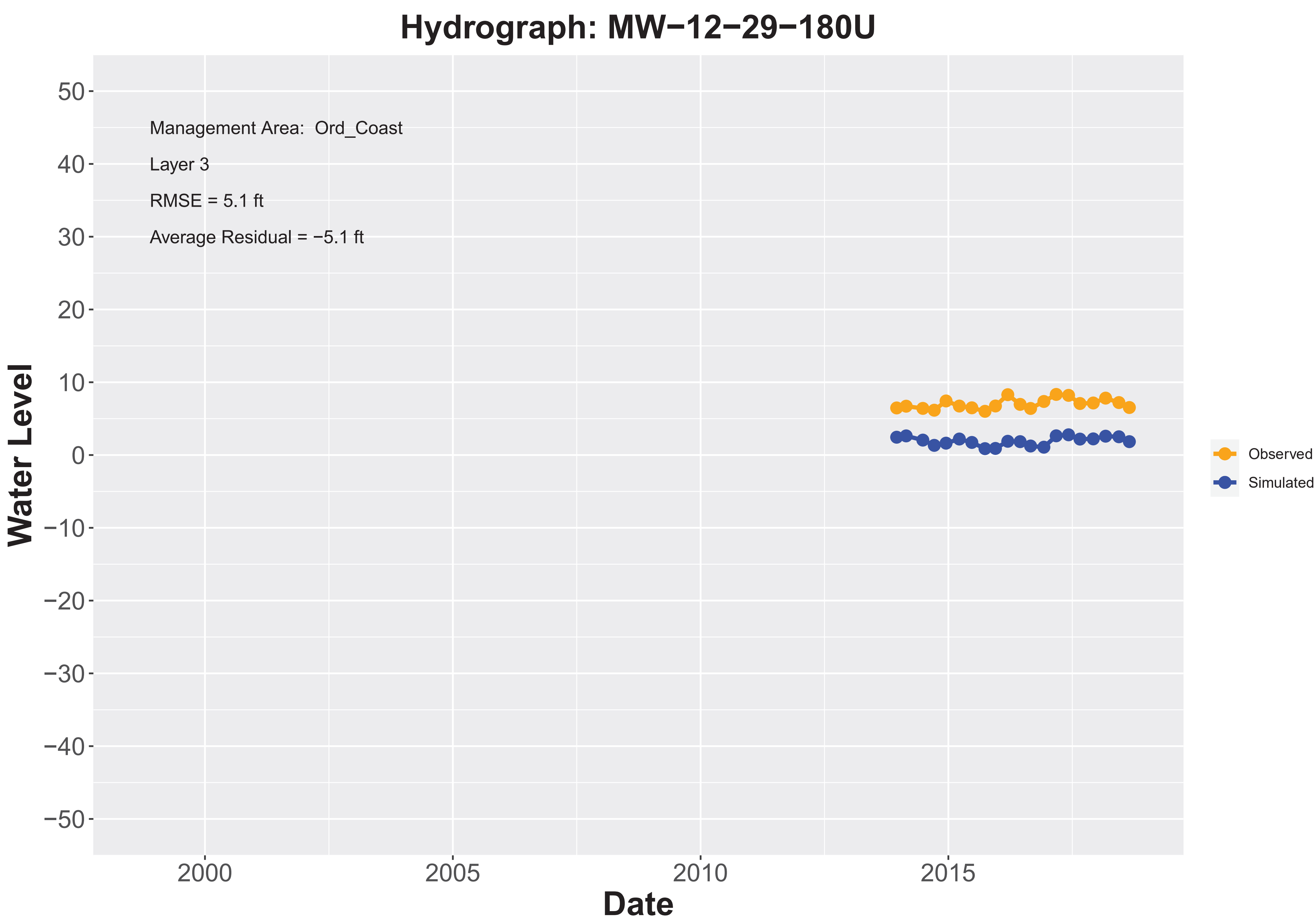

Hydrograph: MW−12−24−180U
Management Area: Ord_Coast
Layer 3
RMSE = 4.9 ft
Average Residual = −4.8 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−12−25−180U
Management Area: Ord_Coast
Layer 3
RMSE = 5.3 ft
Average Residual = −5.2 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

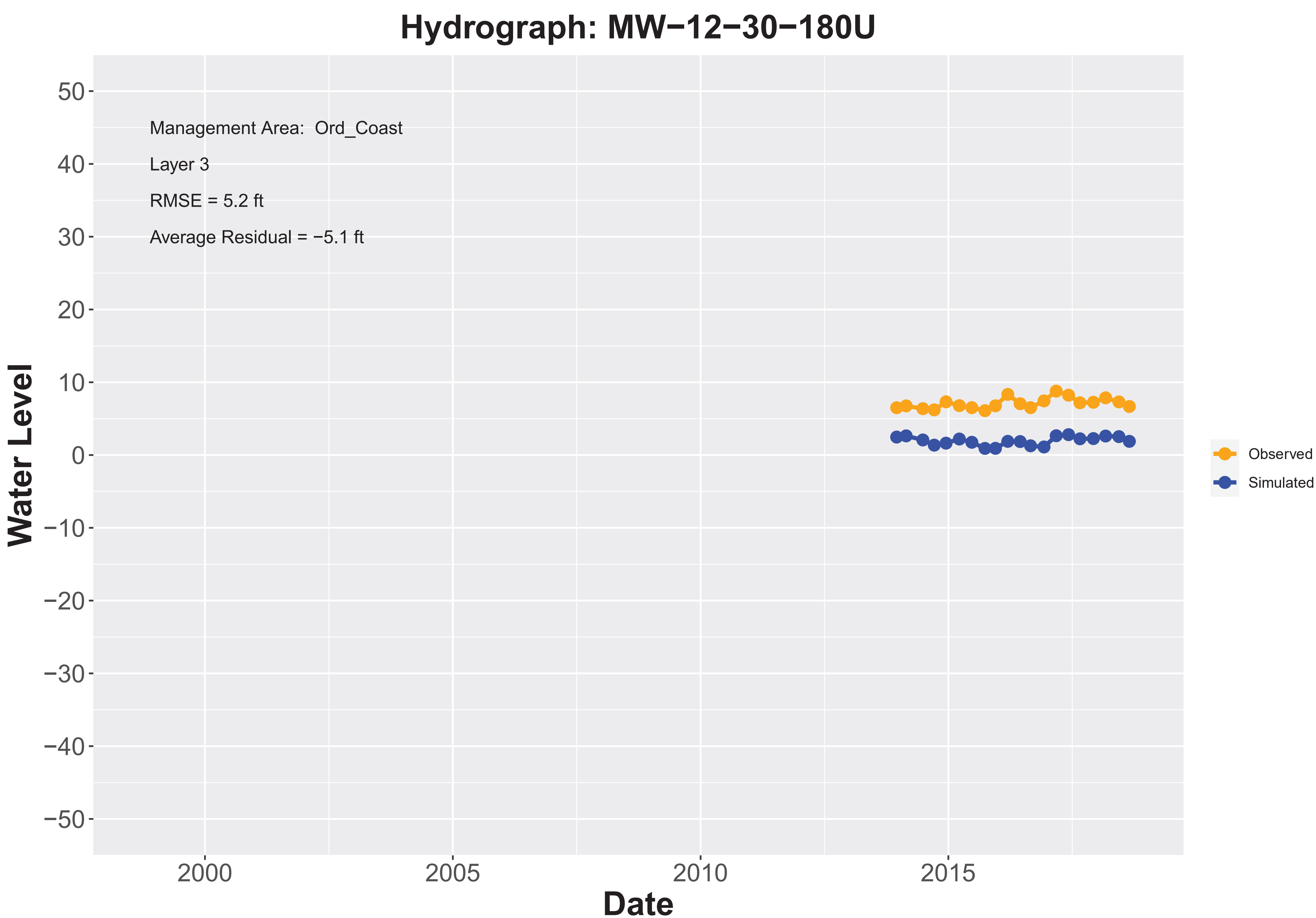

Hydrograph: MW−12−26−180U
Management Area: Ord_Coast
Layer 3
RMSE = 5.4 ft
Average Residual = −5.4 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−12−27−180U
Management Area: Ord_Coast
Layer 3
RMSE = 5.6 ft
Average Residual = −5.5 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

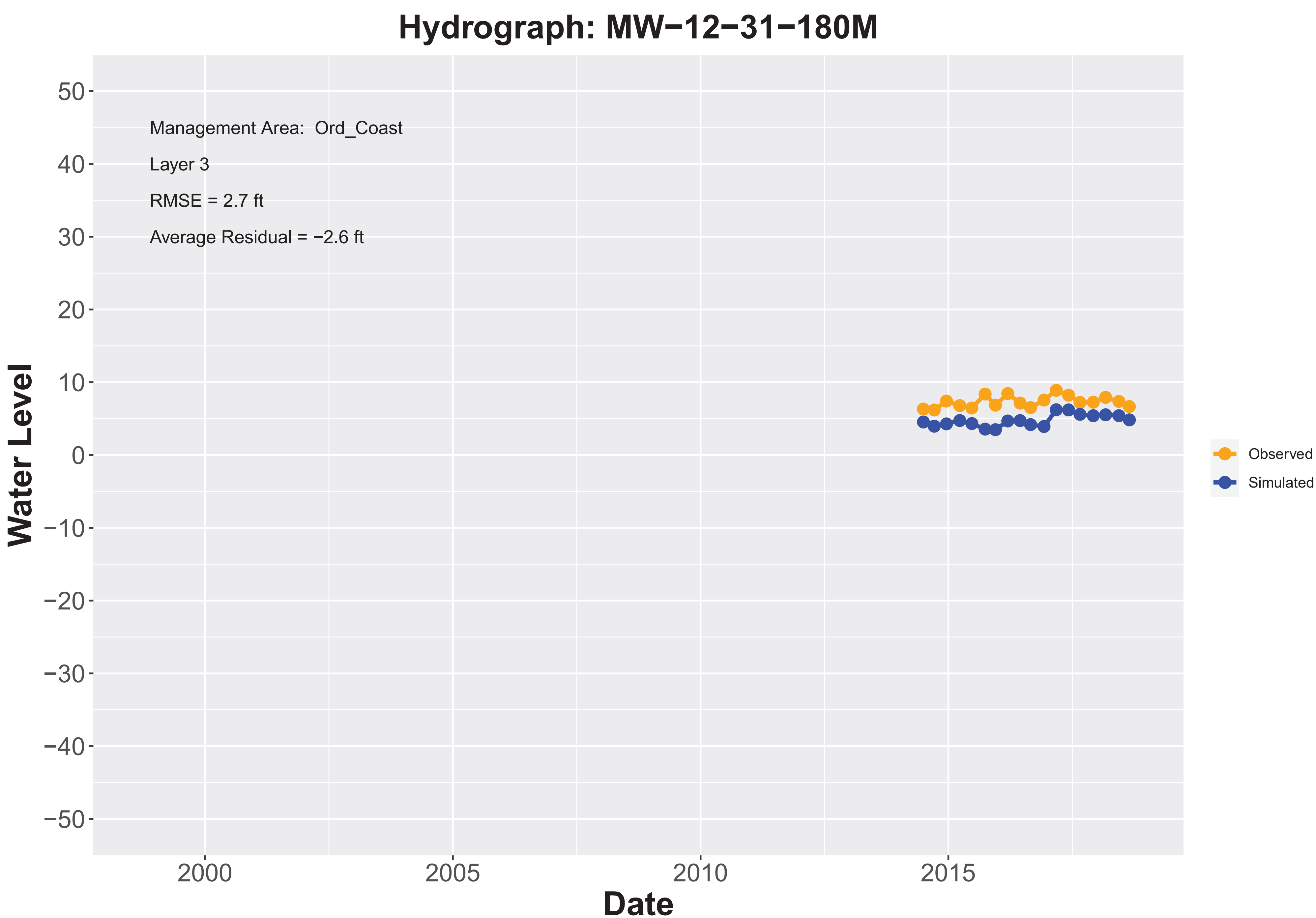

Hydrograph: MW−12−28−180U
Management Area: Ord_Coast
Layer 3
RMSE = 5.0 ft
Average Residual = −4.9 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



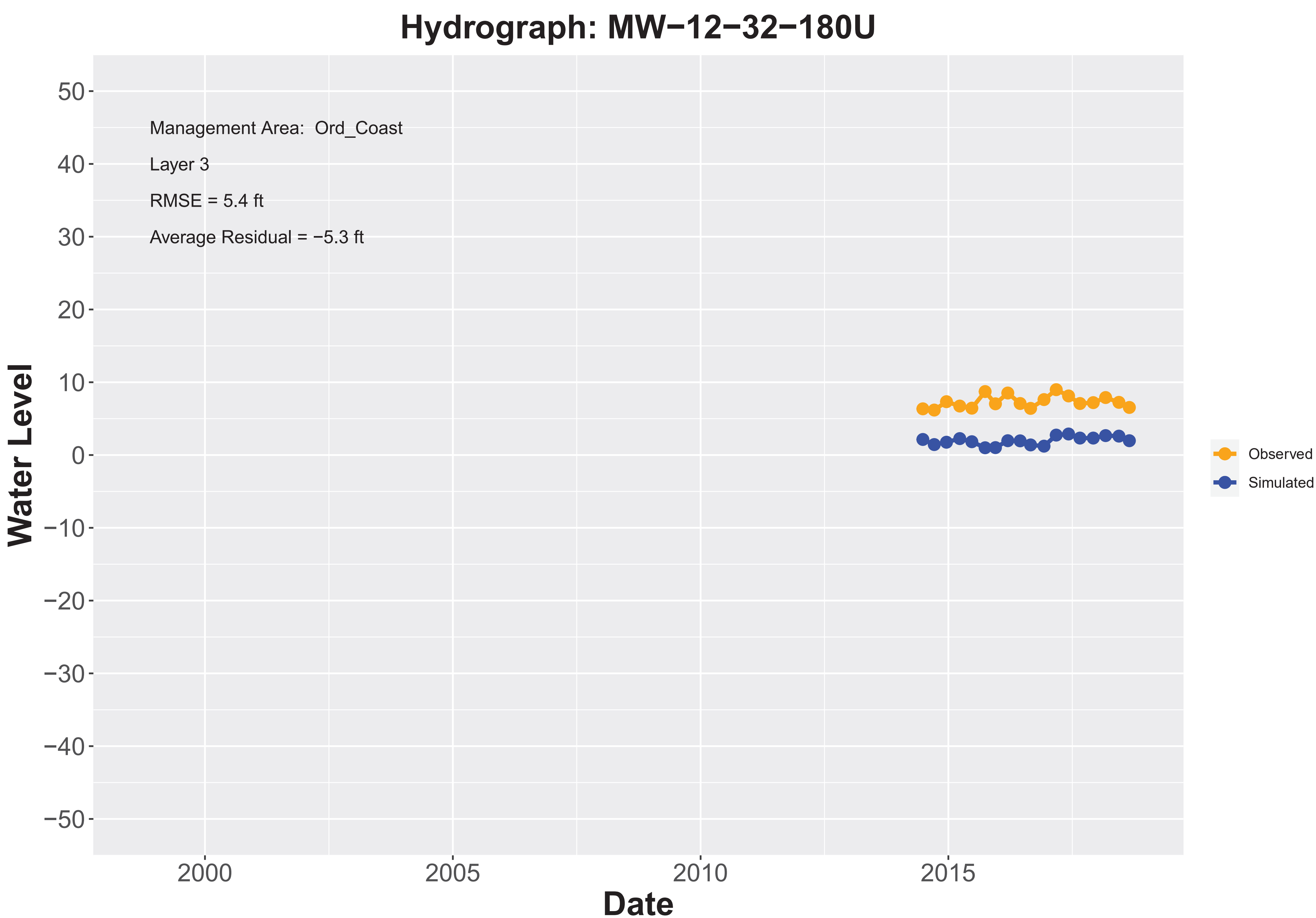
Hydrograph: MW−12−29−180U
Management Area: Ord_Coast
Layer 3
RMSE = 5.1 ft
Average Residual = −5.1 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

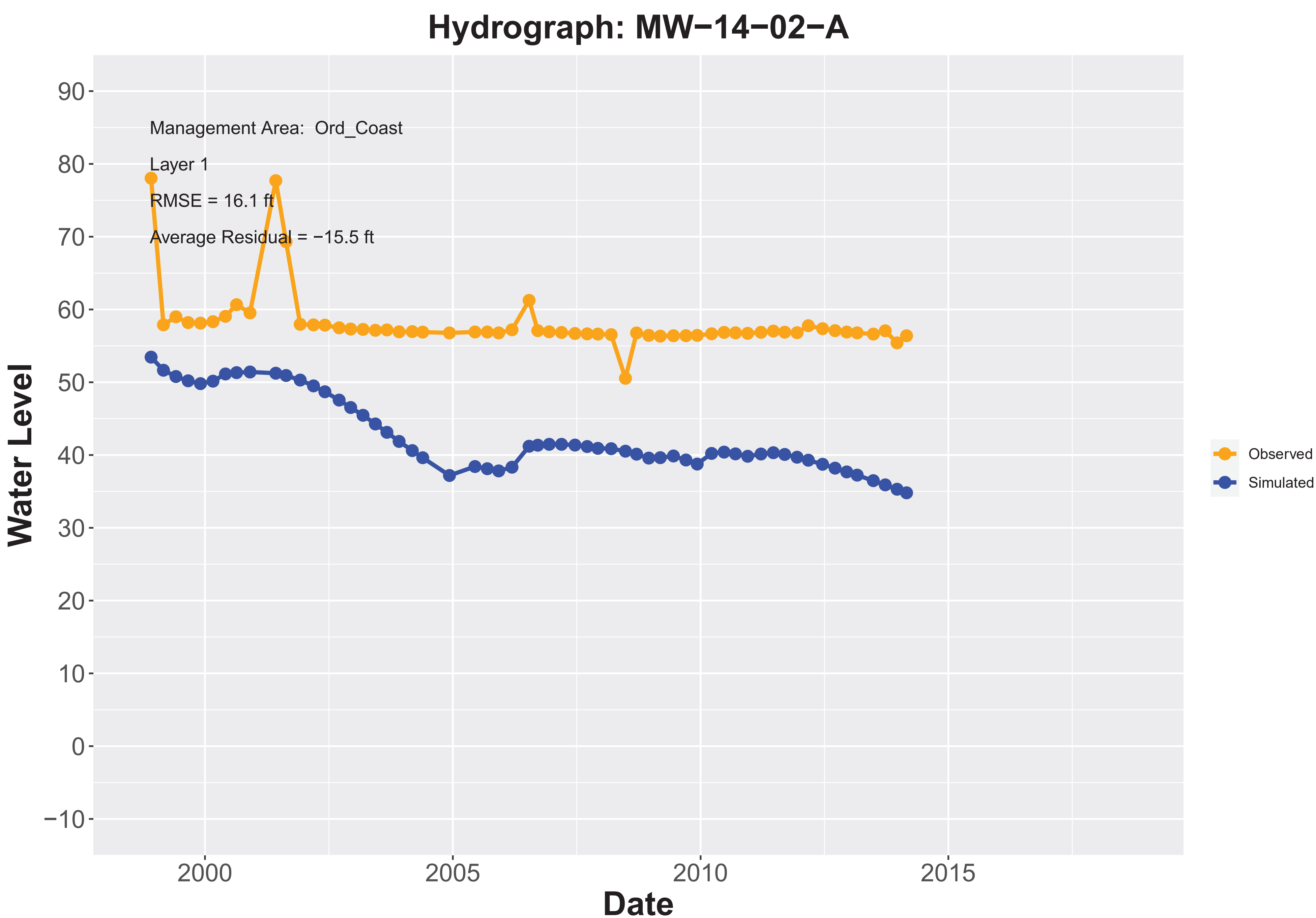


Hydrograph: MW−12−30−180U
Management Area: Ord_Coast
Layer 3
RMSE = 5.2 ft
Average Residual = −5.1 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

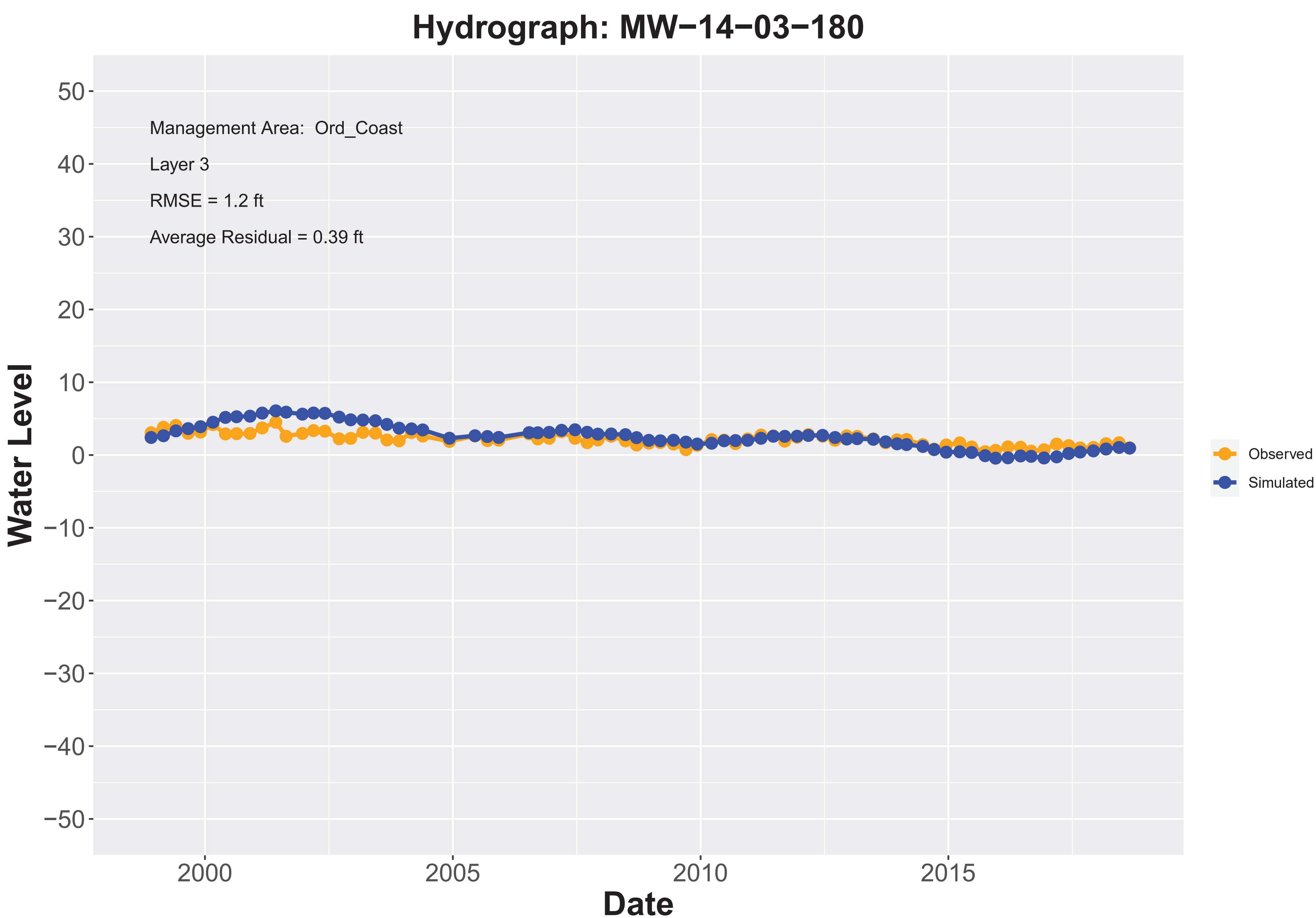


Hydrograph: MW−12−31−180M
Management Area: Ord_Coast
Layer 3
RMSE = 2.7 ft
Average Residual = −2.6 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−12−32−180U
Management Area: Ord_Coast
Layer 3
RMSE = 5.4 ft
Average Residual = −5.3 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

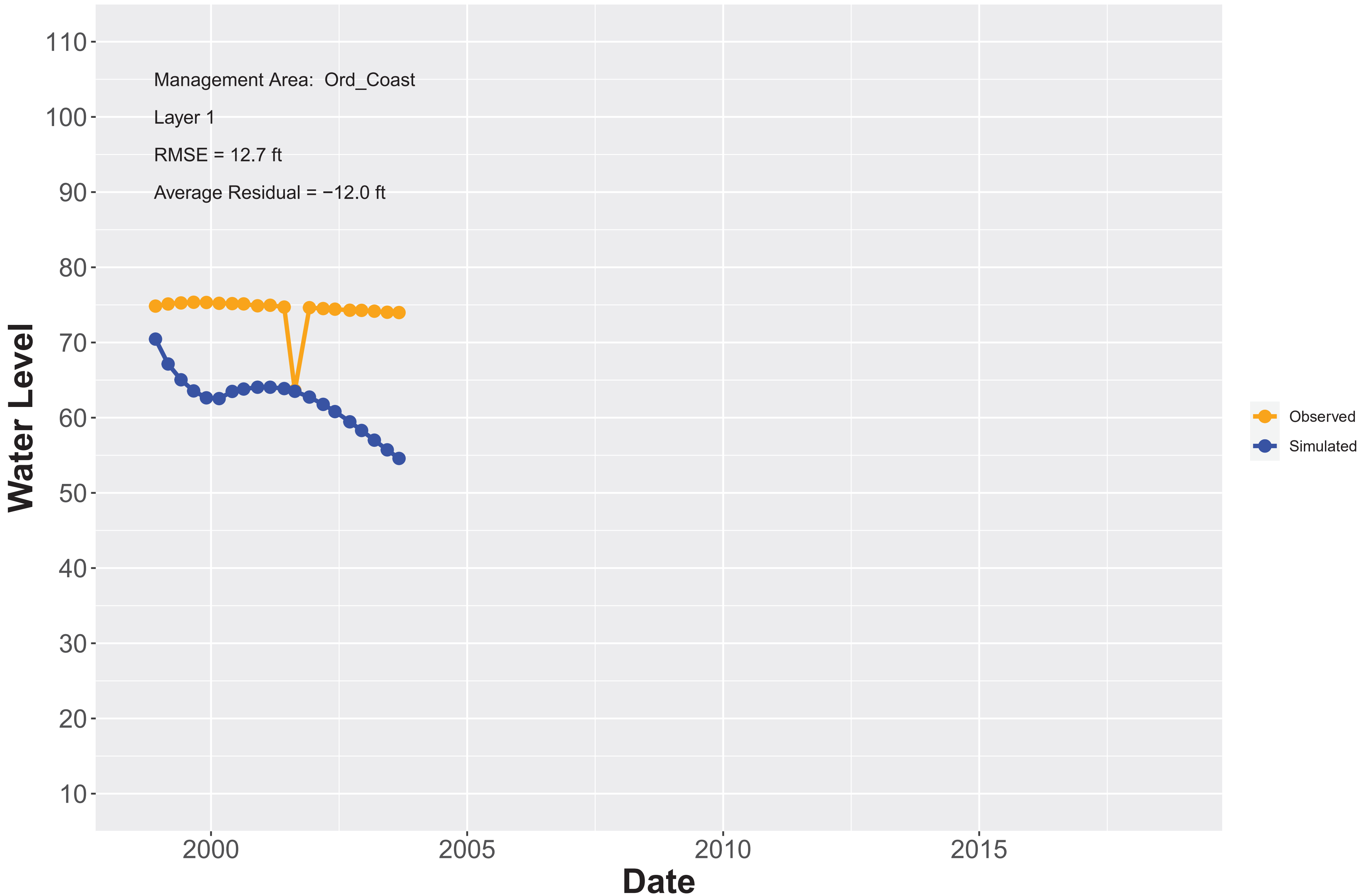


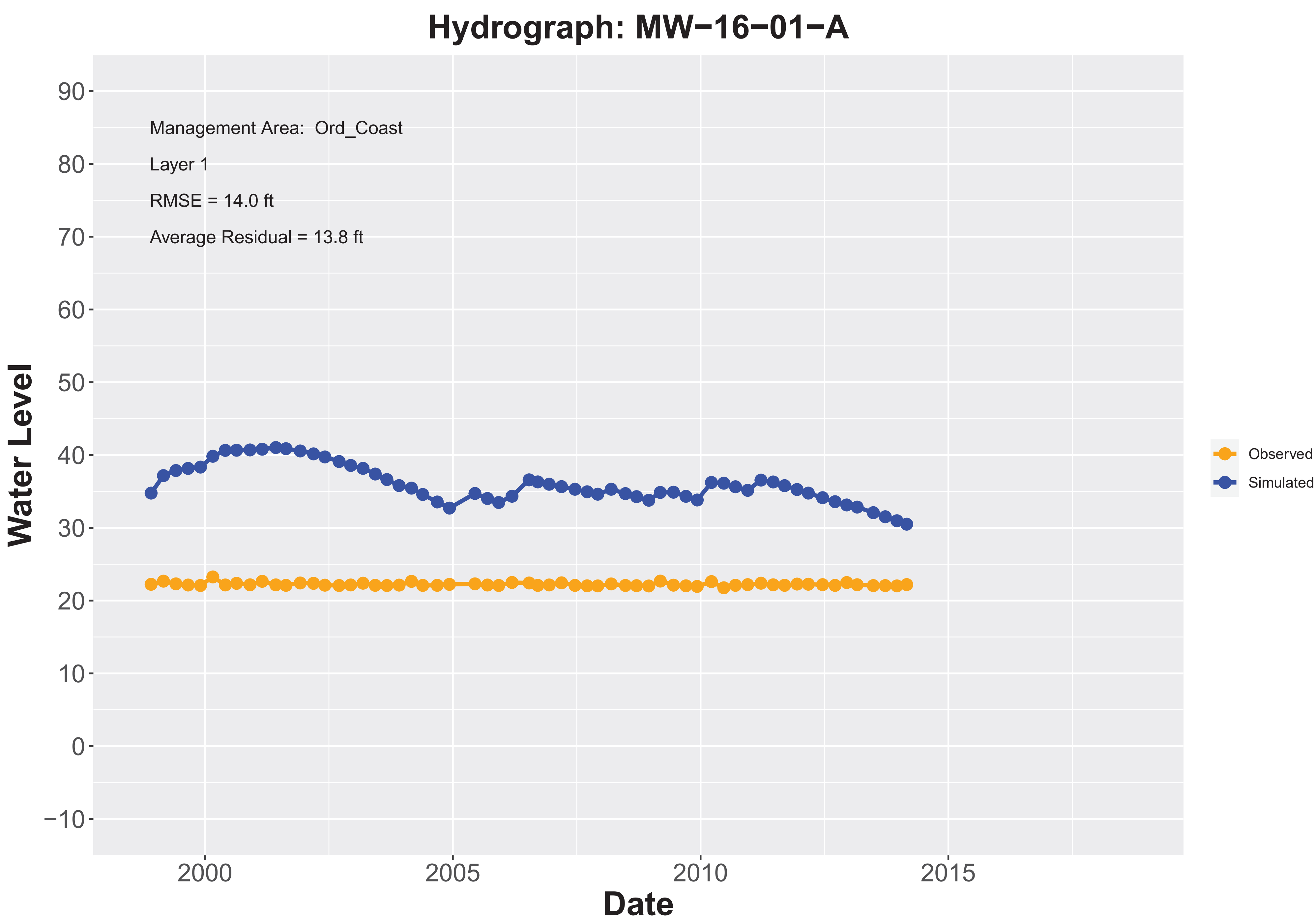
Hydrograph: MW−14−02−A
Management Area: Ord_Coast
Layer 1
RMSE = 16.1 ft
Average Residual = −15.5 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−14−03−180
Management Area: Ord_Coast
Layer 3
RMSE = 1.2 ft
Average Residual = 0.39 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

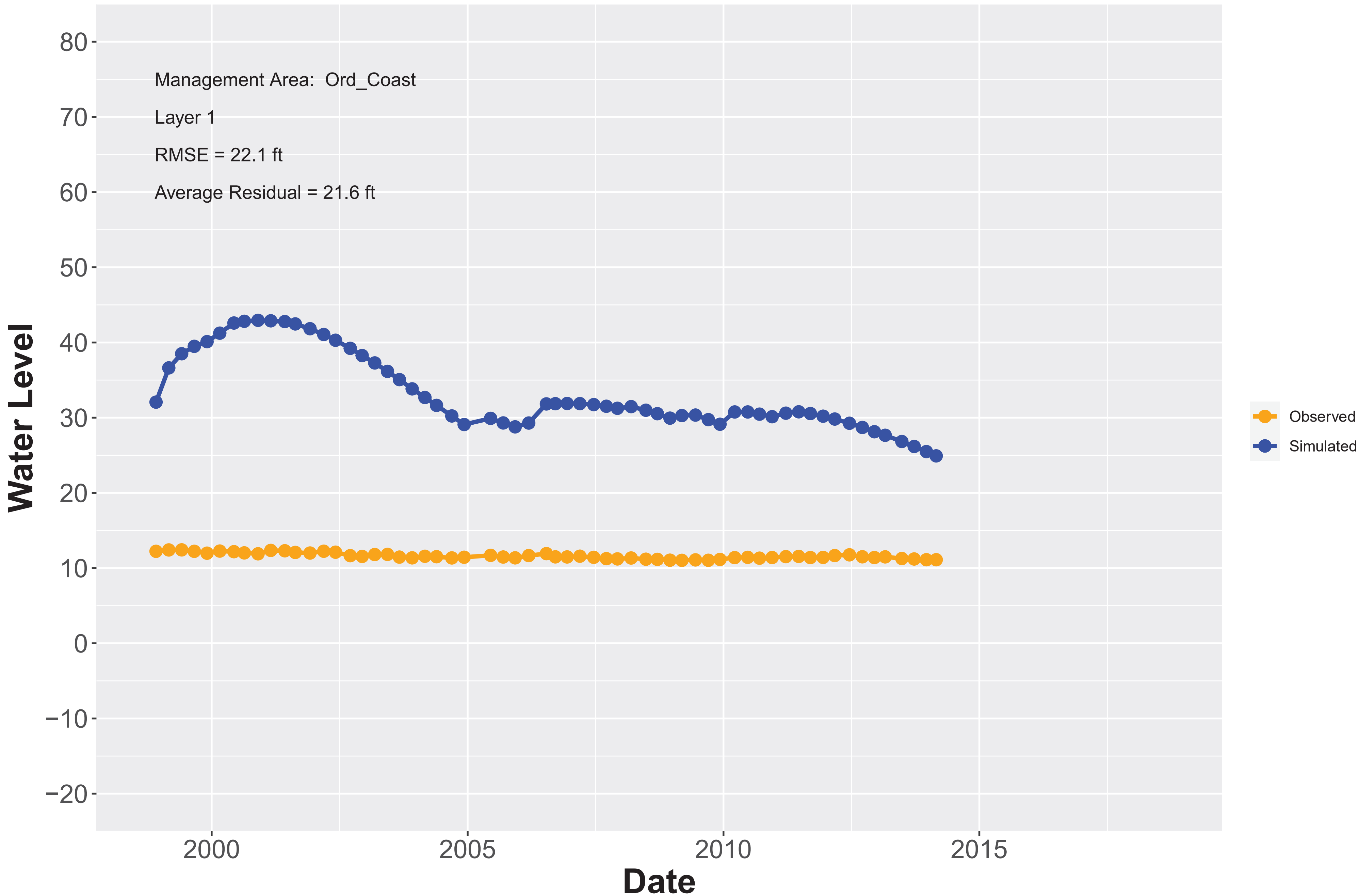
Hydrograph: MW−14−04−A

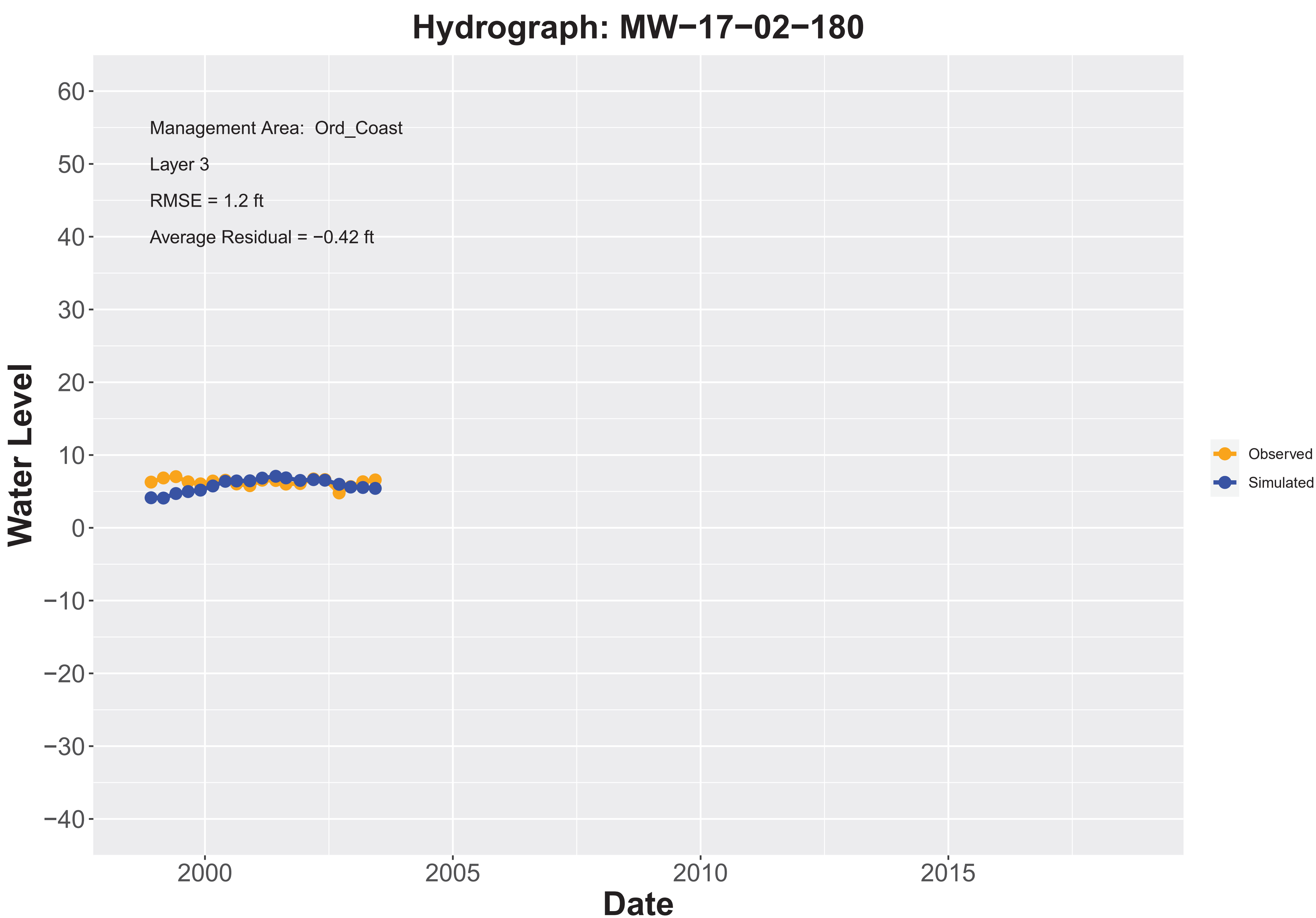


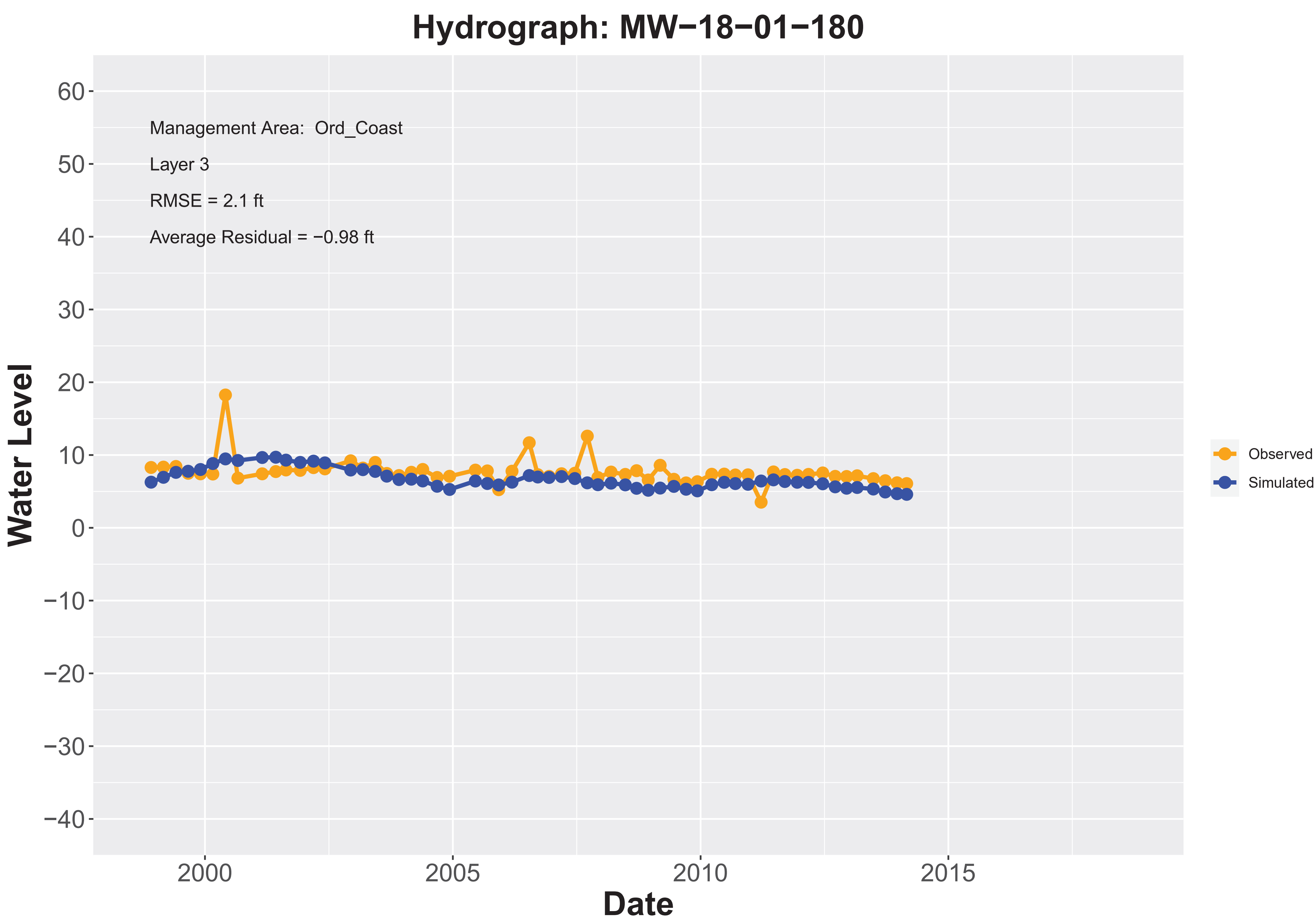


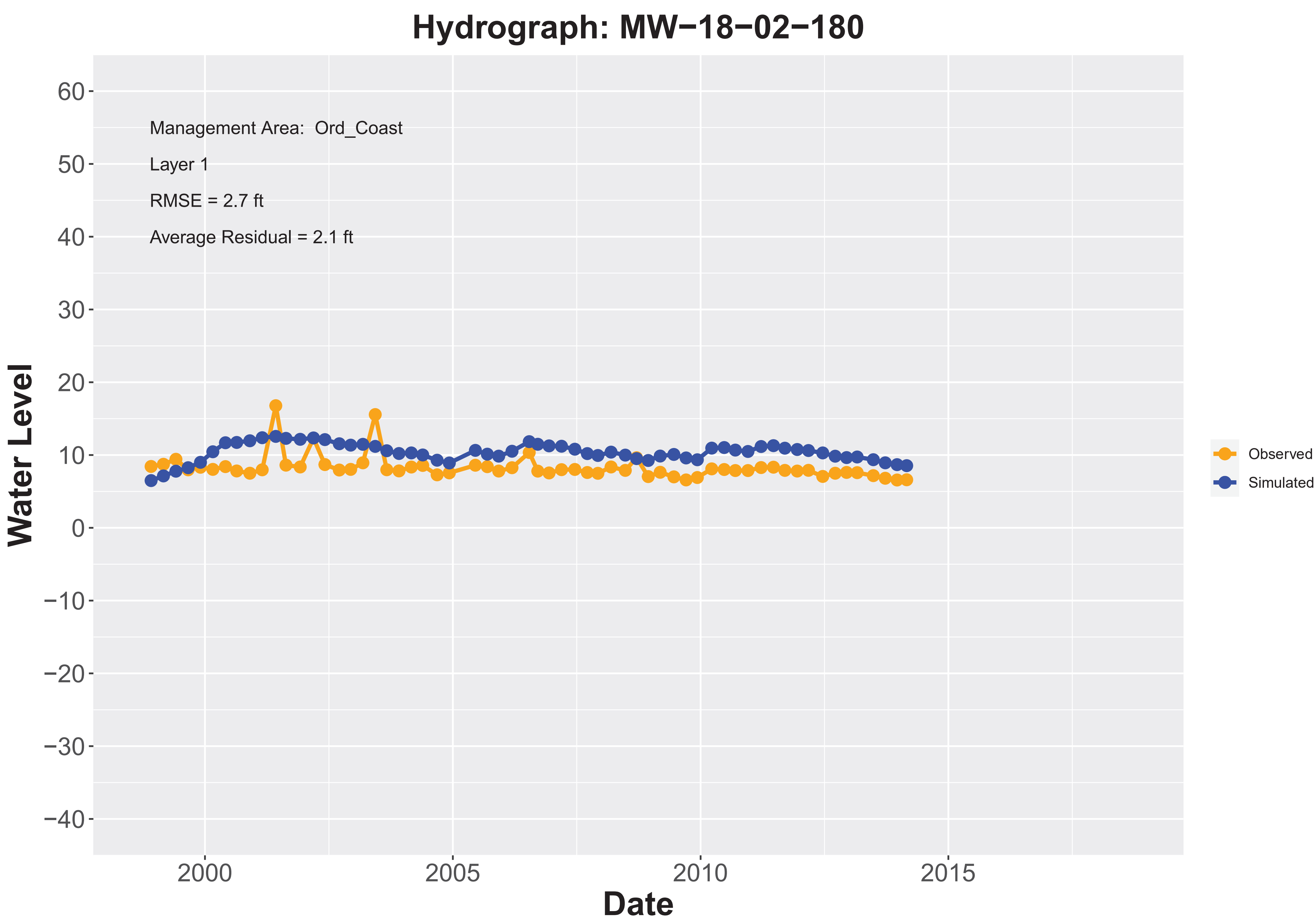
Hydrograph: MW−16−01−A
Management Area: Ord_Coast
Layer 1
RMSE = 14.0 ft
Average Residual = 13.8 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

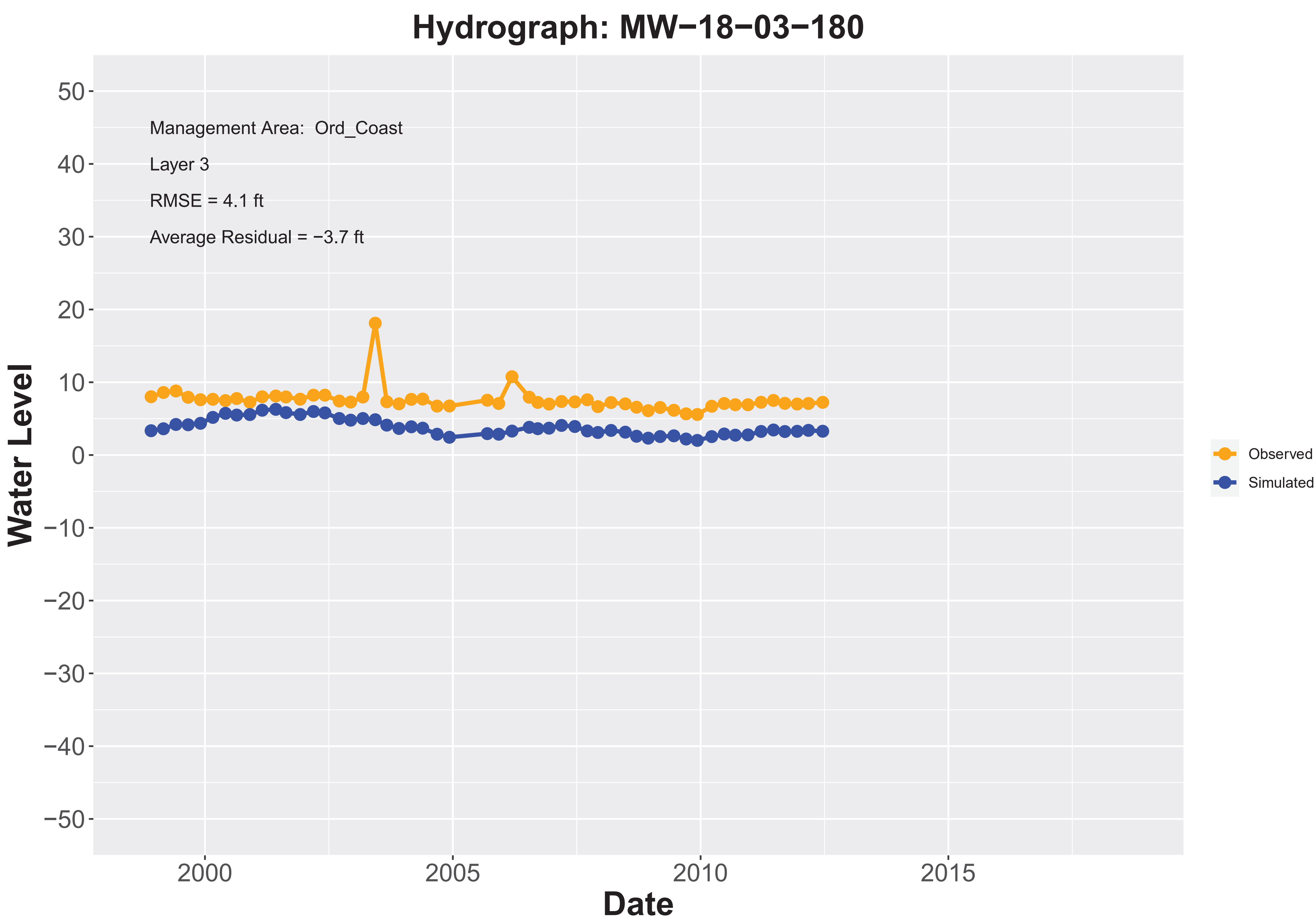
Hydrograph: MW−17−01−A

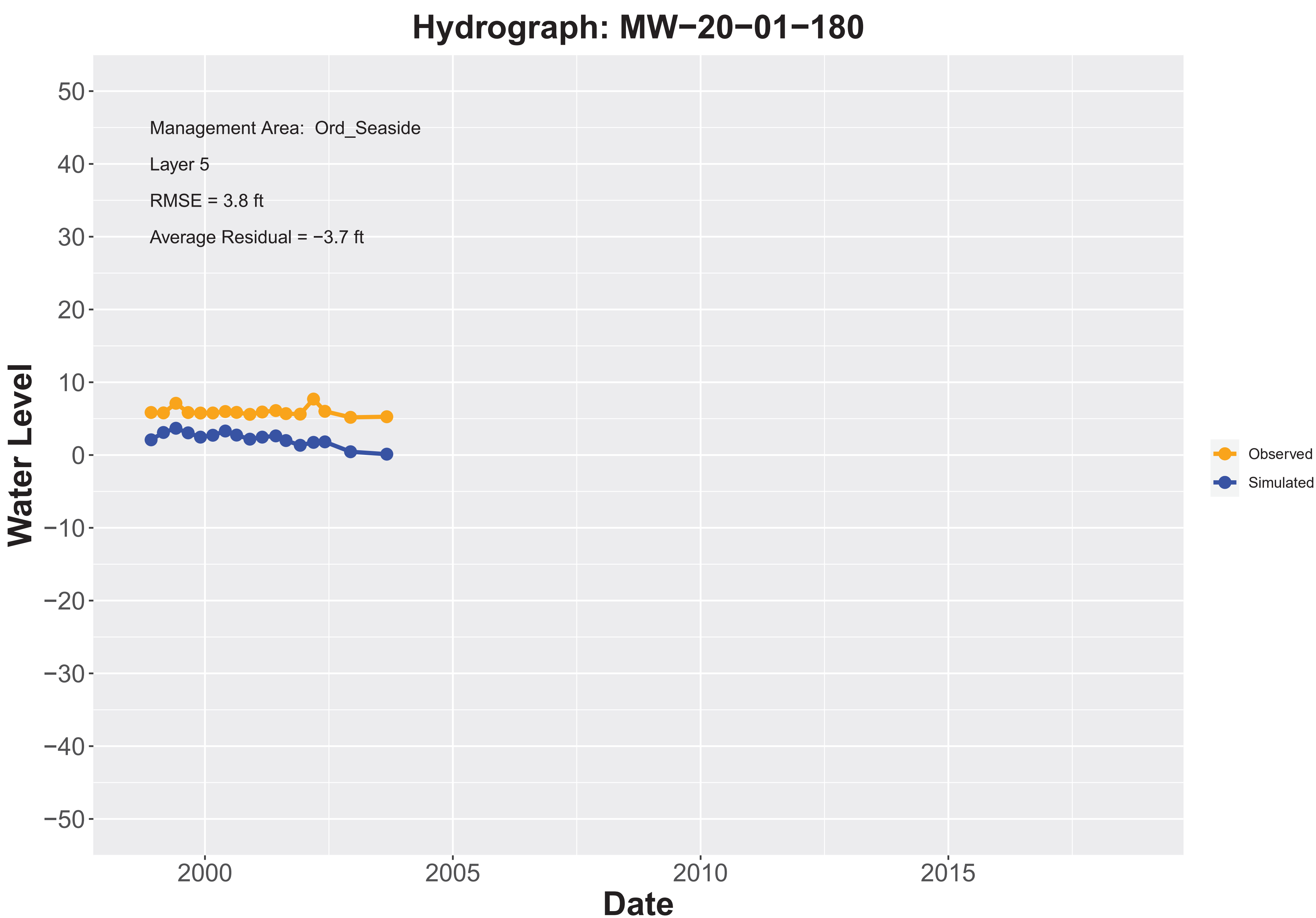


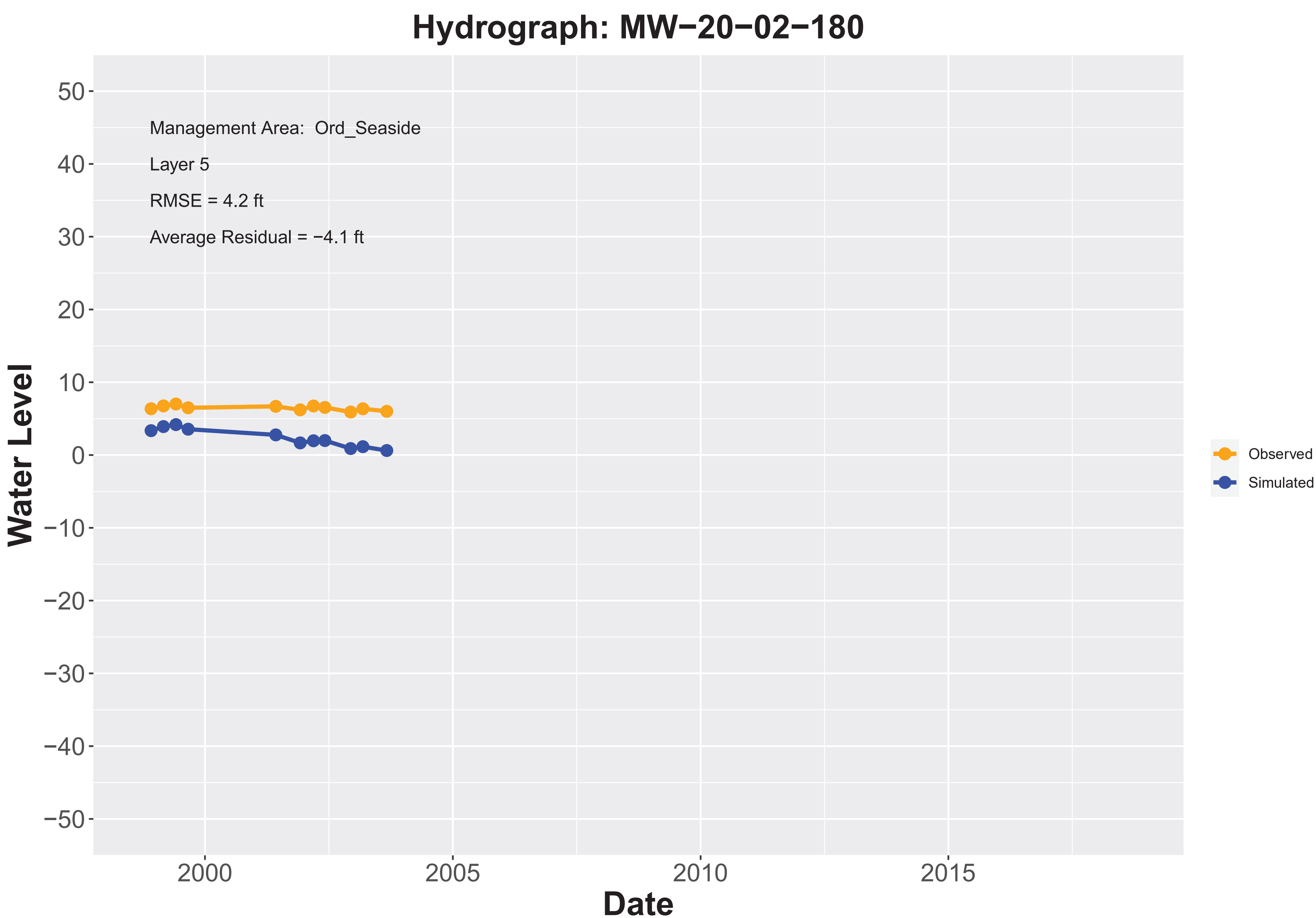

Hydrograph: MW−17−02−180
Management Area: Ord_Coast
Layer 3
RMSE = 1.2 ft
Average Residual = −0.42 ft
Water Level
60
50
40
30
20
10
0
−10
−20
−30
−40
Date
2000
2005
2010
2015
Observed
Simulated

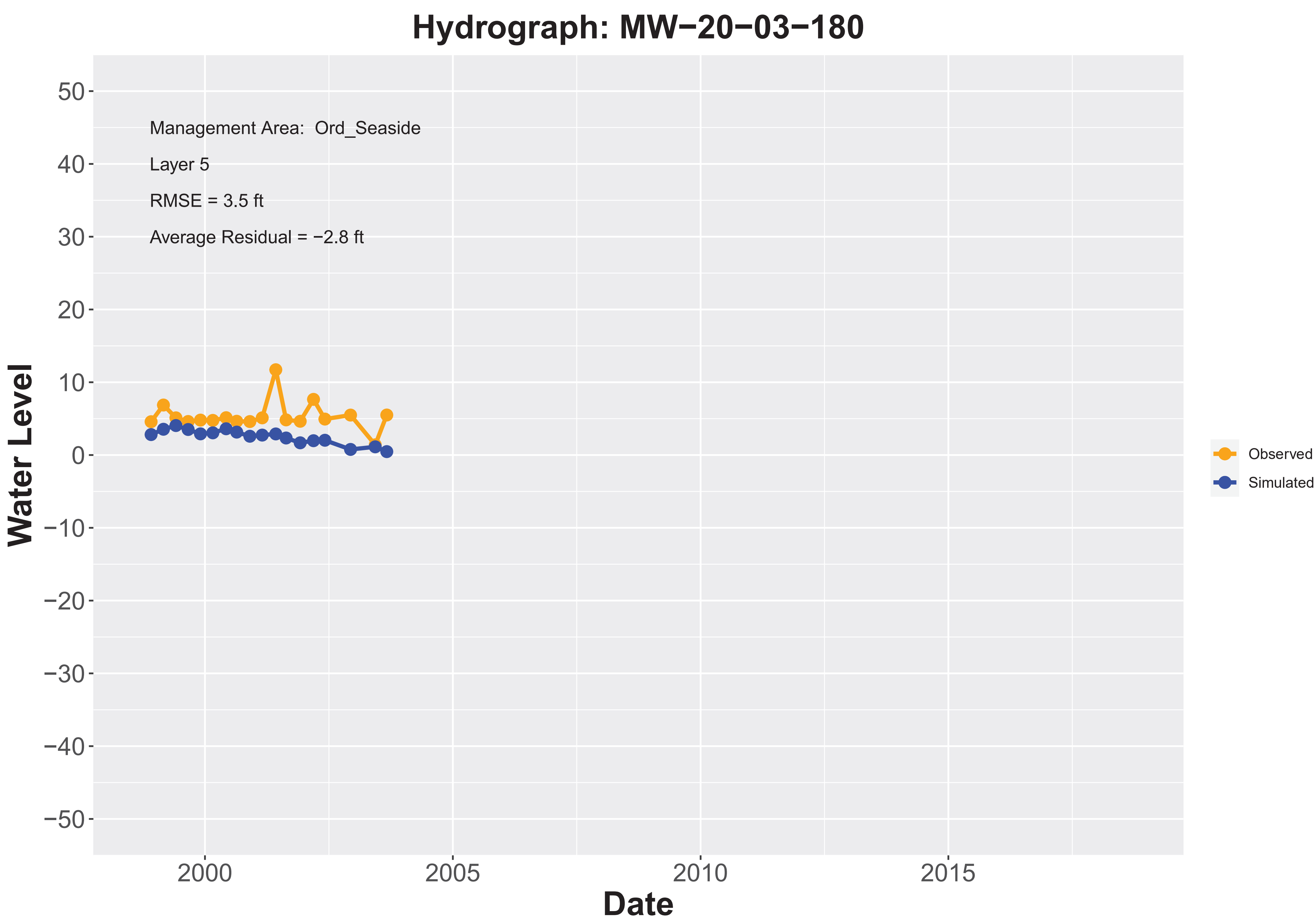

Hydrograph: MW−18−01−180
Management Area: Ord_Coast
Layer 3
RMSE = 2.1 ft
Average Residual = −0.98 ft
Water Level
60
50
40
30
20
10
0
−10
−20
−30
−40
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−18−02−180
Management Area: Ord_Coast
Layer 1
RMSE = 2.7 ft
Average Residual = 2.1 ft
Water Level
60
50
40
30
20
10
0
−10
−20
−30
−40
2000
2005
2010
2015
Date
Observed
Simulated

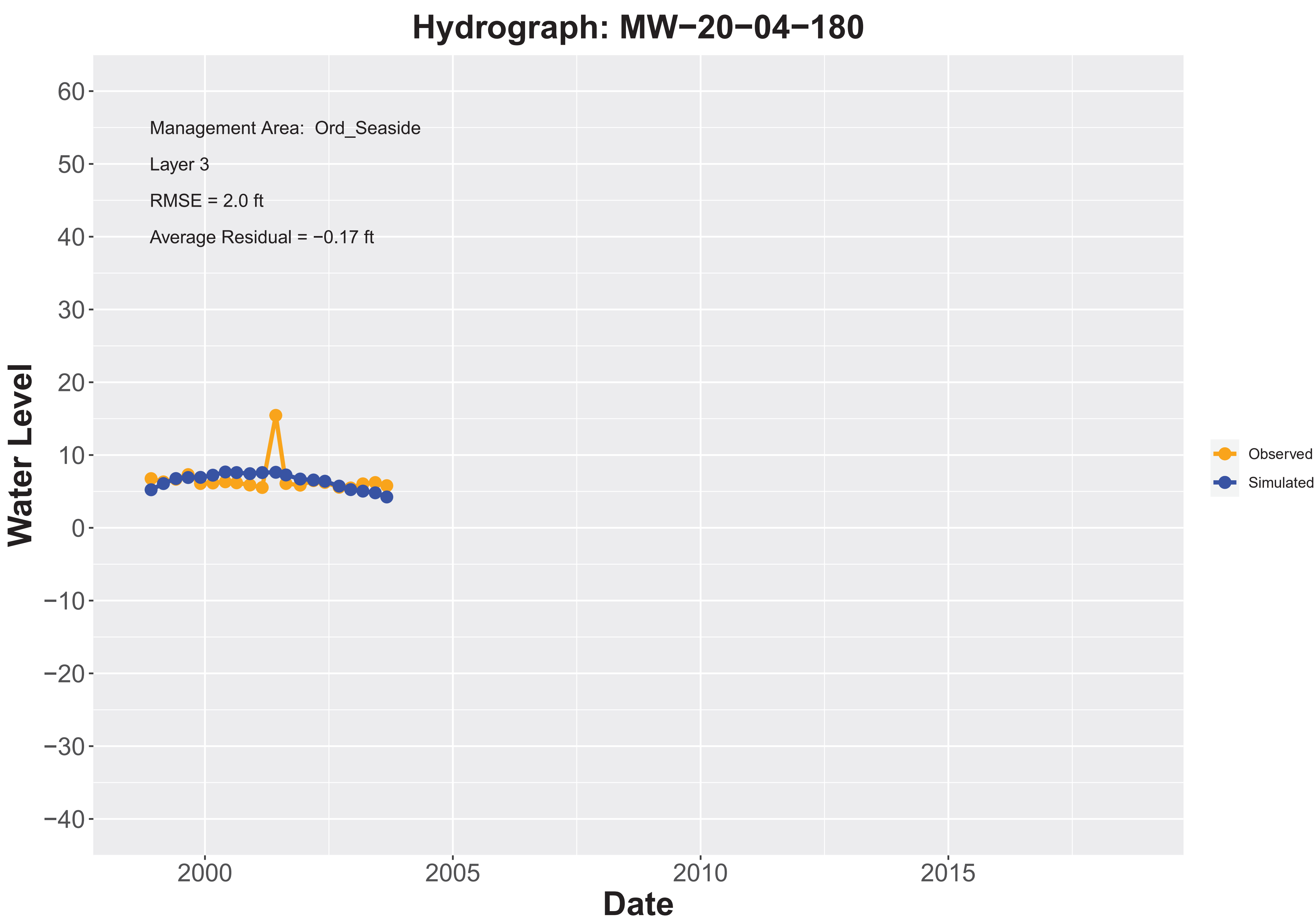

Hydrograph: MW−18−03−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.1 ft
Average Residual = −3.7 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

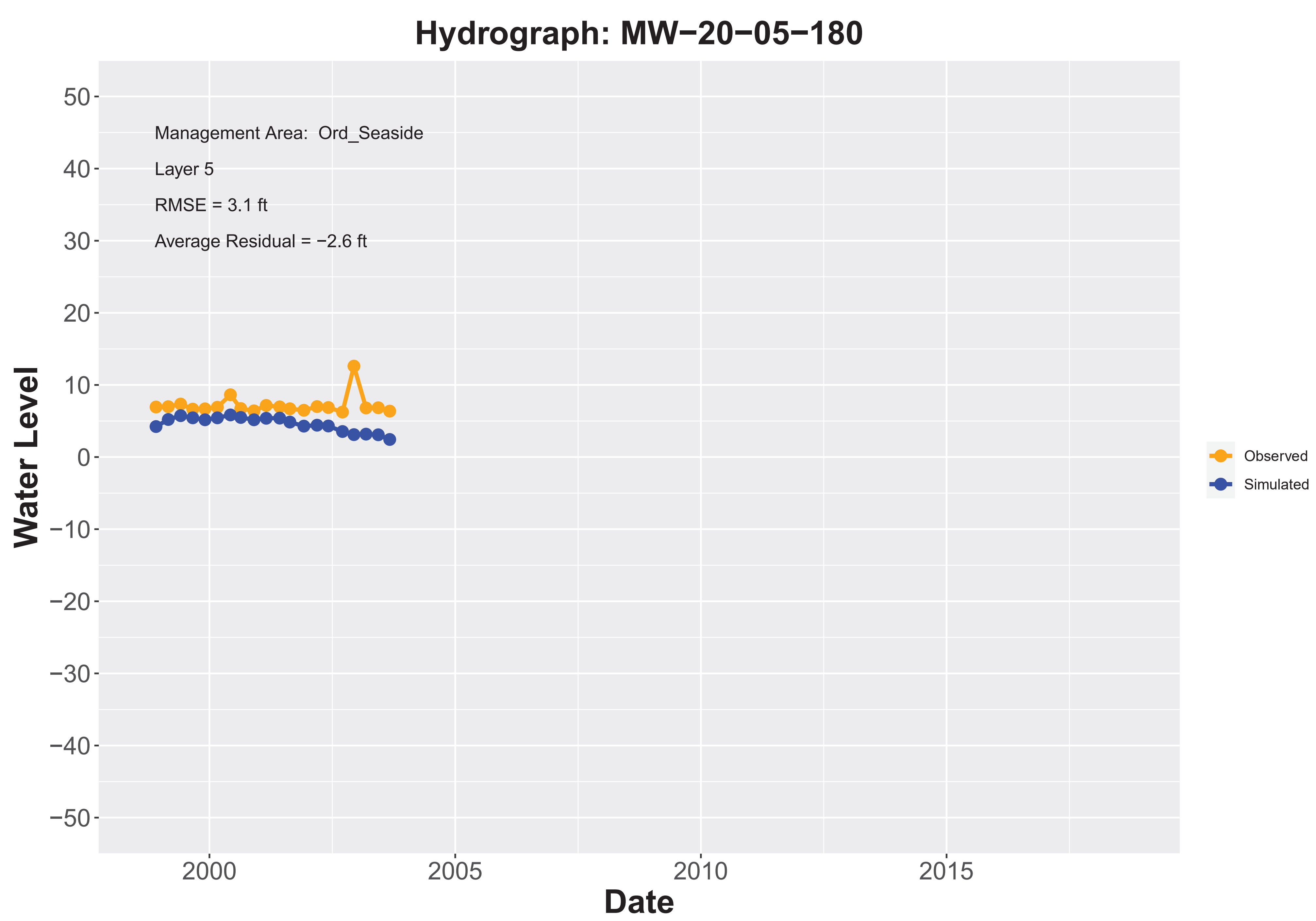

Hydrograph: MW−20−01−180
Management Area: Ord_Seaside
Layer 5
RMSE = 3.8 ft
Average Residual = −3.7 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−20−02−180
Management Area: Ord_Seaside
Layer 5
RMSE = 4.2 ft
Average Residual = −4.1 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



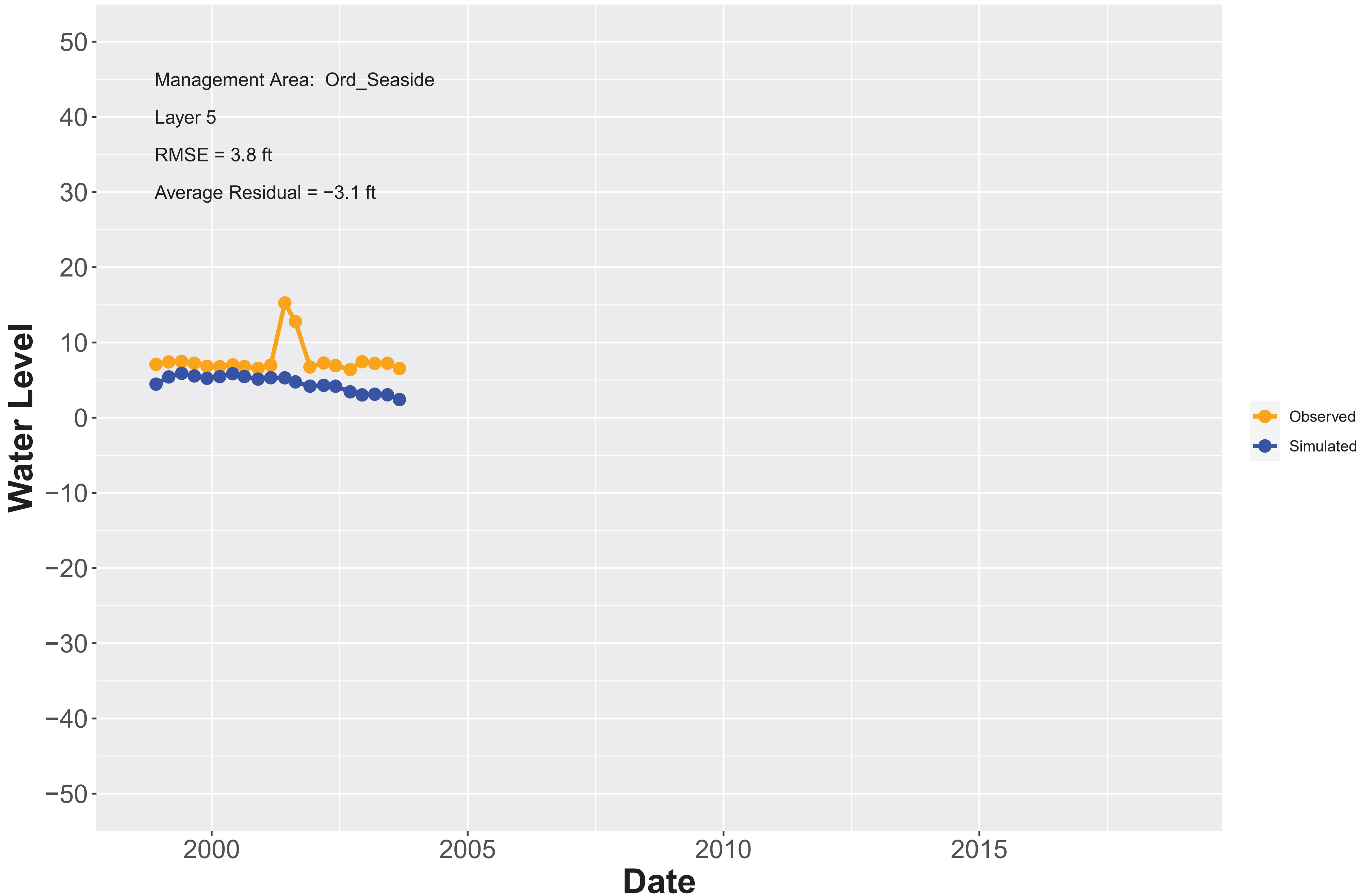
Hydrograph: MW−20−03−180
Management Area: Ord_Seaside
Layer 5
RMSE = 3.5 ft
Average Residual = −2.8 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

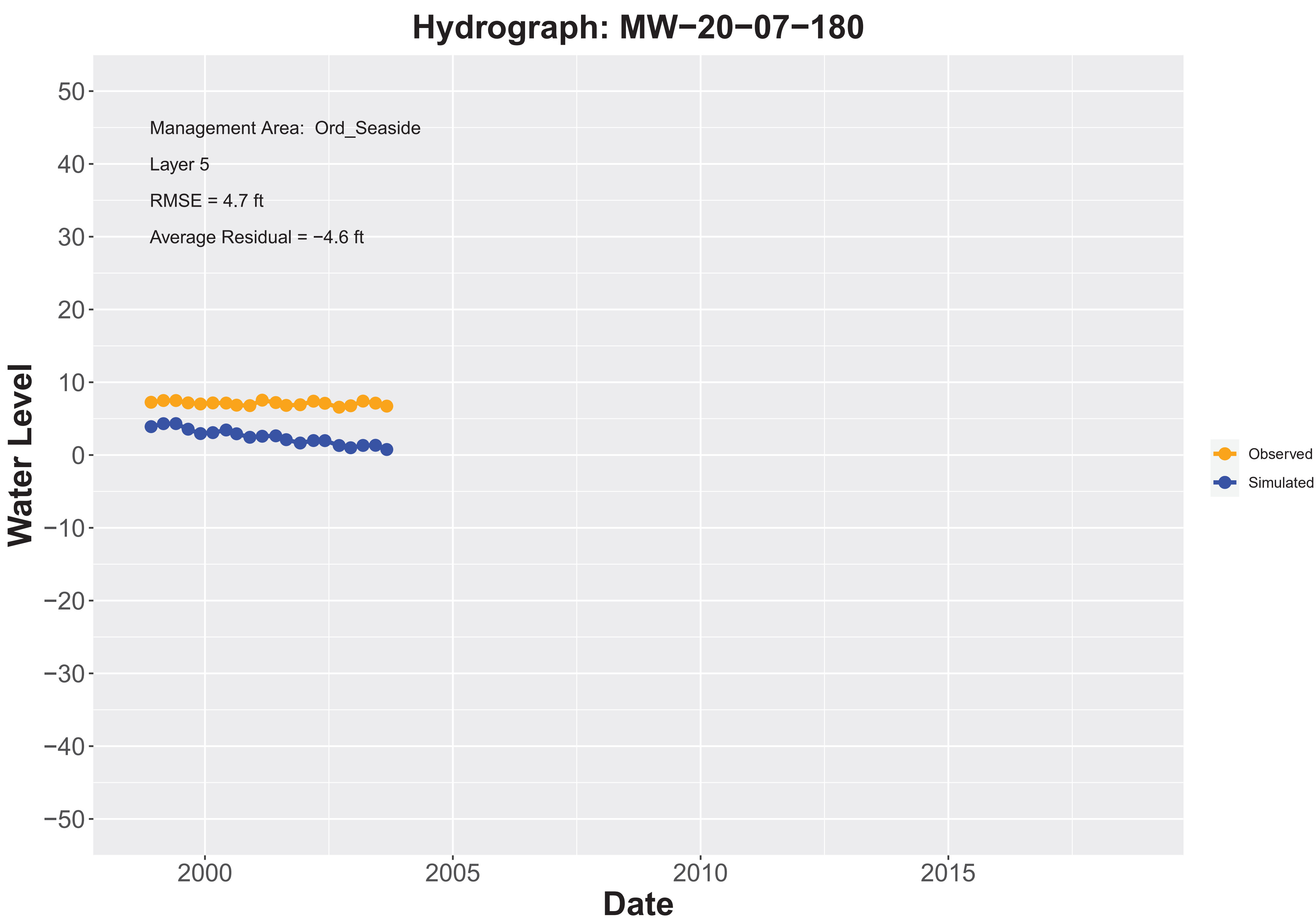

Hydrograph: MW−20−04−180
Management Area: Ord_Seaside
Layer 3
RMSE = 2.0 ft
Average Residual = −0.17 ft
Water Level
60
50
40
30
20
10
0
−10
−20
−30
−40
Date
2000
2005
2010
2015
Observed
Simulated



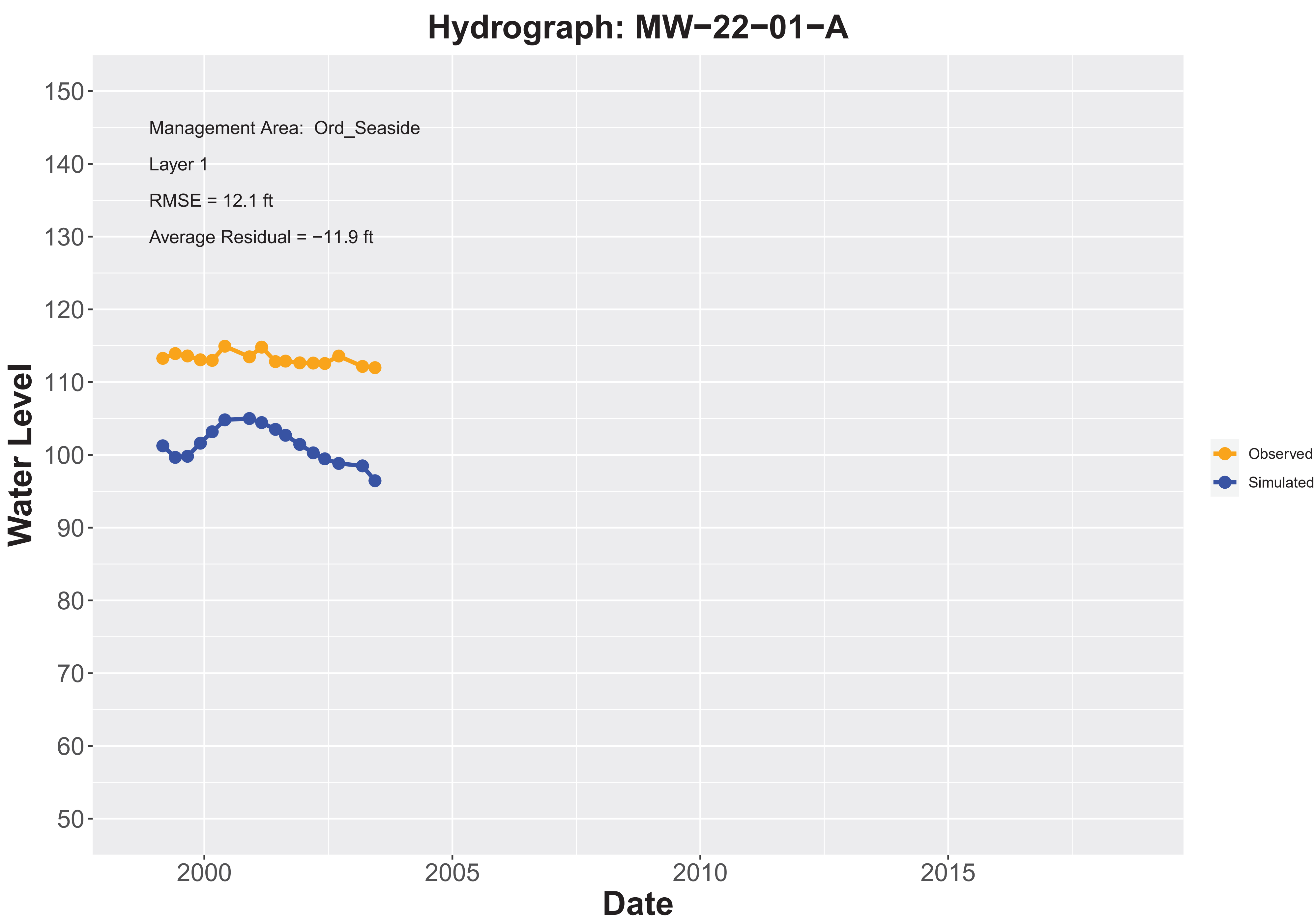
Hydrograph: MW−20−05−180
Management Area: Ord_Seaside
Layer 5
RMSE = 3.1 ft
Average Residual = −2.6 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−20−06−180

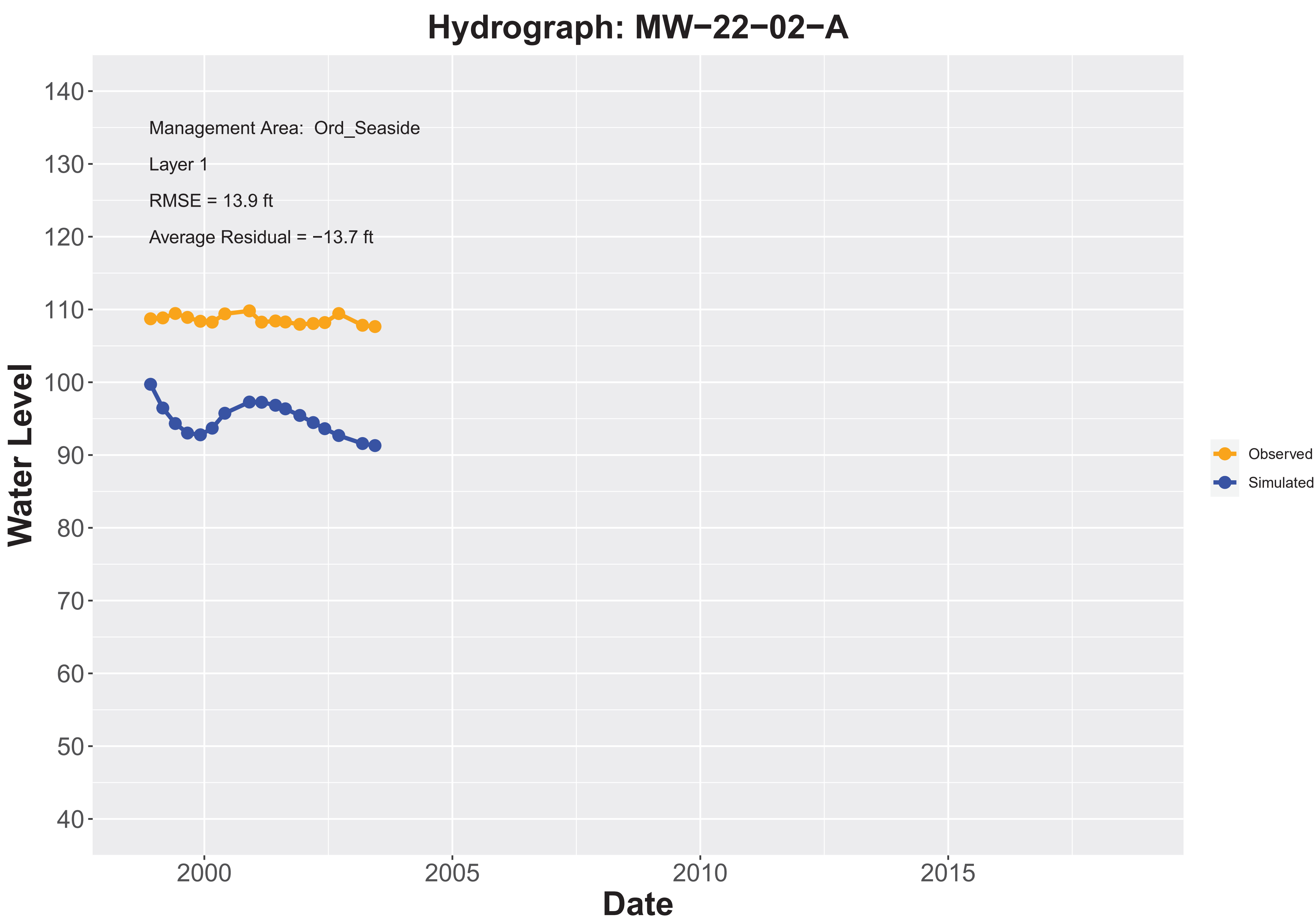




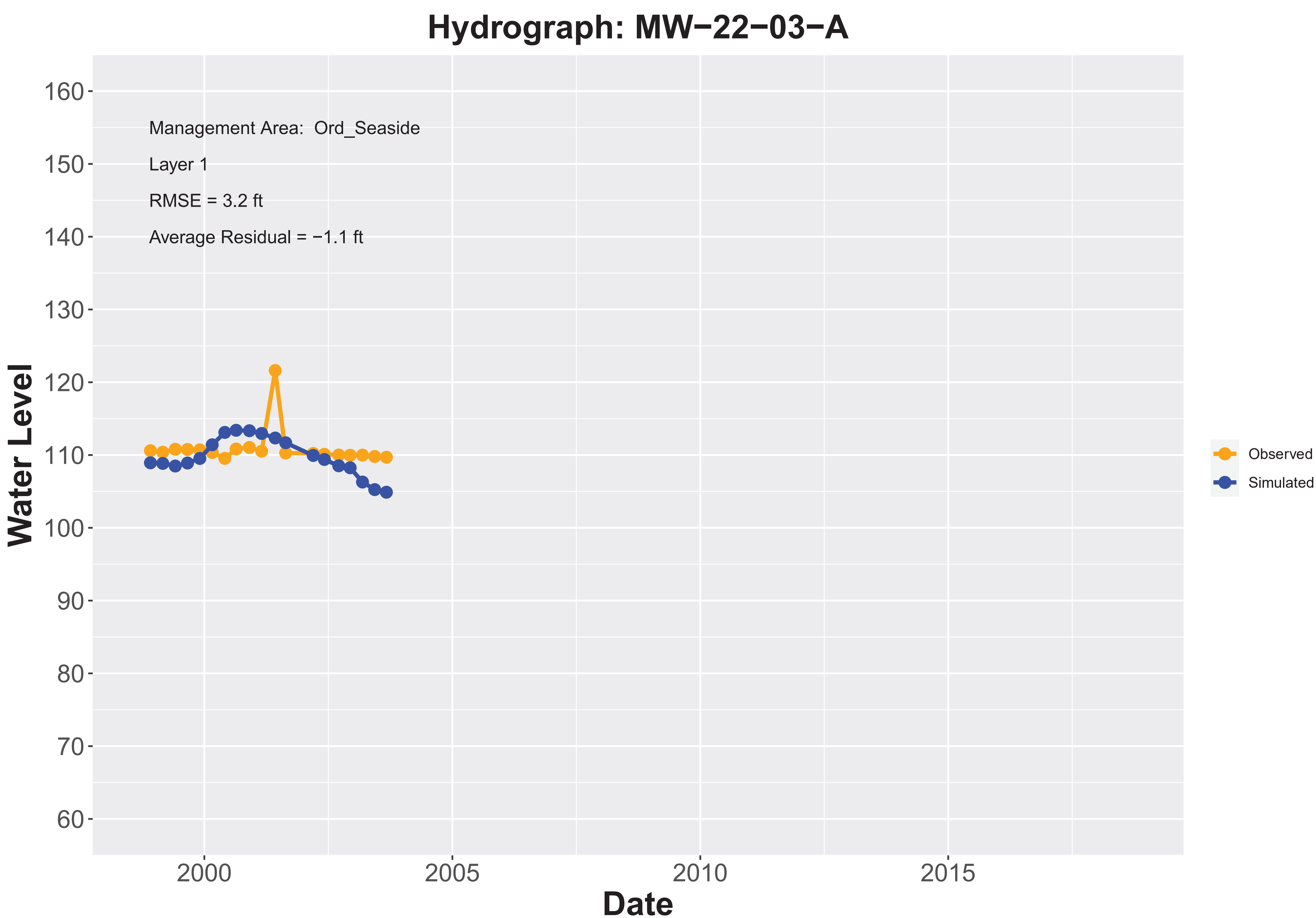
Hydrograph: MW−20−07−180
Management Area: Ord_Seaside
Layer 5
RMSE = 4.7 ft
Average Residual = −4.6 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

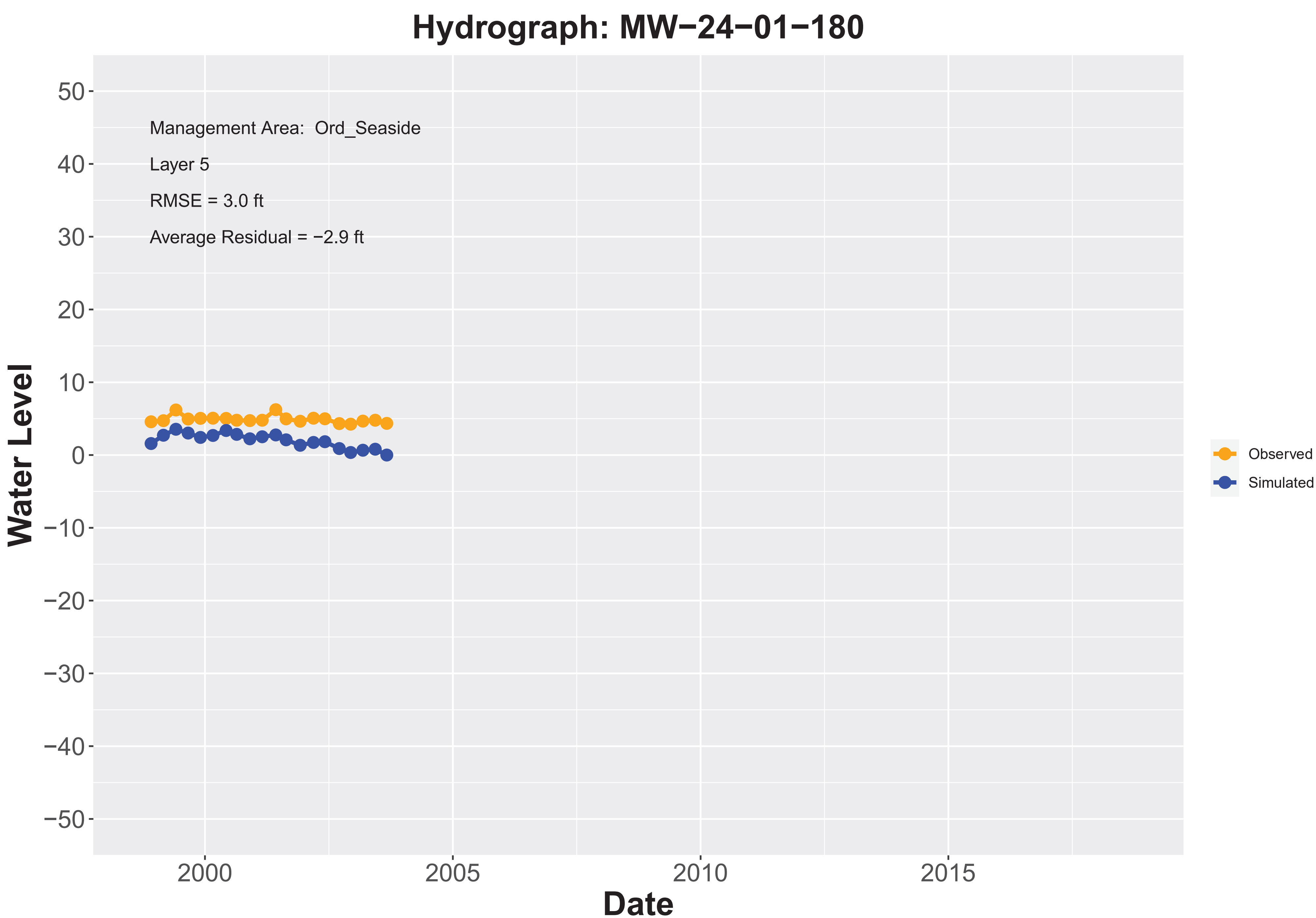


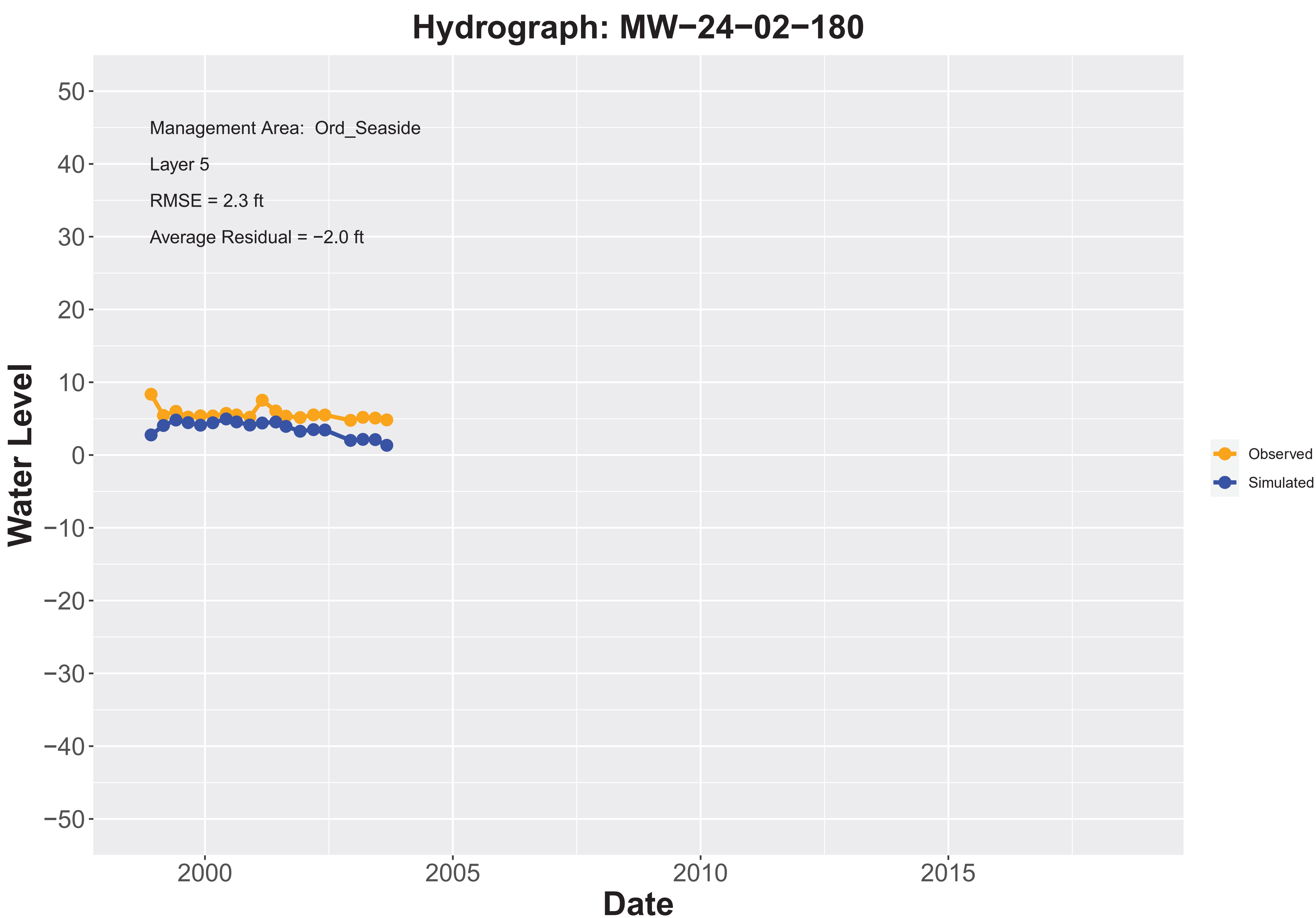
Hydrograph: MW−22−01−A
Management Area: Ord_Seaside
Layer 1
RMSE = 12.1 ft
Average Residual = −11.9 ft
Water Level
150
140
130
120
110
100
90
80
70
60
50
2000
2005
2010
2015
Date
Observed
Simulated



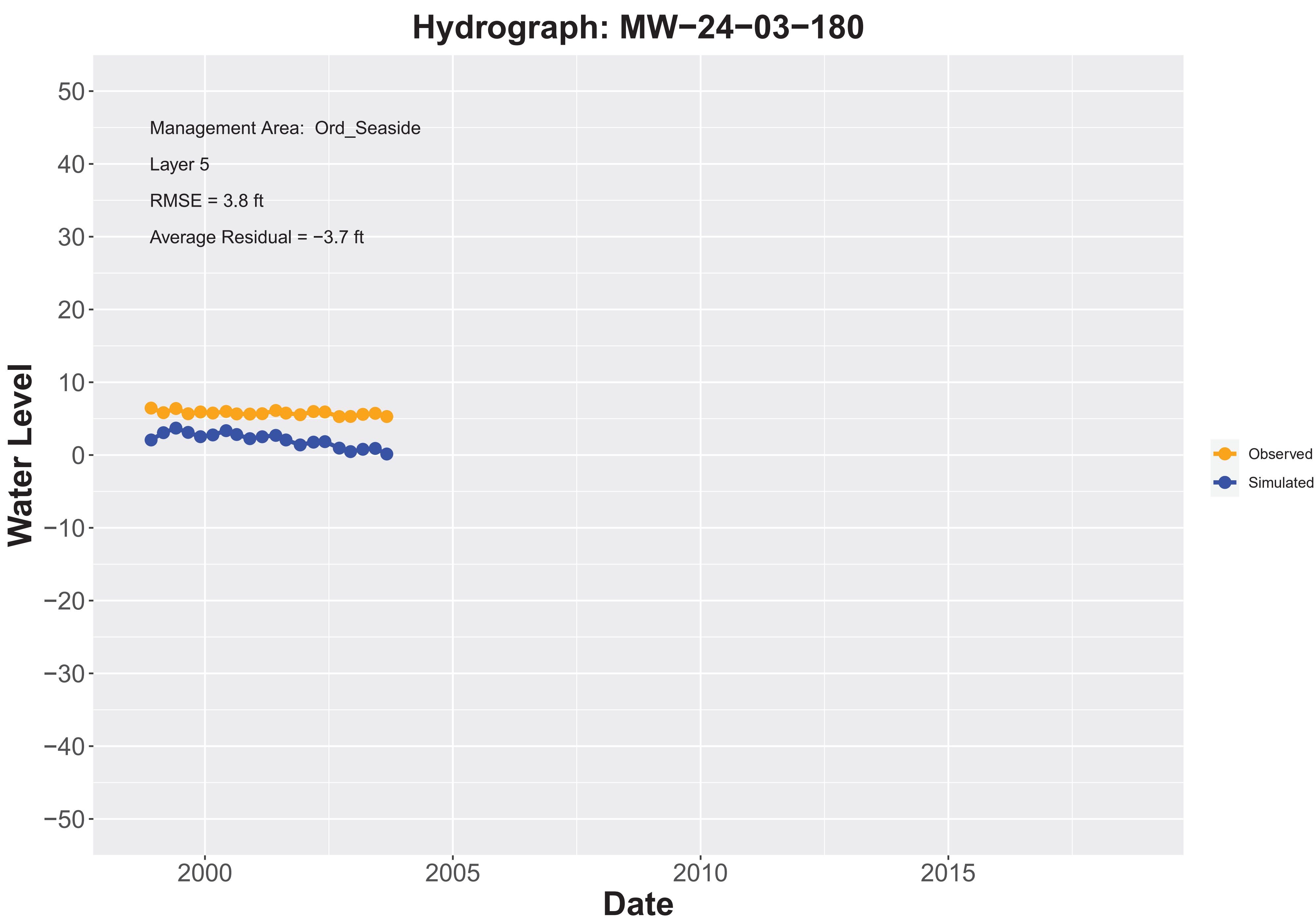
Hydrograph: MW−22−02−A
Management Area: Ord_Seaside
Layer 1
RMSE = 13.9 ft
Average Residual = −13.7 ft
Water Level
140
130
120
110
100
90
80
70
60
50
40
Date
2000
2005
2010
2015
Observed
Simulated

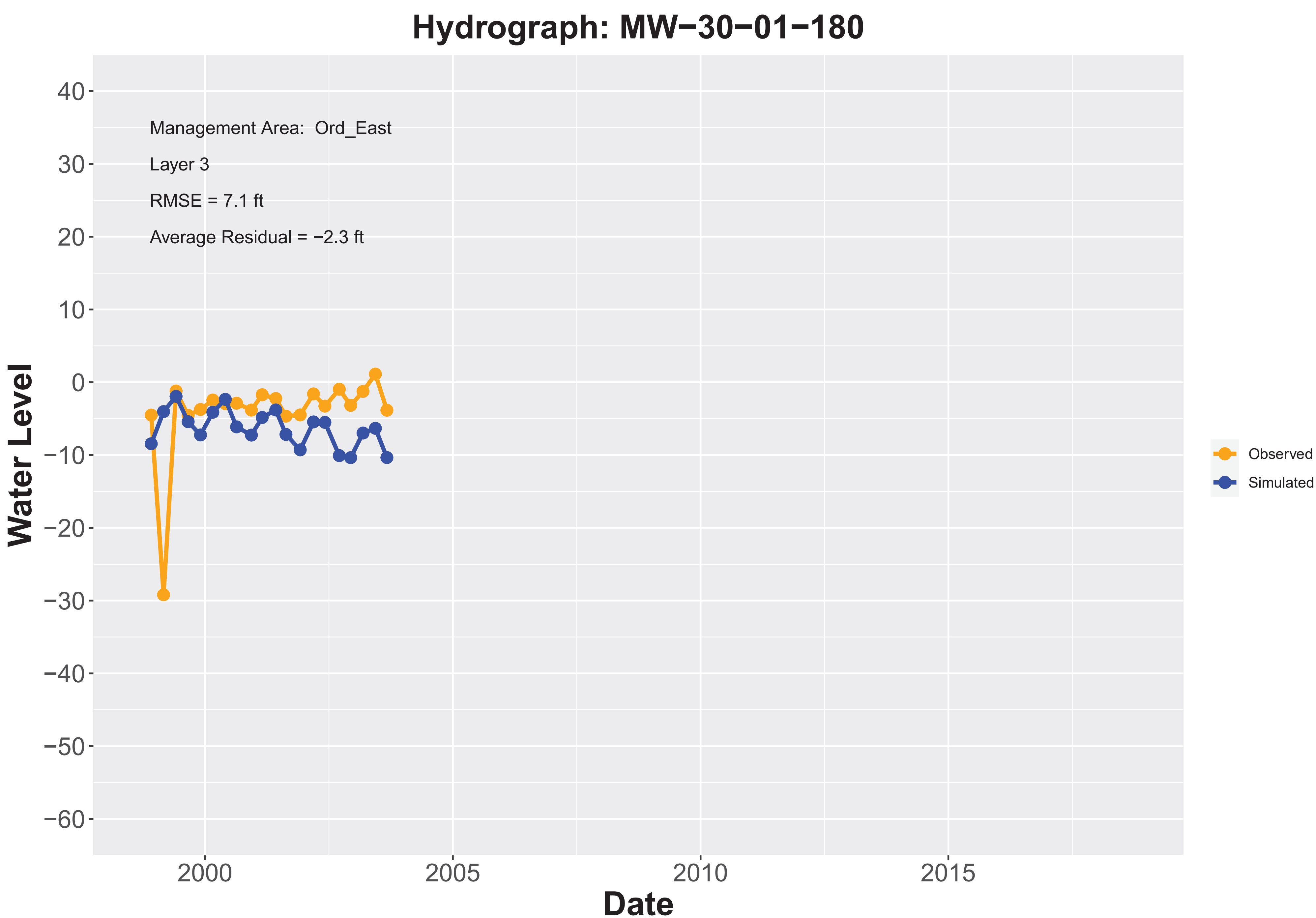

Hydrograph: MW−22−03−A
Management Area: Ord_Seaside
Layer 1
RMSE = 3.2 ft
Average Residual = −1.1 ft
Water Level
160
150
140
130
120
110
100
90
80
70
60
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−24−01−180
Management Area: Ord_Seaside
Layer 5
RMSE = 3.0 ft
Average Residual = −2.9 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

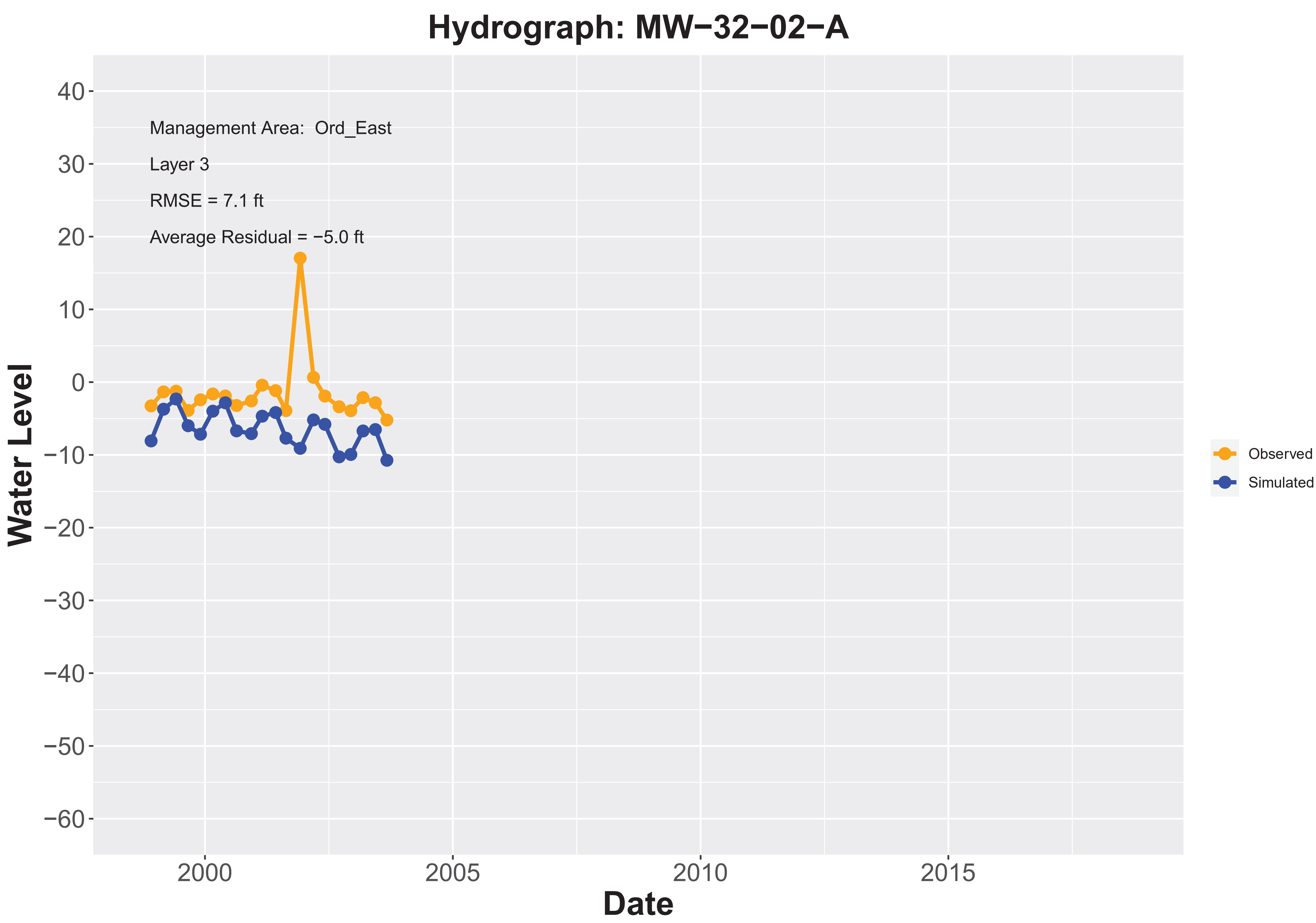


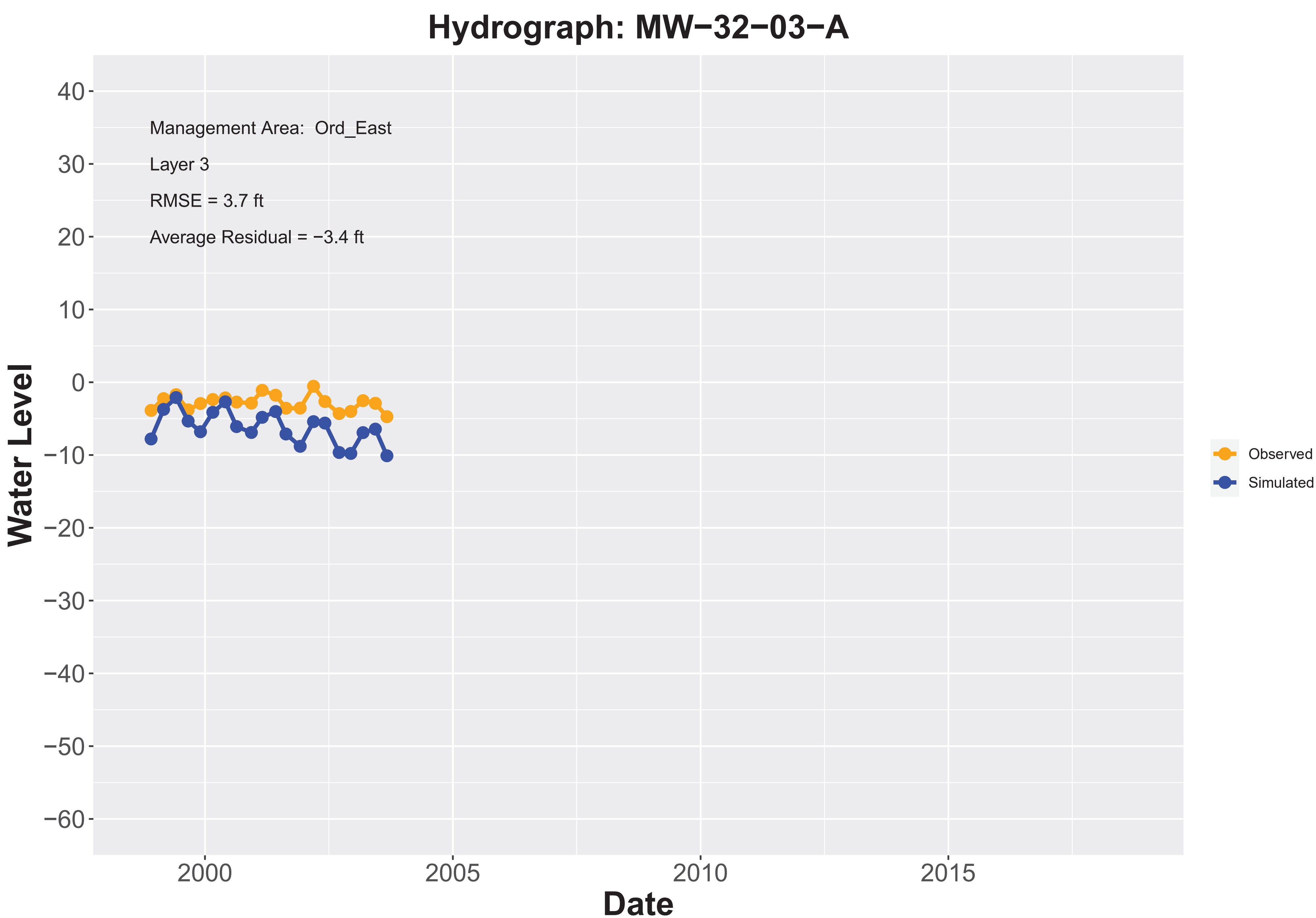
Hydrograph: MW−24−02−180
Management Area: Ord_Seaside
Layer 5
RMSE = 2.3 ft
Average Residual = −2.0 ft
50
40
30
20
10
0
−10
−20
−30
−40
−50
Water Level
2000
2005
2010
2015
Date
Observed
Simulated

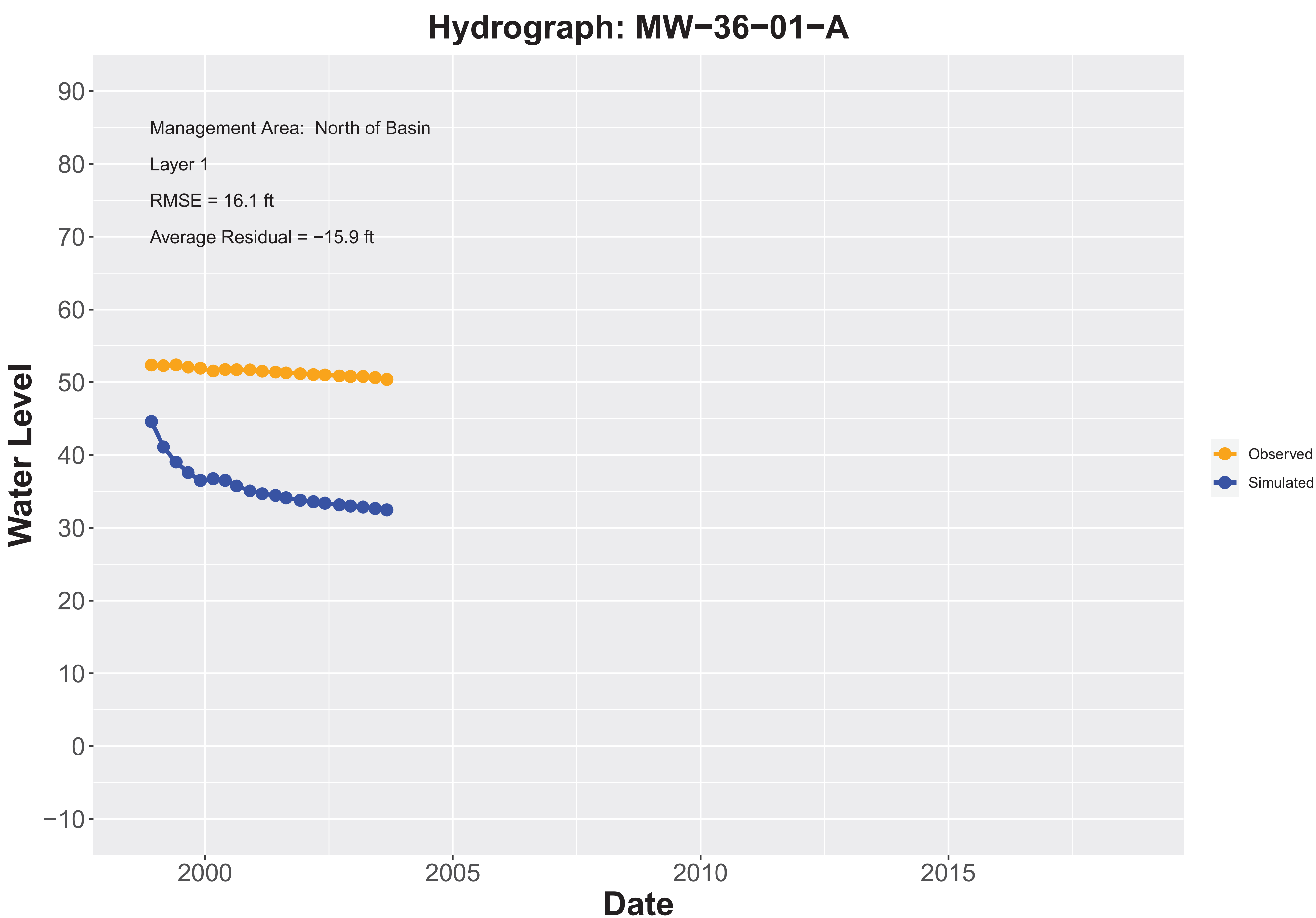

Hydrograph: MW−24−03−180
Management Area: Ord_Seaside
Layer 5
RMSE = 3.8 ft
Average Residual = −3.7 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
Date
2000
2005
2010
2015
Observed
Simulated



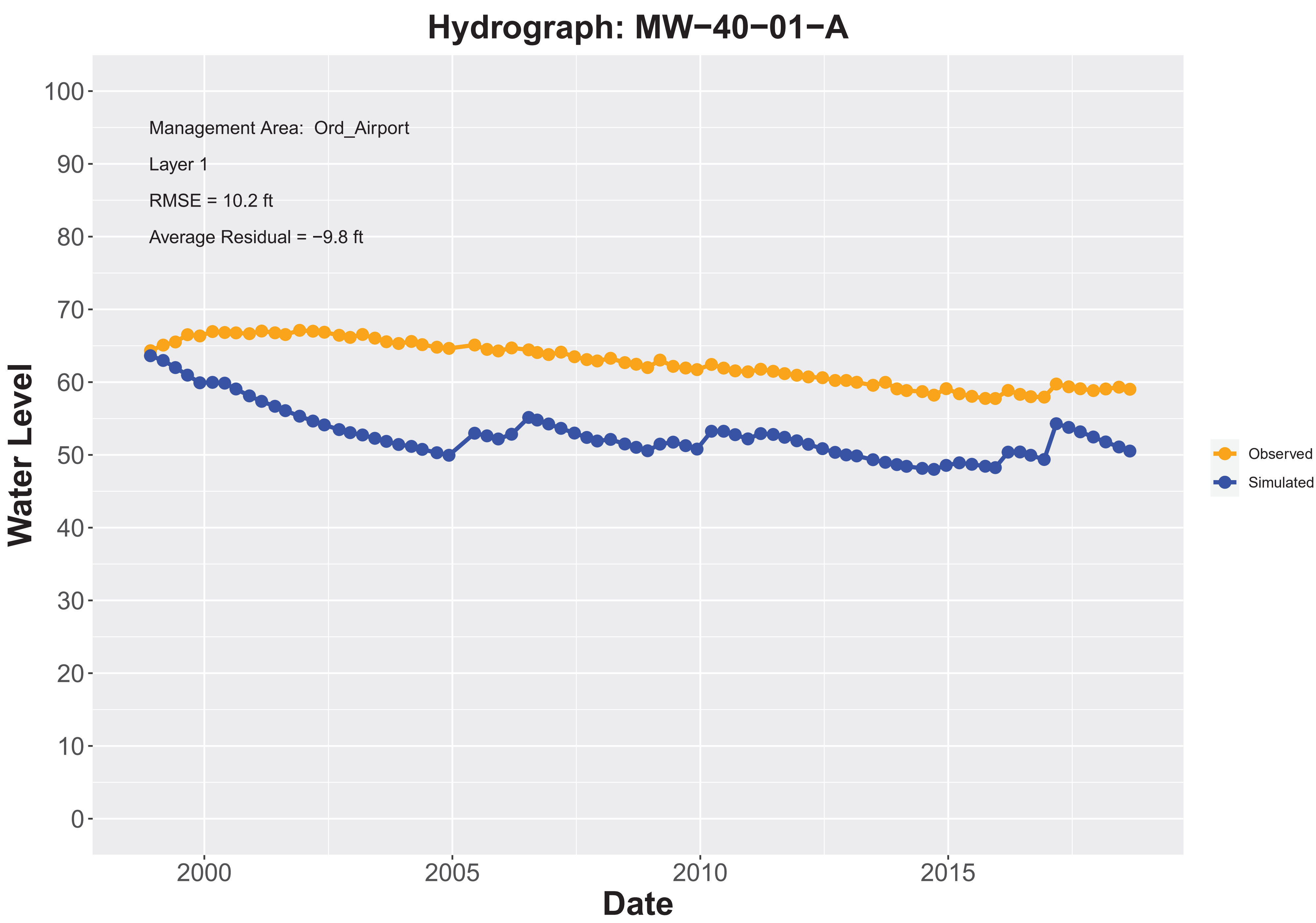
Hydrograph: MW−30−01−180
Management Area: Ord_East
Layer 3
RMSE = 7.1 ft
Average Residual = −2.3 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−32−02−A
Management Area: Ord_East
Layer 3
RMSE = 7.1 ft
Average Residual = −5.0 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

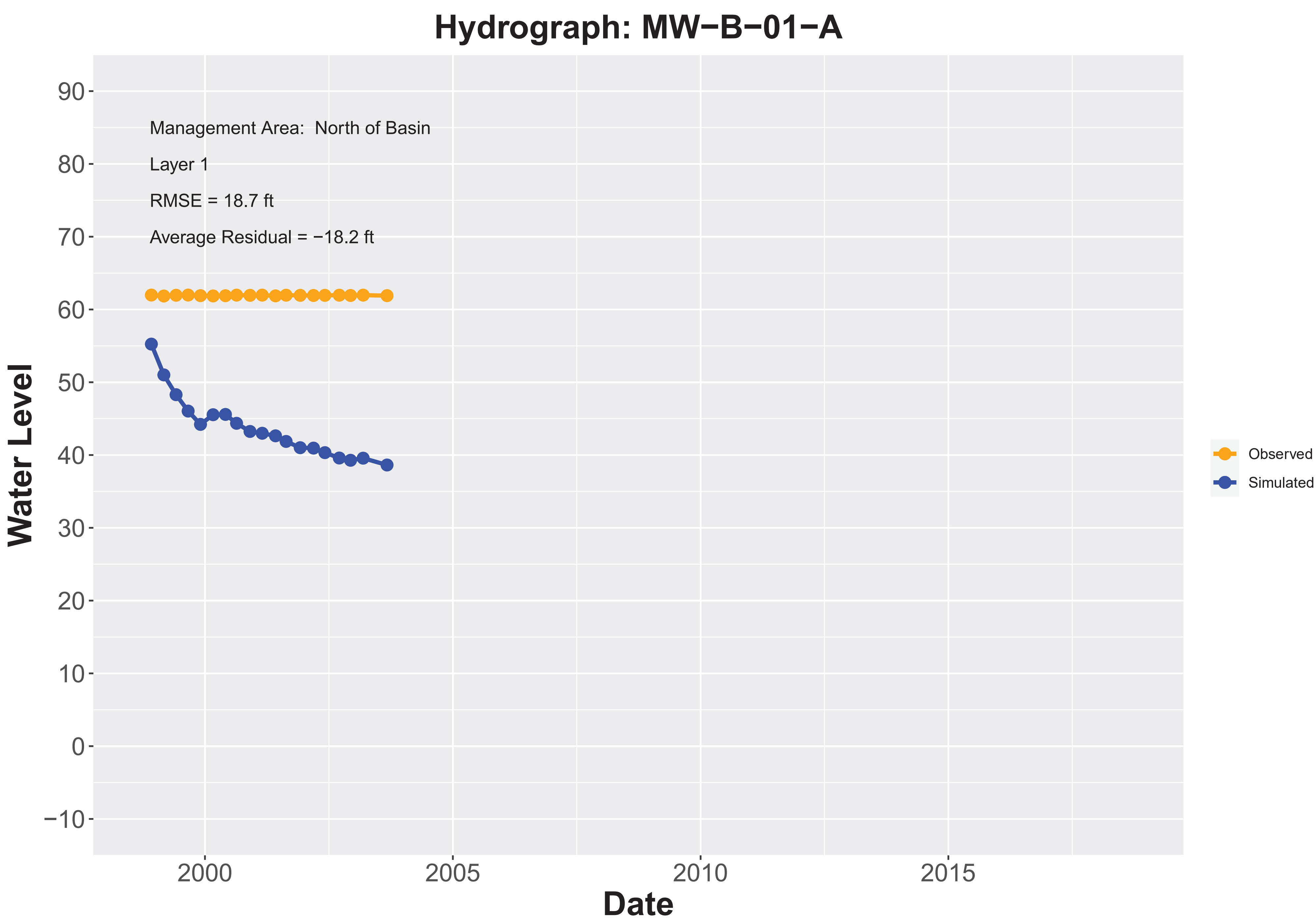

Hydrograph: MW−32−03−A
Management Area: Ord_East
Layer 3
RMSE = 3.7 ft
Average Residual = −3.4 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated



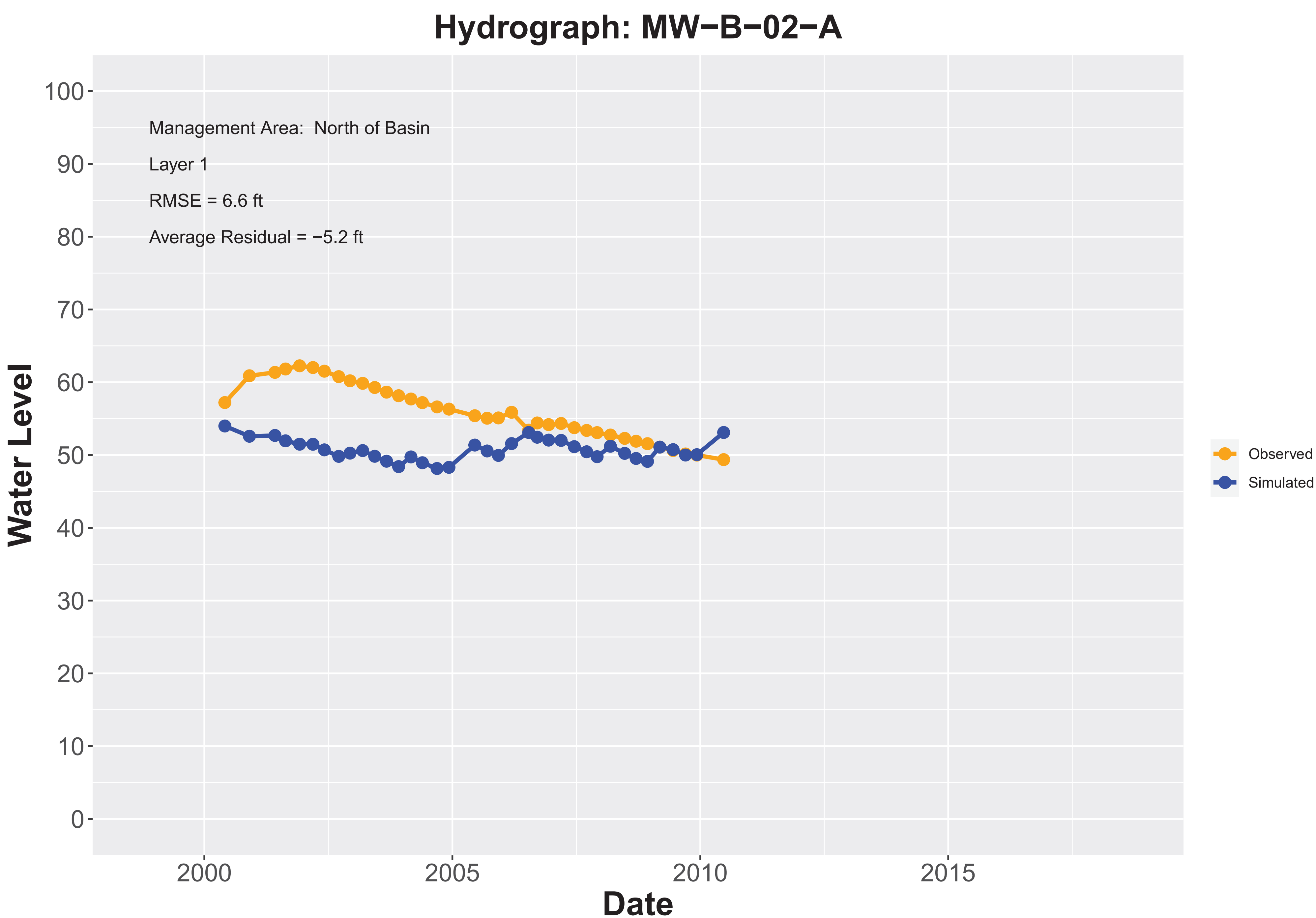
Hydrograph: MW−36−01−A
Management Area: North of Basin
Layer 1
RMSE = 16.1 ft
Average Residual = −15.9 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

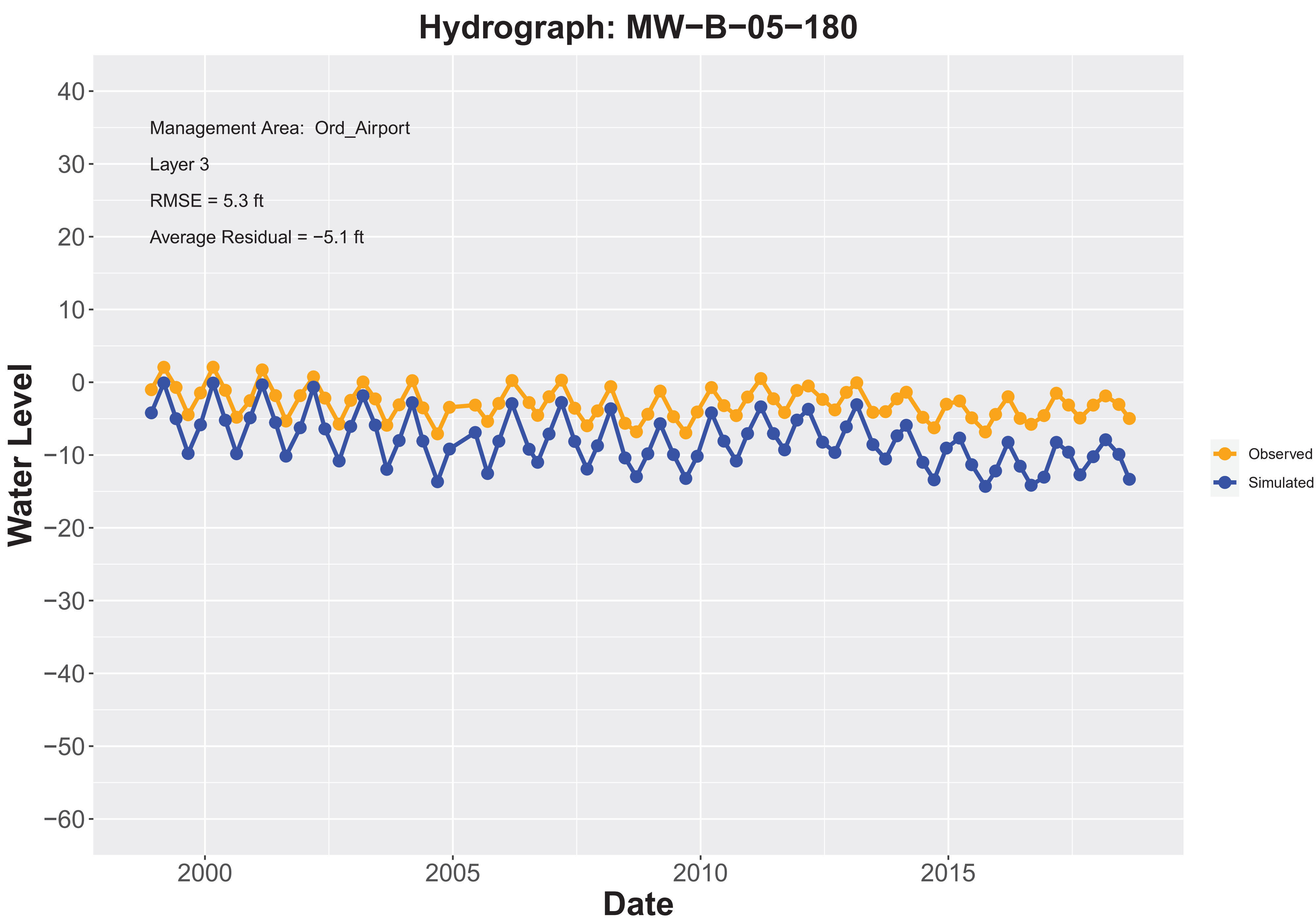


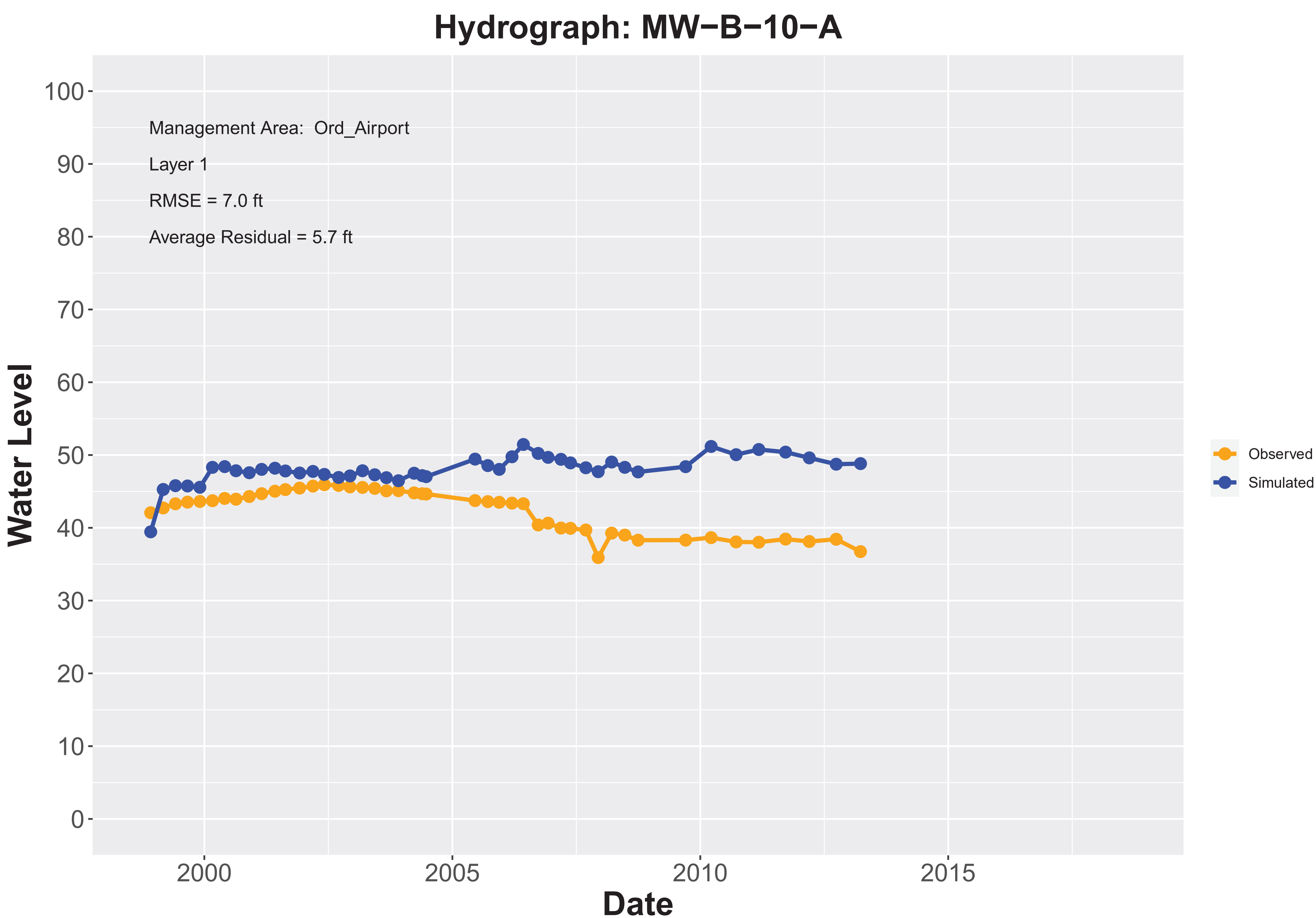
Hydrograph: MW−40−01−A
Management Area: Ord_Airport
Layer 1
RMSE = 10.2 ft
Average Residual = −9.8 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated



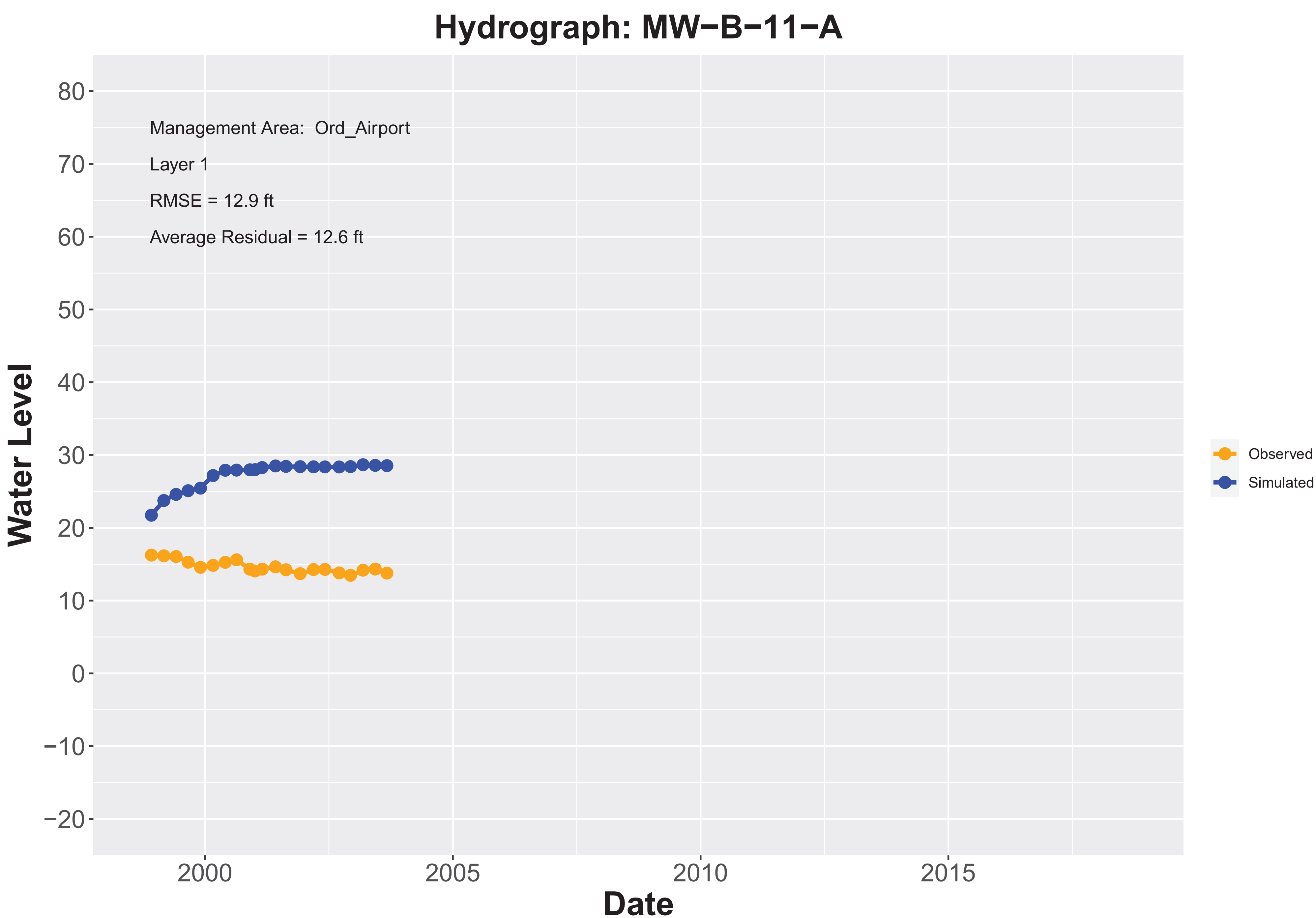
Hydrograph: MW−B−01−A
Management Area: North of Basin
Layer 1
RMSE = 18.7 ft
Average Residual = −18.2 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−B−02−A
Management Area: North of Basin
Layer 1
RMSE = 6.6 ft
Average Residual = −5.2 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−B−05−180
Management Area: Ord_Airport
Layer 3
RMSE = 5.3 ft
Average Residual = −5.1 ft
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Water Level
2000
2005
2010
2015
Date
Observed
Simulated

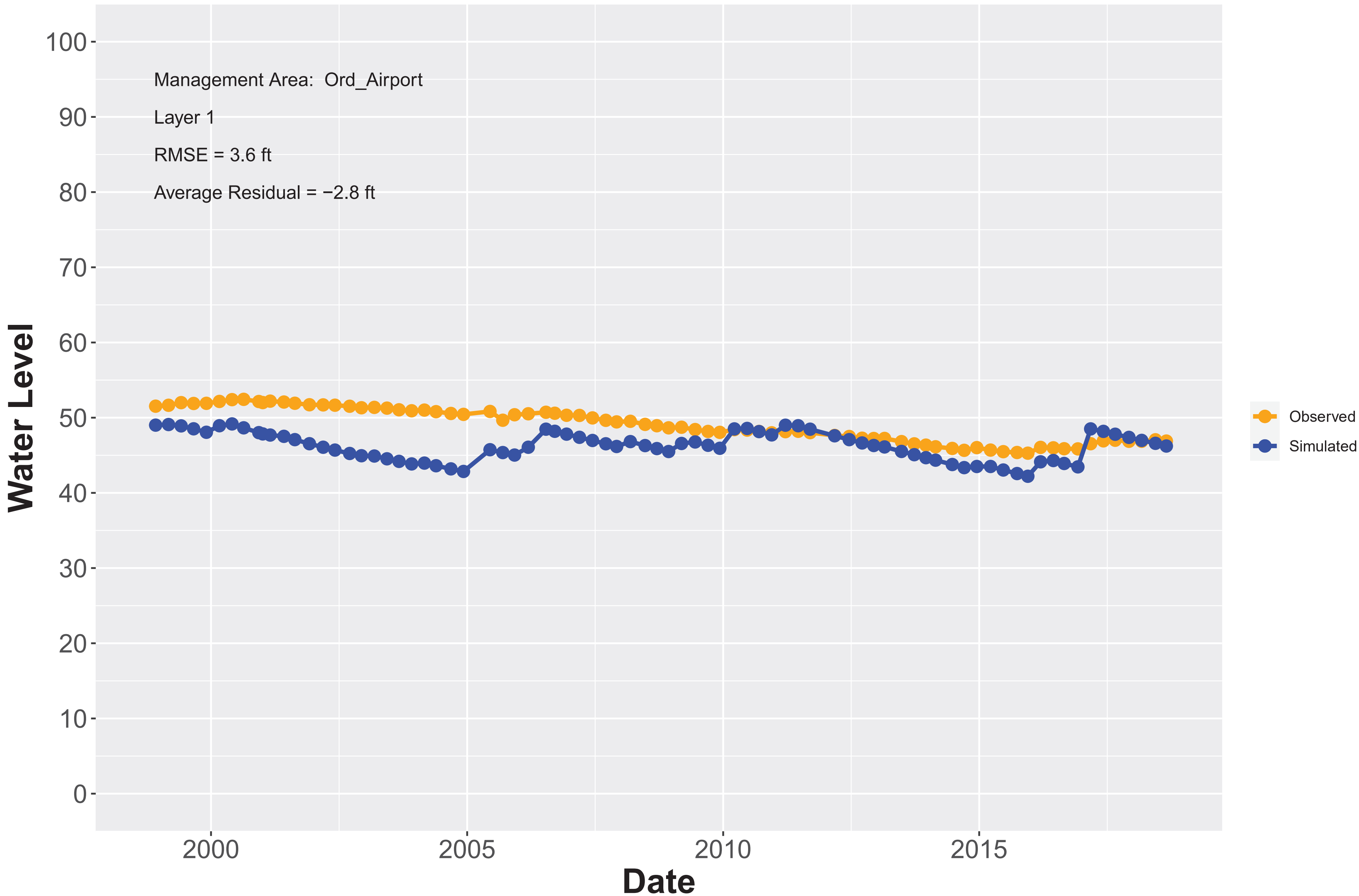


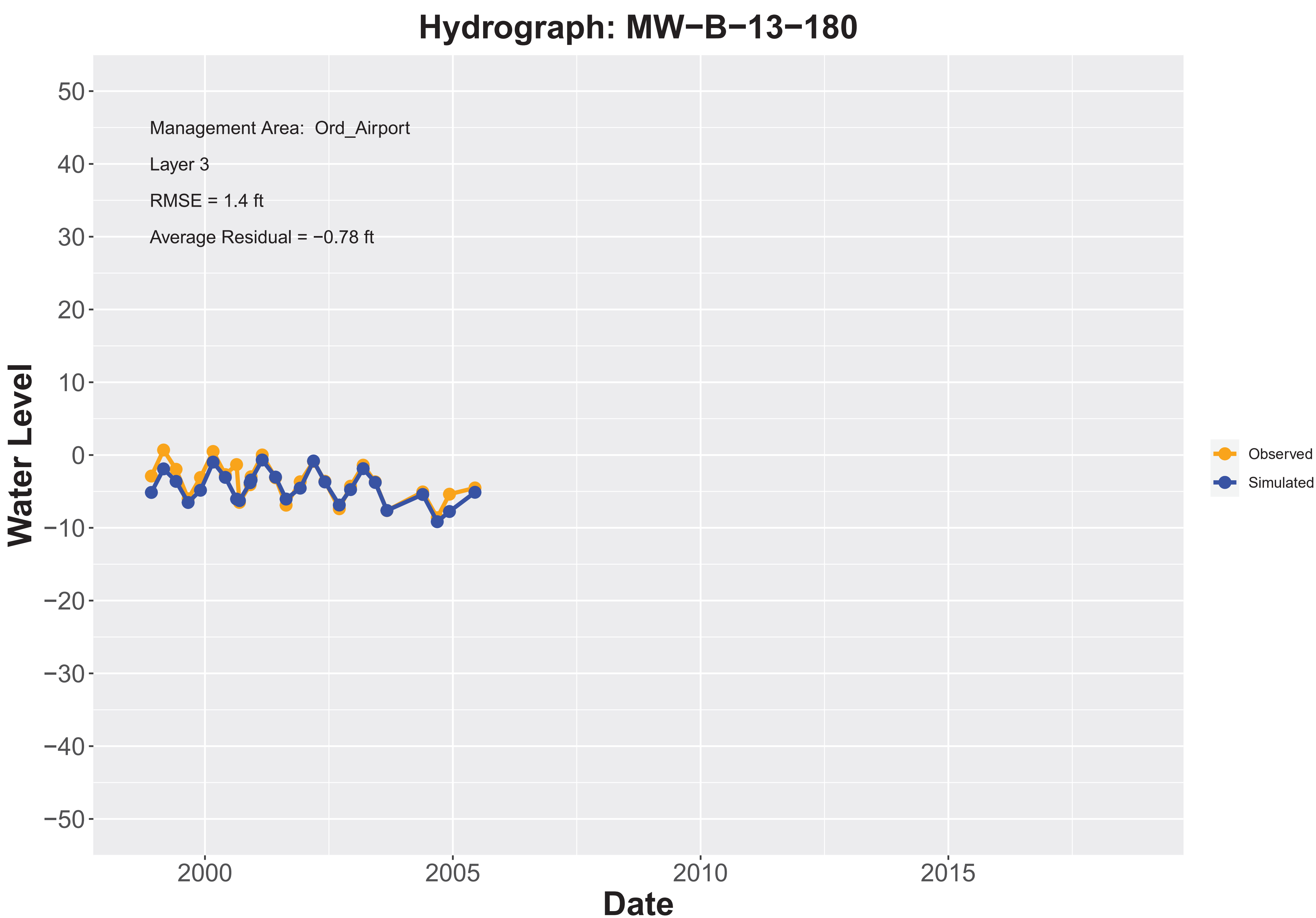
Hydrograph: MW−B−10−A
Management Area: Ord_Airport
Layer 1
RMSE = 7.0 ft
Average Residual = 5.7 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

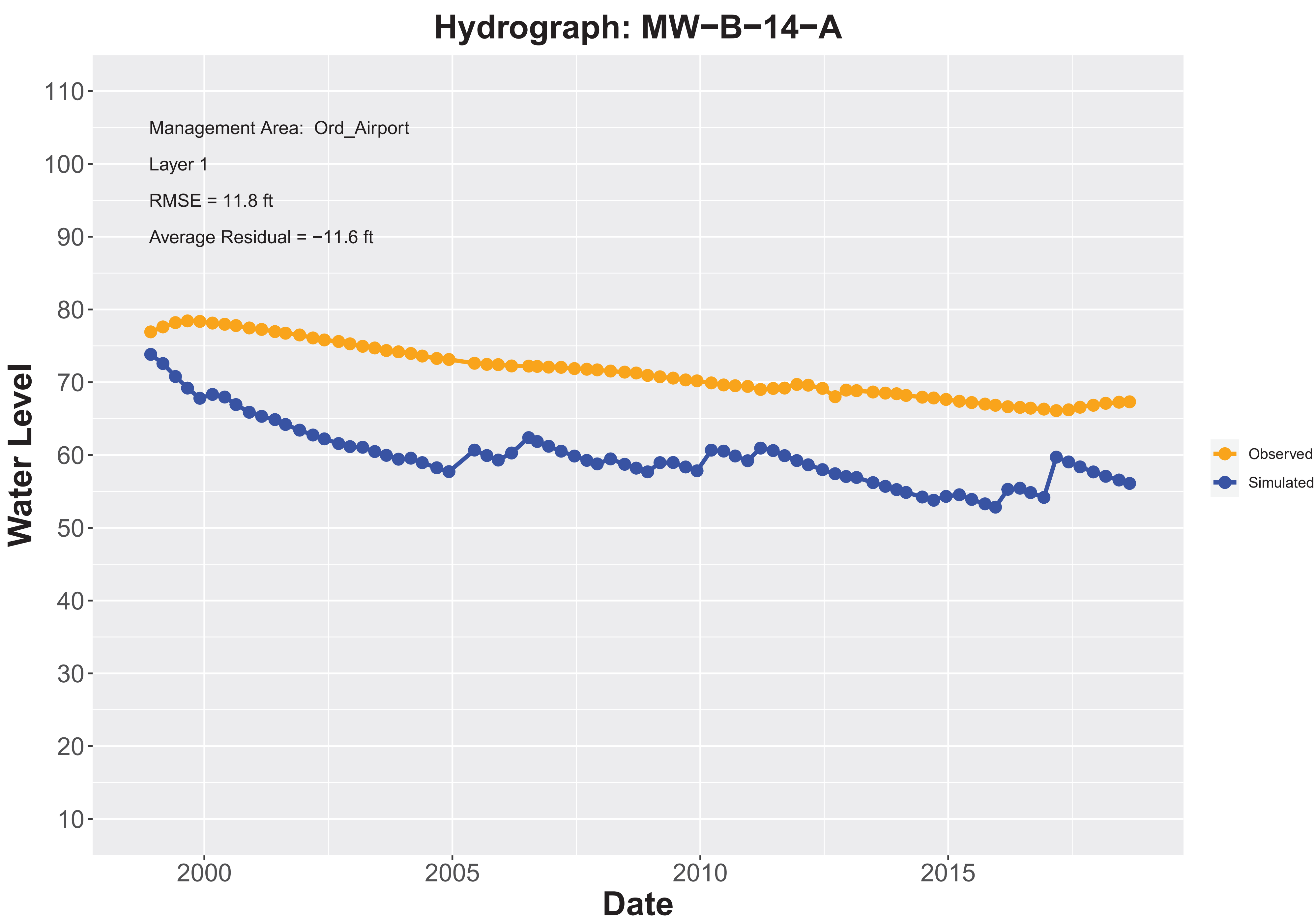


Hydrograph: MW−B−11−A
Management Area: Ord_Airport
Layer 1
RMSE = 12.9 ft
Average Residual = 12.6 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated

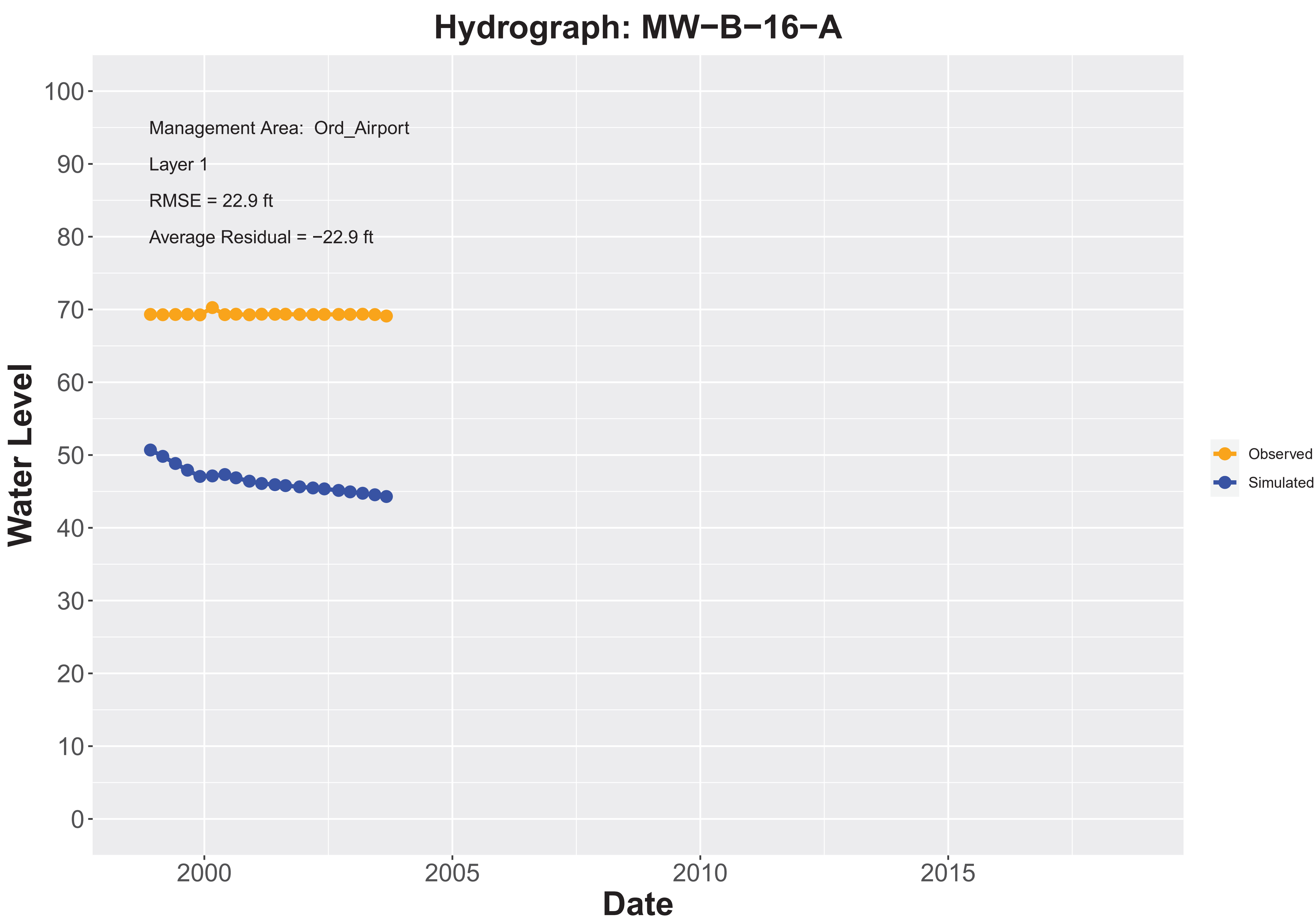
Hydrograph: MW−B−12−A




Hydrograph: MW−B−13−180
Management Area: Ord_Airport
Layer 3
RMSE = 1.4 ft
Average Residual = −0.78 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

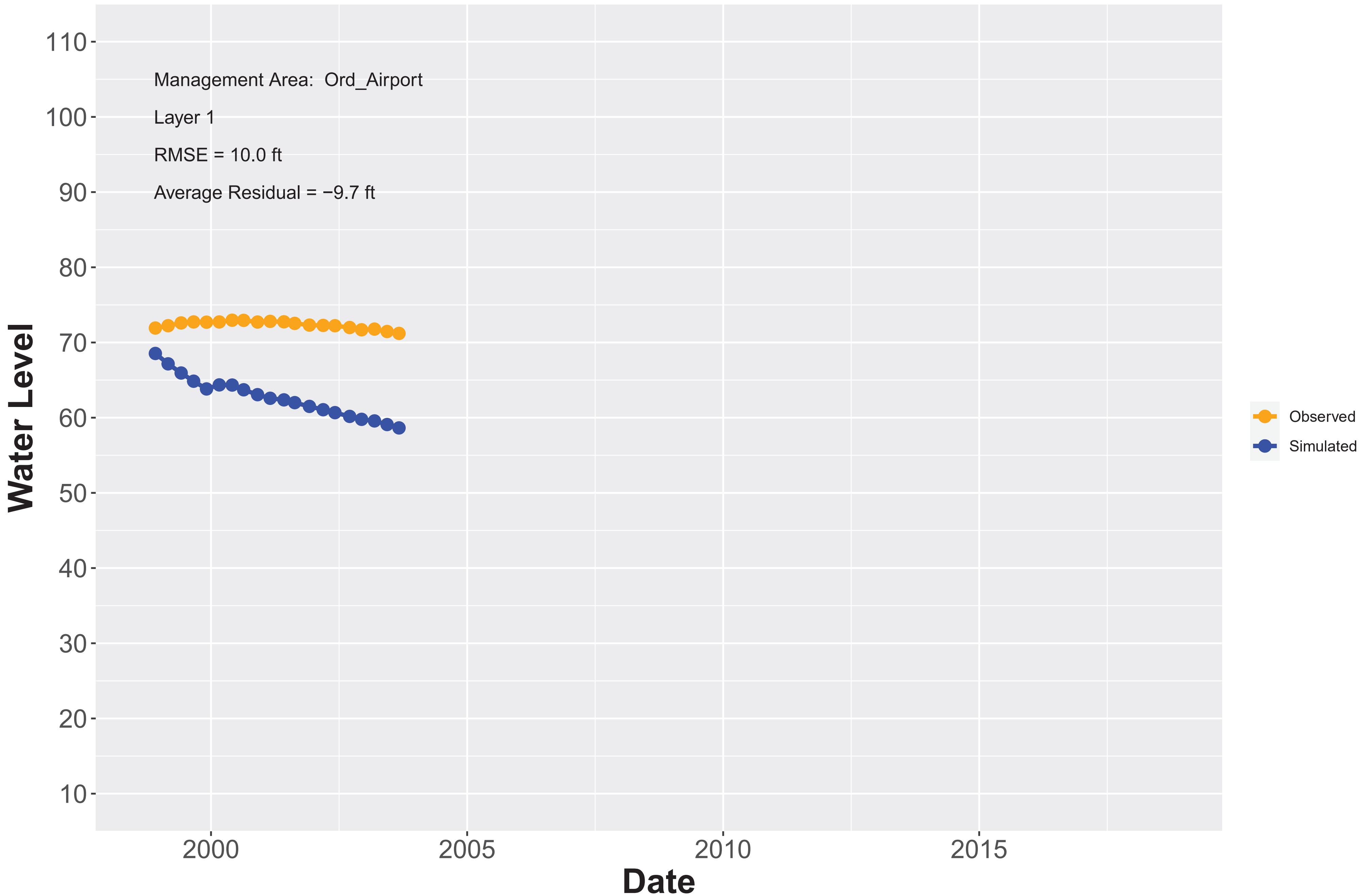


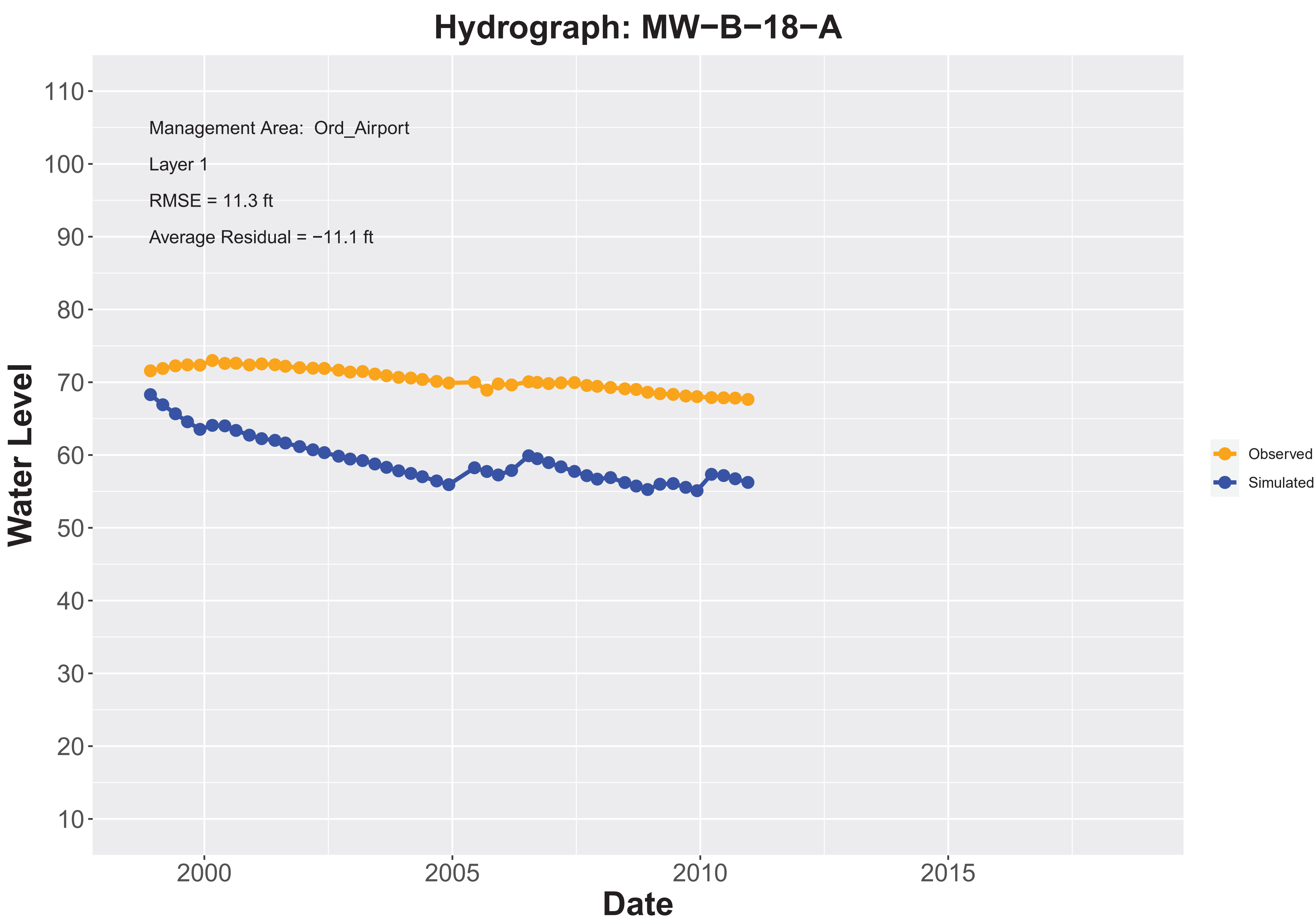
Hydrograph: MW−B−14−A
Management Area: Ord_Airport
Layer 1
RMSE = 11.8 ft
Average Residual = −11.6 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



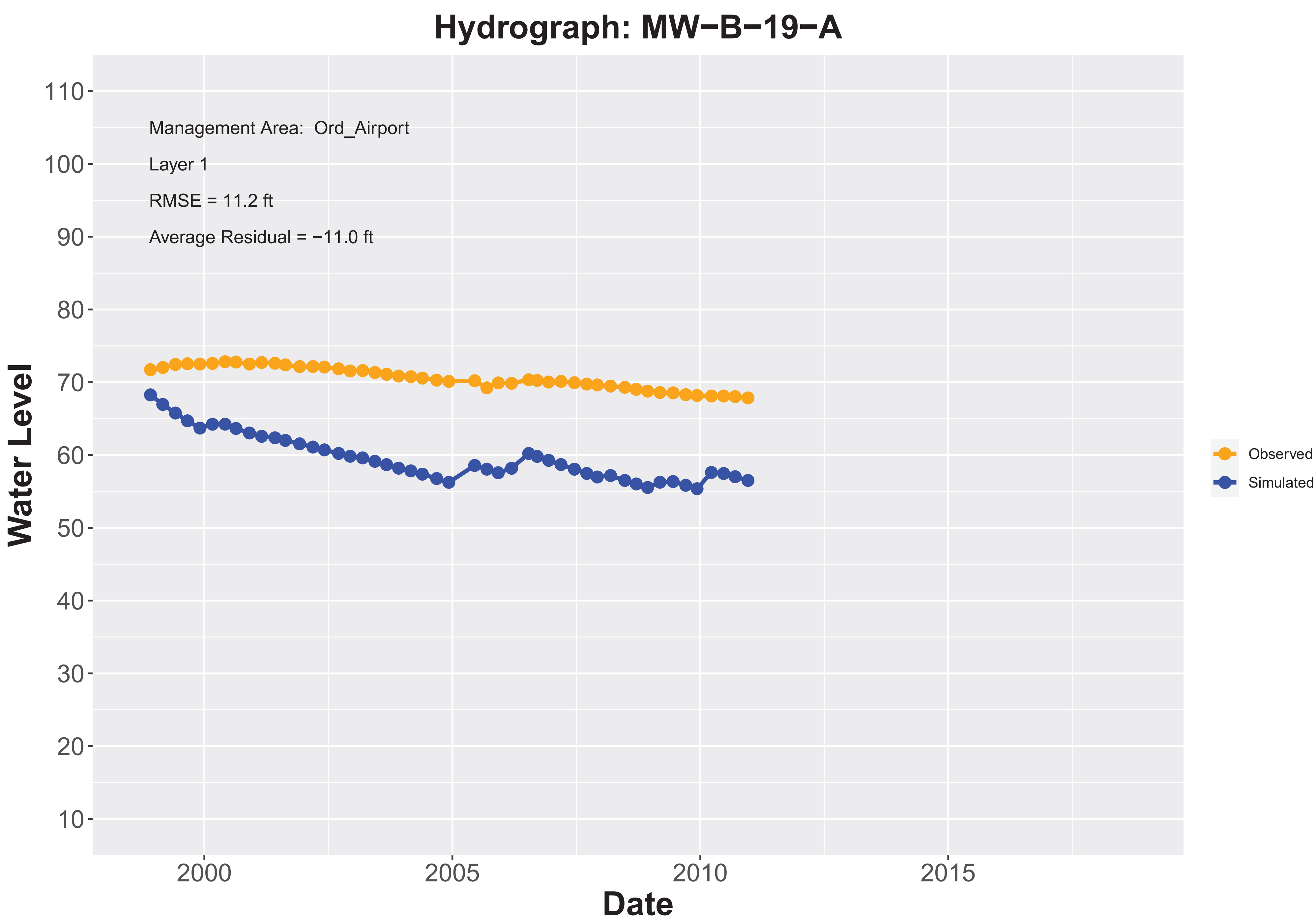
Hydrograph: MW−B−16−A
Management Area: Ord_Airport
Layer 1
RMSE = 22.9 ft
Average Residual = −22.9 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−B−17−A

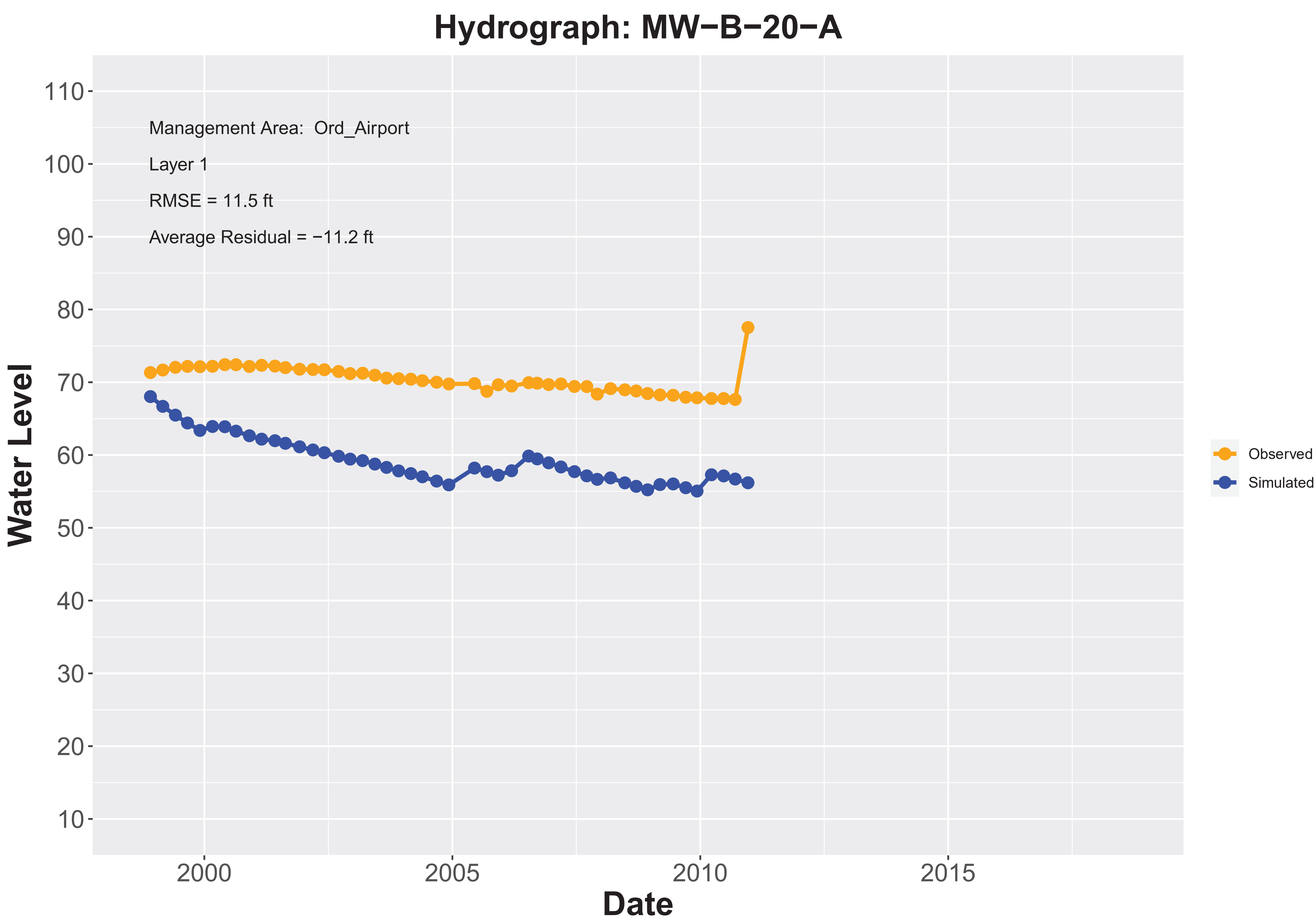




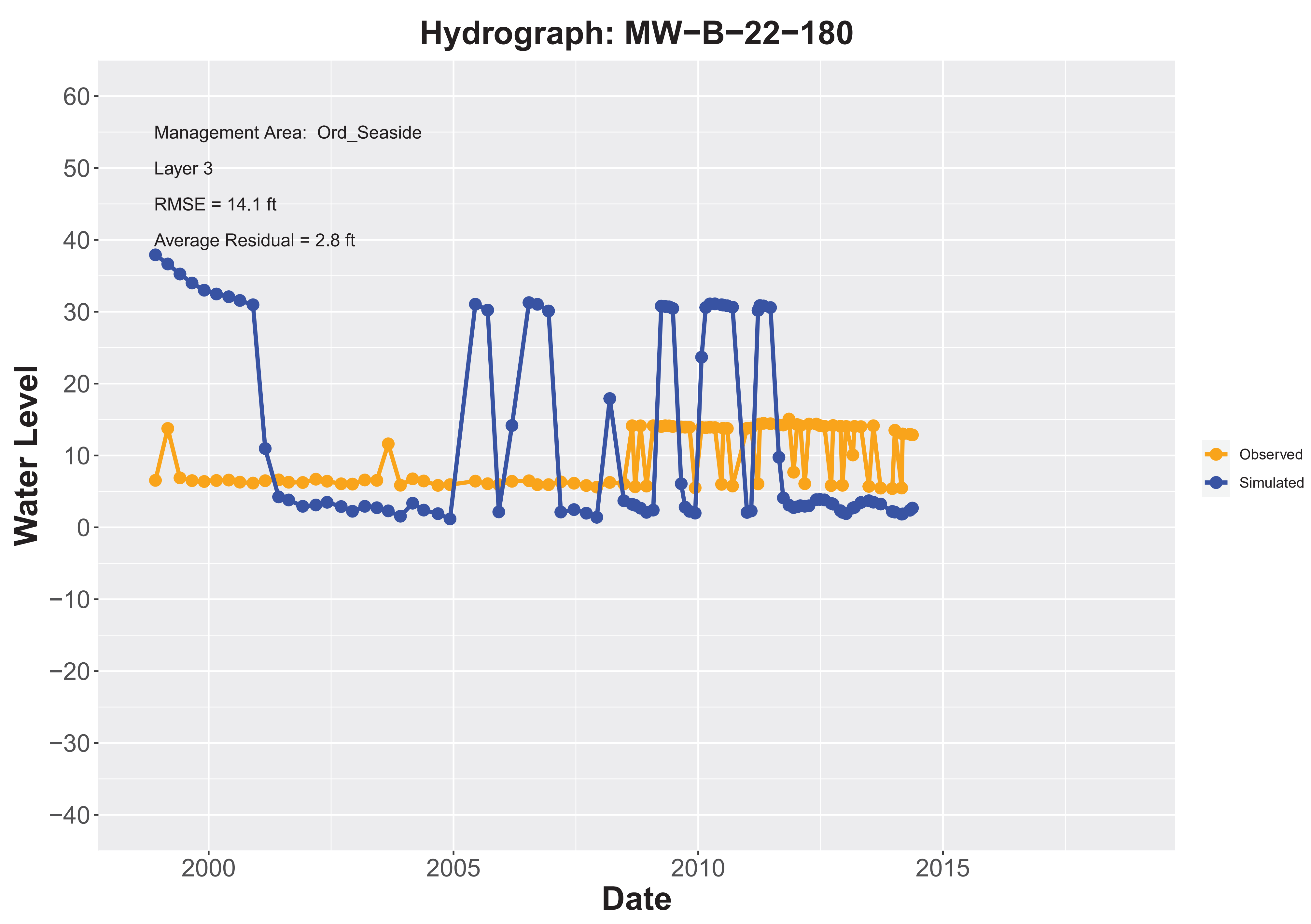
Hydrograph: MW−B−18−A
Management Area: Ord_Airport
Layer 1
RMSE = 11.3 ft
Average Residual = −11.1 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

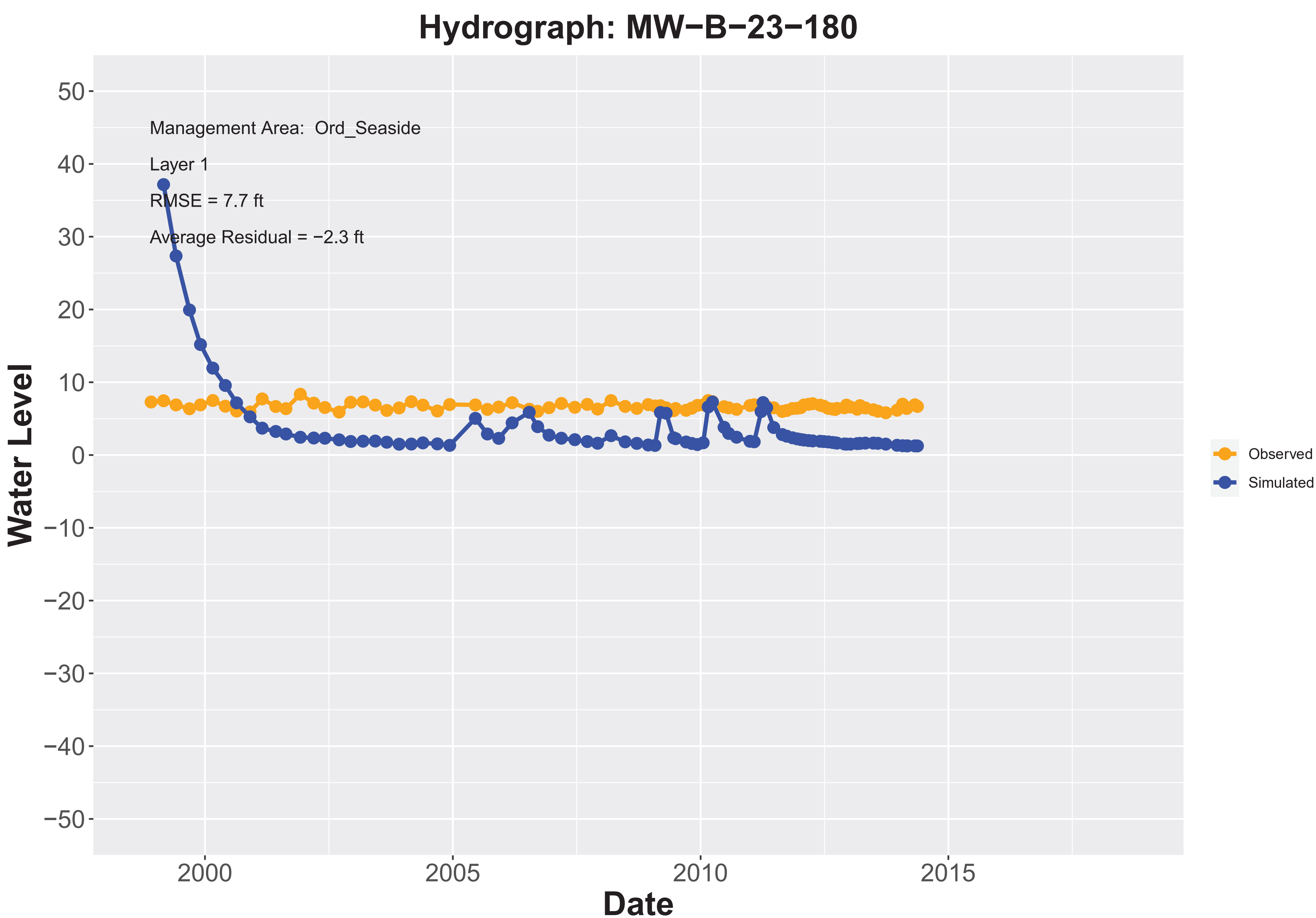


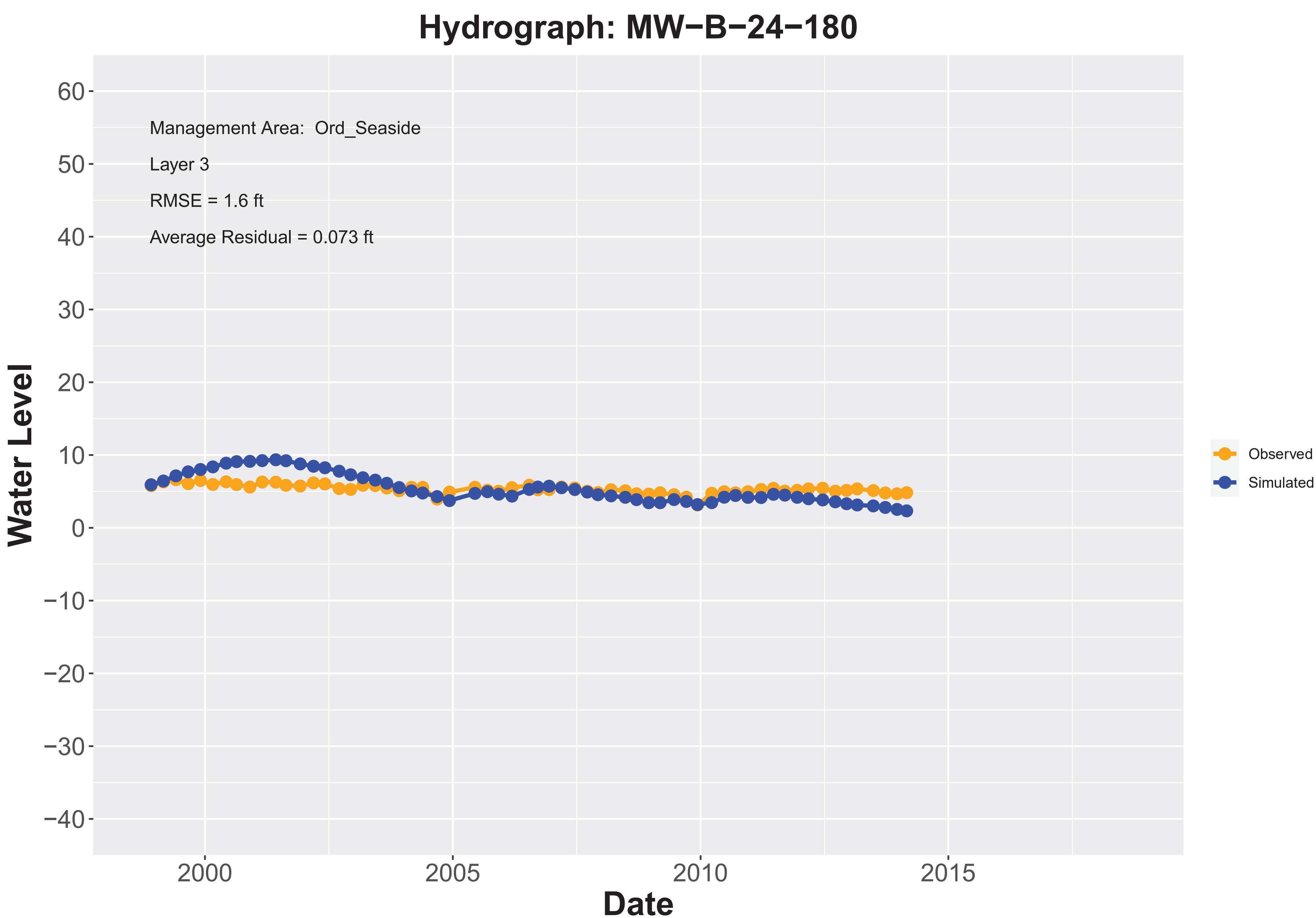
Hydrograph: MW−B−19−A
Management Area: Ord_Airport
Layer 1
RMSE = 11.2 ft
Average Residual = −11.0 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



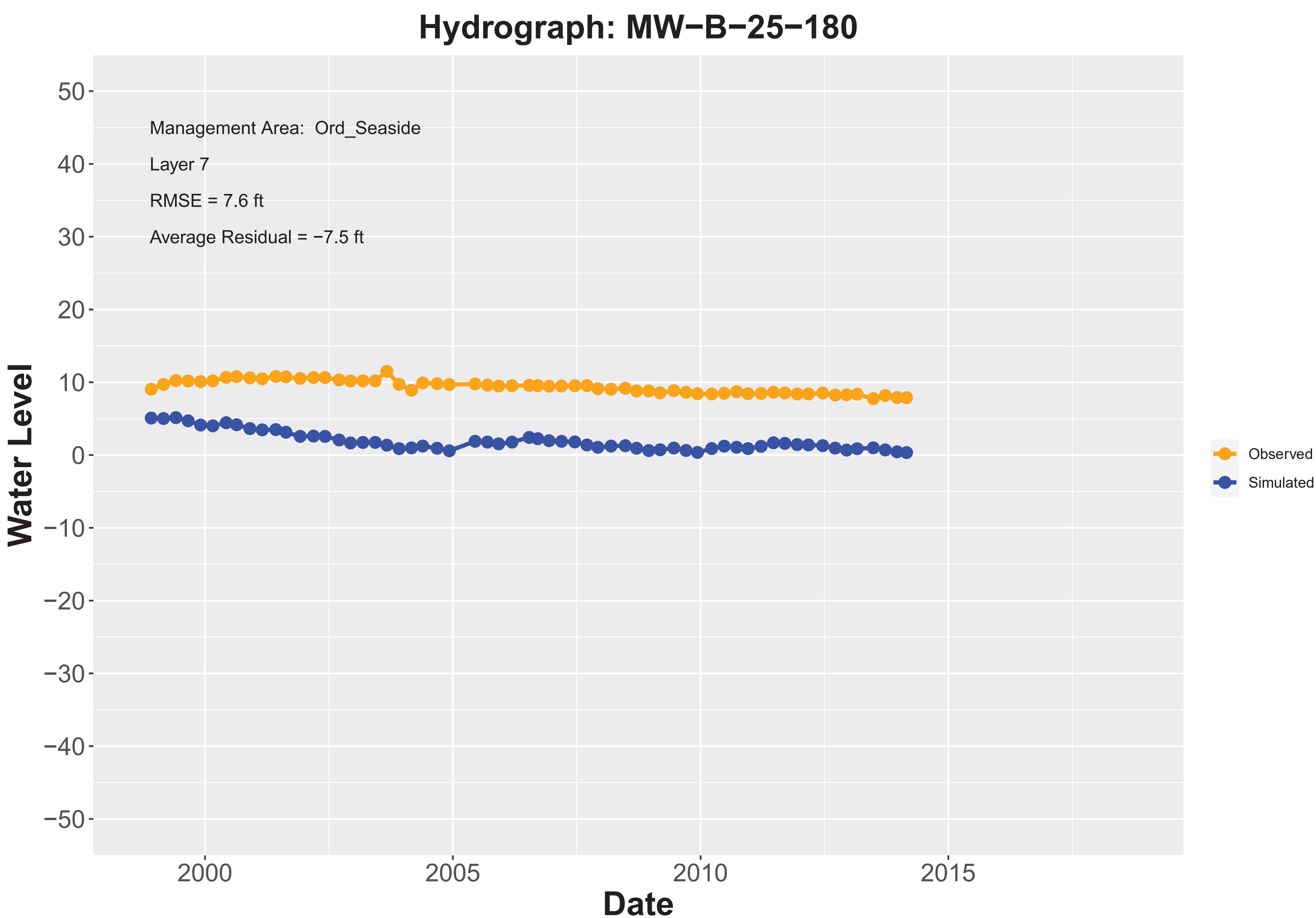
Hydrograph: MW−B−20−A
Management Area: Ord_Airport
Layer 1
RMSE = 11.5 ft
Average Residual = −11.2 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−B−22−180
Management Area: Ord_Seaside
Layer 3
RMSE = 14.1 ft
Average Residual = 2.8 ft
Water Level
60
50
40
30
20
10
0
−10
−20
−30
−40
2000
2005
2010
2015
Date
Observed
Simulated

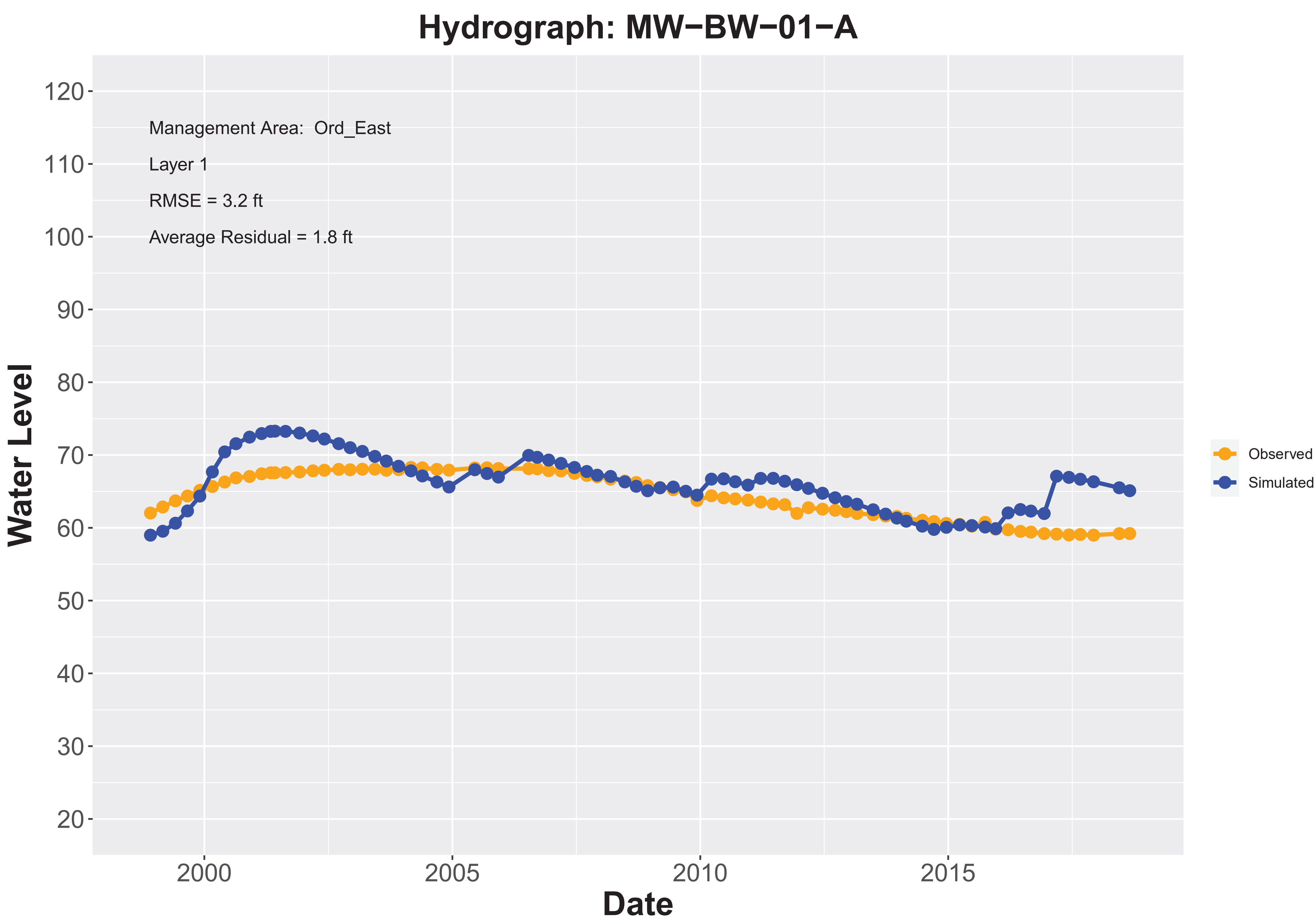

Hydrograph: MW−B−23−180
Management Area: Ord_Seaside
Layer 1
RMSE = 7.7 ft
Average Residual = −2.3 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

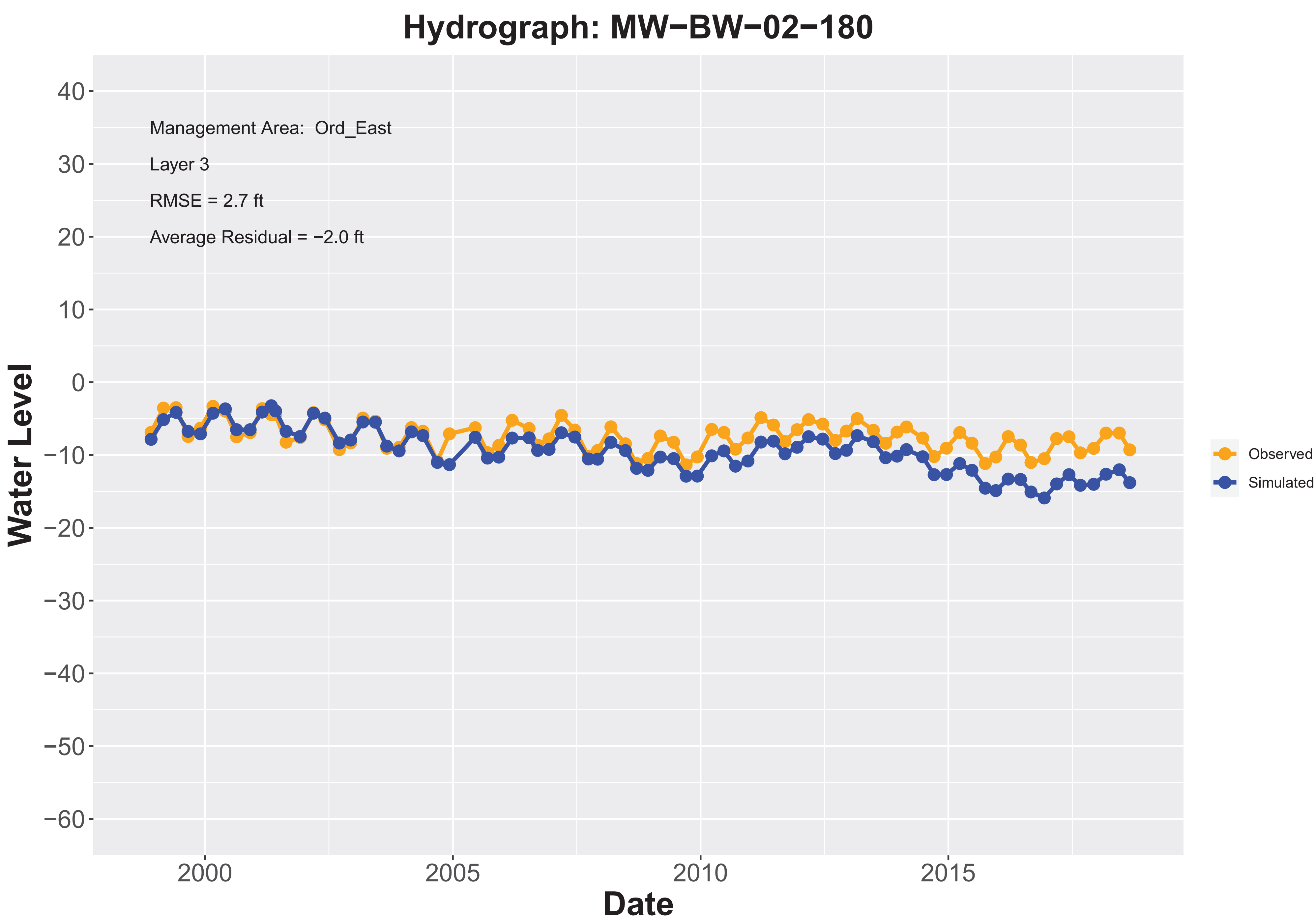


Hydrograph: MW−B−24−180
Management Area: Ord_Seaside
Layer 3
RMSE = 1.6 ft
Average Residual = 0.073 ft
Water Level
60
50
40
30
20
10
0
−10
−20
−30
−40
Date
2000
2005
2010
2015
Observed
Simulated



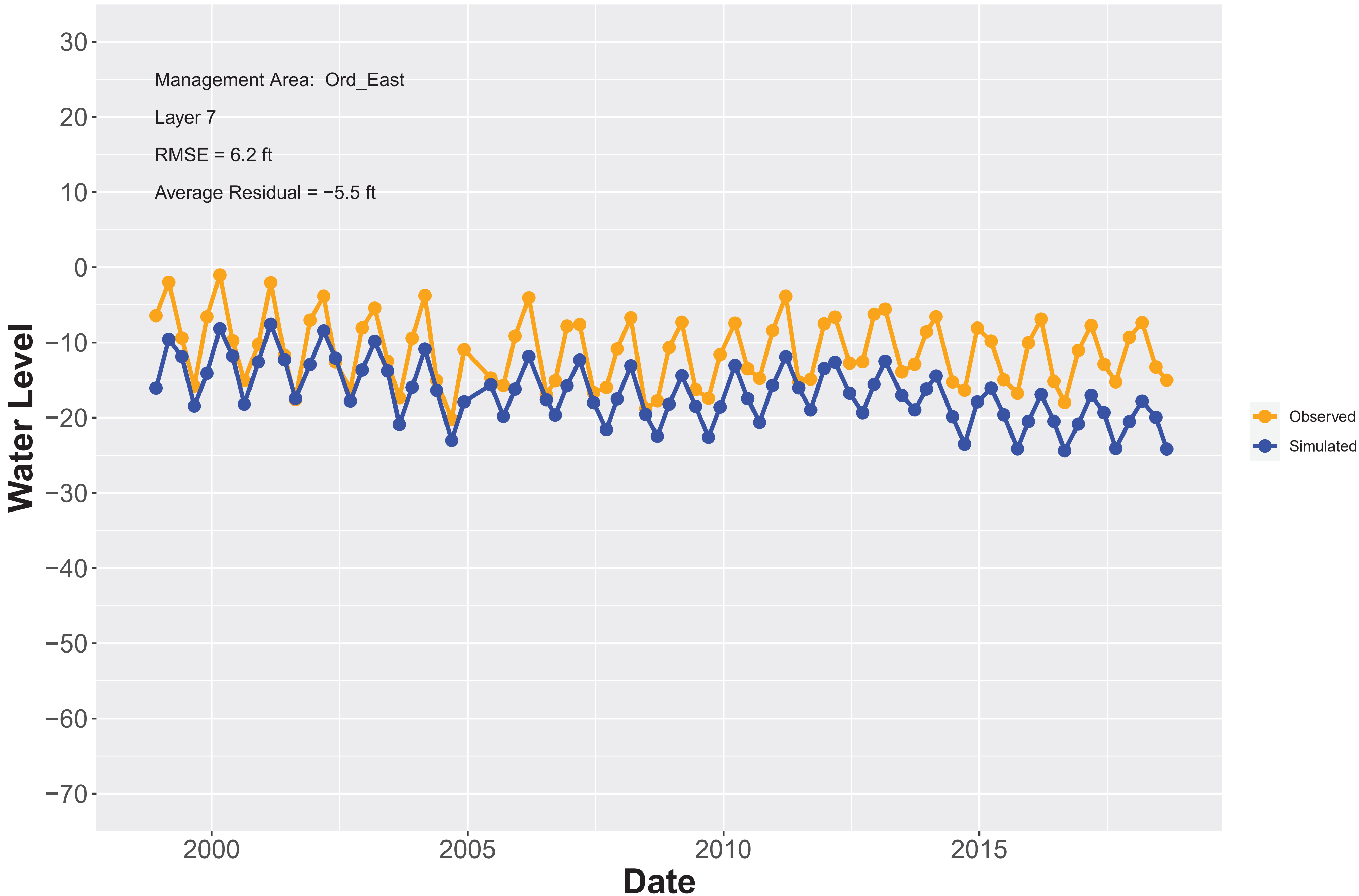
Hydrograph: MW−B−25−180
Management Area: Ord_Seaside
Layer 7
RMSE = 7.6 ft
Average Residual = −7.5 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

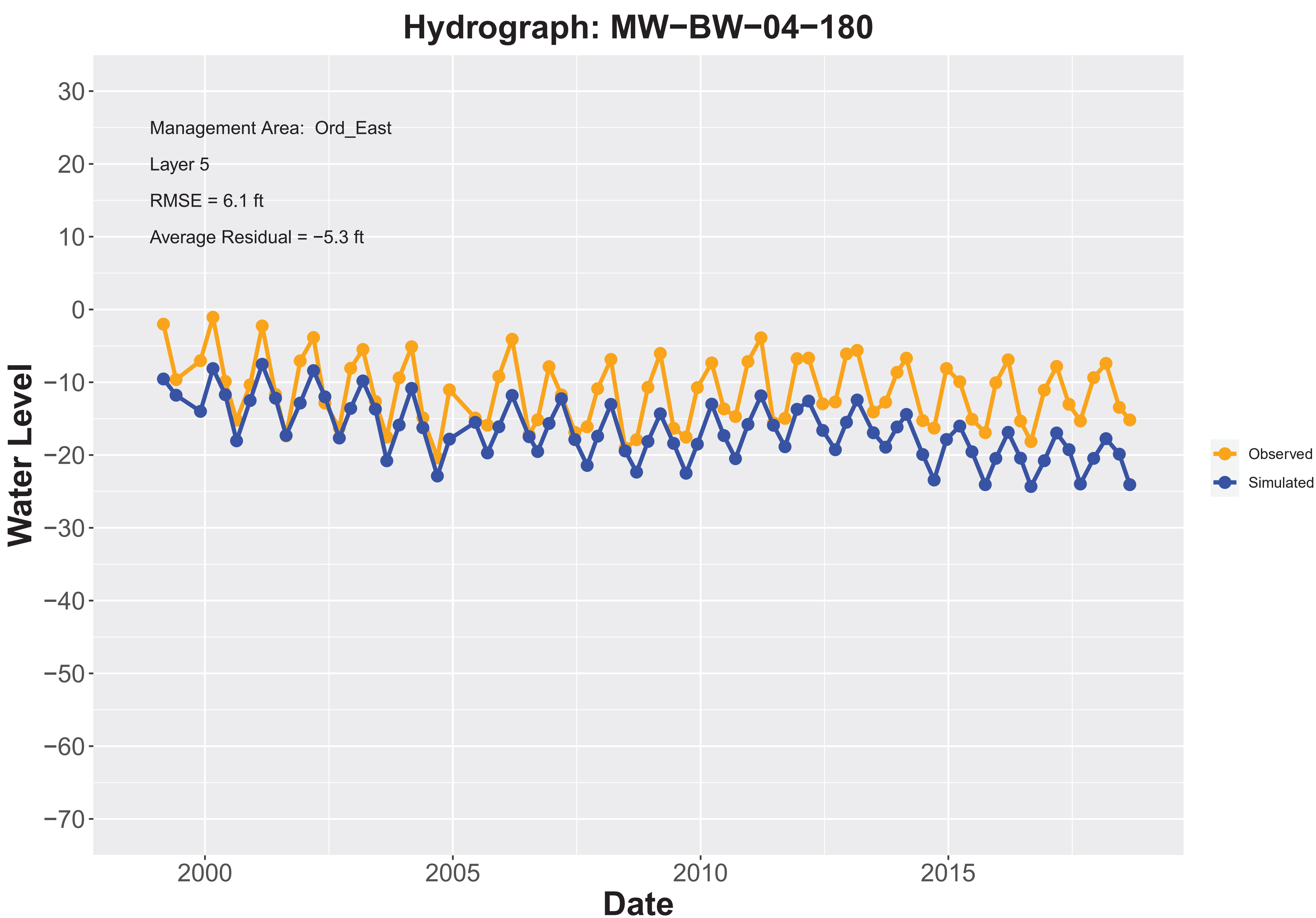

Hydrograph: MW−BW−01−A
Management Area: Ord_East
Layer 1
RMSE = 3.2 ft
Average Residual = 1.8 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated



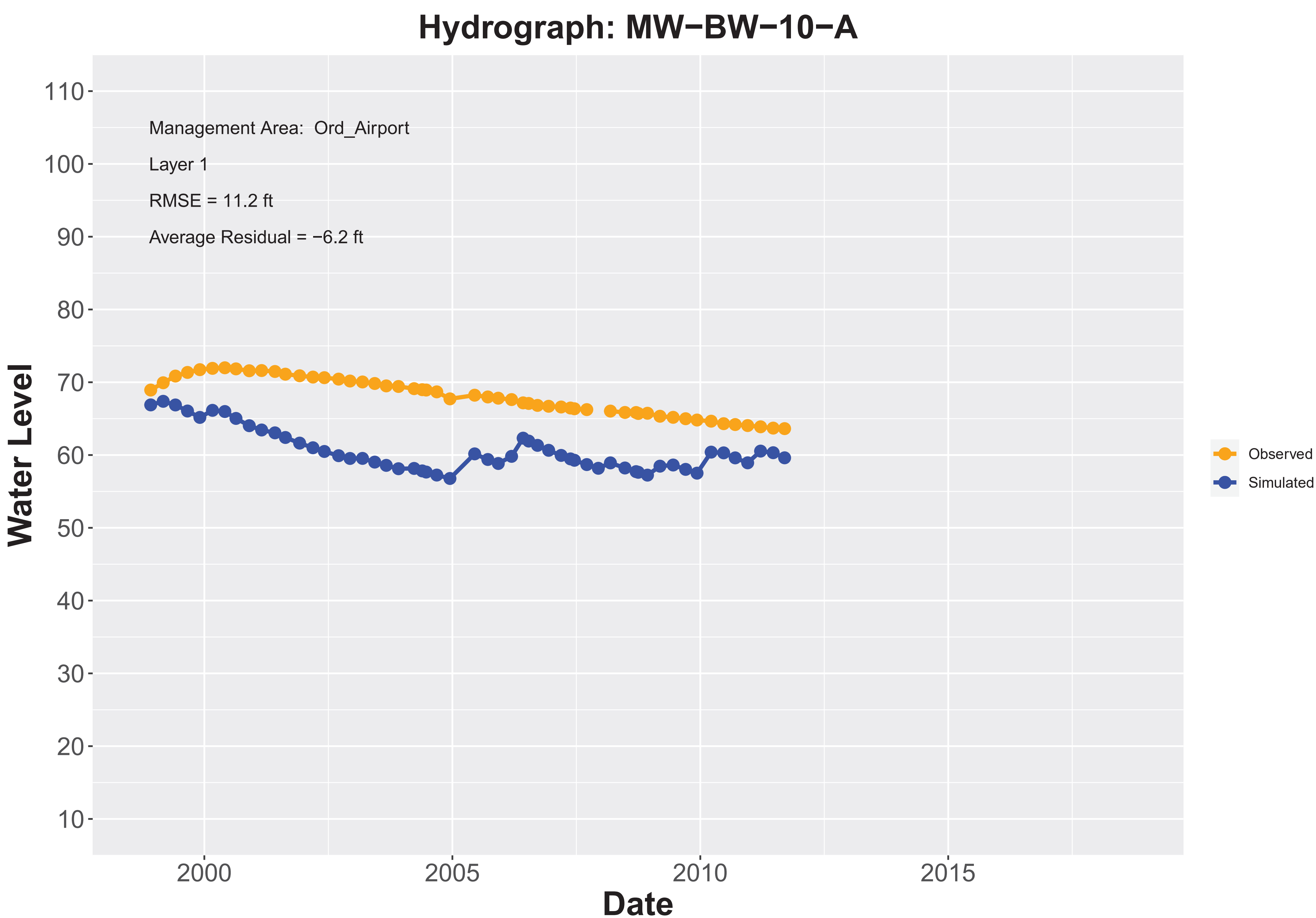
Hydrograph: MW−BW−02−180
Management Area: Ord_East
Layer 3
RMSE = 2.7 ft
Average Residual = −2.0 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

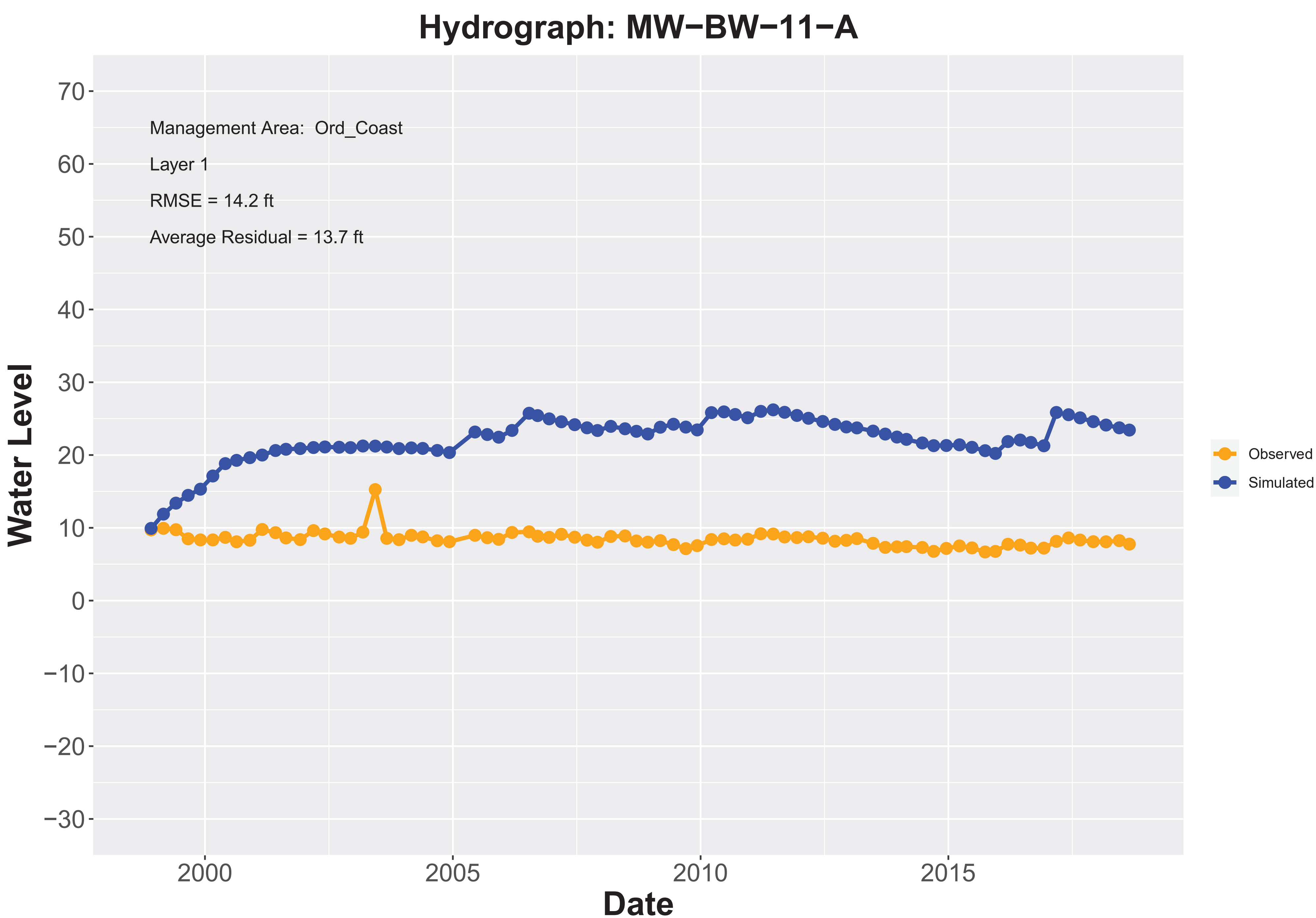
Hydrograph: MW−BW−03−400

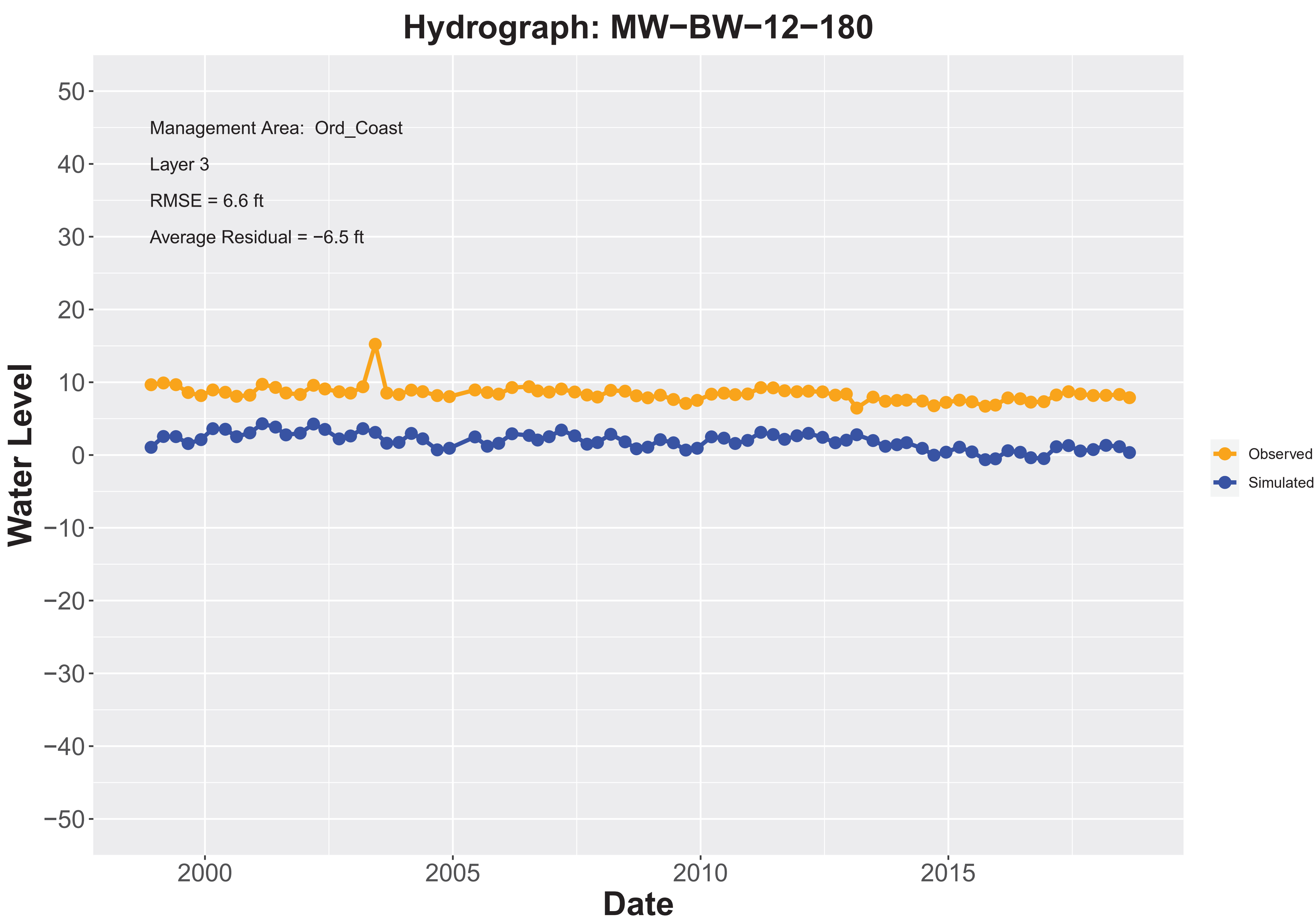




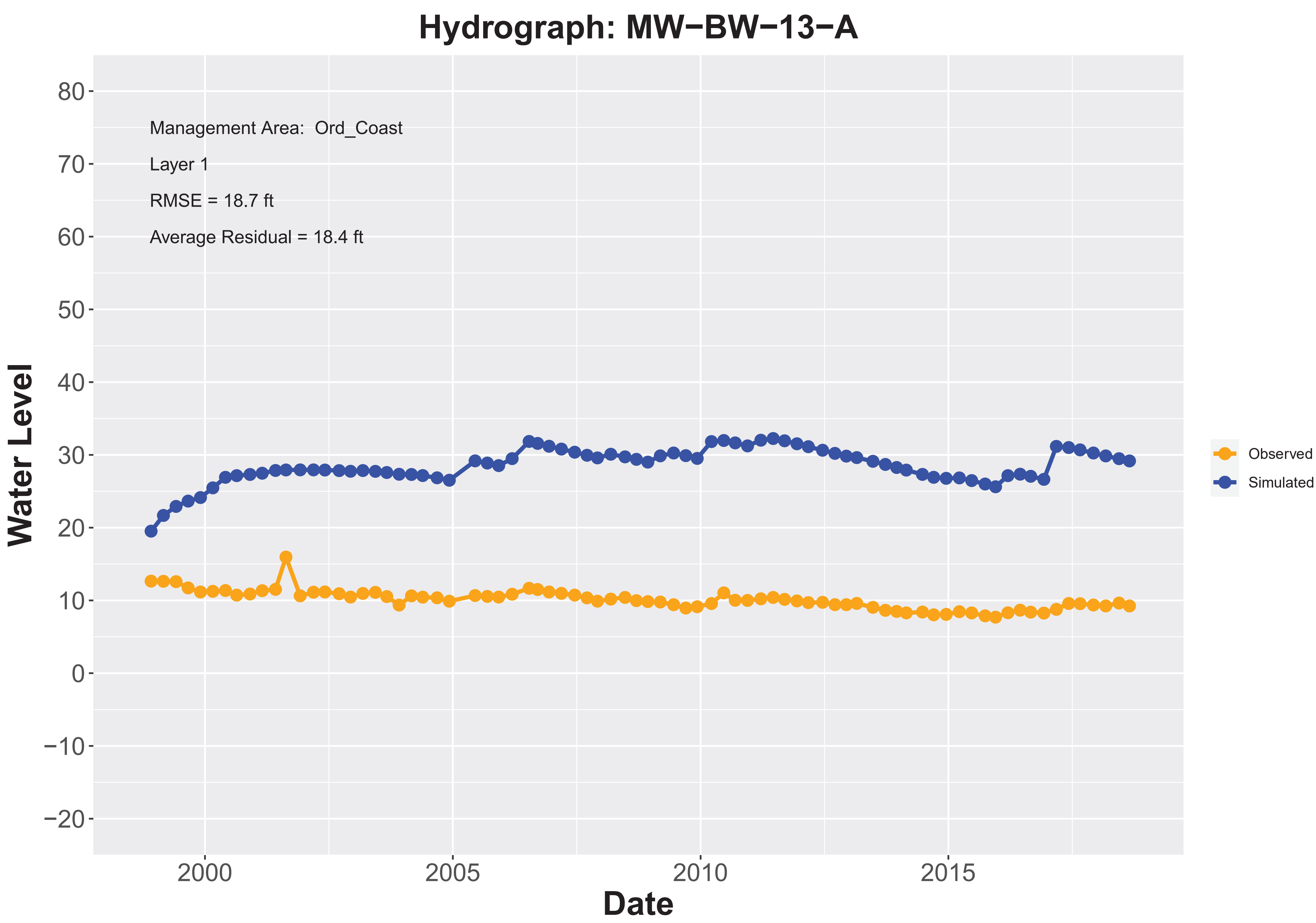
Hydrograph: MW−BW−04−180
Management Area: Ord_East
Layer 5
RMSE = 6.1 ft
Average Residual = −5.3 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−BW−10−A
Management Area: Ord_Airport
Layer 1
RMSE = 11.2 ft
Average Residual = −6.2 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

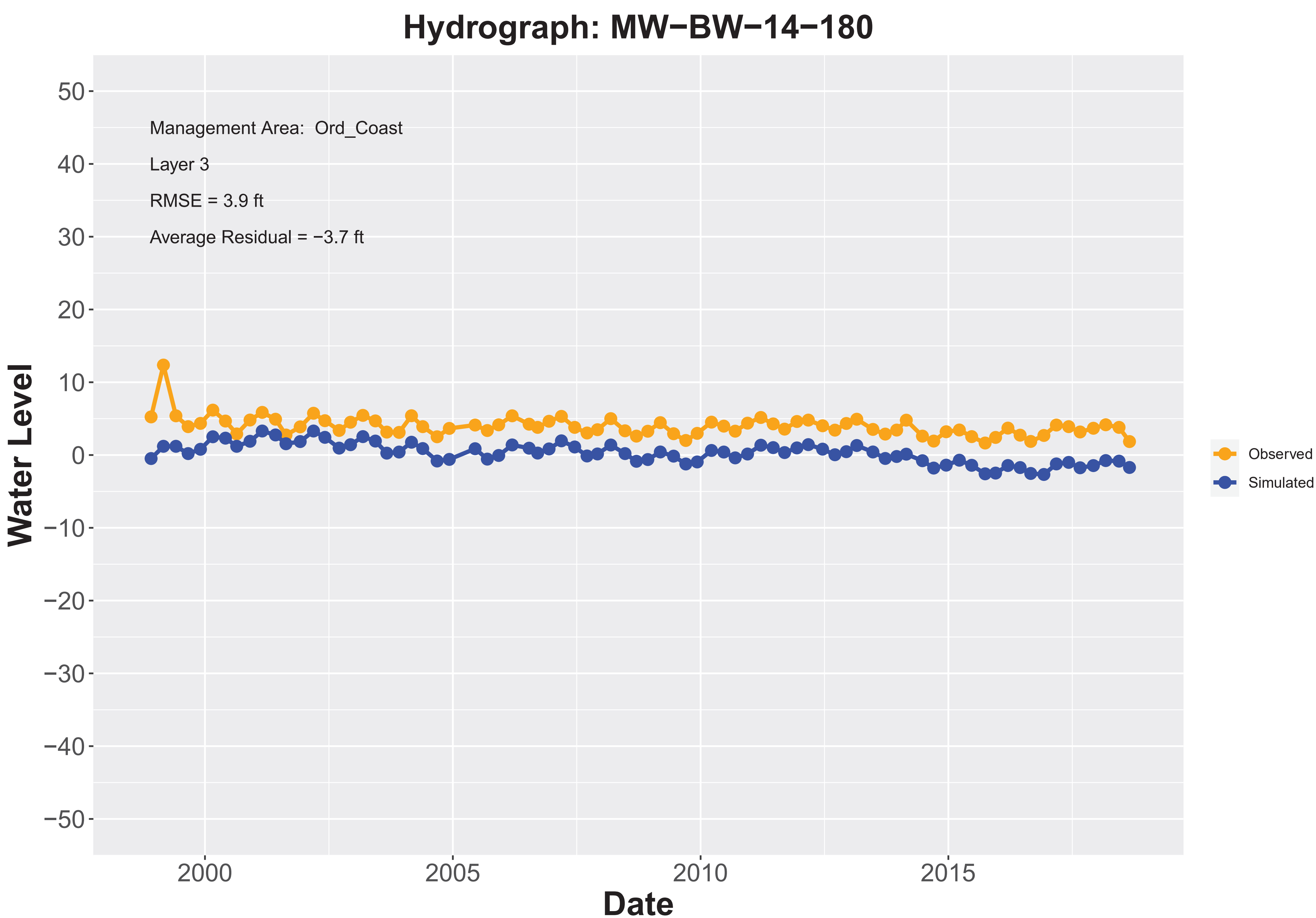

Hydrograph: MW−BW−11−A
Management Area: Ord_Coast
Layer 1
RMSE = 14.2 ft
Average Residual = 13.7 ft
Water Level
70
60
50
40
30
20
10
0
−10
−20
−30
2000
2005
2010
2015
Date
Observed
Simulated



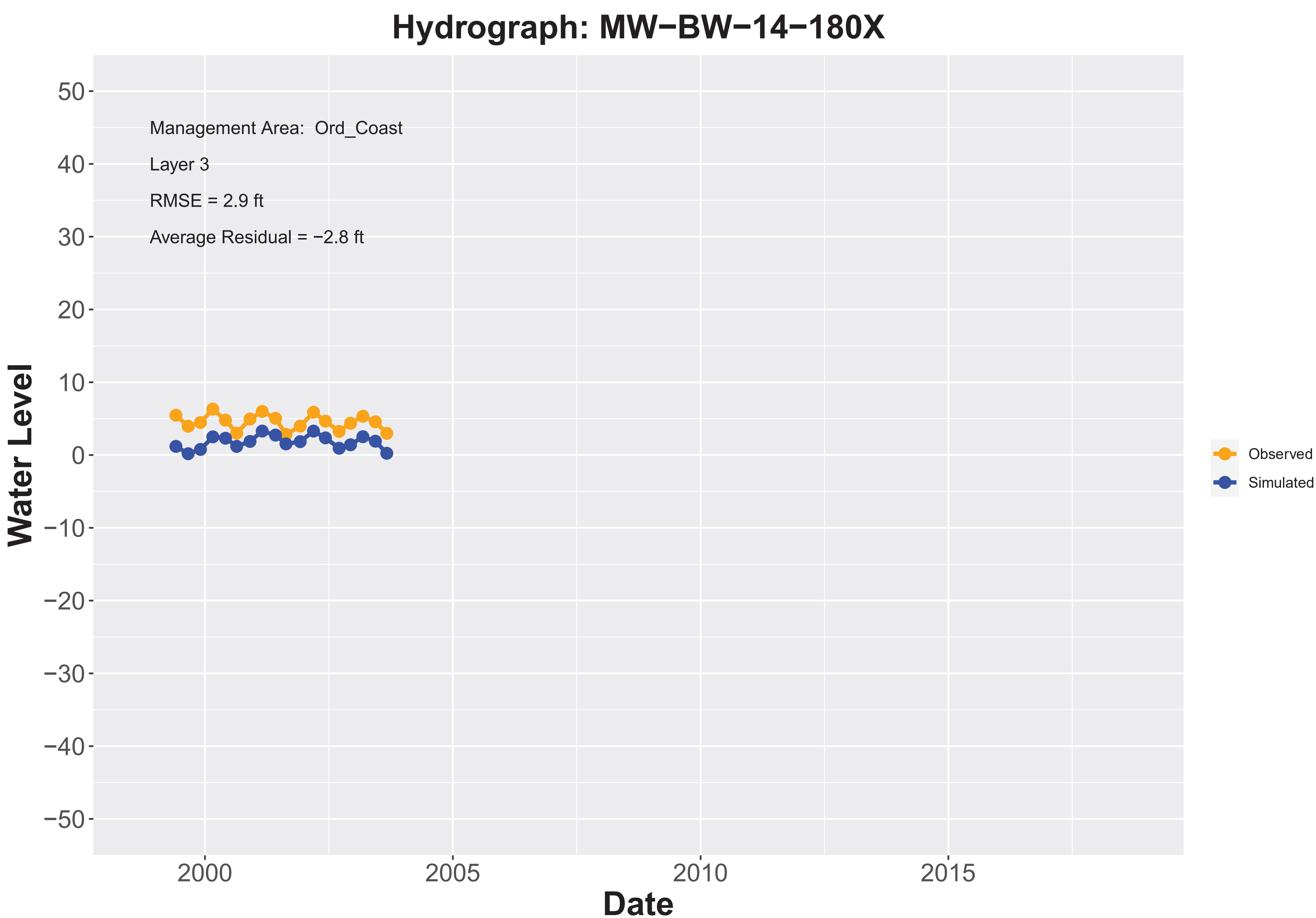
Hydrograph: MW−BW−12−180
Management Area: Ord_Coast
Layer 3
RMSE = 6.6 ft
Average Residual = −6.5 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

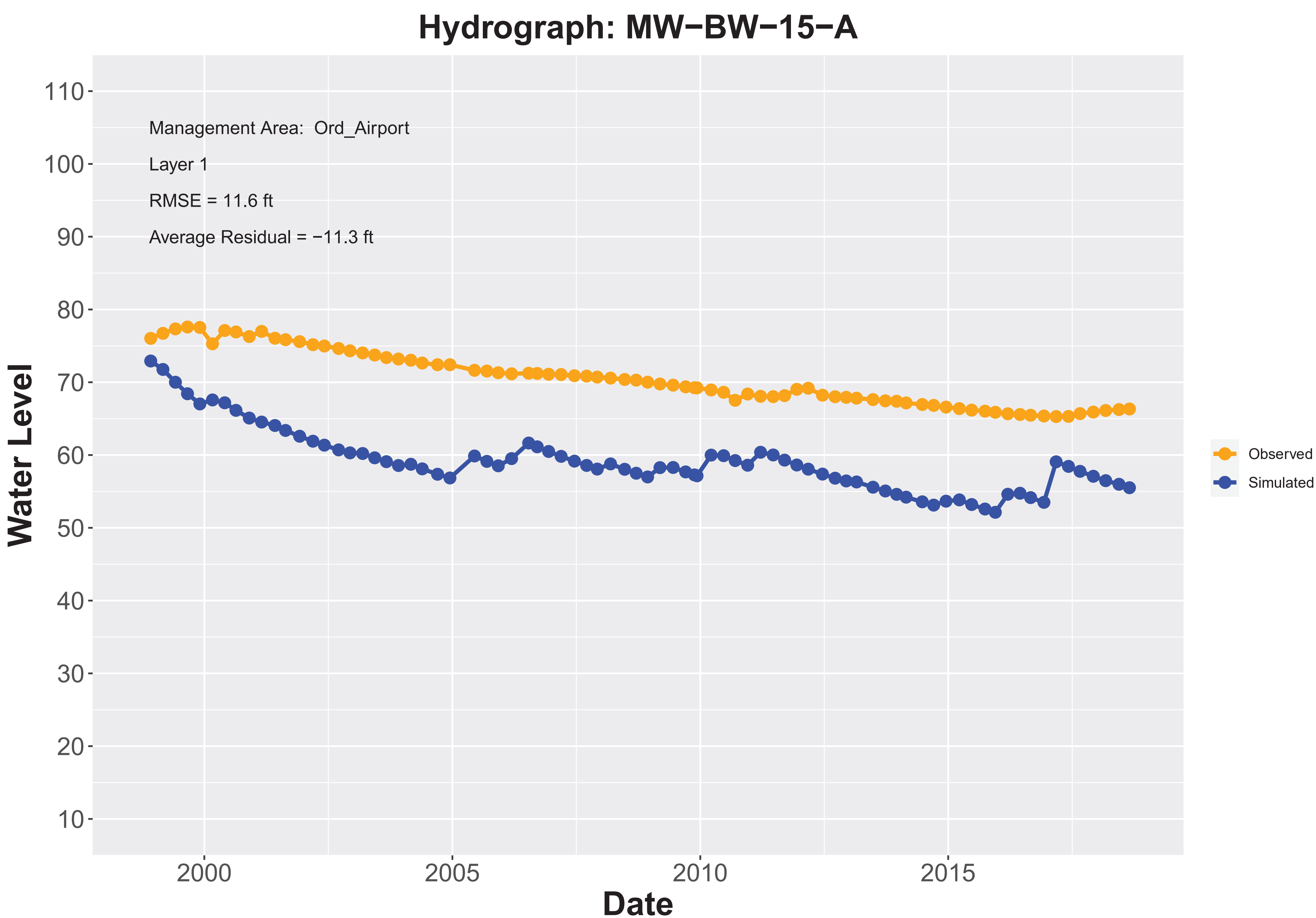


Hydrograph: MW−BW−13−A
Management Area: Ord_Coast
Layer 1
RMSE = 18.7 ft
Average Residual = 18.4 ft
Water Level
Date
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Observed
Simulated

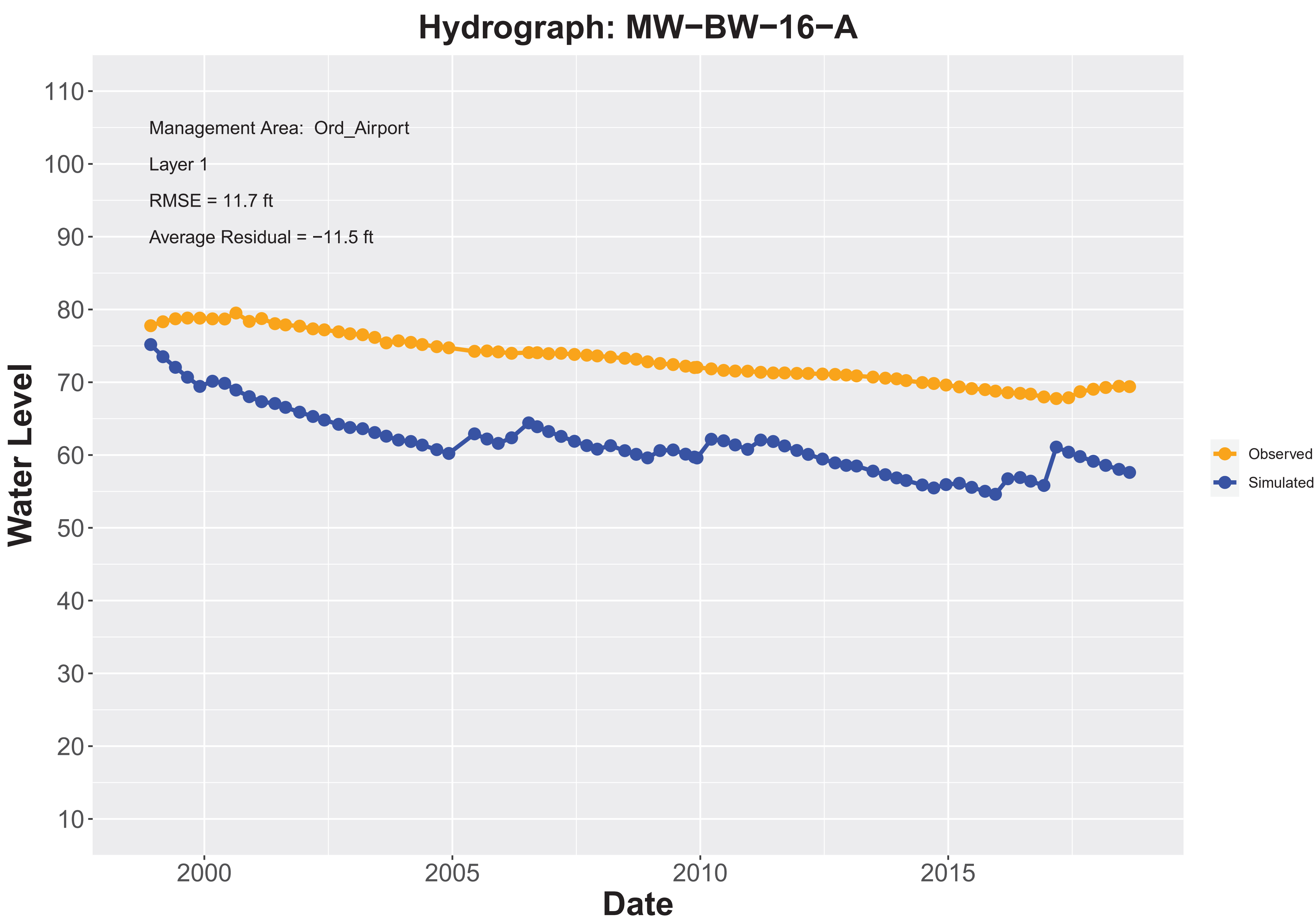


Hydrograph: MW−BW−14−180
Management Area: Ord_Coast
Layer 3
RMSE = 3.9 ft
Average Residual = −3.7 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

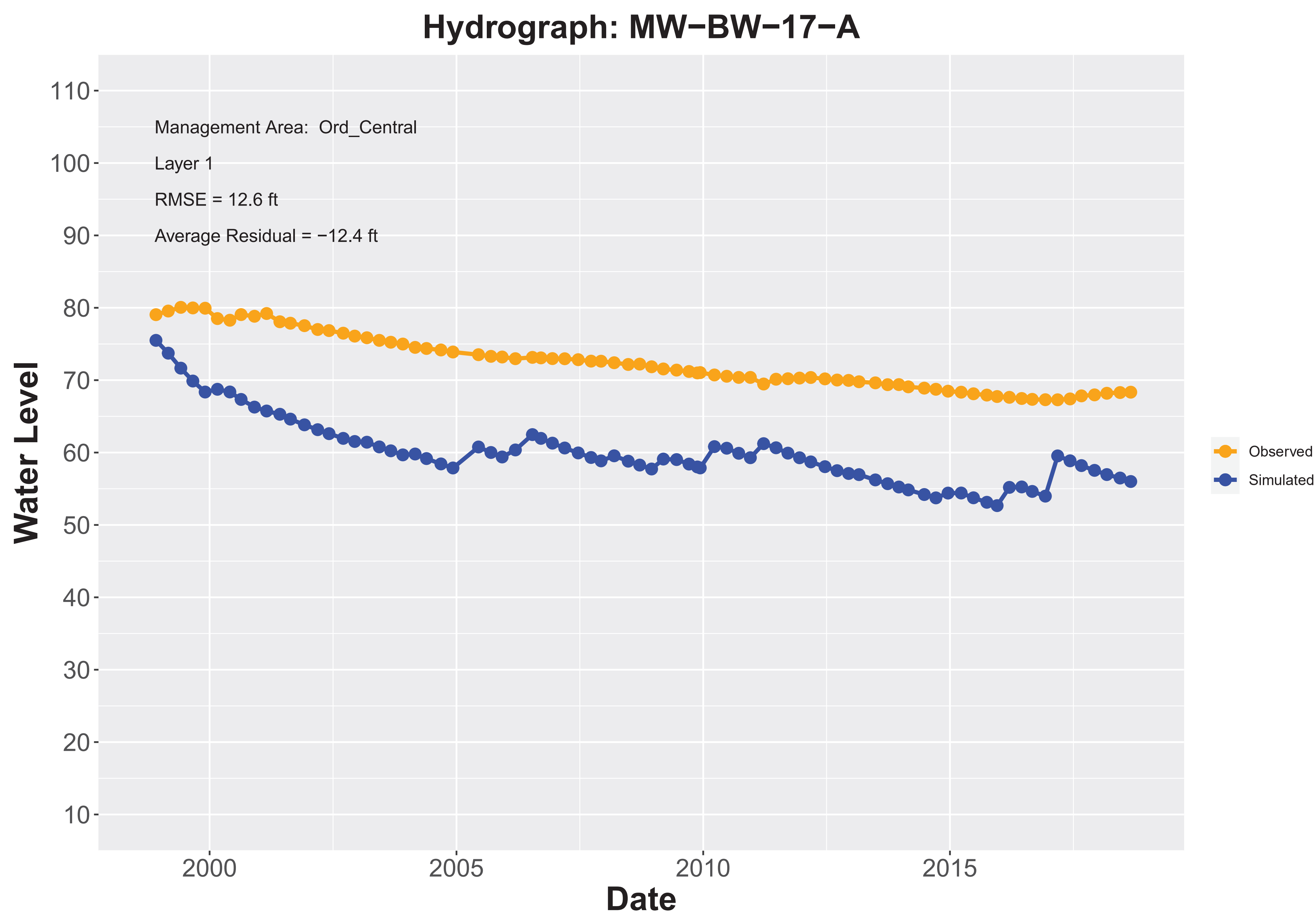

Hydrograph: MW−BW−14−180X
Management Area: Ord_Coast
Layer 3
RMSE = 2.9 ft
Average Residual = −2.8 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−BW−15−A
Management Area: Ord_Airport
Layer 1
RMSE = 11.6 ft
Average Residual = −11.3 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

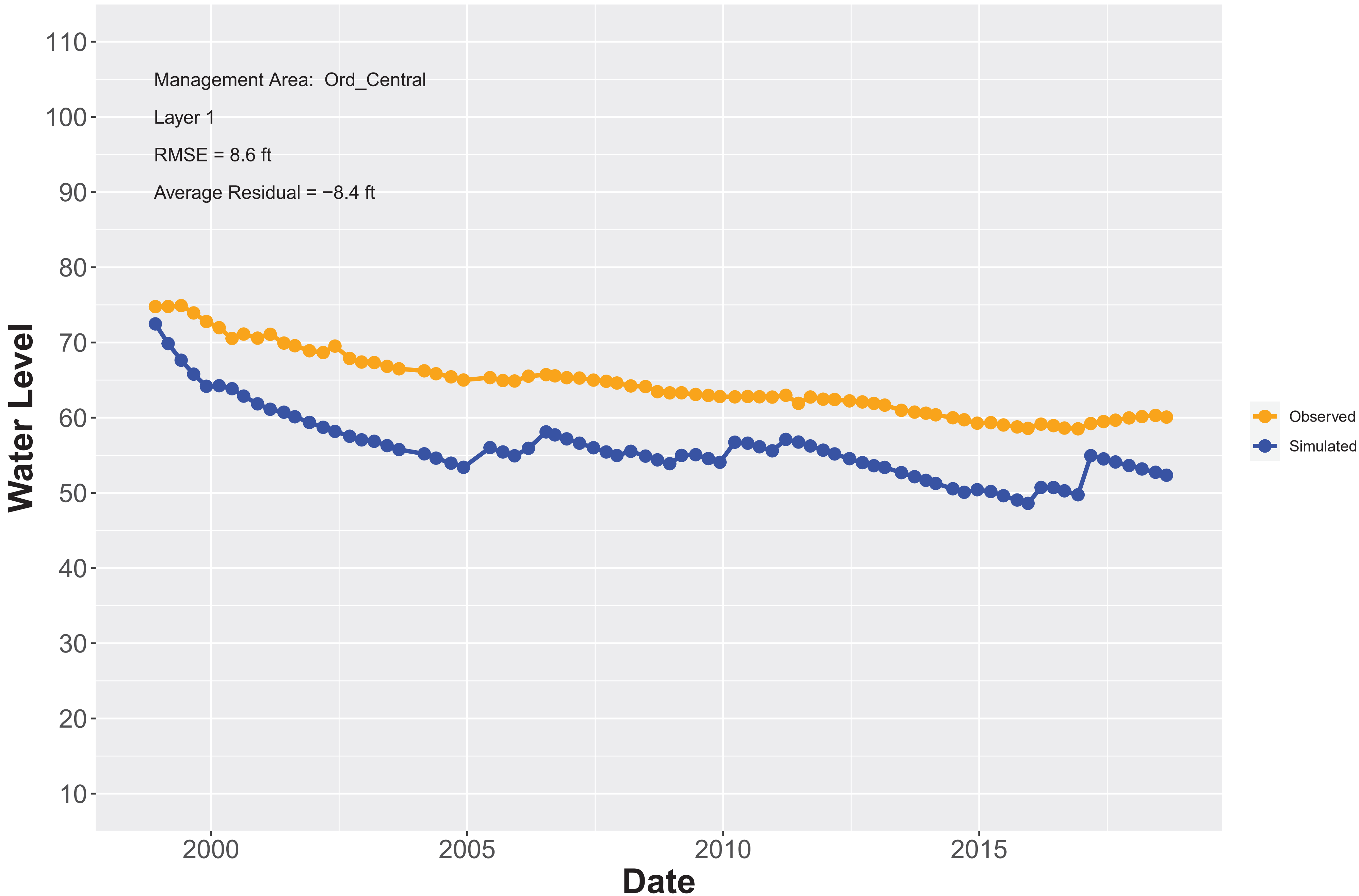


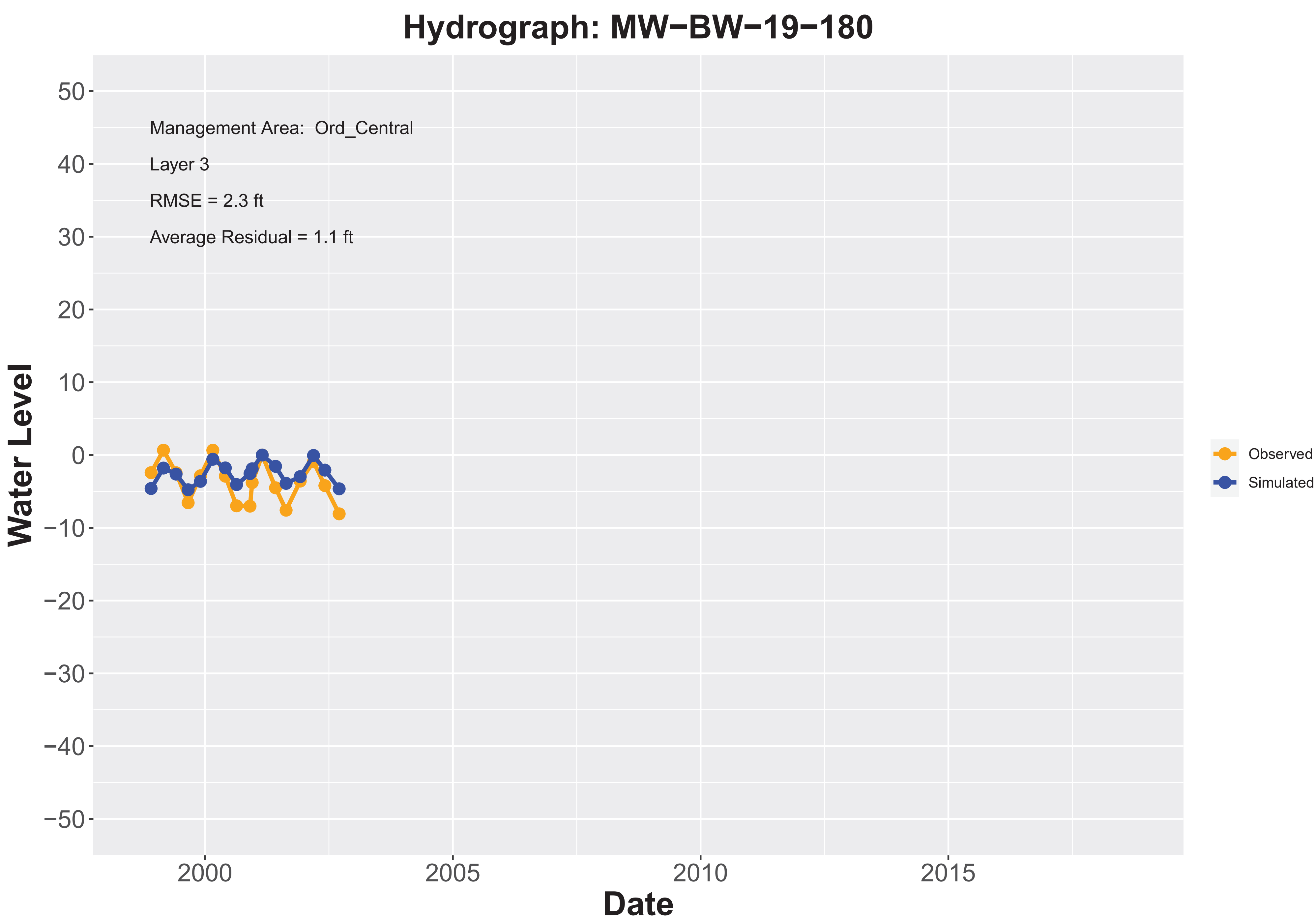
Hydrograph: MW−BW−16−A
Management Area: Ord_Airport
Layer 1
RMSE = 11.7 ft
Average Residual = −11.5 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



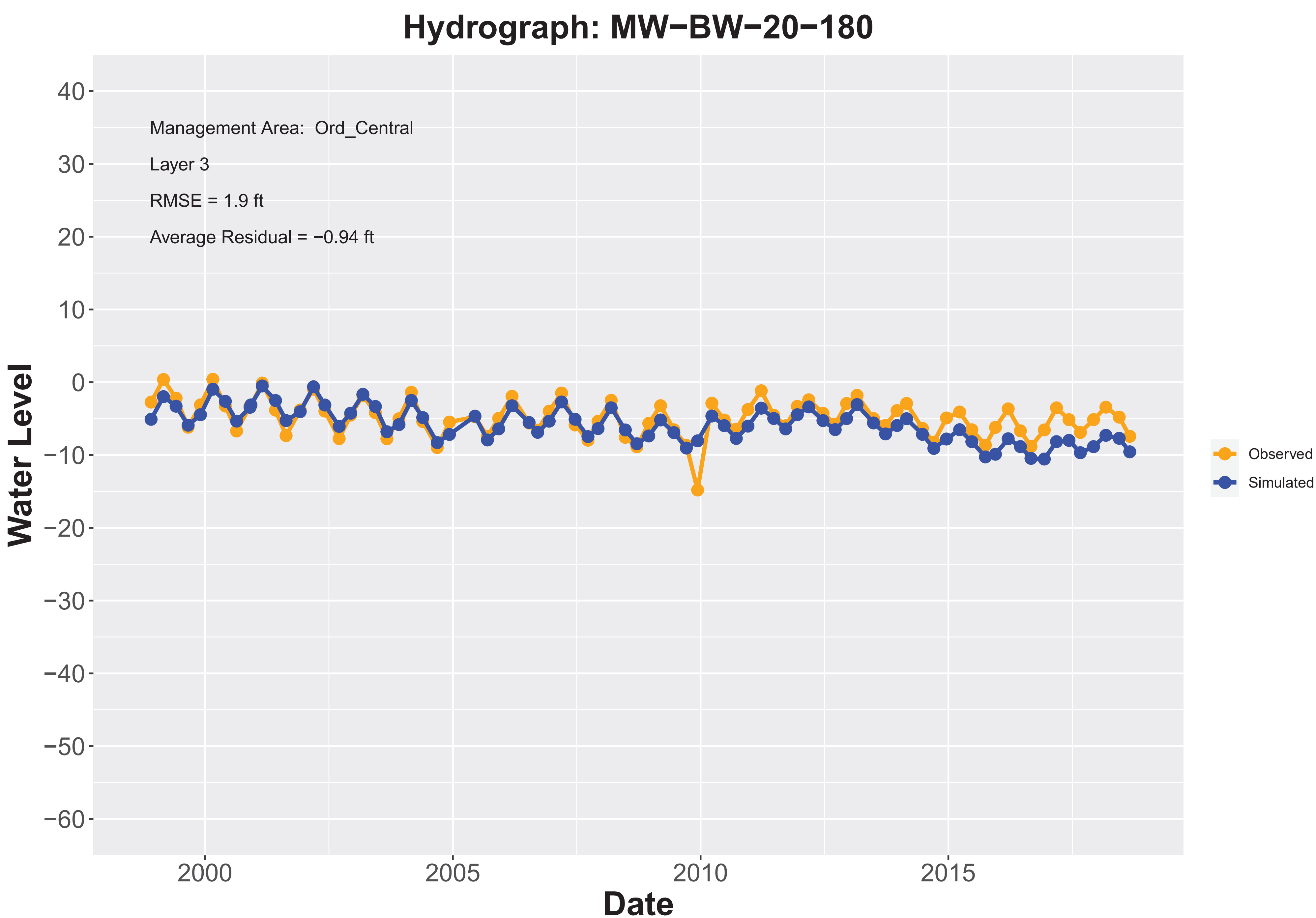
Hydrograph: MW−BW−17−A
Management Area: Ord_Central
Layer 1
RMSE = 12.6 ft
Average Residual = −12.4 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

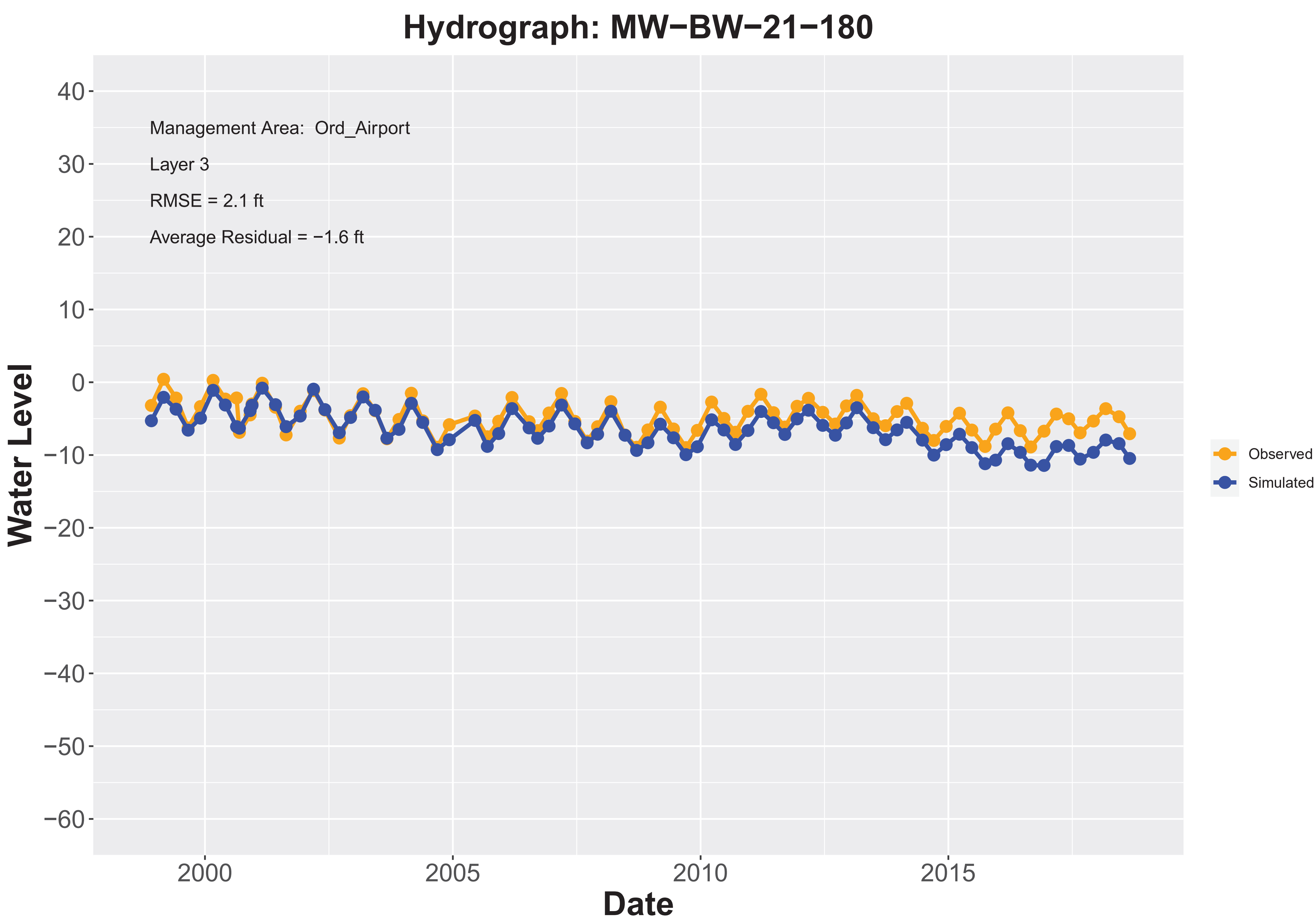
Hydrograph: MW−BW−18−A

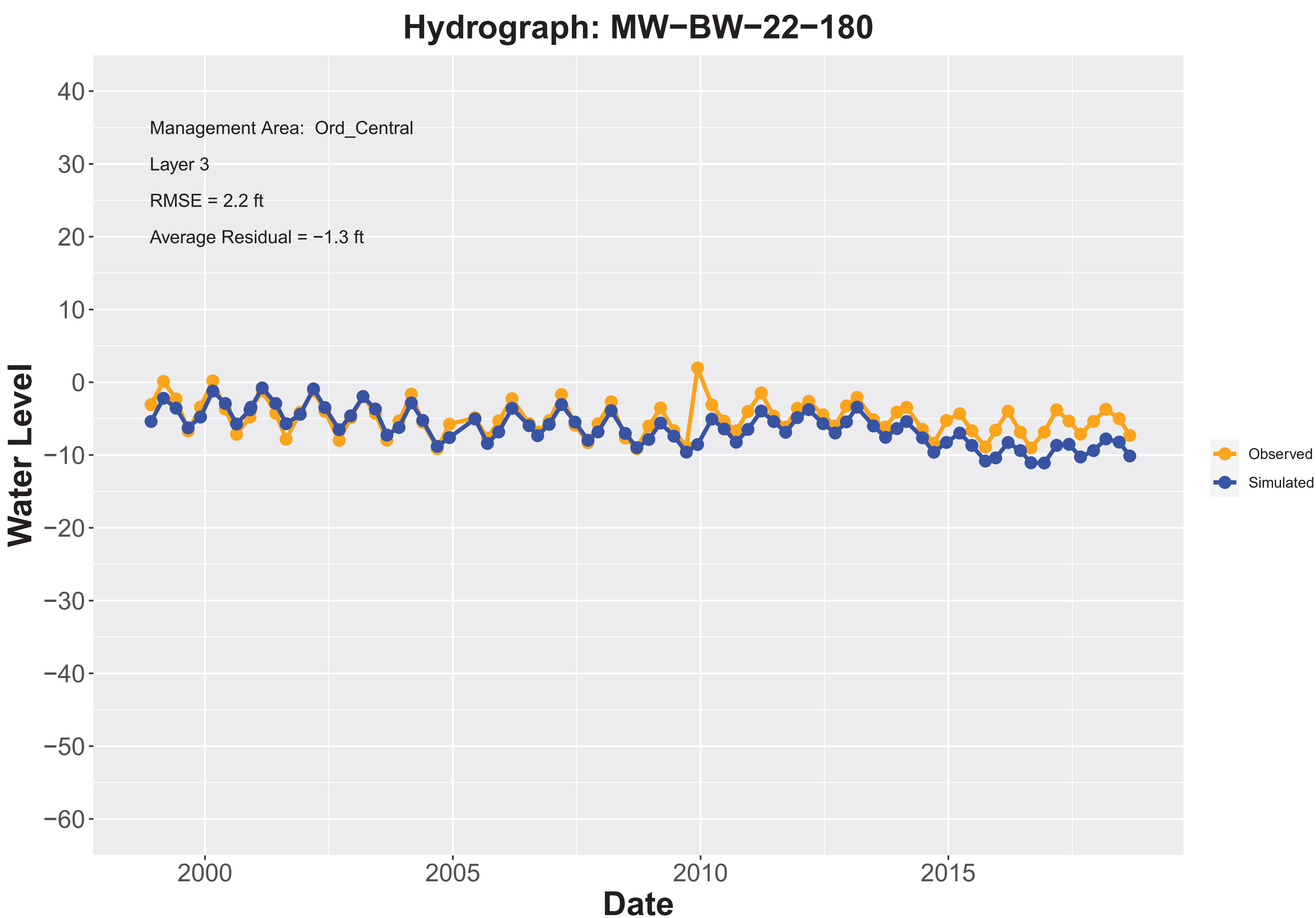




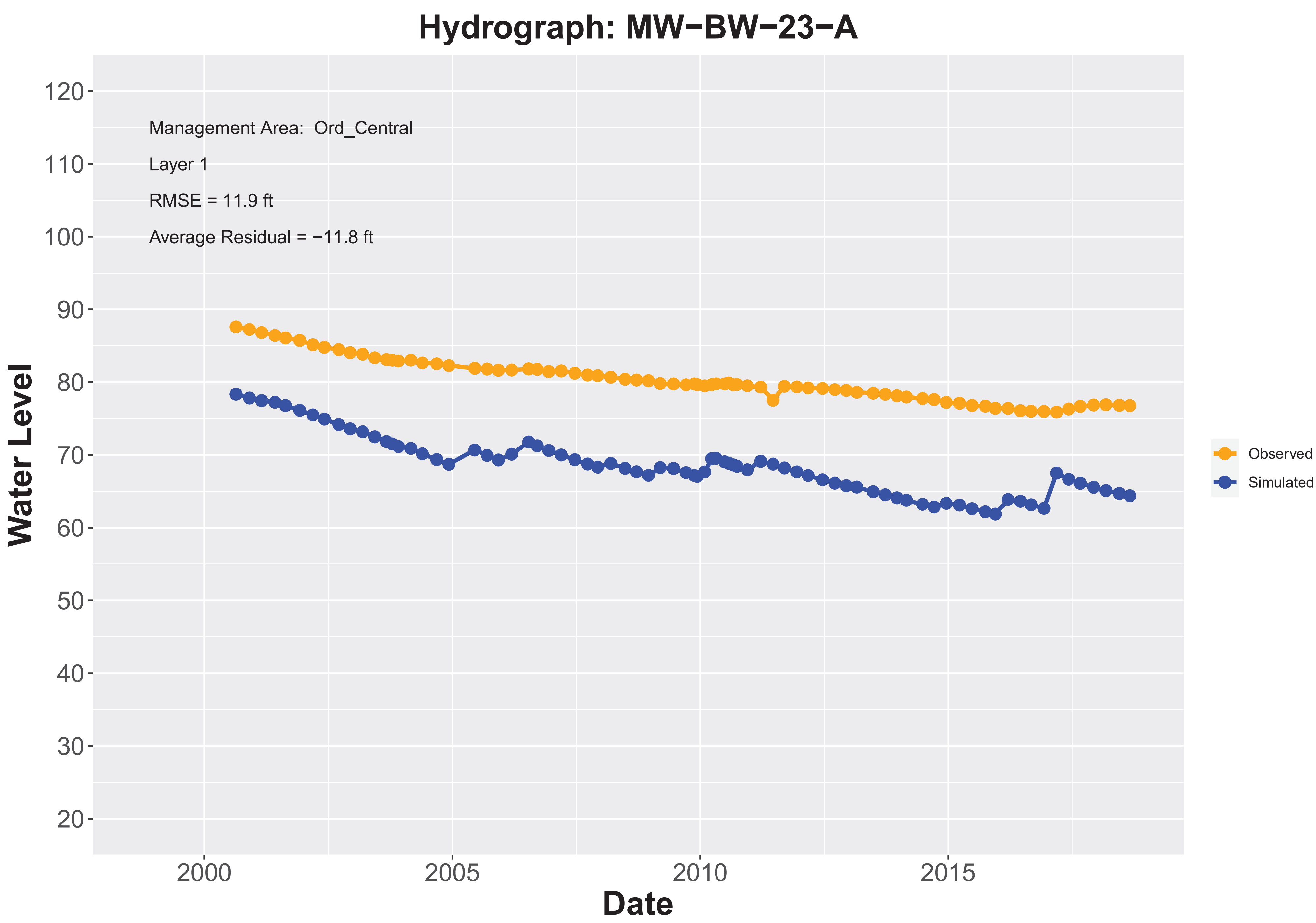
Hydrograph: MW−BW−19−180
Management Area: Ord_Central
Layer 3
RMSE = 2.3 ft
Average Residual = 1.1 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
Date
2000
2005
2010
2015
Observed
Simulated

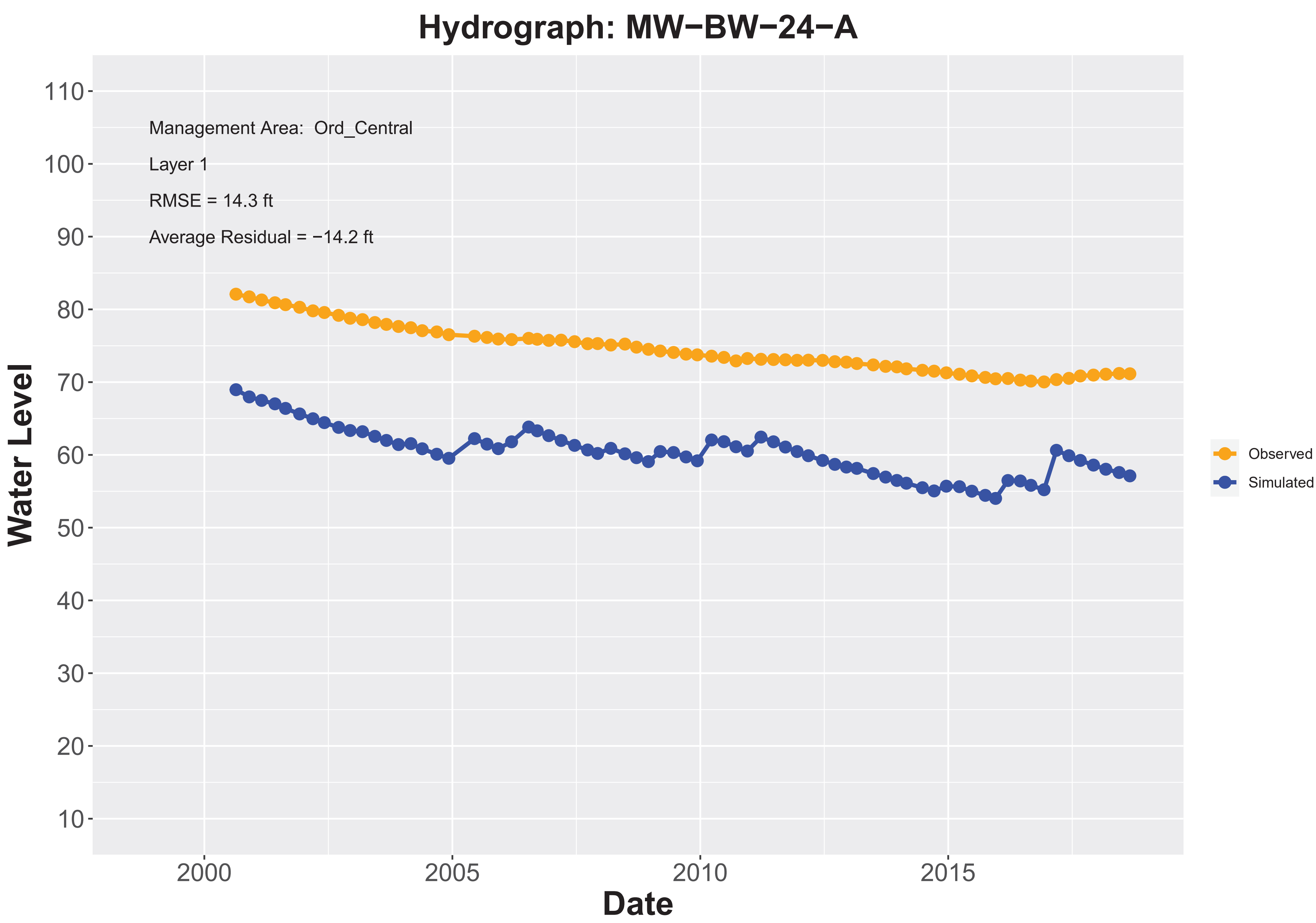

Hydrograph: MW−BW−20−180
Management Area: Ord_Central
Layer 3
RMSE = 1.9 ft
Average Residual = −0.94 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

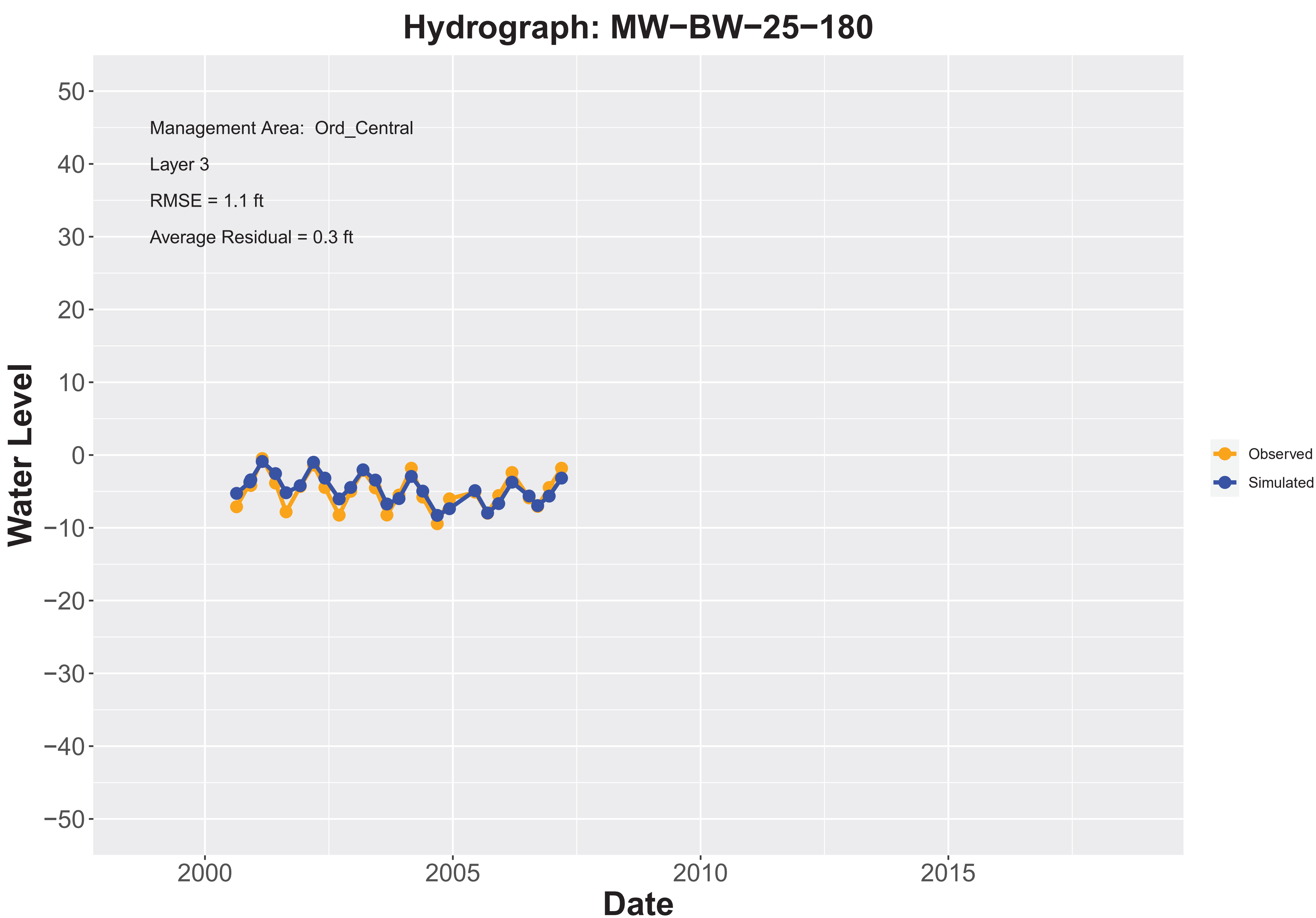

Hydrograph: MW−BW−21−180
Management Area: Ord_Airport
Layer 3
RMSE = 2.1 ft
Average Residual = −1.6 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

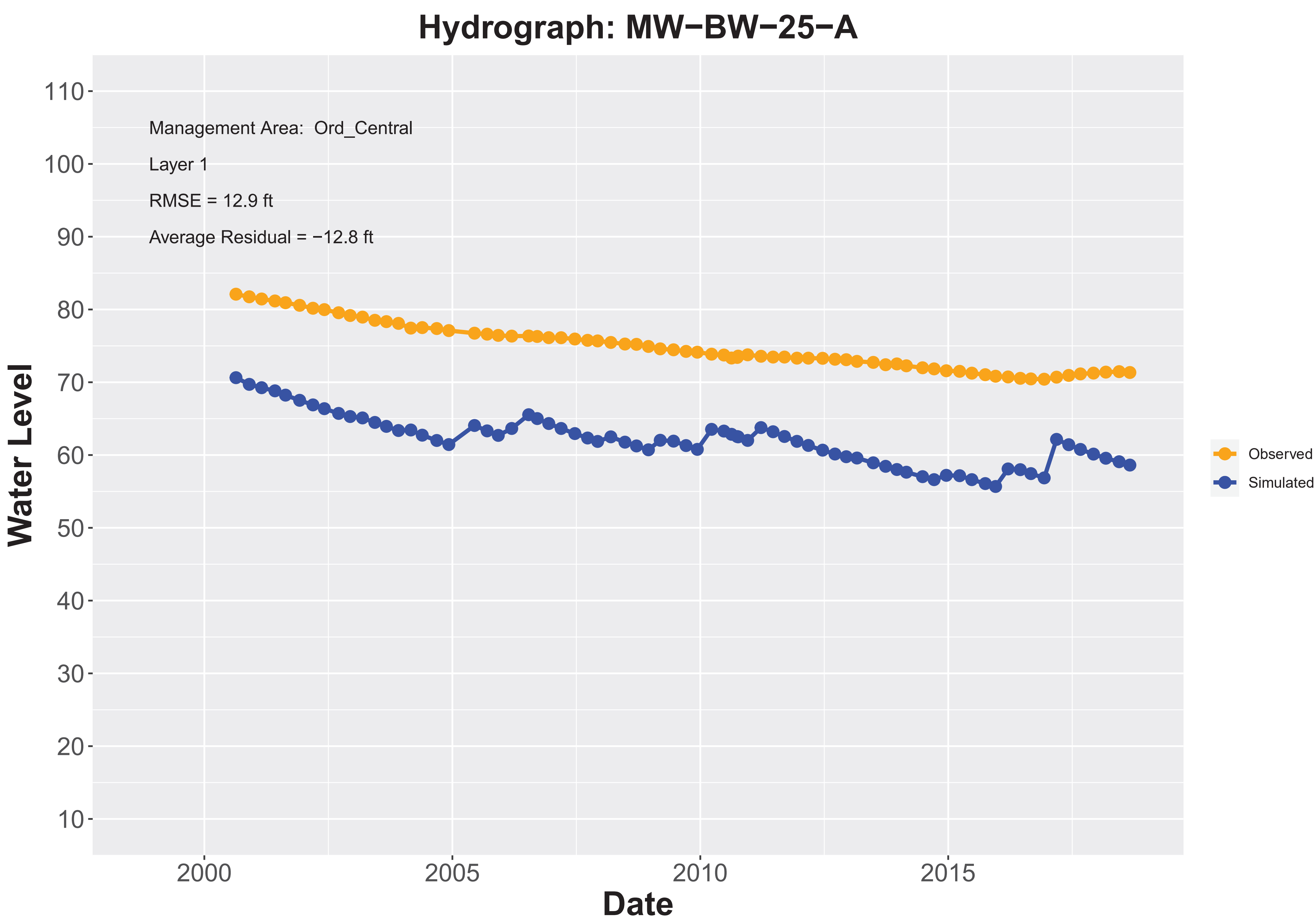


Hydrograph: MW−BW−22−180
Management Area: Ord_Central
Layer 3
RMSE = 2.2 ft
Average Residual = −1.3 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

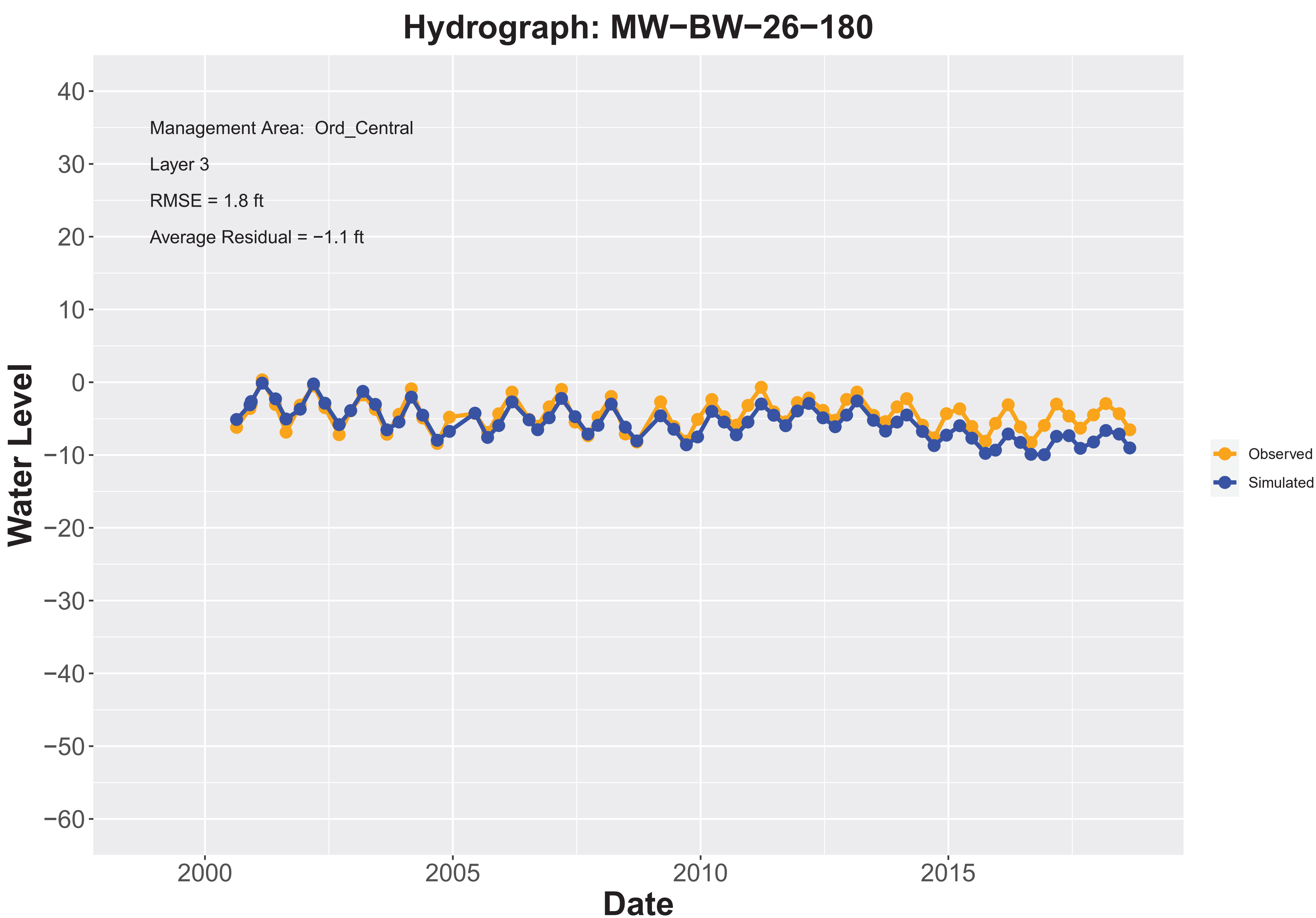

Hydrograph: MW−BW−23−A
Management Area: Ord_Central
Layer 1
RMSE = 11.9 ft
Average Residual = −11.8 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
Date
2000
2005
2010
2015
Observed
Simulated


Hydrograph: MW−BW−24−A
Management Area: Ord_Central
Layer 1
RMSE = 14.3 ft
Average Residual = −14.2 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

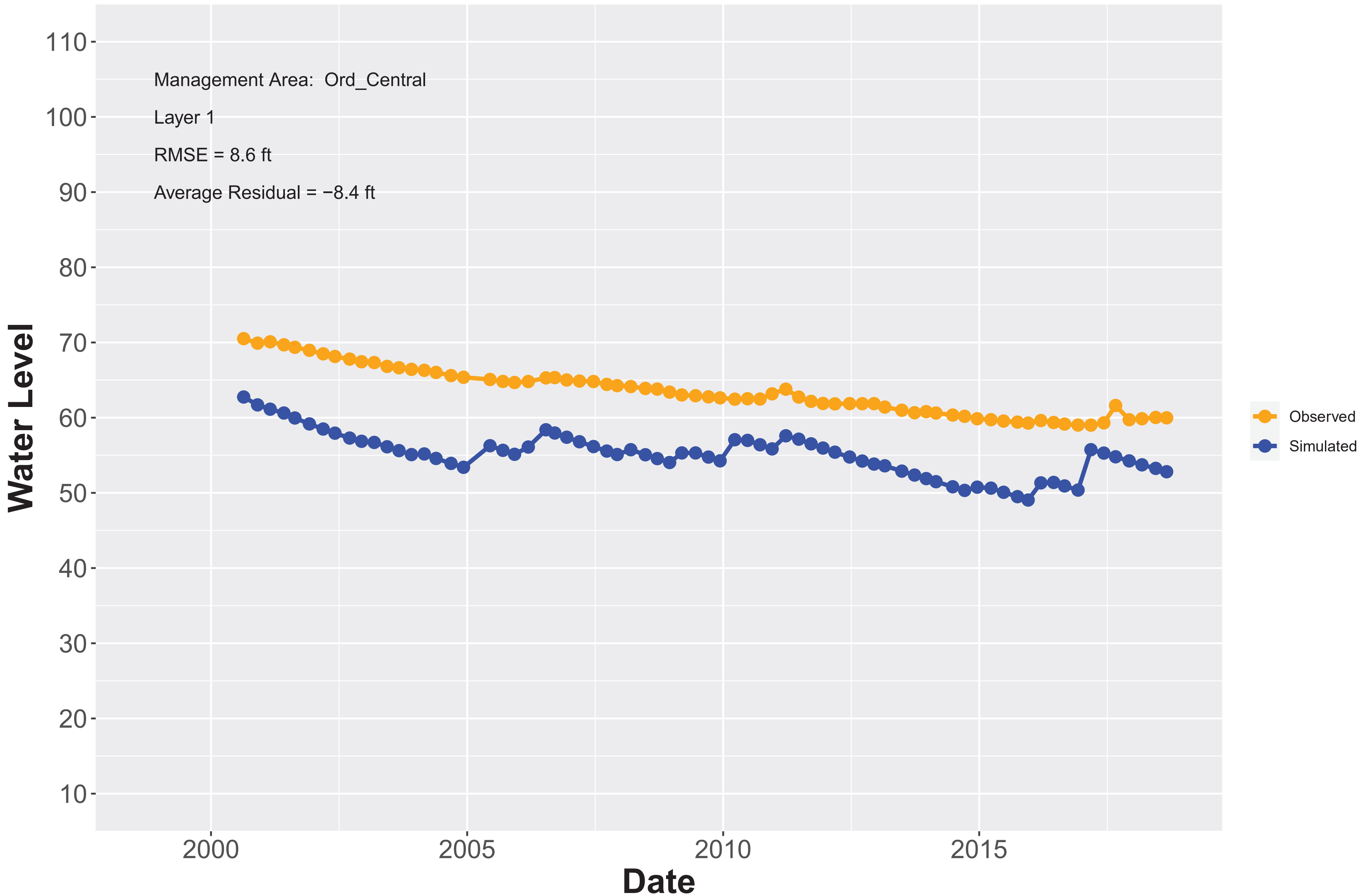

Hydrograph: MW−BW−25−180
Management Area: Ord_Central
Layer 3
RMSE = 1.1 ft
Average Residual = 0.3 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

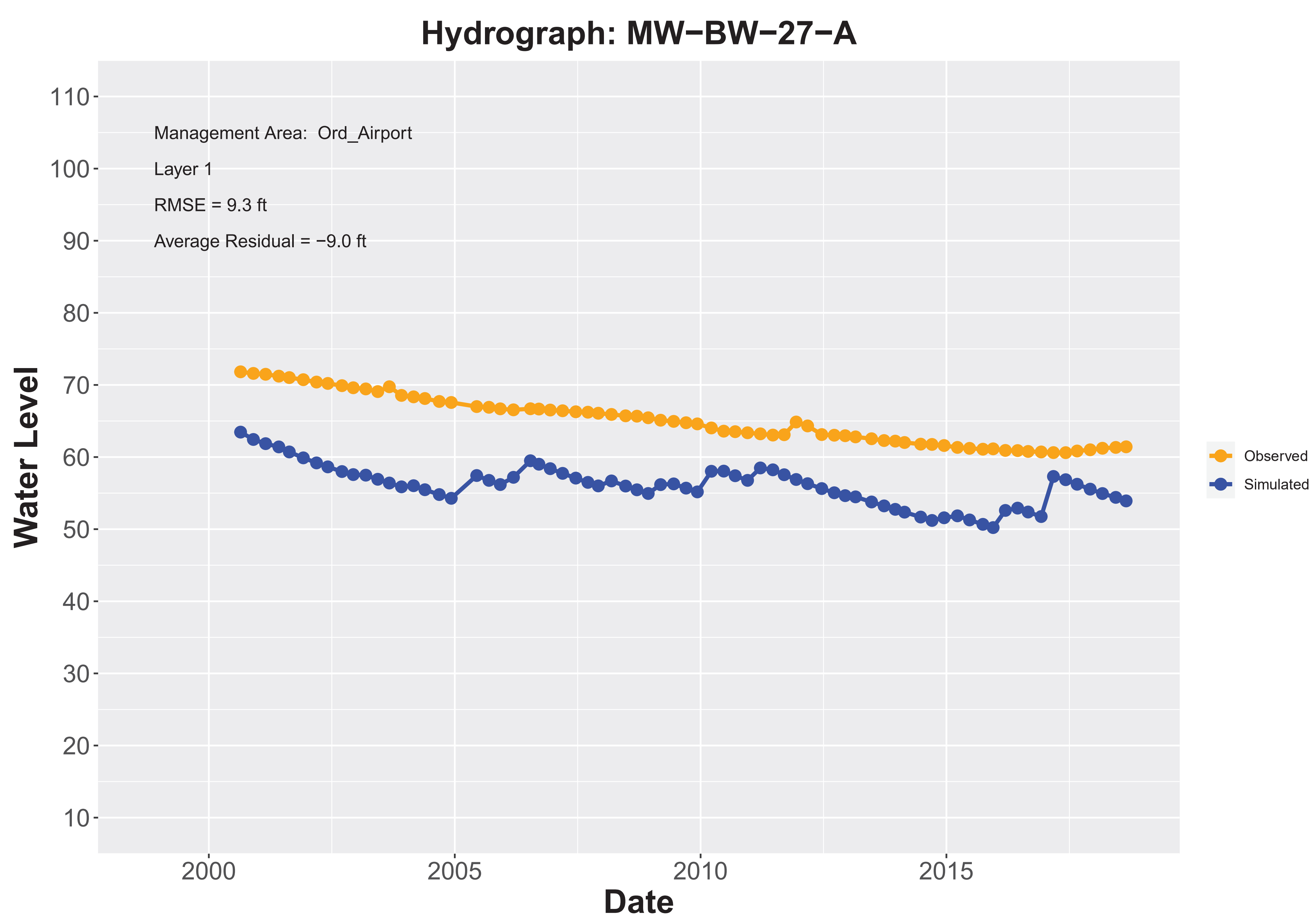


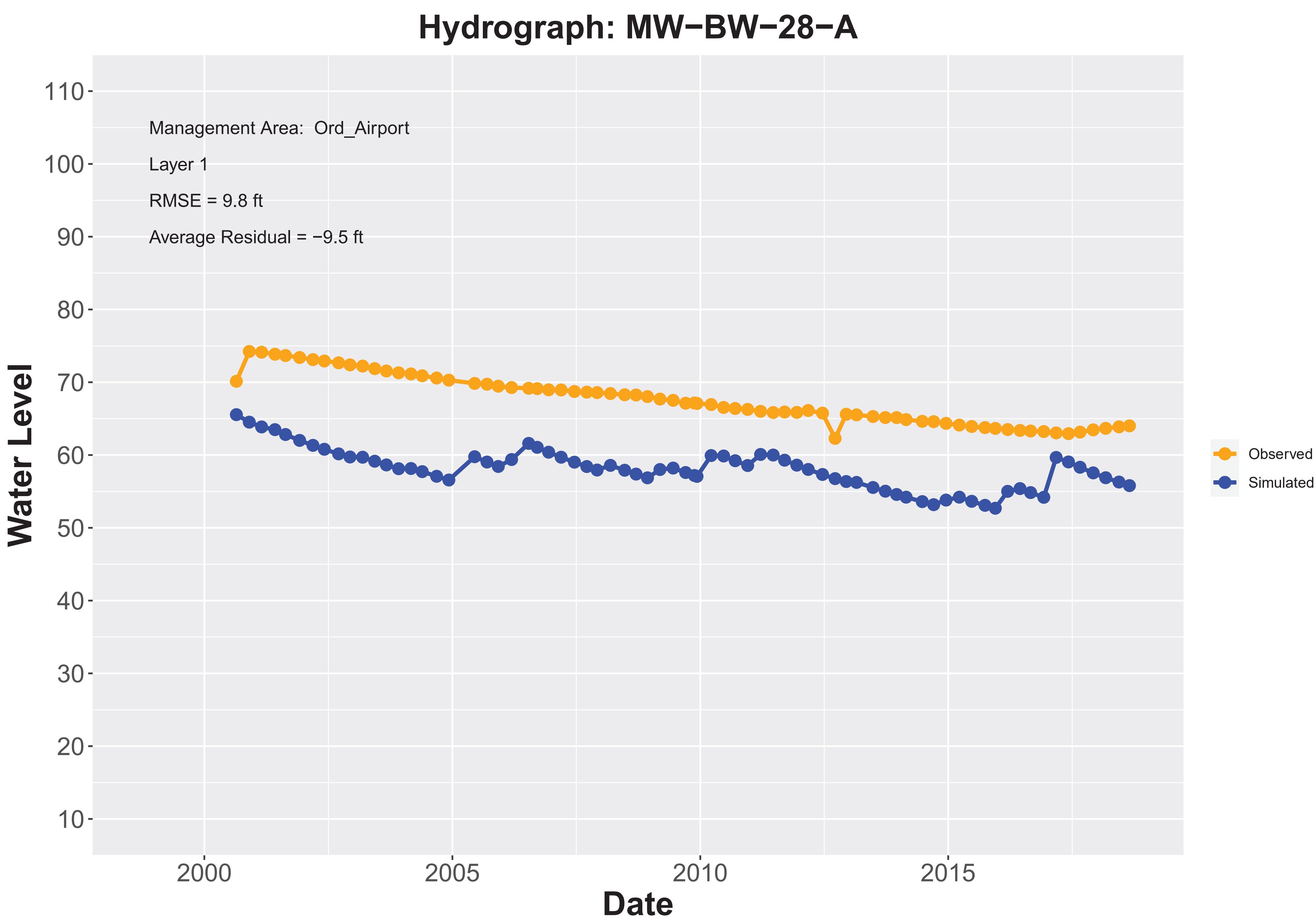
Hydrograph: MW−BW−25−A
Management Area: Ord_Central
Layer 1
RMSE = 12.9 ft
Average Residual = −12.8 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−BW−26−180
Management Area: Ord_Central
Layer 3
RMSE = 1.8 ft
Average Residual = −1.1 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−BW−26−A

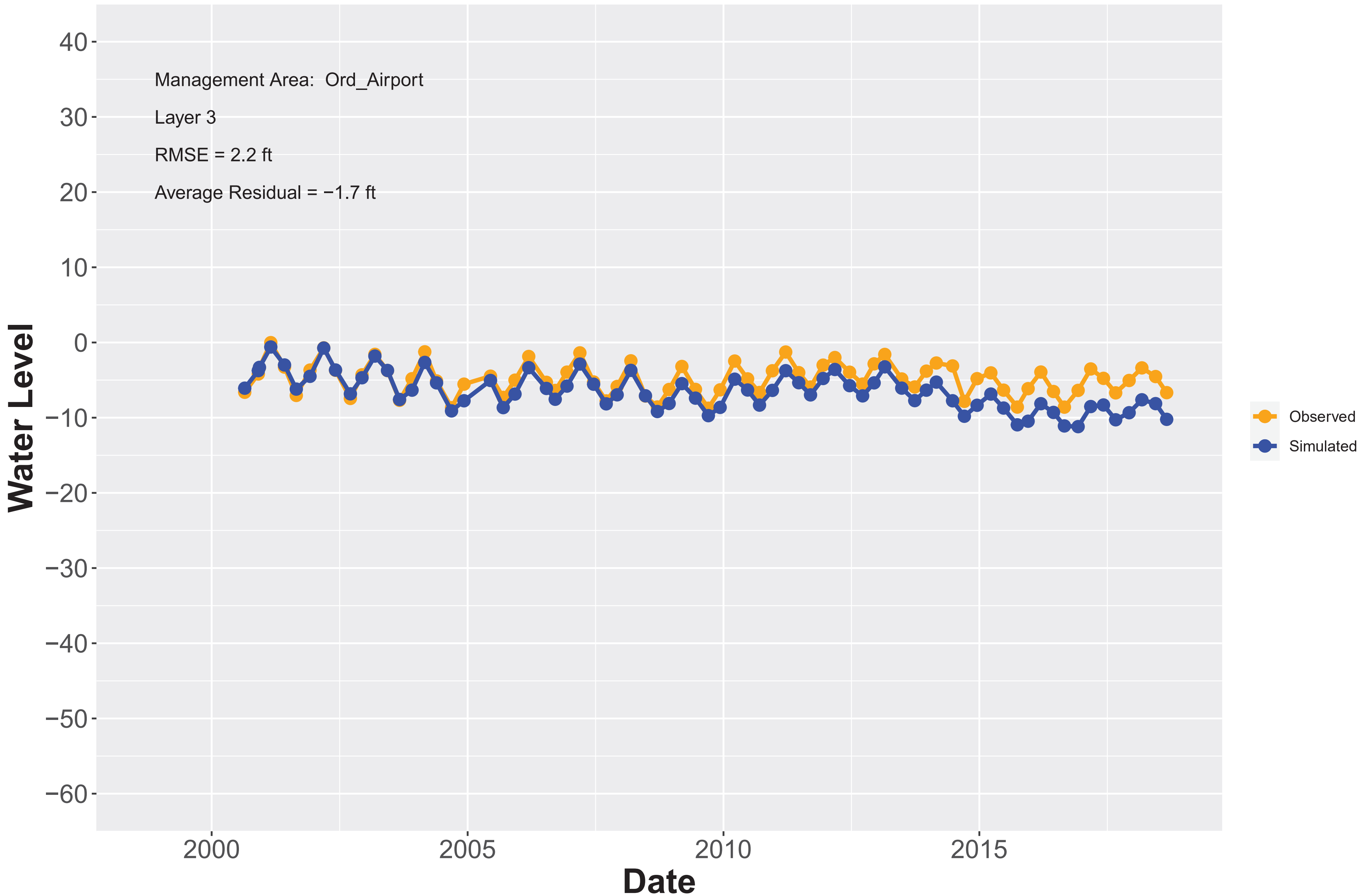


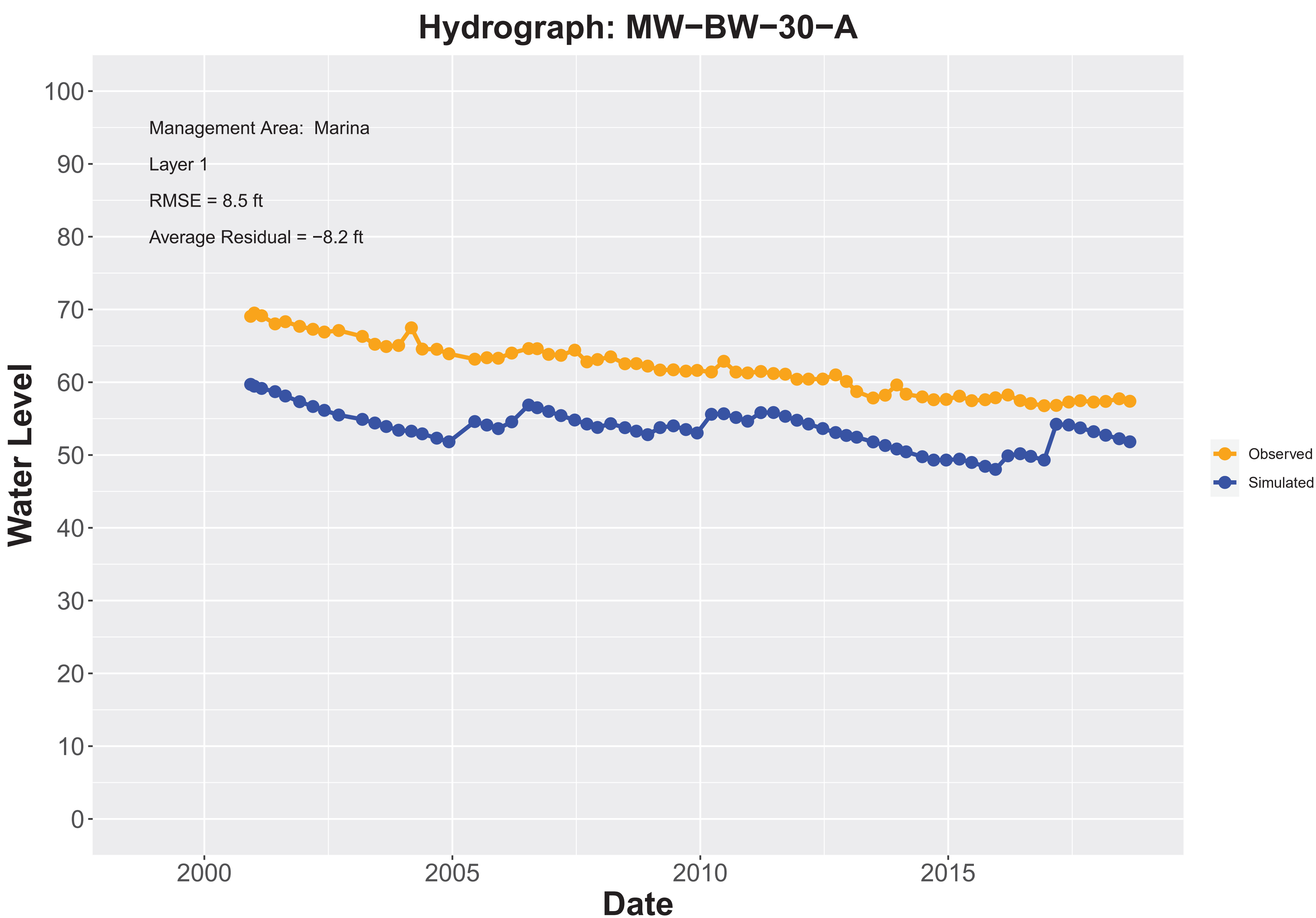

Hydrograph: MW−BW−27−A
Management Area: Ord_Airport
Layer 1
RMSE = 9.3 ft
Average Residual = −9.0 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



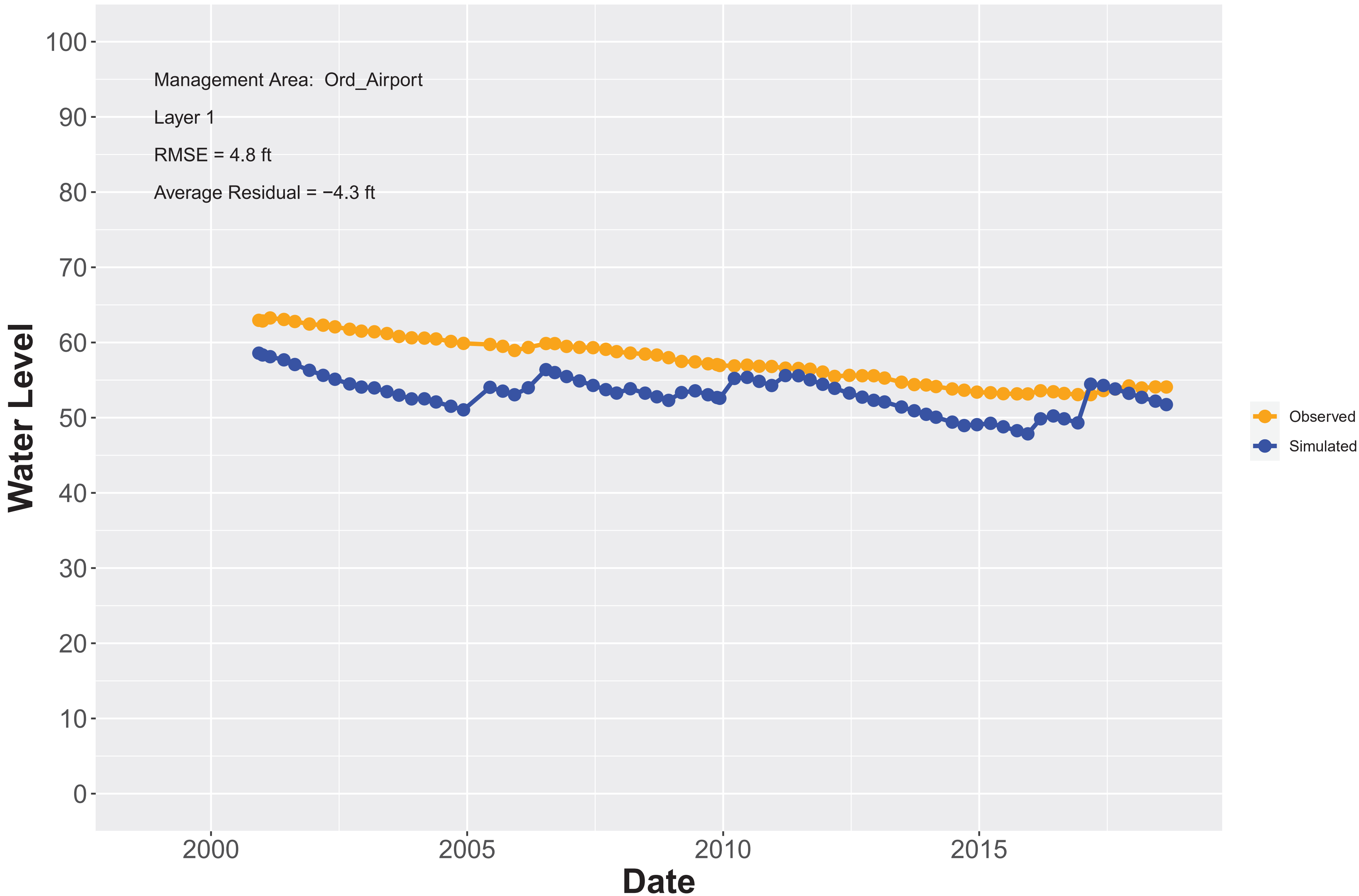
Hydrograph: MW−BW−28−A
Management Area: Ord_Airport
Layer 1
RMSE = 9.8 ft
Average Residual = −9.5 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−BW−29−180

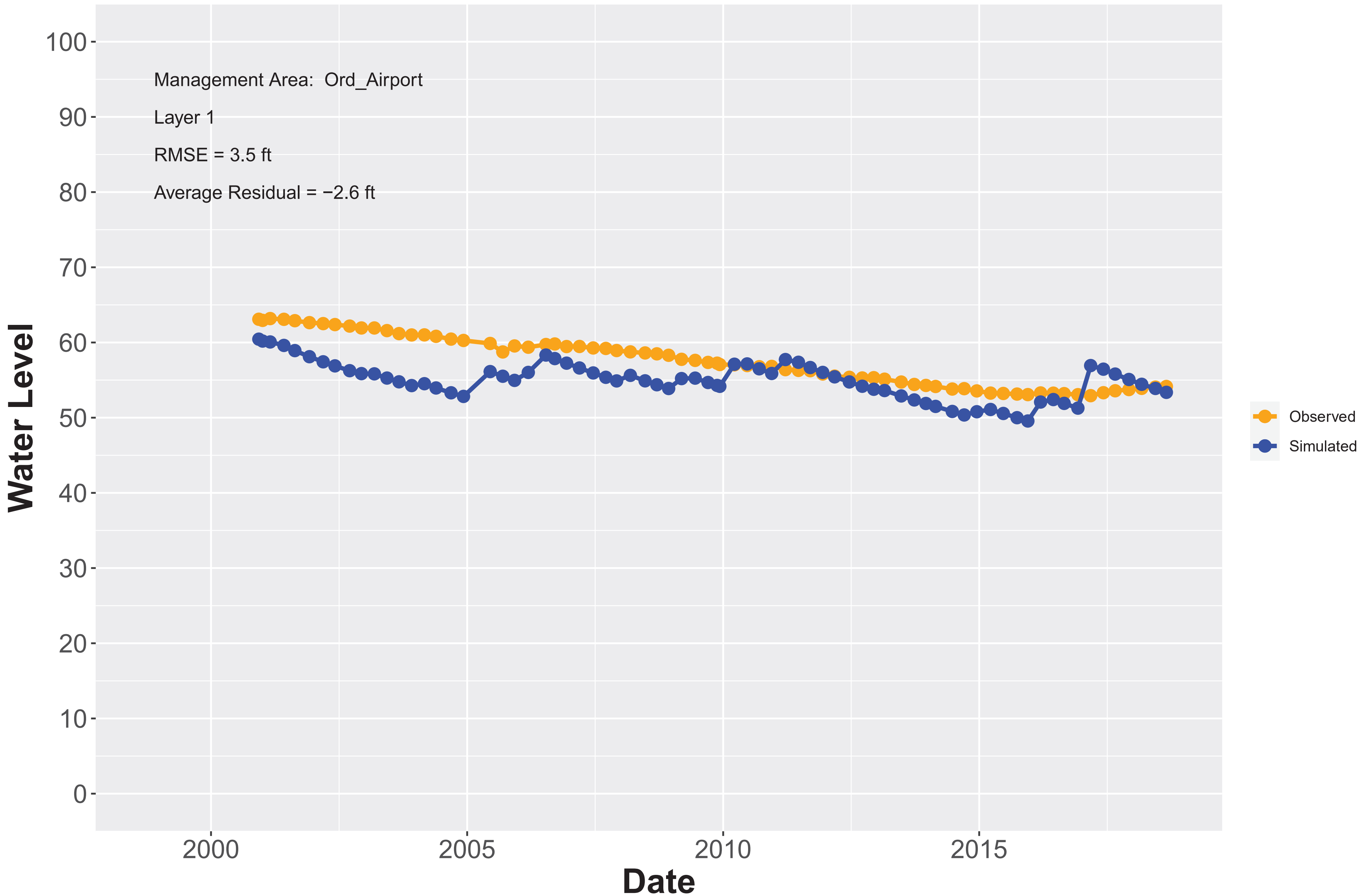


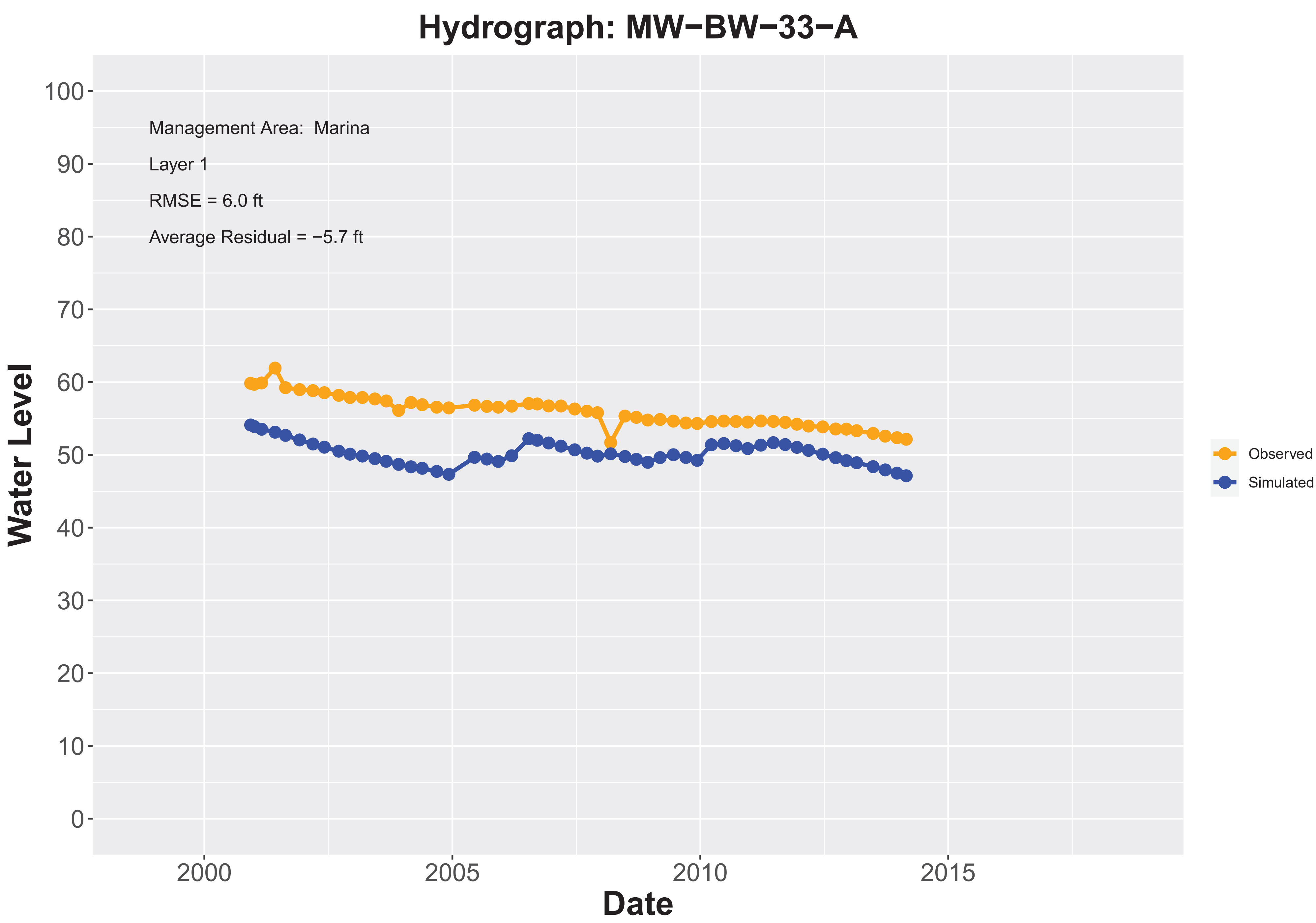

Hydrograph: MW−BW−30−A
Management Area: Marina
Layer 1
RMSE = 8.5 ft
Average Residual = −8.2 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−BW−31−A

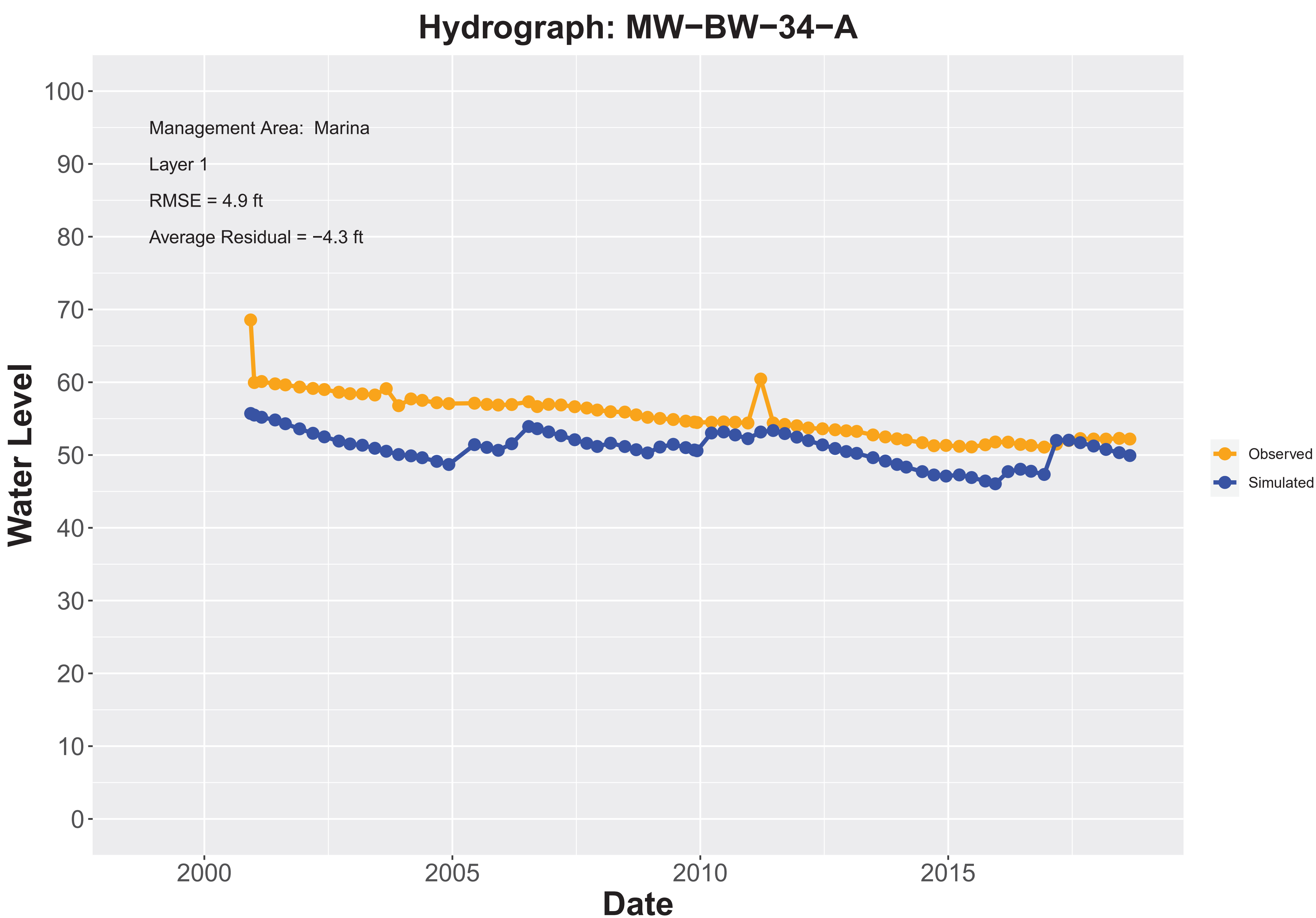


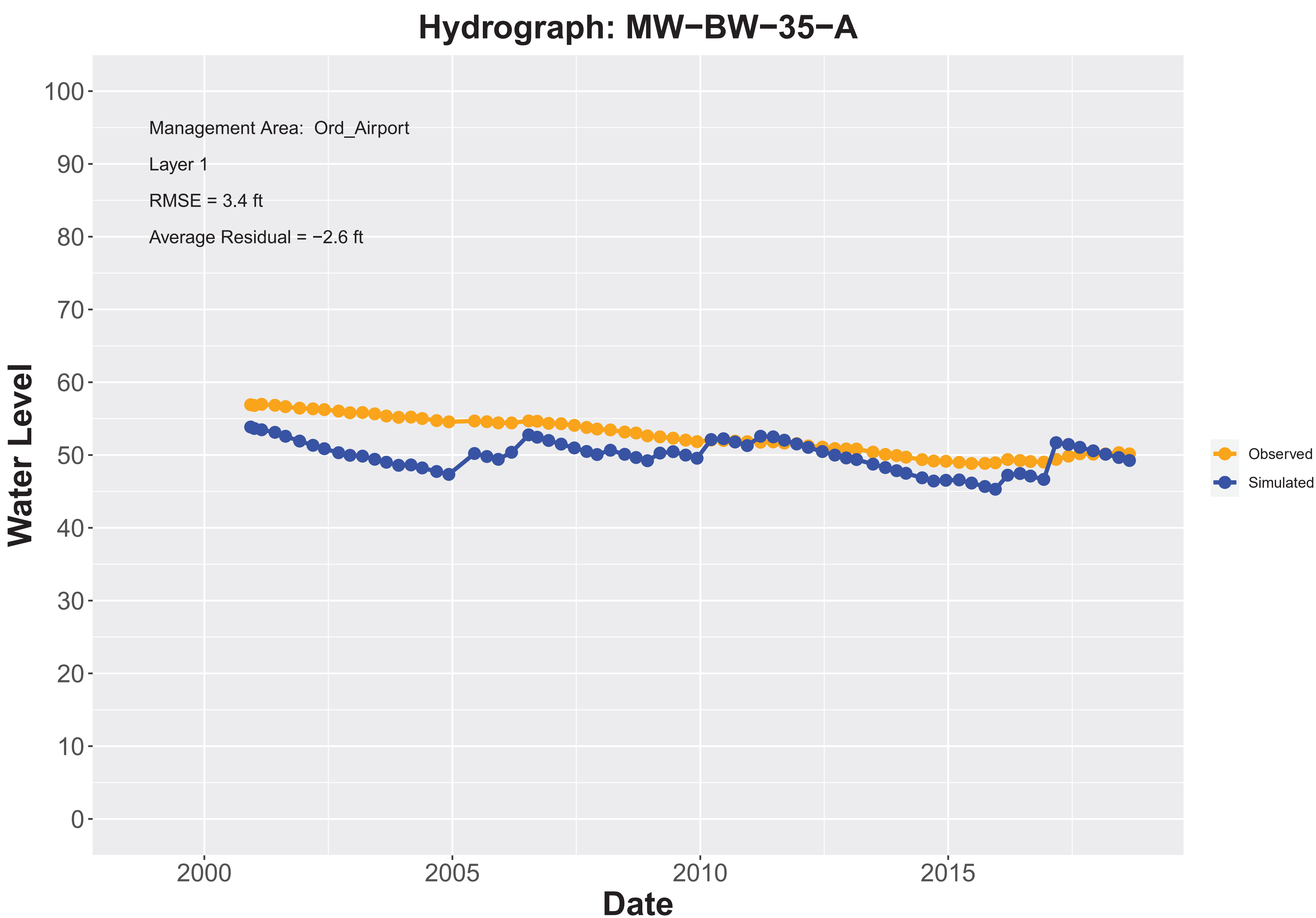
Hydrograph: MW−BW−32−A



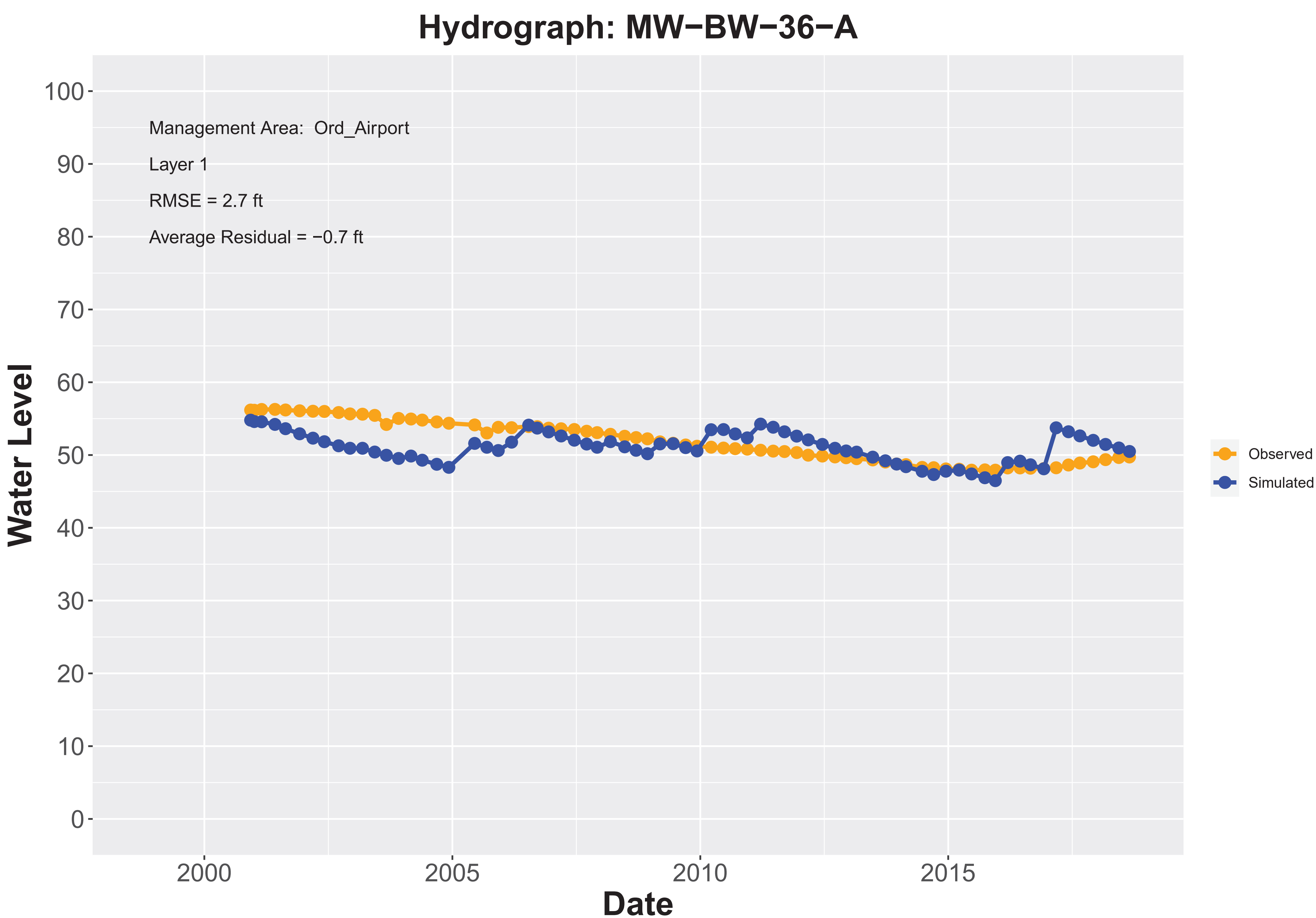


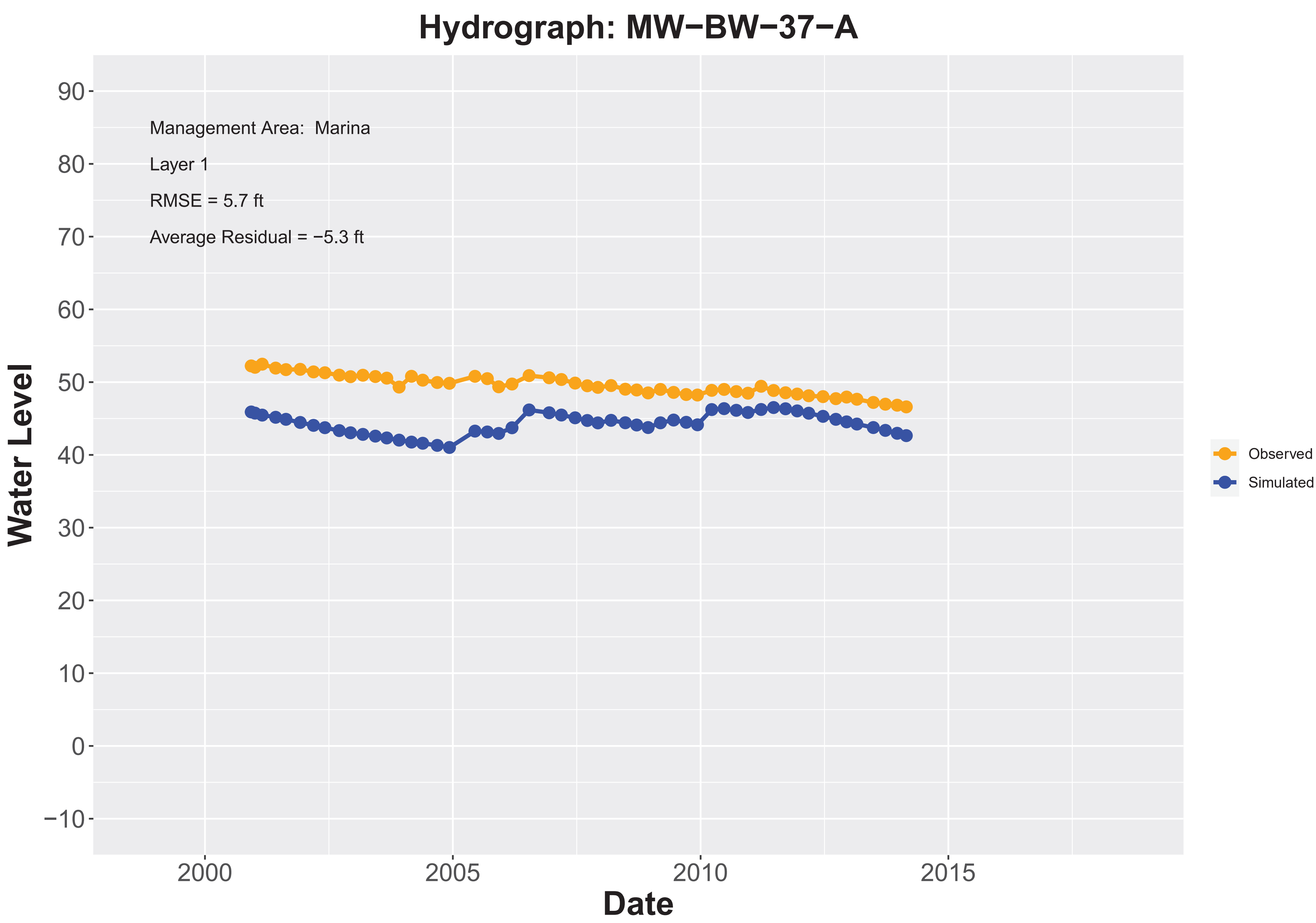
Hydrograph: MW−BW−33−A
Management Area: Marina
Layer 1
RMSE = 6.0 ft
Average Residual = −5.7 ft
Water Level
0
10
20
30
40
50
60
70
80
90
100
Date
2000
2005
2010
2015
Observed
Simulated


Hydrograph: MW−BW−34−A
Management Area: Marina
Layer 1
RMSE = 4.9 ft
Average Residual = −4.3 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

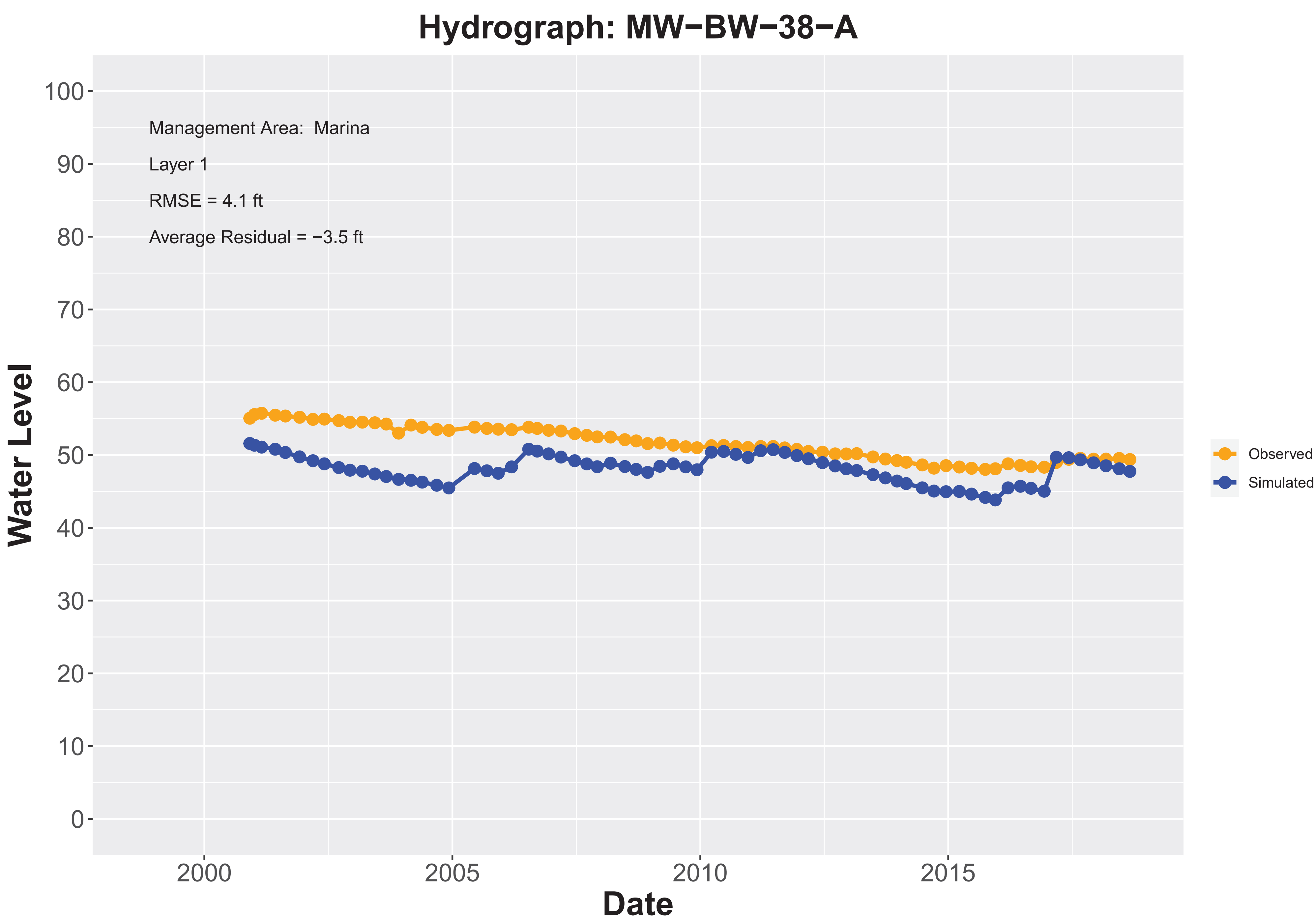


Hydrograph: MW−BW−35−A
Management Area: Ord_Airport
Layer 1
RMSE = 3.4 ft
Average Residual = −2.6 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−BW−36−A
Management Area: Ord_Airport
Layer 1
RMSE = 2.7 ft
Average Residual = −0.7 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

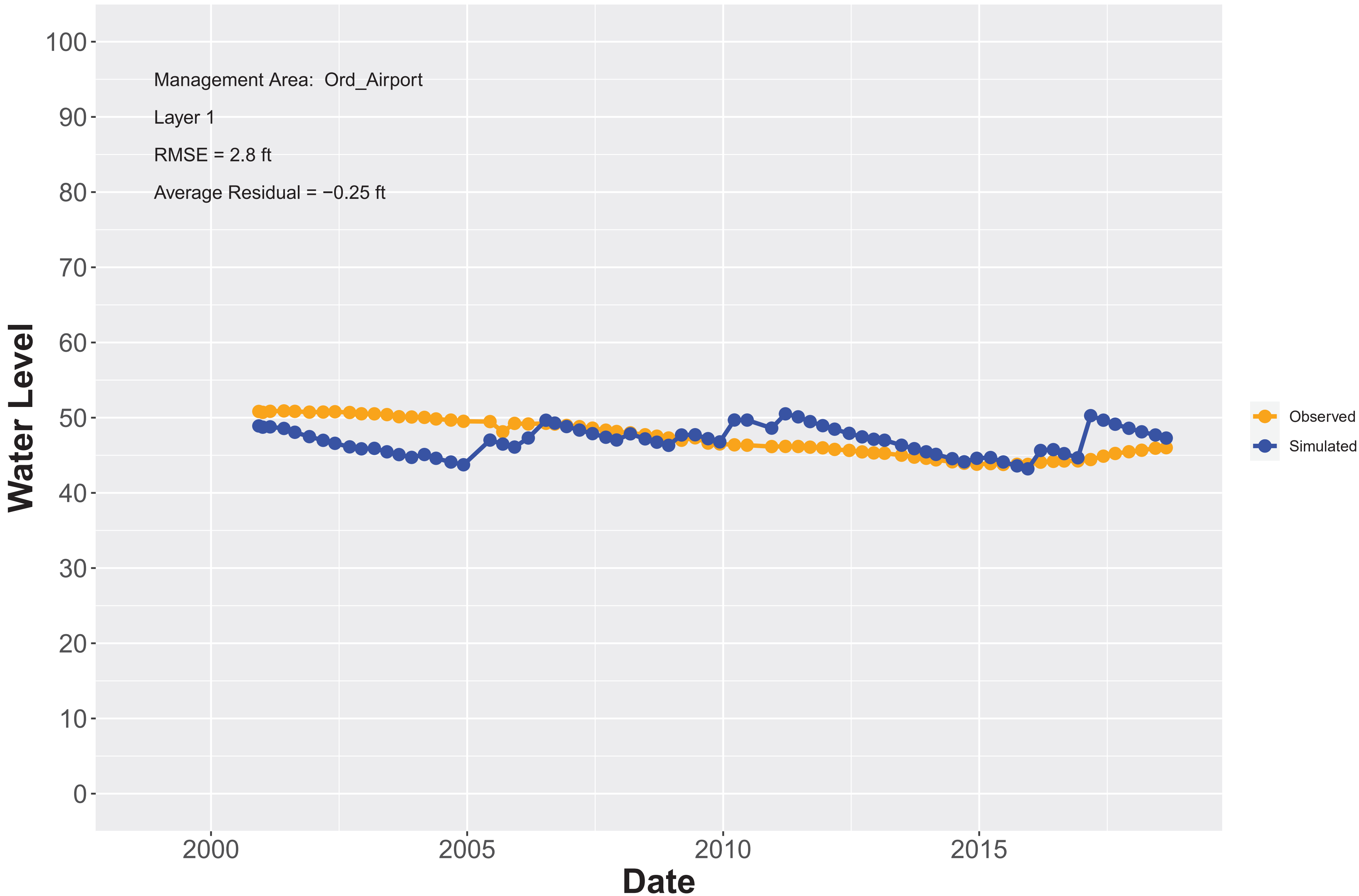


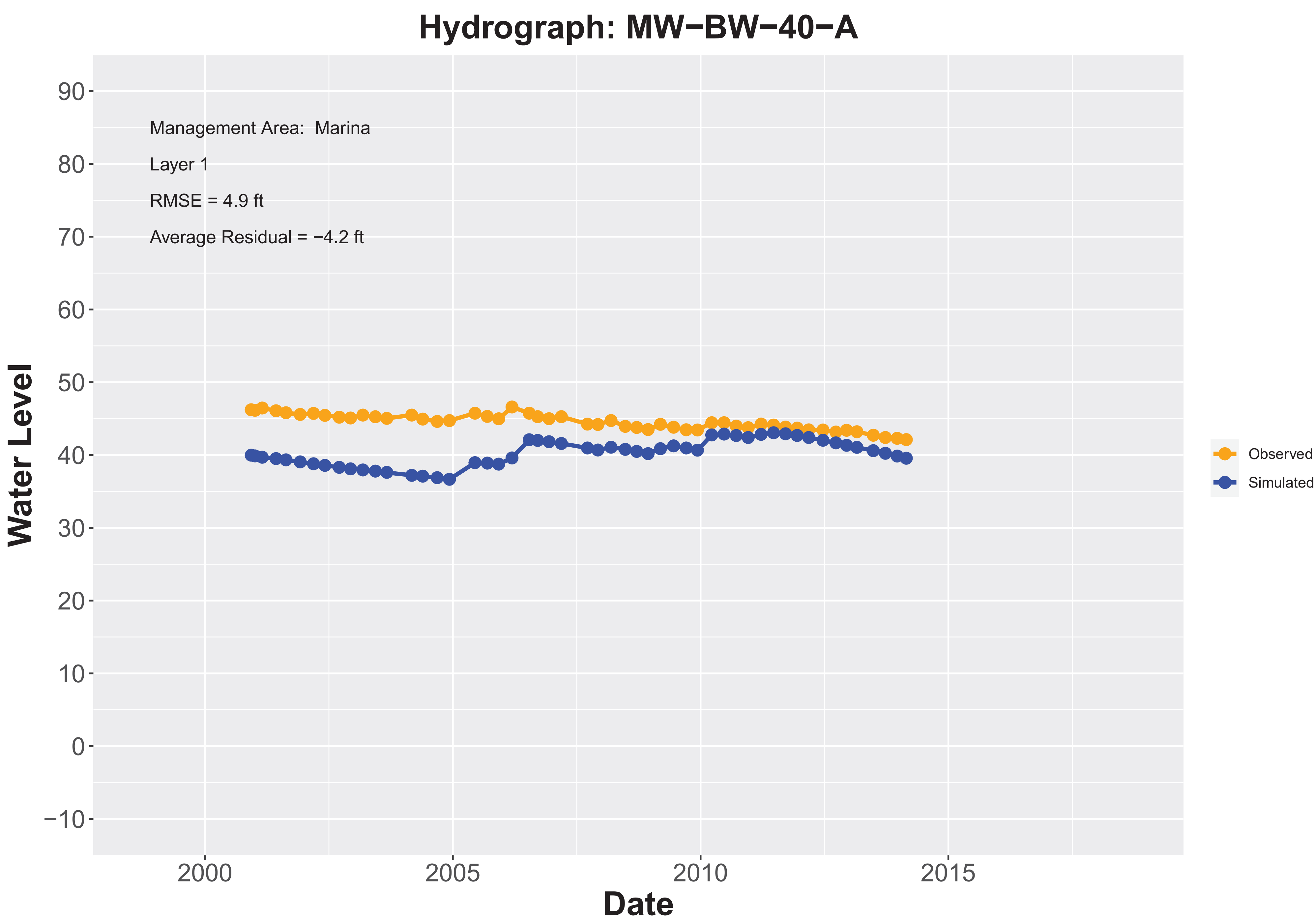
Hydrograph: MW−BW−37−A
Management Area: Marina
Layer 1
RMSE = 5.7 ft
Average Residual = −5.3 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated



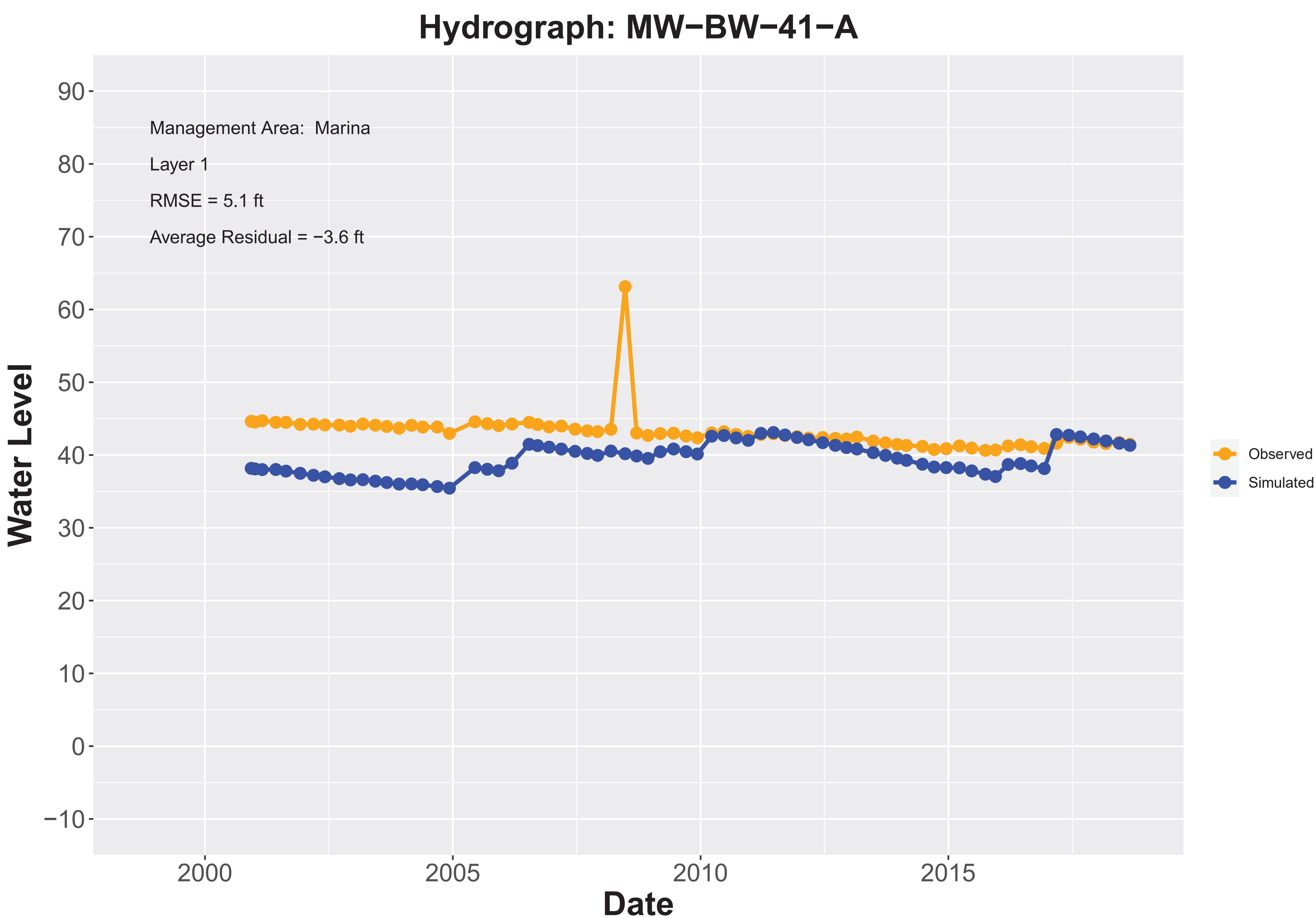
Hydrograph: MW−BW−38−A
Management Area: Marina
Layer 1
RMSE = 4.1 ft
Average Residual = −3.5 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

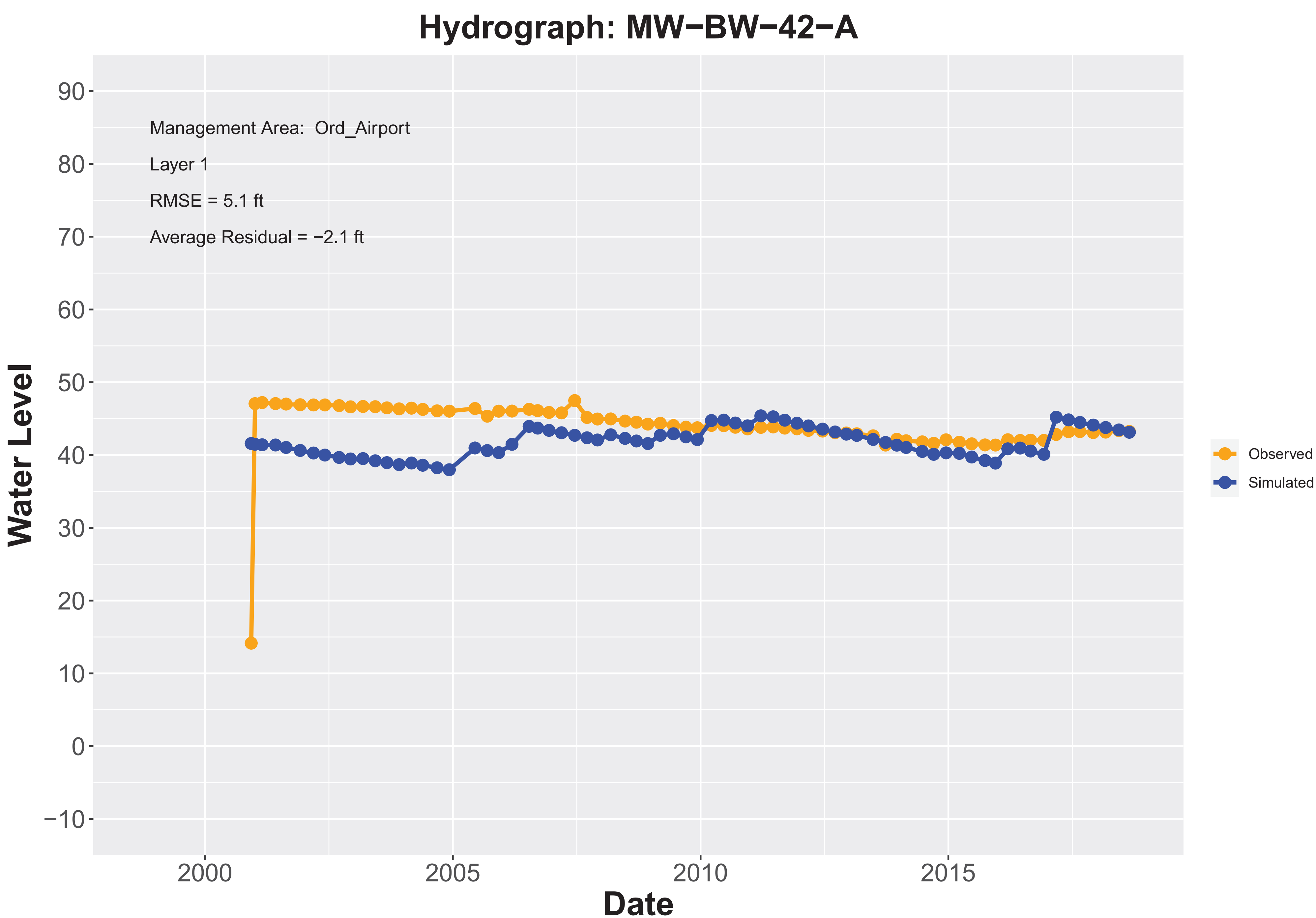
Hydrograph: MW−BW−39−A



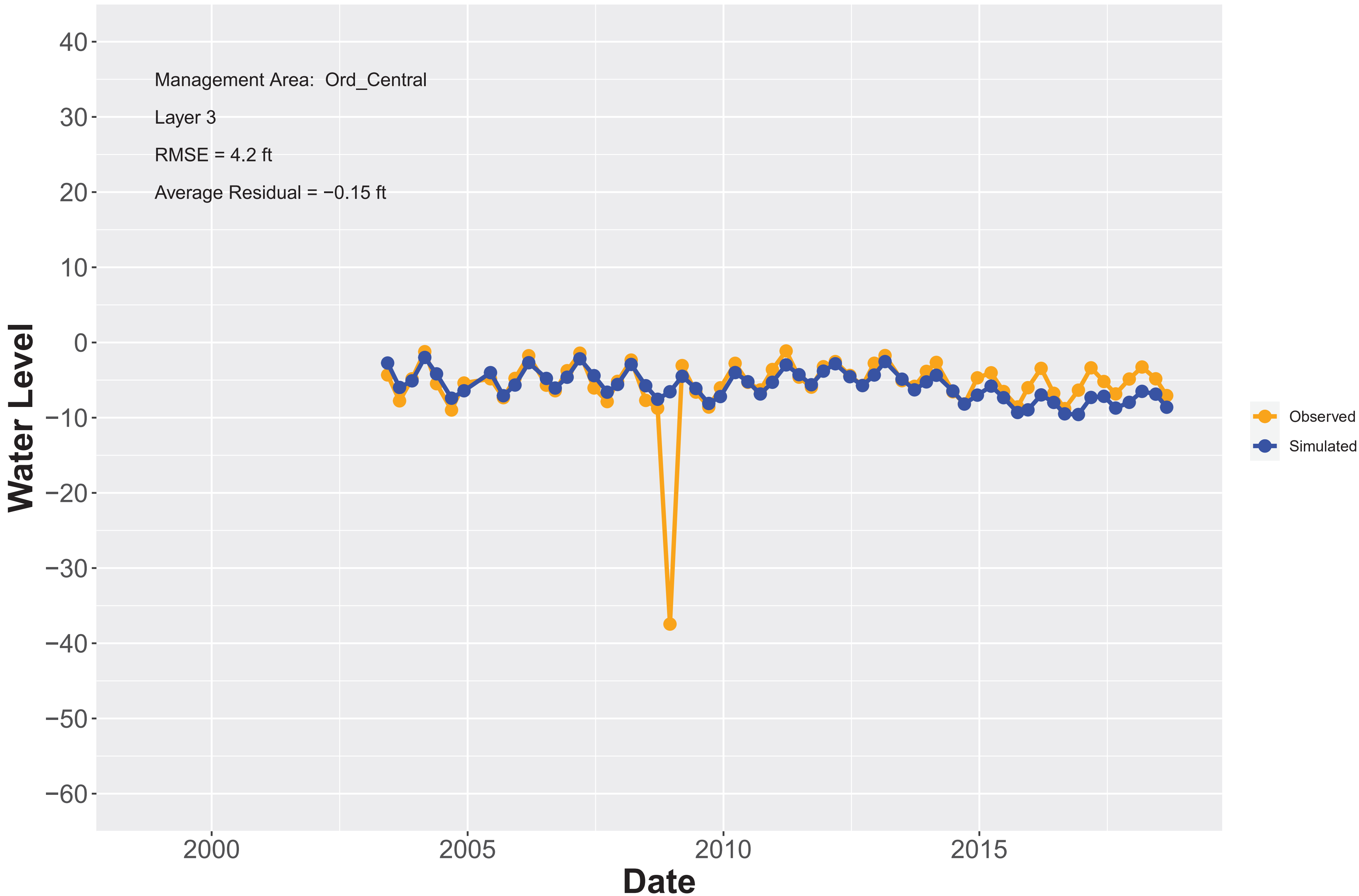


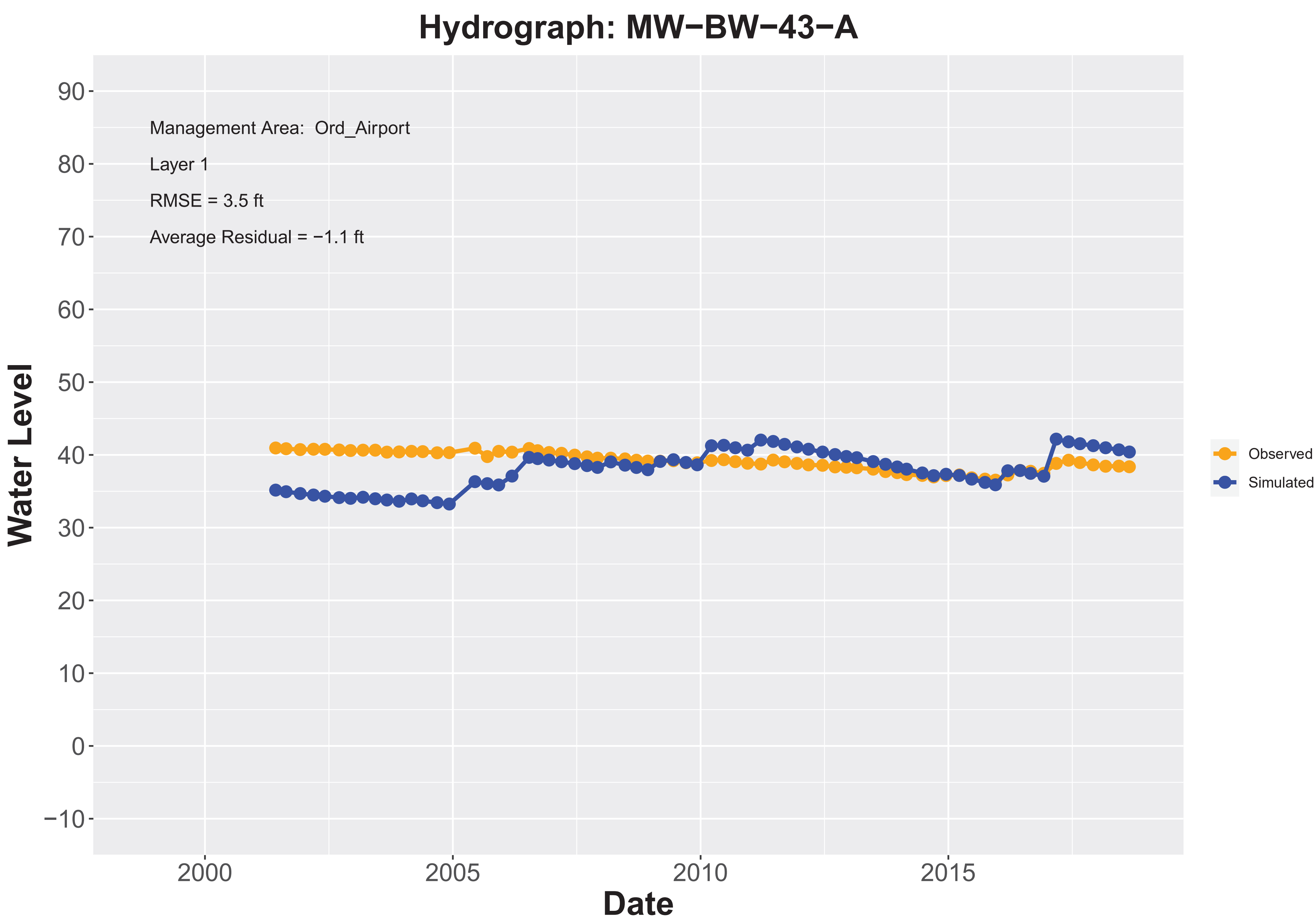
Hydrograph: MW−BW−40−A
Management Area: Marina
Layer 1
RMSE = 4.9 ft
Average Residual = −4.2 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−BW−41−A
Management Area: Marina
Layer 1
RMSE = 5.1 ft
Average Residual = −3.6 ft
Water Level
Date
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Observed
Simulated

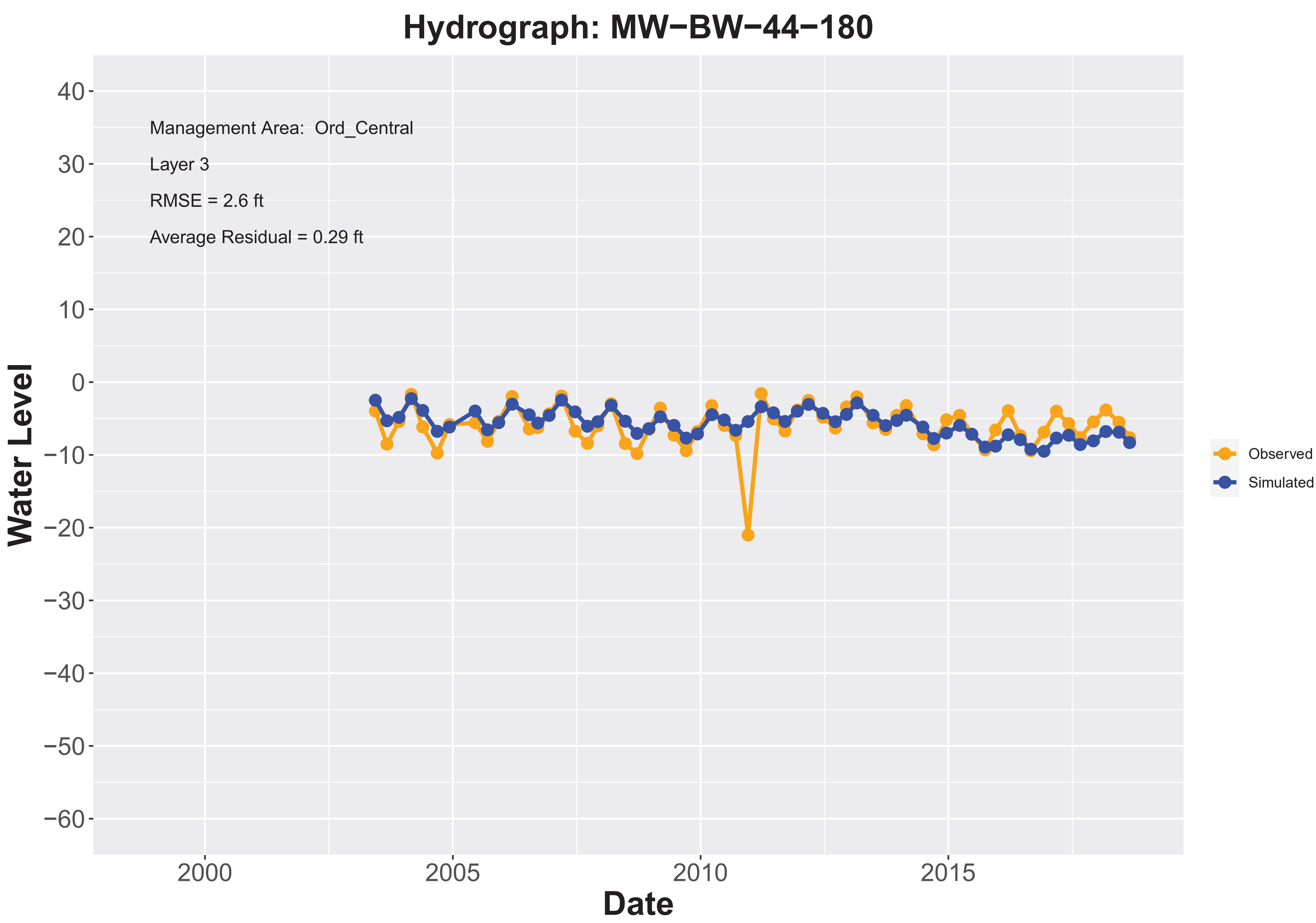

Hydrograph: MW−BW−42−A
Management Area: Ord_Airport
Layer 1
RMSE = 5.1 ft
Average Residual = −2.1 ft
Water Level
Date
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Observed
Simulated

Hydrograph: MW−BW−43−180

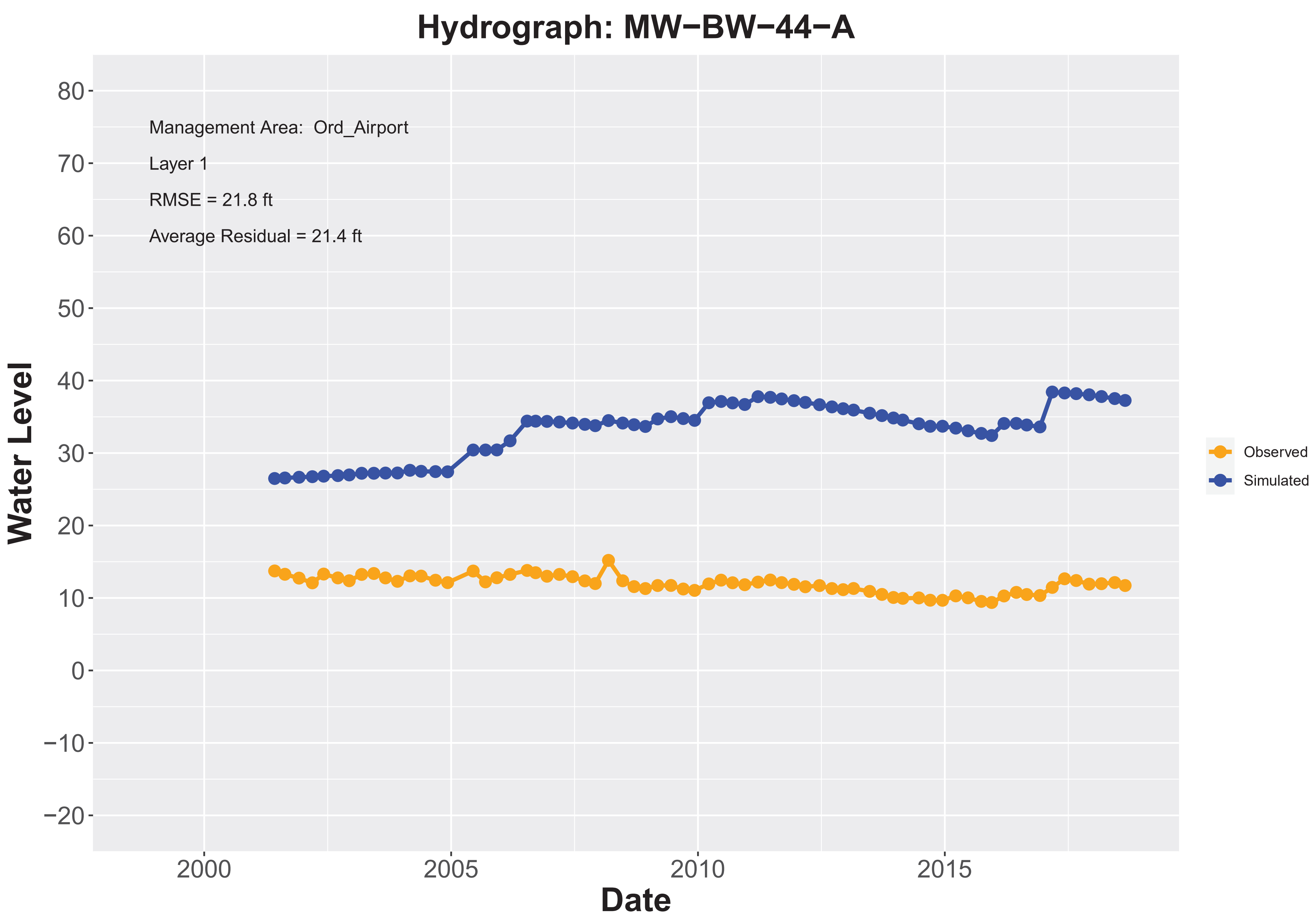


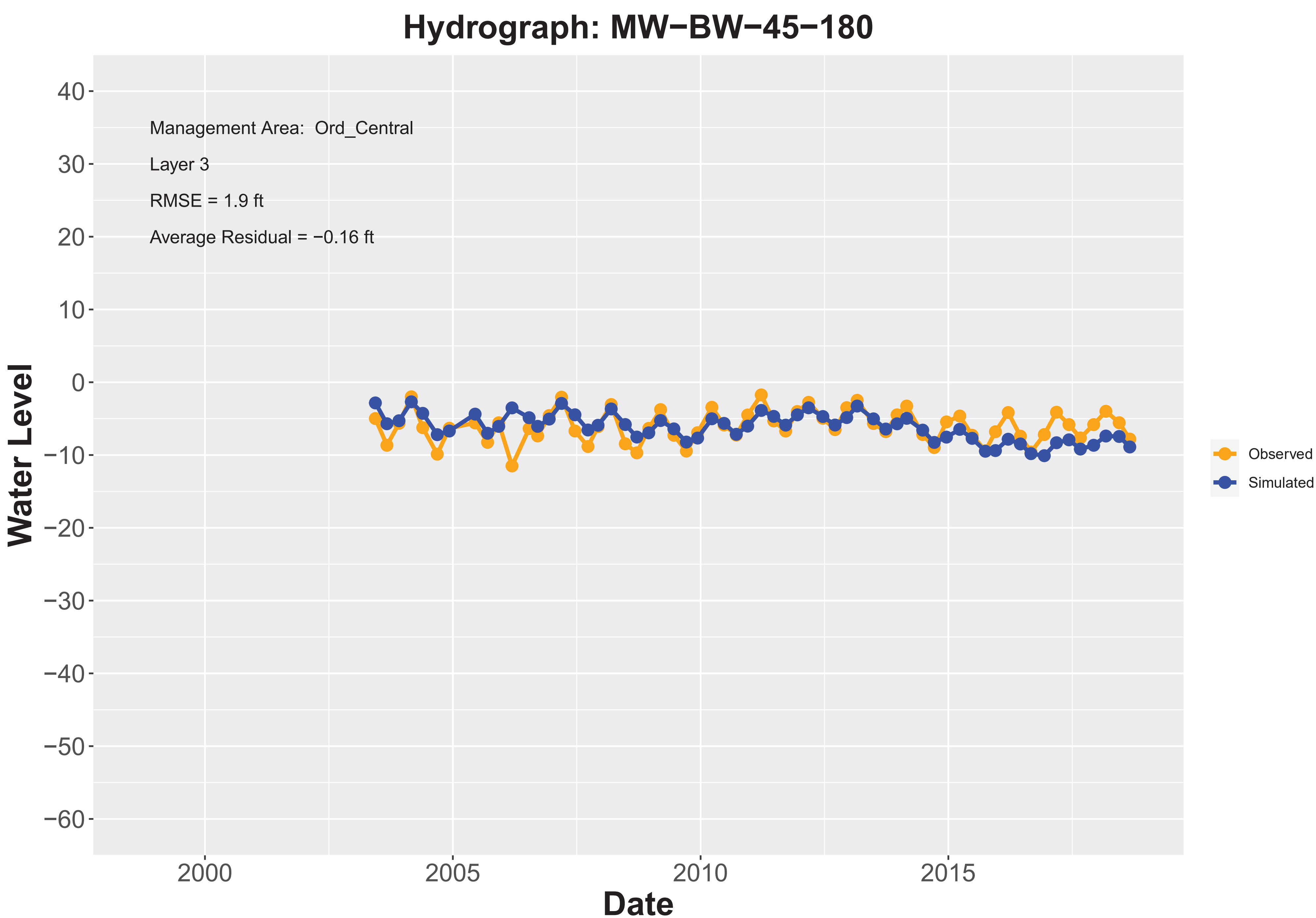


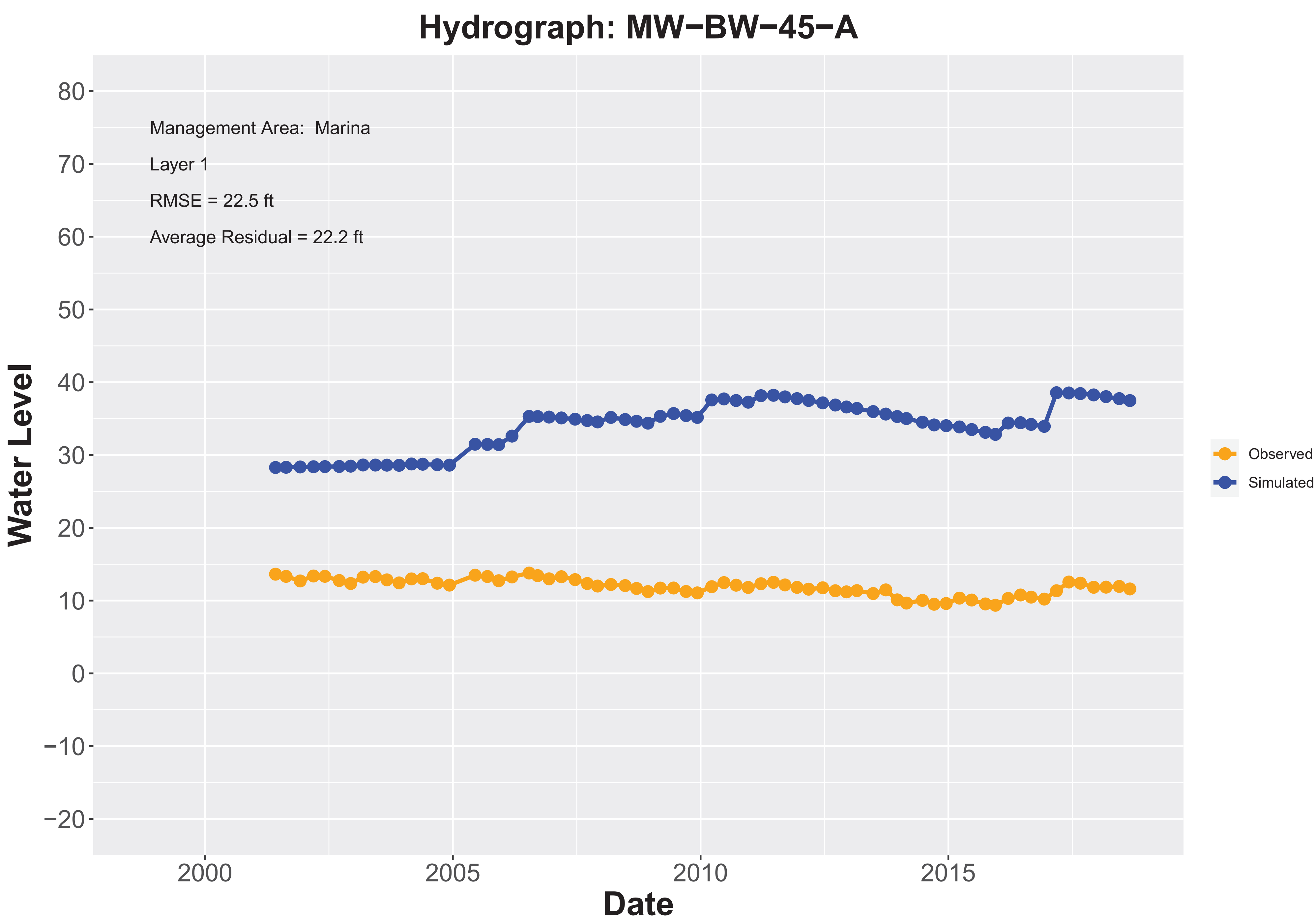
Hydrograph: MW−BW−43−A
Management Area: Ord_Airport
Layer 1
RMSE = 3.5 ft
Average Residual = −1.1 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated



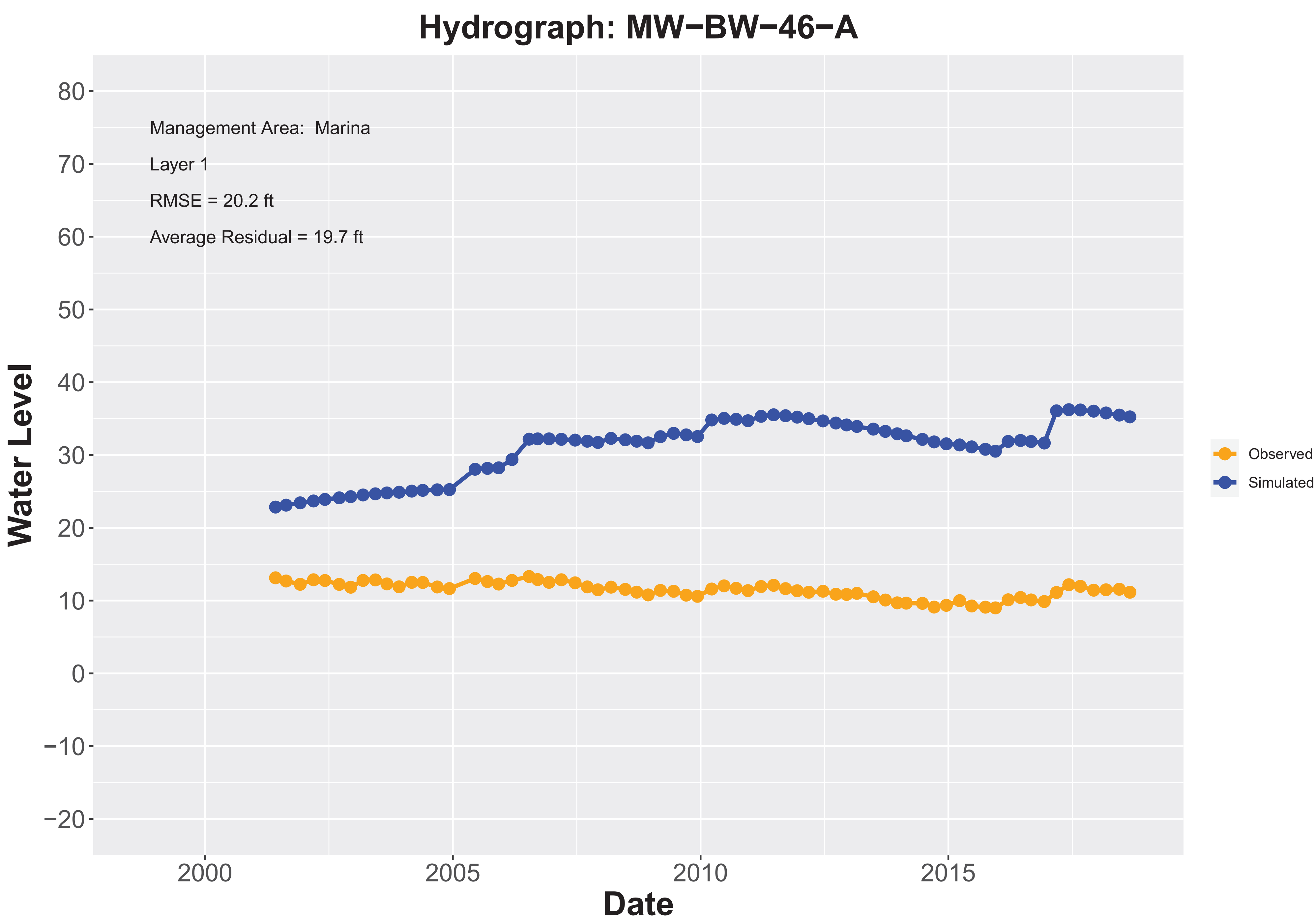
Hydrograph: MW−BW−44−180
Management Area: Ord_Central
Layer 3
RMSE = 2.6 ft
Average Residual = 0.29 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

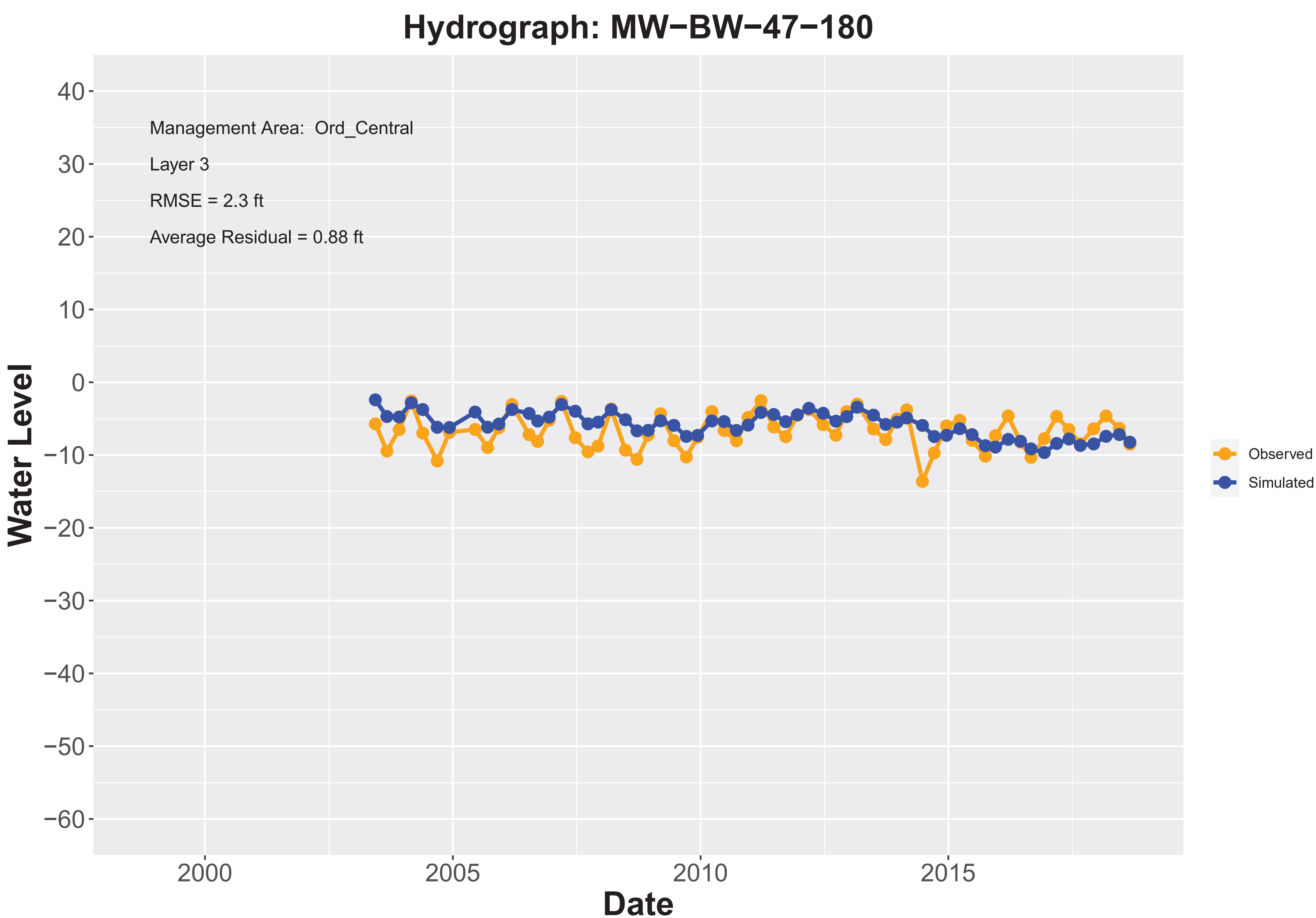

Hydrograph: MW−BW−44−A
Management Area: Ord_Airport
Layer 1
RMSE = 21.8 ft
Average Residual = 21.4 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−BW−45−180
Management Area: Ord_Central
Layer 3
RMSE = 1.9 ft
Average Residual = −0.16 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

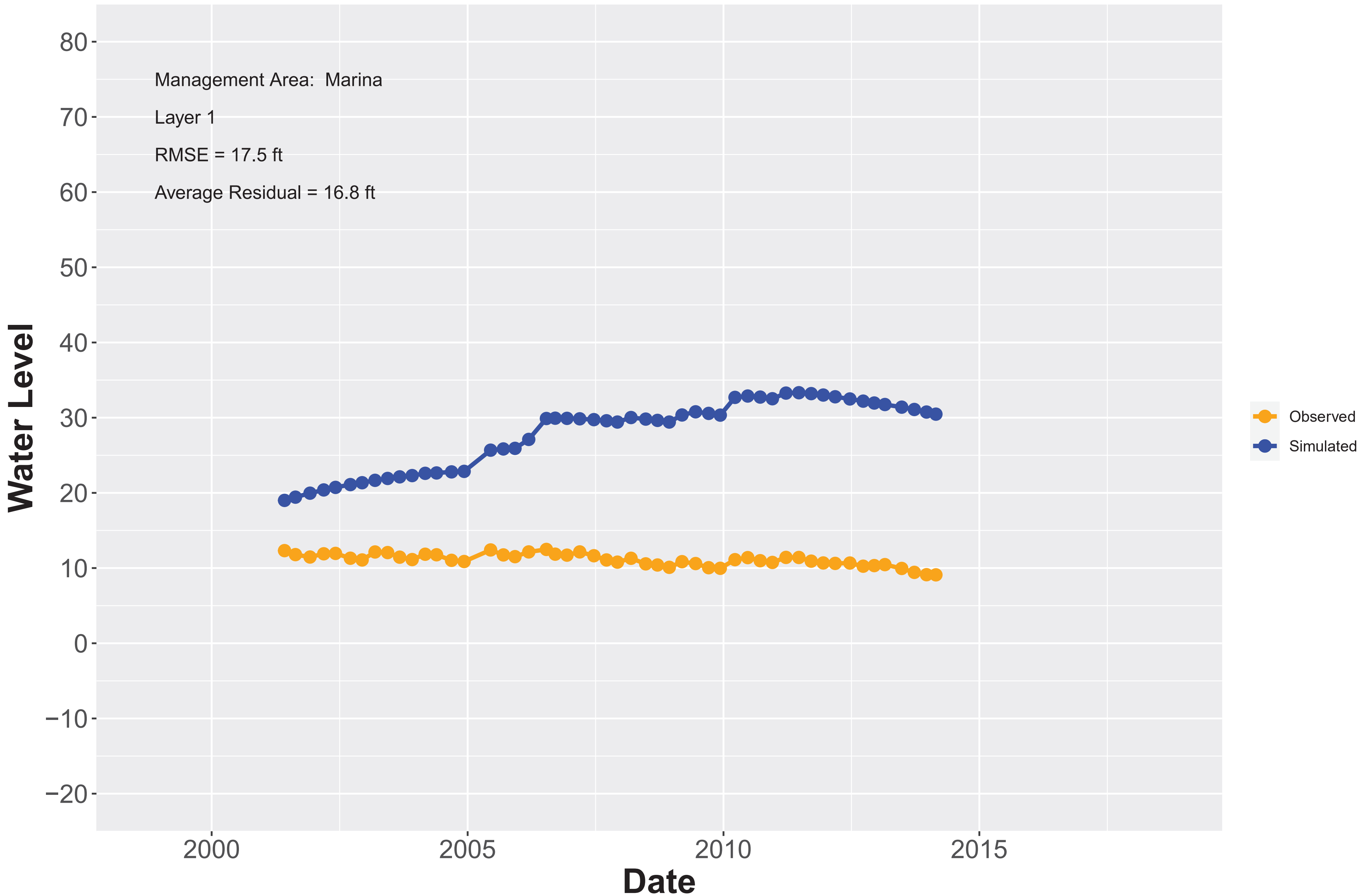


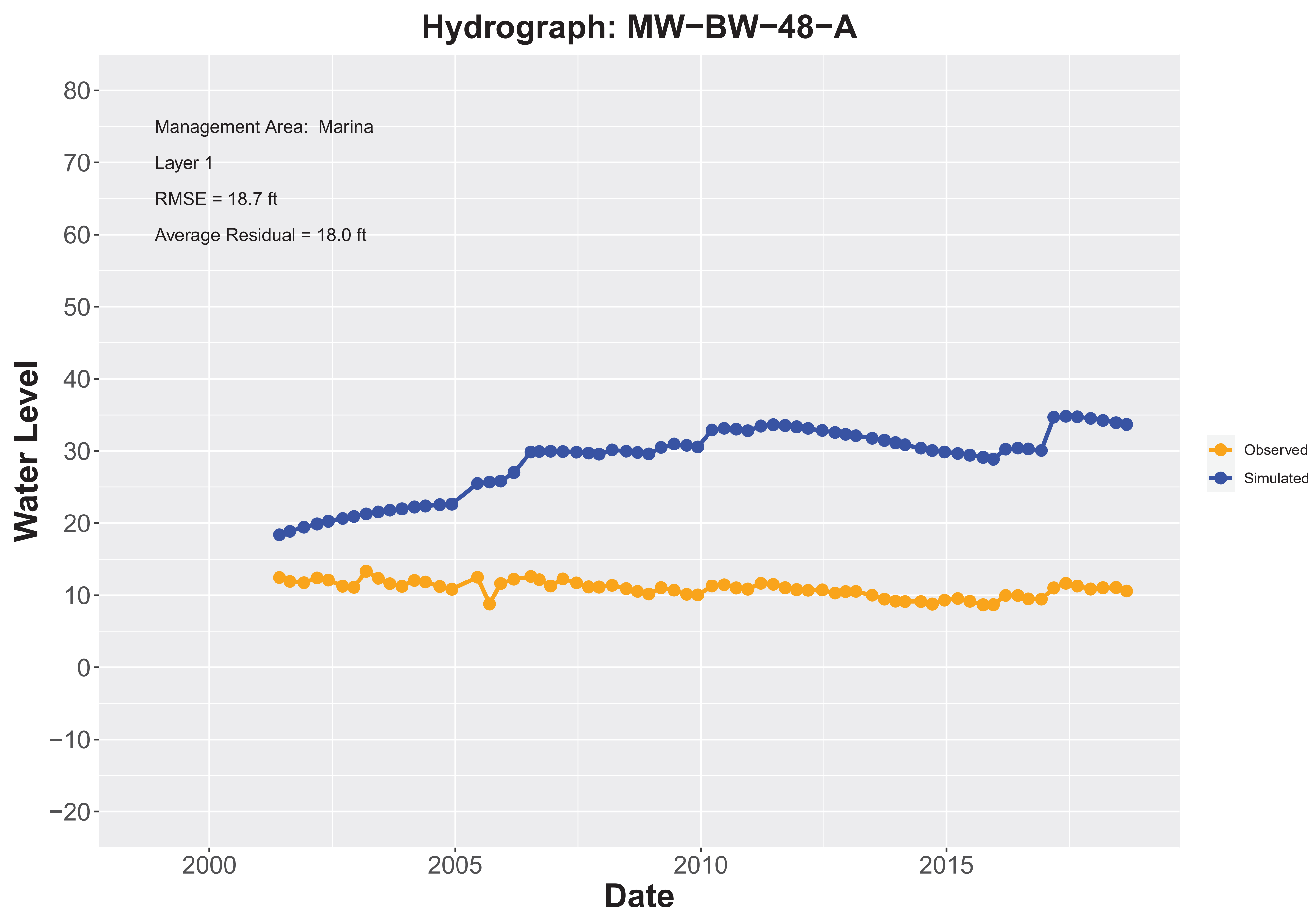
Hydrograph: MW−BW−45−A
Management Area: Marina
Layer 1
RMSE = 22.5 ft
Average Residual = 22.2 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated

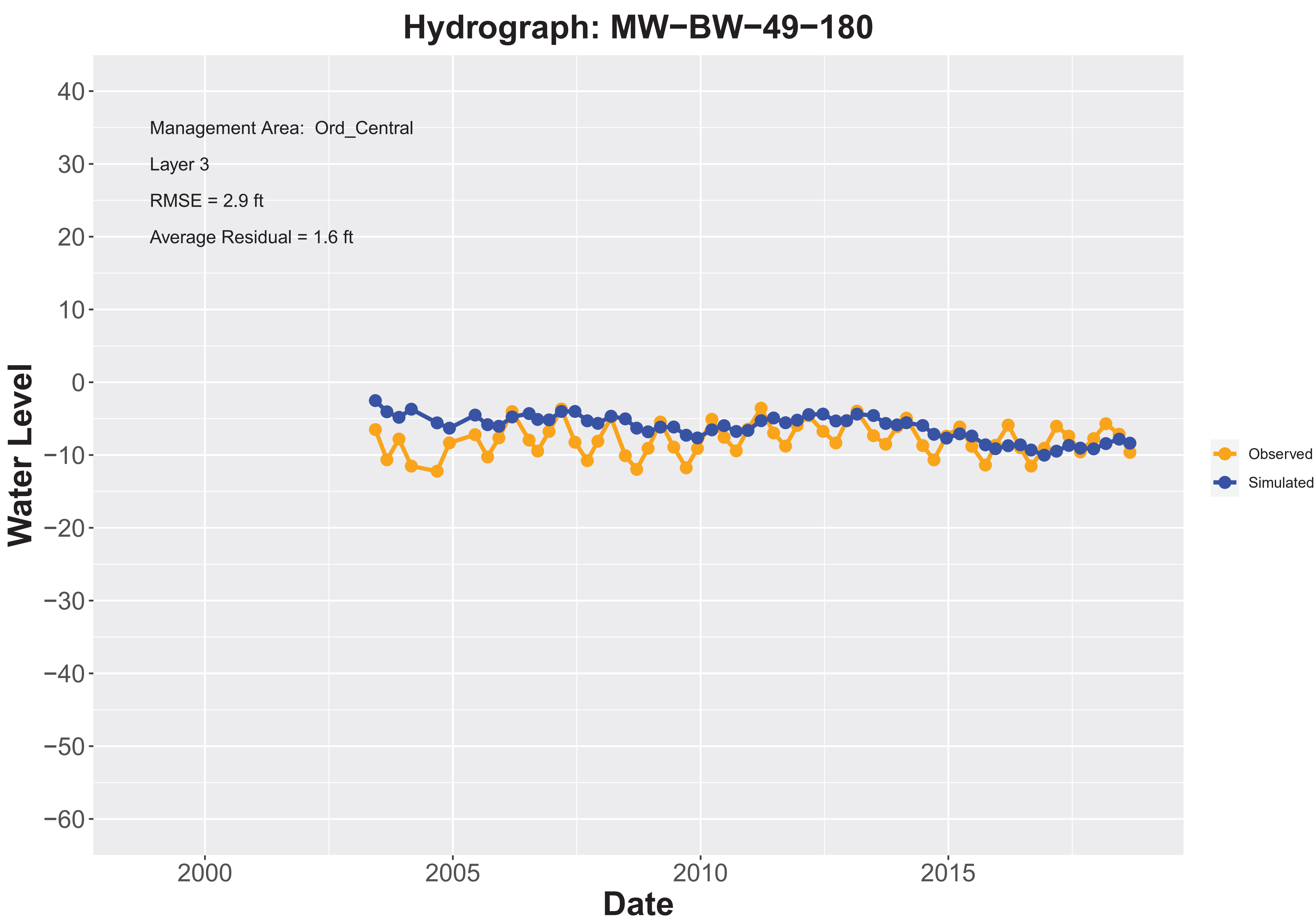

Hydrograph: MW−BW−46−A
Management Area: Marina
Layer 1
RMSE = 20.2 ft
Average Residual = 19.7 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−BW−47−180
Management Area: Ord_Central
Layer 3
RMSE = 2.3 ft
Average Residual = 0.88 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

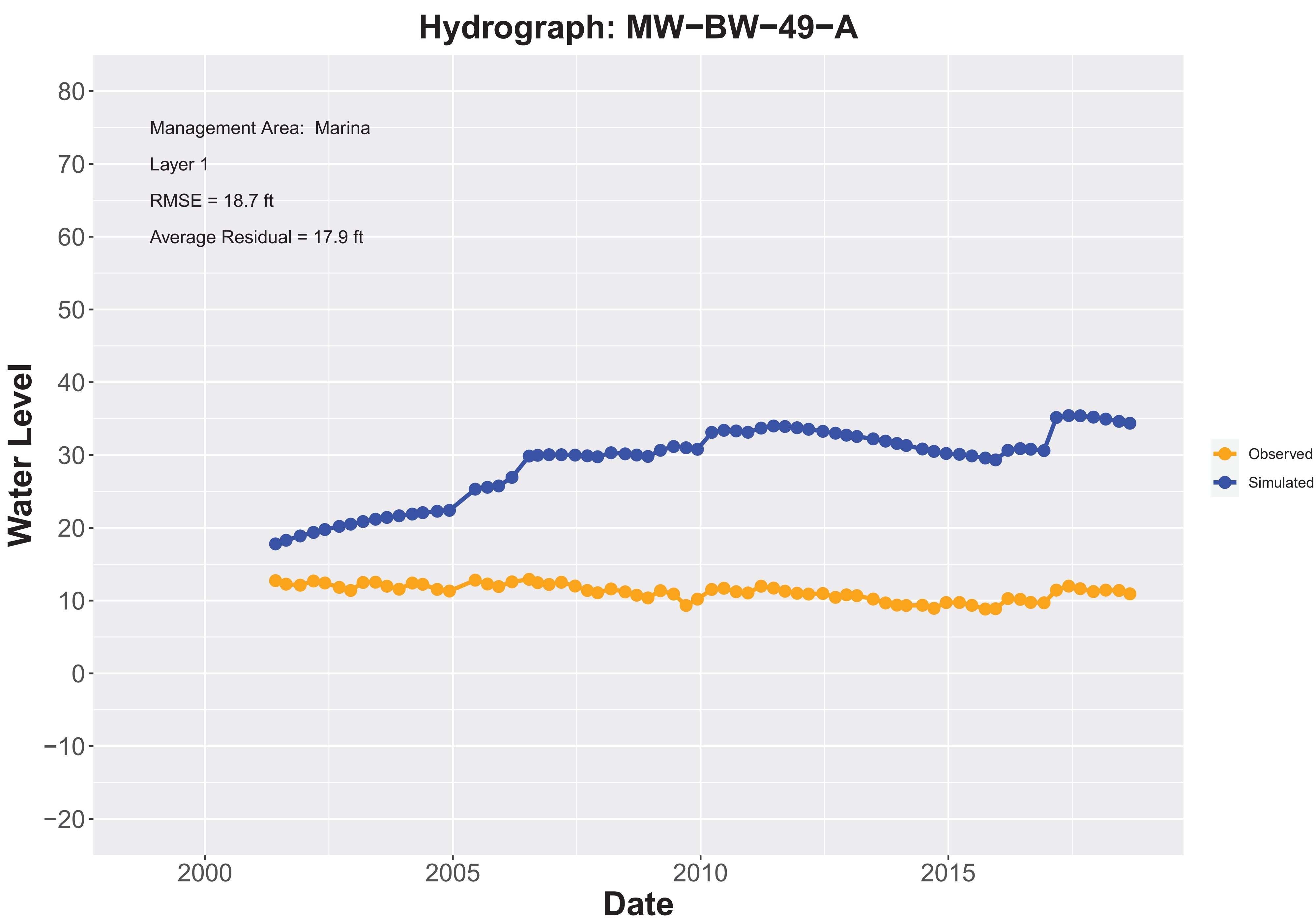
Hydrograph: MW−BW−47−A

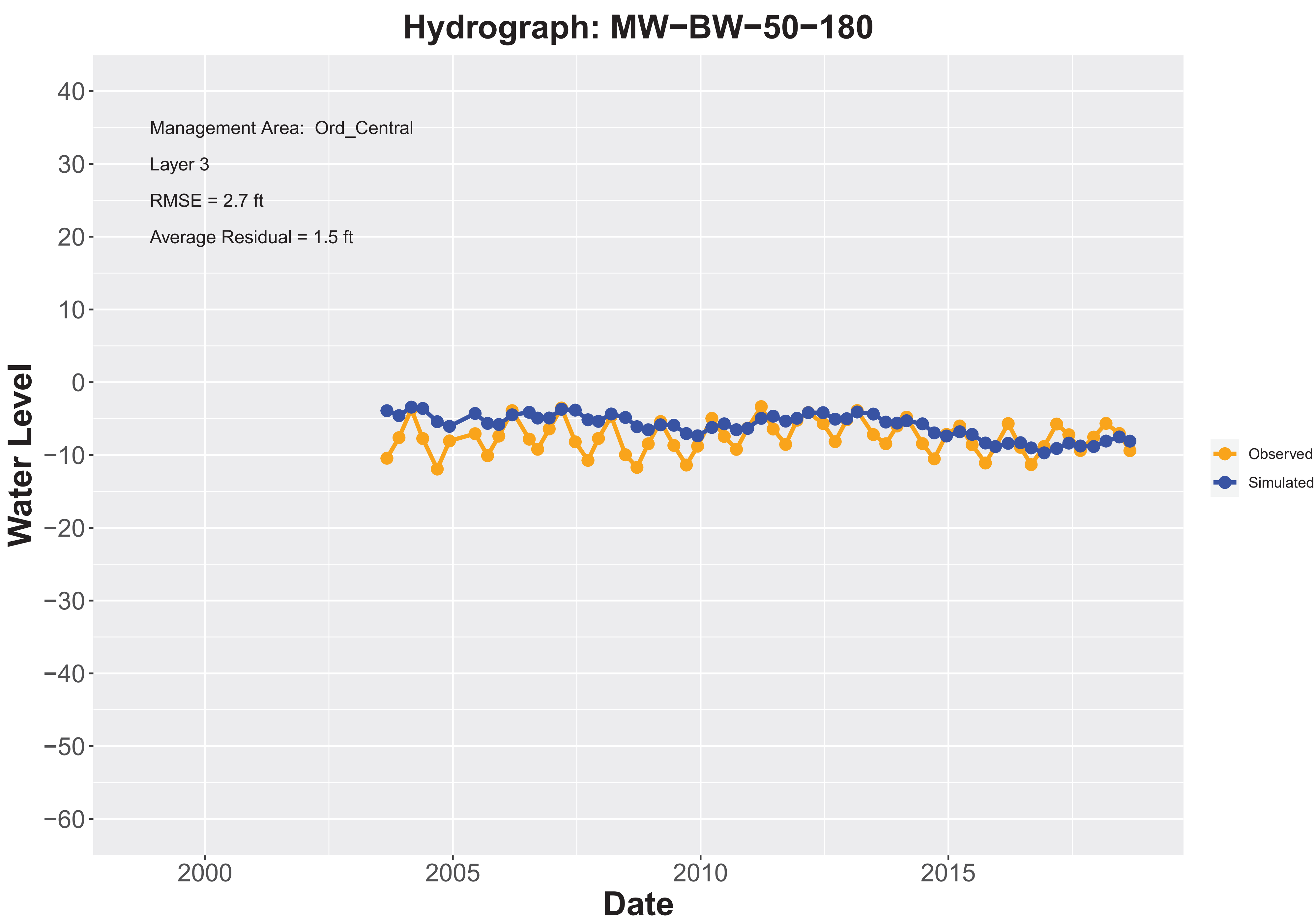



Hydrograph: MW−BW−48−A
Management Area: Marina
Layer 1
RMSE = 18.7 ft
Average Residual = 18.0 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated

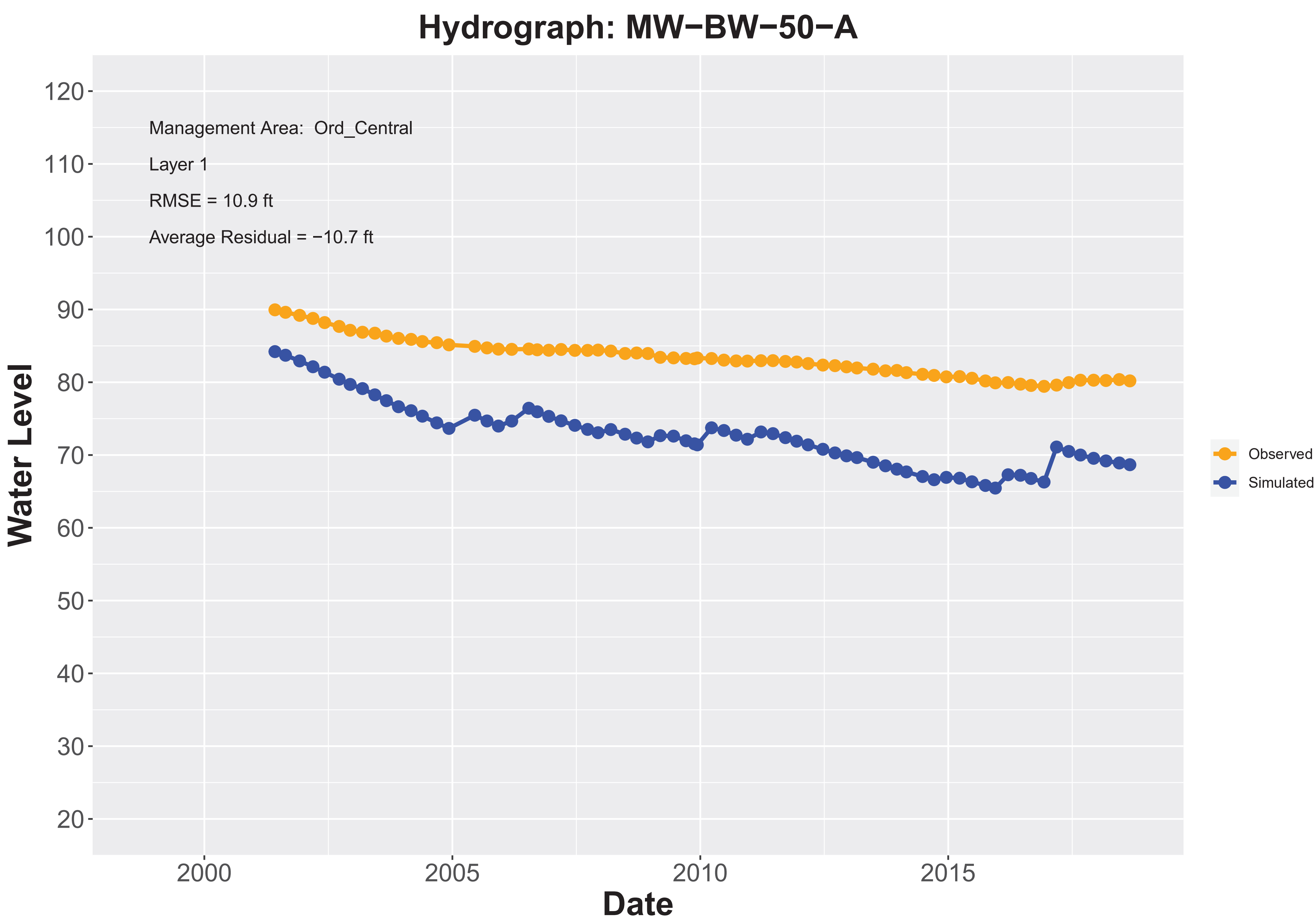


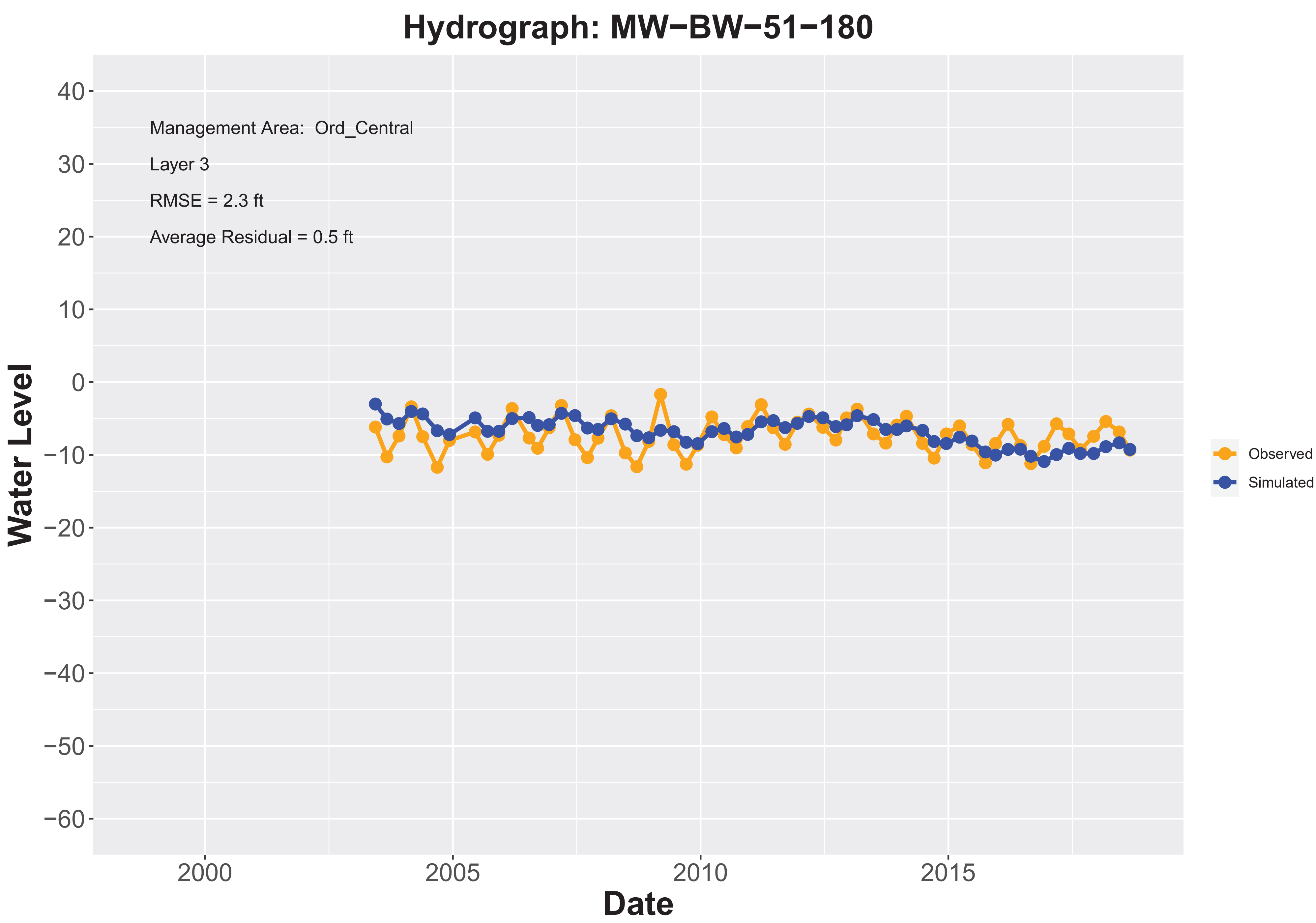
Hydrograph: MW−BW−49−180
Management Area: Ord_Central
Layer 3
RMSE = 2.9 ft
Average Residual = 1.6 ft
Water Level
Date
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Observed
Simulated

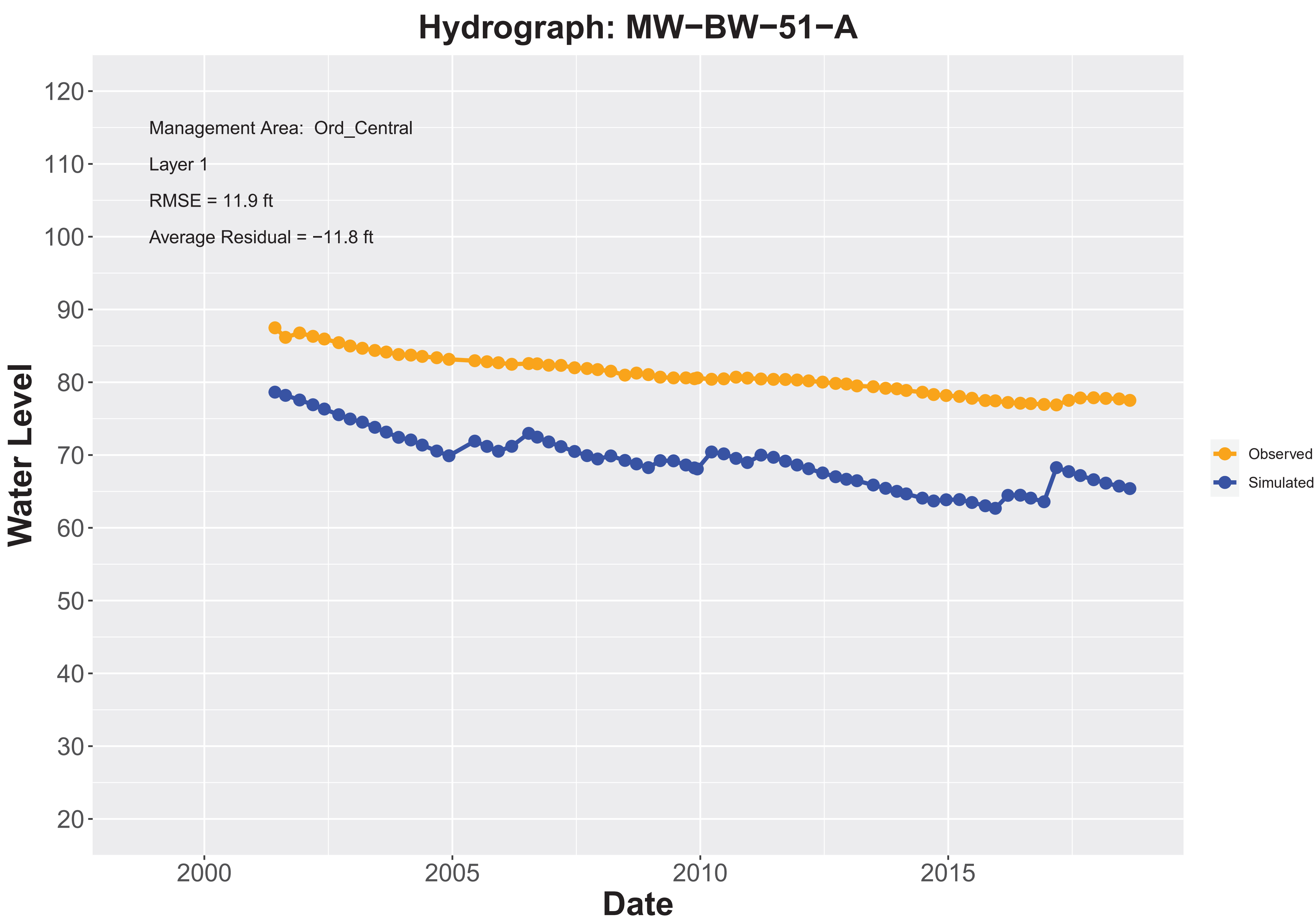

Hydrograph: MW−BW−49−A
Management Area: Marina
Layer 1
RMSE = 18.7 ft
Average Residual = 17.9 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated



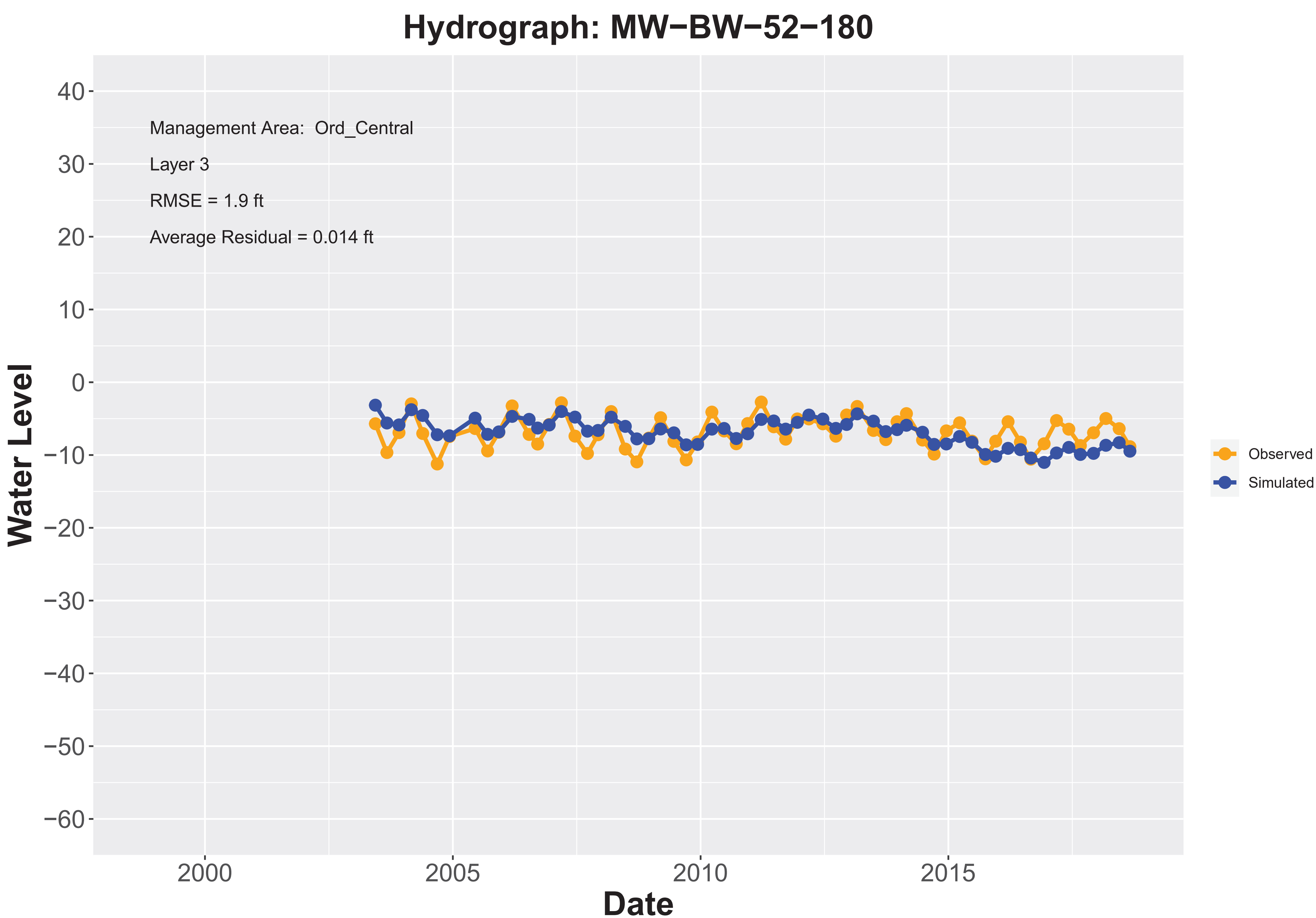
Hydrograph: MW−BW−50−180
Management Area: Ord_Central
Layer 3
RMSE = 2.7 ft
Average Residual = 1.5 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−BW−50−A
Management Area: Ord_Central
Layer 1
RMSE = 10.9 ft
Average Residual = −10.7 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated

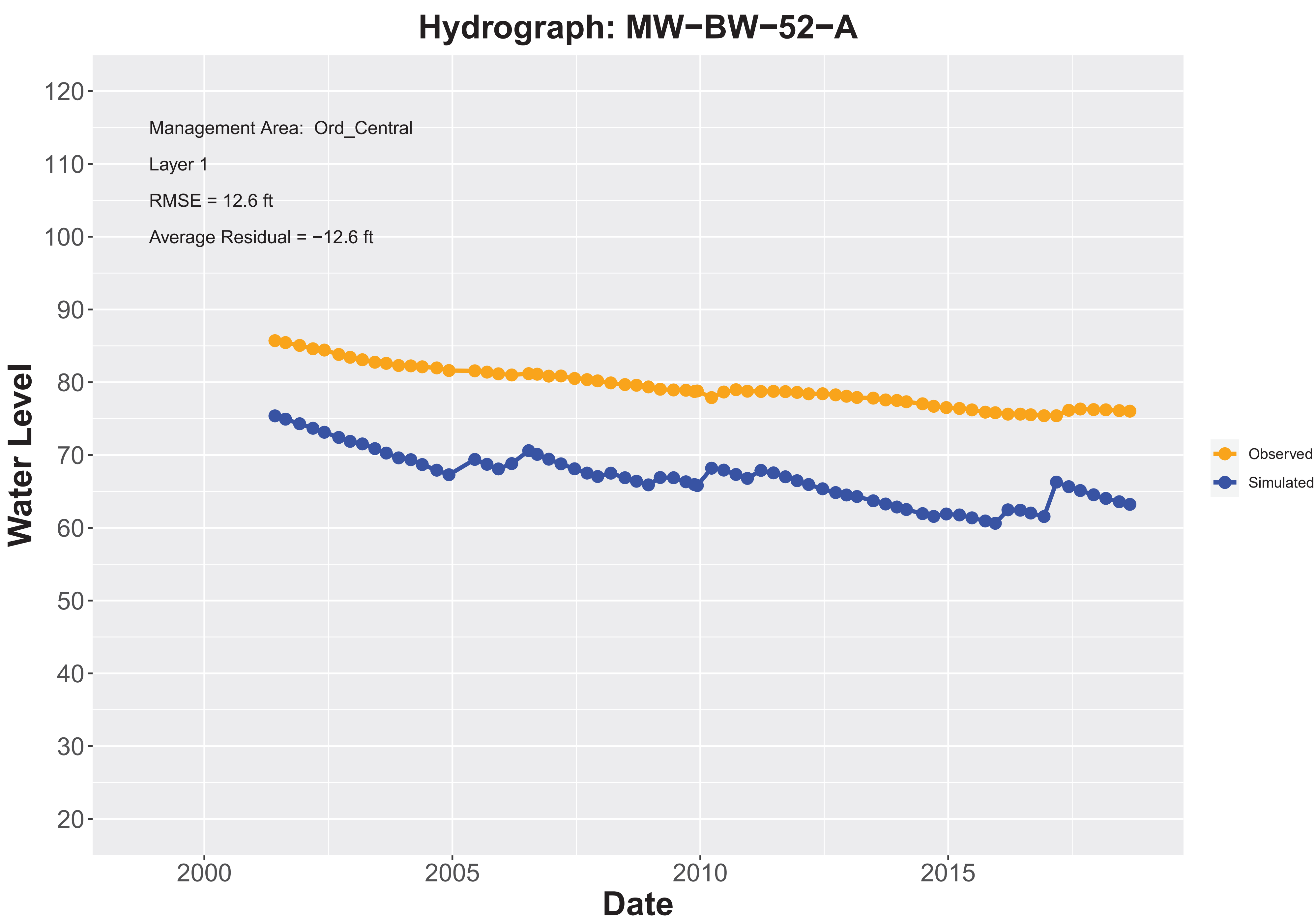

Hydrograph: MW−BW−51−180
Management Area: Ord_Central
Layer 3
RMSE = 2.3 ft
Average Residual = 0.5 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated



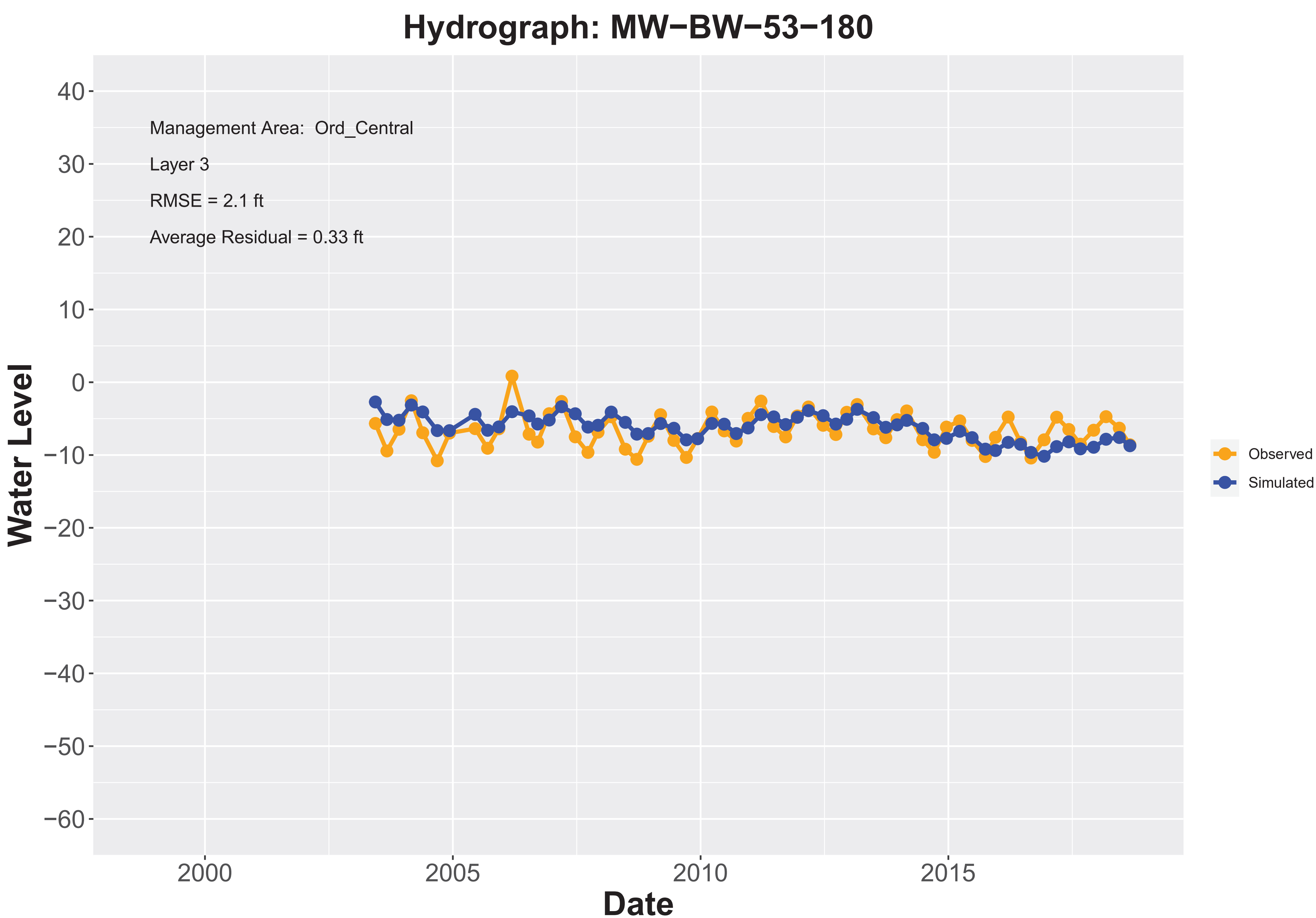
Hydrograph: MW−BW−51−A
Management Area: Ord_Central
Layer 1
RMSE = 11.9 ft
Average Residual = −11.8 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated

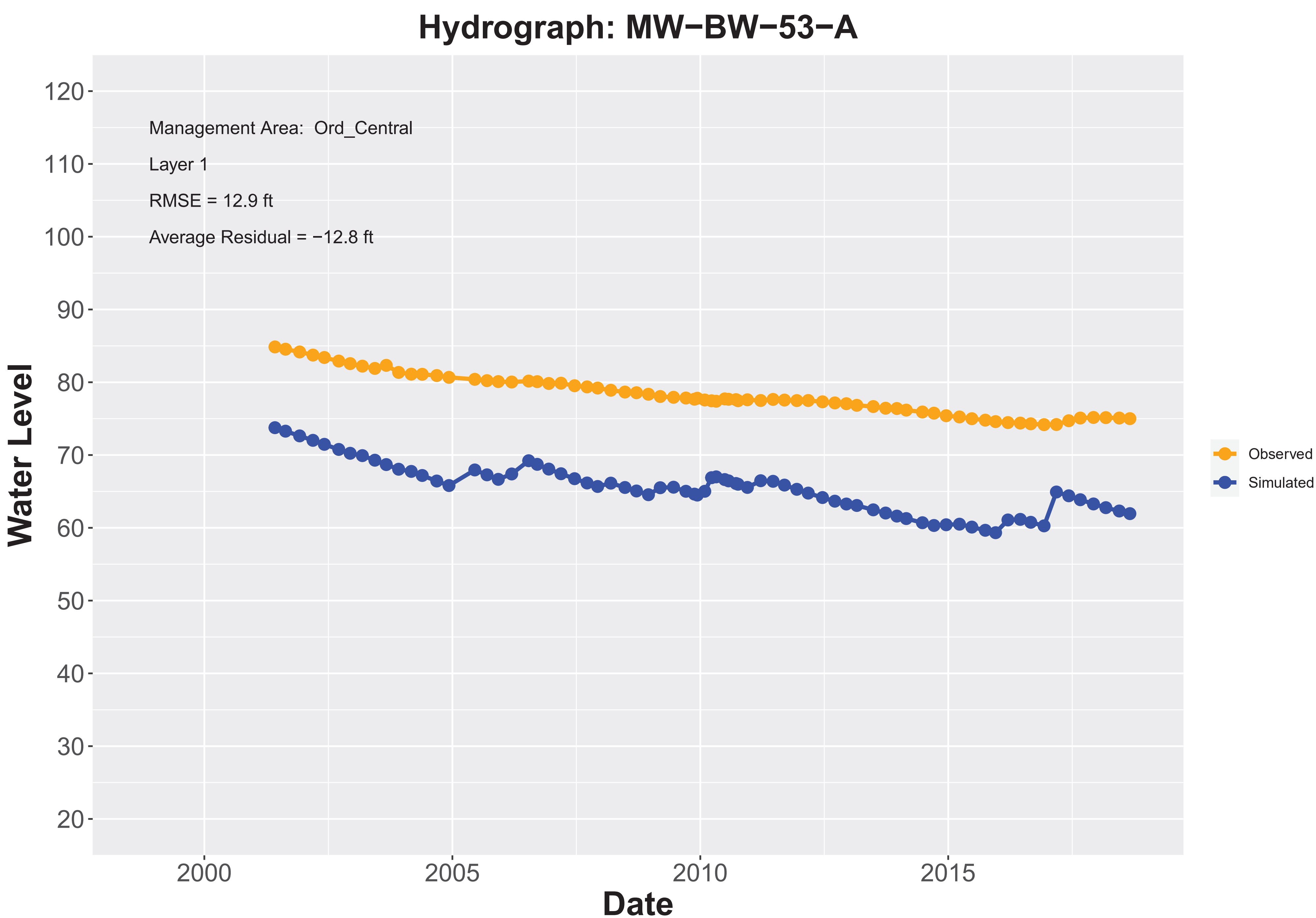


Hydrograph: MW−BW−52−180
Management Area: Ord_Central
Layer 3
RMSE = 1.9 ft
Average Residual = 0.014 ft
Water Level
Date
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Observed
Simulated

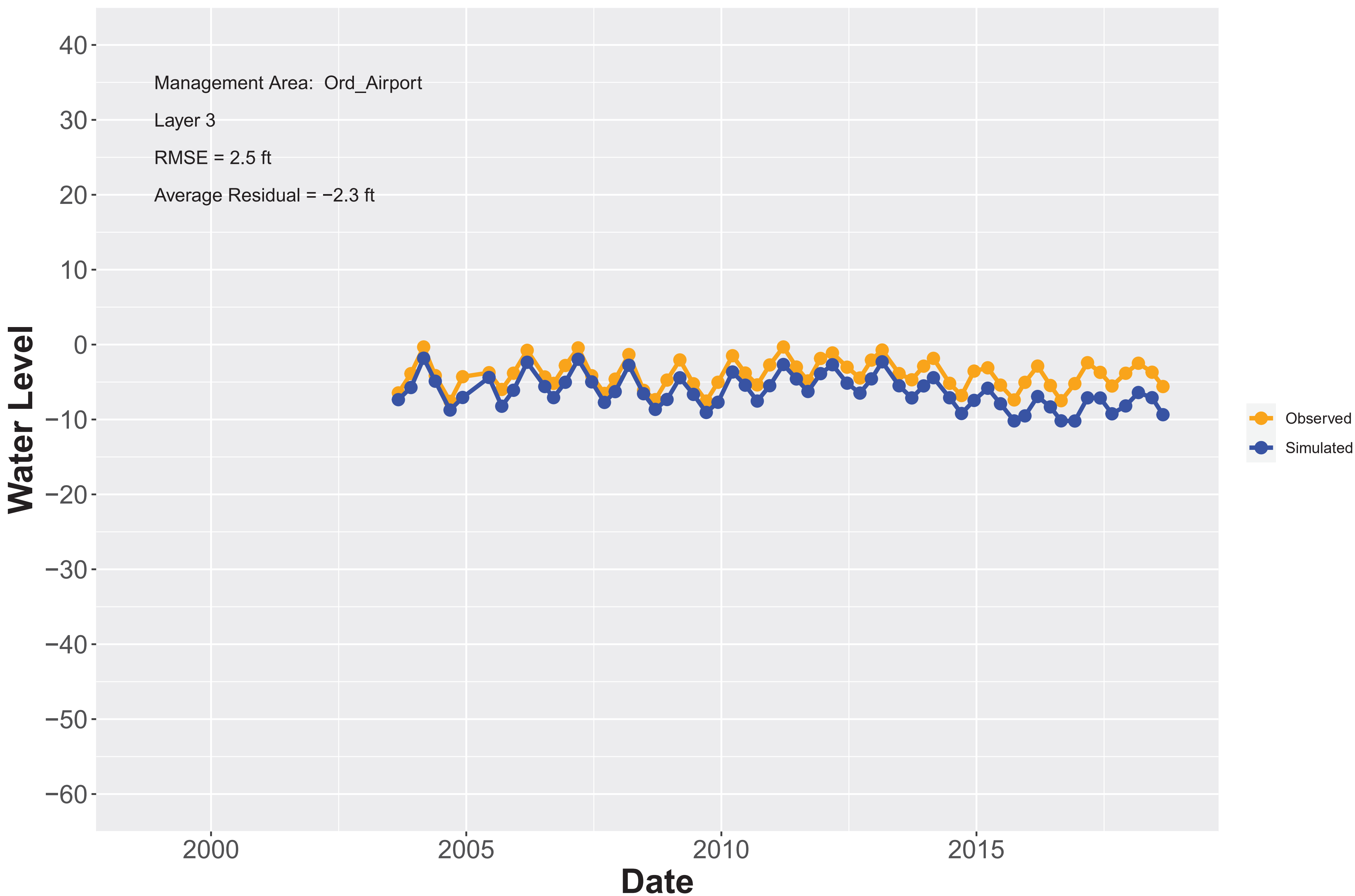


Hydrograph: MW−BW−52−A
Management Area: Ord_Central
Layer 1
RMSE = 12.6 ft
Average Residual = −12.6 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated

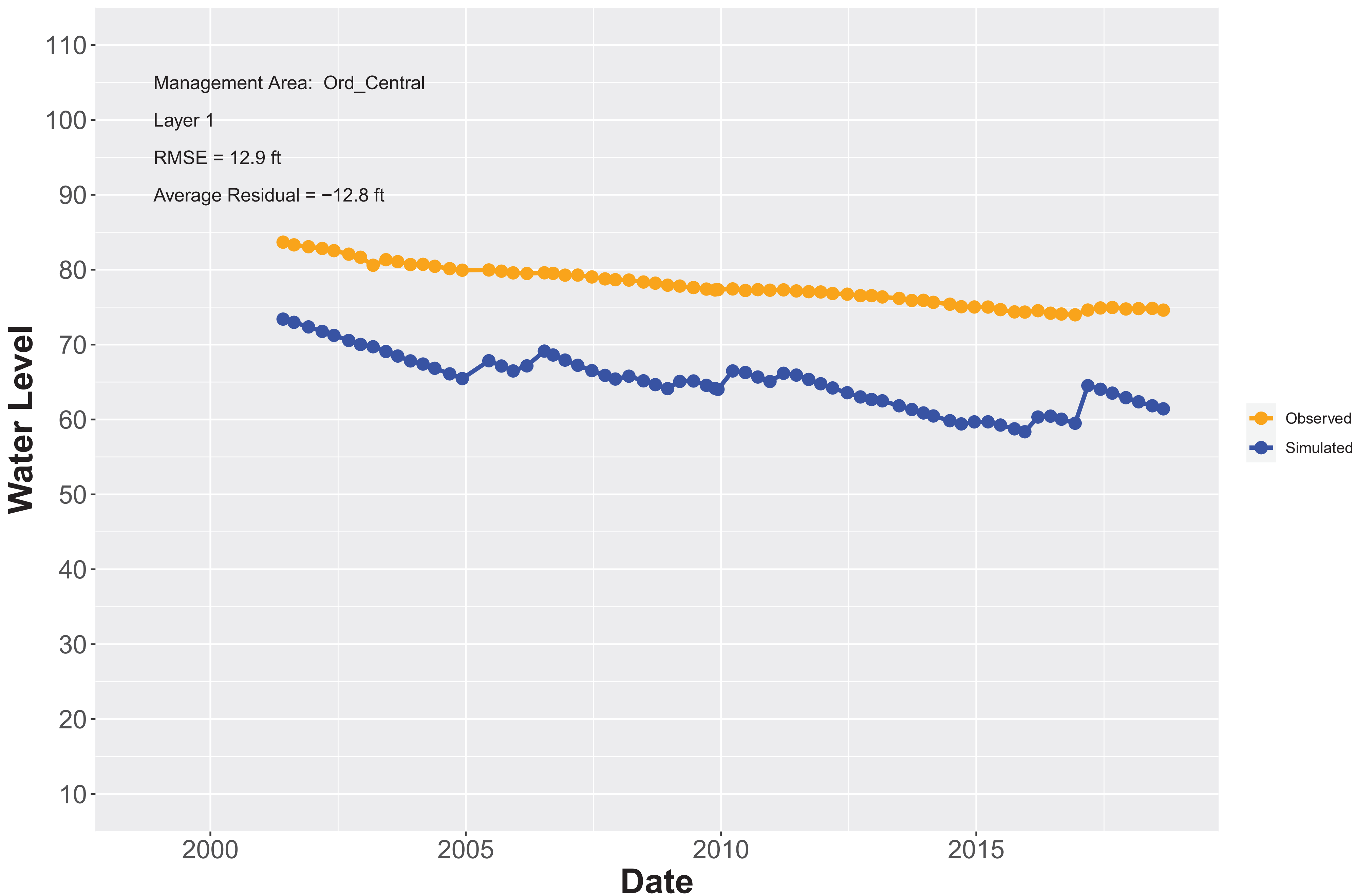

Hydrograph: MW−BW−53−180
Management Area: Ord_Central
Layer 3
RMSE = 2.1 ft
Average Residual = 0.33 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

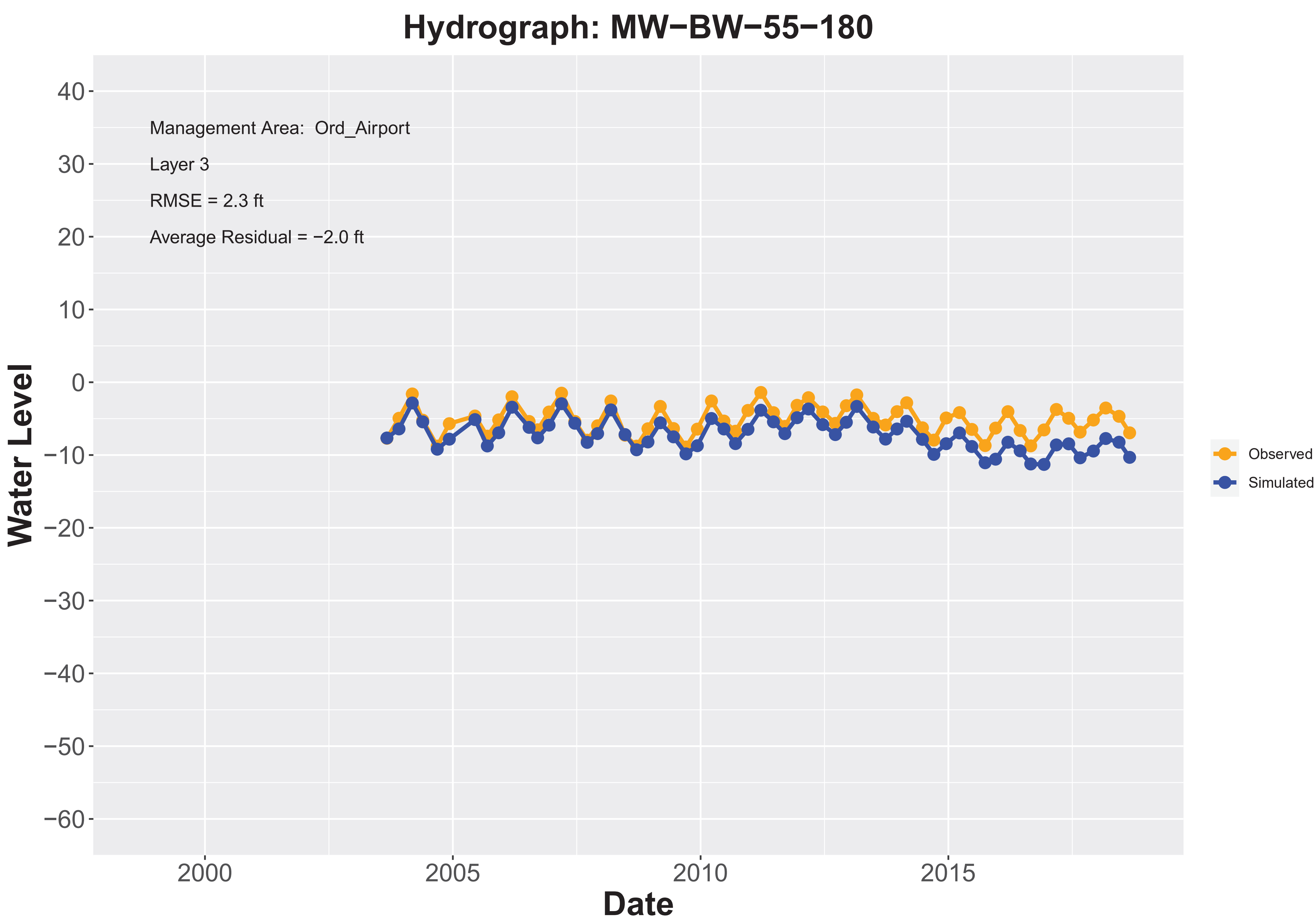

Hydrograph: MW−BW−53−A
Management Area: Ord_Central
Layer 1
RMSE = 12.9 ft
Average Residual = −12.8 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
Date
2000
2005
2010
2015
Observed
Simulated

Hydrograph: MW−BW−54−180

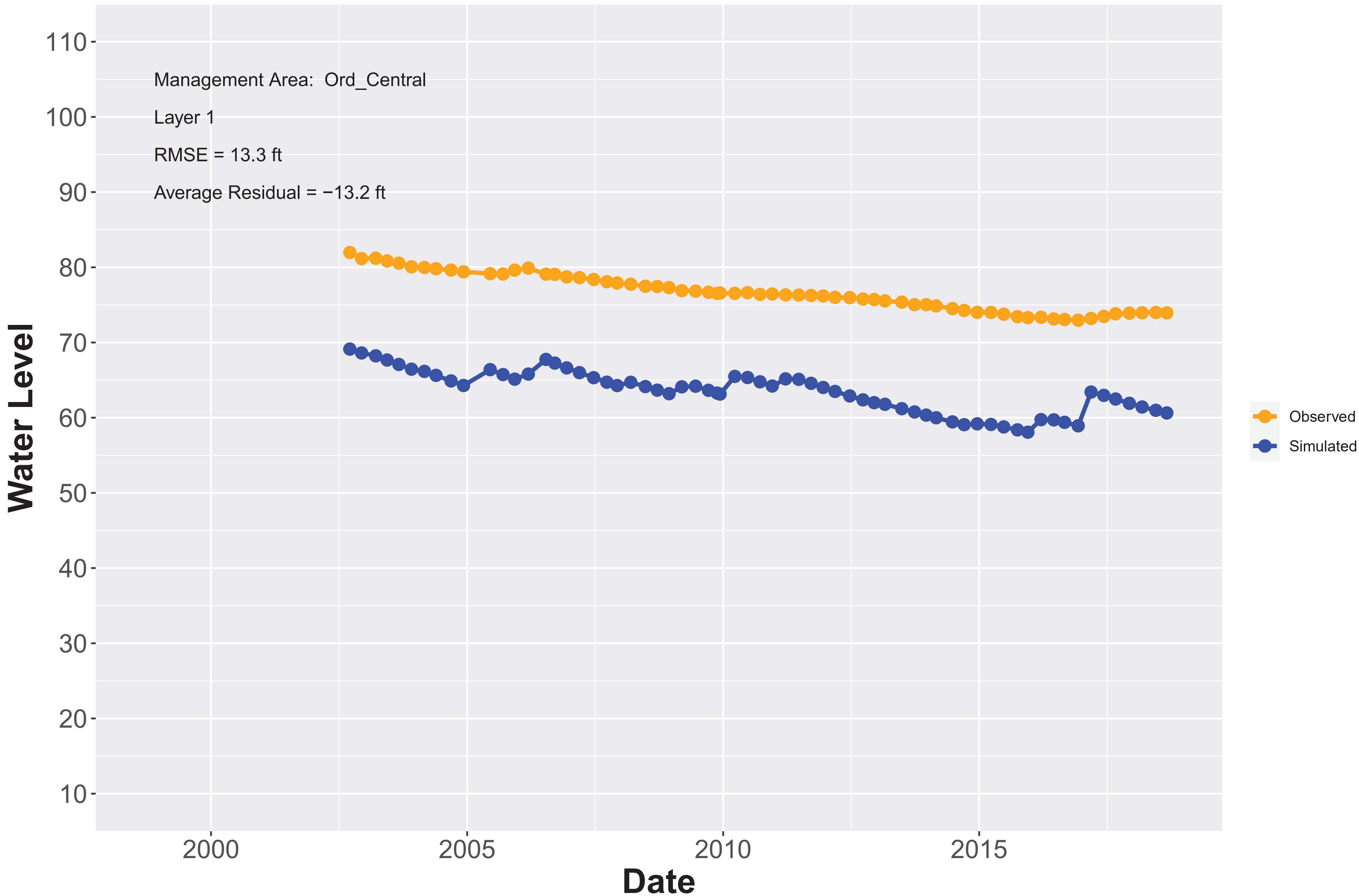


Hydrograph: MW−BW−54−A

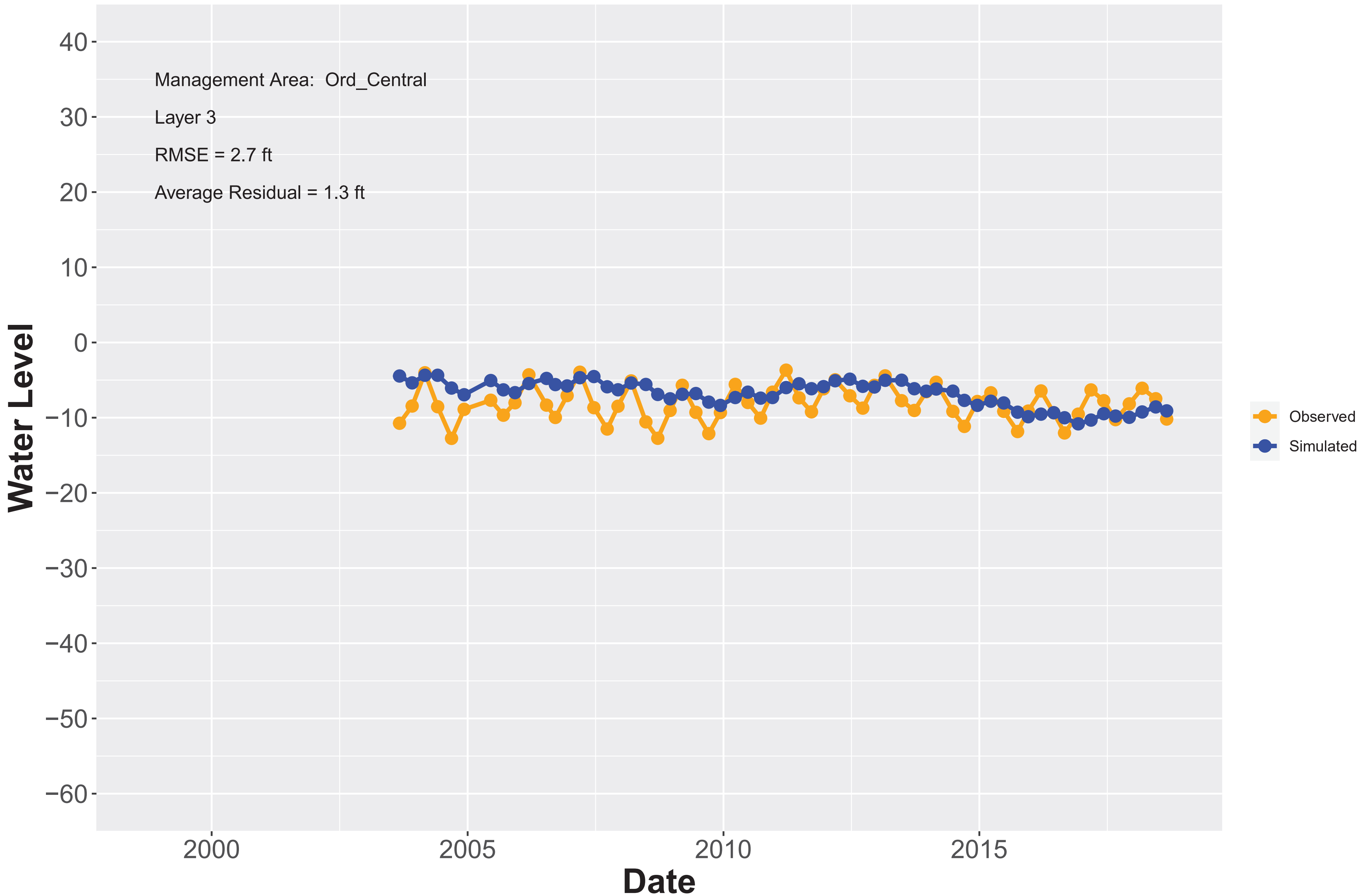


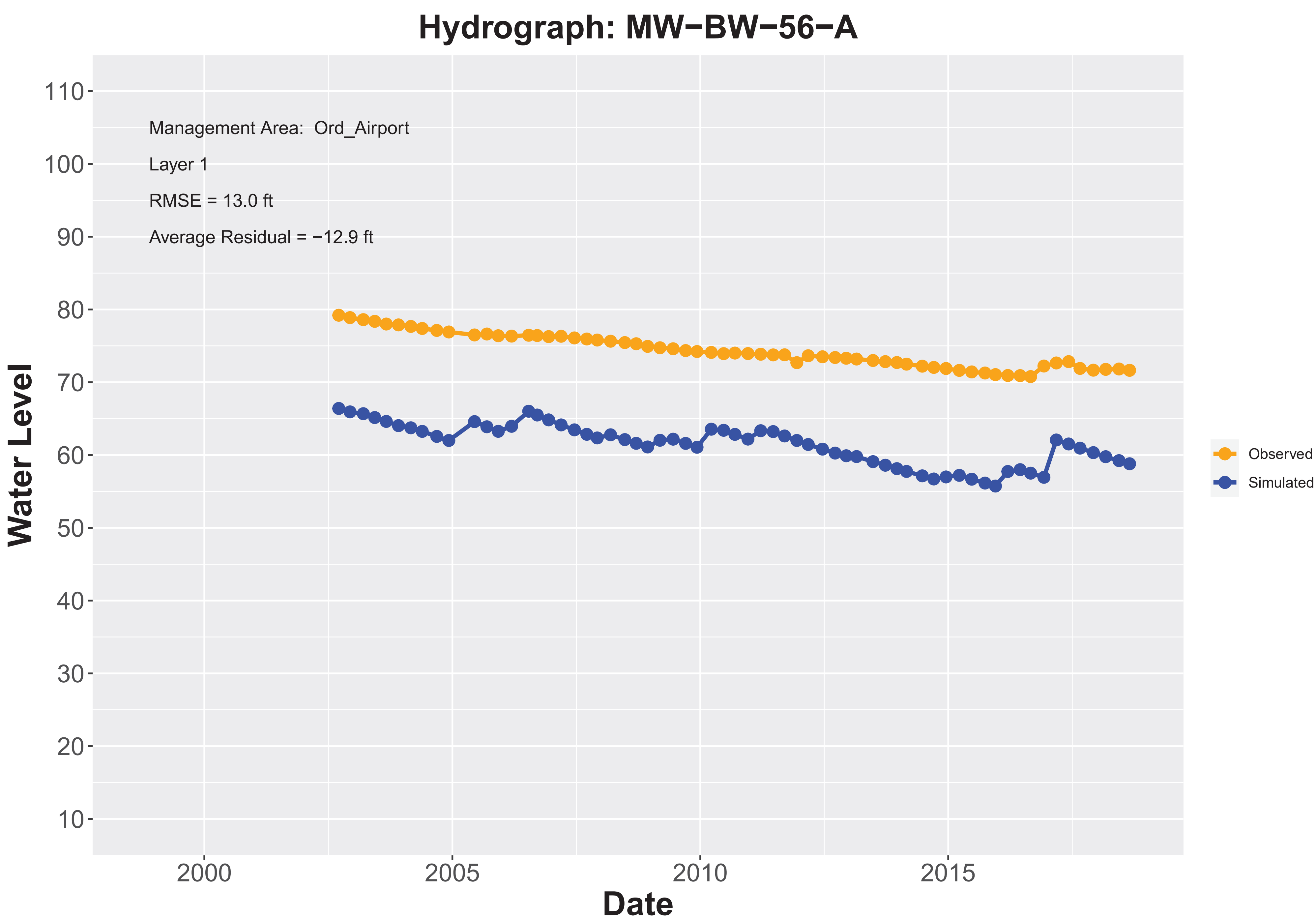

Hydrograph: MW−BW−55−180
Management Area: Ord_Airport
Layer 3
RMSE = 2.3 ft
Average Residual = −2.0 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

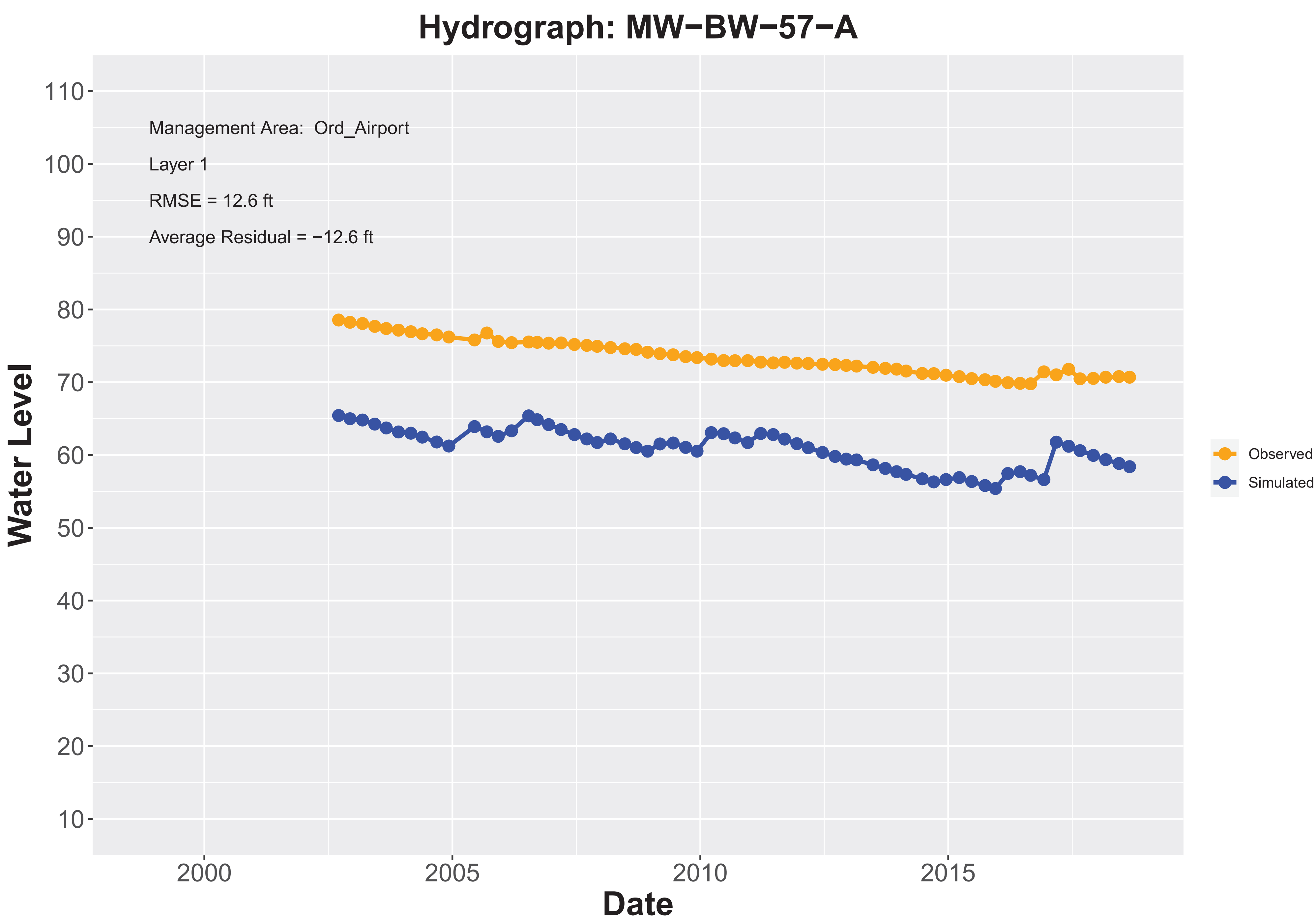
Hydrograph: MW−BW−55−A



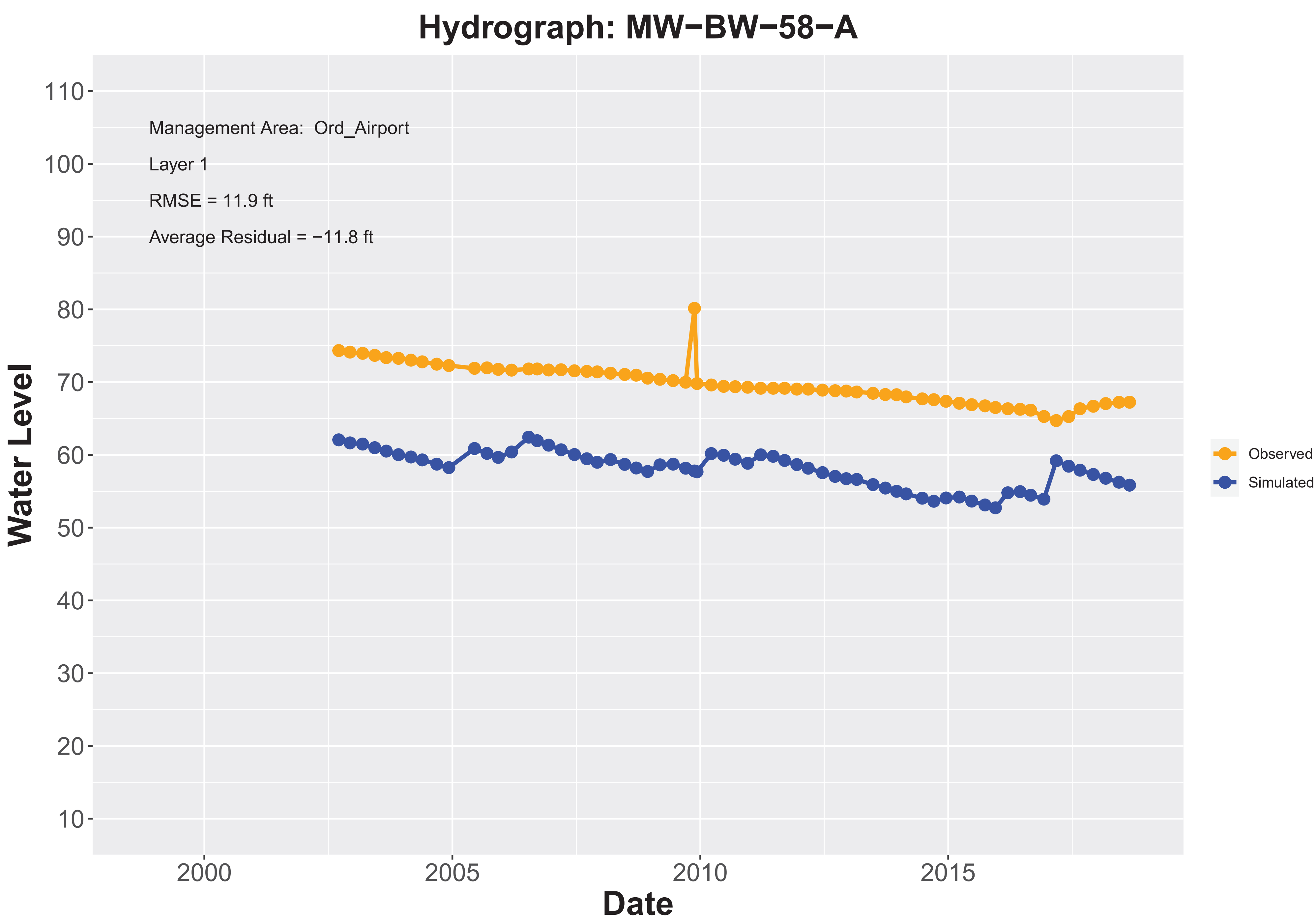
Hydrograph: MW−BW−56−180



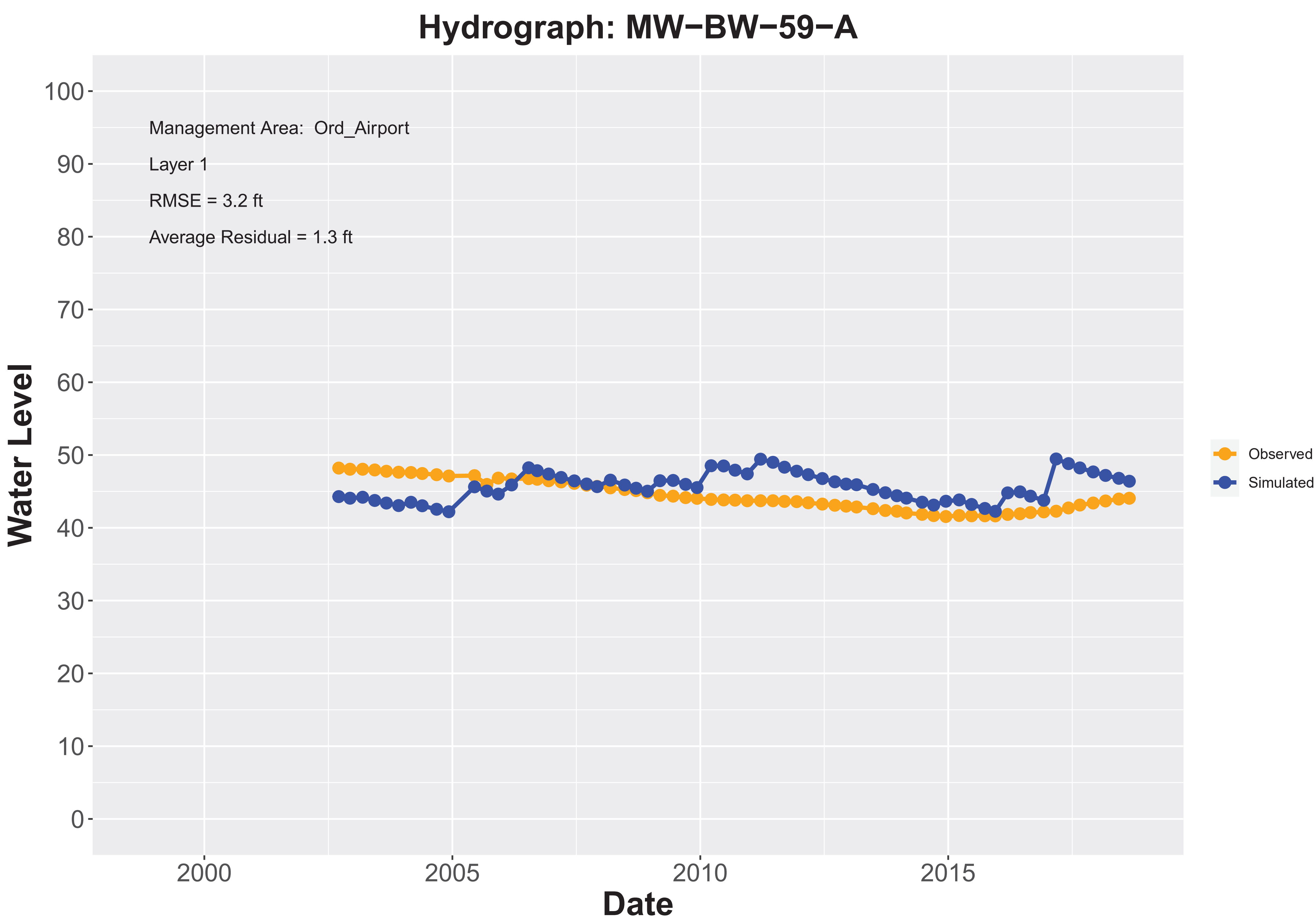

Hydrograph: MW−BW−56−A
Management Area: Ord_Airport
Layer 1
RMSE = 13.0 ft
Average Residual = −12.9 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



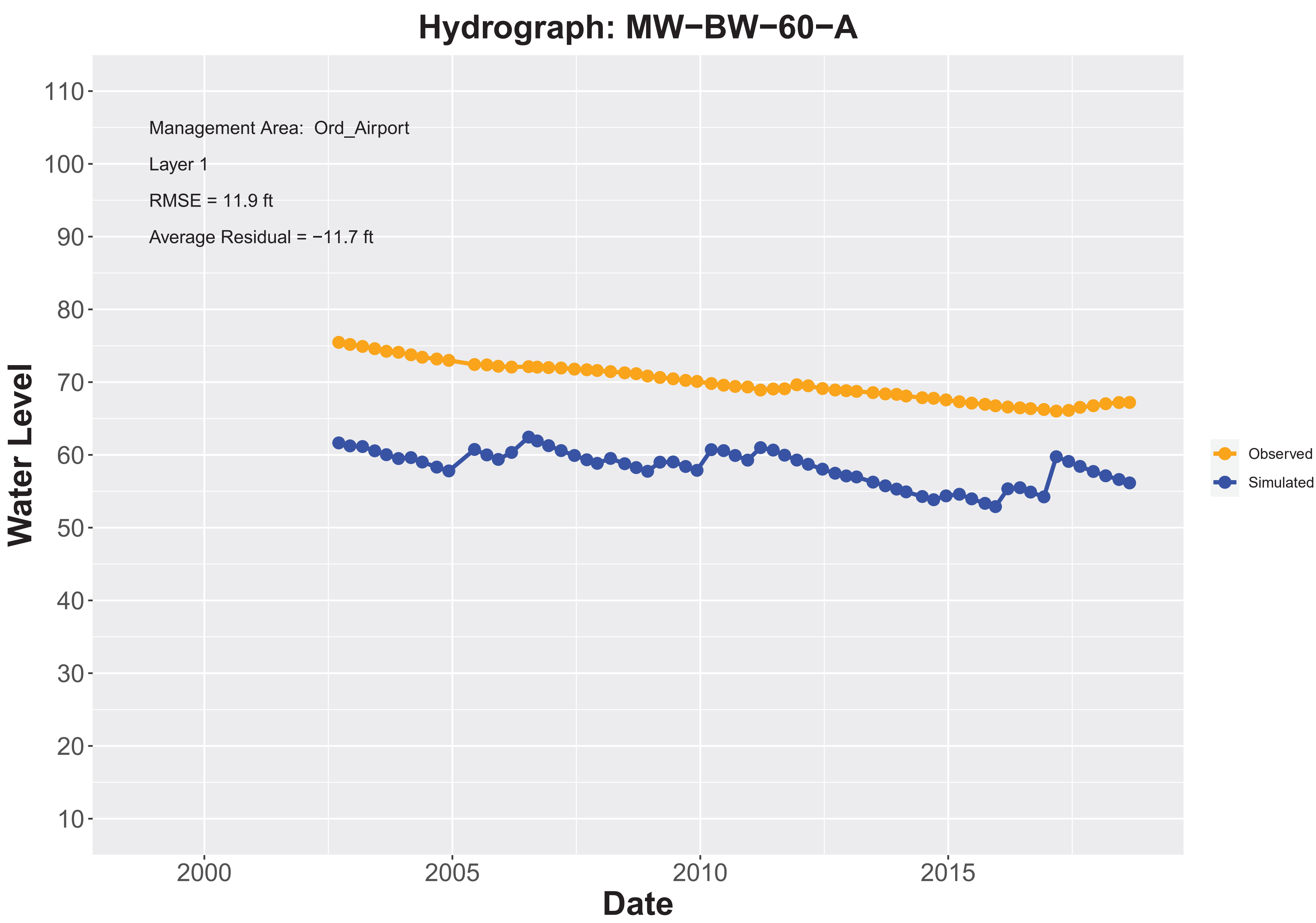
Hydrograph: MW−BW−57−A
Management Area: Ord_Airport
Layer 1
RMSE = 12.6 ft
Average Residual = −12.6 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



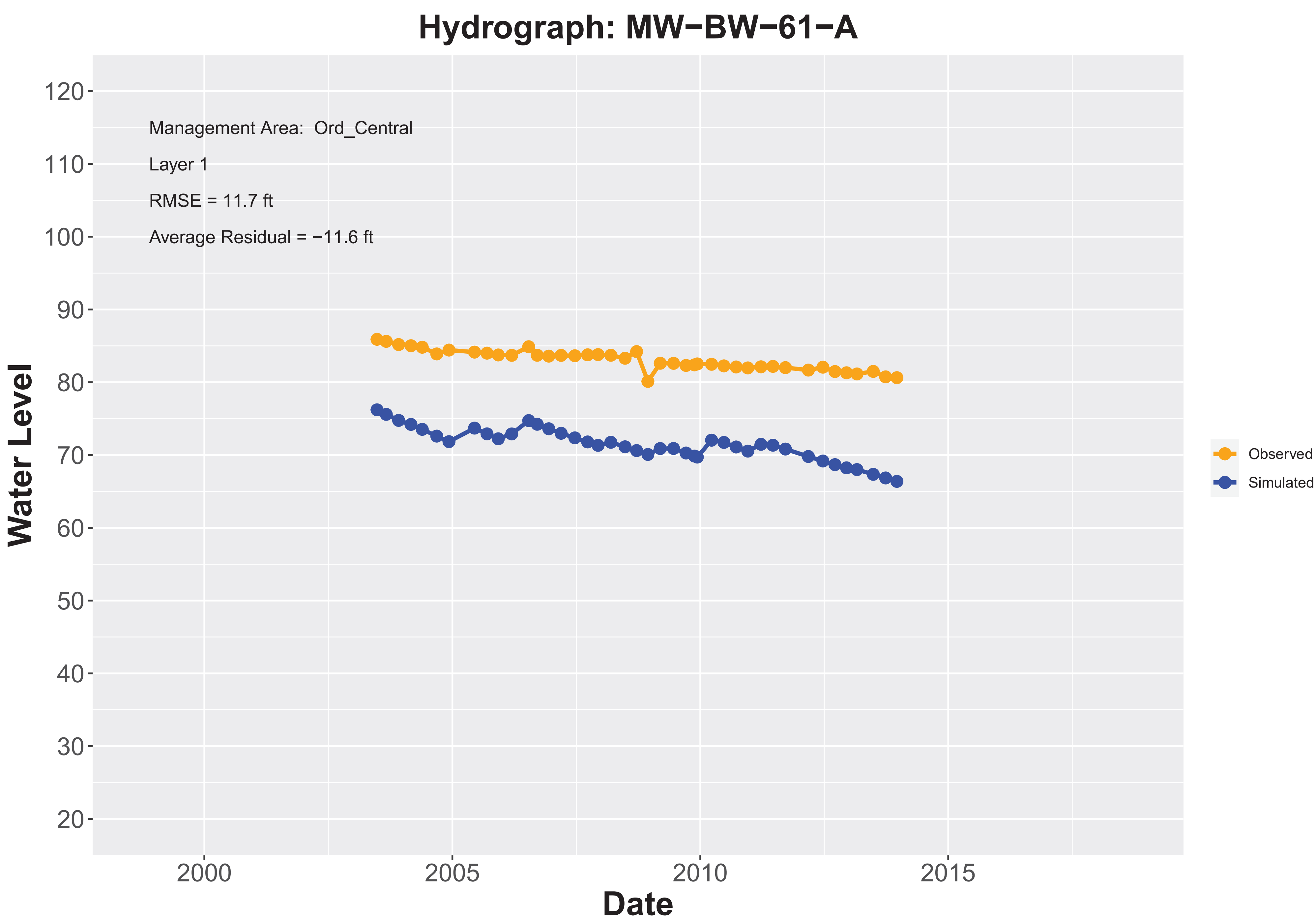
Hydrograph: MW−BW−58−A
Management Area: Ord_Airport
Layer 1
RMSE = 11.9 ft
Average Residual = −11.8 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−BW−59−A
Management Area: Ord_Airport
Layer 1
RMSE = 3.2 ft
Average Residual = 1.3 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

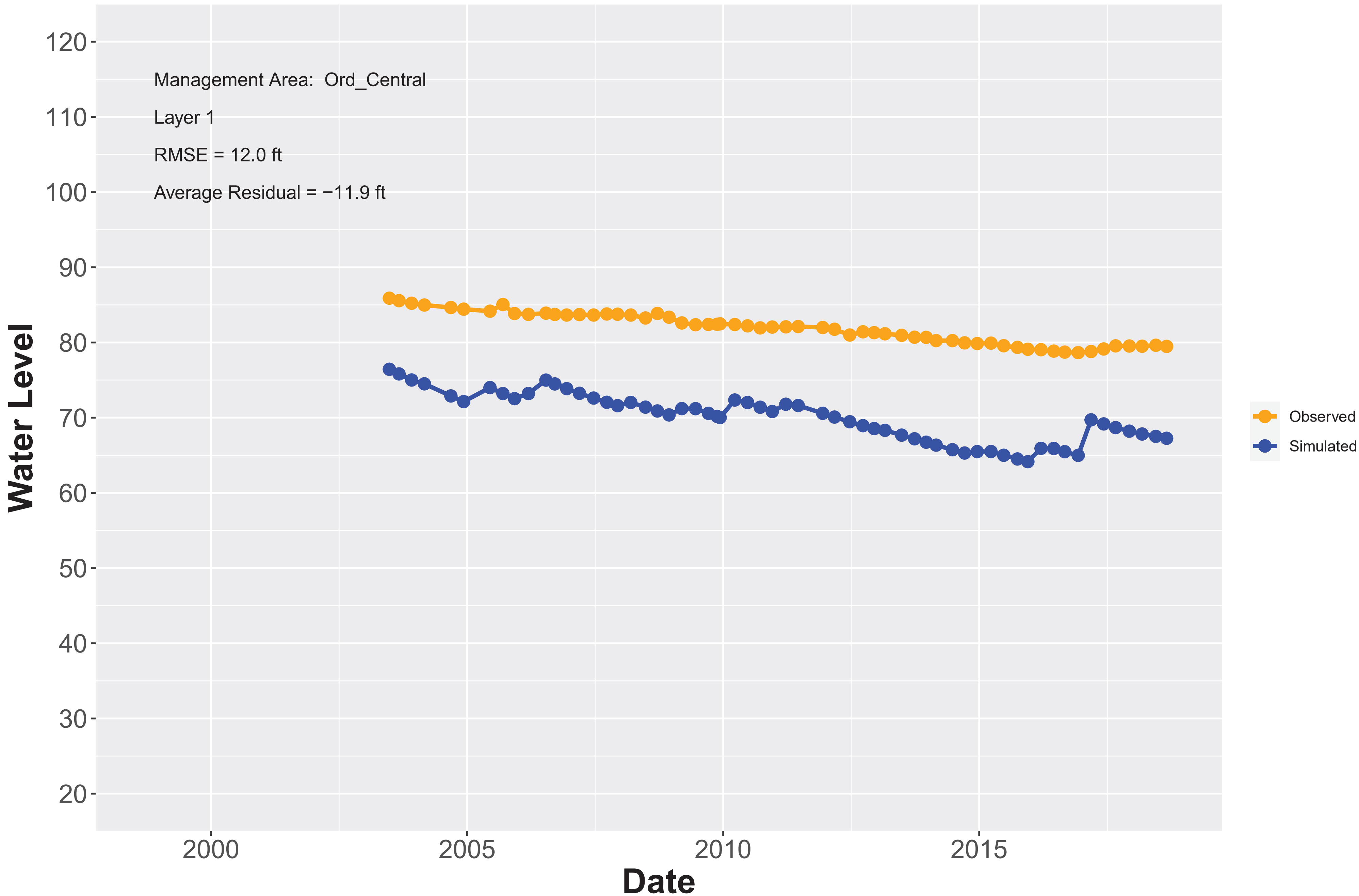


Hydrograph: MW−BW−60−A
Management Area: Ord_Airport
Layer 1
RMSE = 11.9 ft
Average Residual = −11.7 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

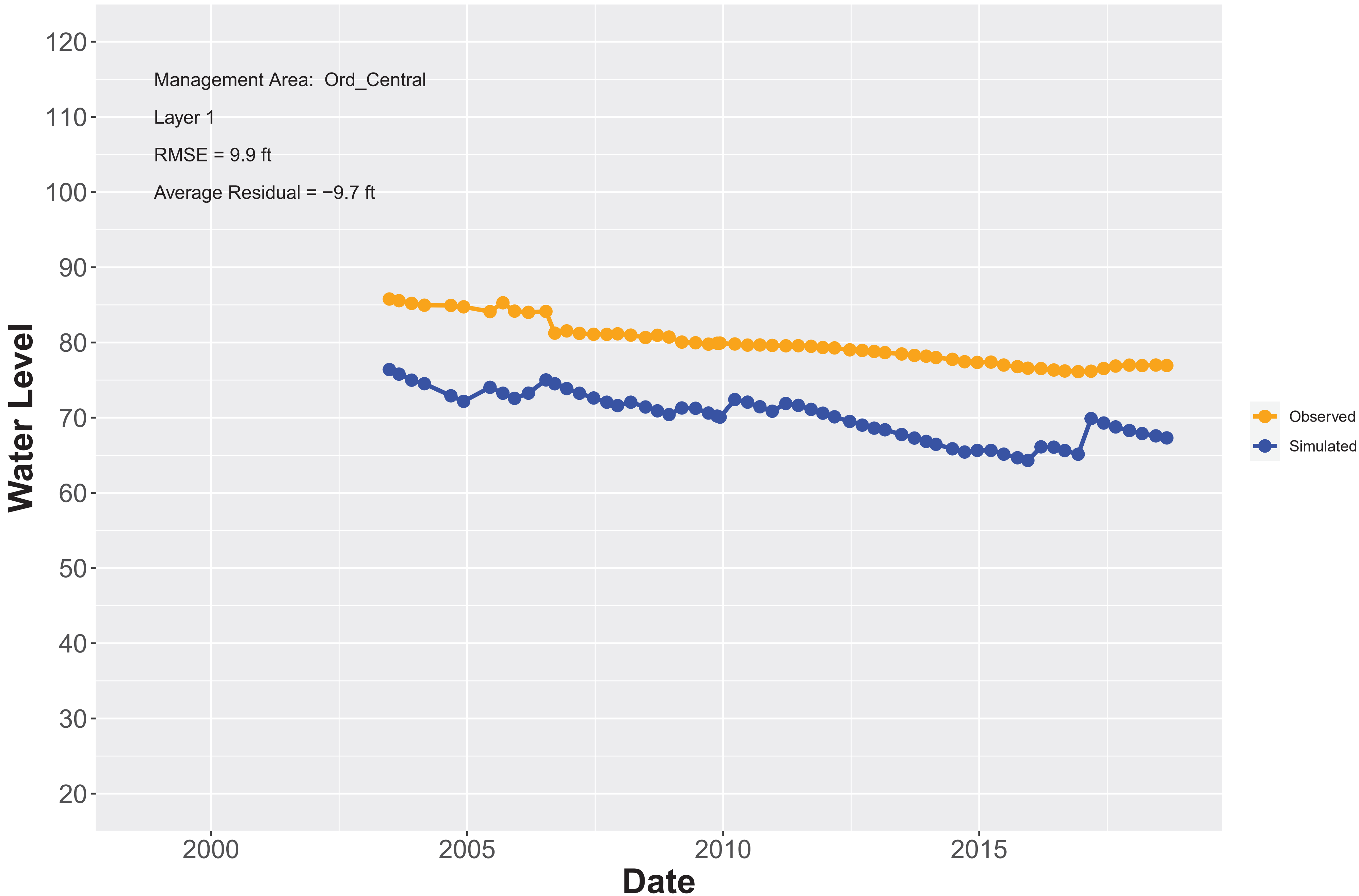


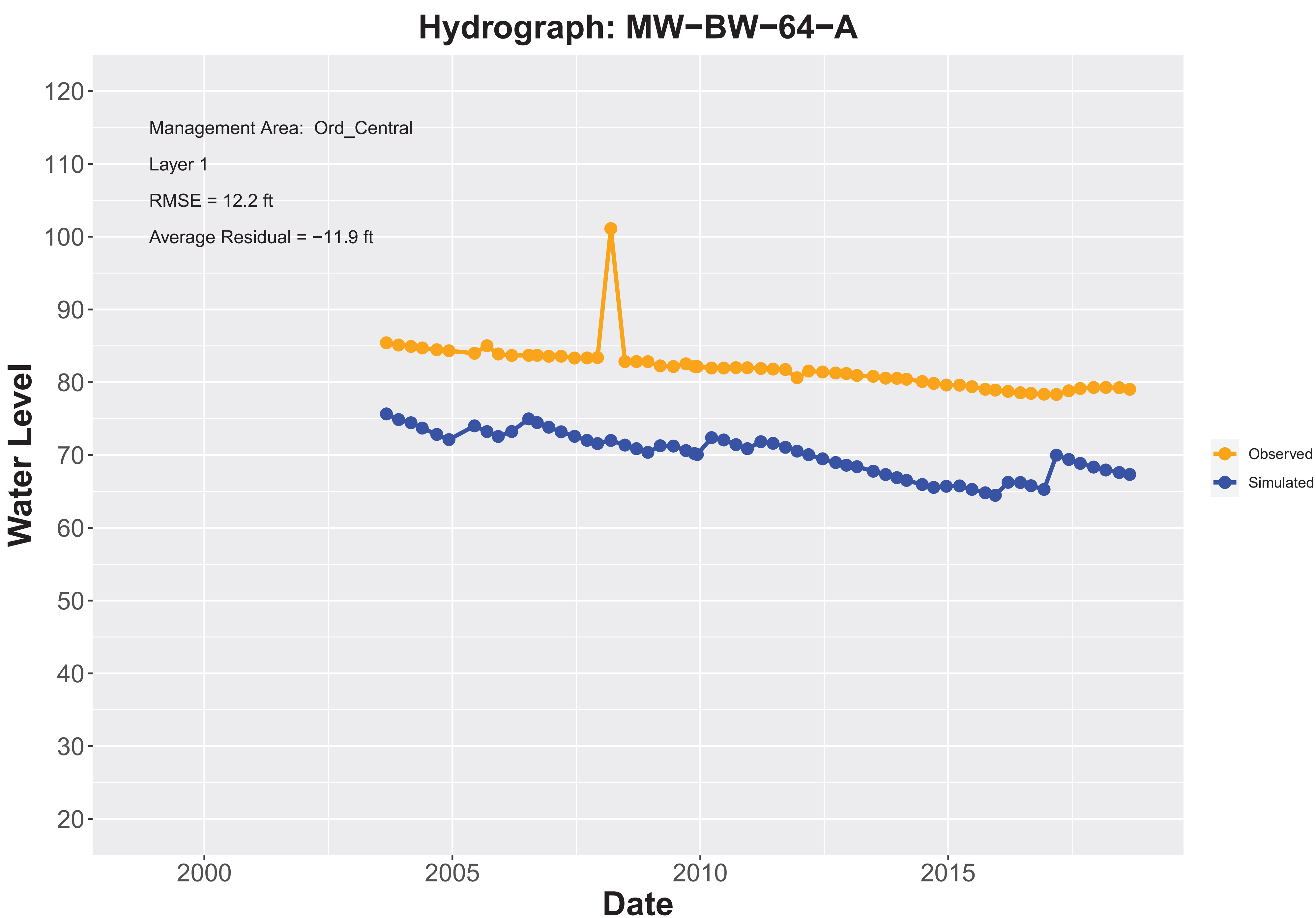
Hydrograph: MW−BW−61−A
Management Area: Ord_Central
Layer 1
RMSE = 11.7 ft
Average Residual = −11.6 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−BW−62−A

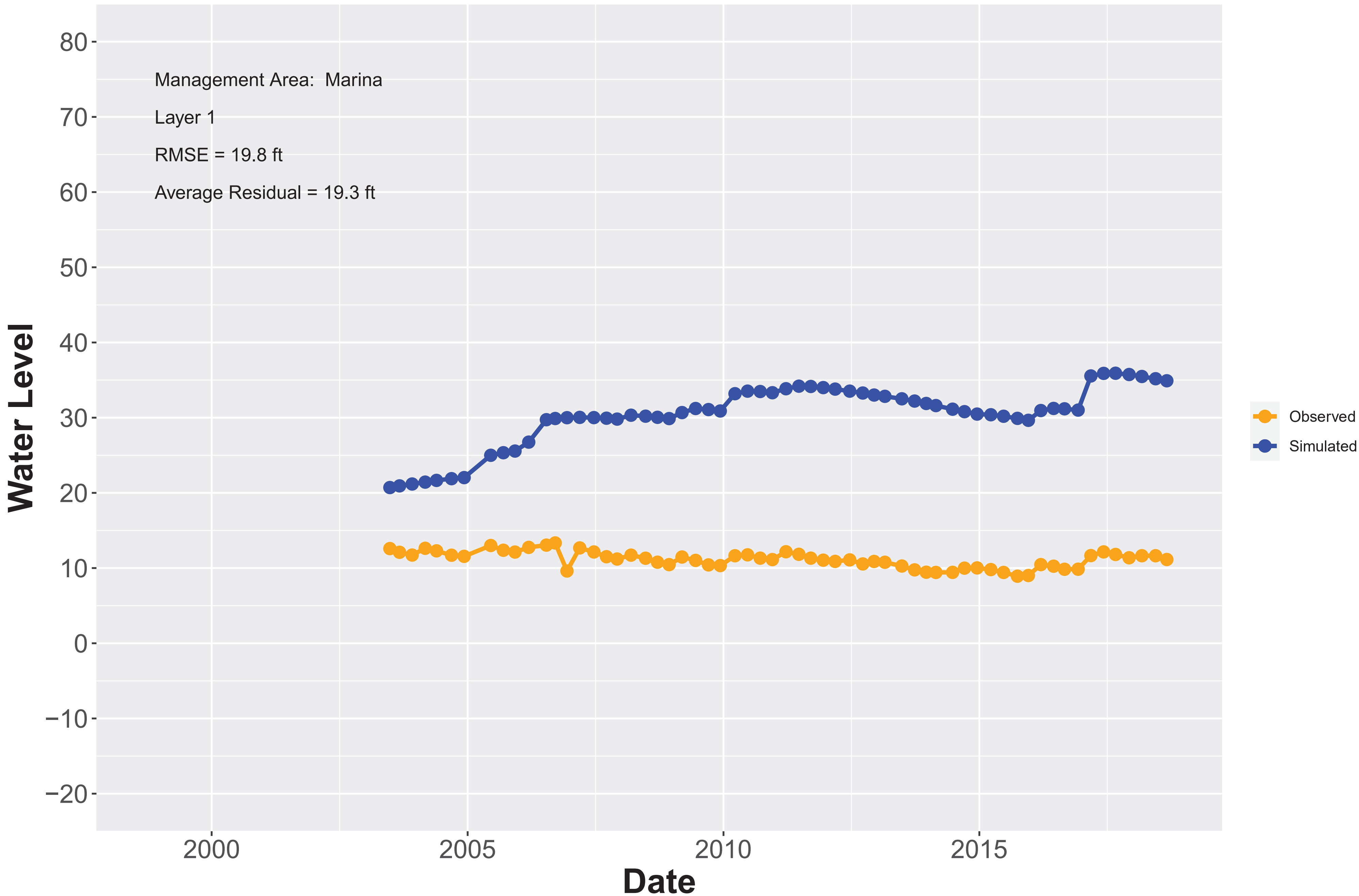


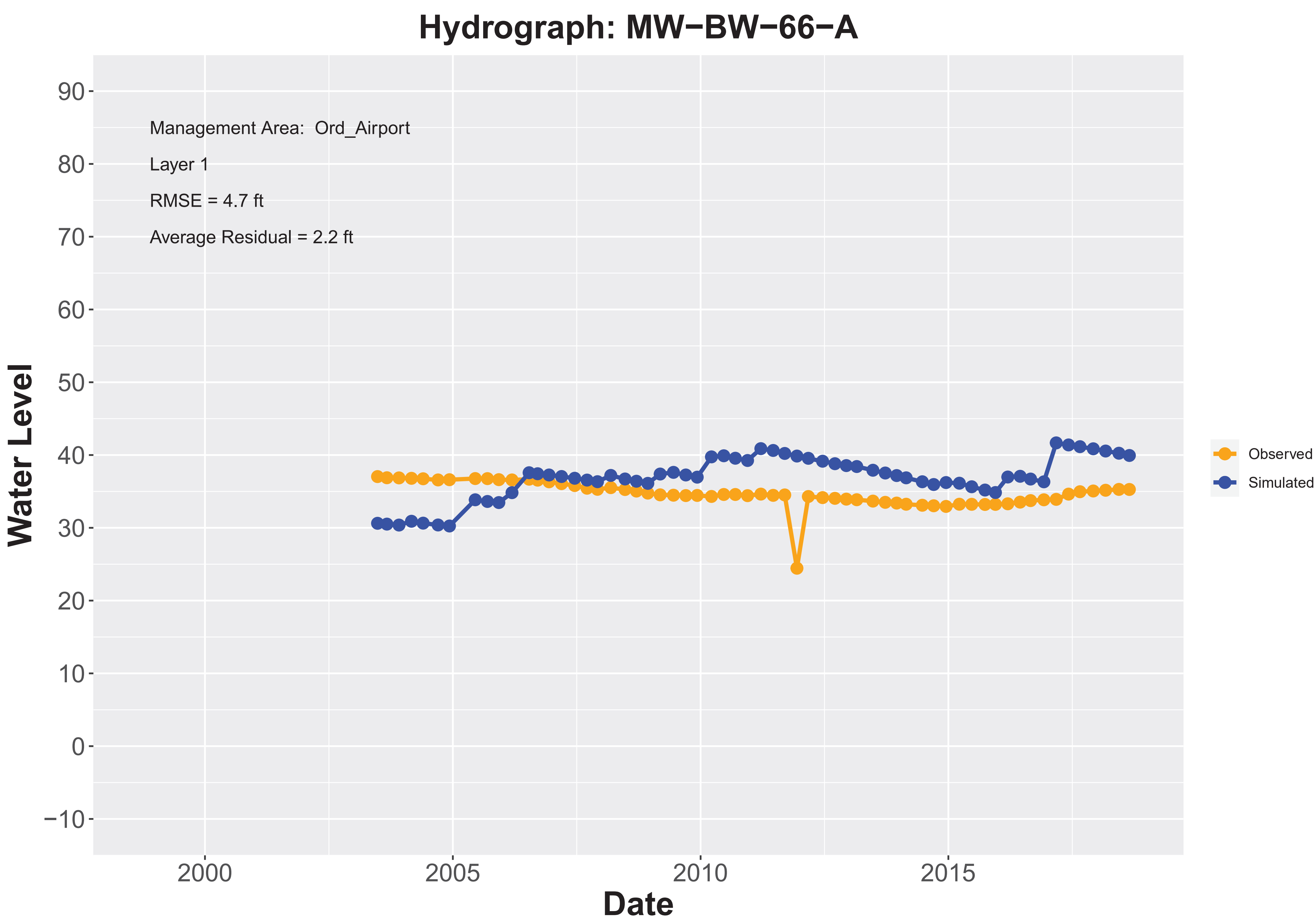
Hydrograph: MW−BW−63−A

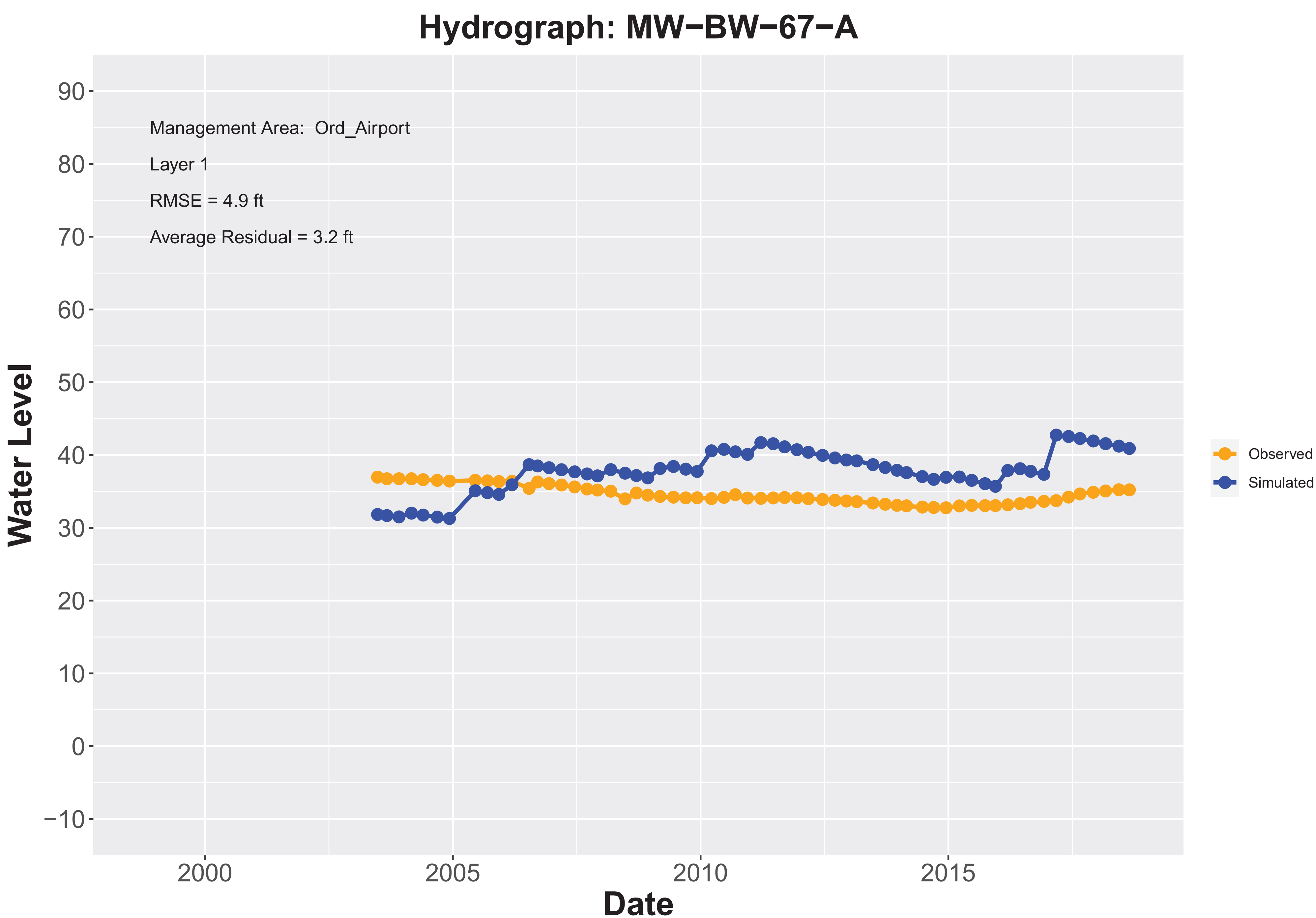


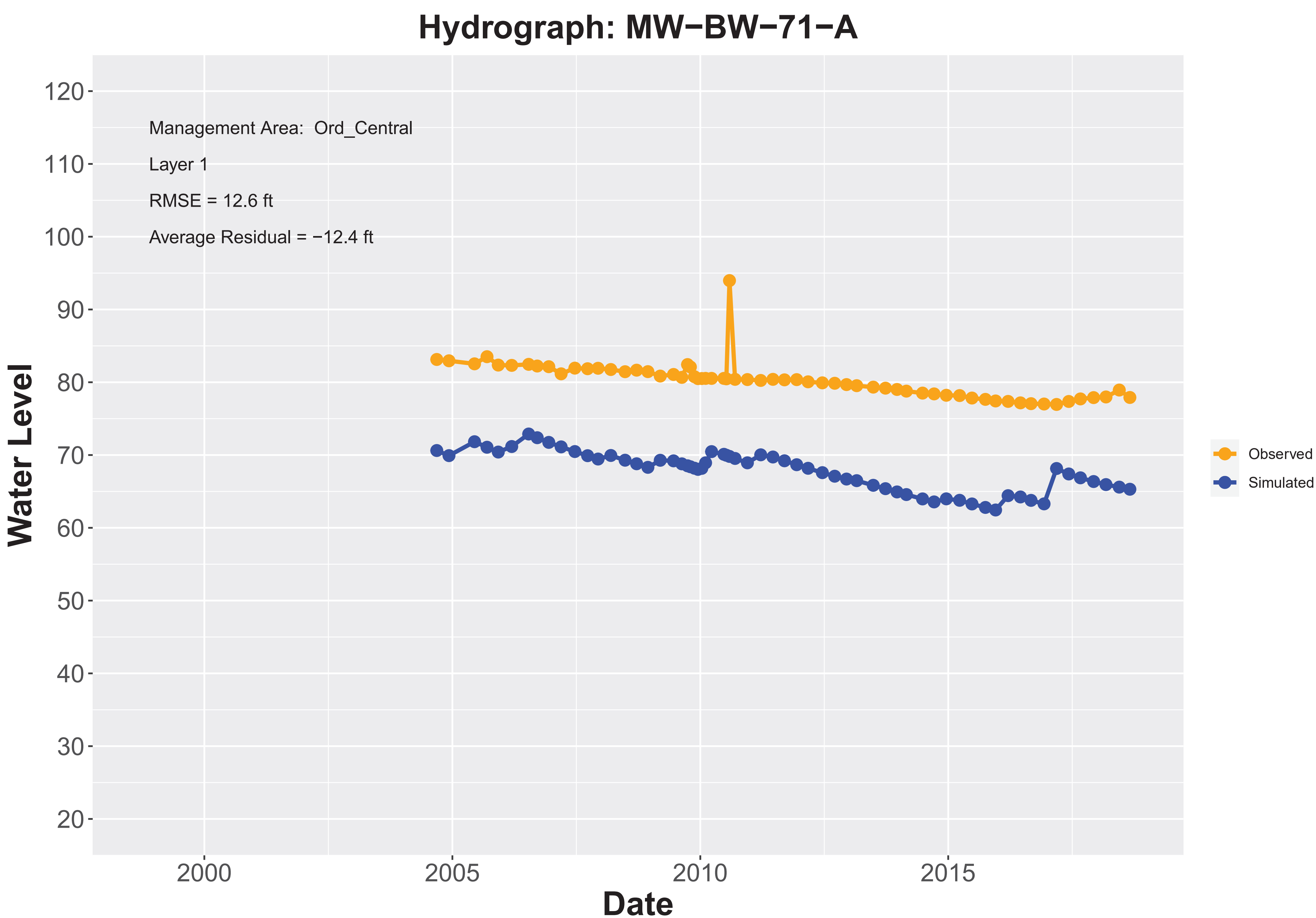

Hydrograph: MW−BW−64−A
Management Area: Ord_Central
Layer 1
RMSE = 12.2 ft
Average Residual = −11.9 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−BW−65−A

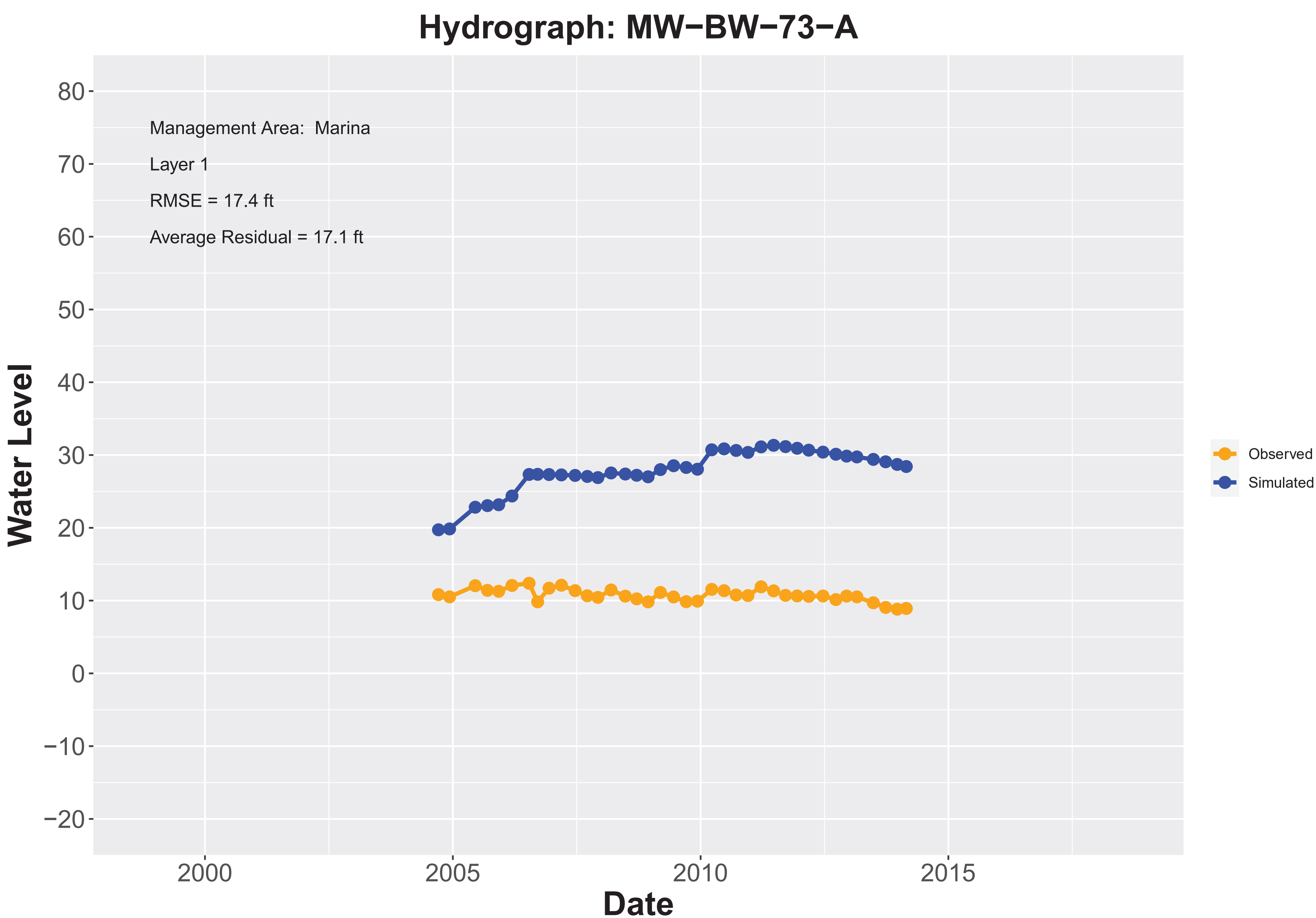



Hydrograph: MW−BW−66−A
Management Area: Ord_Airport
Layer 1
RMSE = 4.7 ft
Average Residual = 2.2 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

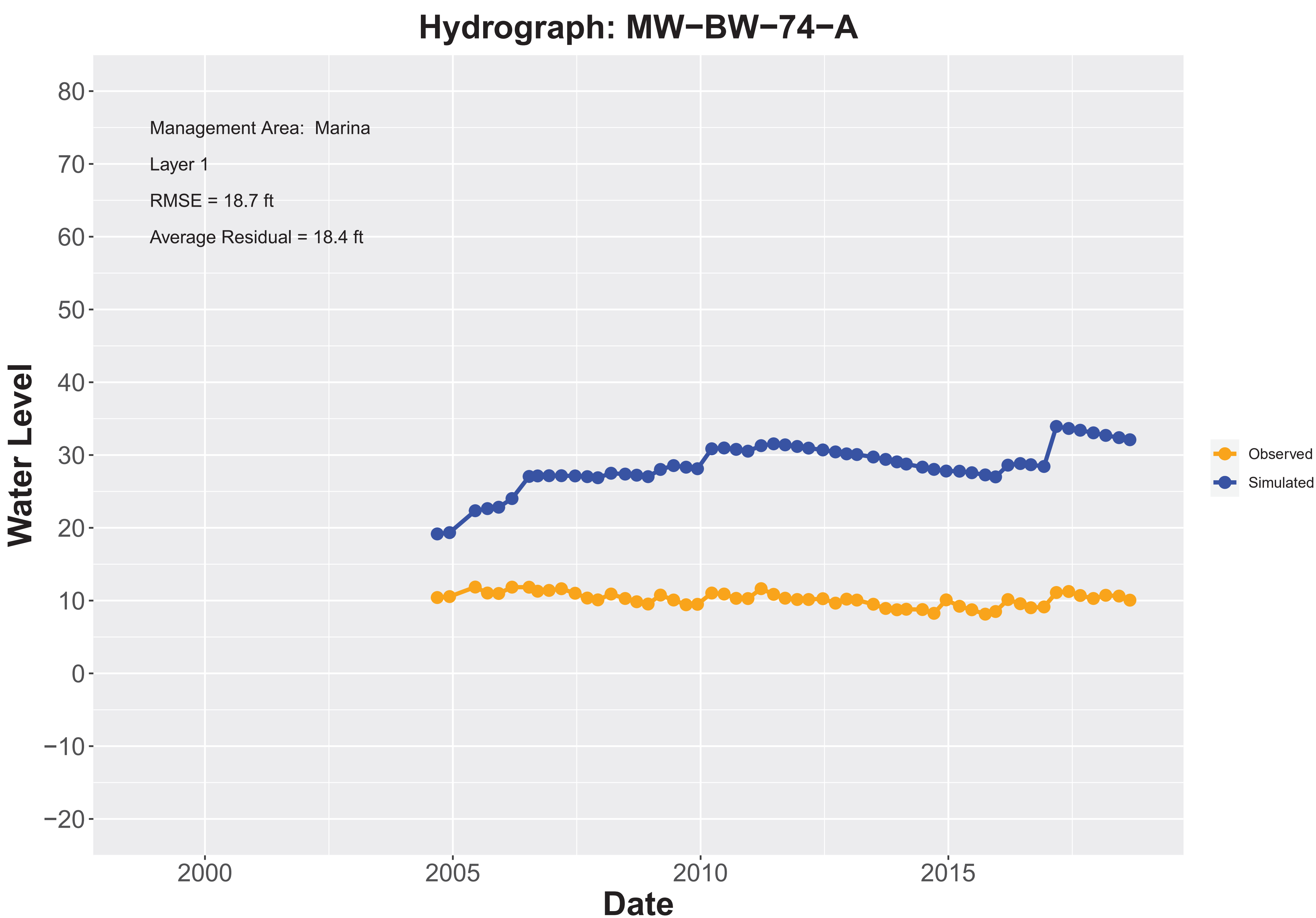

Hydrograph: MW−BW−67−A
Management Area: Ord_Airport
Layer 1
RMSE = 4.9 ft
Average Residual = 3.2 ft
Water Level
Date
Observed
Simulated
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015

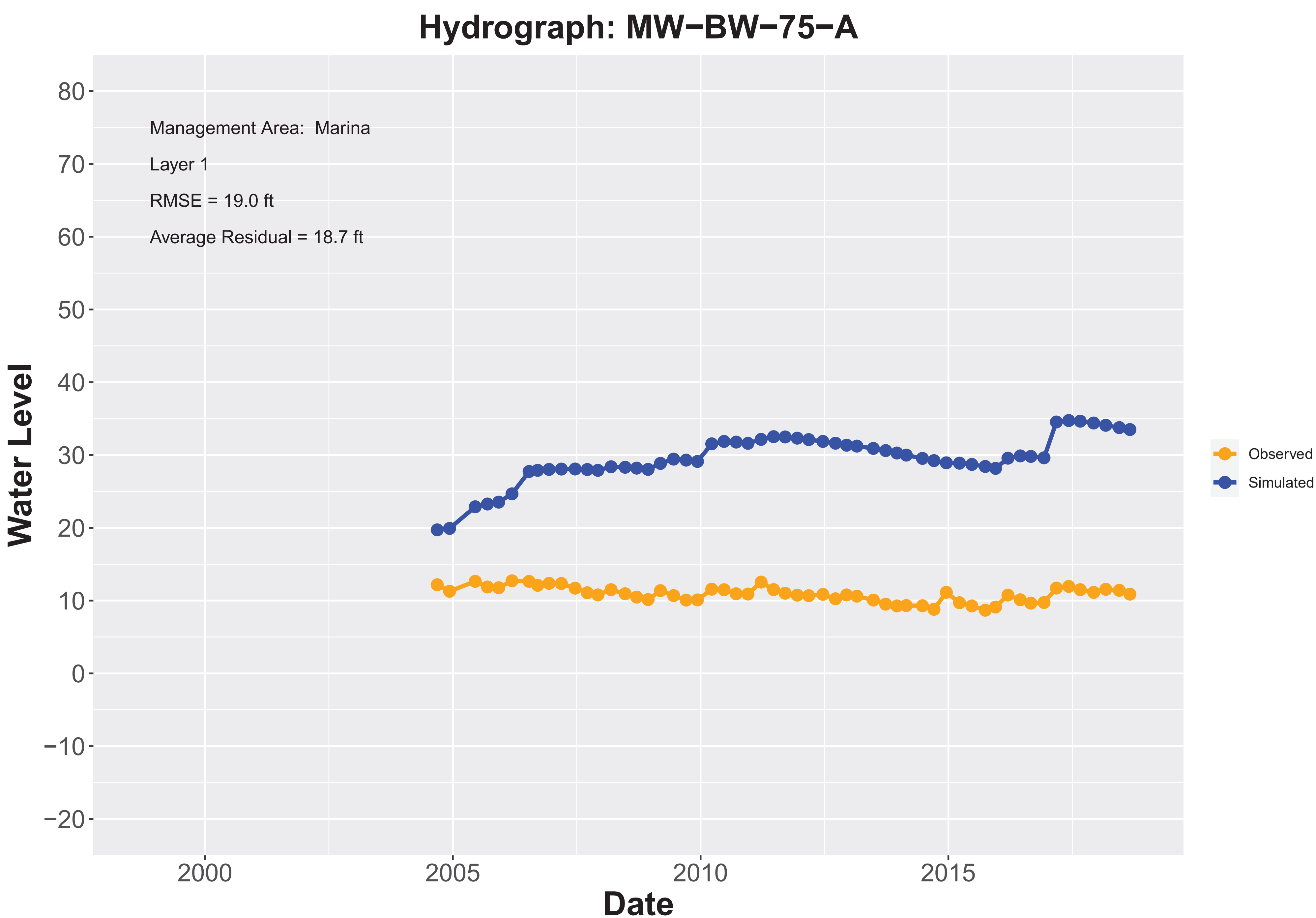


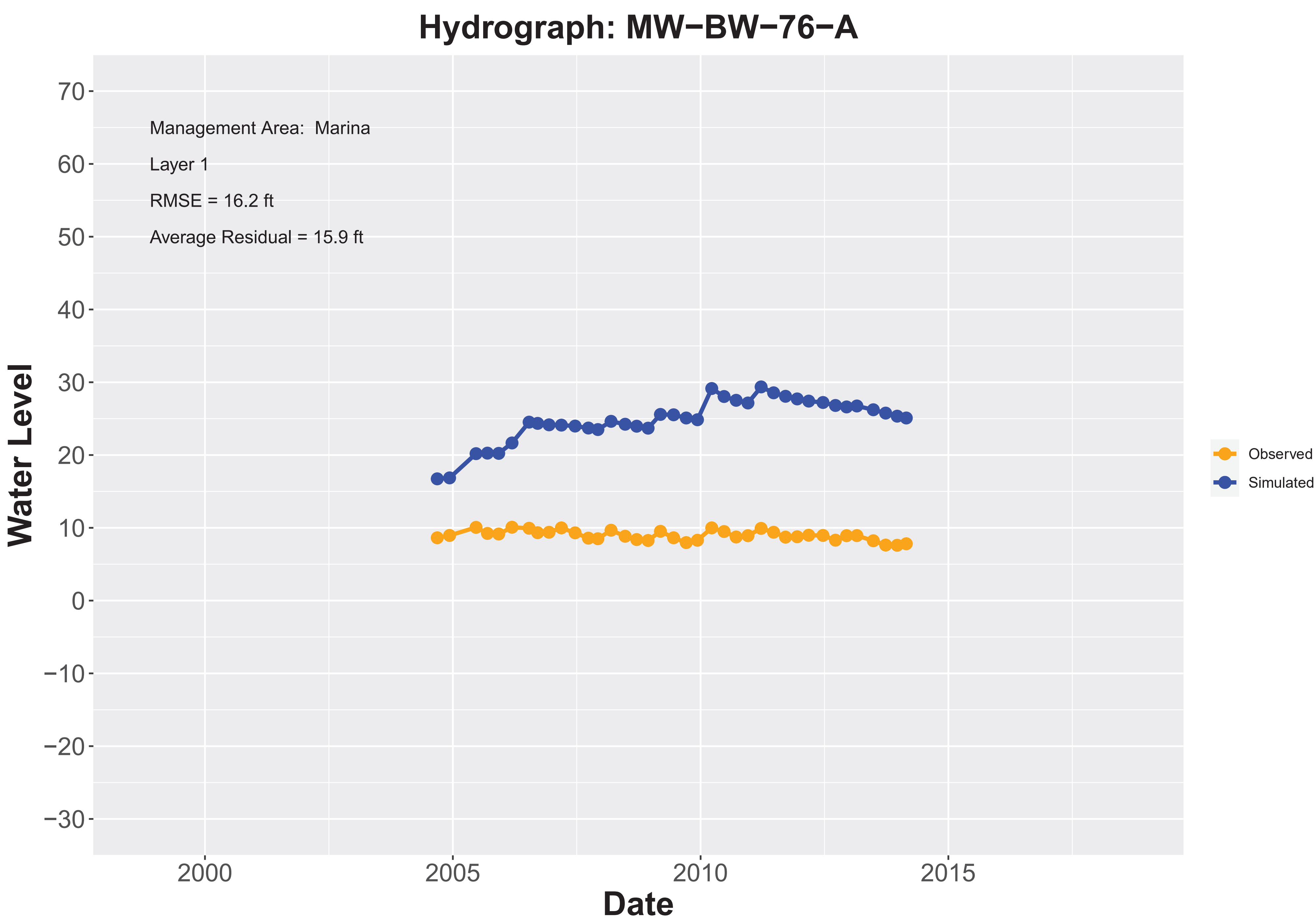
Hydrograph: MW−BW−71−A
Management Area: Ord_Central
Layer 1
RMSE = 12.6 ft
Average Residual = −12.4 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
Date
2000
2005
2010
2015
Observed
Simulated



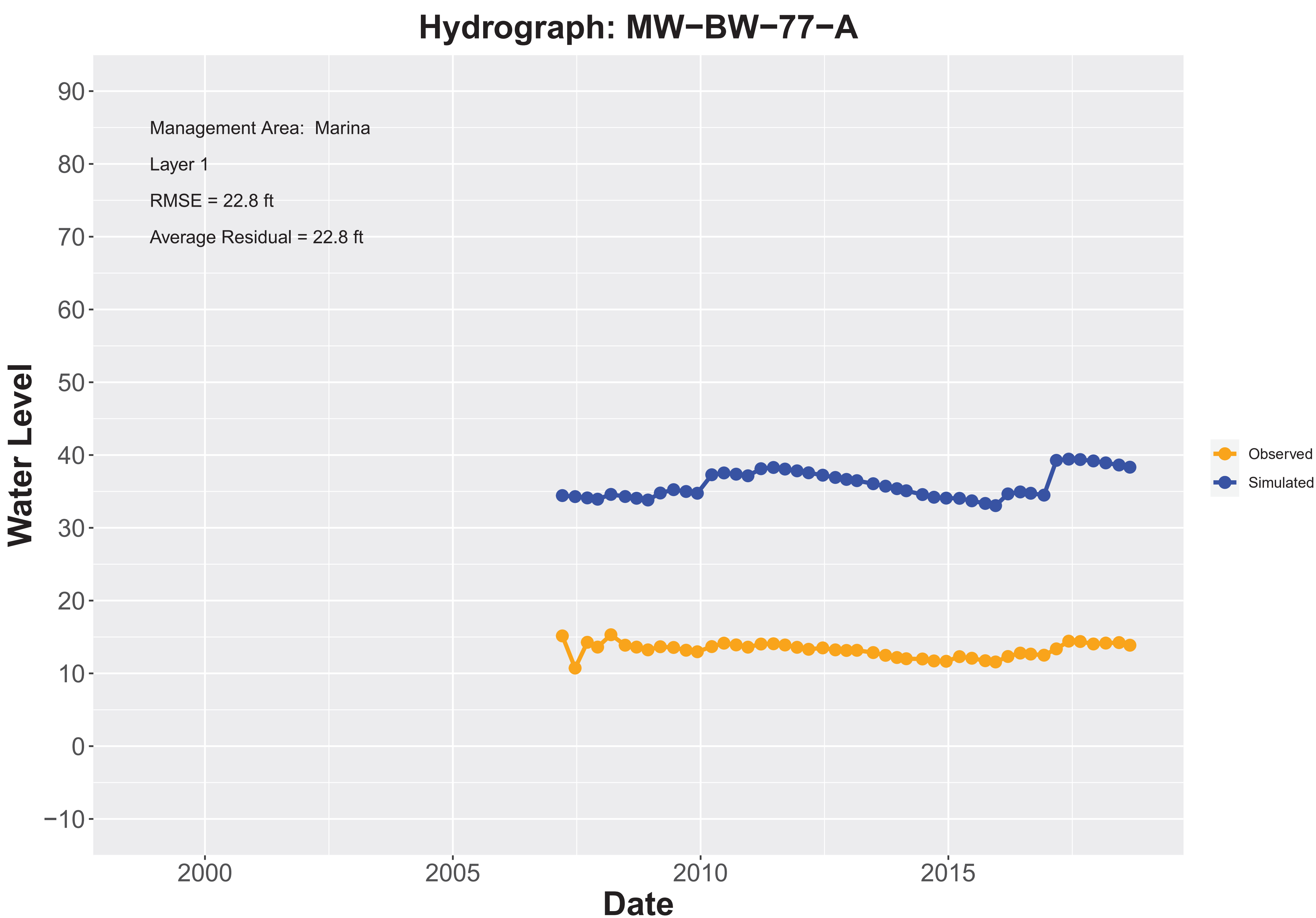
Hydrograph: MW−BW−73−A
Management Area: Marina
Layer 1
RMSE = 17.4 ft
Average Residual = 17.1 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−BW−74−A
Management Area: Marina
Layer 1
RMSE = 18.7 ft
Average Residual = 18.4 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated

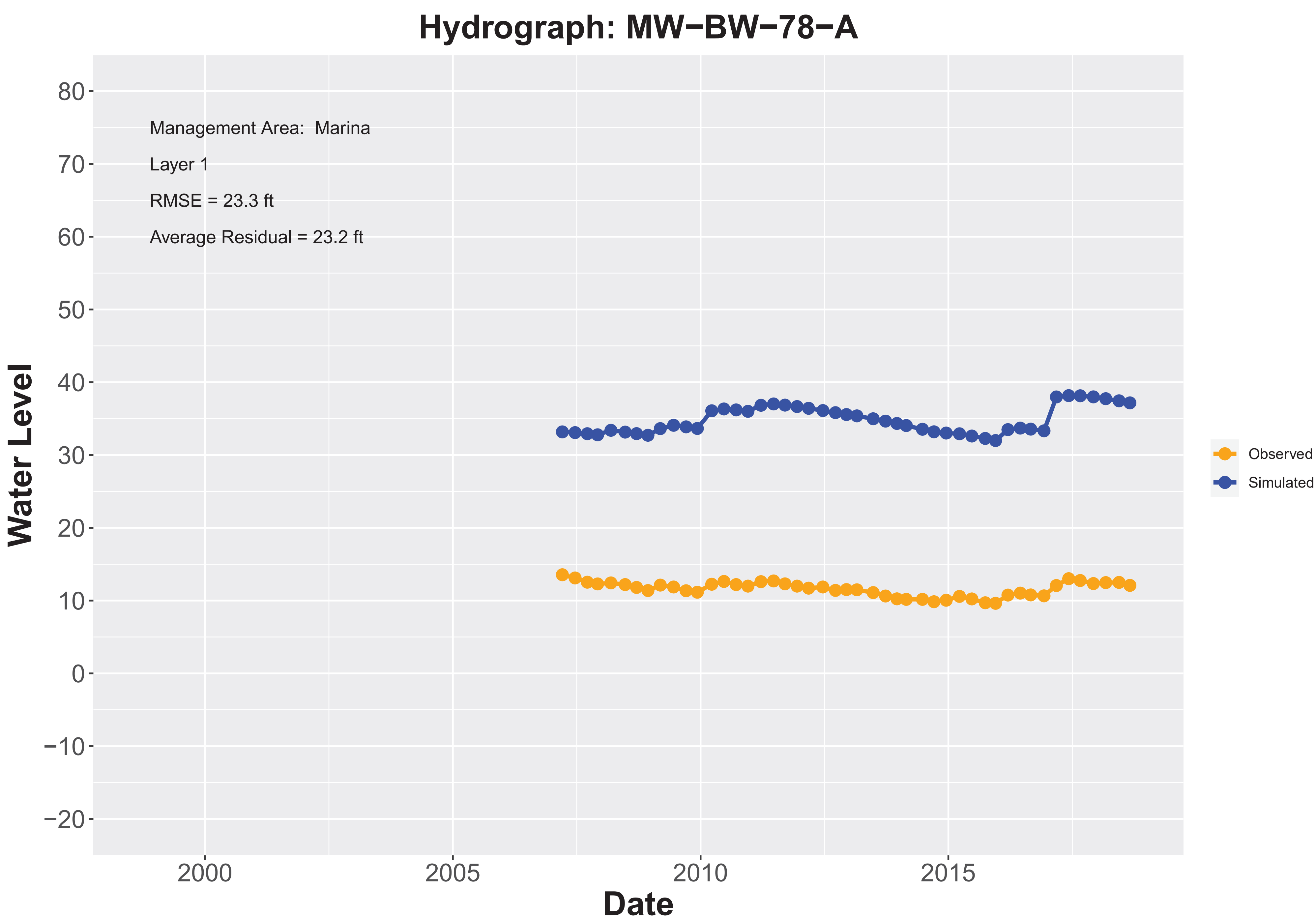

Hydrograph: MW−BW−75−A
Management Area: Marina
Layer 1
RMSE = 19.0 ft
Average Residual = 18.7 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated



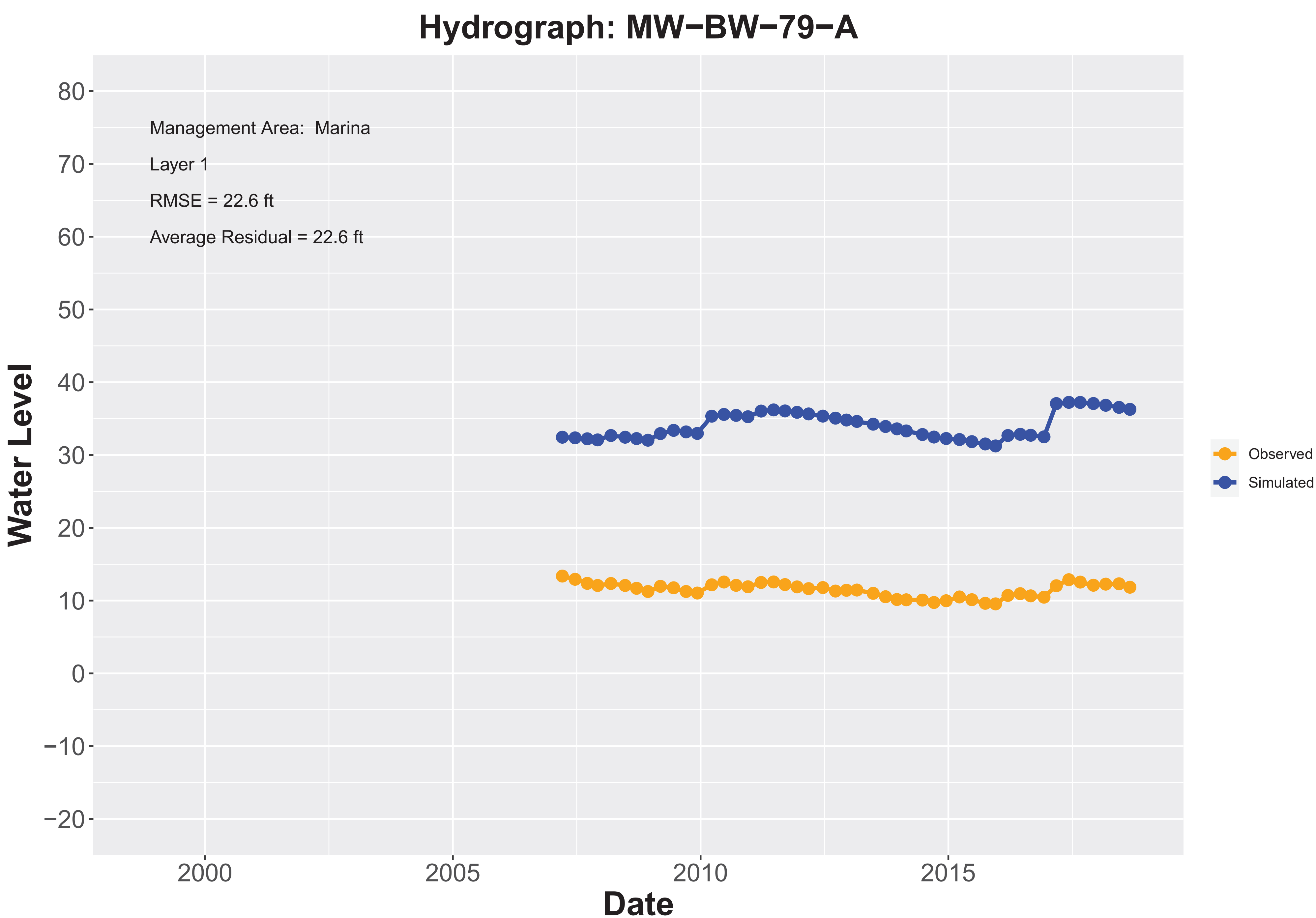
Hydrograph: MW−BW−76−A
Management Area: Marina
Layer 1
RMSE = 16.2 ft
Average Residual = 15.9 ft
Water Level
70
60
50
40
30
20
10
0
−10
−20
−30
2000
2005
2010
2015
Date
Observed
Simulated



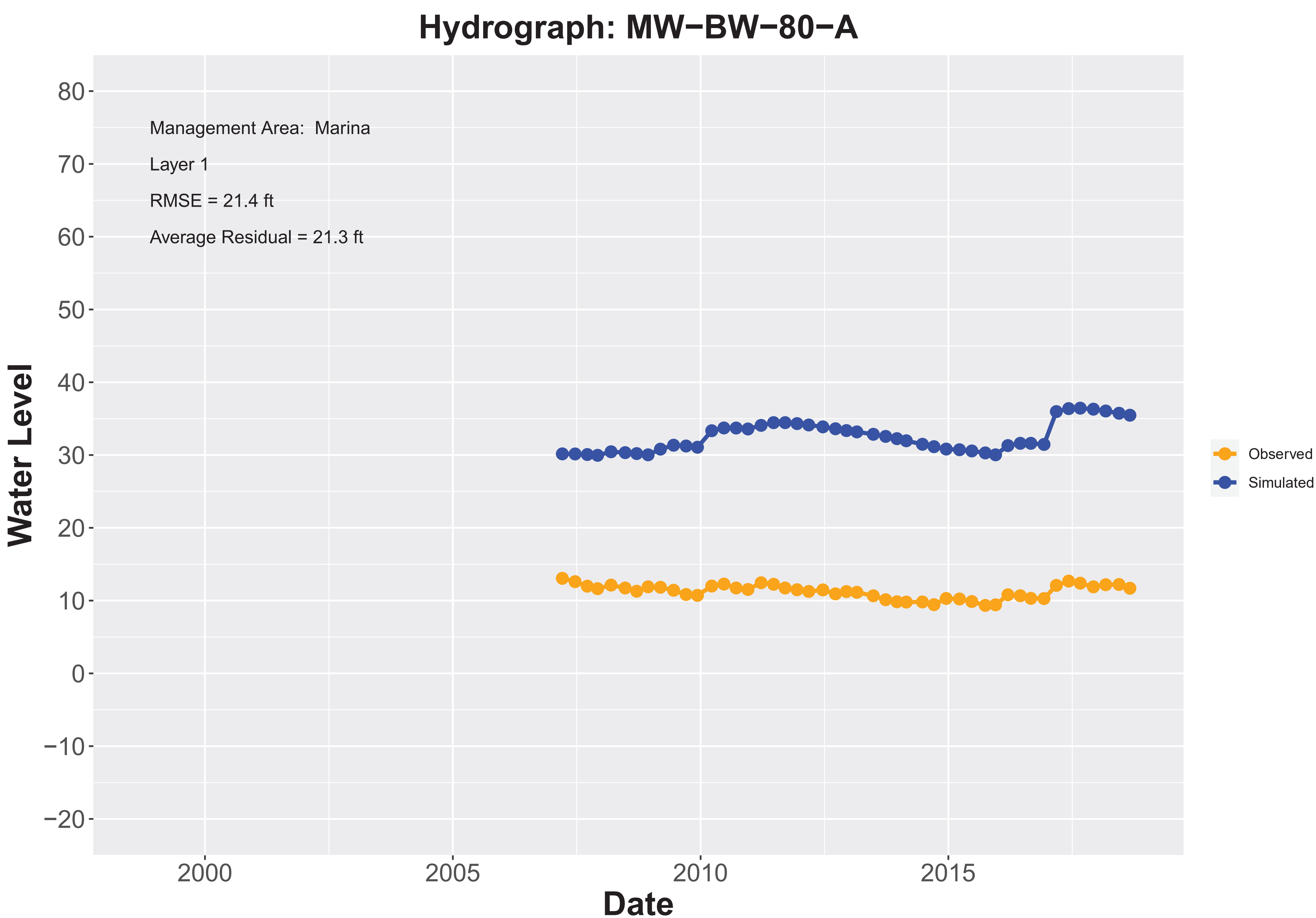
Hydrograph: MW−BW−77−A
Management Area: Marina
Layer 1
RMSE = 22.8 ft
Average Residual = 22.8 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated



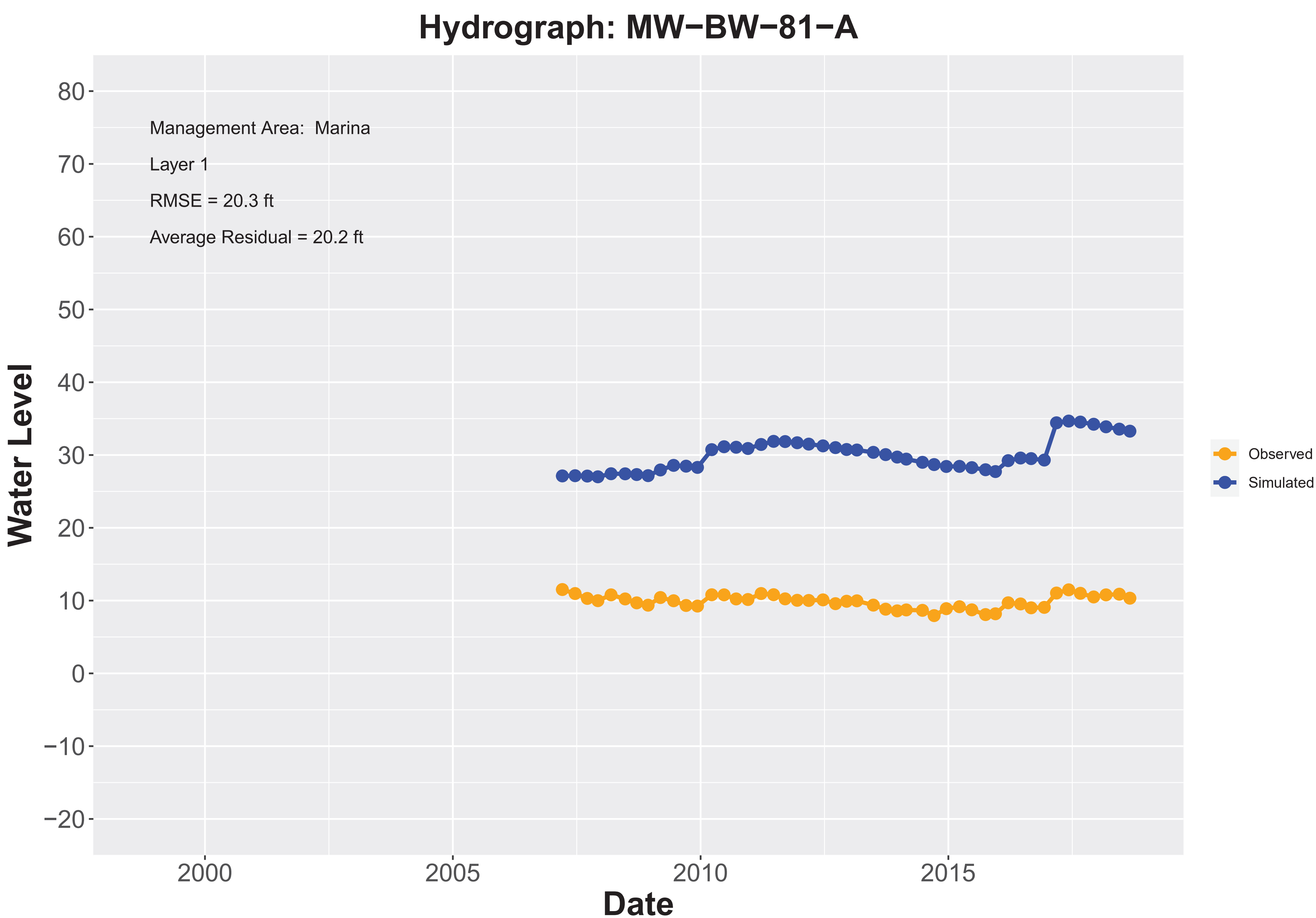
Hydrograph: MW−BW−78−A
Management Area: Marina
Layer 1
RMSE = 23.3 ft
Average Residual = 23.2 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated

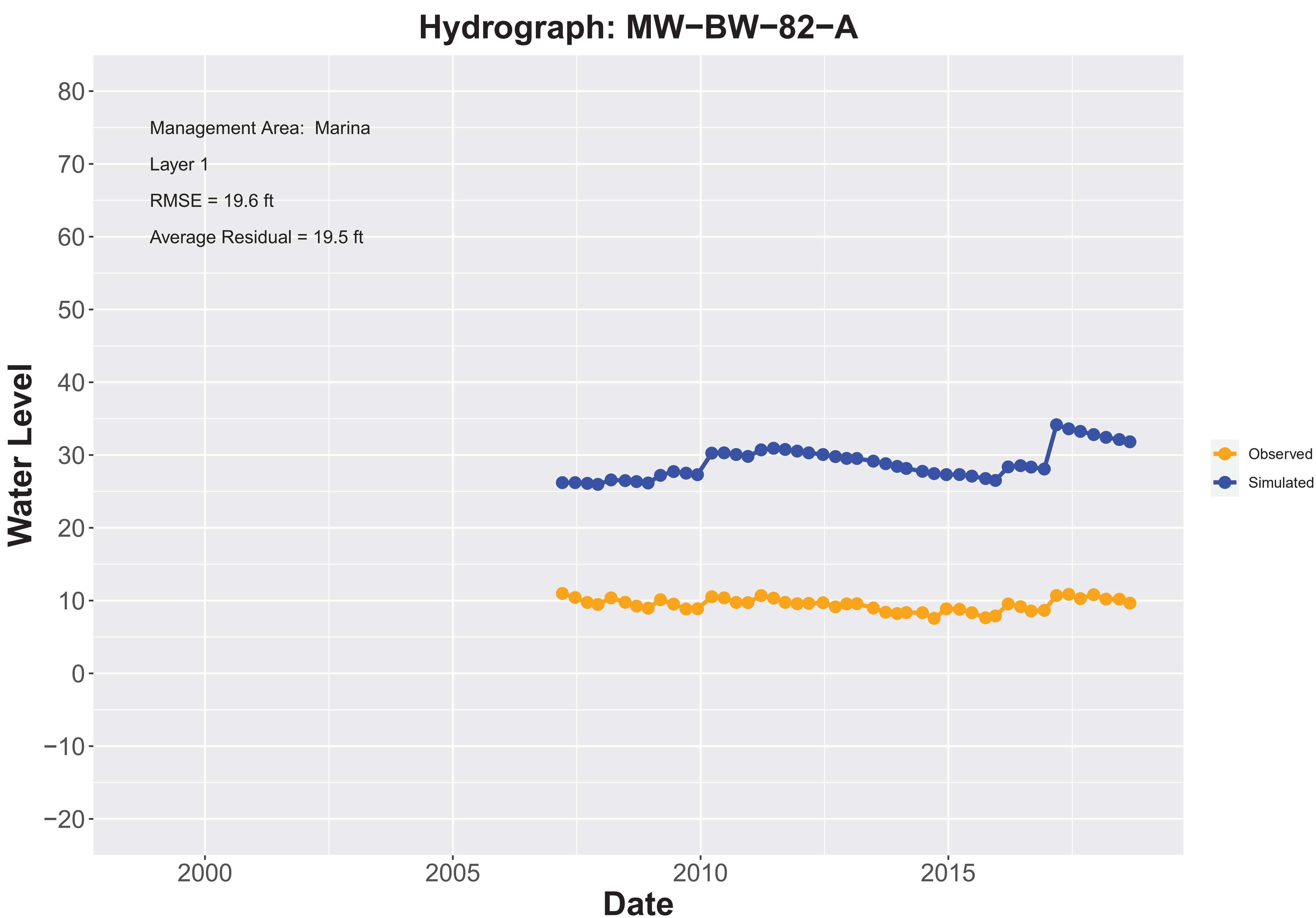


Hydrograph: MW−BW−79−A
Management Area: Marina
Layer 1
RMSE = 22.6 ft
Average Residual = 22.6 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated

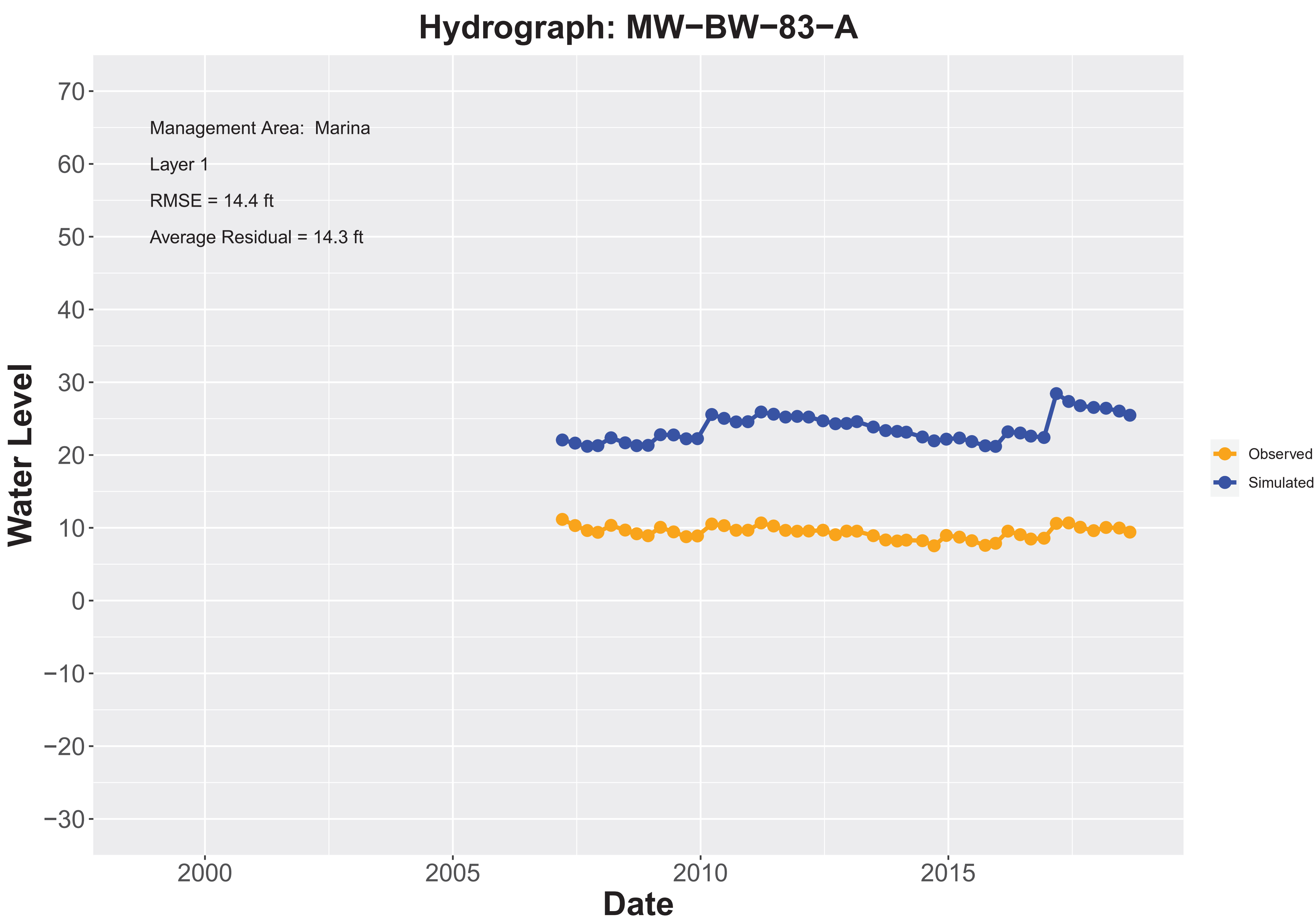


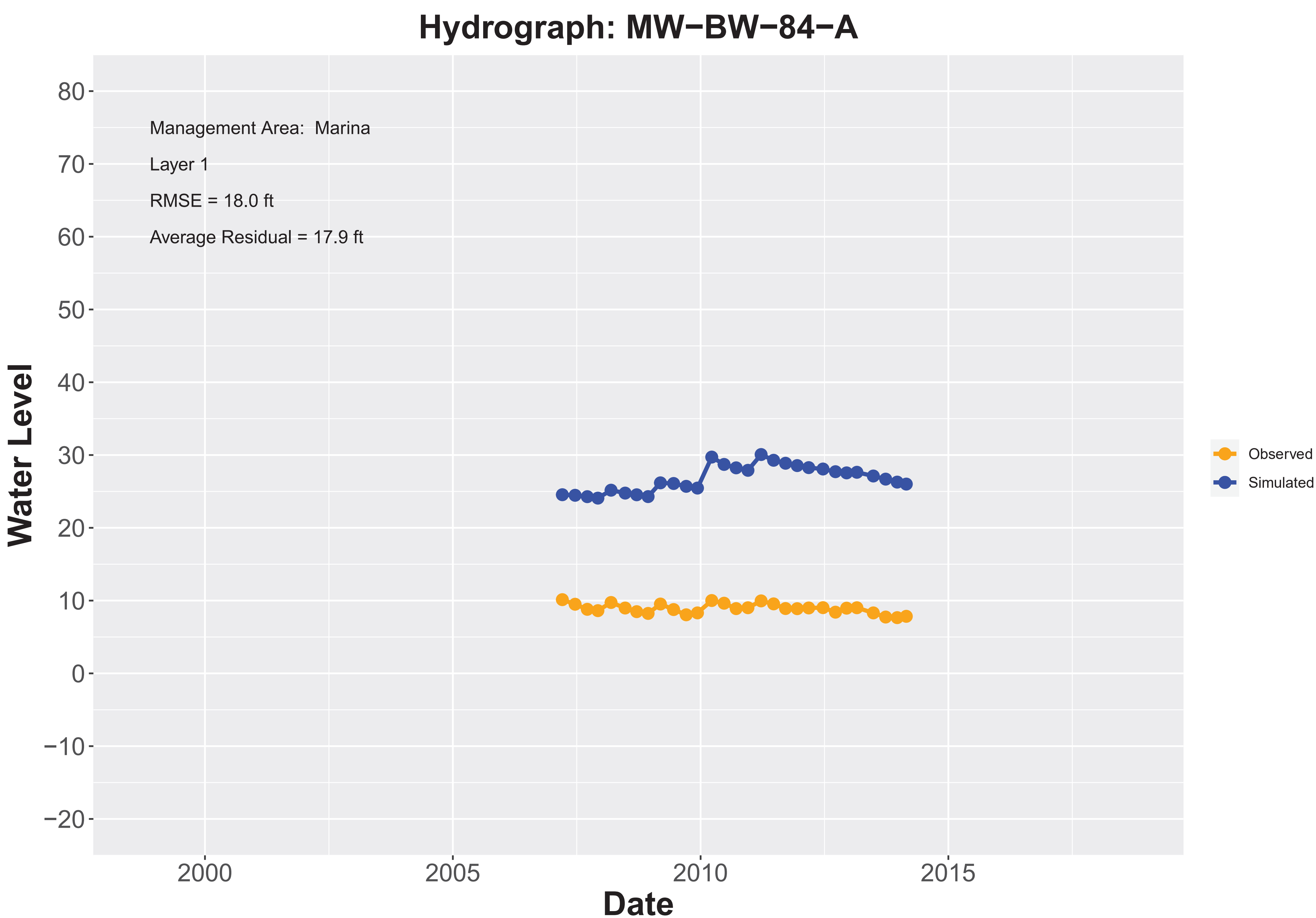
Hydrograph: MW−BW−80−A
Management Area: Marina
Layer 1
RMSE = 21.4 ft
Average Residual = 21.3 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated

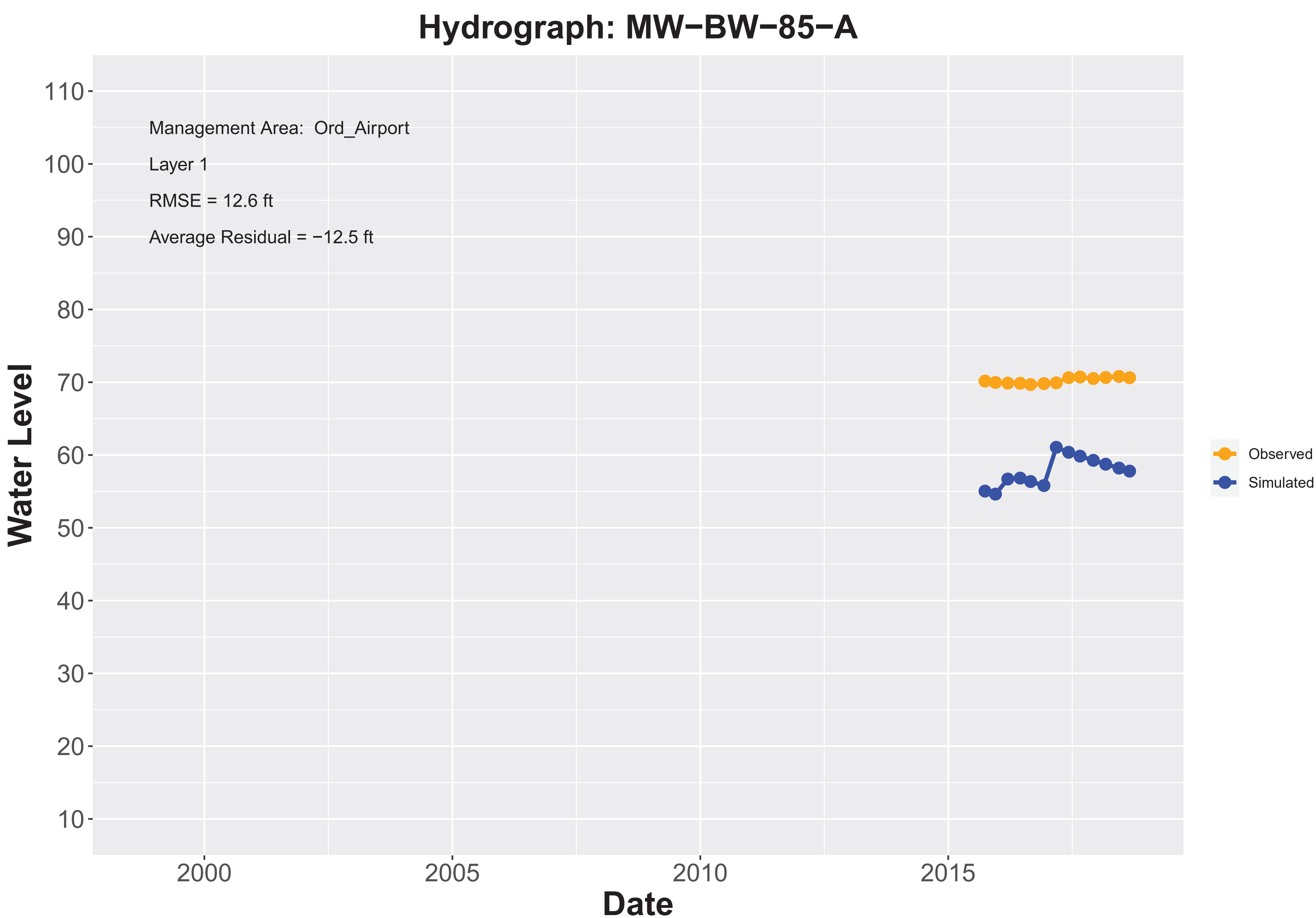

Hydrograph: MW−BW−81−A
Management Area: Marina
Layer 1
RMSE = 20.3 ft
Average Residual = 20.2 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated



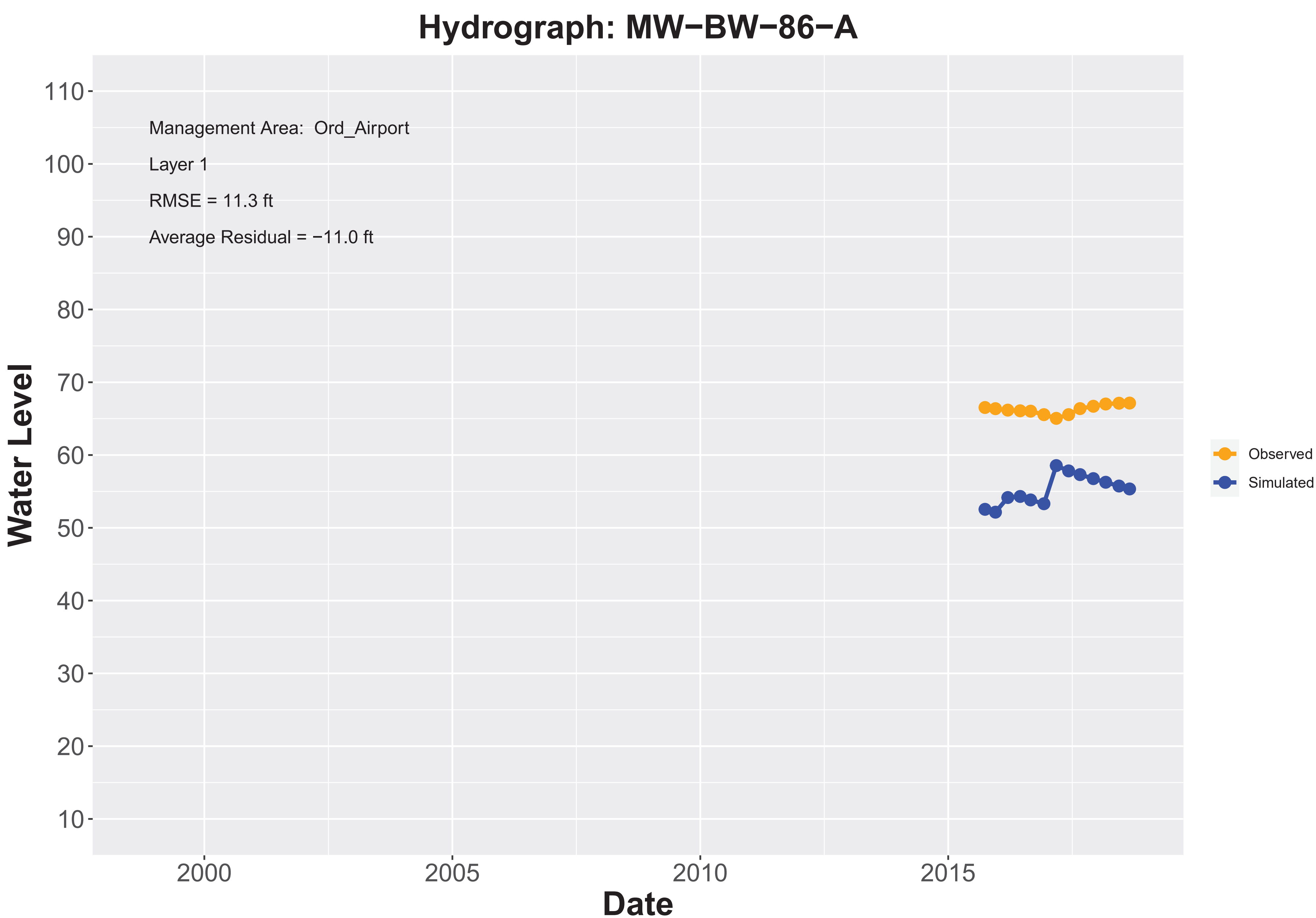
Hydrograph: MW−BW−82−A
Management Area: Marina
Layer 1
RMSE = 19.6 ft
Average Residual = 19.5 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated

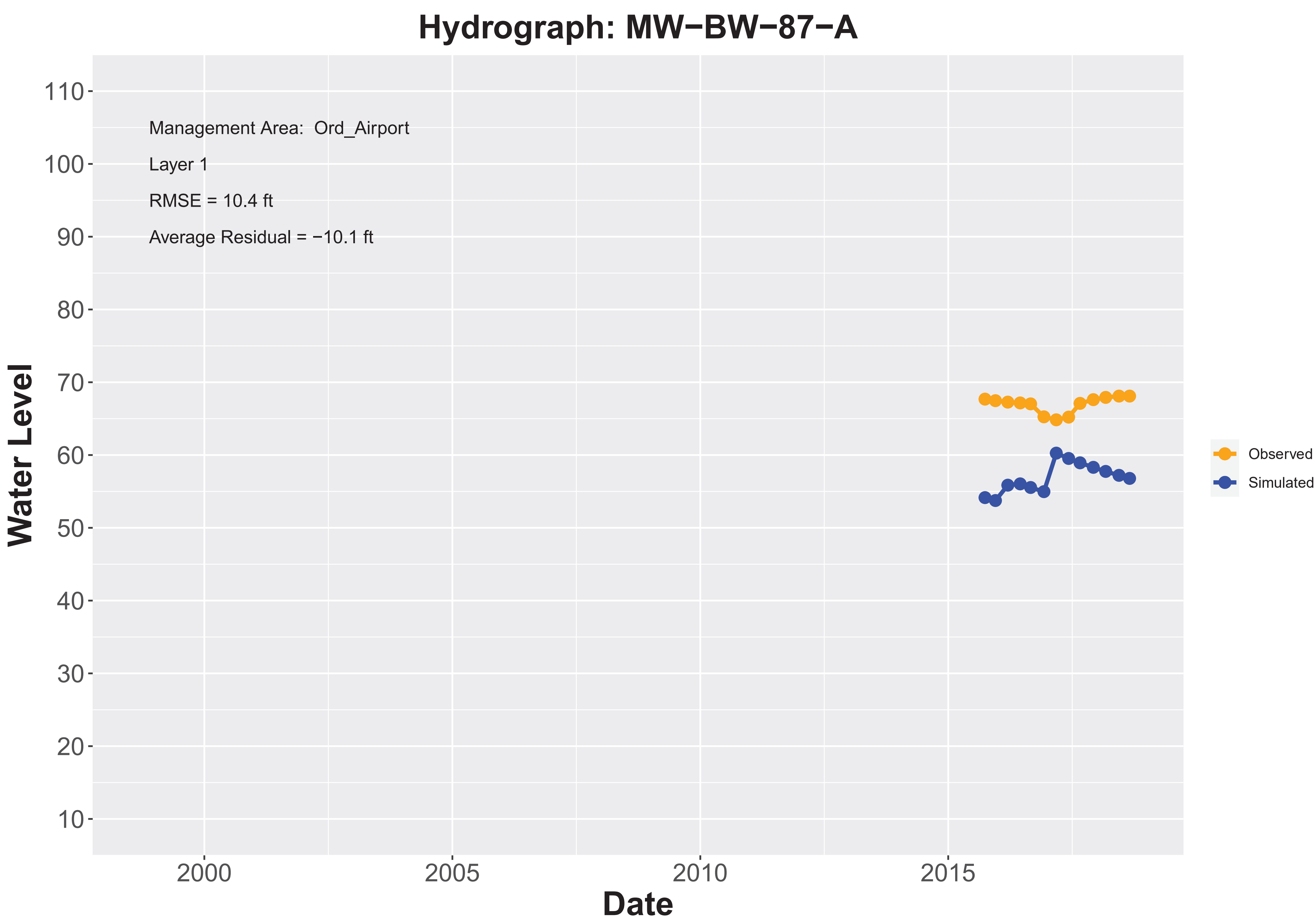

Hydrograph: MW−BW−83−A
Management Area: Marina
Layer 1
RMSE = 14.4 ft
Average Residual = 14.3 ft
Water Level
70
60
50
40
30
20
10
0
−10
−20
−30
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−BW−84−A
Management Area: Marina
Layer 1
RMSE = 18.0 ft
Average Residual = 17.9 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated



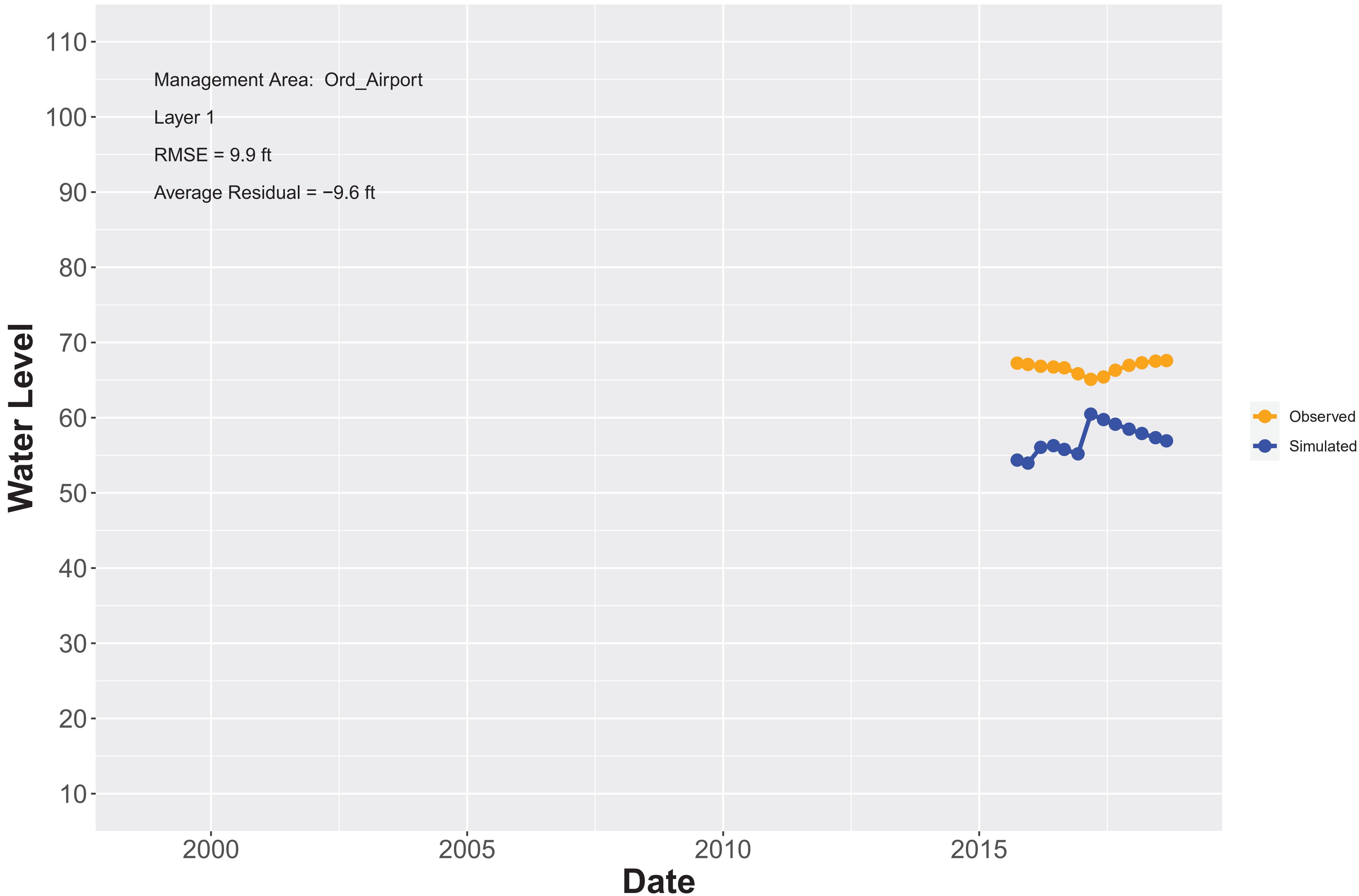
Hydrograph: MW−BW−85−A
Management Area: Ord_Airport
Layer 1
RMSE = 12.6 ft
Average Residual = −12.5 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

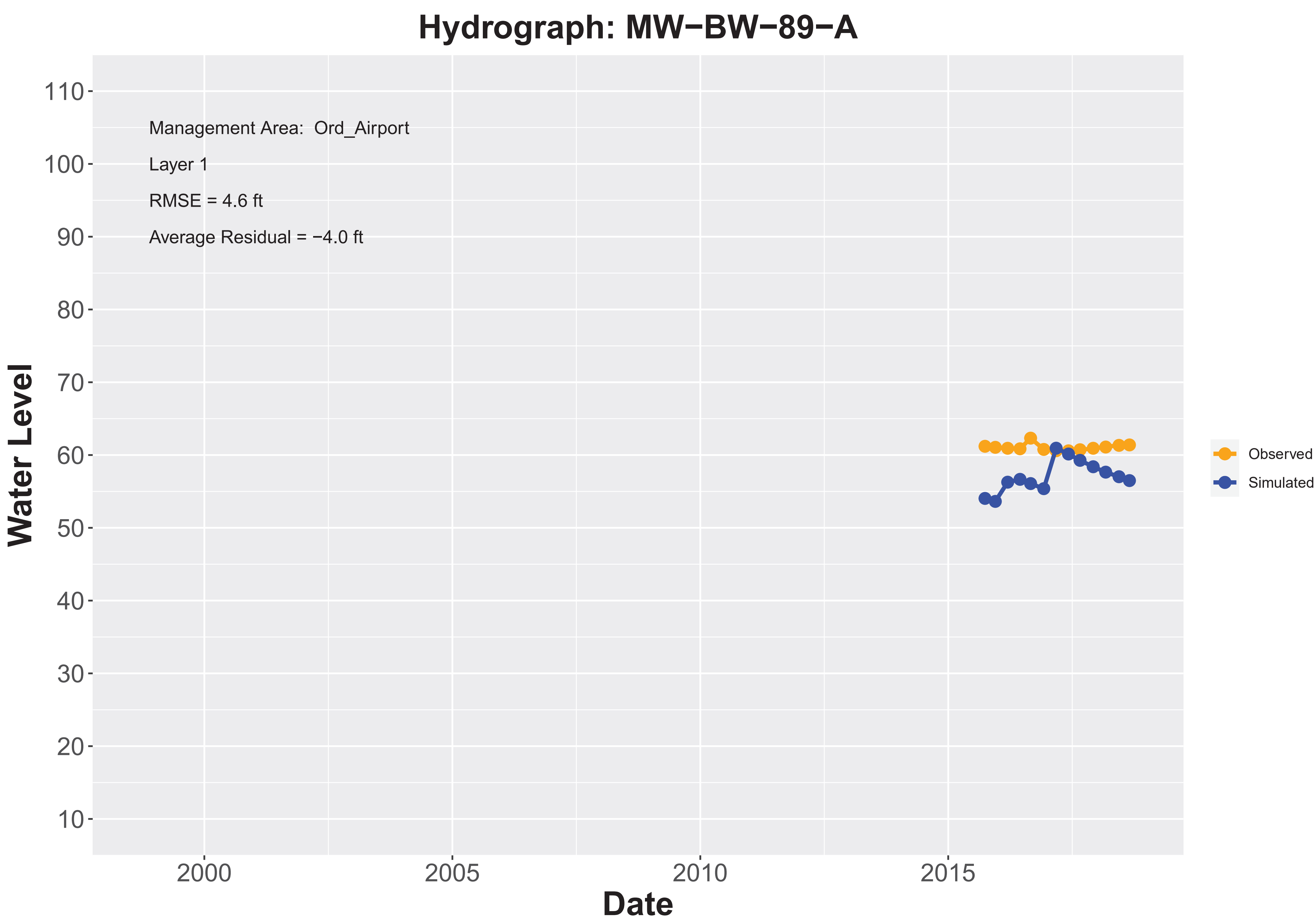

Hydrograph: MW−BW−86−A
Management Area: Ord_Airport
Layer 1
RMSE = 11.3 ft
Average Residual = −11.0 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



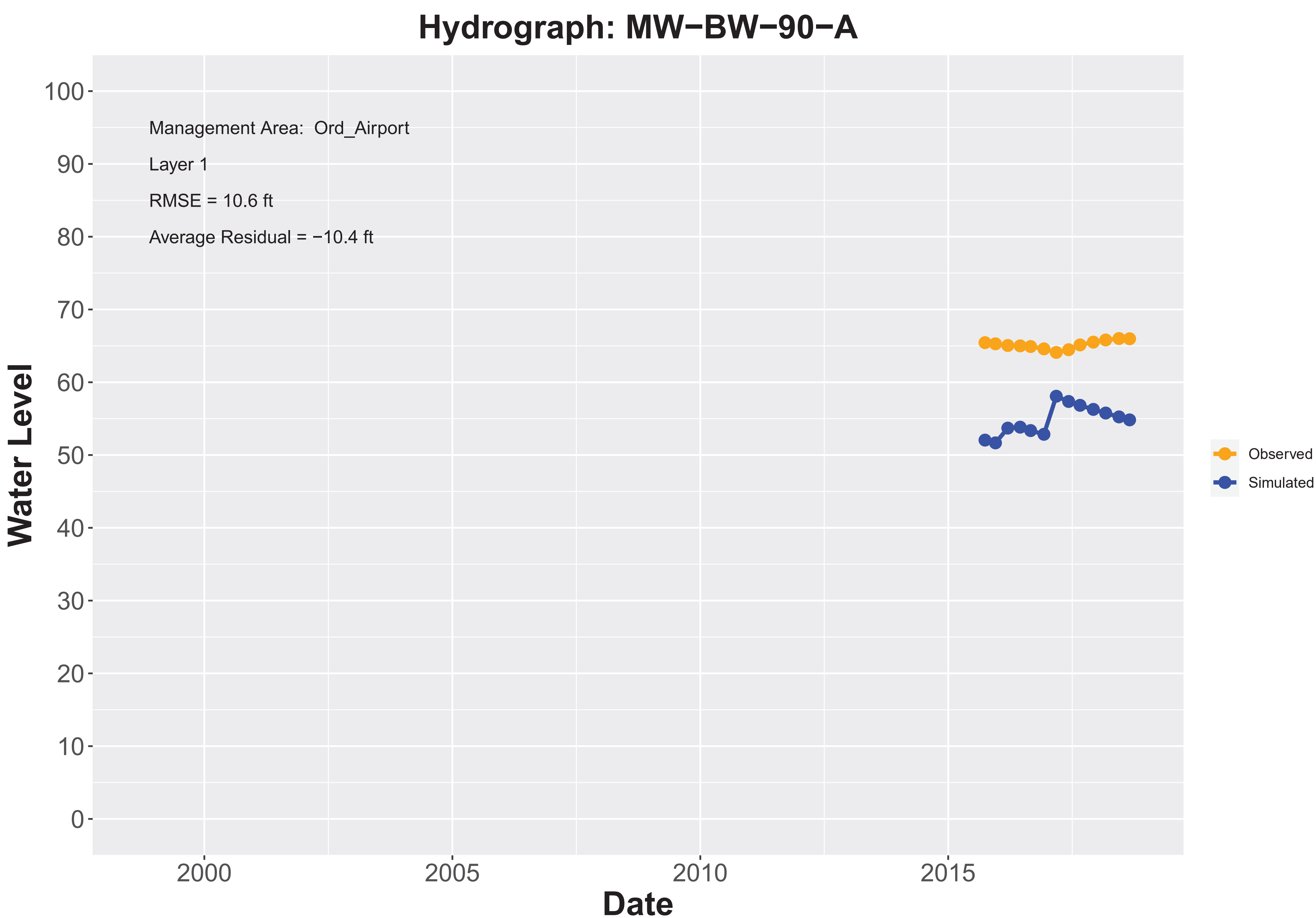
Hydrograph: MW−BW−87−A
Management Area: Ord_Airport
Layer 1
RMSE = 10.4 ft
Average Residual = −10.1 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−BW−88−A

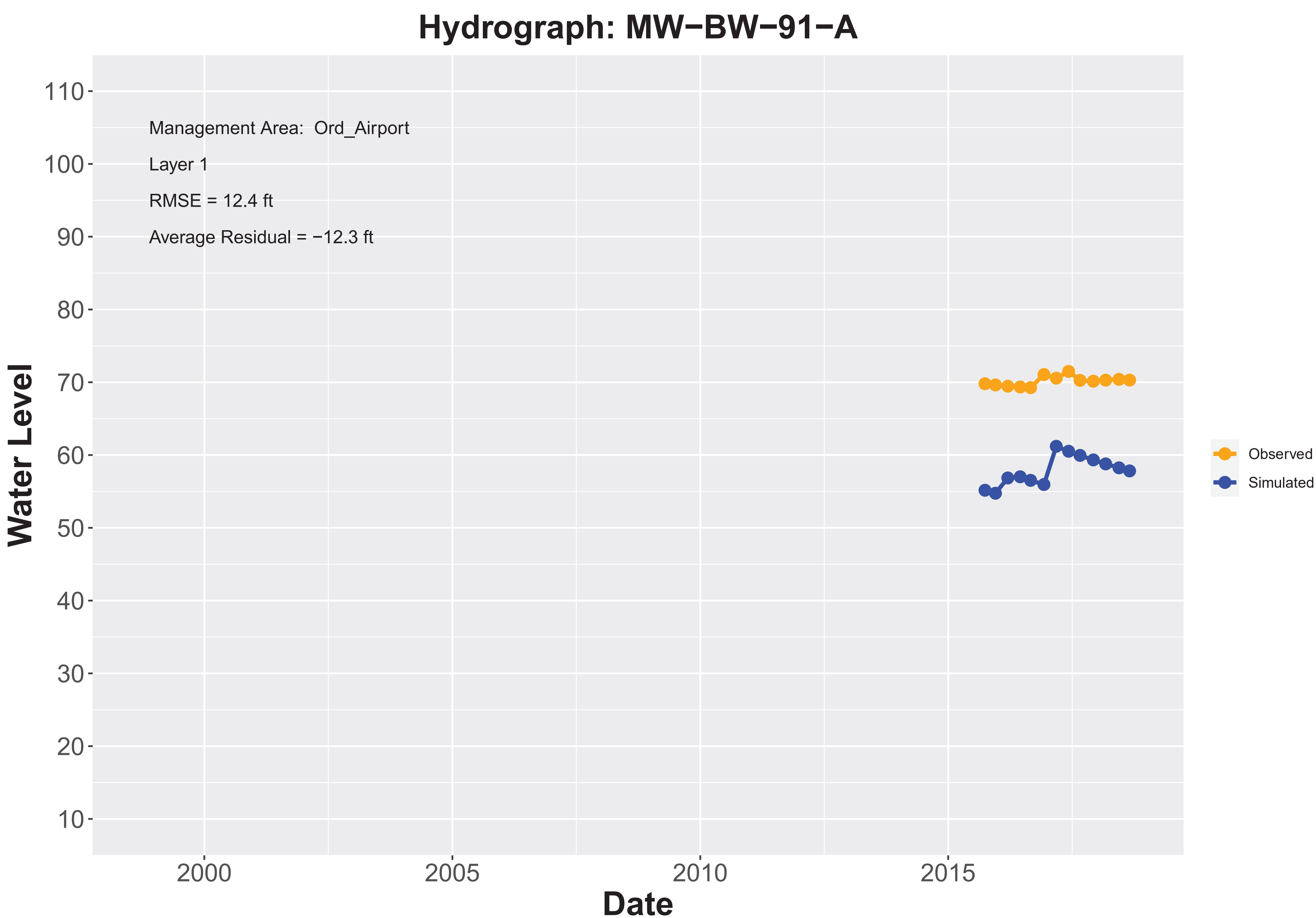




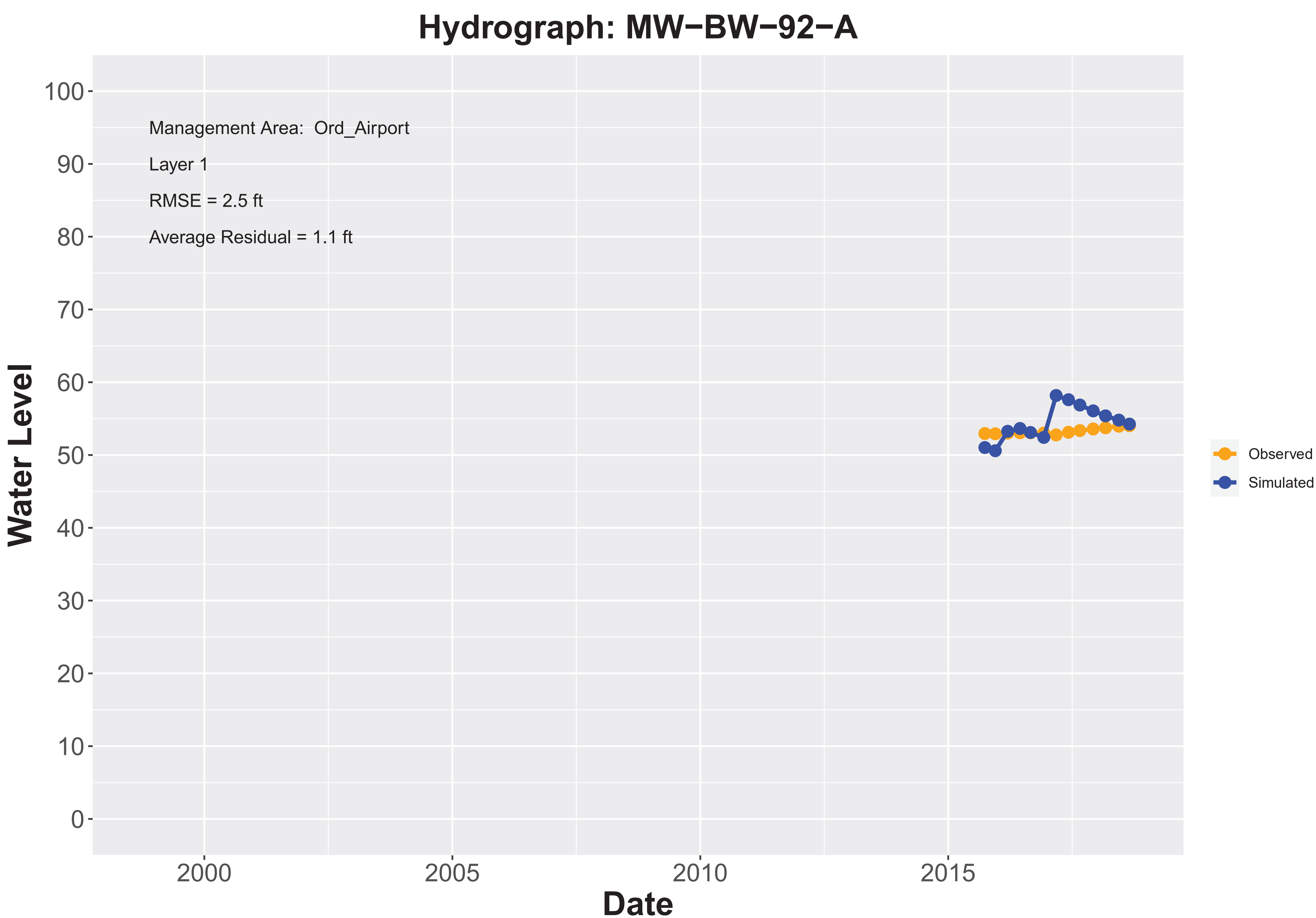
Hydrograph: MW−BW−89−A
Management Area: Ord_Airport
Layer 1
RMSE = 4.6 ft
Average Residual = −4.0 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

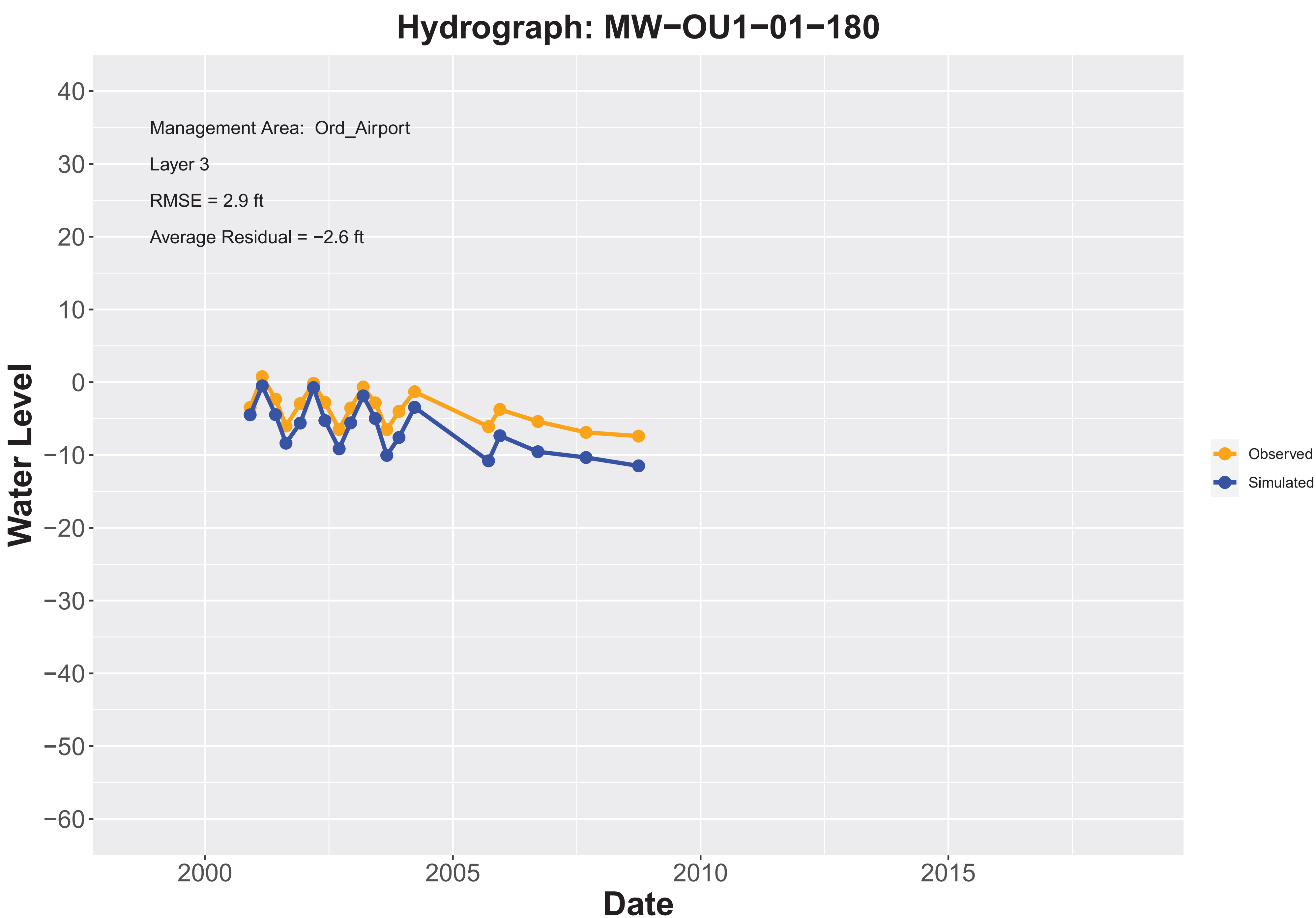


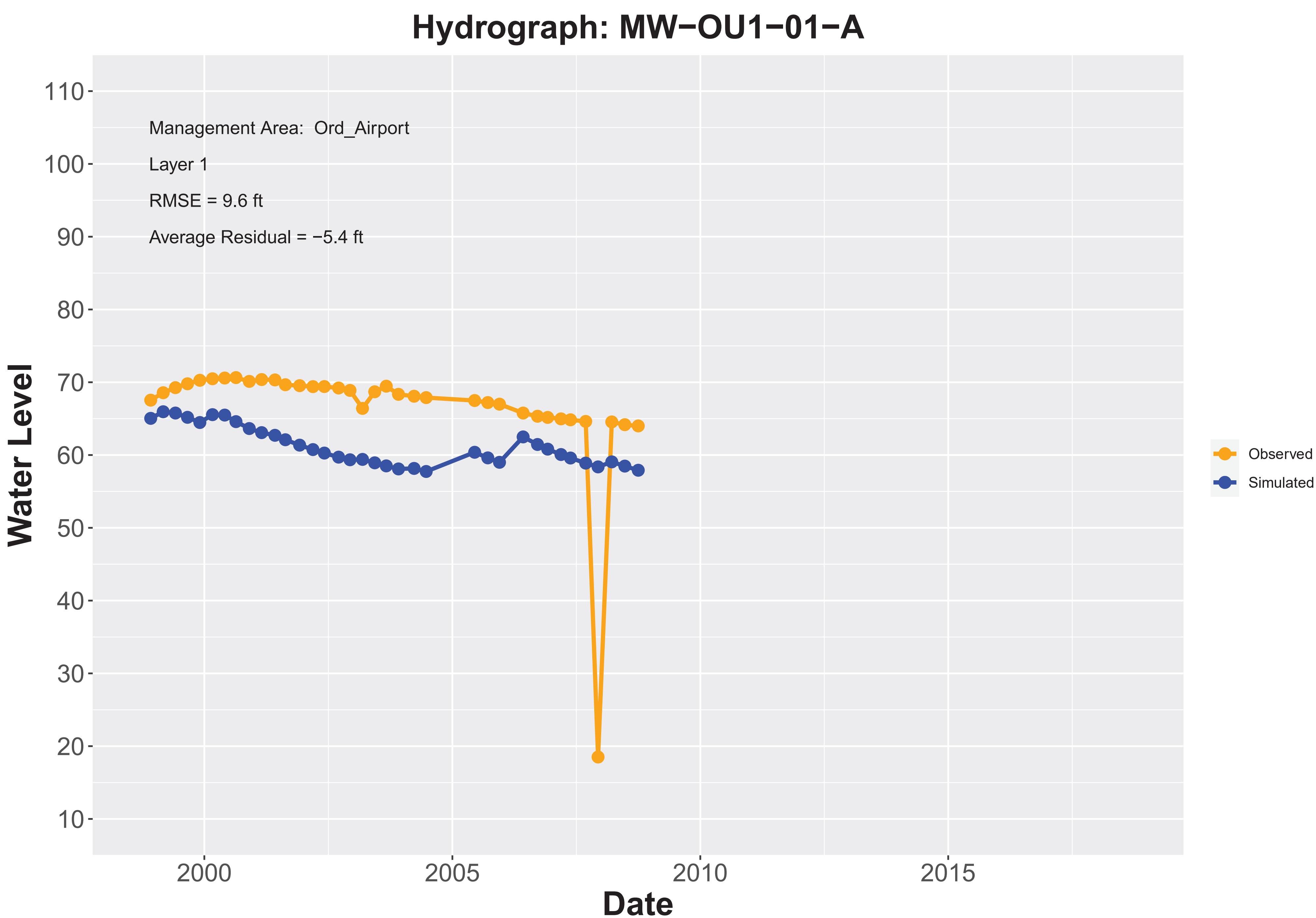
Hydrograph: MW−BW−90−A
Management Area: Ord_Airport
Layer 1
RMSE = 10.6 ft
Average Residual = −10.4 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated



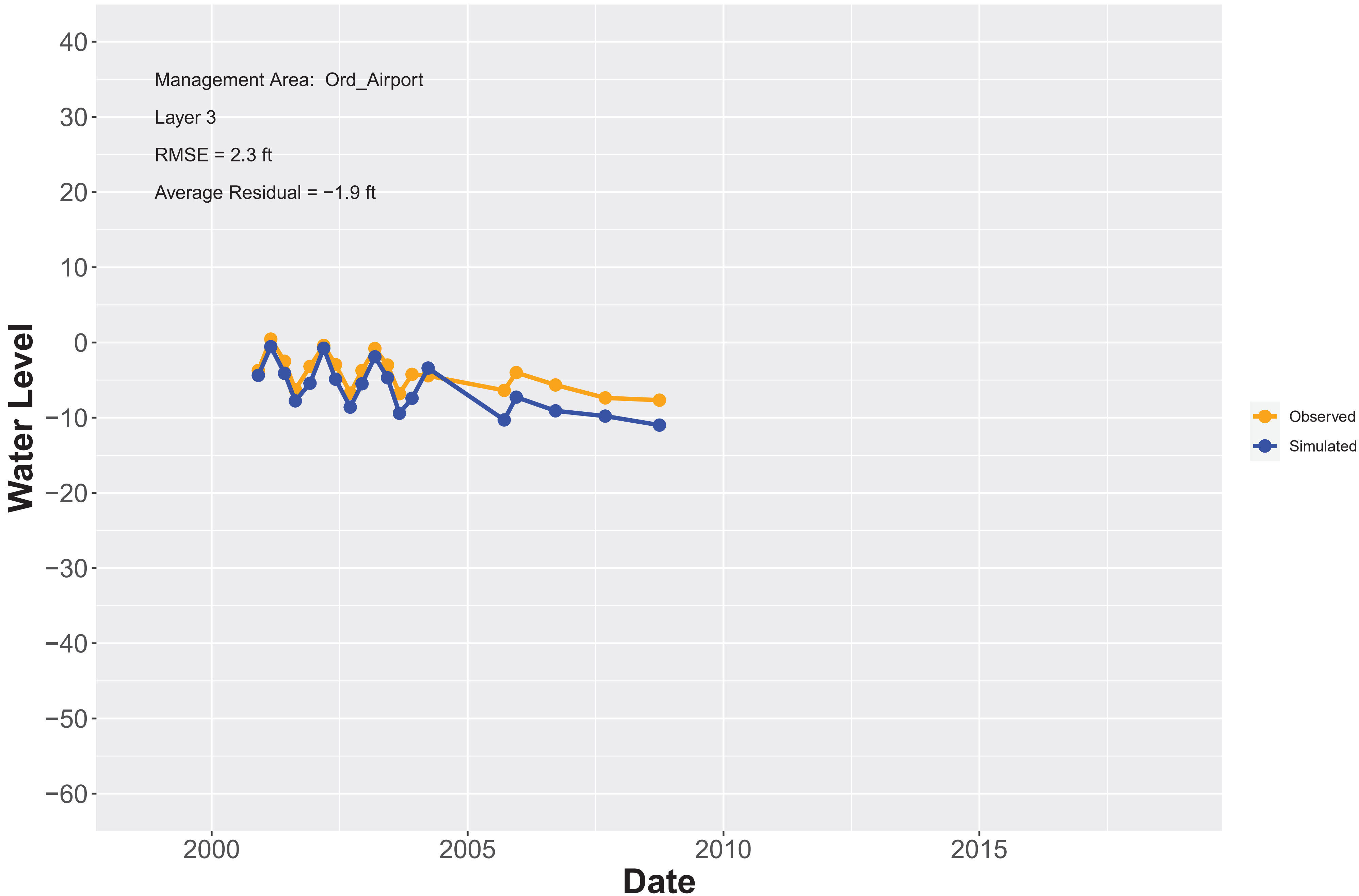
Hydrograph: MW−BW−91−A
Management Area: Ord_Airport
Layer 1
RMSE = 12.4 ft
Average Residual = −12.3 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

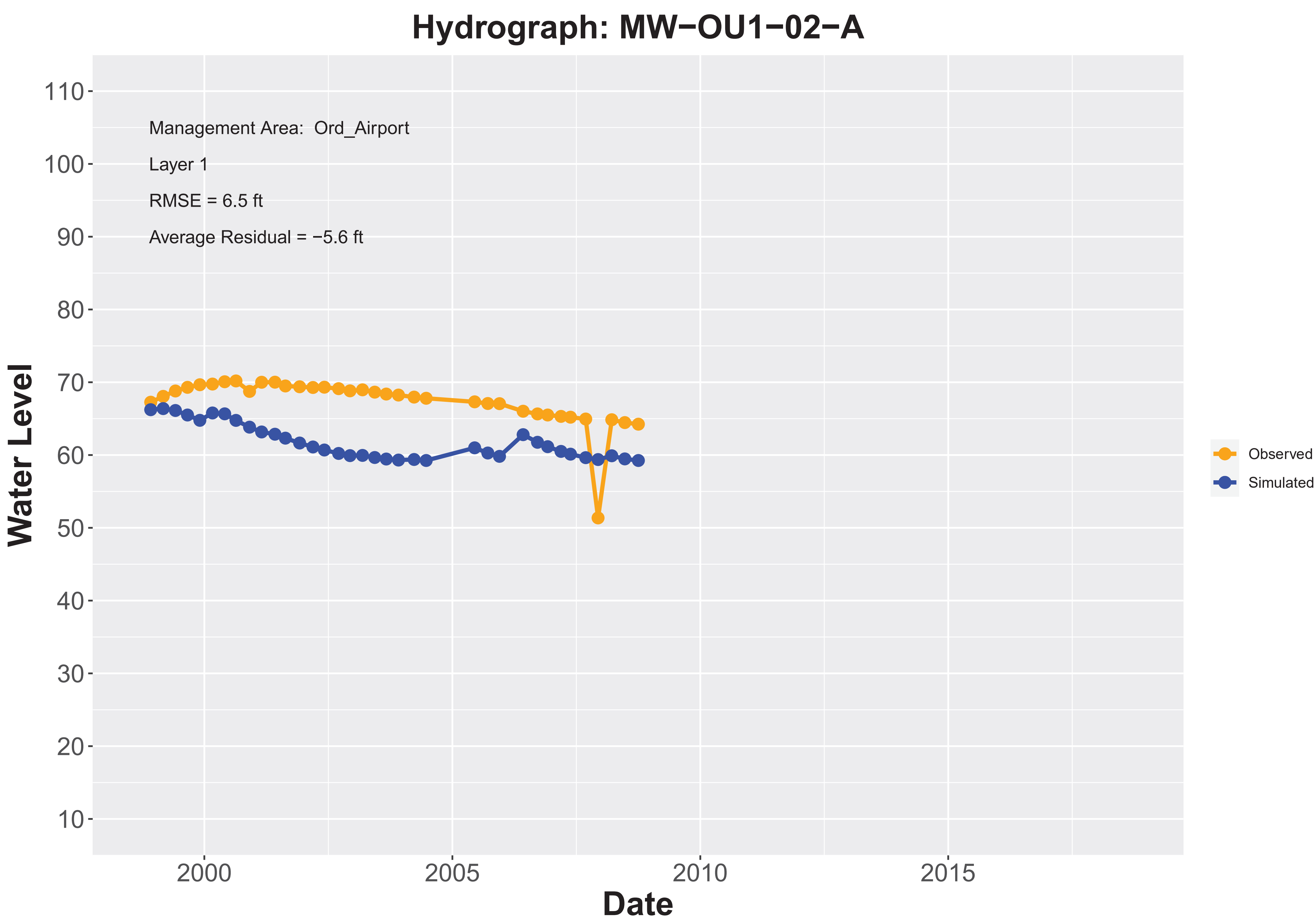

Hydrograph: MW−BW−92−A
Management Area: Ord_Airport
Layer 1
RMSE = 2.5 ft
Average Residual = 1.1 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU1−01−180
Management Area: Ord_Airport
Layer 3
RMSE = 2.9 ft
Average Residual = −2.6 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

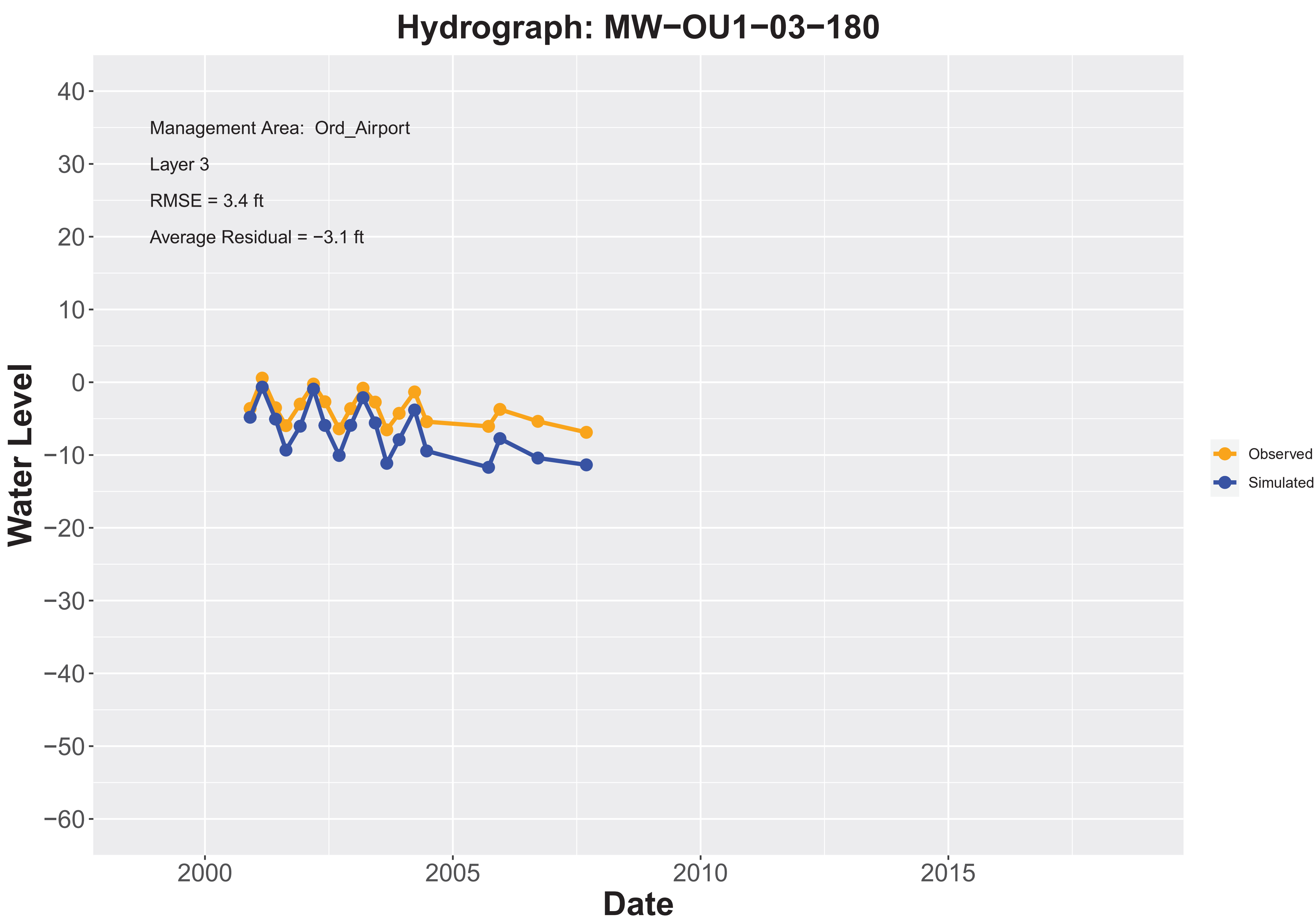

Hydrograph: MW−OU1−01−A
Management Area: Ord_Airport
Layer 1
RMSE = 9.6 ft
Average Residual = −5.4 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

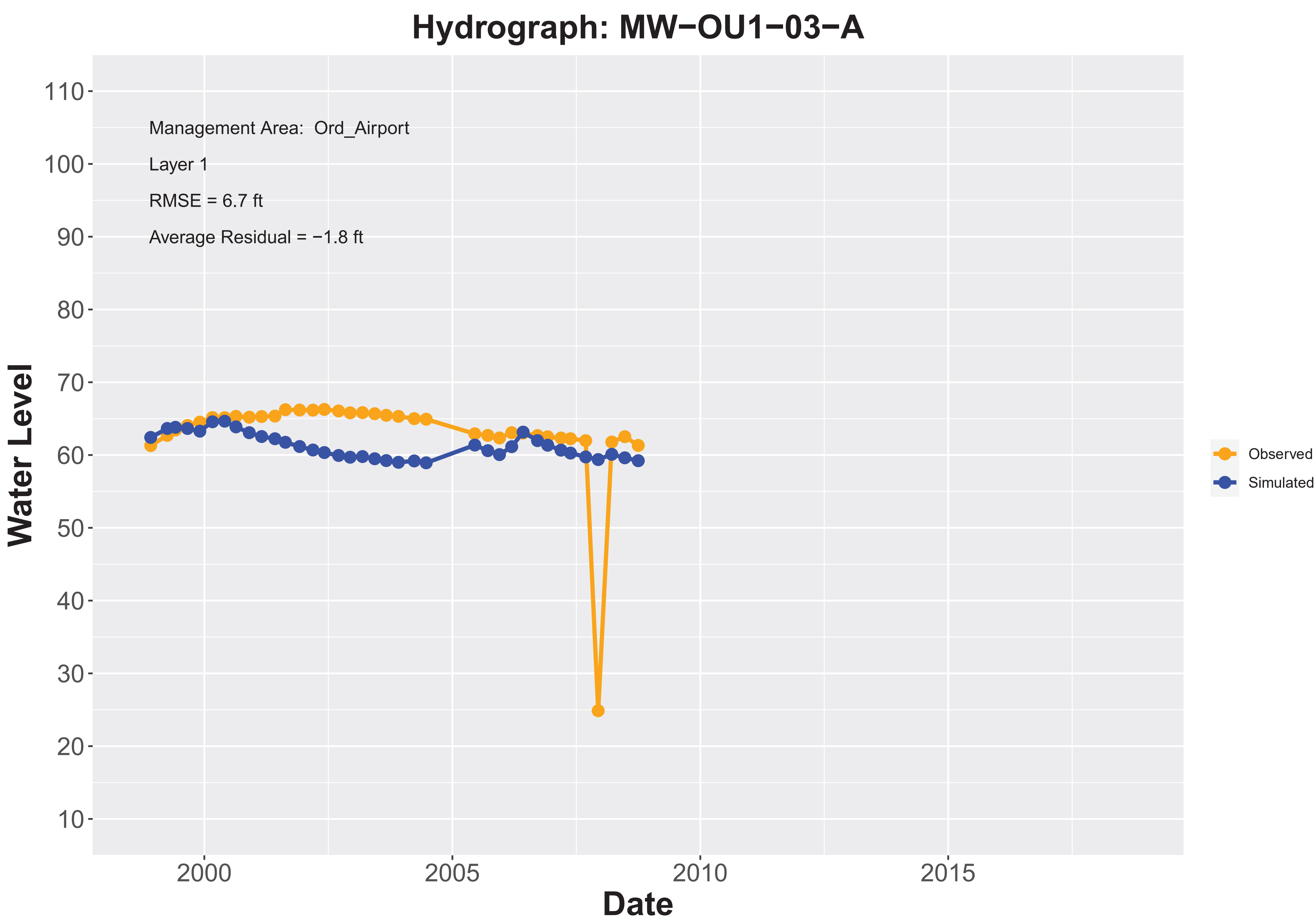
Hydrograph: MW−OU1−02−180



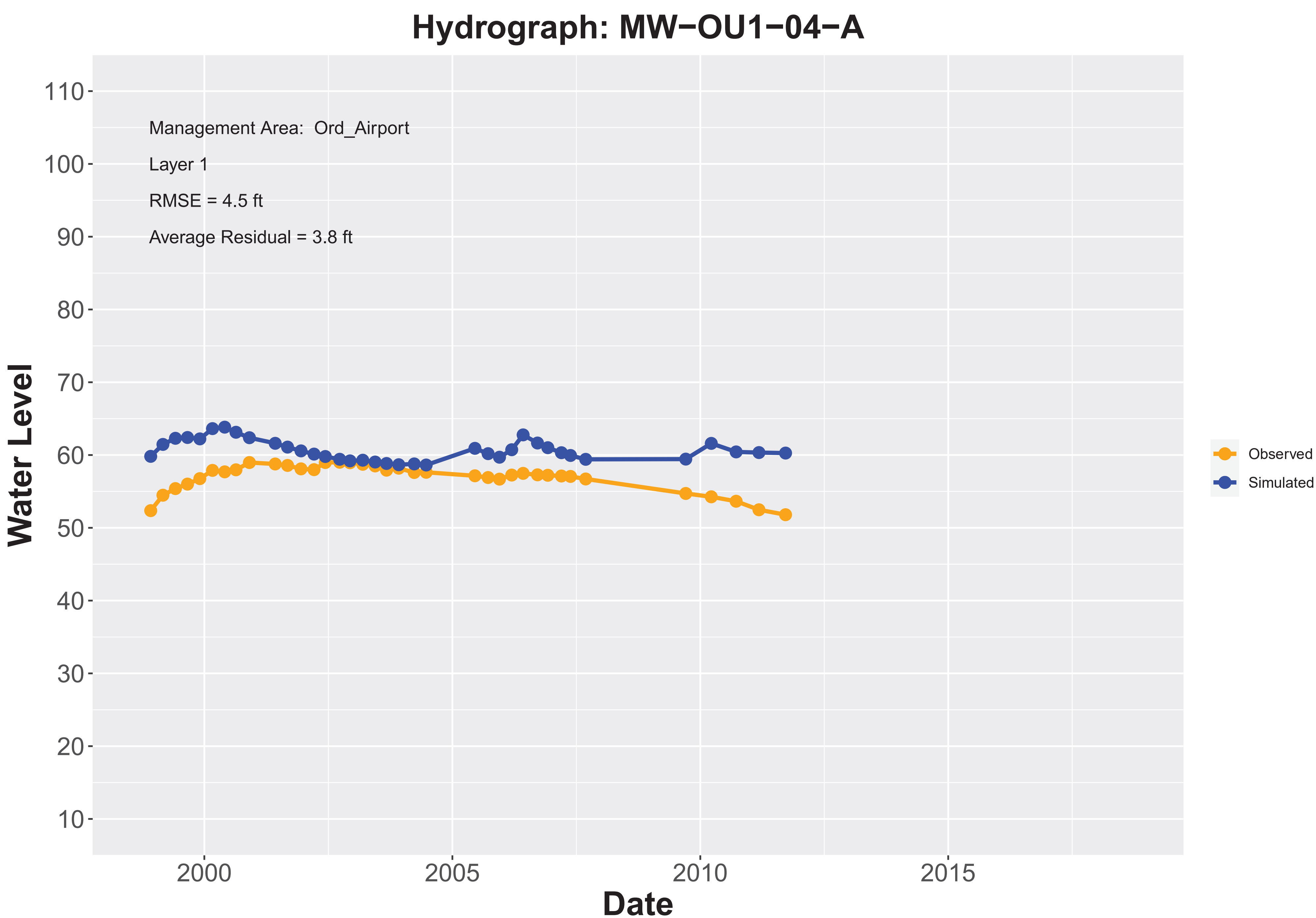


Hydrograph: MW−OU1−02−A
Management Area: Ord_Airport
Layer 1
RMSE = 6.5 ft
Average Residual = −5.6 ft
Water Level
Date
Observed
Simulated
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015


Hydrograph: MW−OU1−03−180
Management Area: Ord_Airport
Layer 3
RMSE = 3.4 ft
Average Residual = −3.1 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

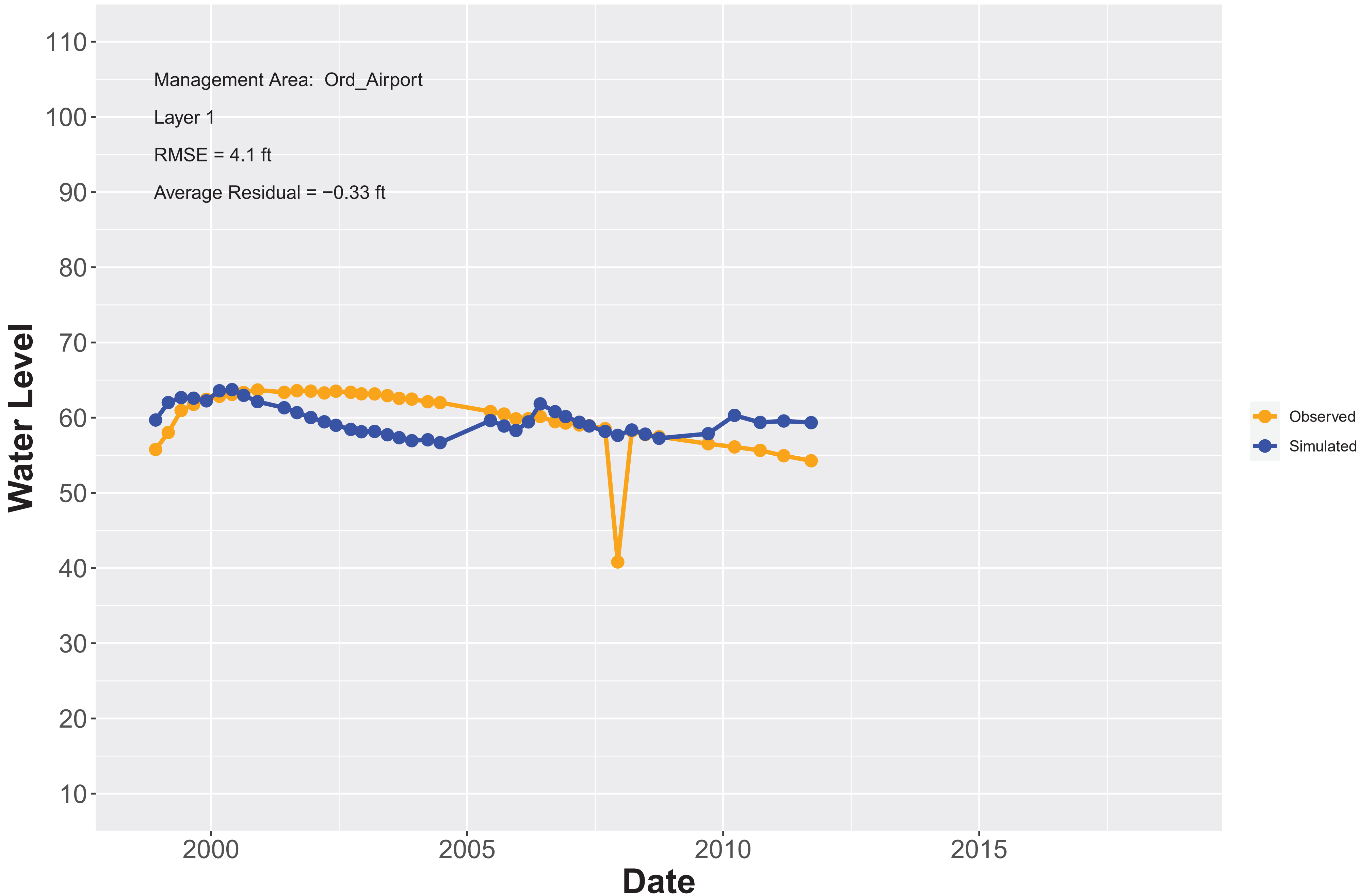


Hydrograph: MW−OU1−03−A
Management Area: Ord_Airport
Layer 1
RMSE = 6.7 ft
Average Residual = −1.8 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

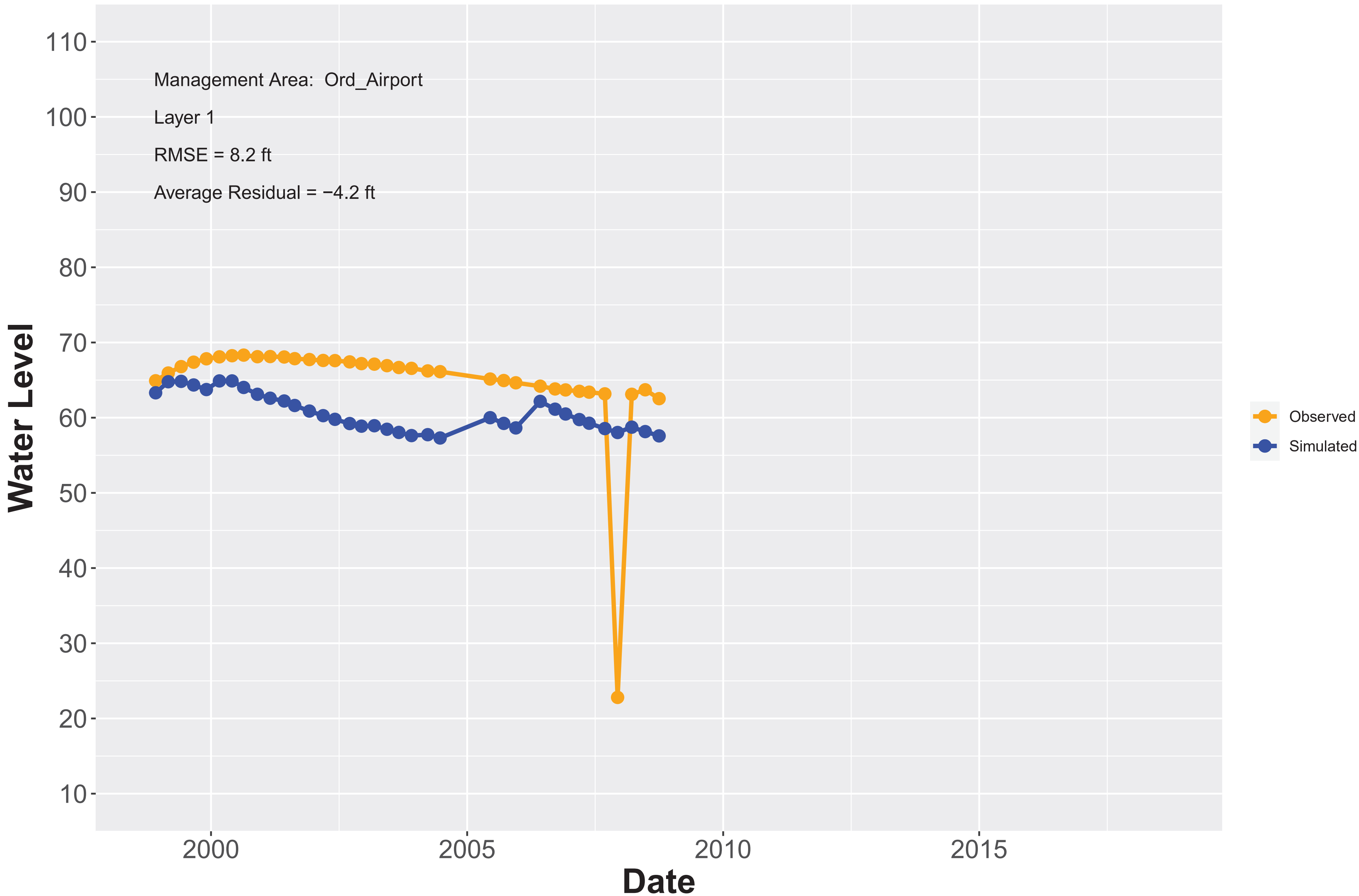


Hydrograph: MW−OU1−04−A
Management Area: Ord_Airport
Layer 1
RMSE = 4.5 ft
Average Residual = 3.8 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

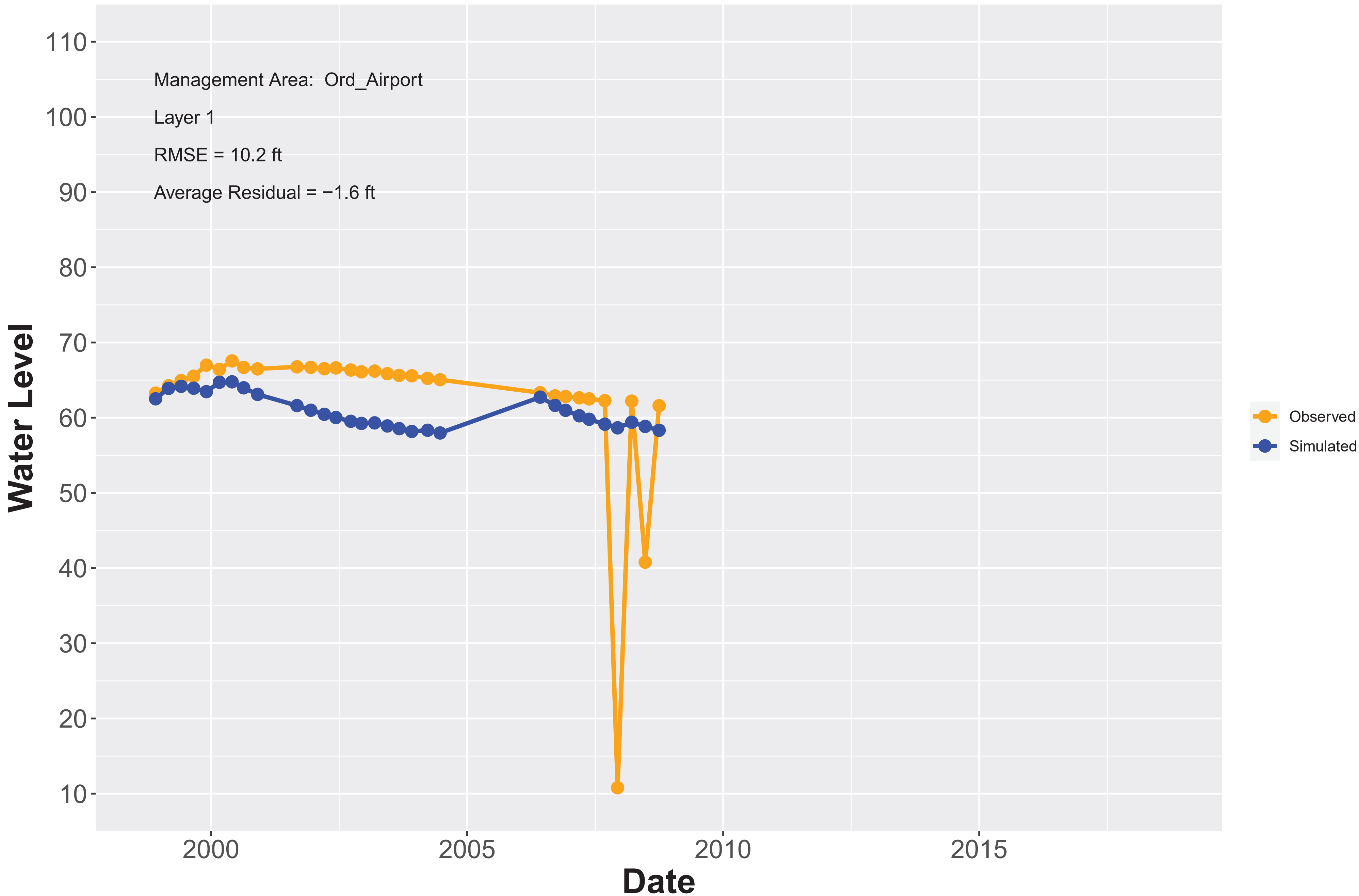
Hydrograph: MW−OU1−05−A

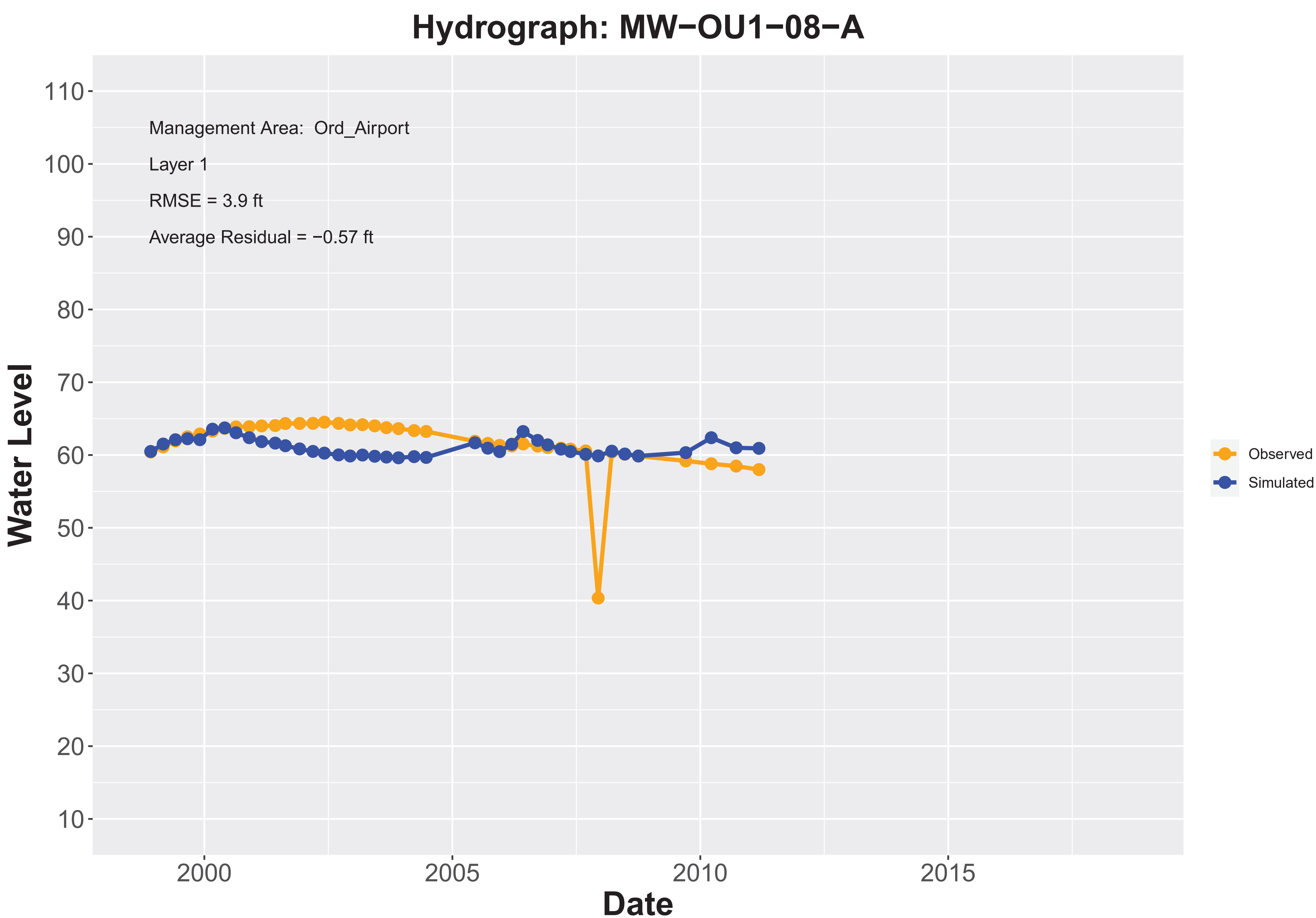


Hydrograph: MW−OU1−06−A

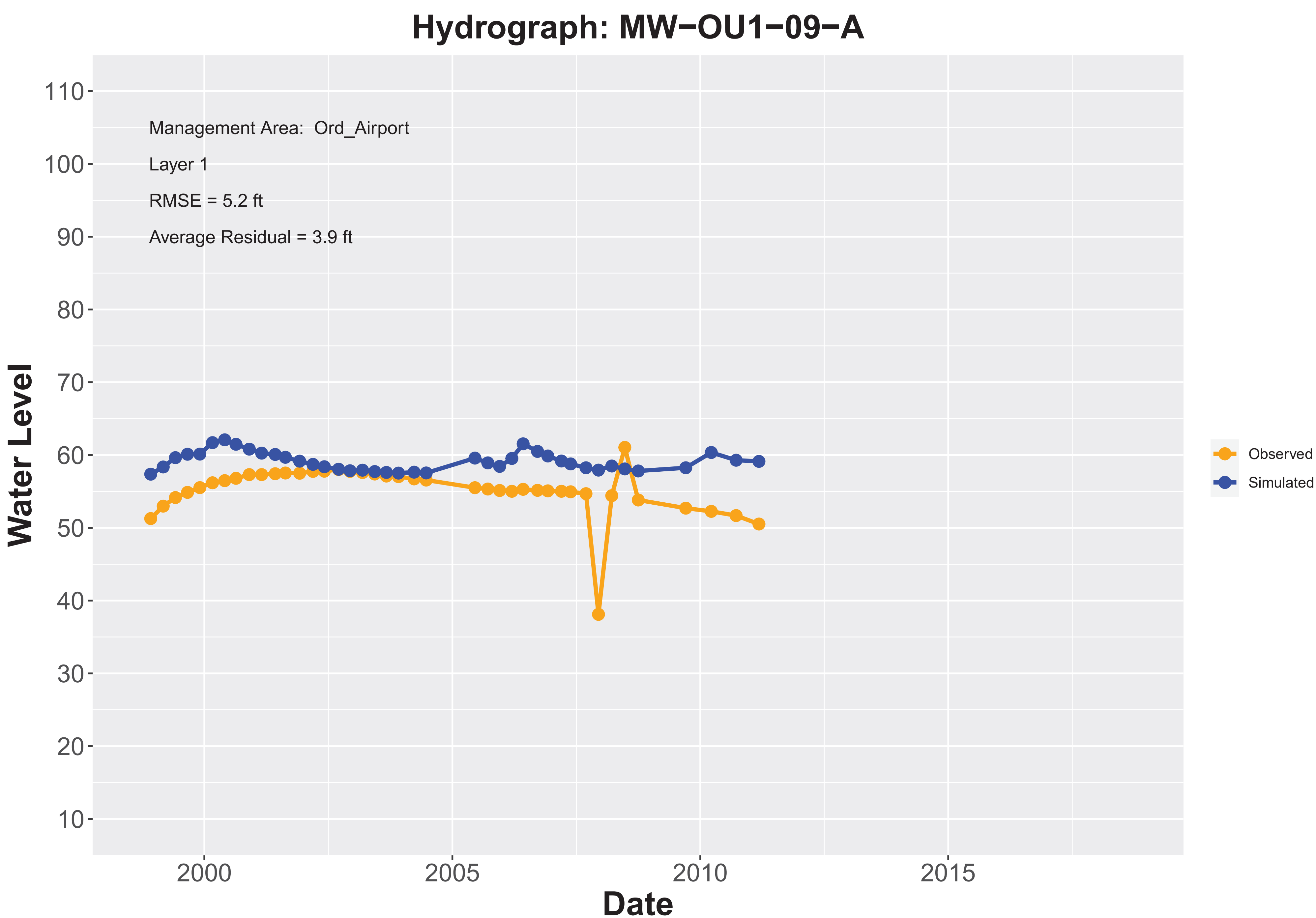


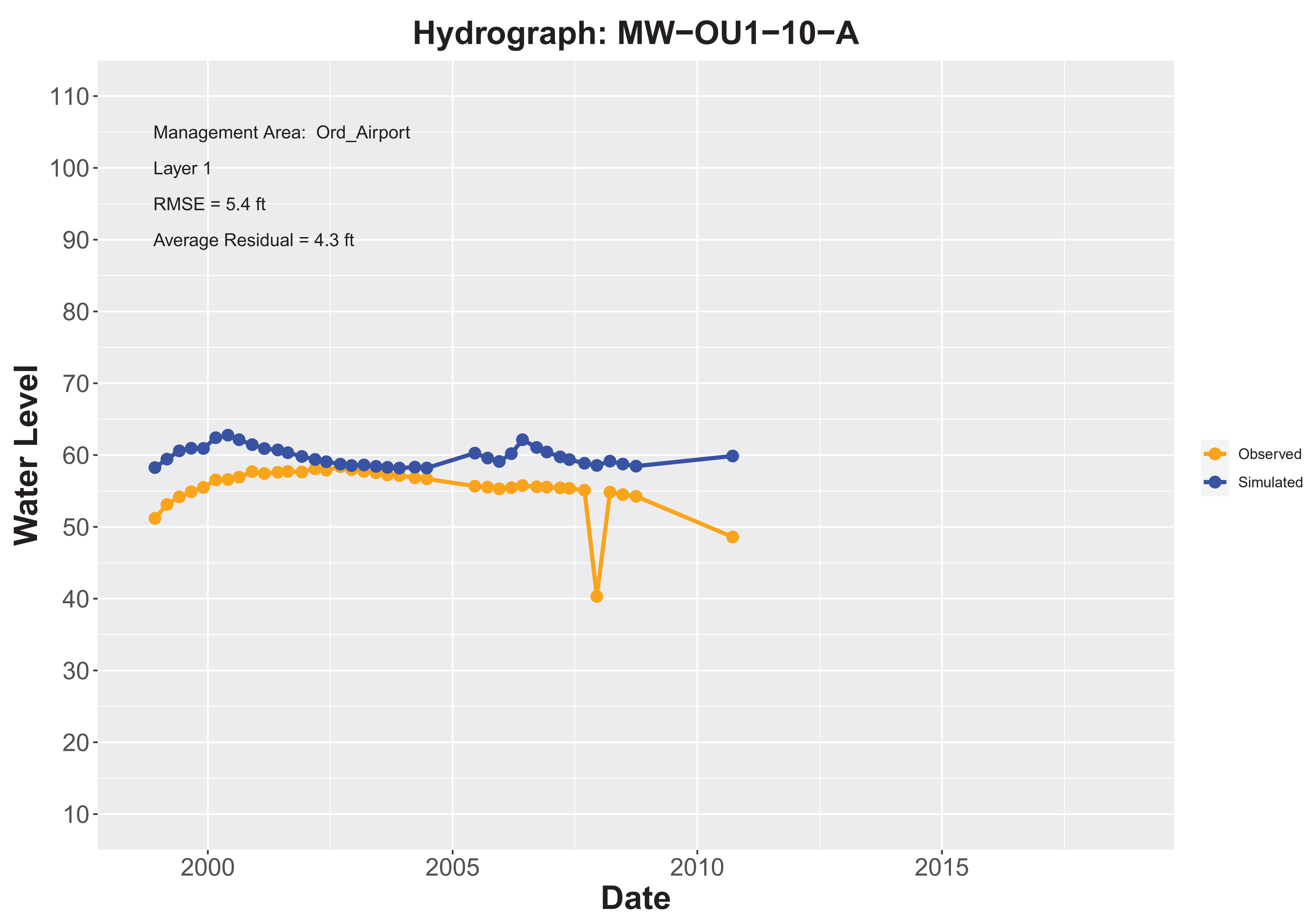
Hydrograph: MW−OU1−07−A



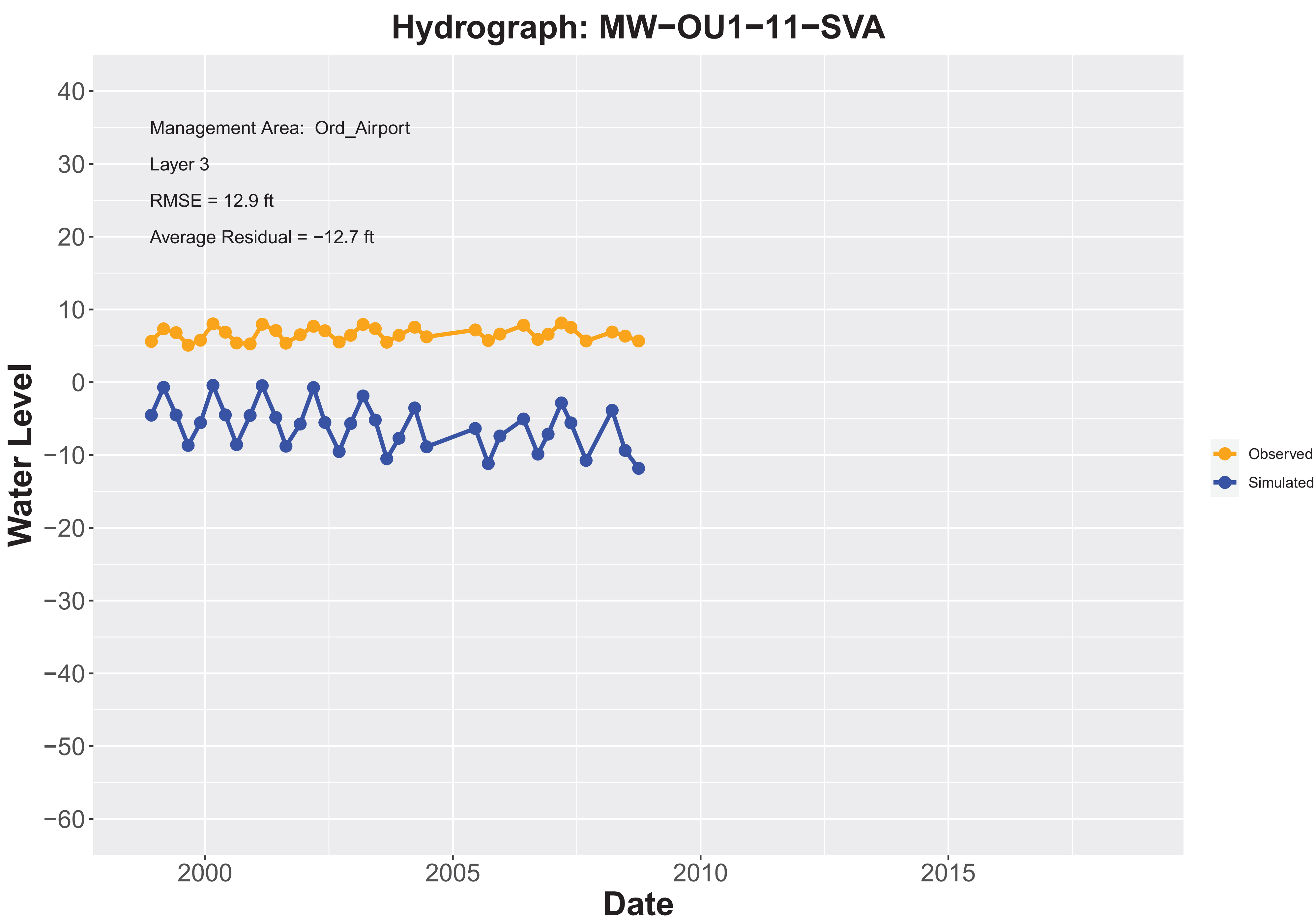


Hydrograph: MW−OU1−08−A
Management Area: Ord_Airport
Layer 1
RMSE = 3.9 ft
Average Residual = −0.57 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

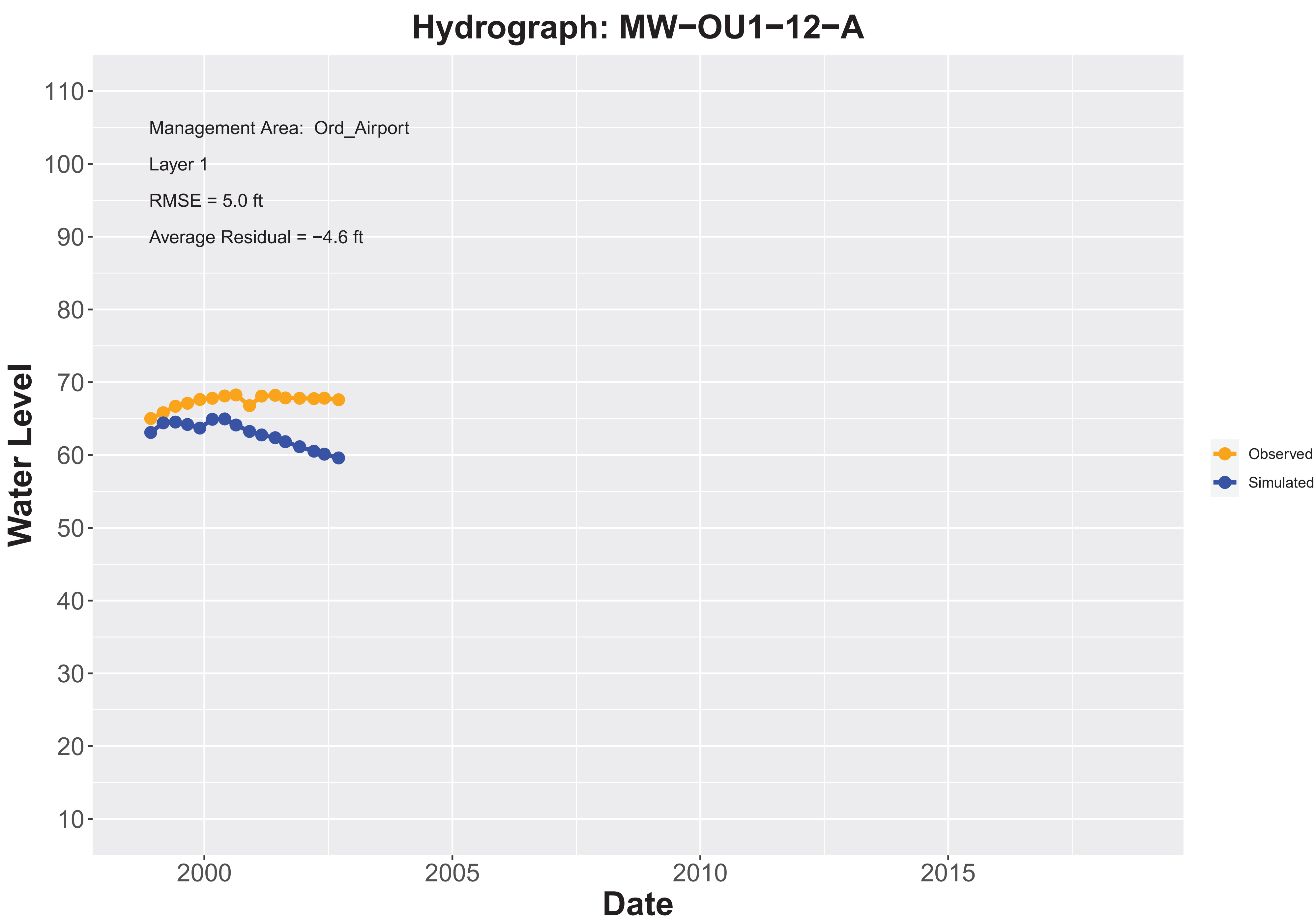

Hydrograph: MW−OU1−09−A
Management Area: Ord_Airport
Layer 1
RMSE = 5.2 ft
Average Residual = 3.9 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

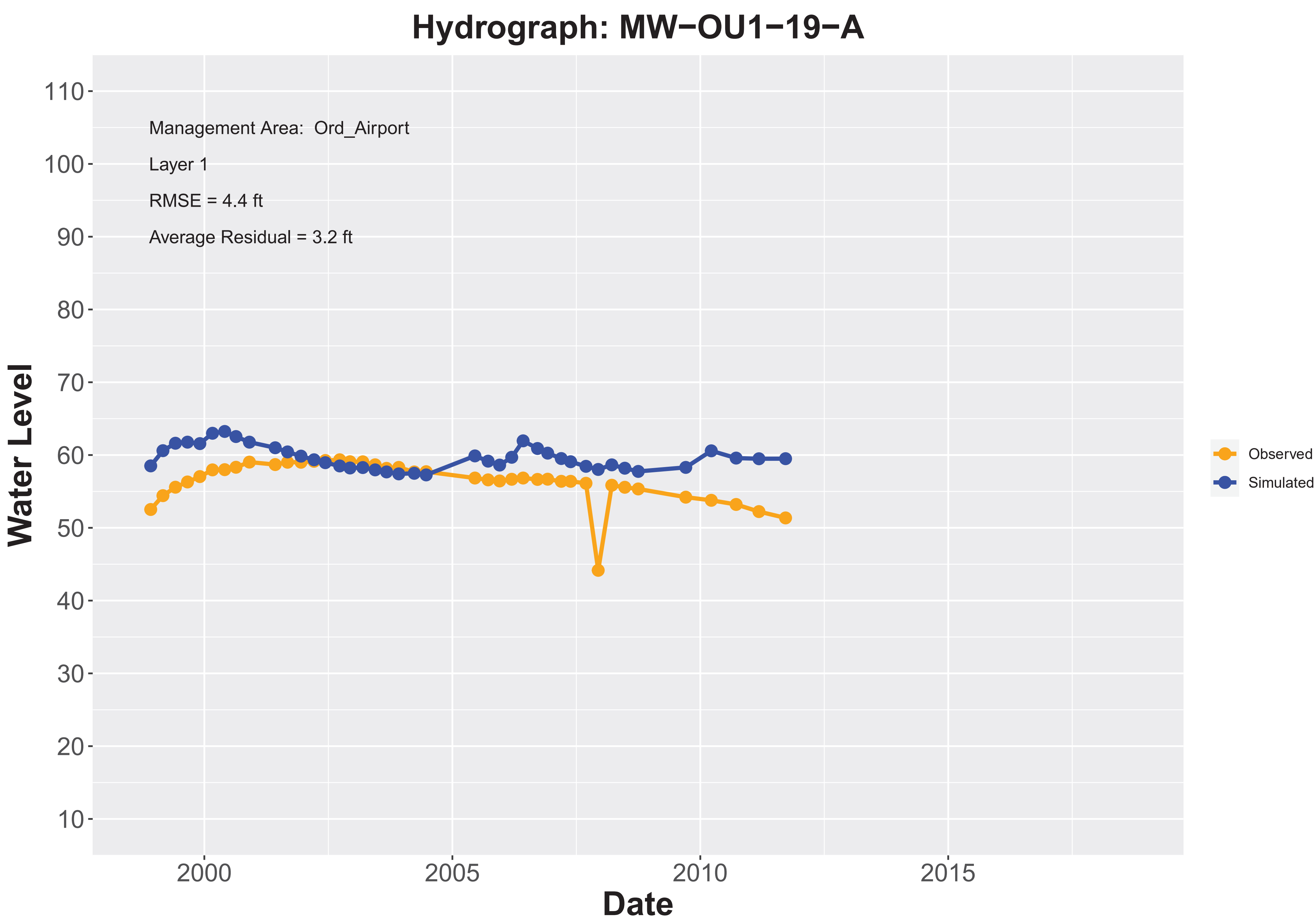


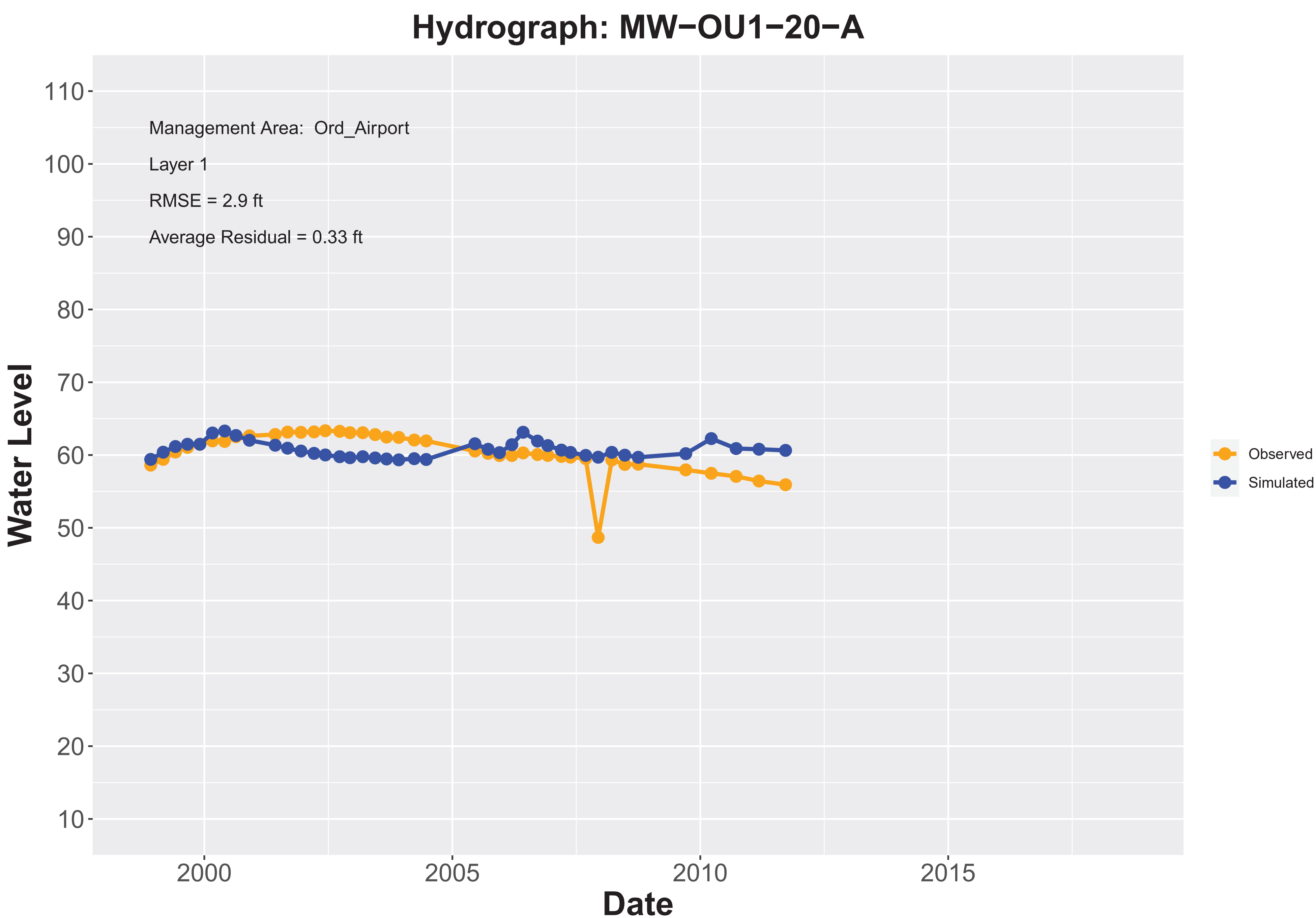
Hydrograph: MW−OU1−10−A
Management Area: Ord_Airport
Layer 1
RMSE = 5.4 ft
Average Residual = 4.3 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

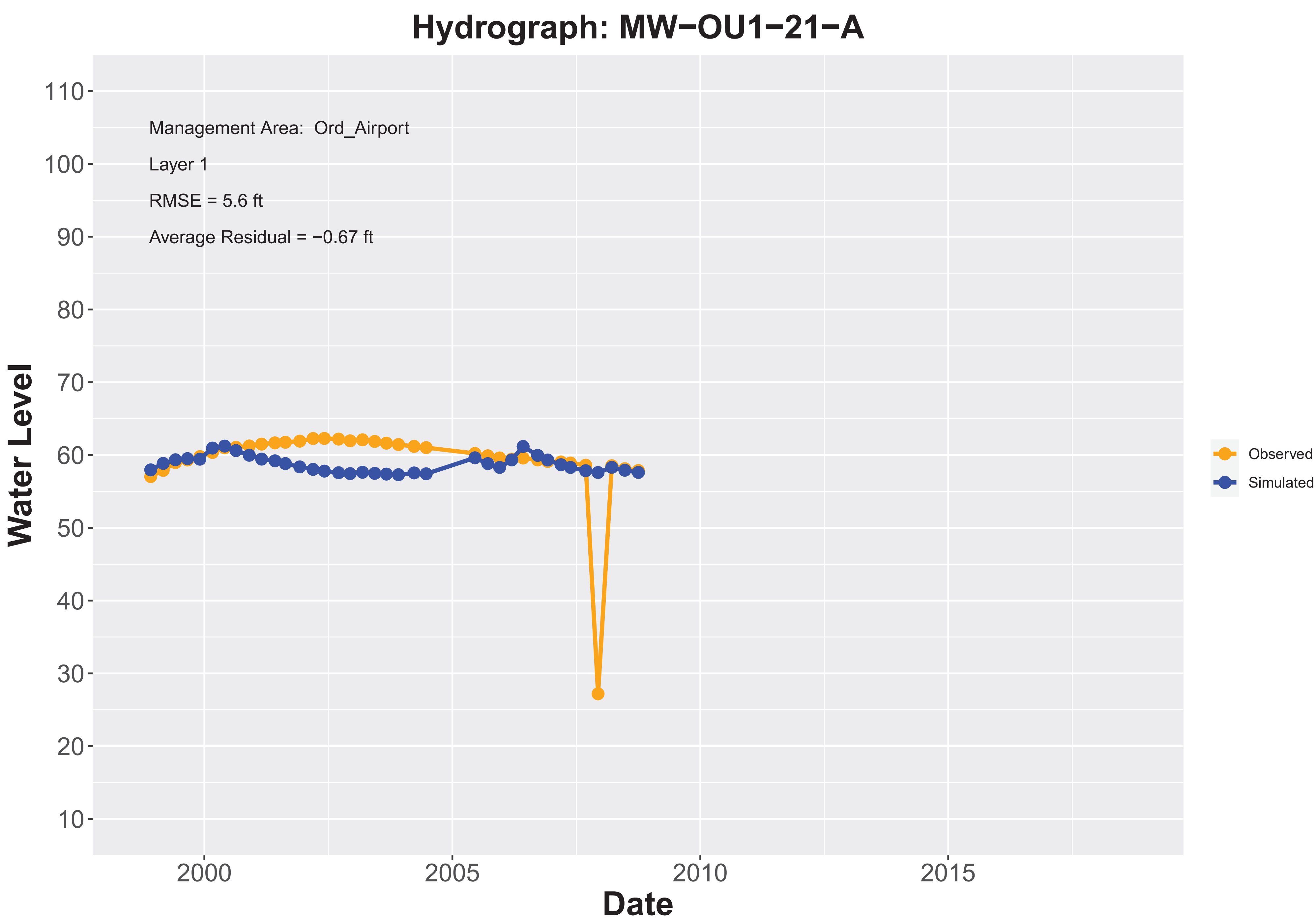


Hydrograph: MW−OU1−11−SVA
Management Area: Ord_Airport
Layer 3
RMSE = 12.9 ft
Average Residual = −12.7 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

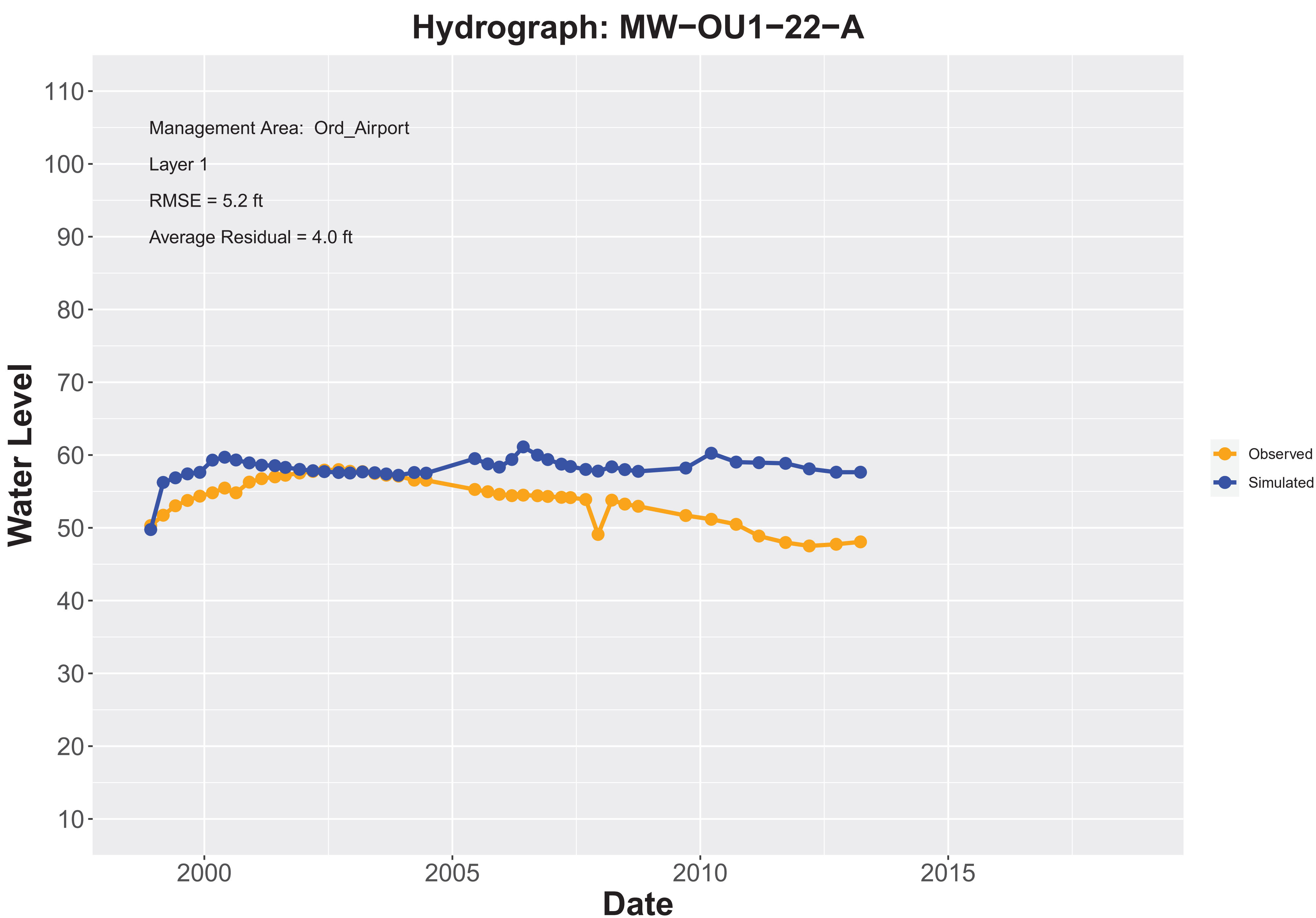

Hydrograph: MW−OU1−12−A
Management Area: Ord_Airport
Layer 1
RMSE = 5.0 ft
Average Residual = −4.6 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

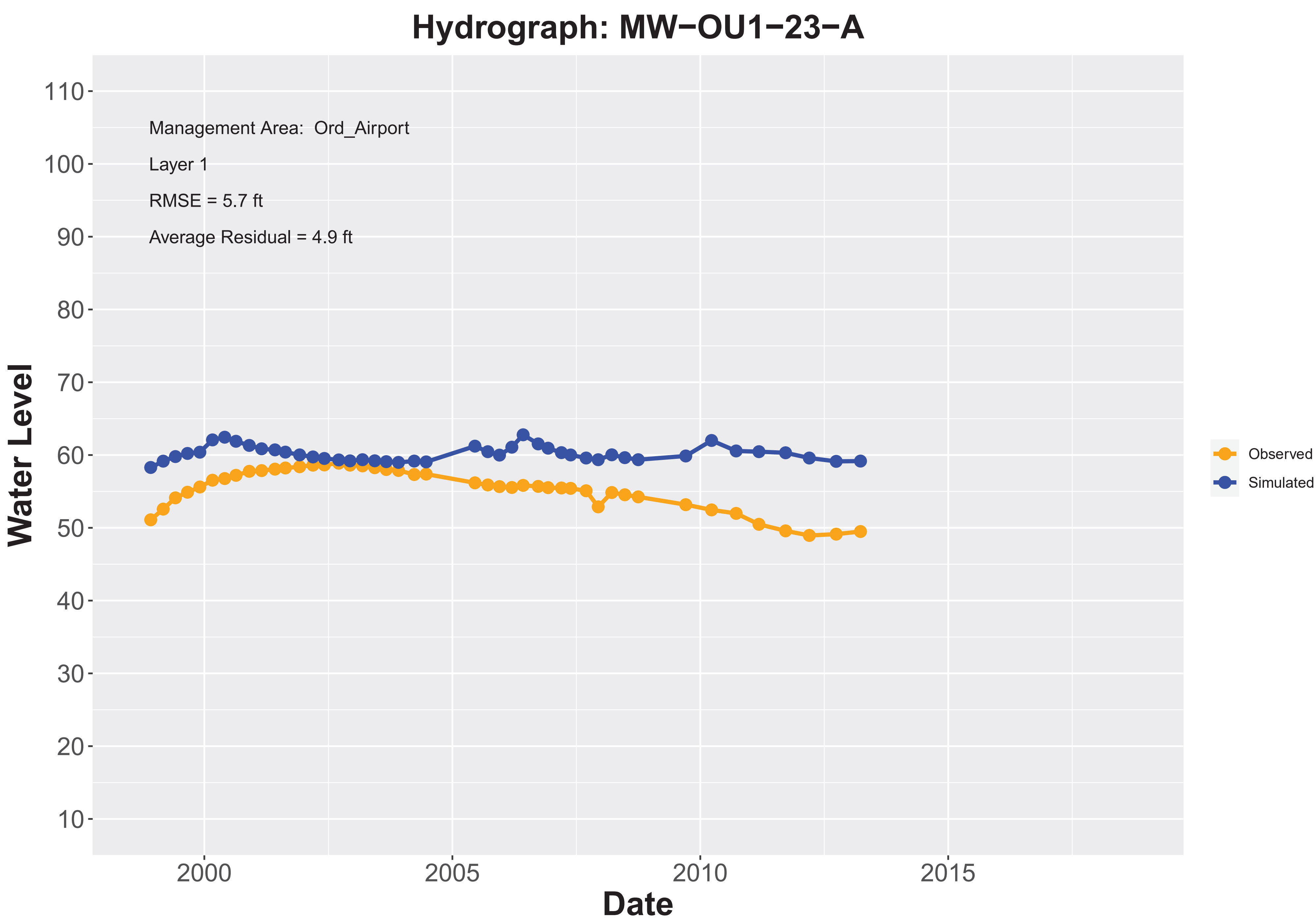

Hydrograph: MW−OU1−19−A
Management Area: Ord_Airport
Layer 1
RMSE = 4.4 ft
Average Residual = 3.2 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU1−20−A
Management Area: Ord_Airport
Layer 1
RMSE = 2.9 ft
Average Residual = 0.33 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

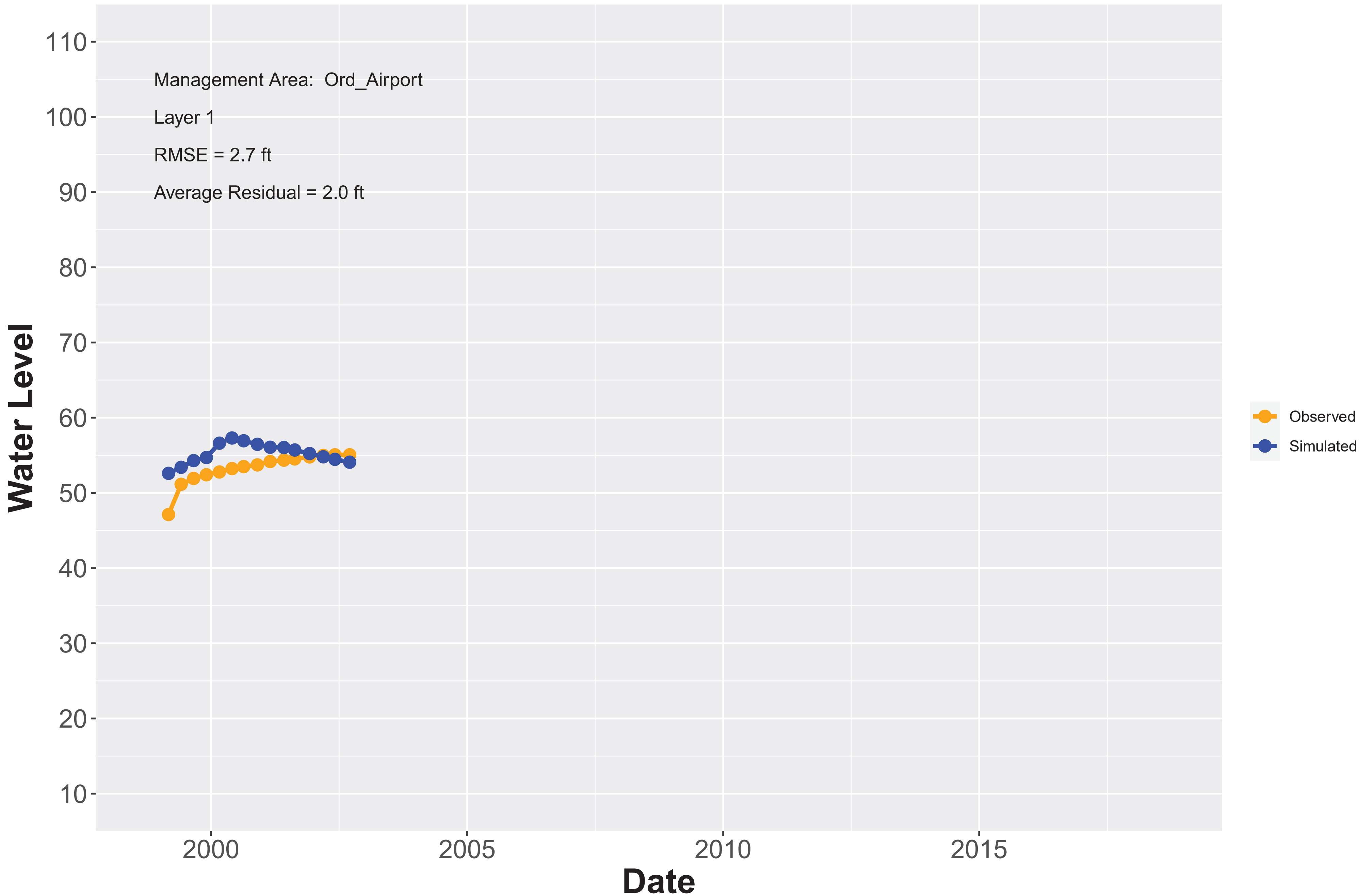


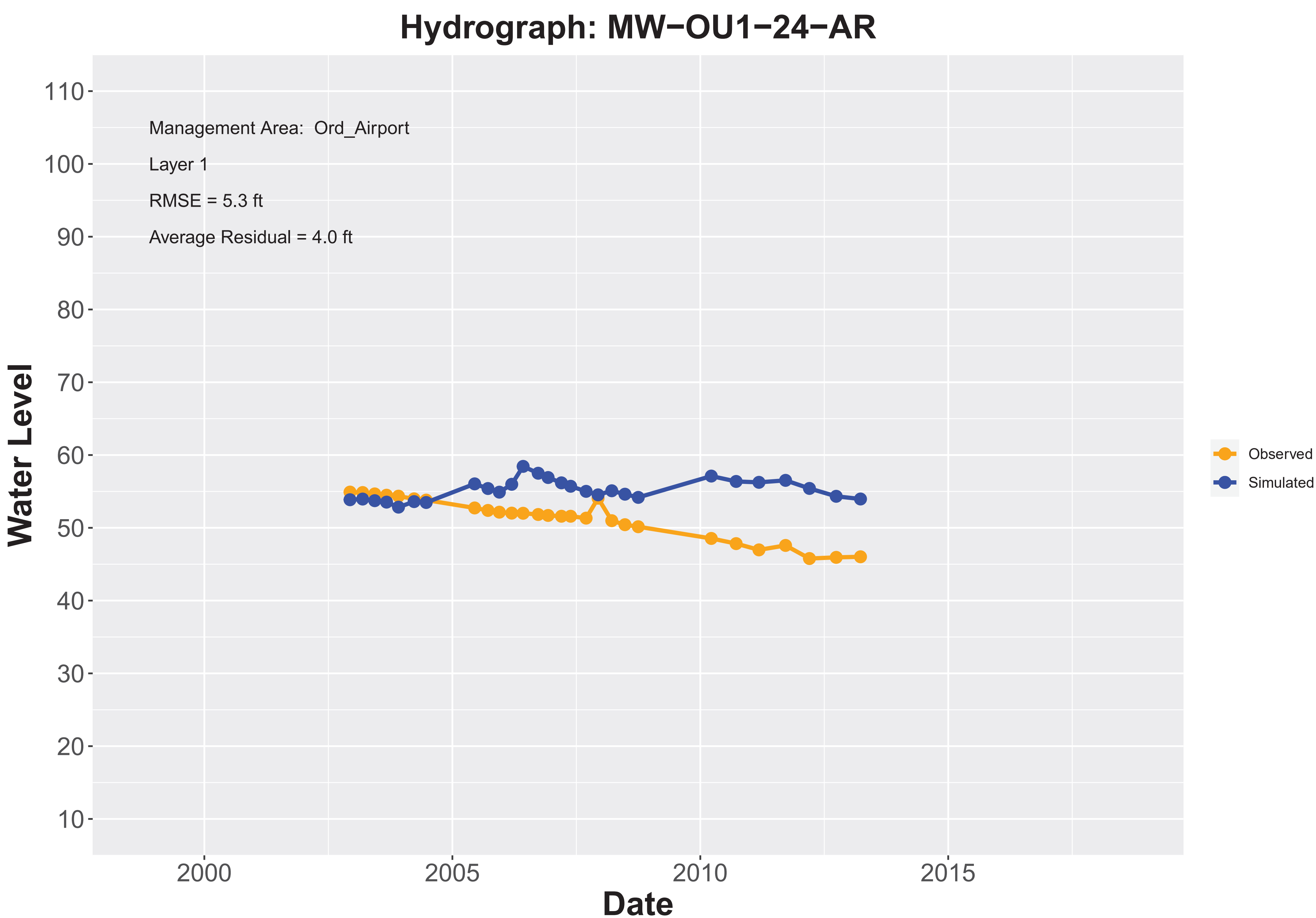
Hydrograph: MW−OU1−21−A
Management Area: Ord_Airport
Layer 1
RMSE = 5.6 ft
Average Residual = −0.67 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

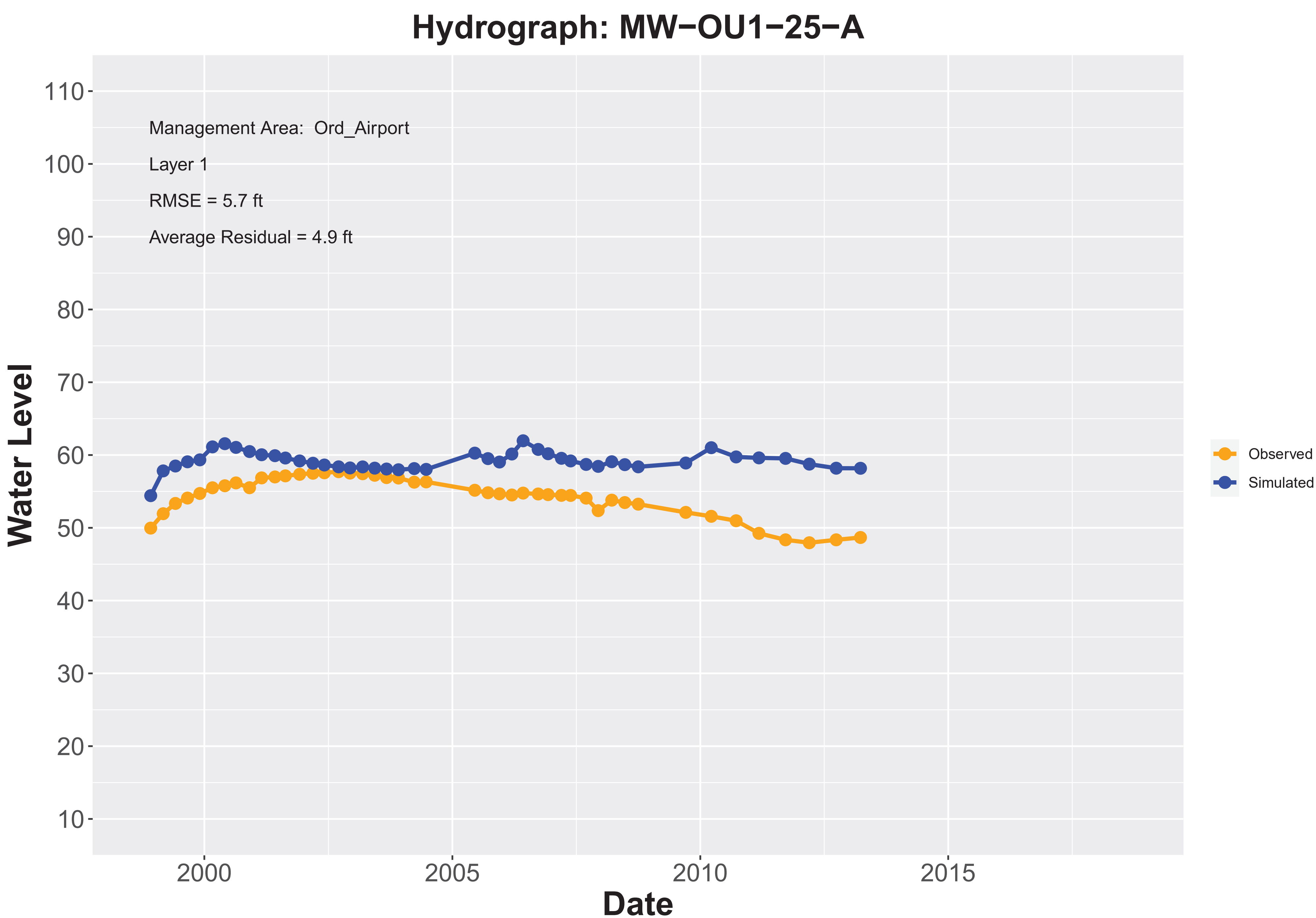

Hydrograph: MW−OU1−22−A
Management Area: Ord_Airport
Layer 1
RMSE = 5.2 ft
Average Residual = 4.0 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

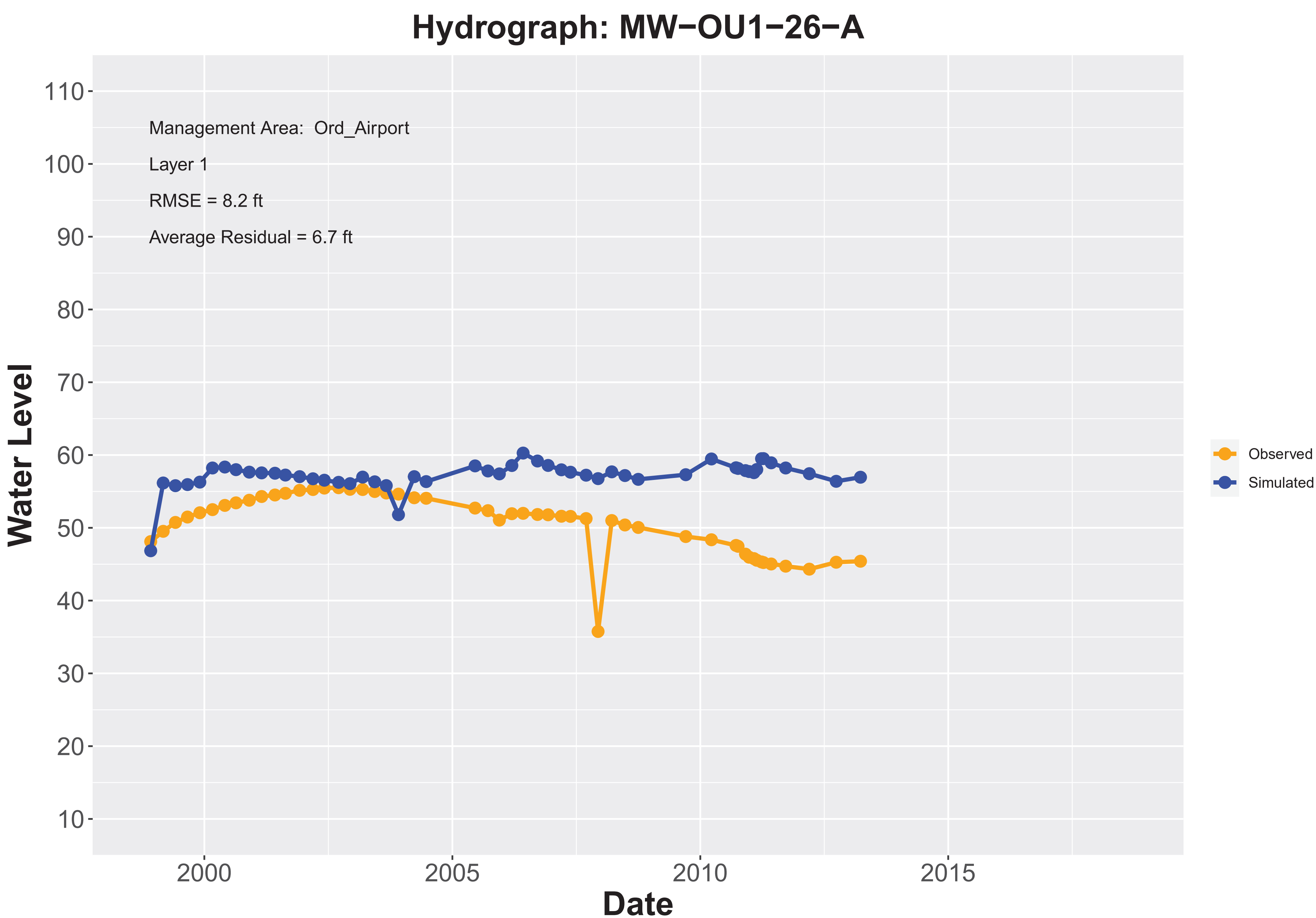

Hydrograph: MW−OU1−23−A
Management Area: Ord_Airport
Layer 1
RMSE = 5.7 ft
Average Residual = 4.9 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

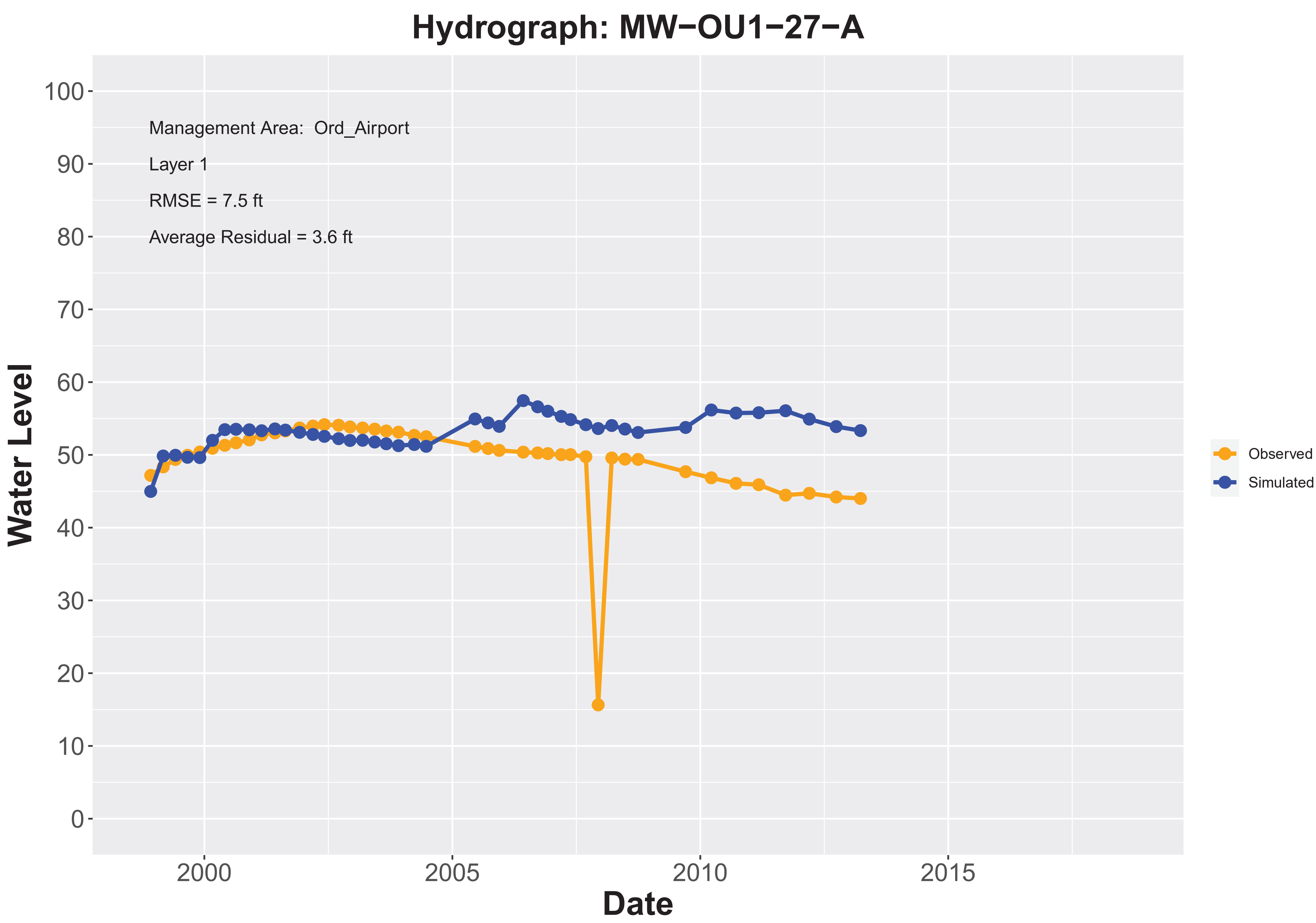
Hydrograph: MW−OU1−24−A



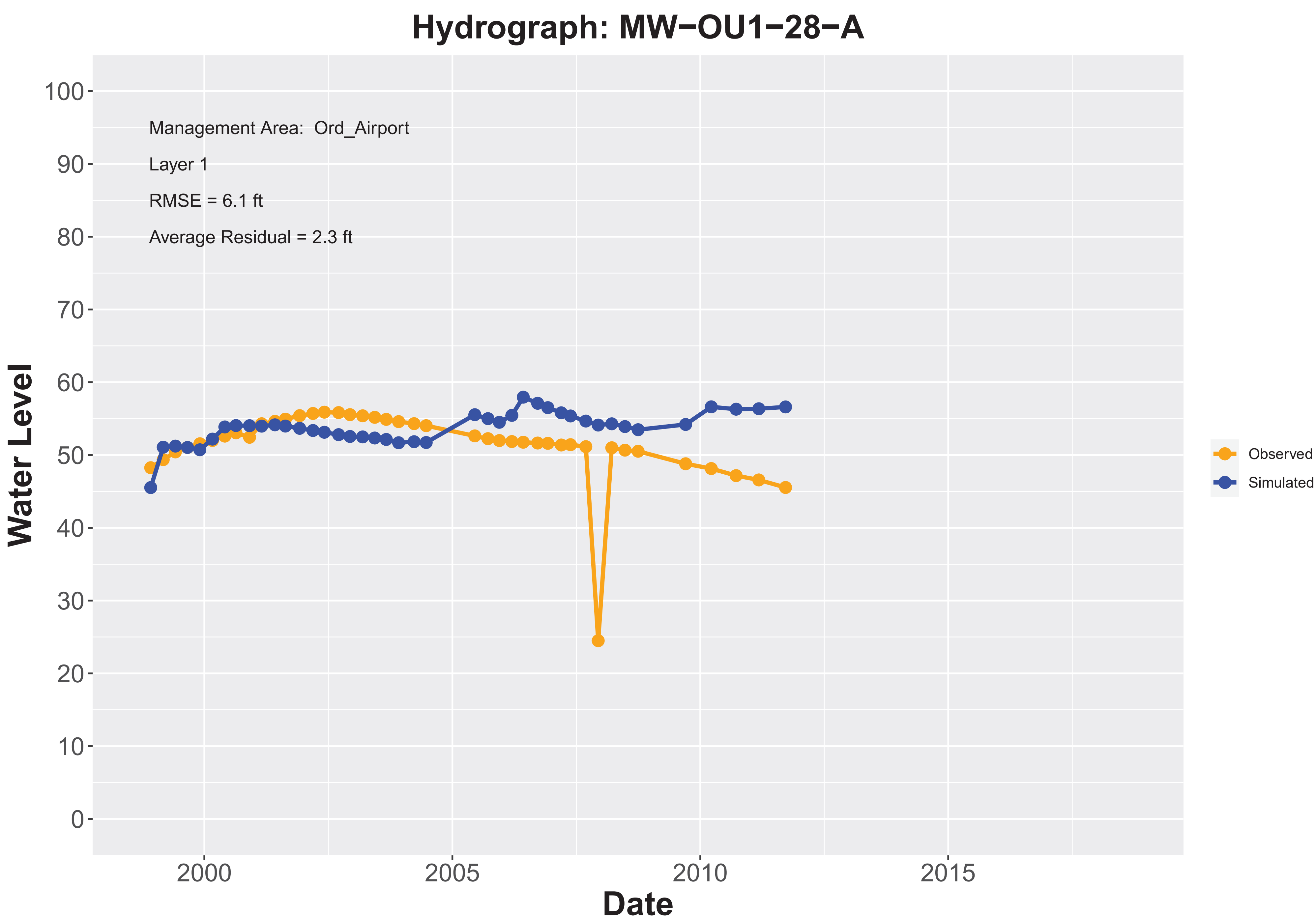

Hydrograph: MW−OU1−24−AR
Management Area: Ord_Airport
Layer 1
RMSE = 5.3 ft
Average Residual = 4.0 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

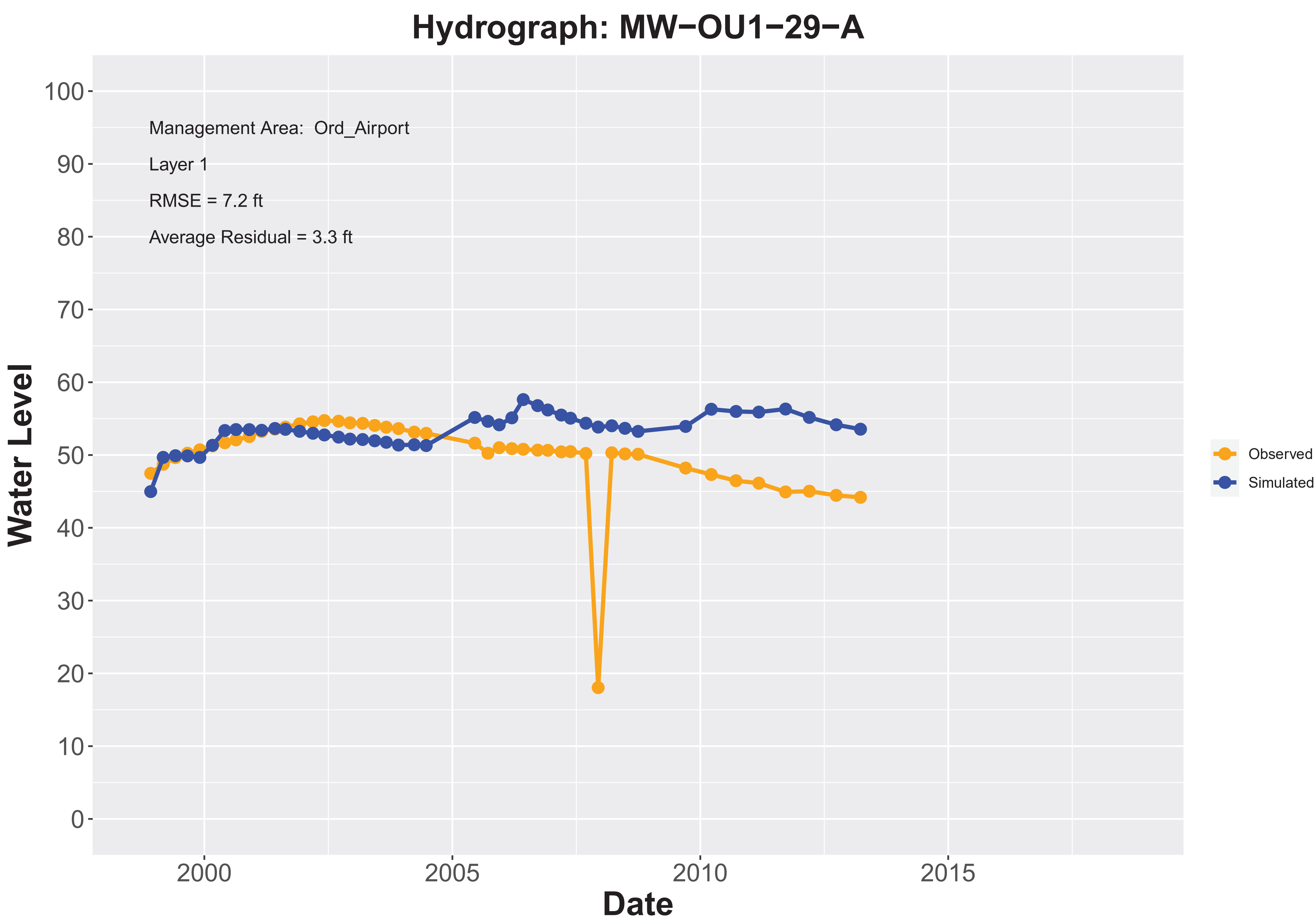

Hydrograph: MW−OU1−25−A
Management Area: Ord_Airport
Layer 1
RMSE = 5.7 ft
Average Residual = 4.9 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU1−26−A
Management Area: Ord_Airport
Layer 1
RMSE = 8.2 ft
Average Residual = 6.7 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

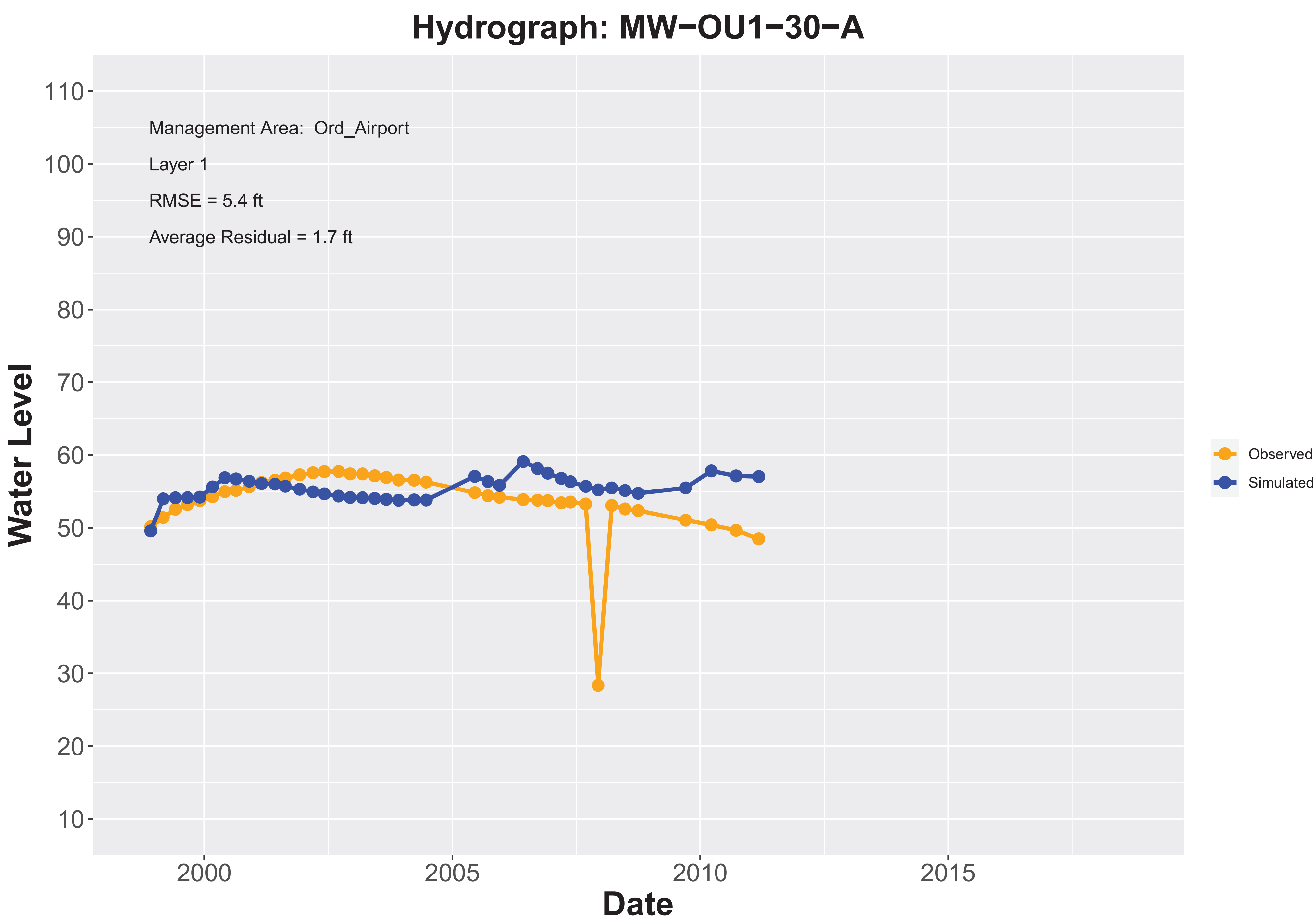


Hydrograph: MW−OU1−27−A
Management Area: Ord_Airport
Layer 1
RMSE = 7.5 ft
Average Residual = 3.6 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

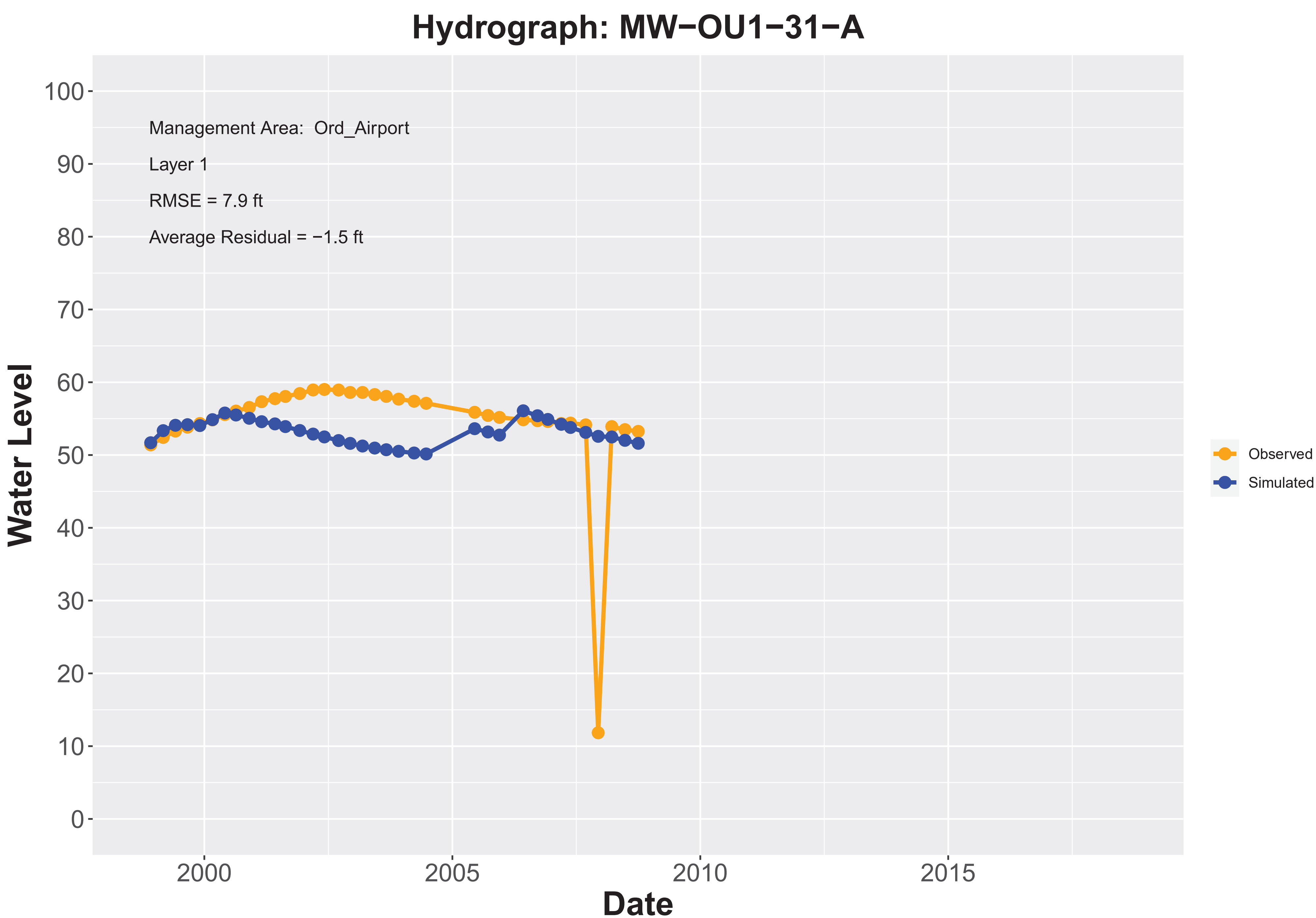

Hydrograph: MW−OU1−28−A
Management Area: Ord_Airport
Layer 1
RMSE = 6.1 ft
Average Residual = 2.3 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated



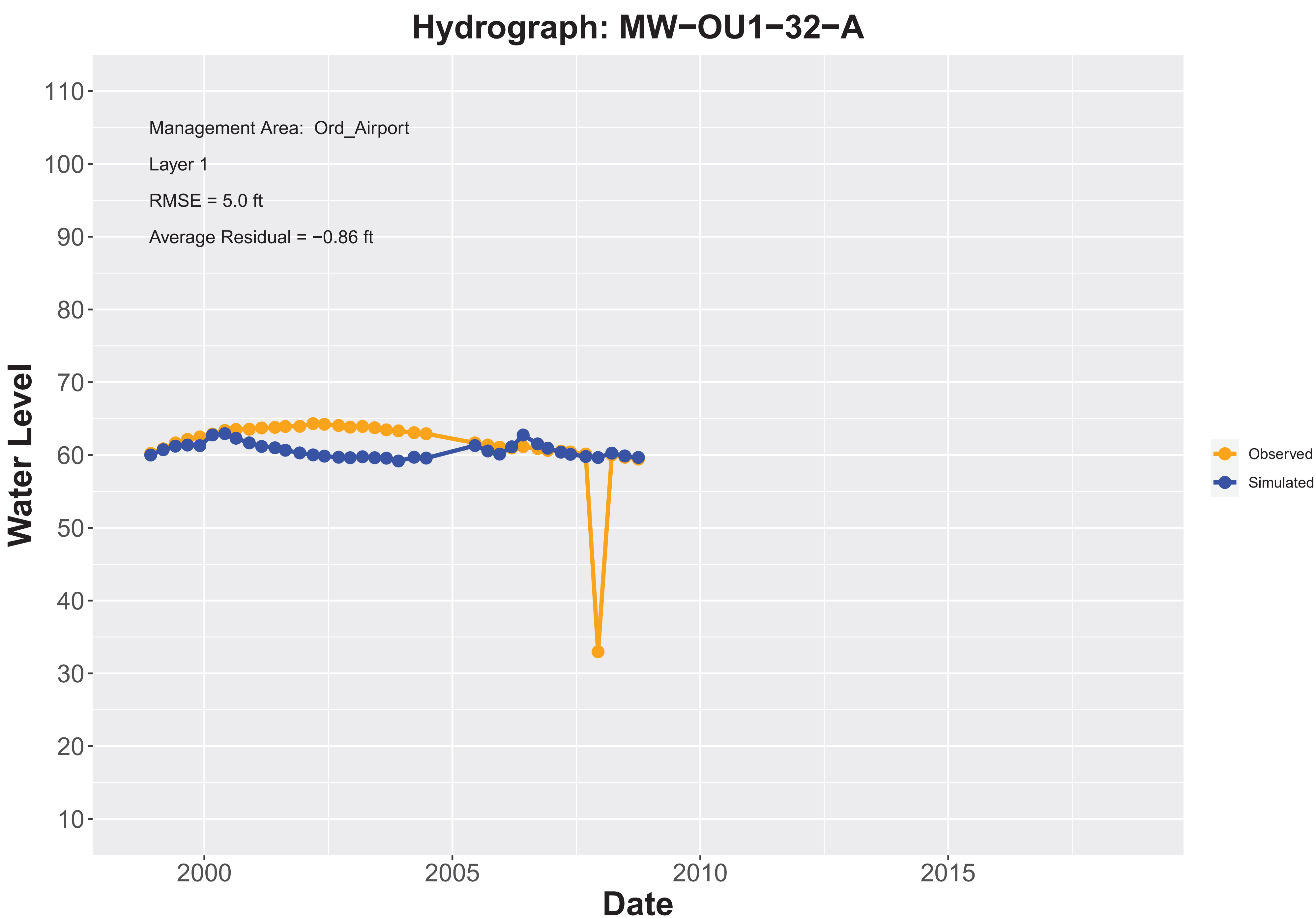
Hydrograph: MW−OU1−29−A
Management Area: Ord_Airport
Layer 1
RMSE = 7.2 ft
Average Residual = 3.3 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

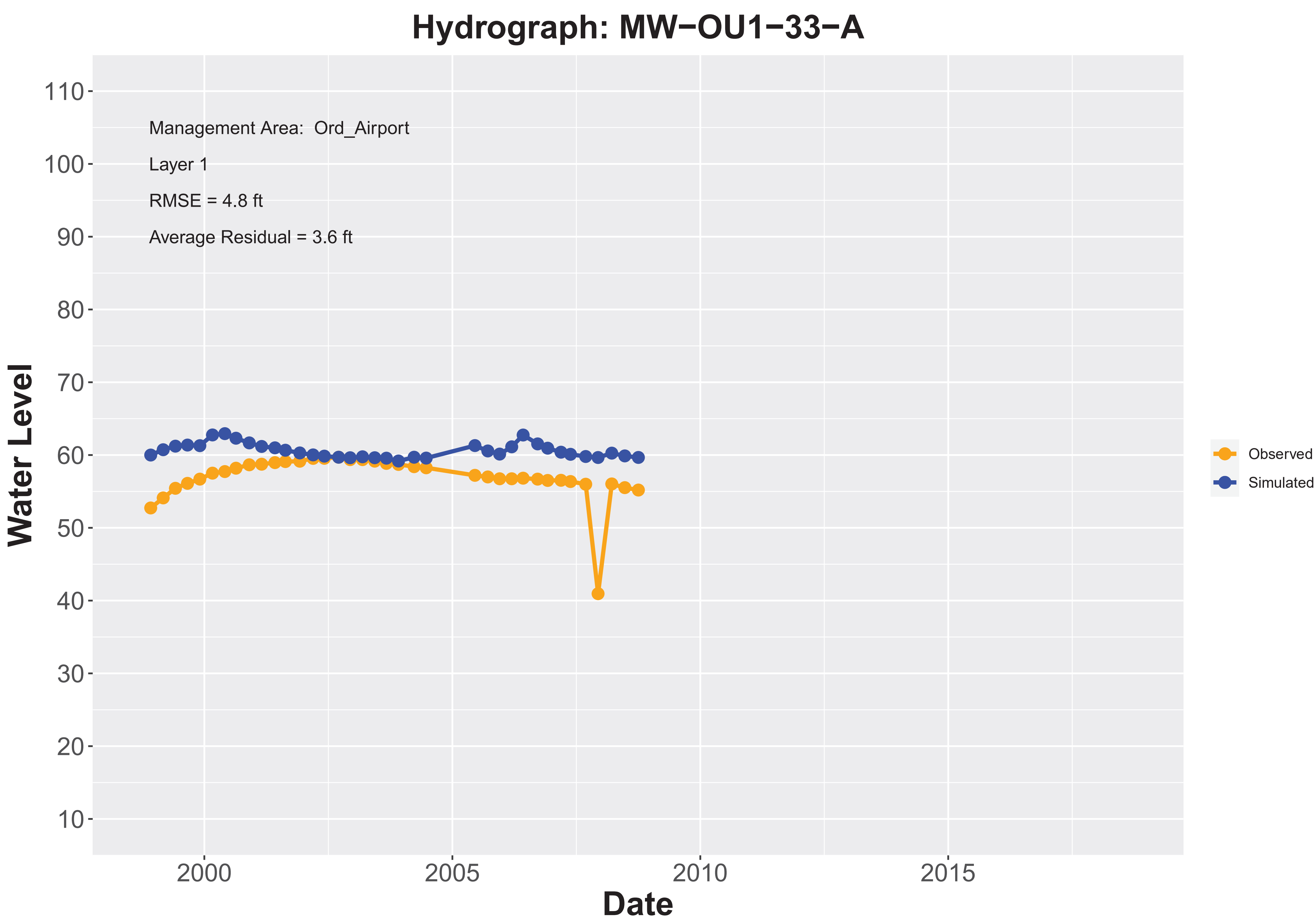


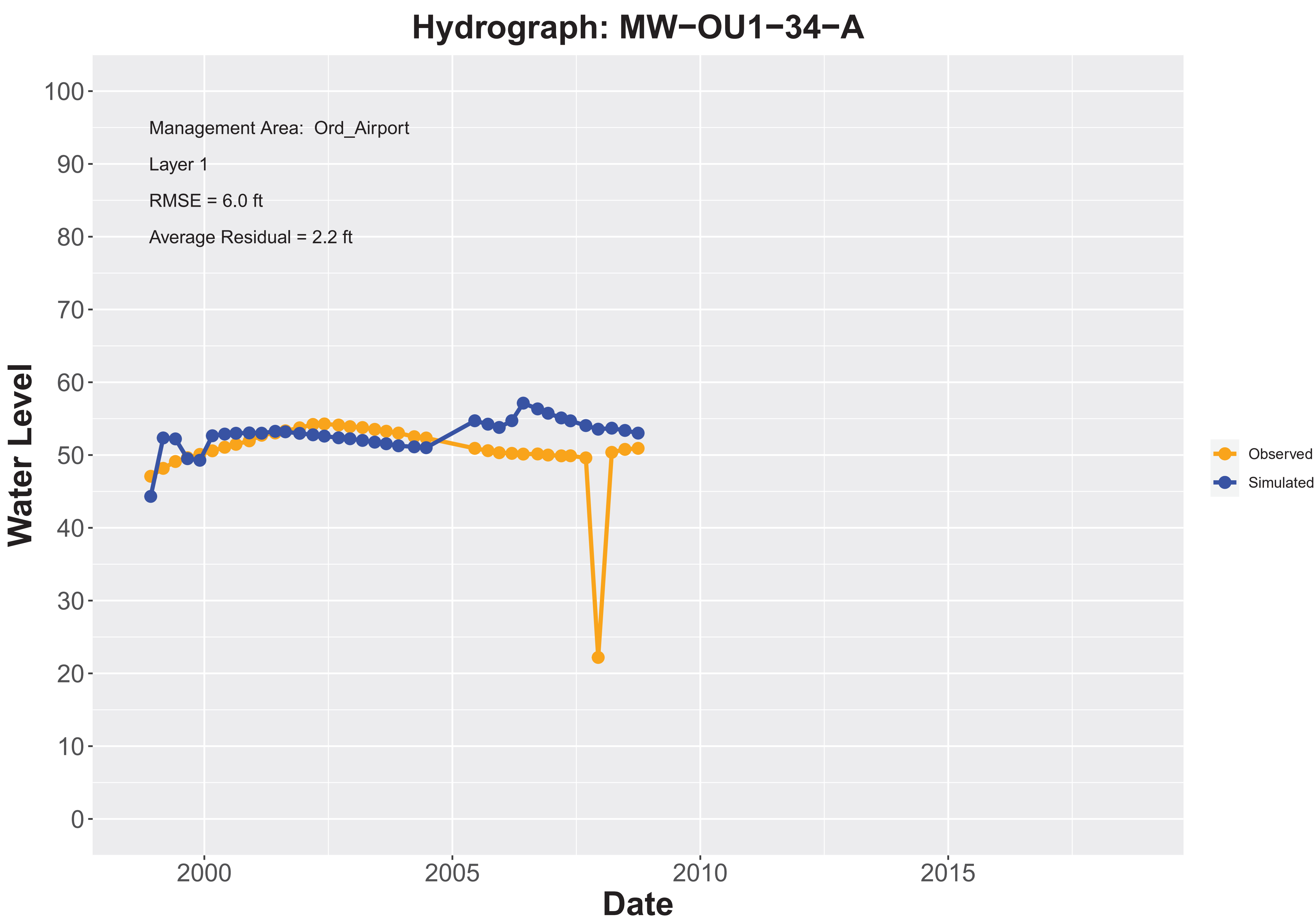
Hydrograph: MW−OU1−30−A
Management Area: Ord_Airport
Layer 1
RMSE = 5.4 ft
Average Residual = 1.7 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



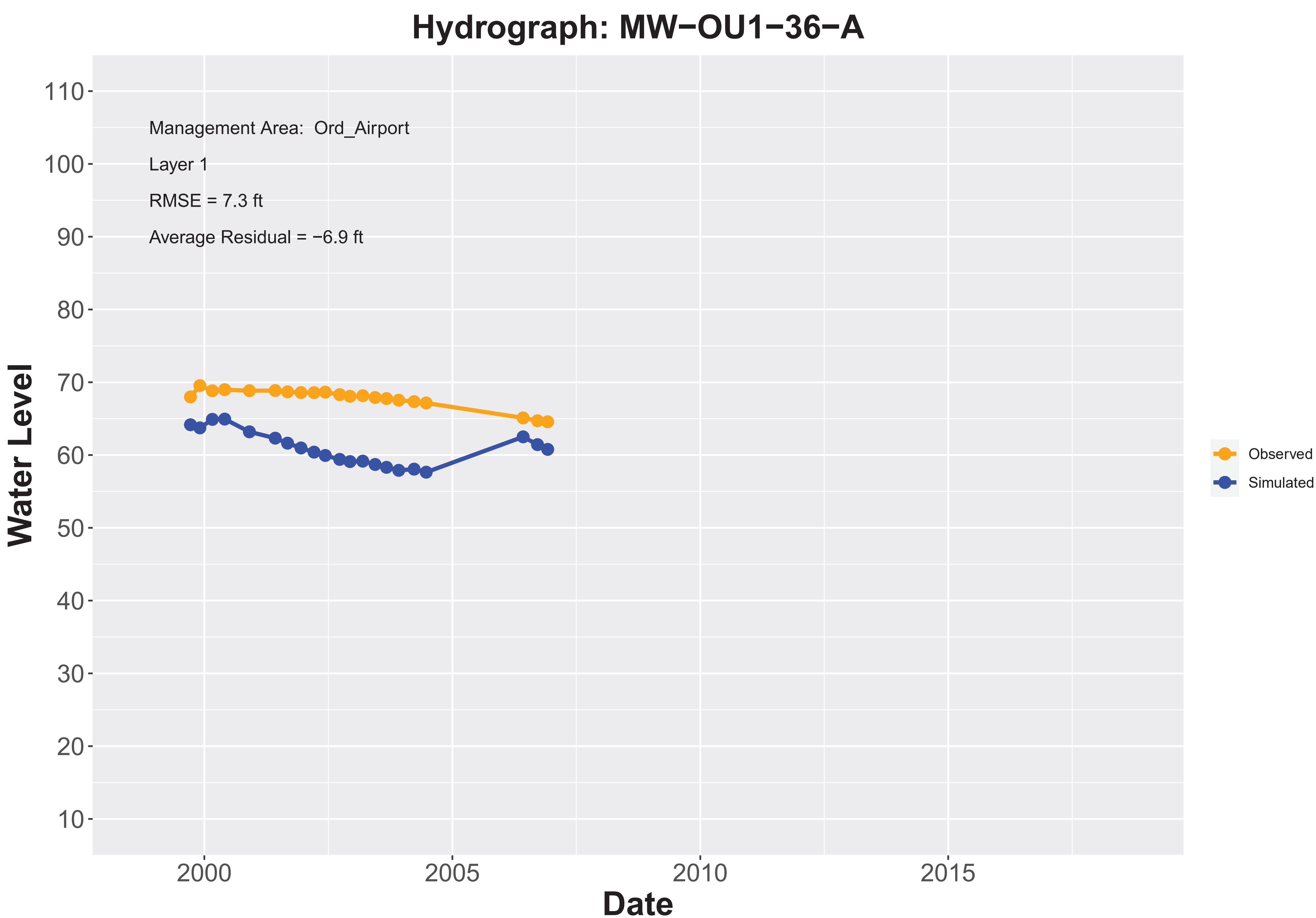
Hydrograph: MW−OU1−31−A
Management Area: Ord_Airport
Layer 1
RMSE = 7.9 ft
Average Residual = −1.5 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

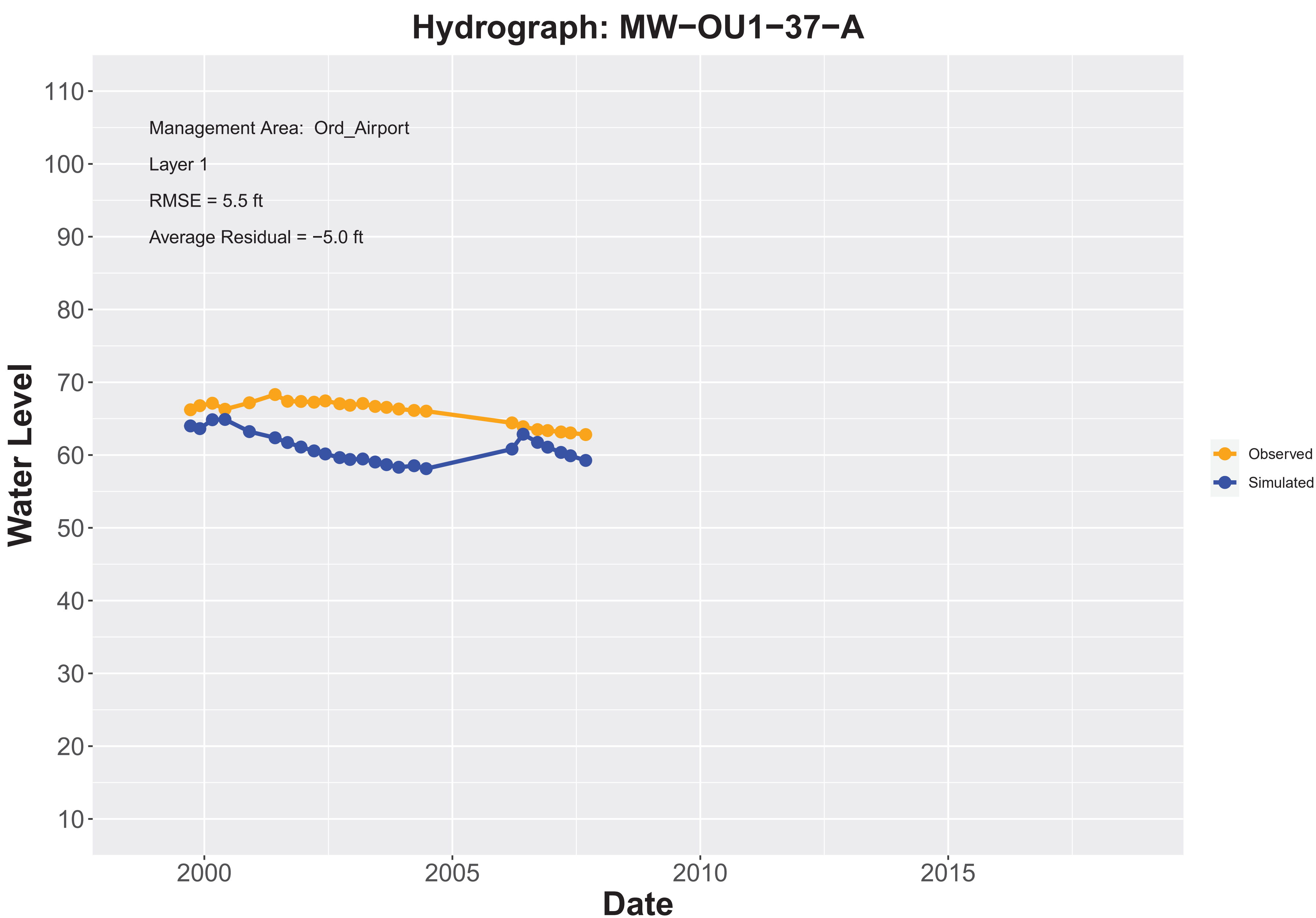

Hydrograph: MW−OU1−32−A
Management Area: Ord_Airport
Layer 1
RMSE = 5.0 ft
Average Residual = −0.86 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
Date
2000
2005
2010
2015
Observed
Simulated

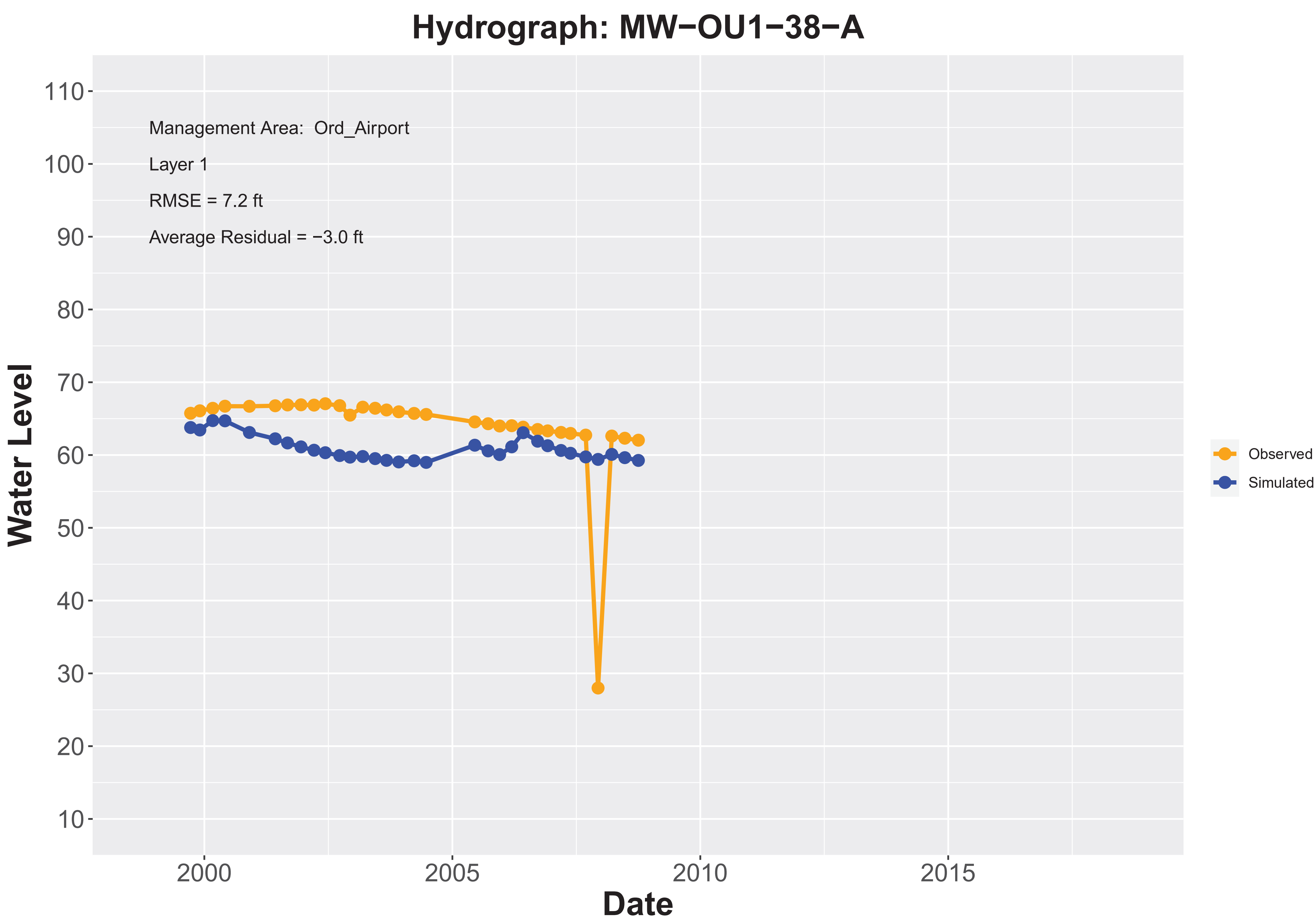

Hydrograph: MW−OU1−33−A
Management Area: Ord_Airport
Layer 1
RMSE = 4.8 ft
Average Residual = 3.6 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: MW−OU1−34−A
Management Area: Ord_Airport
Layer 1
RMSE = 6.0 ft
Average Residual = 2.2 ft
Water Level
0
10
20
30
40
50
60
70
80
90
100
Date
2000
2005
2010
2015
Observed
Simulated

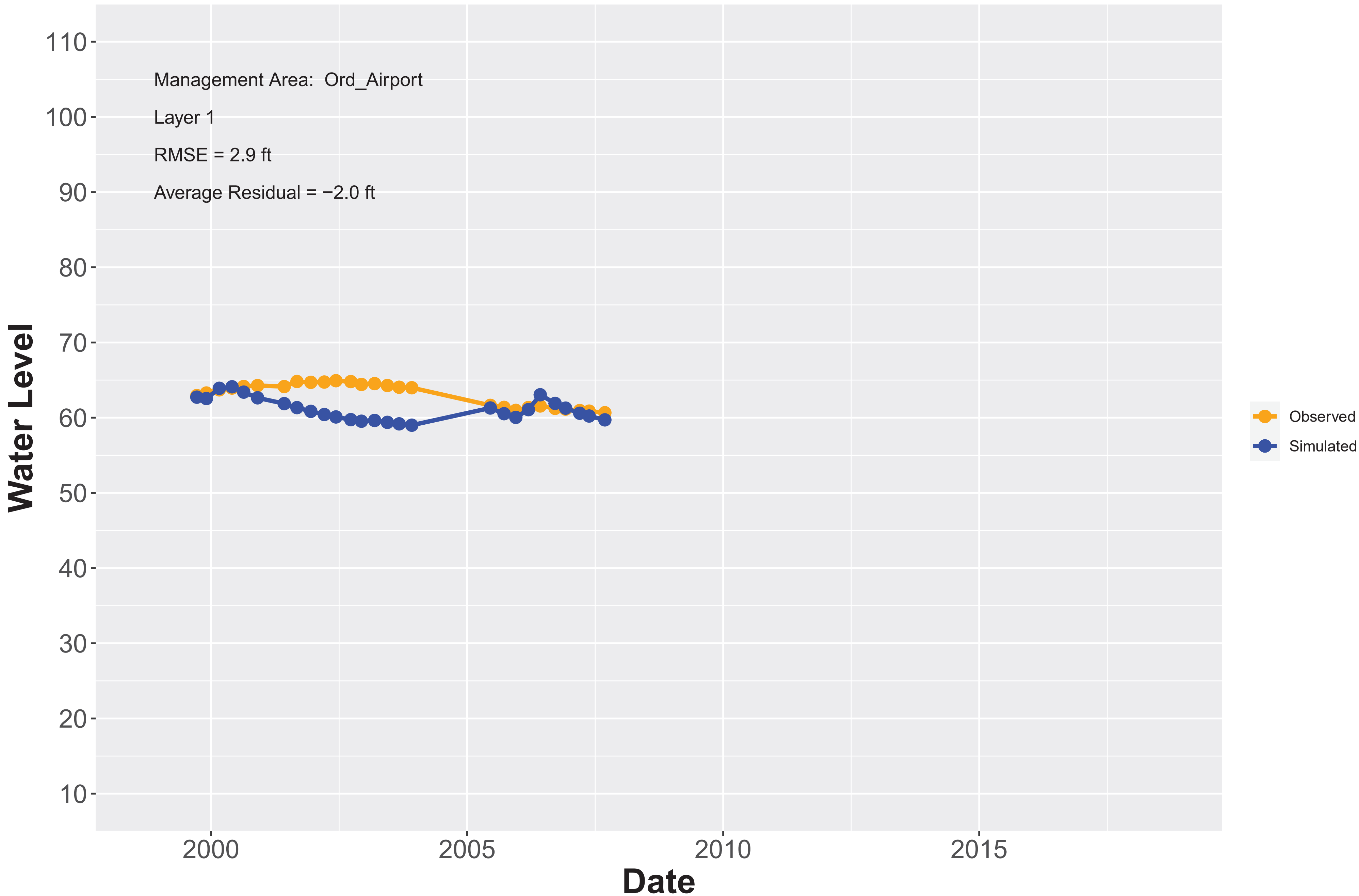

Hydrograph: MW−OU1−36−A
Management Area: Ord_Airport
Layer 1
RMSE = 7.3 ft
Average Residual = −6.9 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

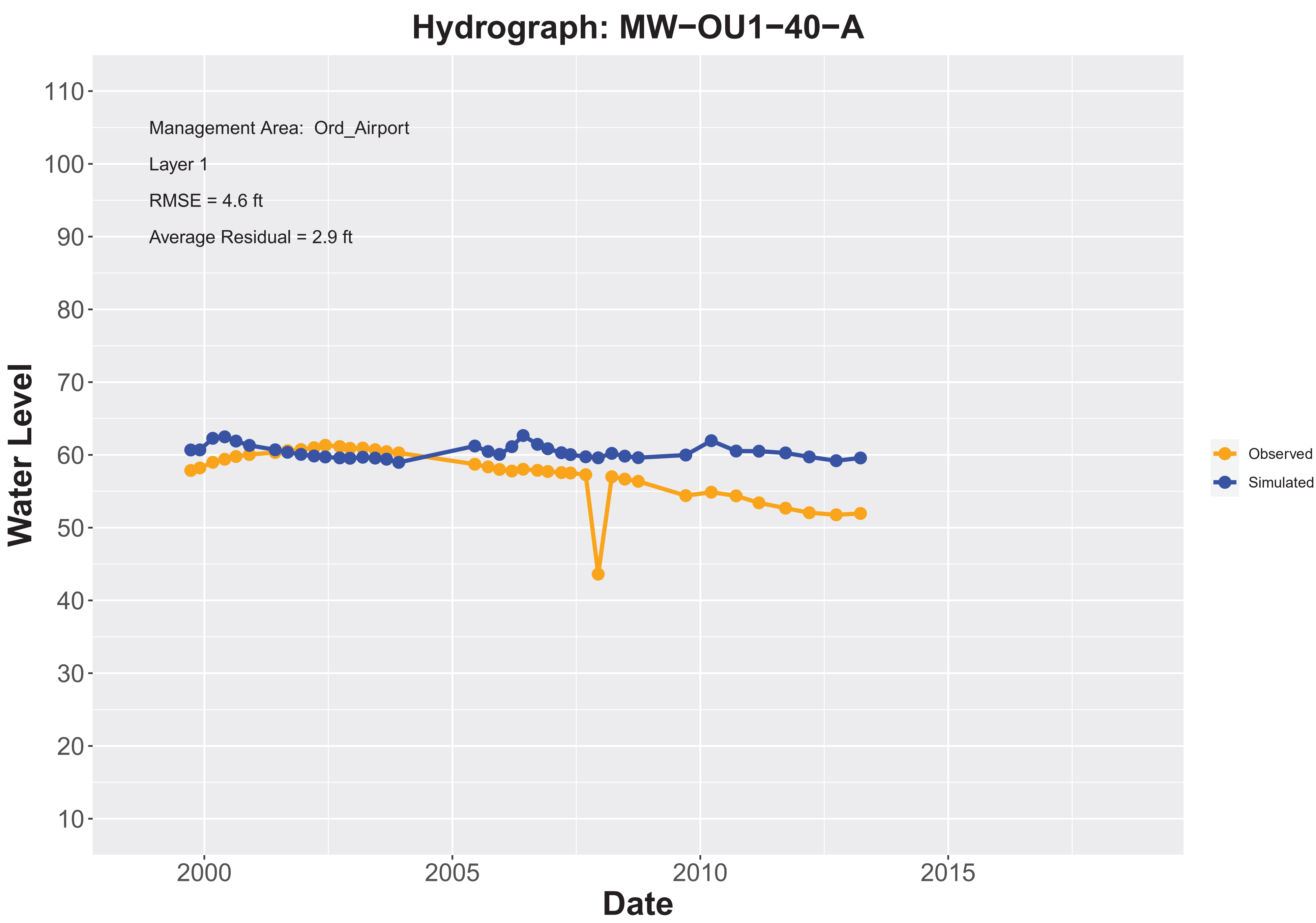

Hydrograph: MW−OU1−37−A
Management Area: Ord_Airport
Layer 1
RMSE = 5.5 ft
Average Residual = −5.0 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



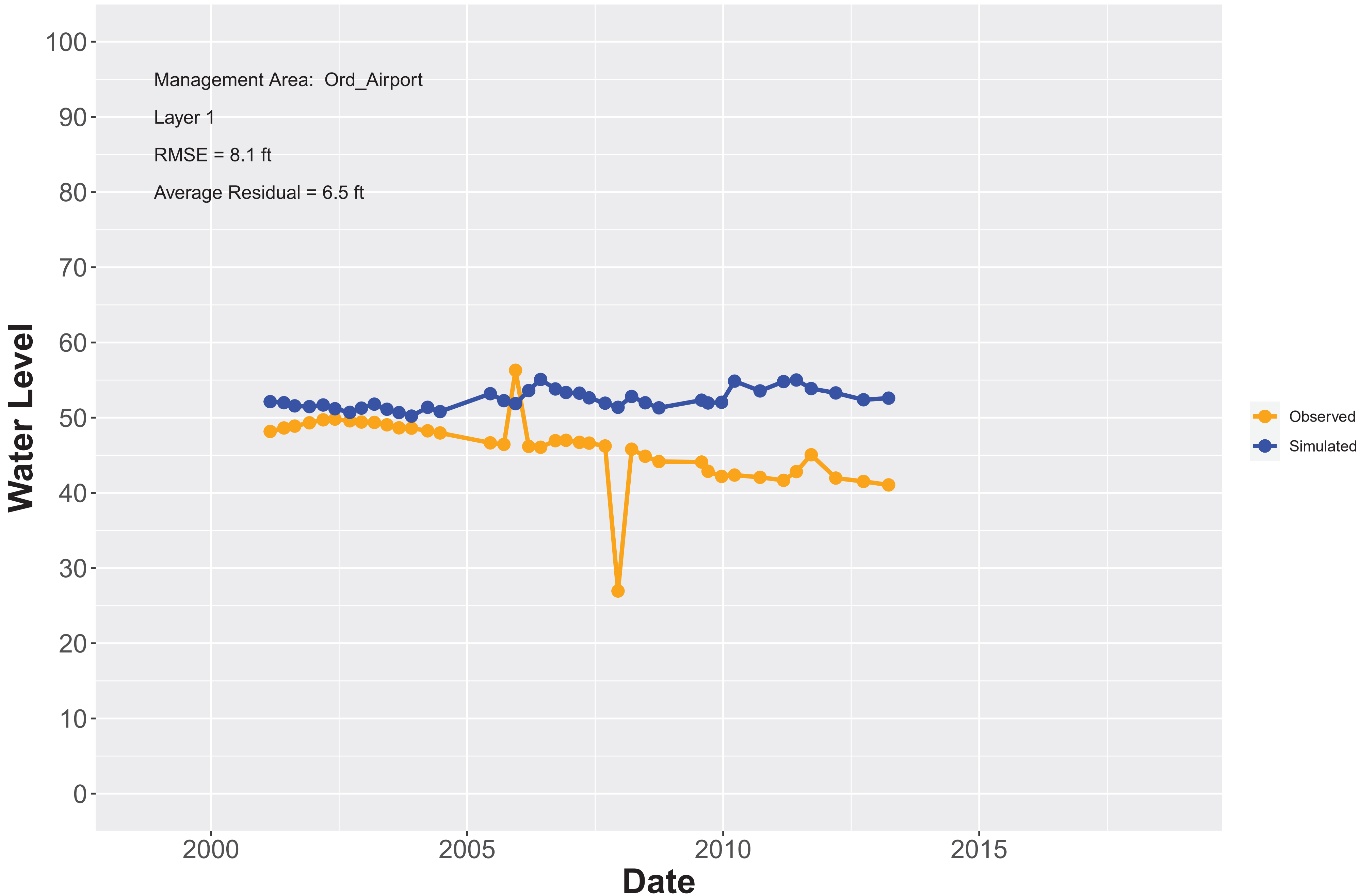
Hydrograph: MW−OU1−38−A
Management Area: Ord_Airport
Layer 1
RMSE = 7.2 ft
Average Residual = −3.0 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

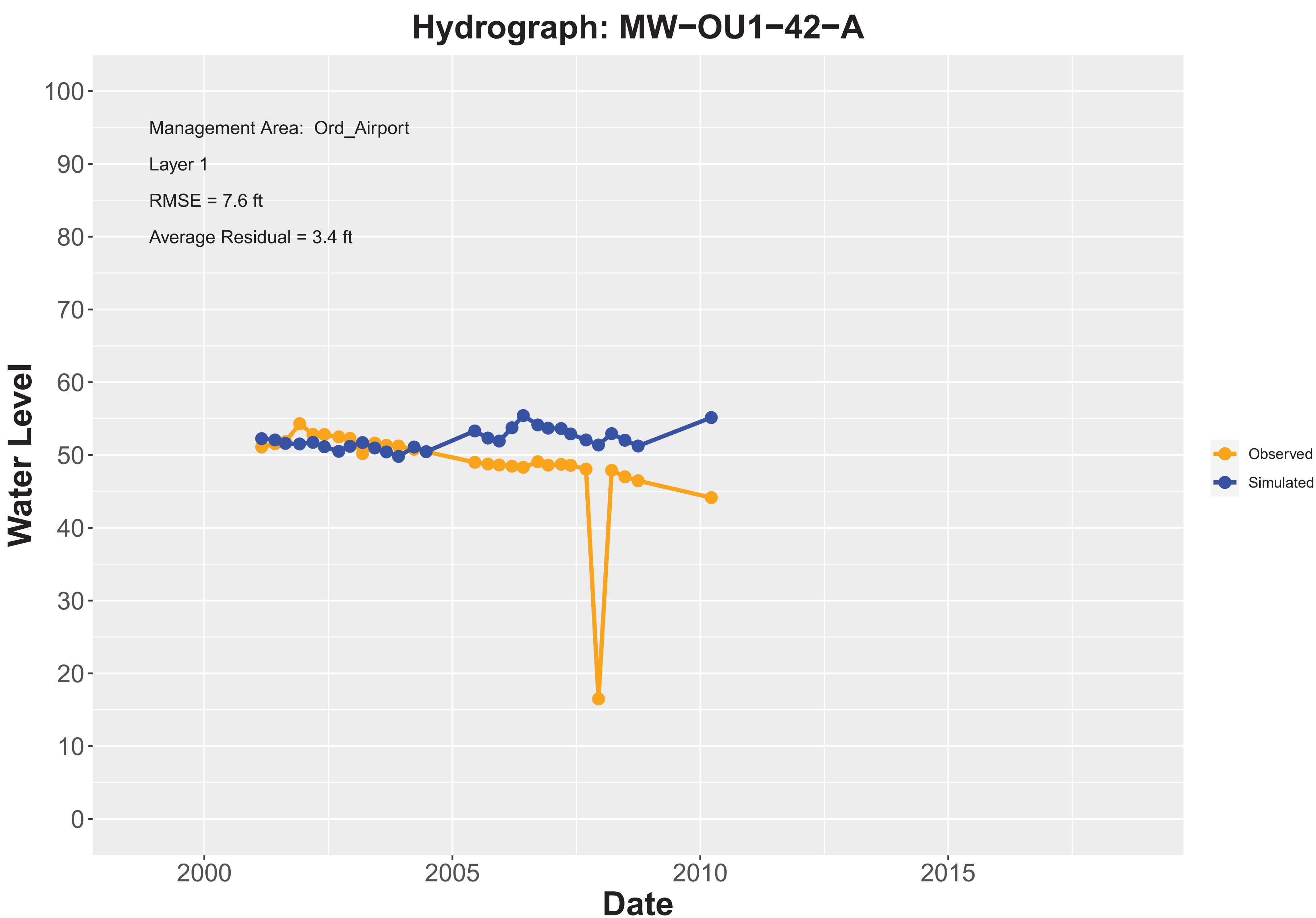
Hydrograph: MW−OU1−39−A



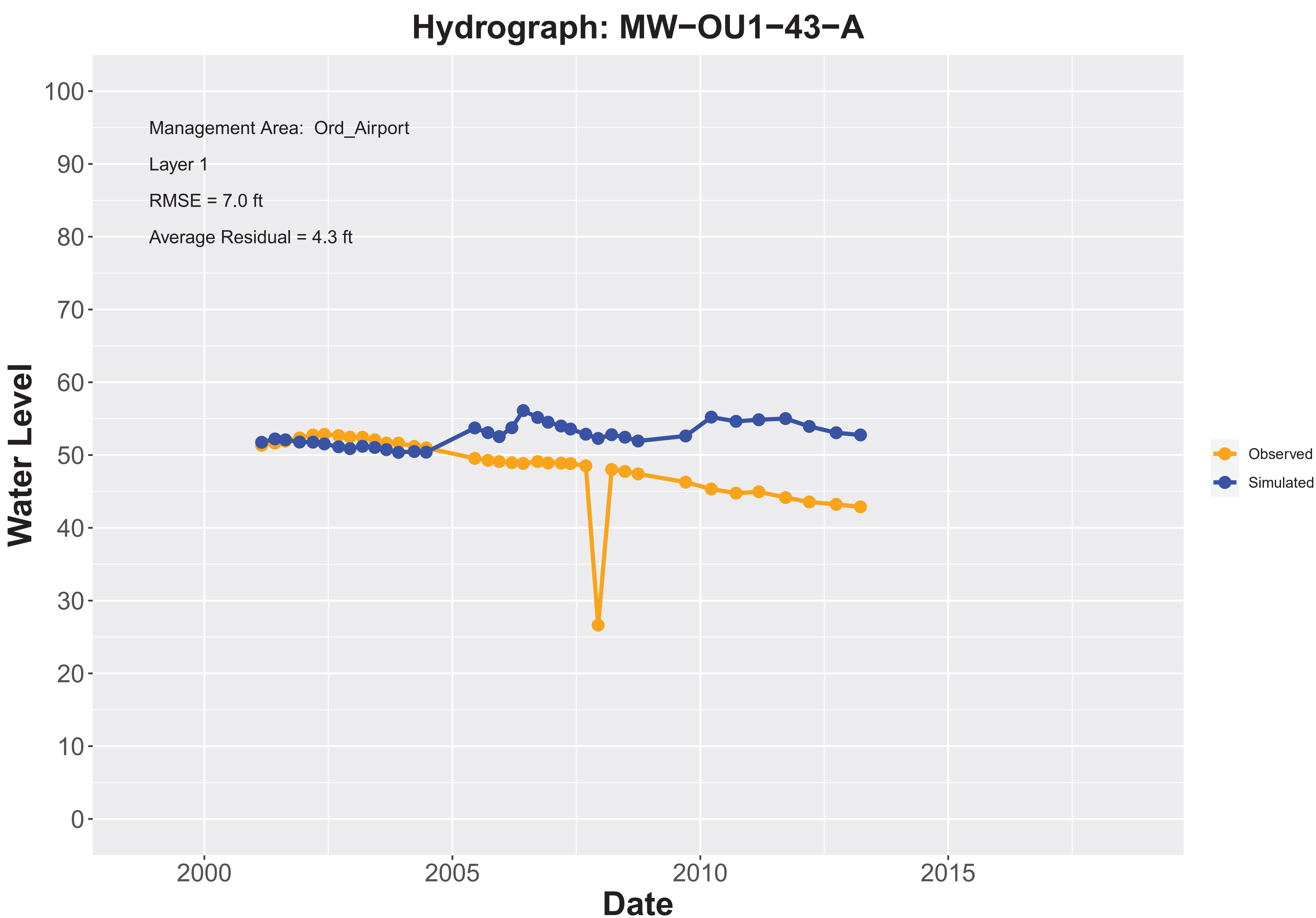

Hydrograph: MW−OU1−40−A
Management Area: Ord_Airport
Layer 1
RMSE = 4.6 ft
Average Residual = 2.9 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−OU1−41−A

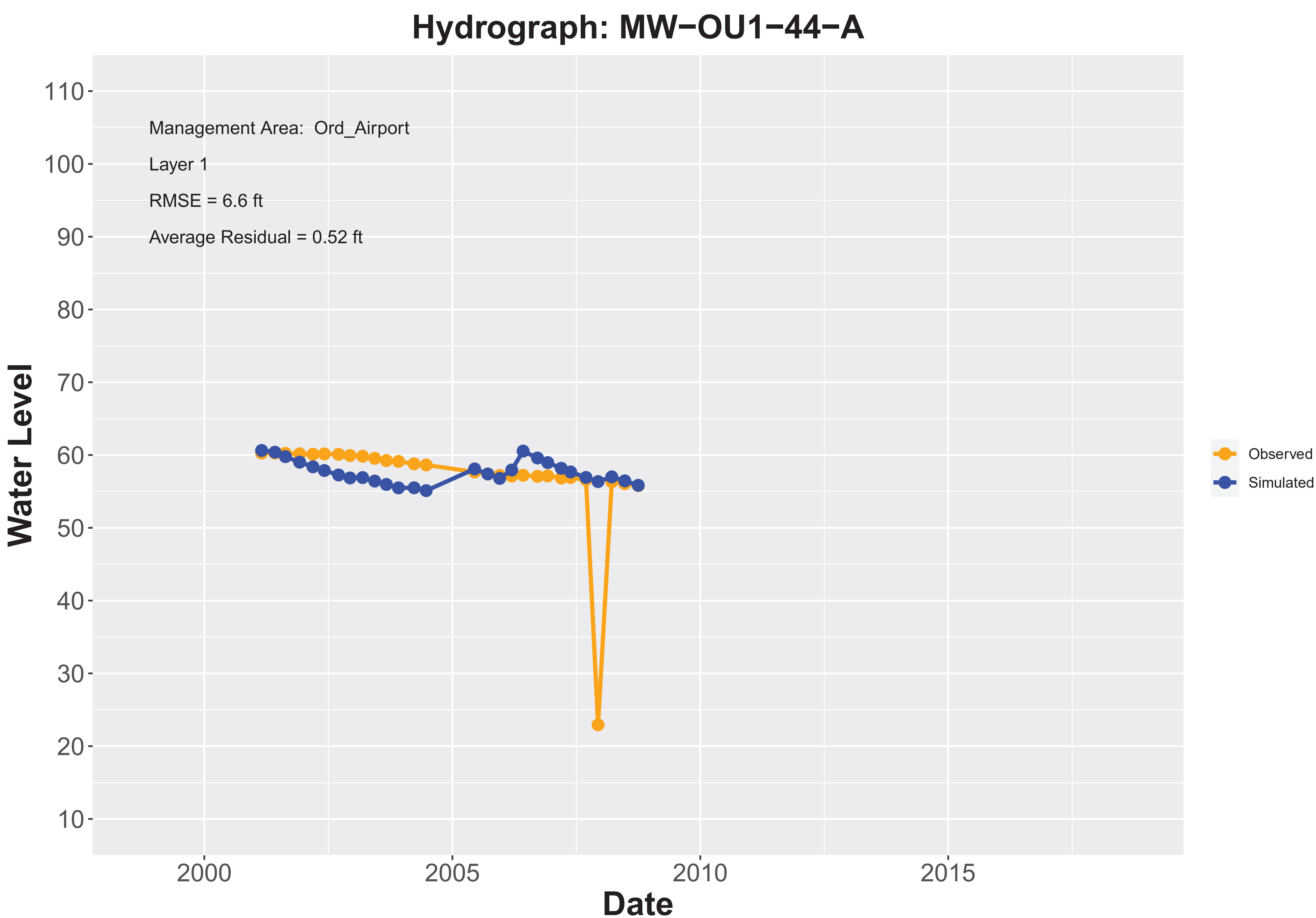




Hydrograph: MW−OU1−42−A
Management Area: Ord_Airport
Layer 1
RMSE = 7.6 ft
Average Residual = 3.4 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

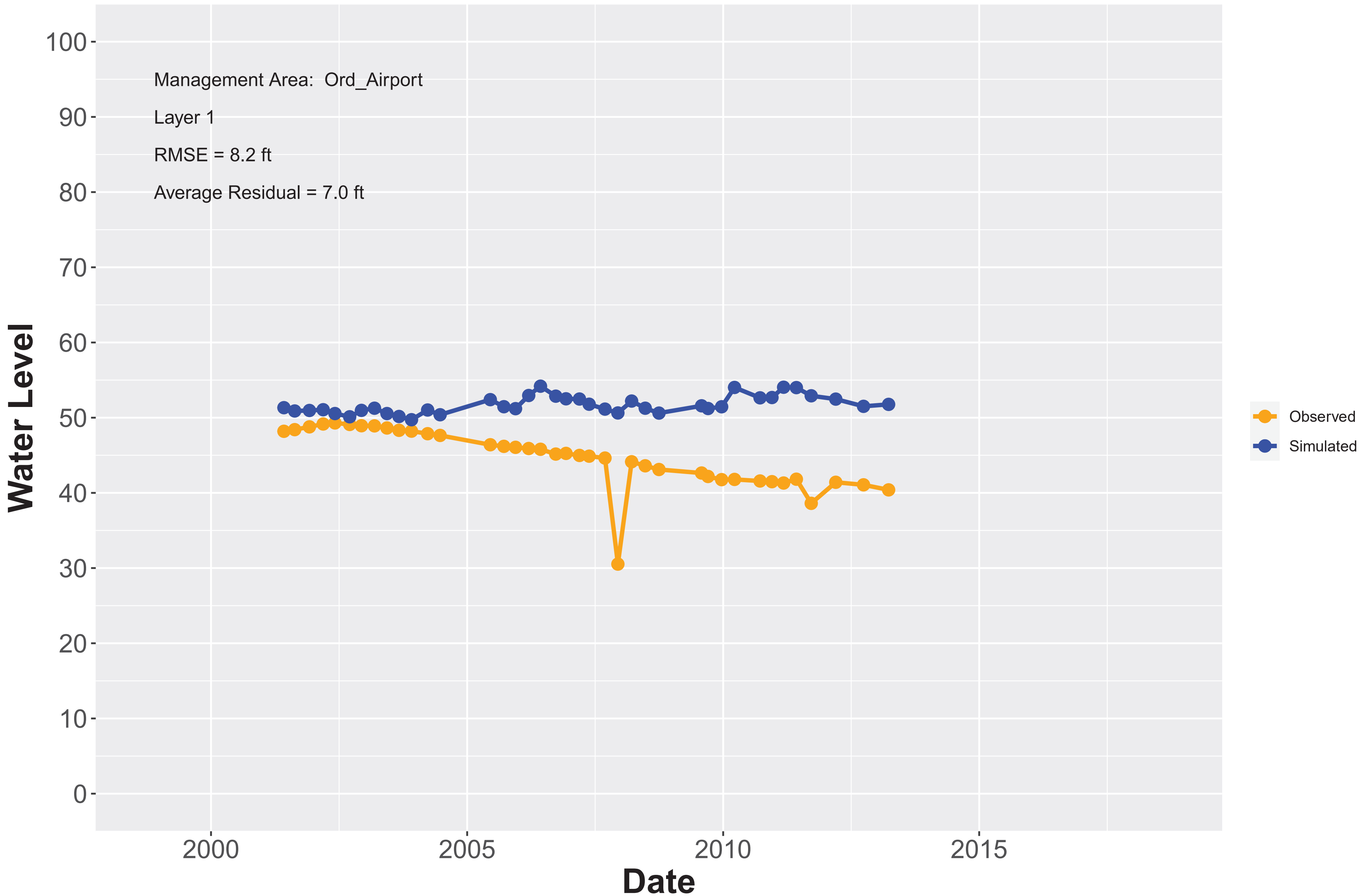


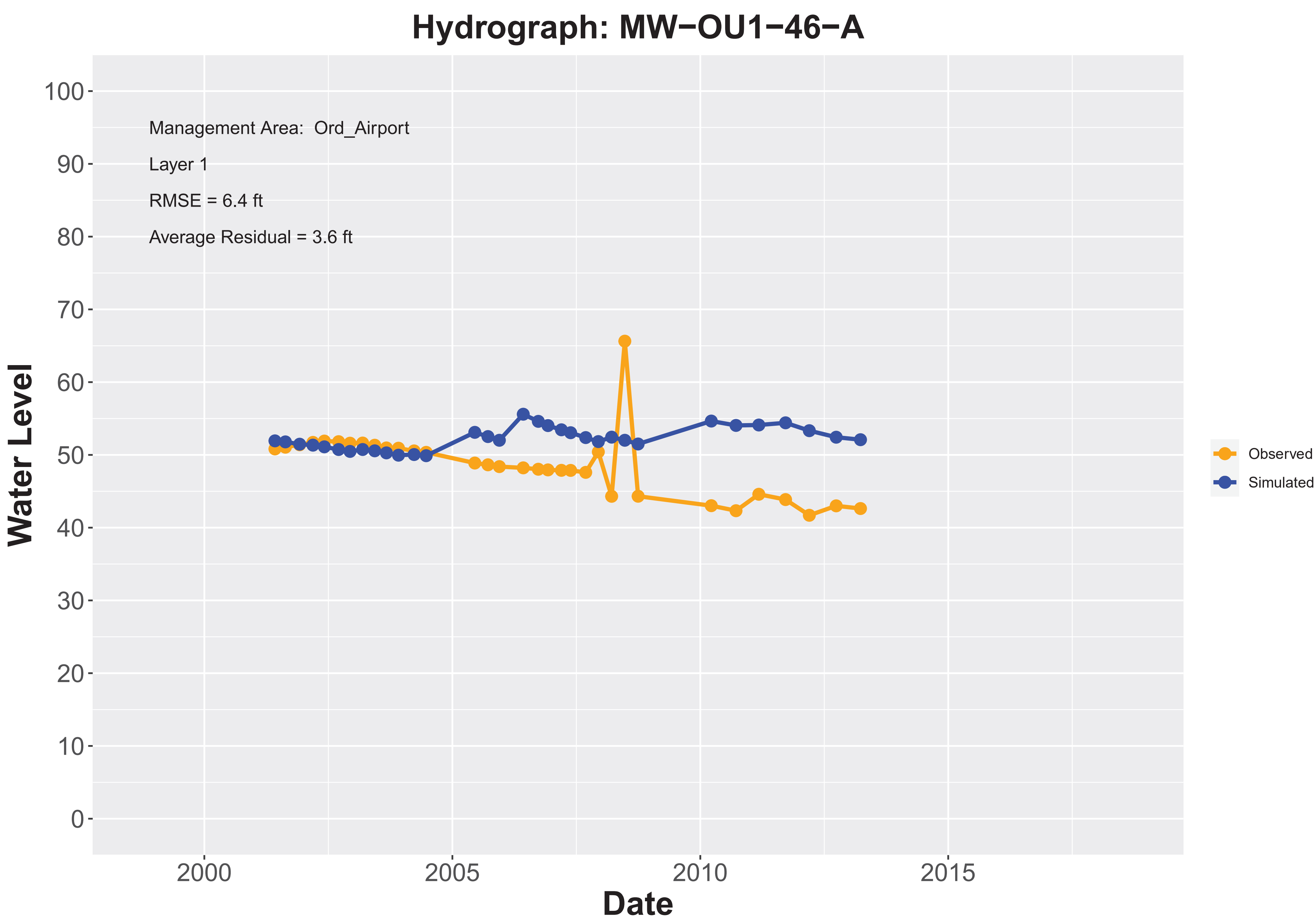
Hydrograph: MW−OU1−43−A
Management Area: Ord_Airport
Layer 1
RMSE = 7.0 ft
Average Residual = 4.3 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

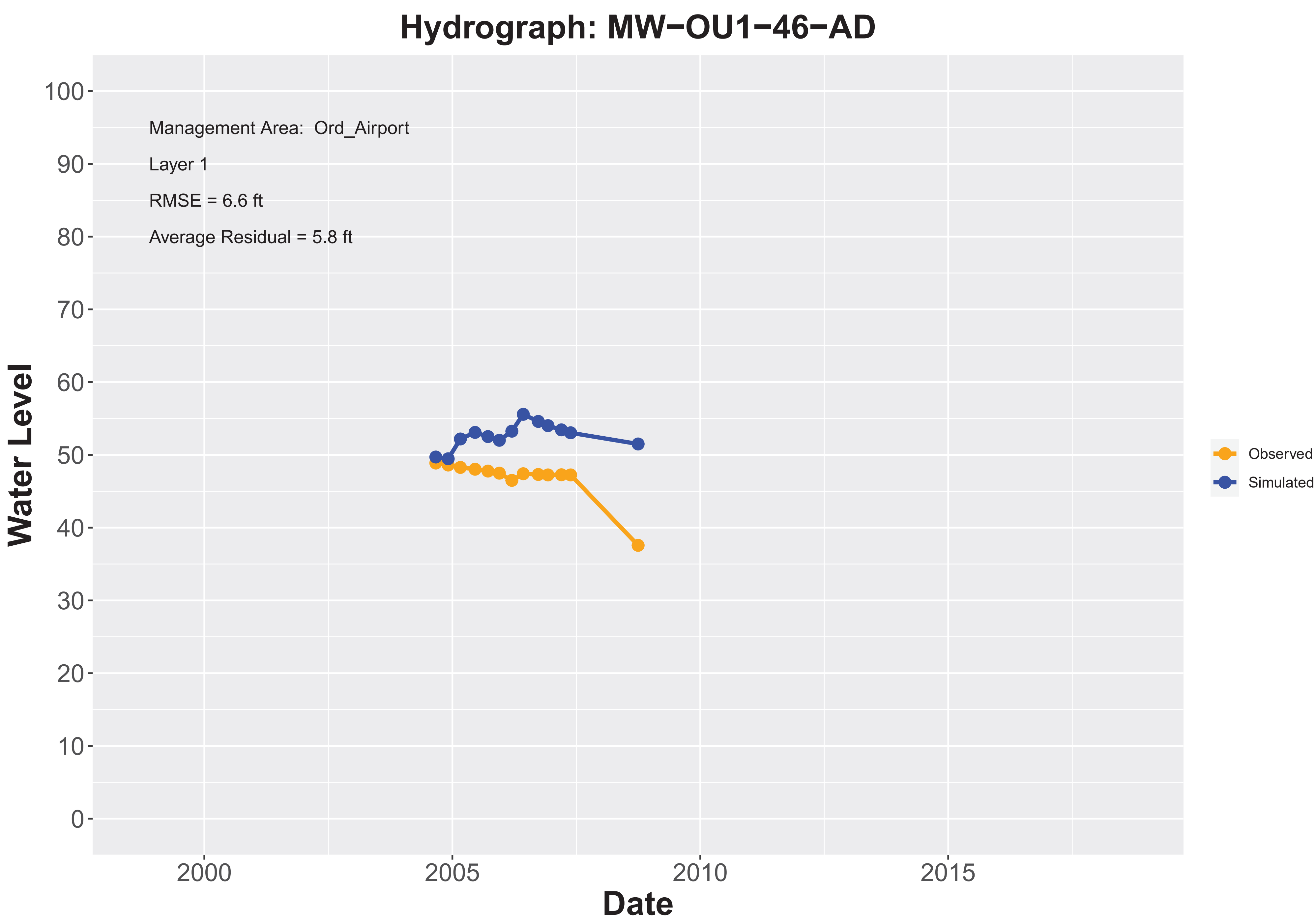


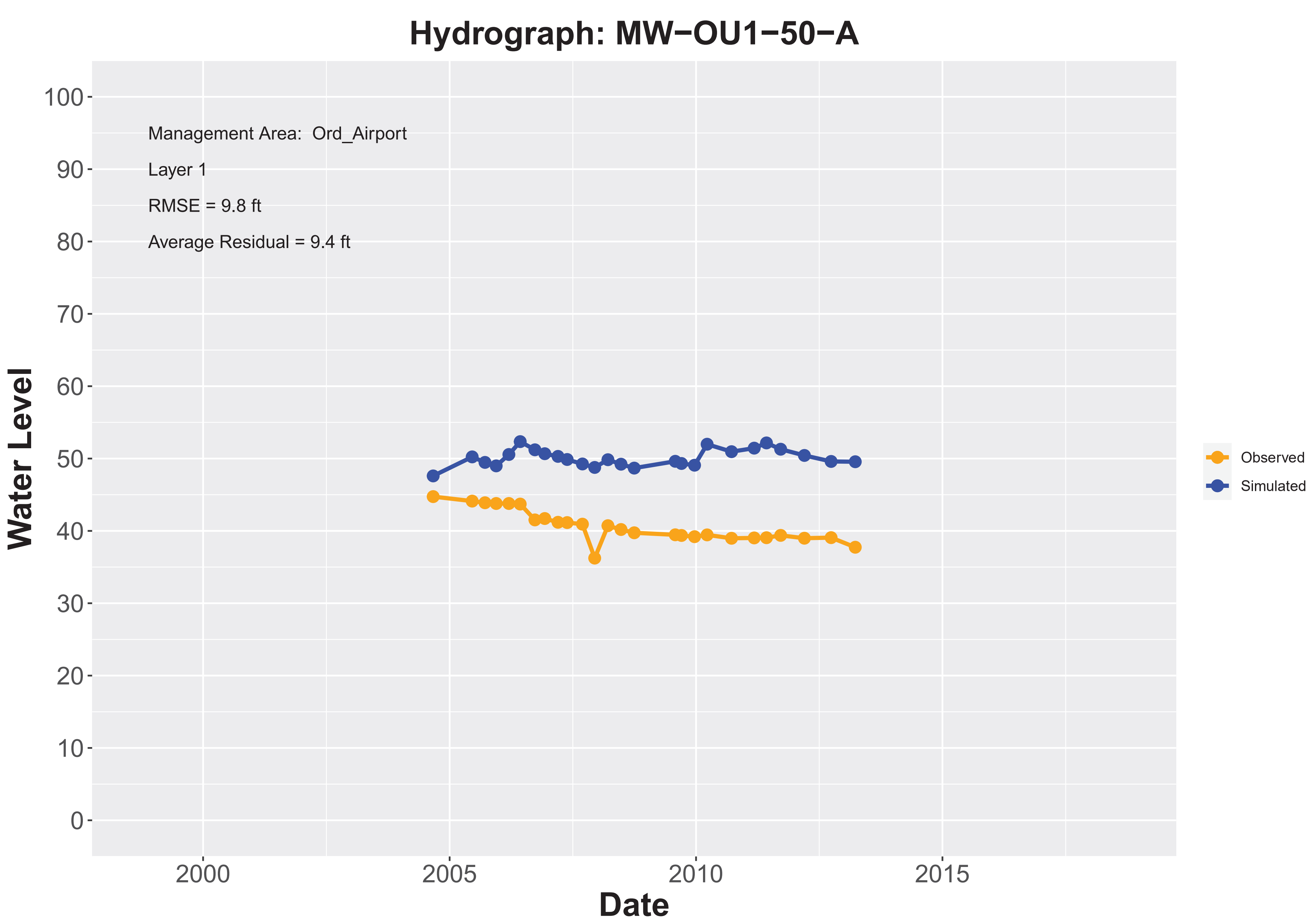
Hydrograph: MW−OU1−44−A
Management Area: Ord_Airport
Layer 1
RMSE = 6.6 ft
Average Residual = 0.52 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−OU1−45−A

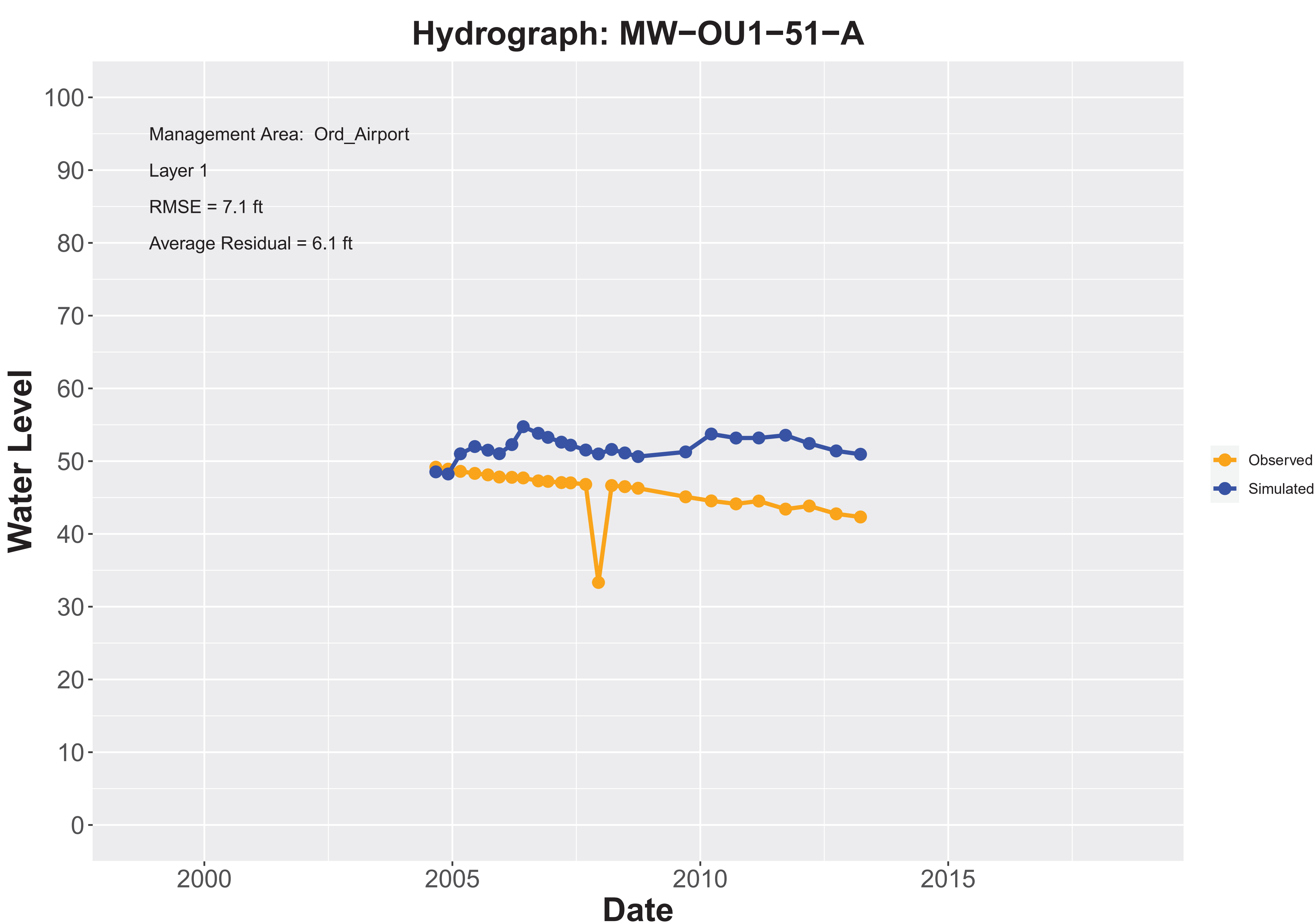



Hydrograph: MW−OU1−46−A
Management Area: Ord_Airport
Layer 1
RMSE = 6.4 ft
Average Residual = 3.6 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

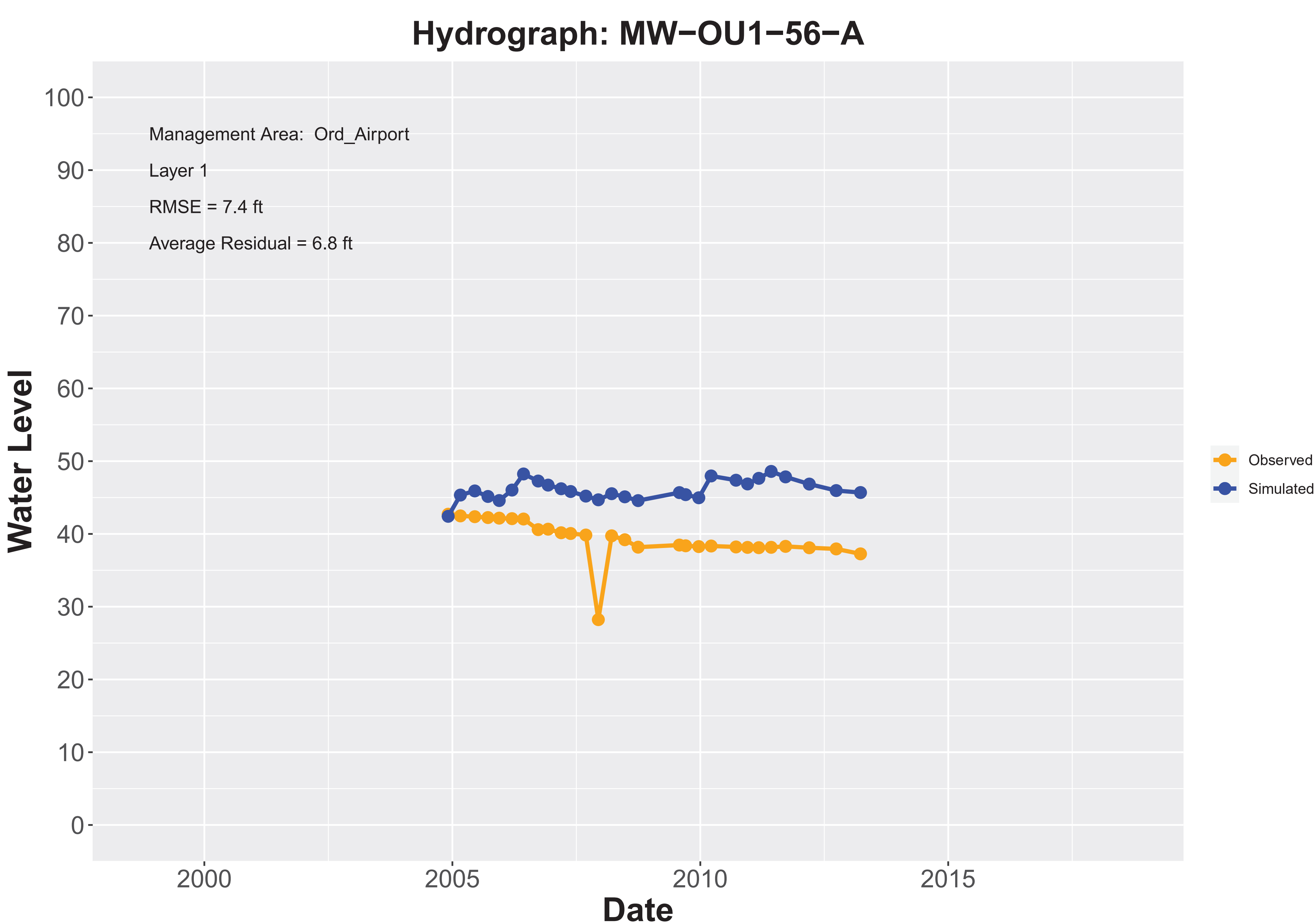

Hydrograph: MW−OU1−46−AD
Management Area: Ord_Airport
Layer 1
RMSE = 6.6 ft
Average Residual = 5.8 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated



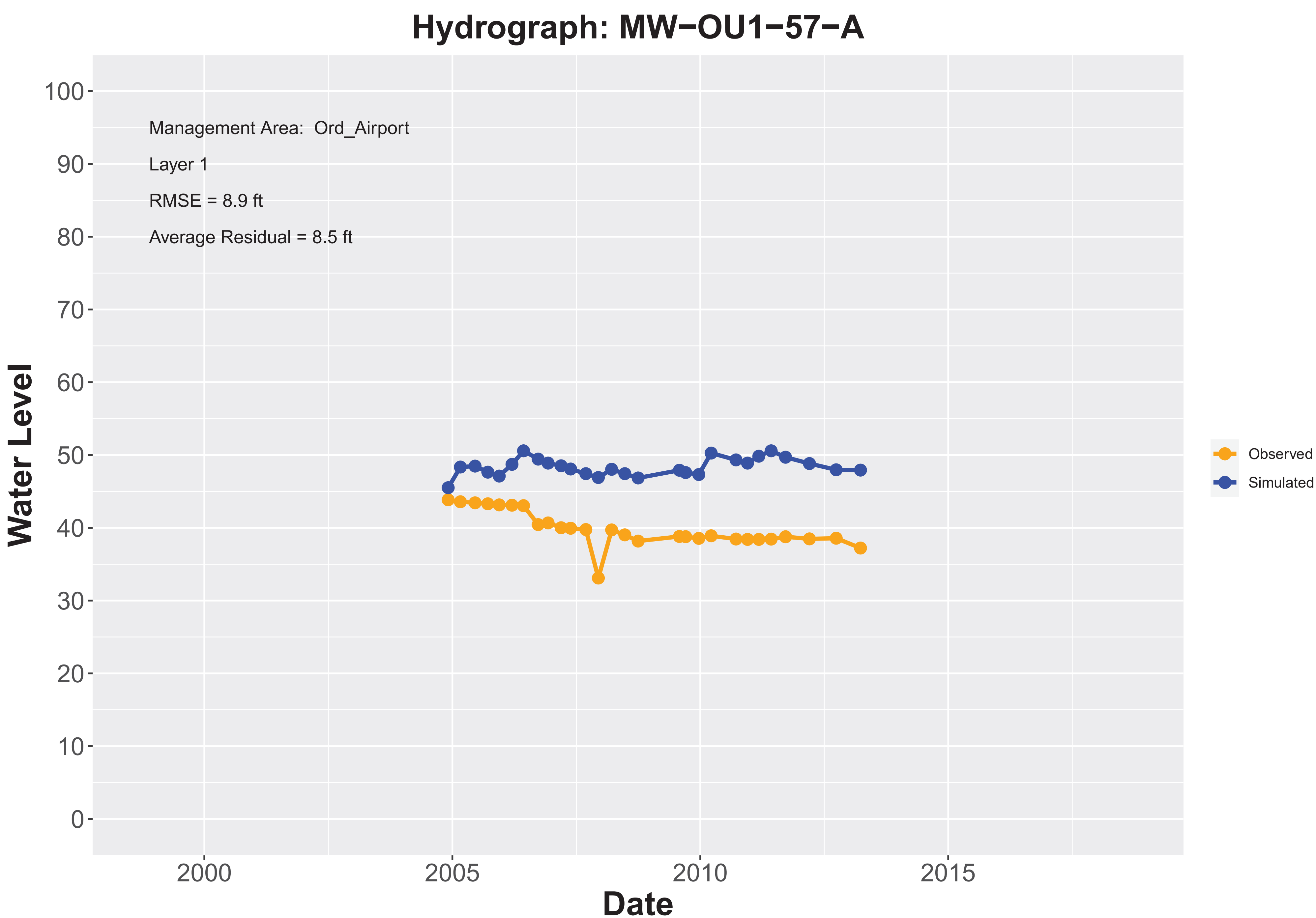
Hydrograph: MW−OU1−50−A
Management Area: Ord_Airport
Layer 1
RMSE = 9.8 ft
Average Residual = 9.4 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated



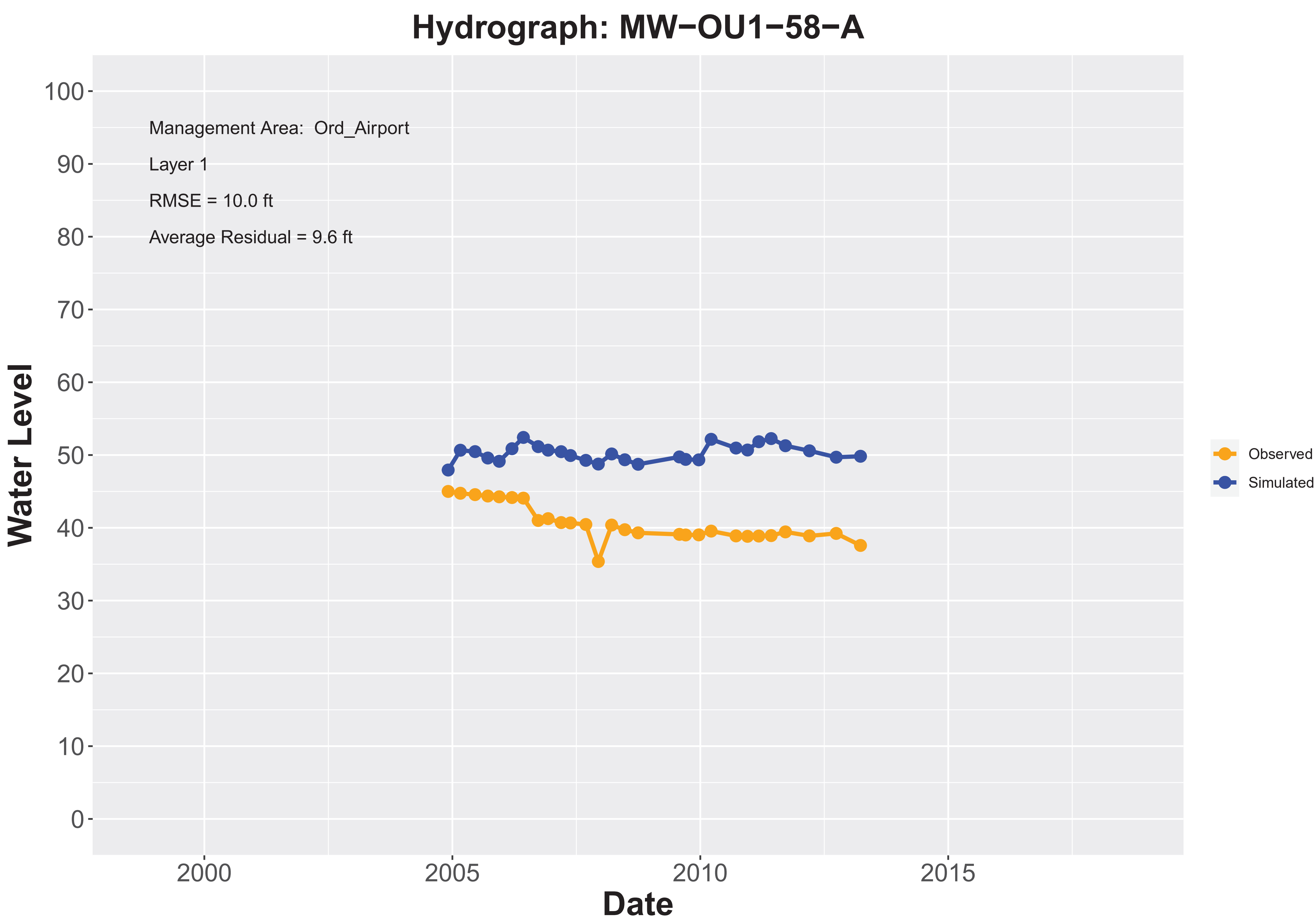
Hydrograph: MW−OU1−51−A
Management Area: Ord_Airport
Layer 1
RMSE = 7.1 ft
Average Residual = 6.1 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

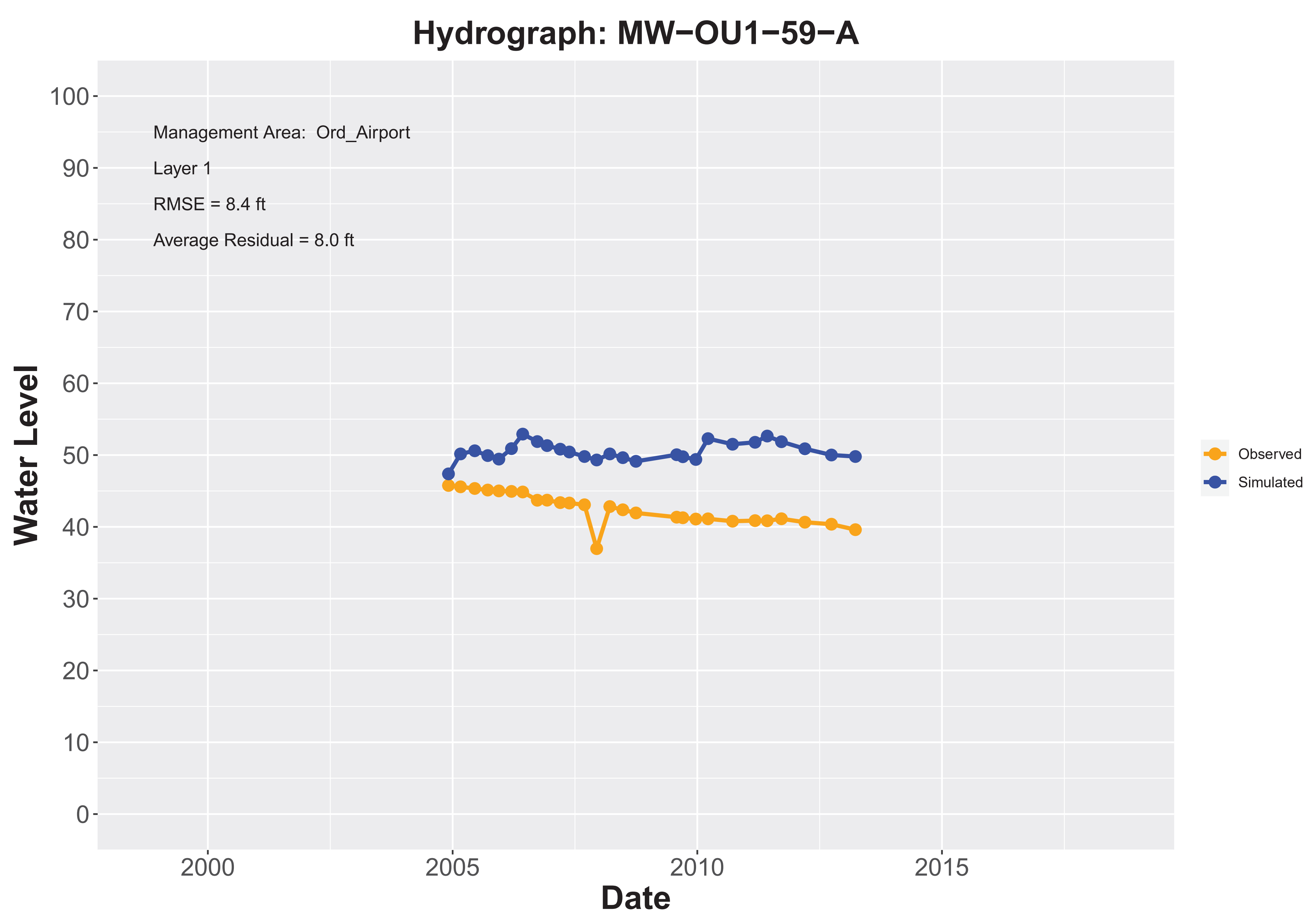


Hydrograph: MW−OU1−56−A
Management Area: Ord_Airport
Layer 1
RMSE = 7.4 ft
Average Residual = 6.8 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

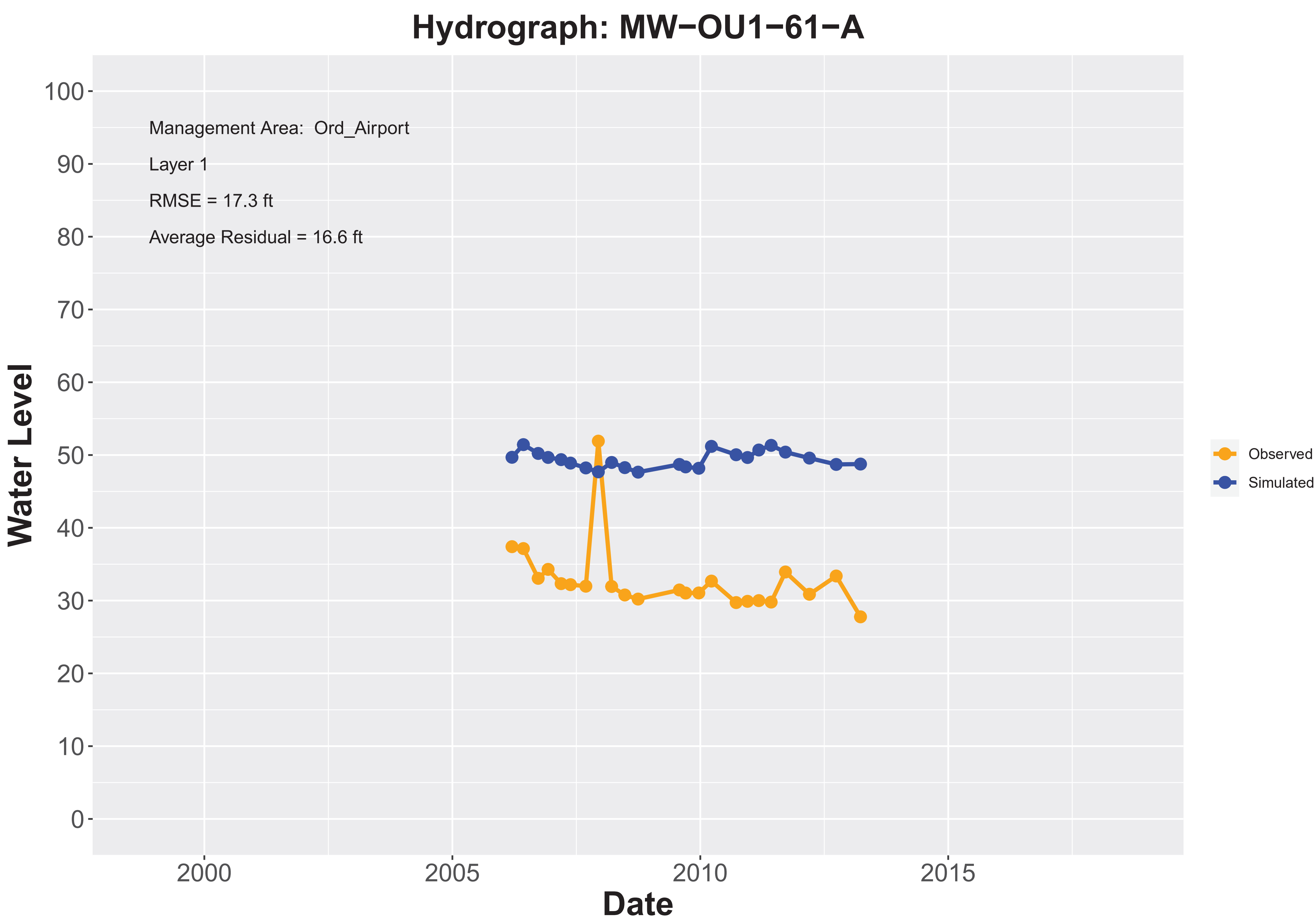


Hydrograph: MW−OU1−57−A
Management Area: Ord_Airport
Layer 1
RMSE = 8.9 ft
Average Residual = 8.5 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

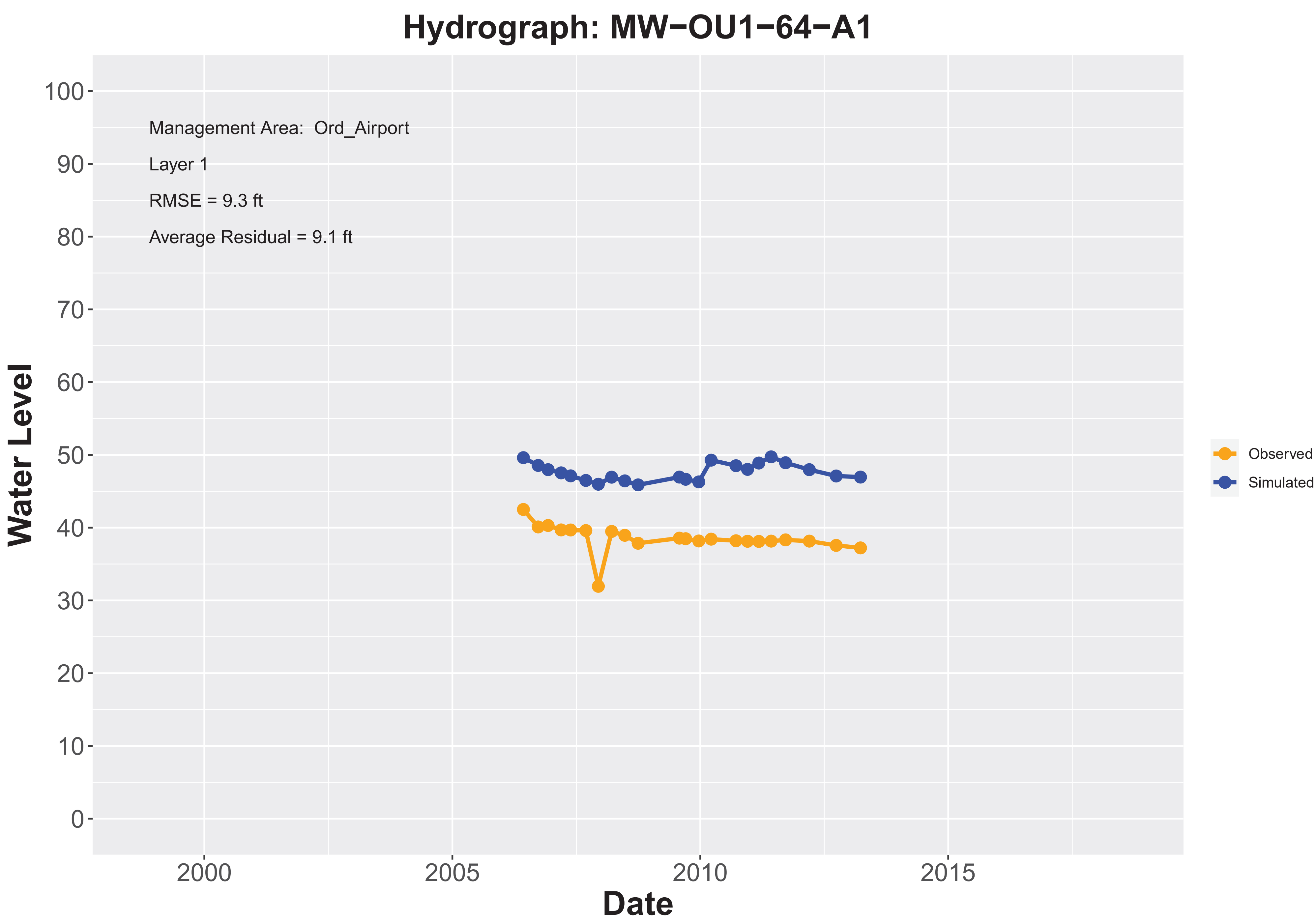

Hydrograph: MW−OU1−58−A
Management Area: Ord_Airport
Layer 1
RMSE = 10.0 ft
Average Residual = 9.6 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

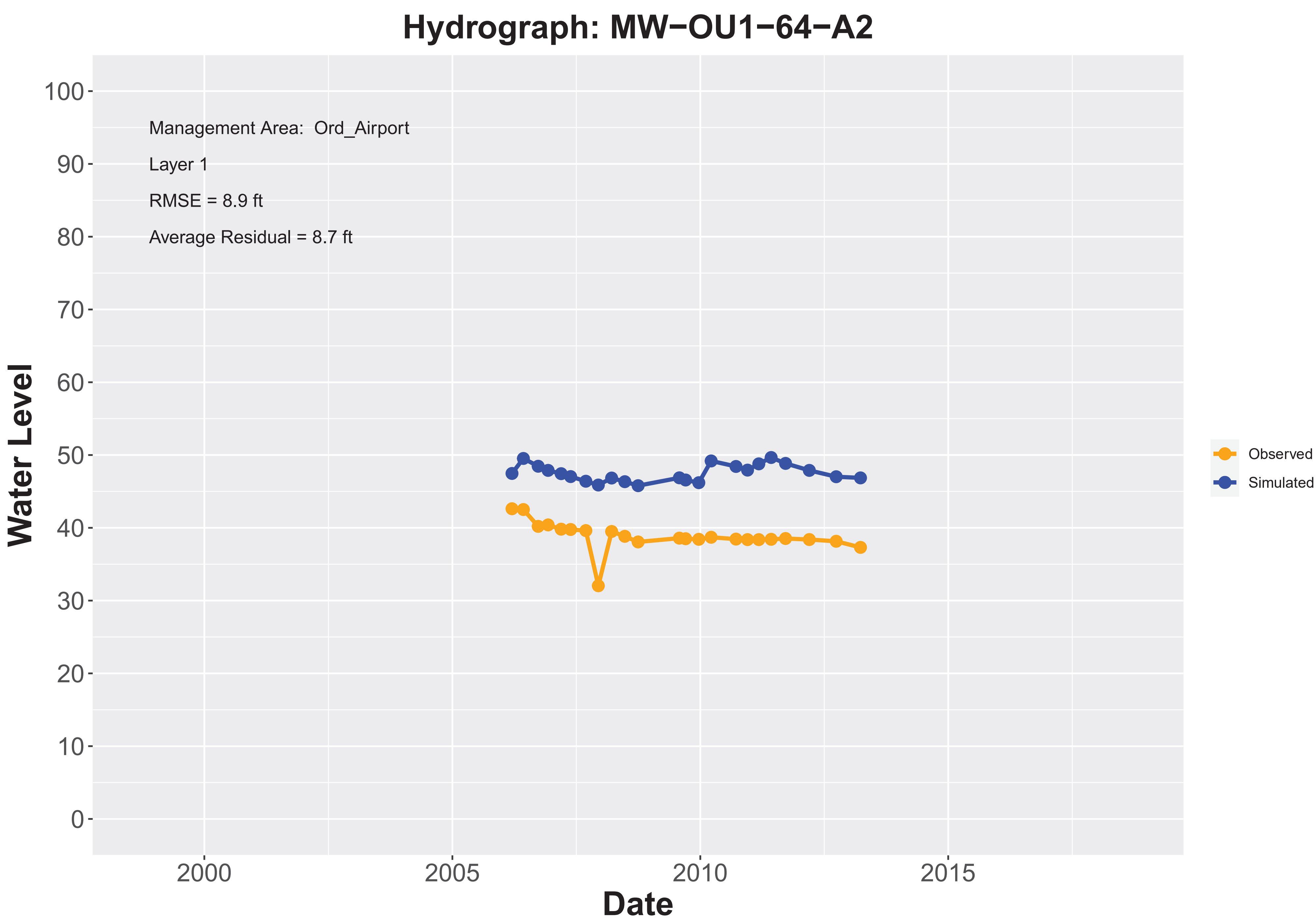


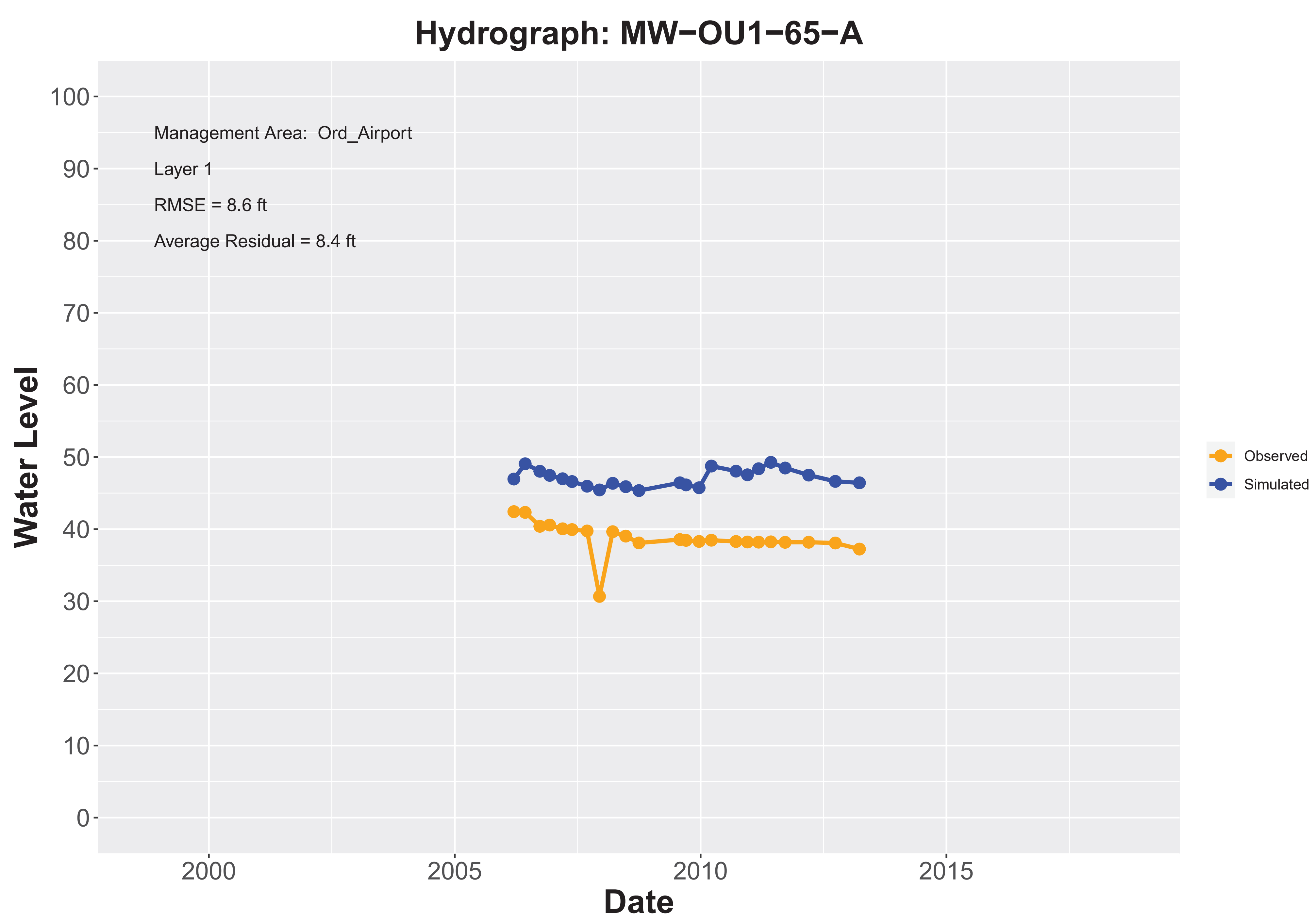
Hydrograph: MW−OU1−59−A
Management Area: Ord_Airport
Layer 1
RMSE = 8.4 ft
Average Residual = 8.0 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

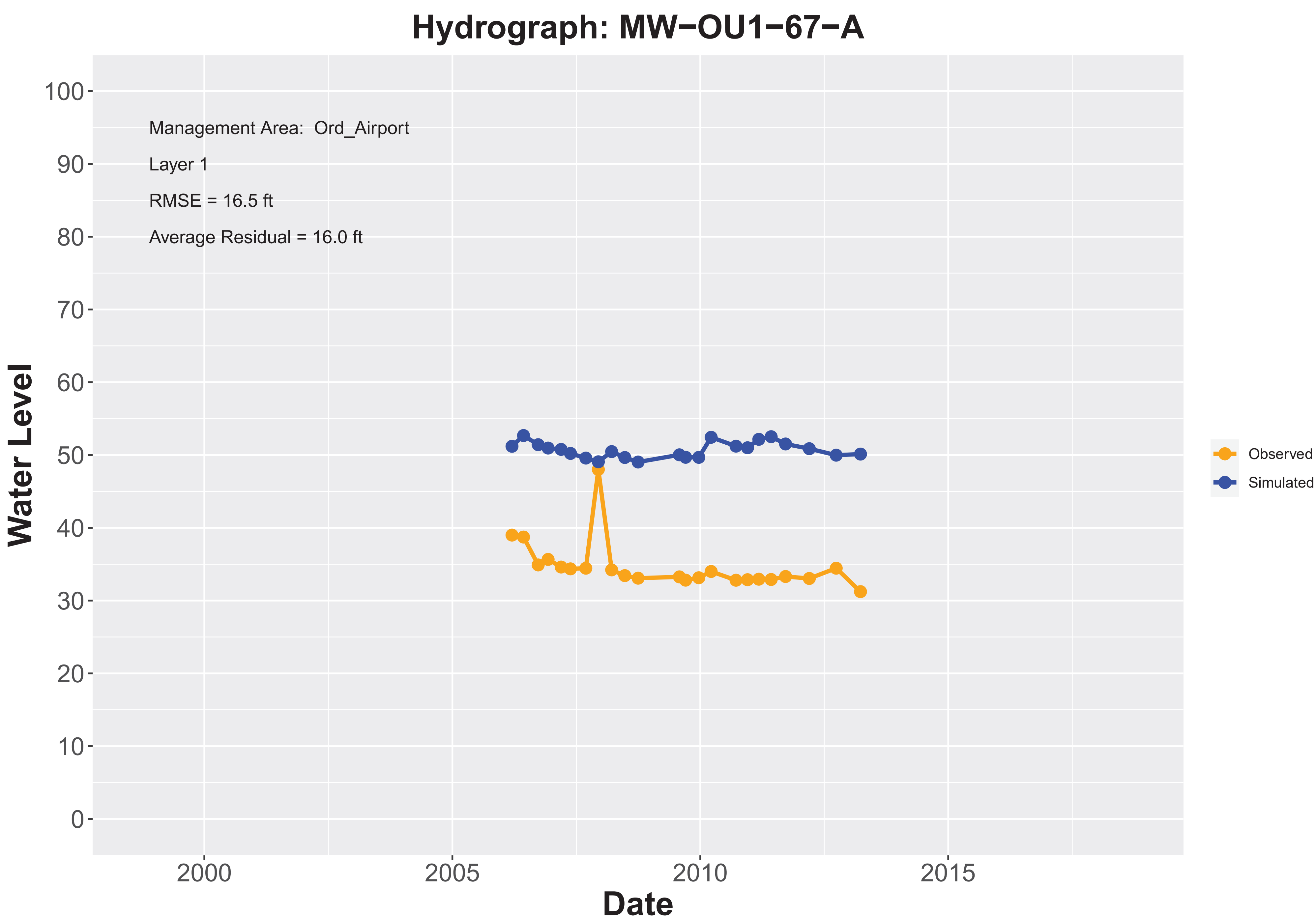


Hydrograph: MW−OU1−61−A
Management Area: Ord_Airport
Layer 1
RMSE = 17.3 ft
Average Residual = 16.6 ft
Water Level
Date
Observed
Simulated
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015

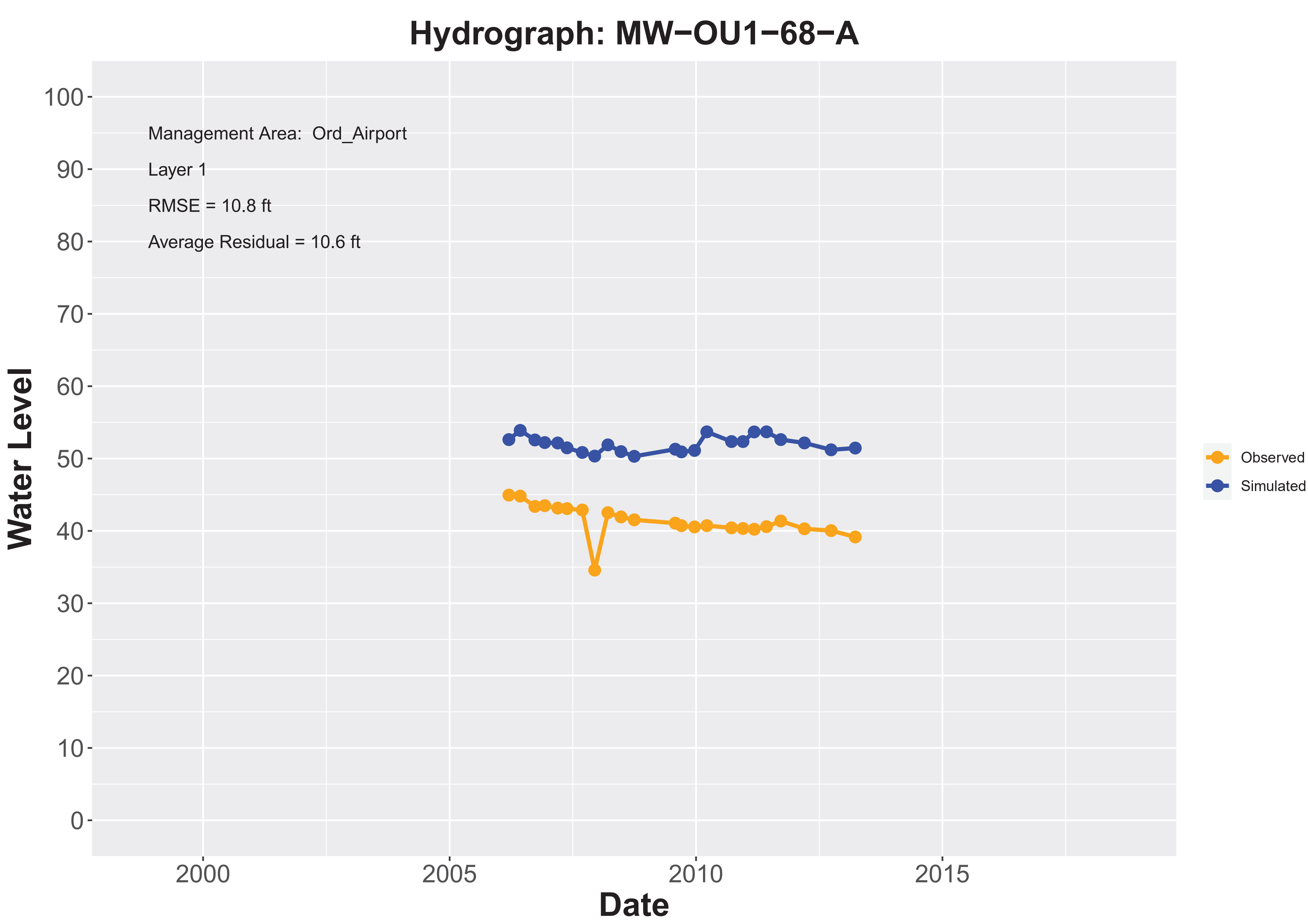

Hydrograph: MW−OU1−64−A1
Management Area: Ord_Airport
Layer 1
RMSE = 9.3 ft
Average Residual = 9.1 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU1−64−A2
Management Area: Ord_Airport
Layer 1
RMSE = 8.9 ft
Average Residual = 8.7 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

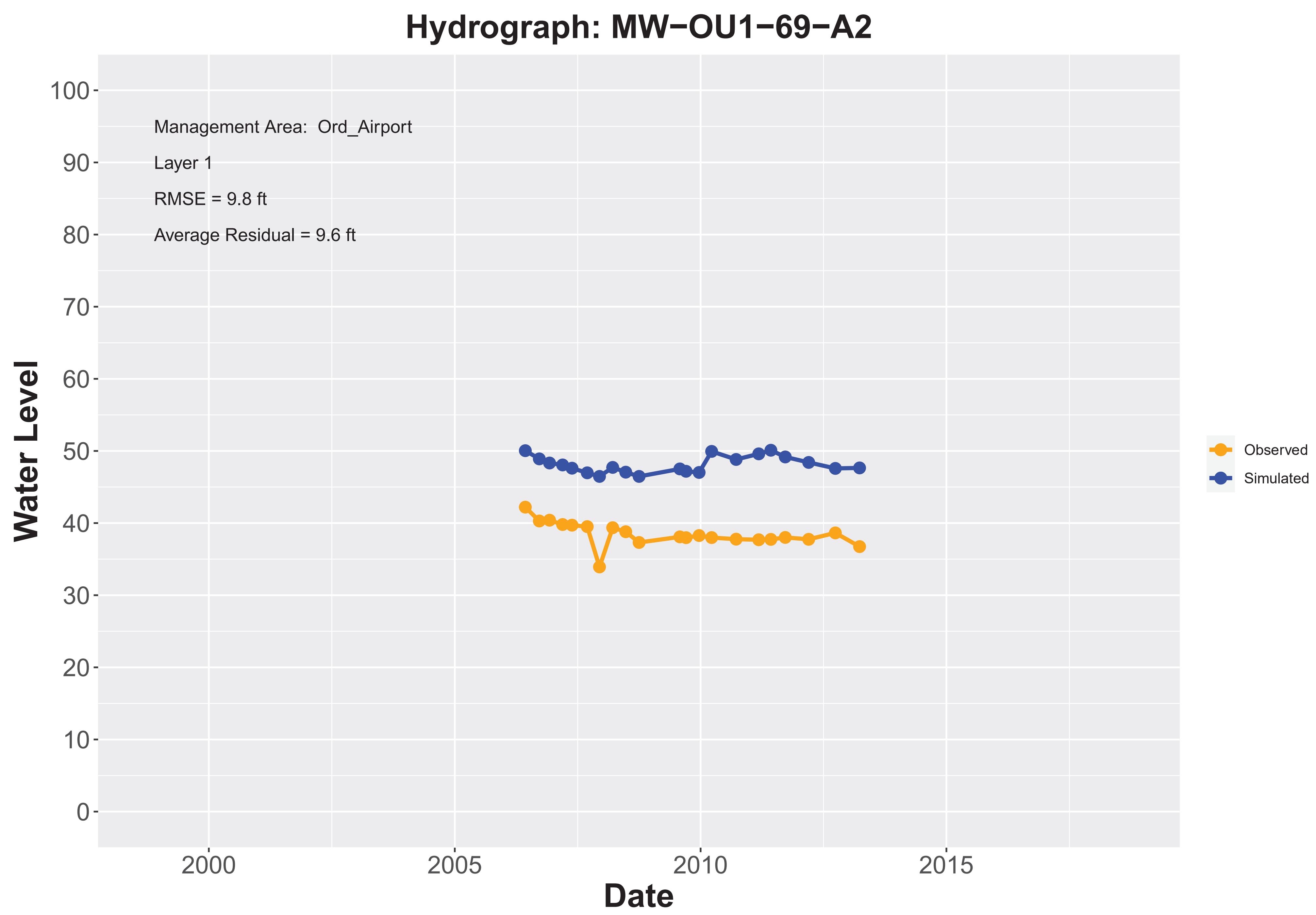

Hydrograph: MW−OU1−65−A
Management Area: Ord_Airport
Layer 1
RMSE = 8.6 ft
Average Residual = 8.4 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated



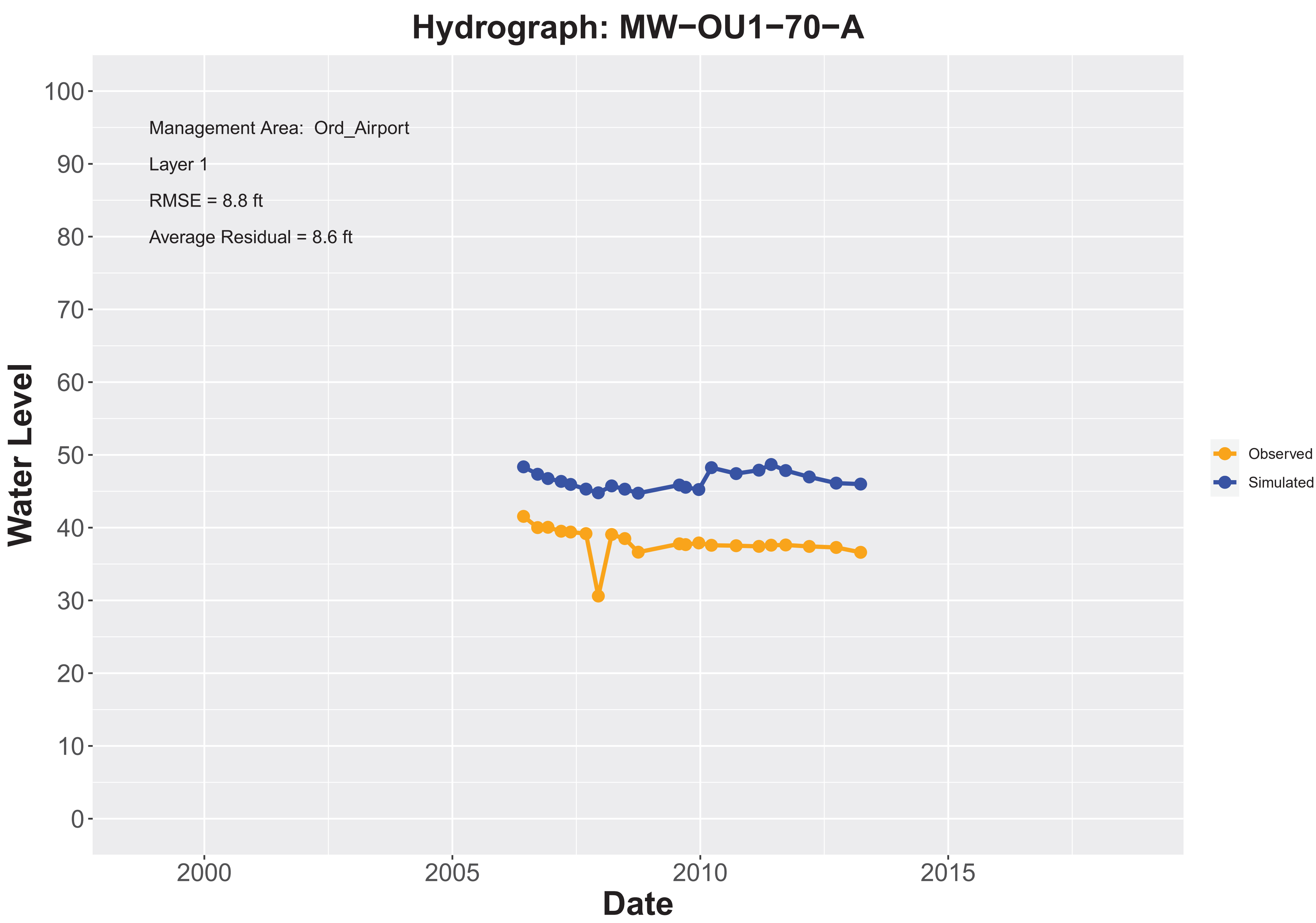
Hydrograph: MW−OU1−67−A
Management Area: Ord_Airport
Layer 1
RMSE = 16.5 ft
Average Residual = 16.0 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated



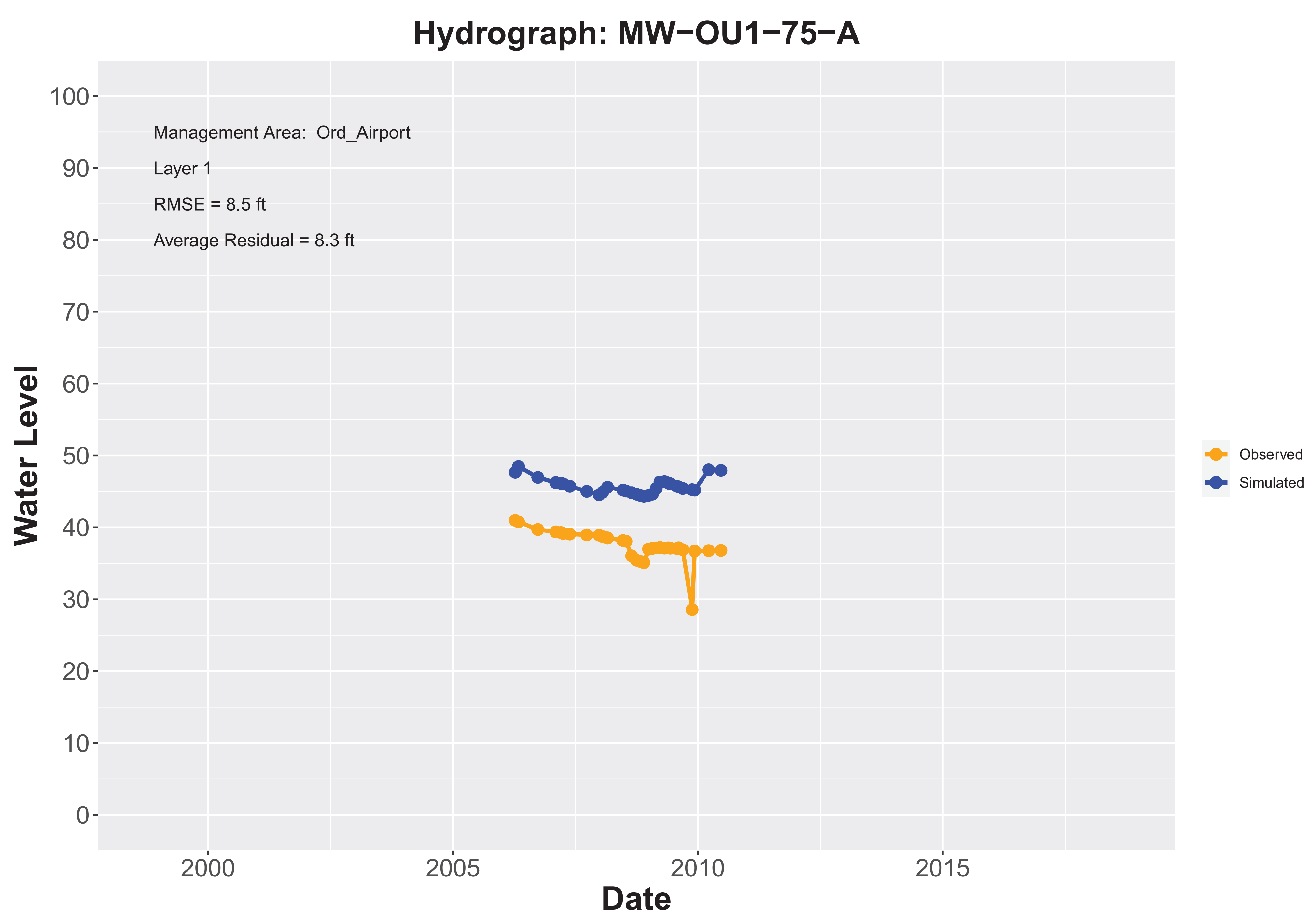
Hydrograph: MW−OU1−68−A
Management Area: Ord_Airport
Layer 1
RMSE = 10.8 ft
Average Residual = 10.6 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated



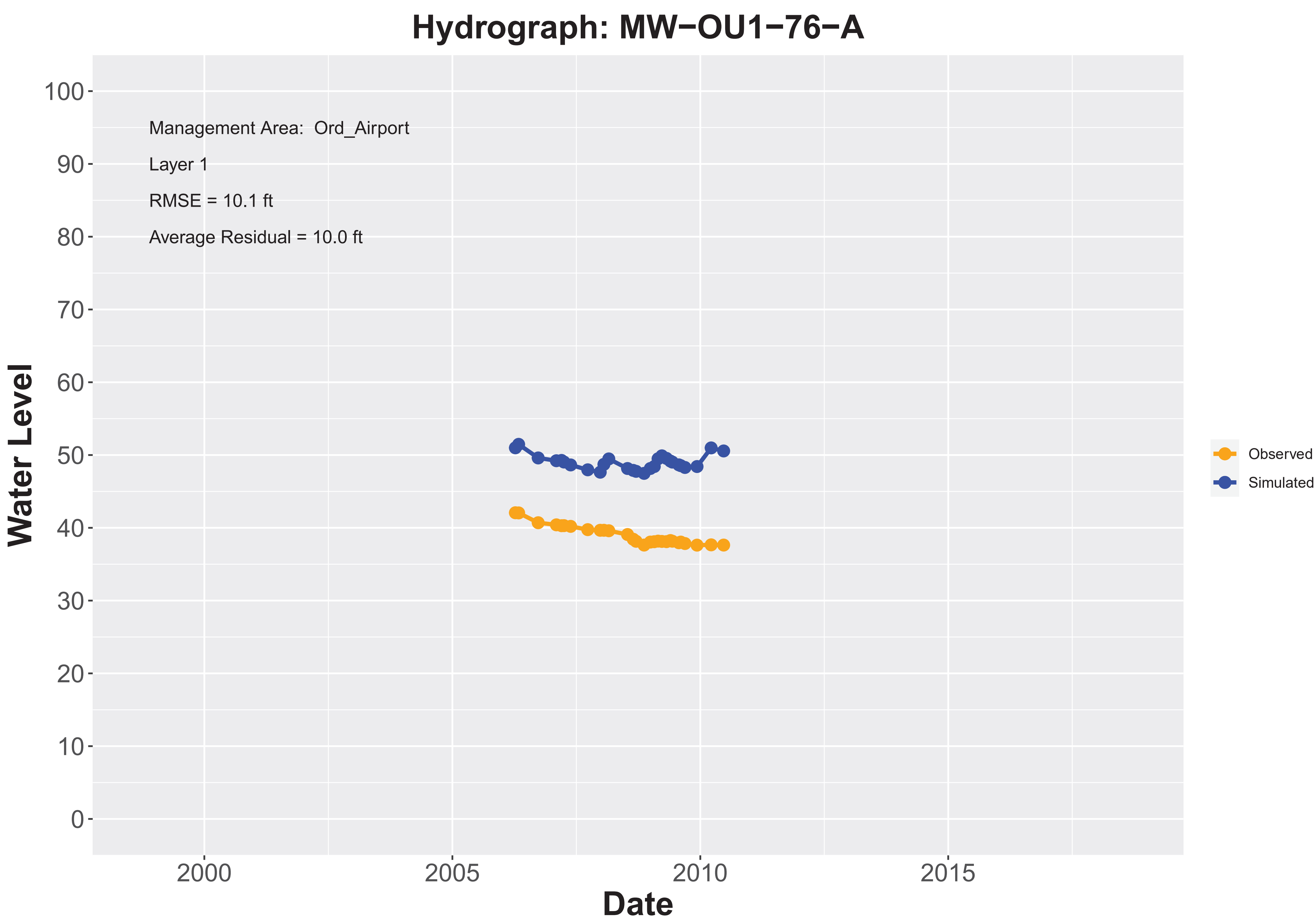
Hydrograph: MW−OU1−69−A2
Management Area: Ord_Airport
Layer 1
RMSE = 9.8 ft
Average Residual = 9.6 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

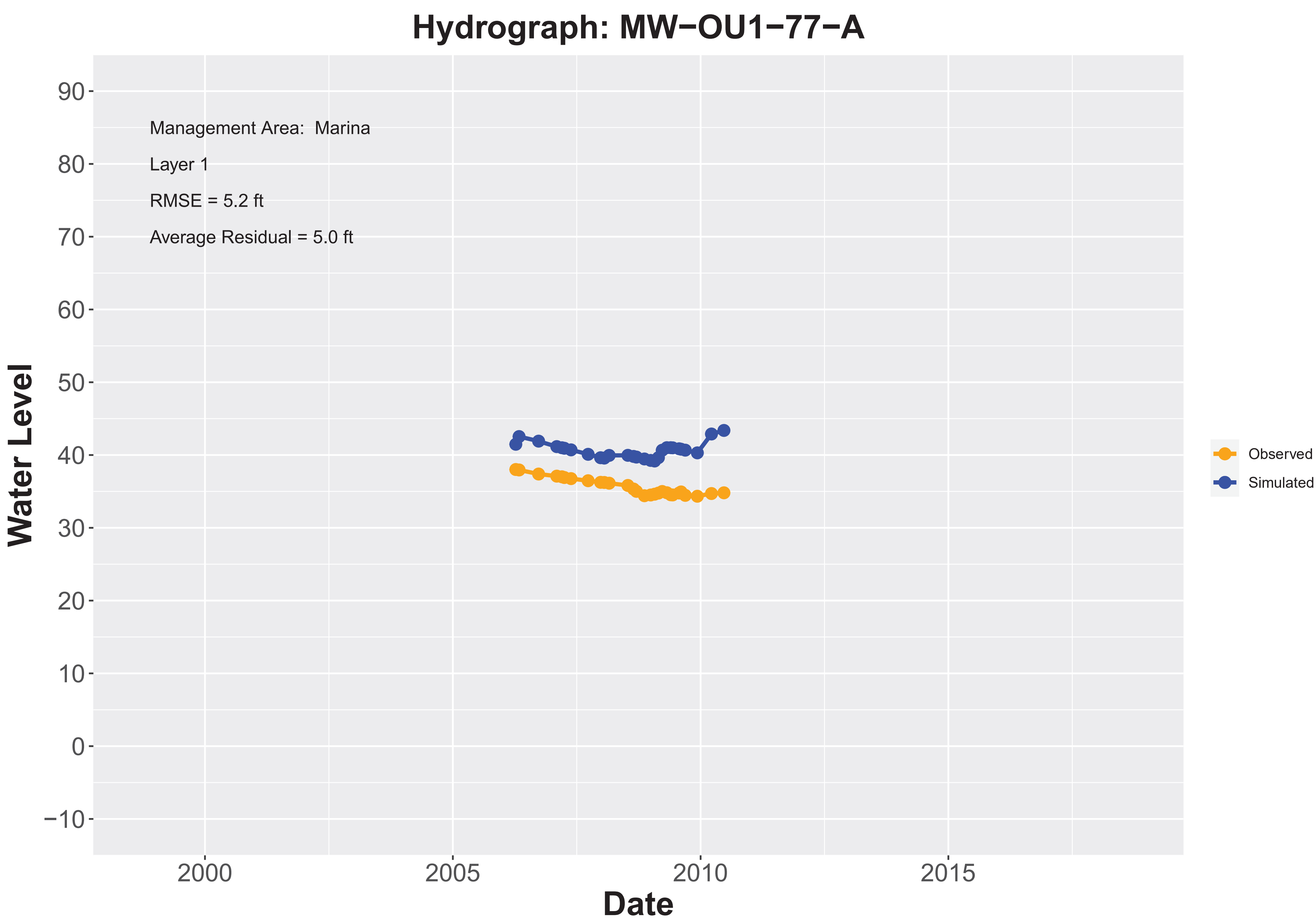


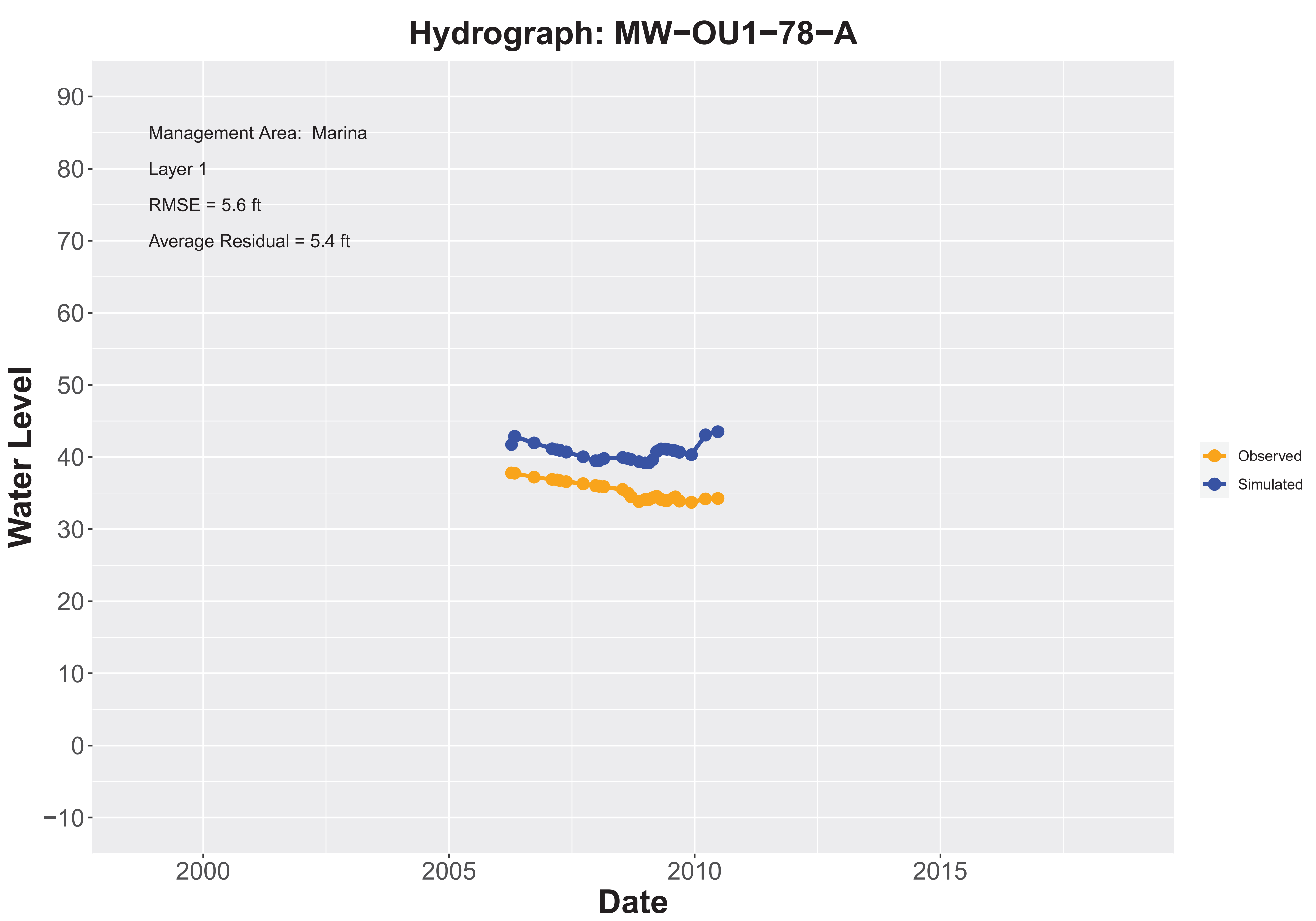
Hydrograph: MW−OU1−70−A
Management Area: Ord_Airport
Layer 1
RMSE = 8.8 ft
Average Residual = 8.6 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated



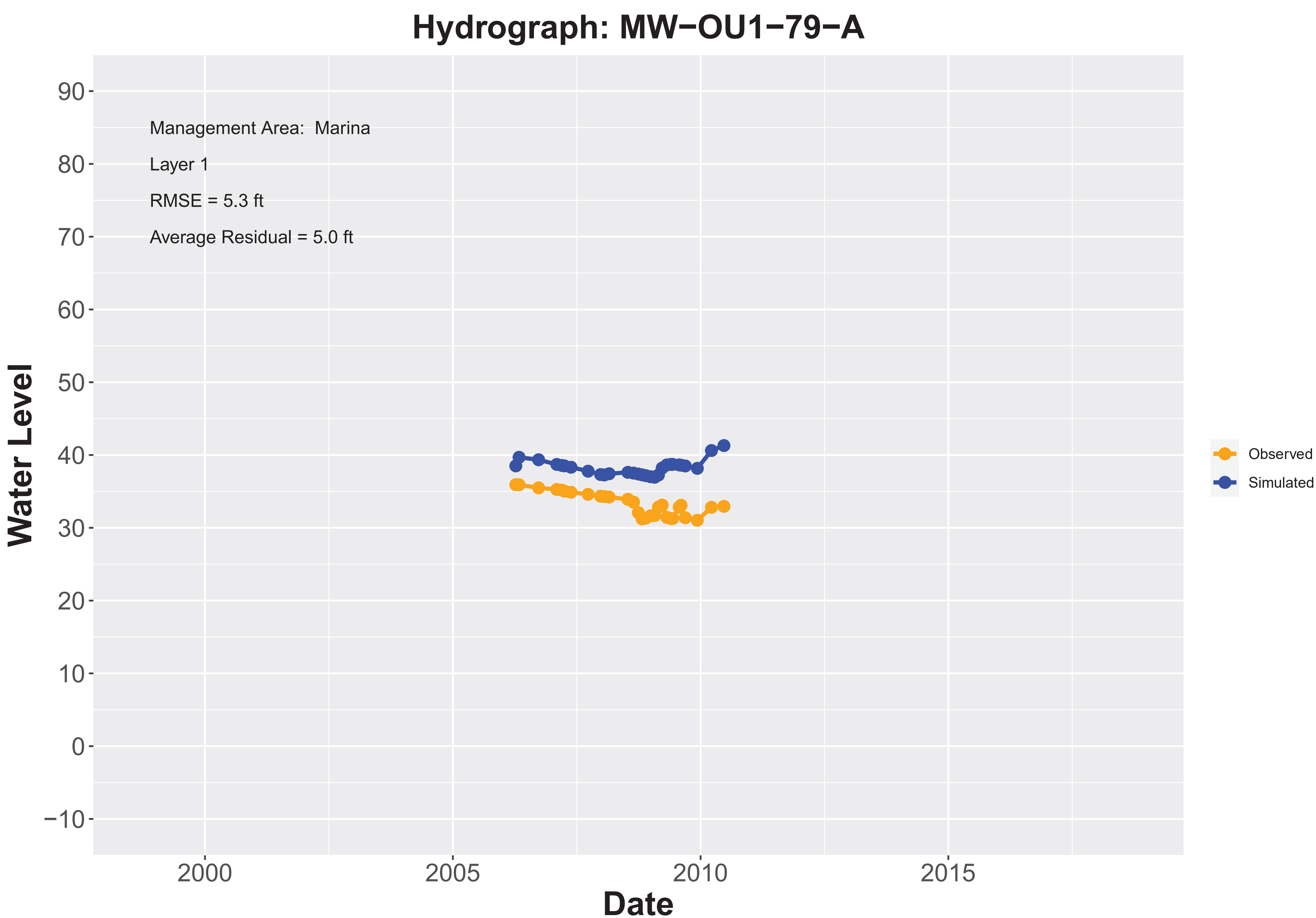
Hydrograph: MW−OU1−75−A
Management Area: Ord_Airport
Layer 1
RMSE = 8.5 ft
Average Residual = 8.3 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU1−76−A
Management Area: Ord_Airport
Layer 1
RMSE = 10.1 ft
Average Residual = 10.0 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

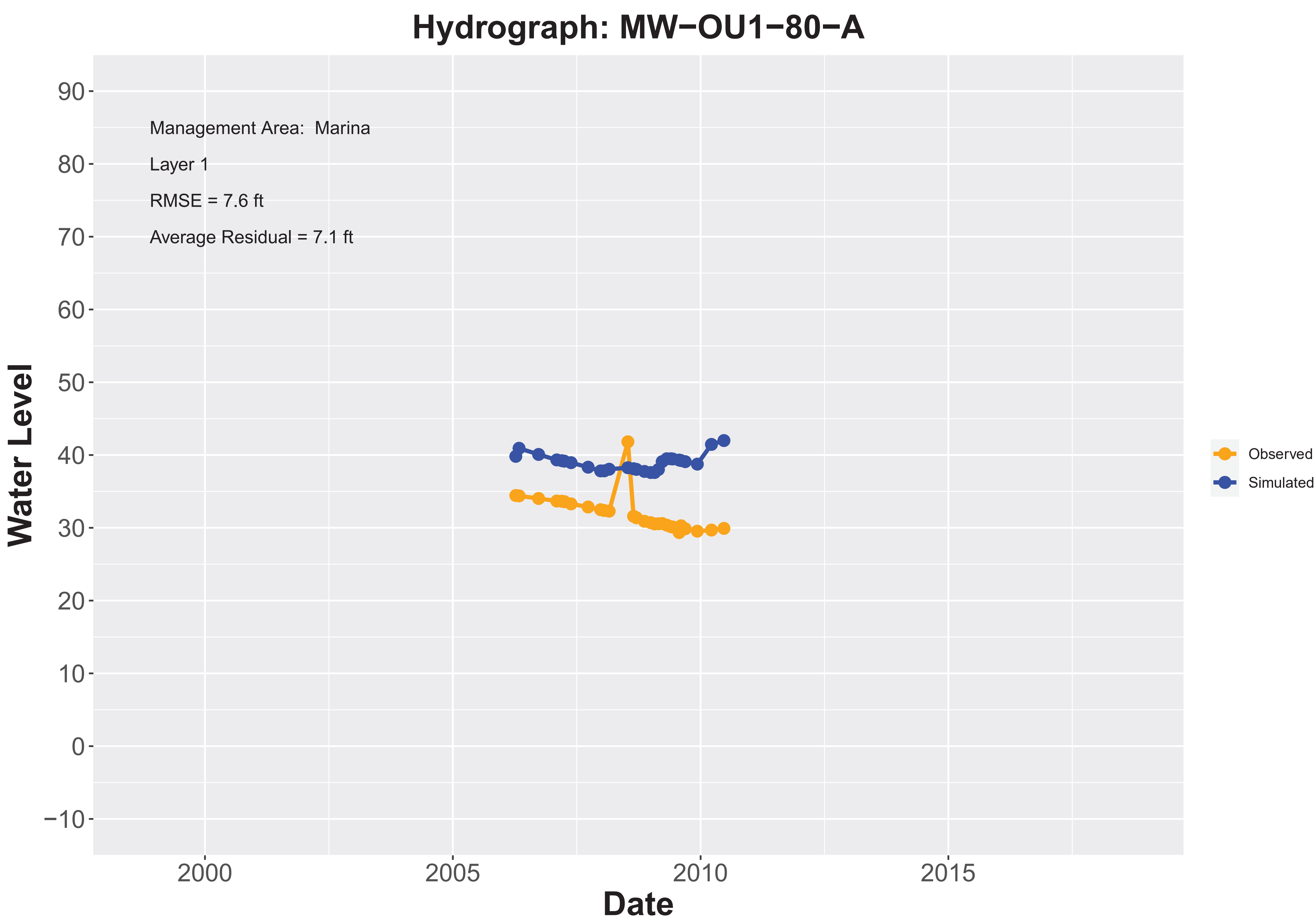

Hydrograph: MW−OU1−77−A
Management Area: Marina
Layer 1
RMSE = 5.2 ft
Average Residual = 5.0 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

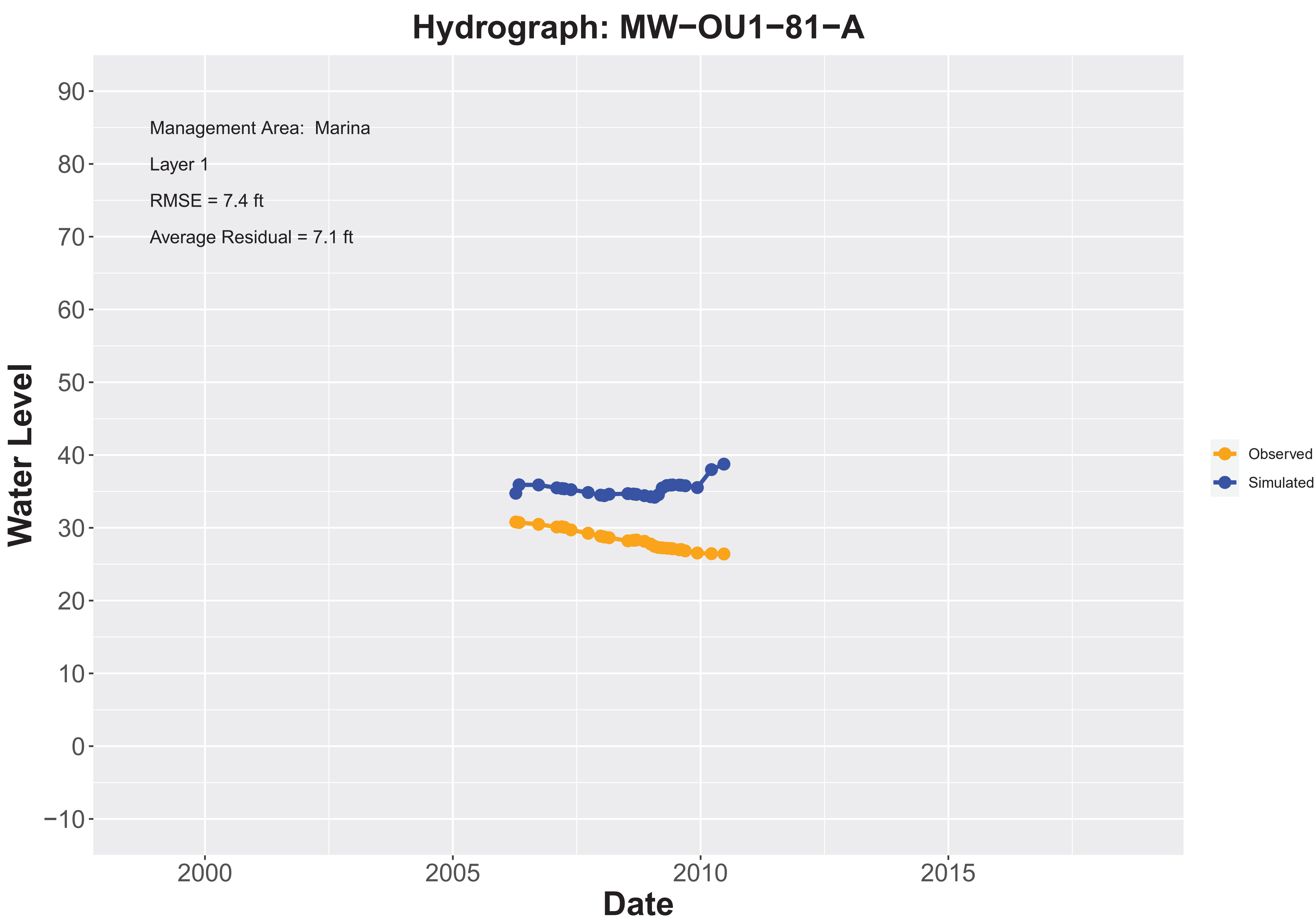


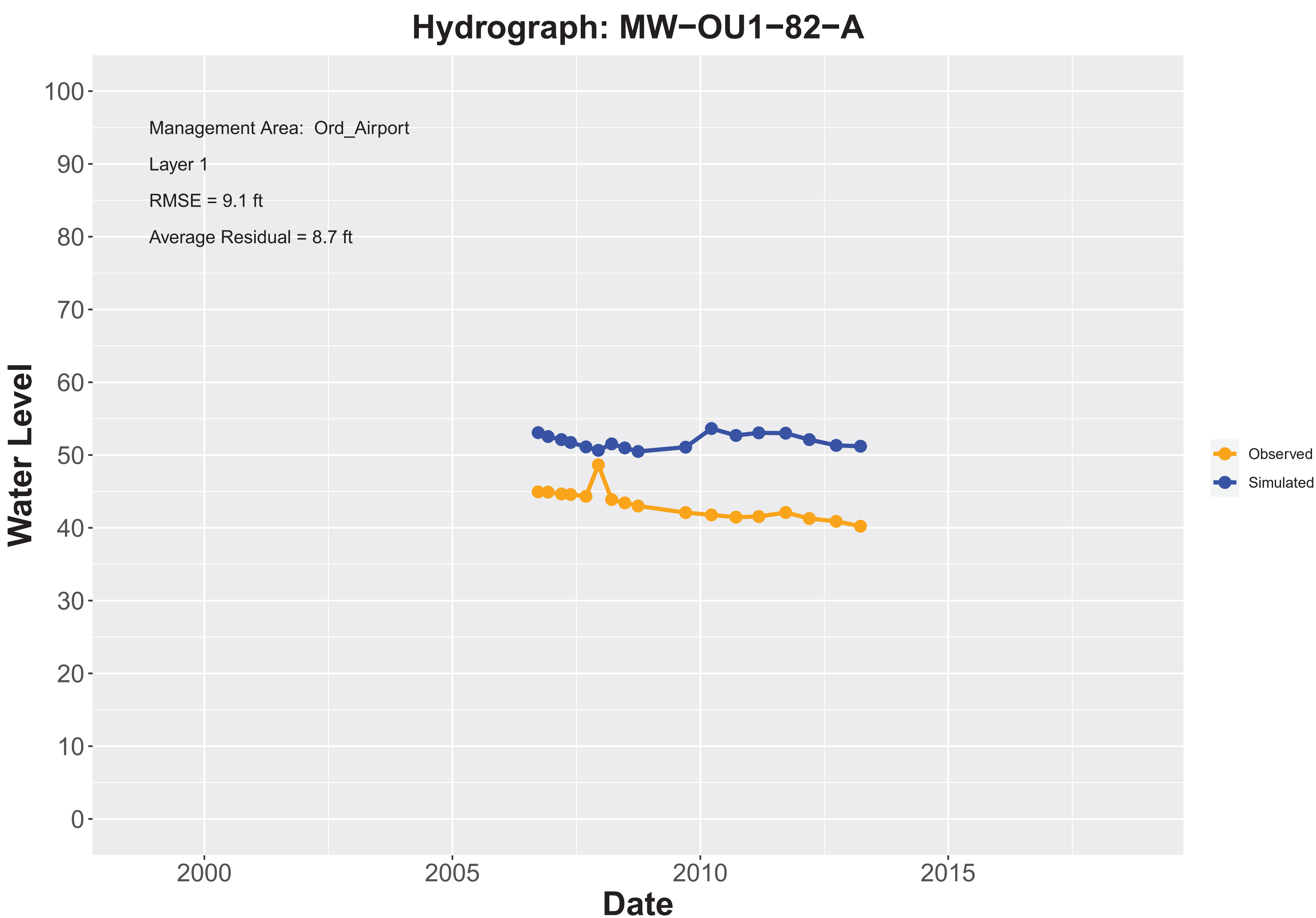
Hydrograph: MW−OU1−78−A
Management Area: Marina
Layer 1
RMSE = 5.6 ft
Average Residual = 5.4 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated



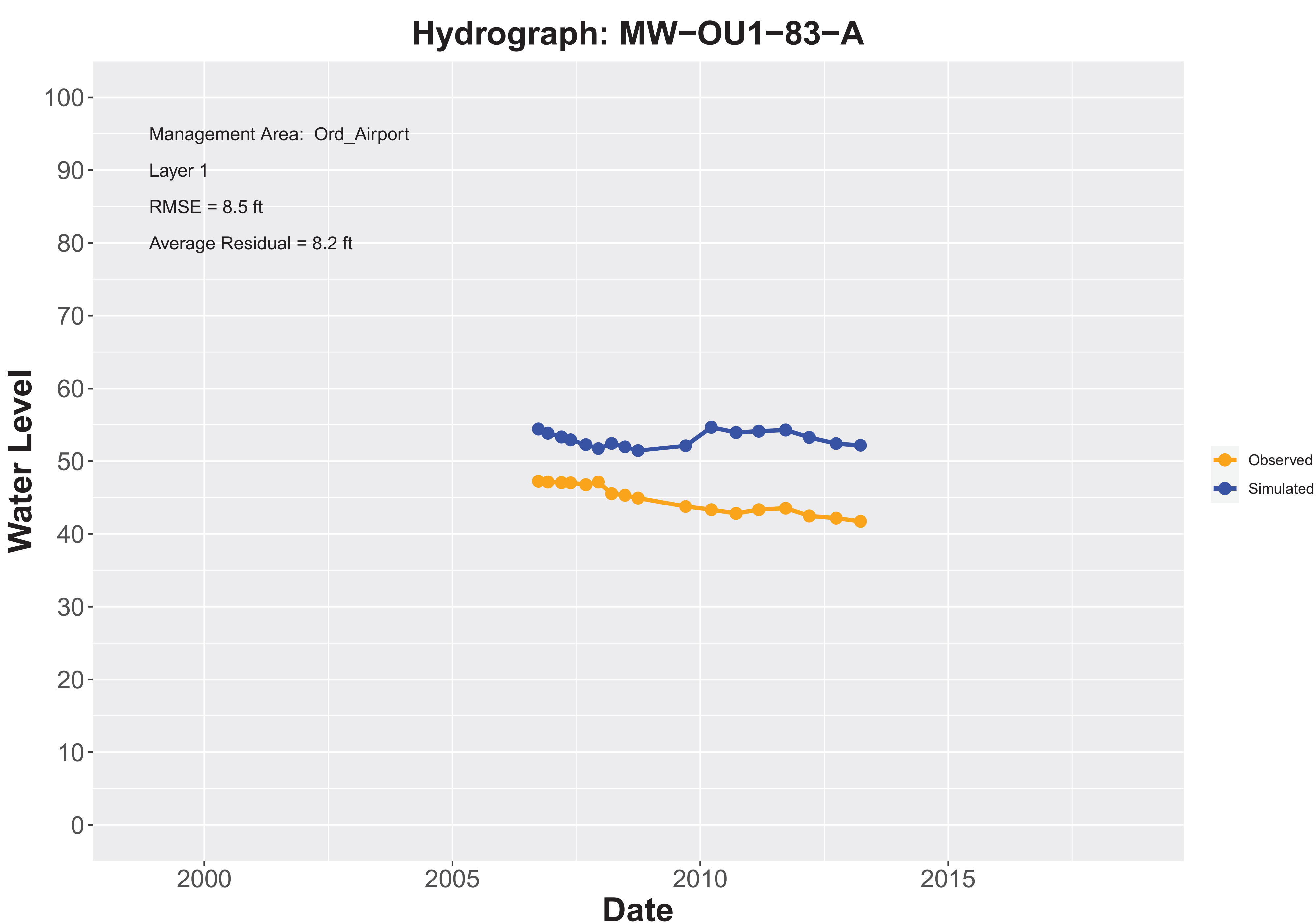
Hydrograph: MW−OU1−79−A
Management Area: Marina
Layer 1
RMSE = 5.3 ft
Average Residual = 5.0 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

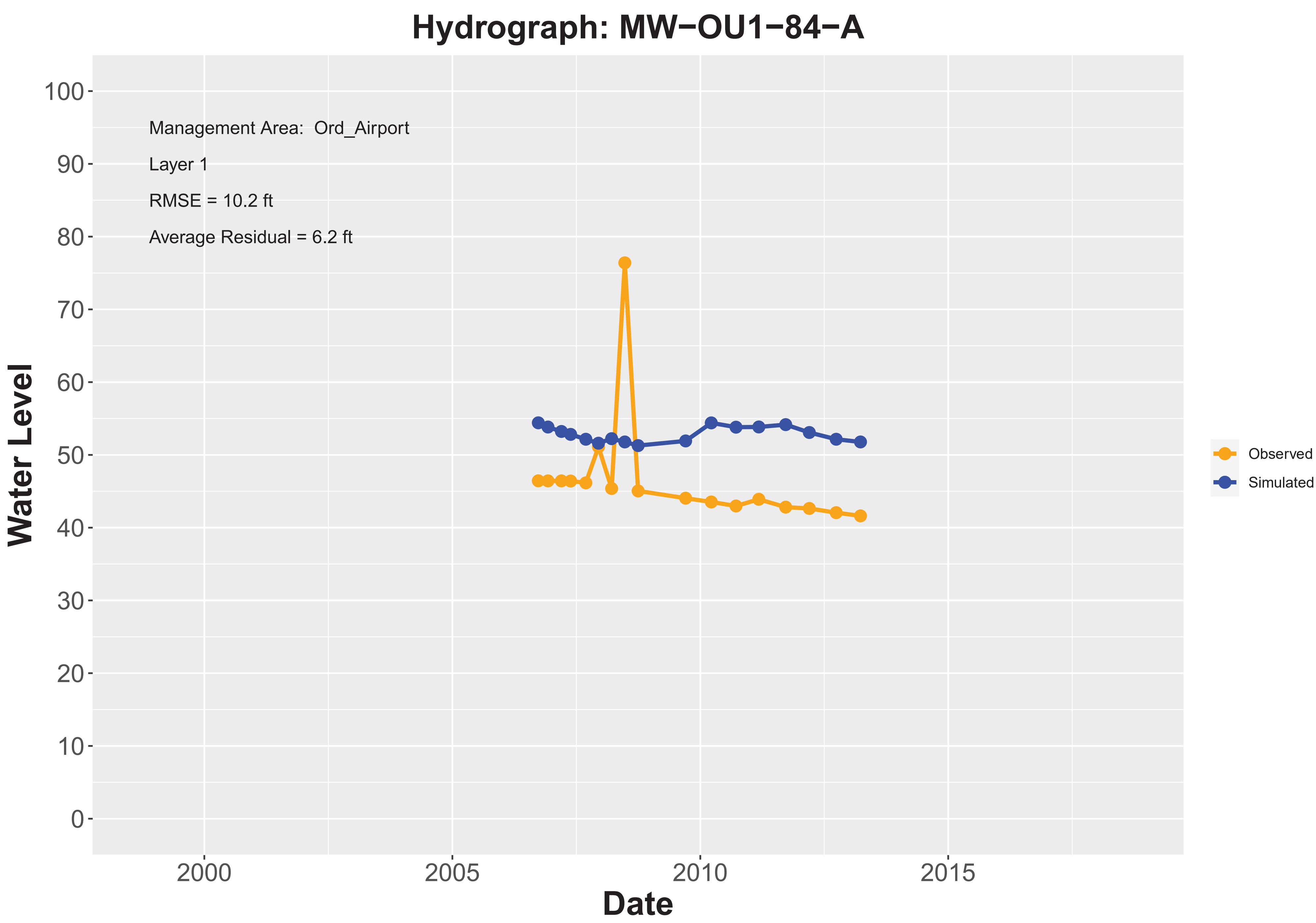

Hydrograph: MW−OU1−80−A
Management Area: Marina
Layer 1
RMSE = 7.6 ft
Average Residual = 7.1 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

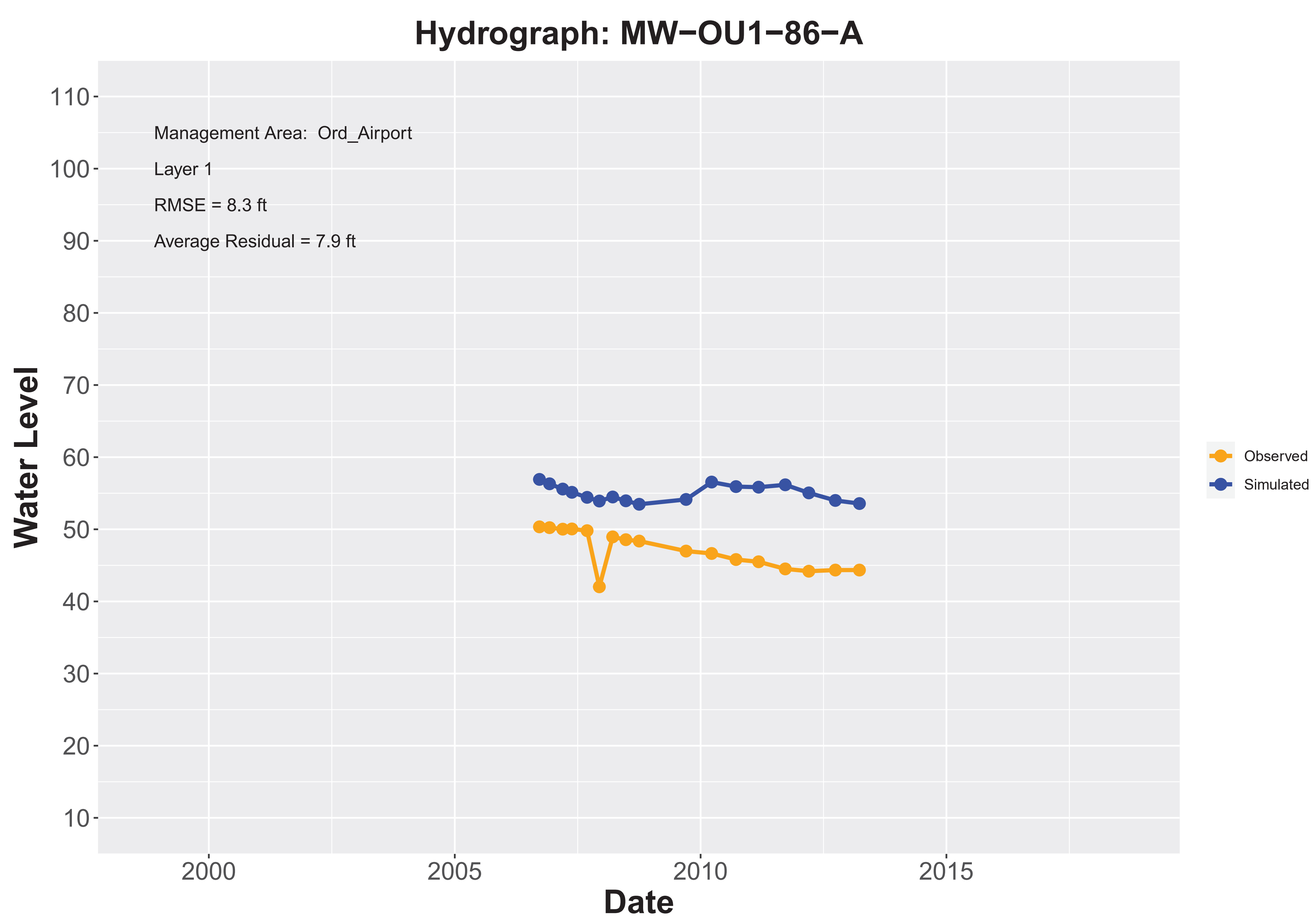

Hydrograph: MW−OU1−81−A
Management Area: Marina
Layer 1
RMSE = 7.4 ft
Average Residual = 7.1 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
Date
2000
2005
2010
2015
Observed
Simulated



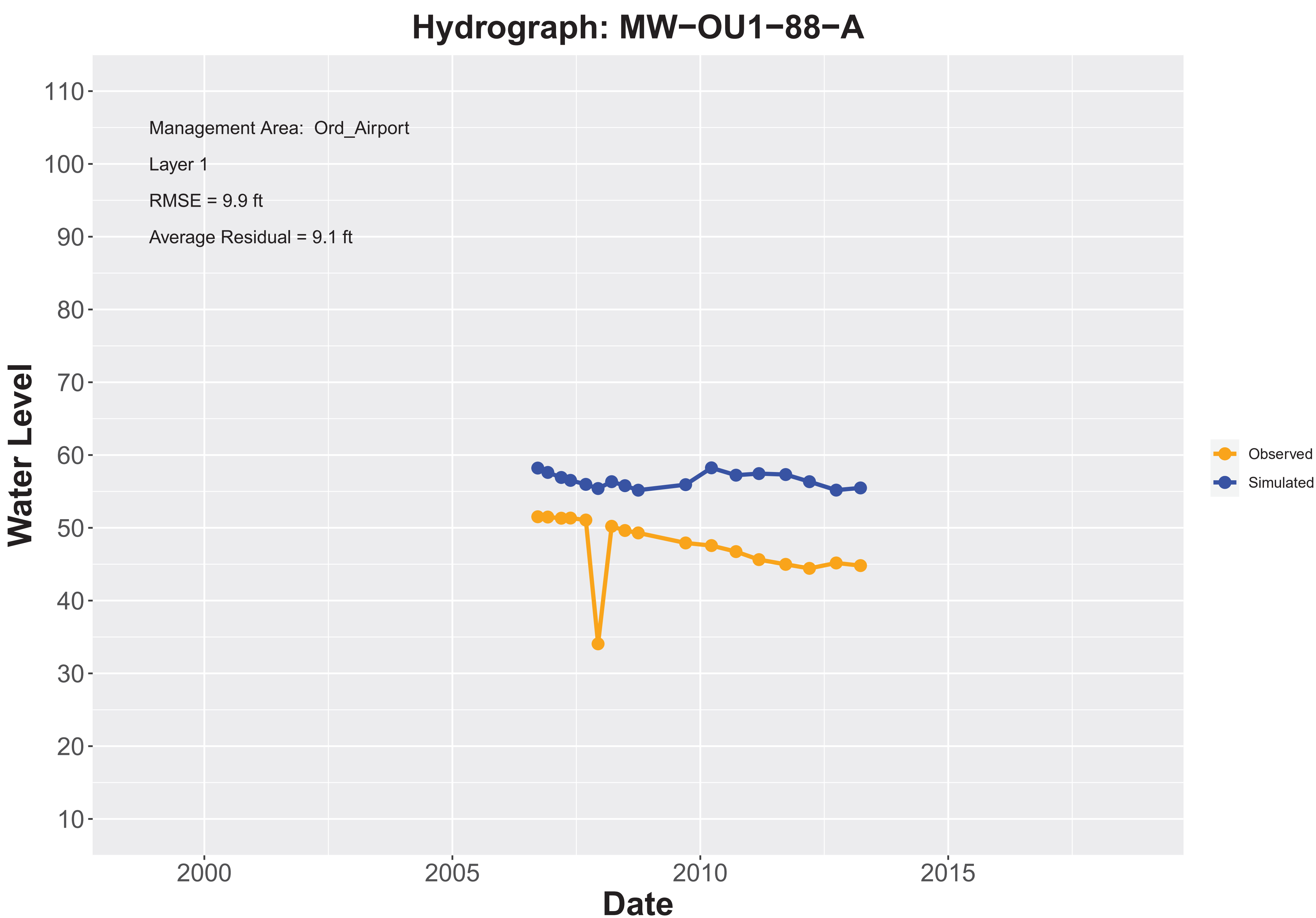
Hydrograph: MW−OU1−82−A
Management Area: Ord_Airport
Layer 1
RMSE = 9.1 ft
Average Residual = 8.7 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU1−83−A
Management Area: Ord_Airport
Layer 1
RMSE = 8.5 ft
Average Residual = 8.2 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

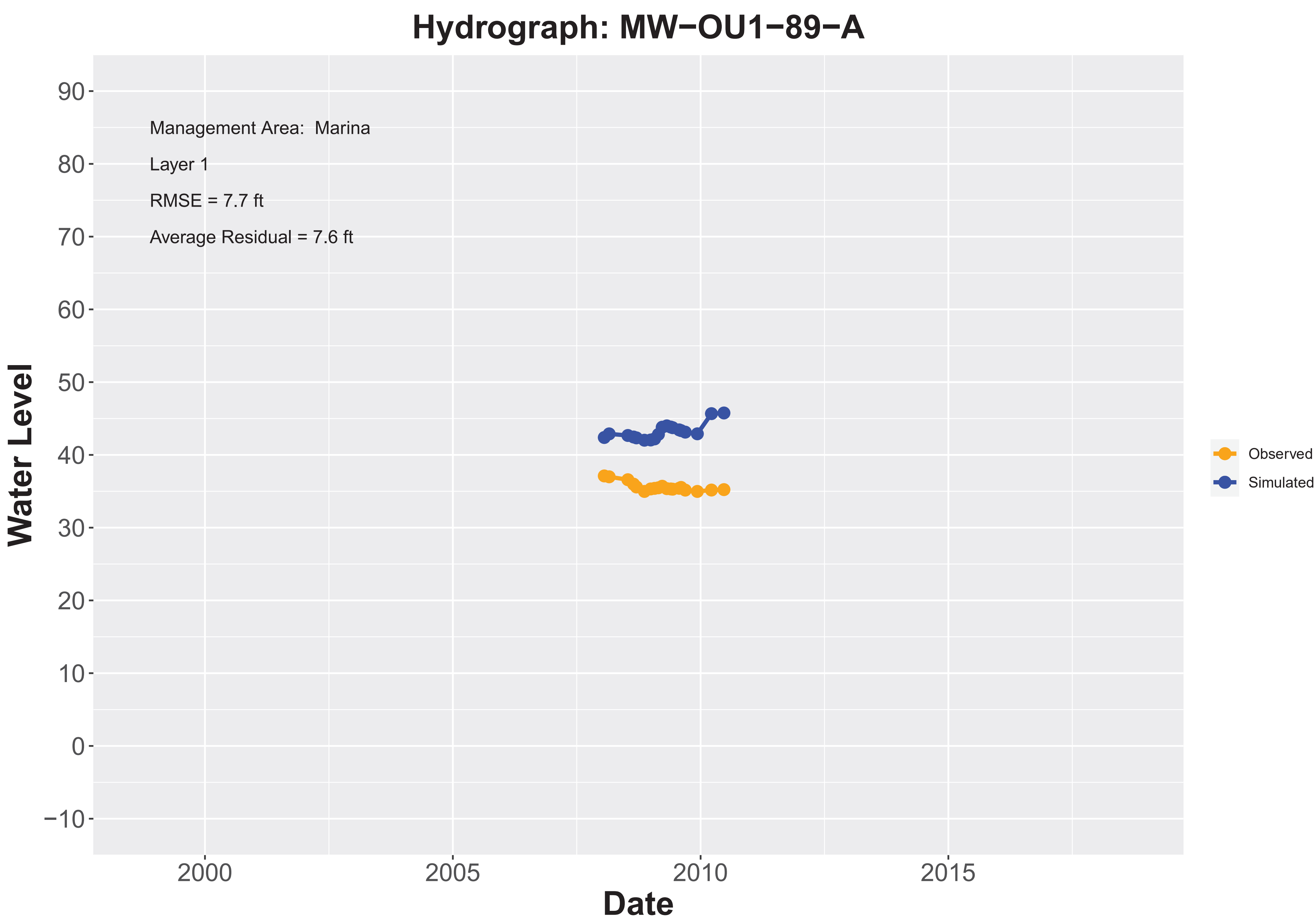

Hydrograph: MW−OU1−84−A
Management Area: Ord_Airport
Layer 1
RMSE = 10.2 ft
Average Residual = 6.2 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated



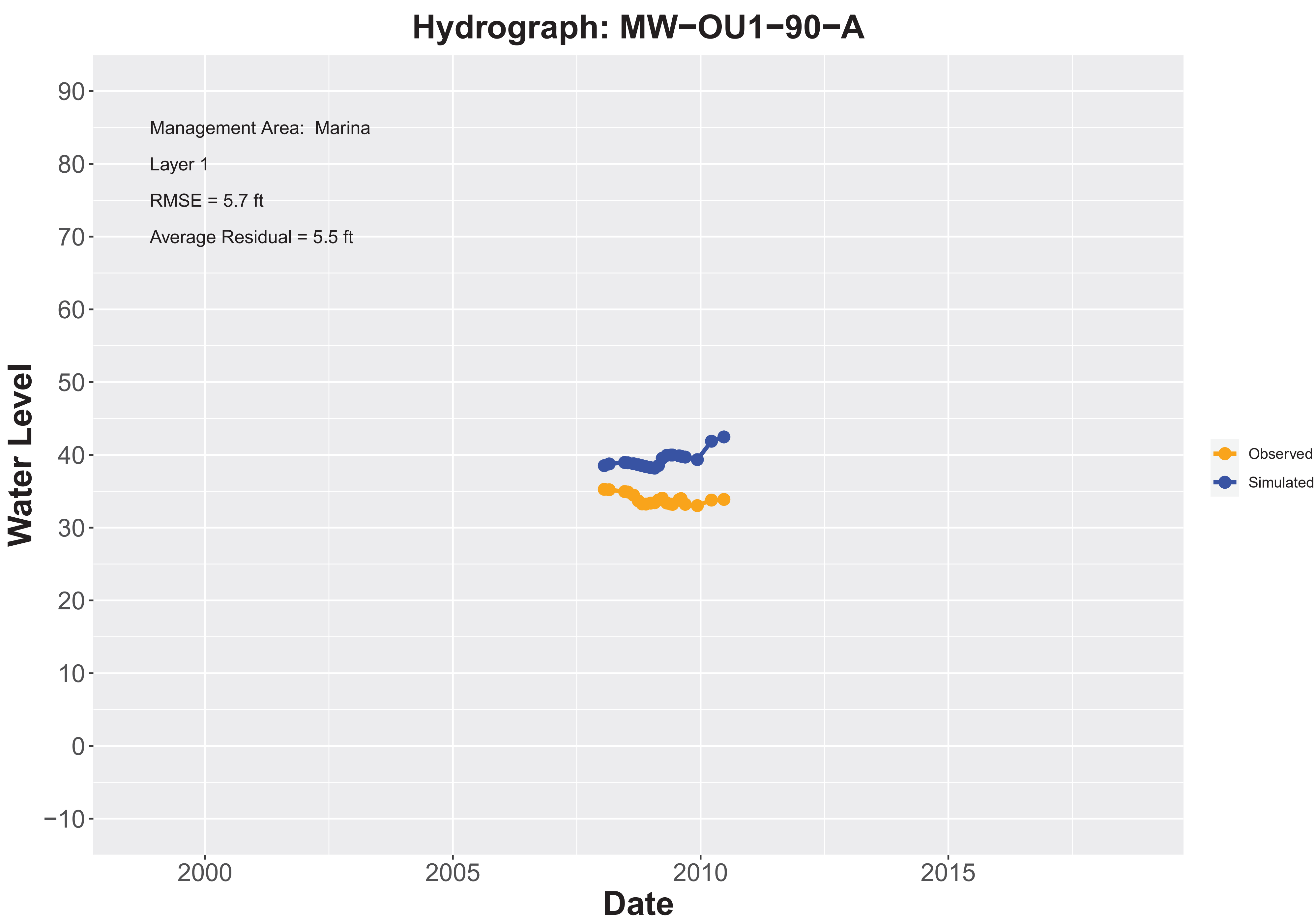
Hydrograph: MW−OU1−86−A
Management Area: Ord_Airport
Layer 1
RMSE = 8.3 ft
Average Residual = 7.9 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



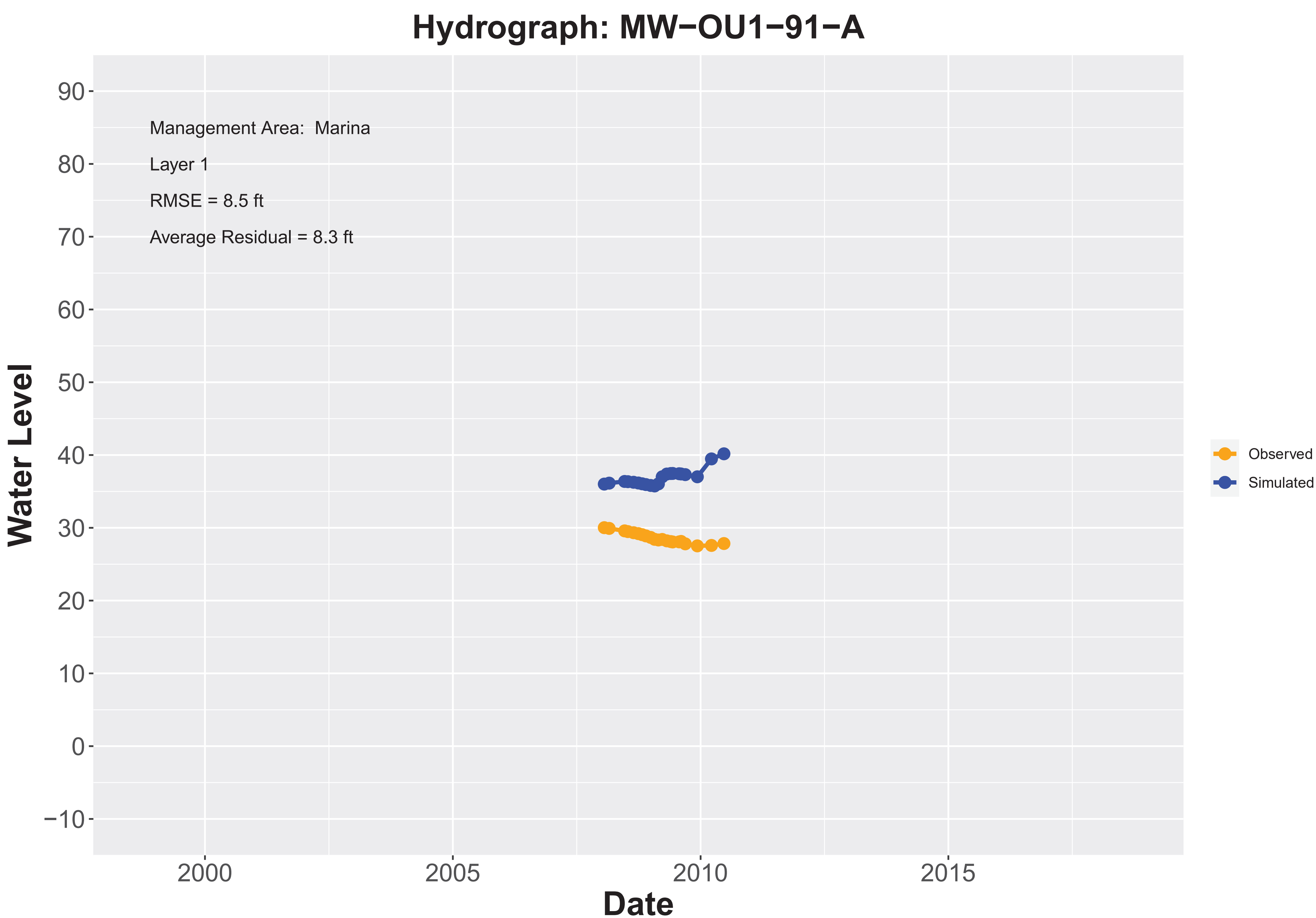
Hydrograph: MW−OU1−88−A
Management Area: Ord_Airport
Layer 1
RMSE = 9.9 ft
Average Residual = 9.1 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



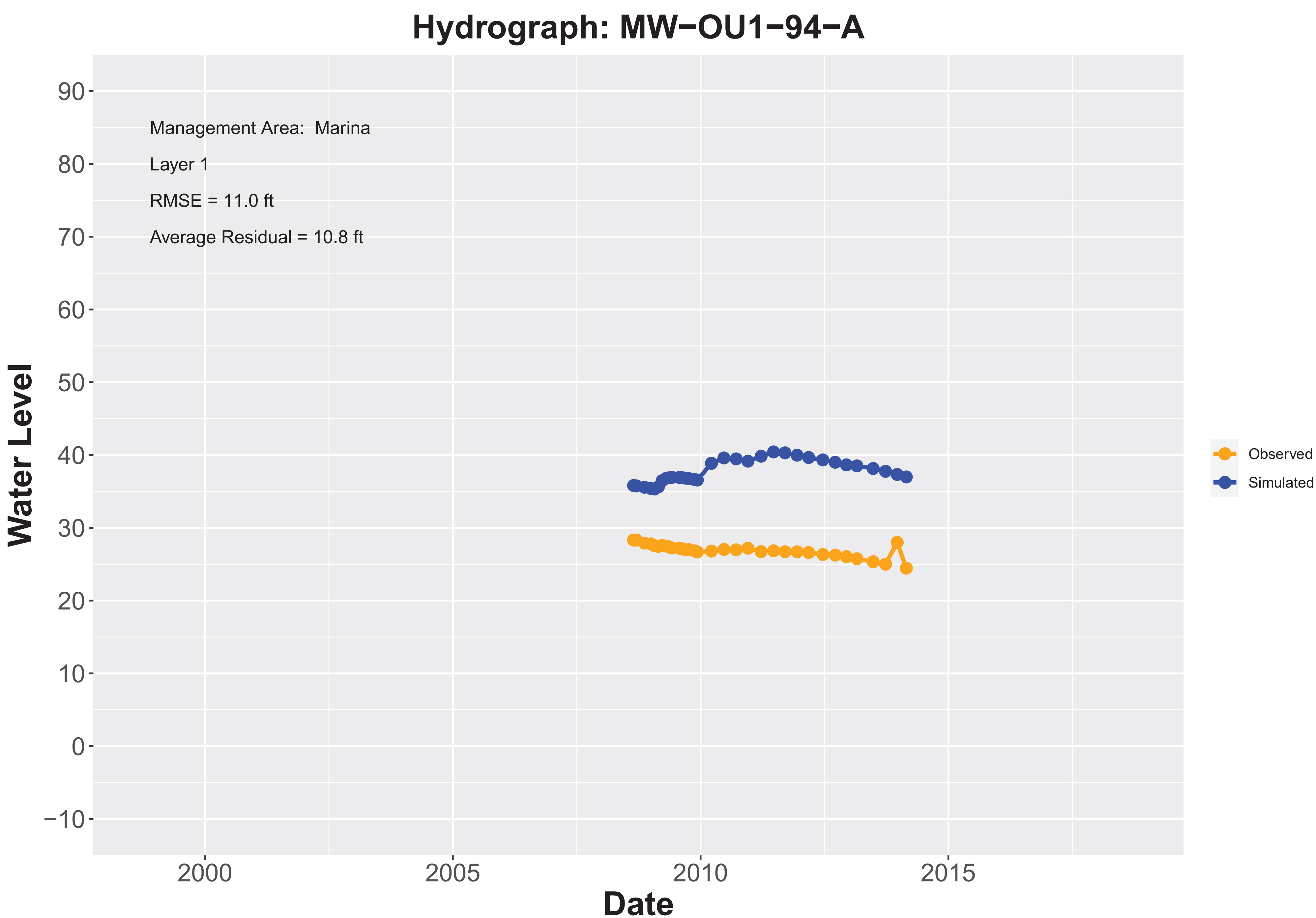
Hydrograph: MW−OU1−89−A
Management Area: Marina
Layer 1
RMSE = 7.7 ft
Average Residual = 7.6 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated



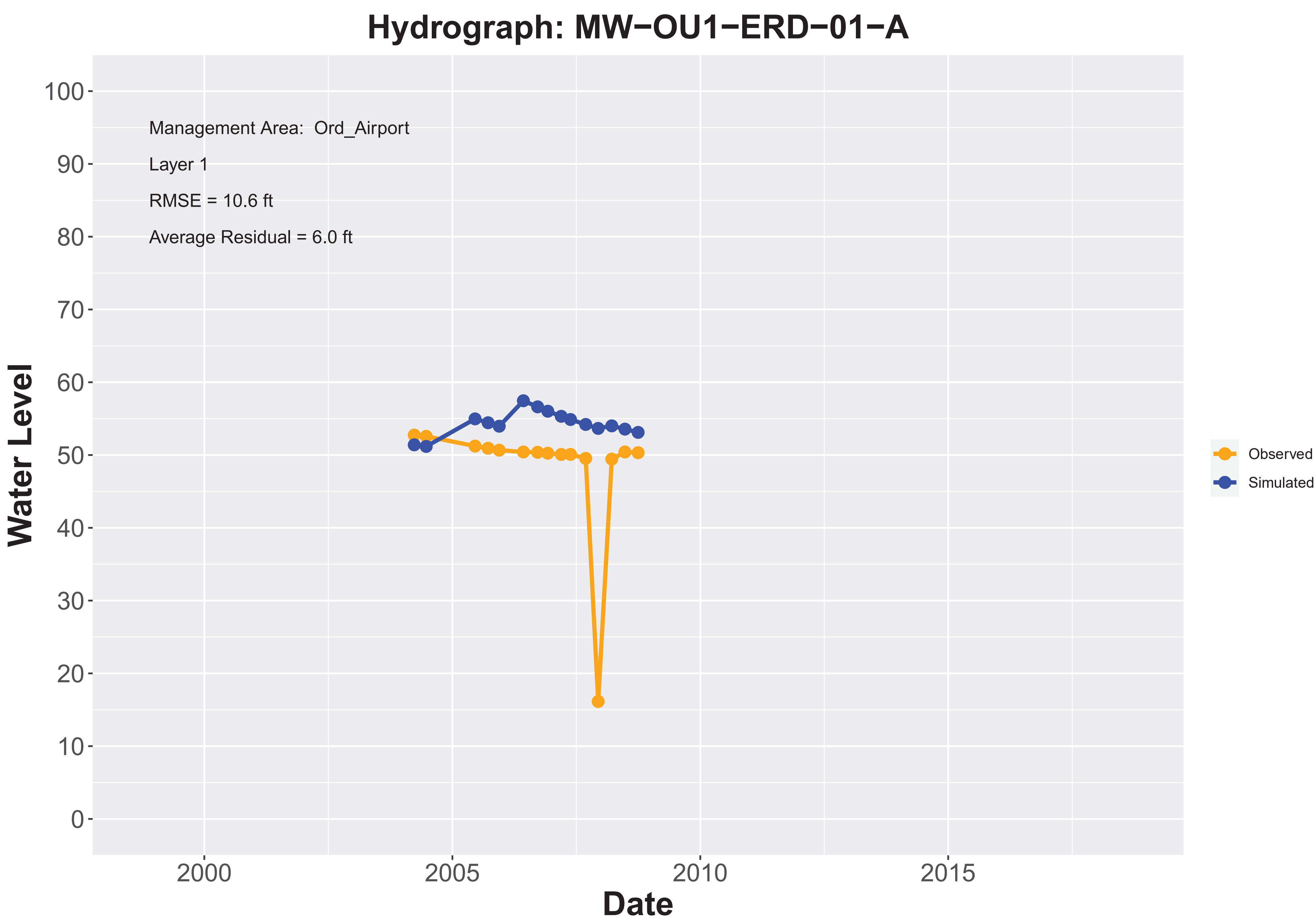
Hydrograph: MW−OU1−90−A
Management Area: Marina
Layer 1
RMSE = 5.7 ft
Average Residual = 5.5 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

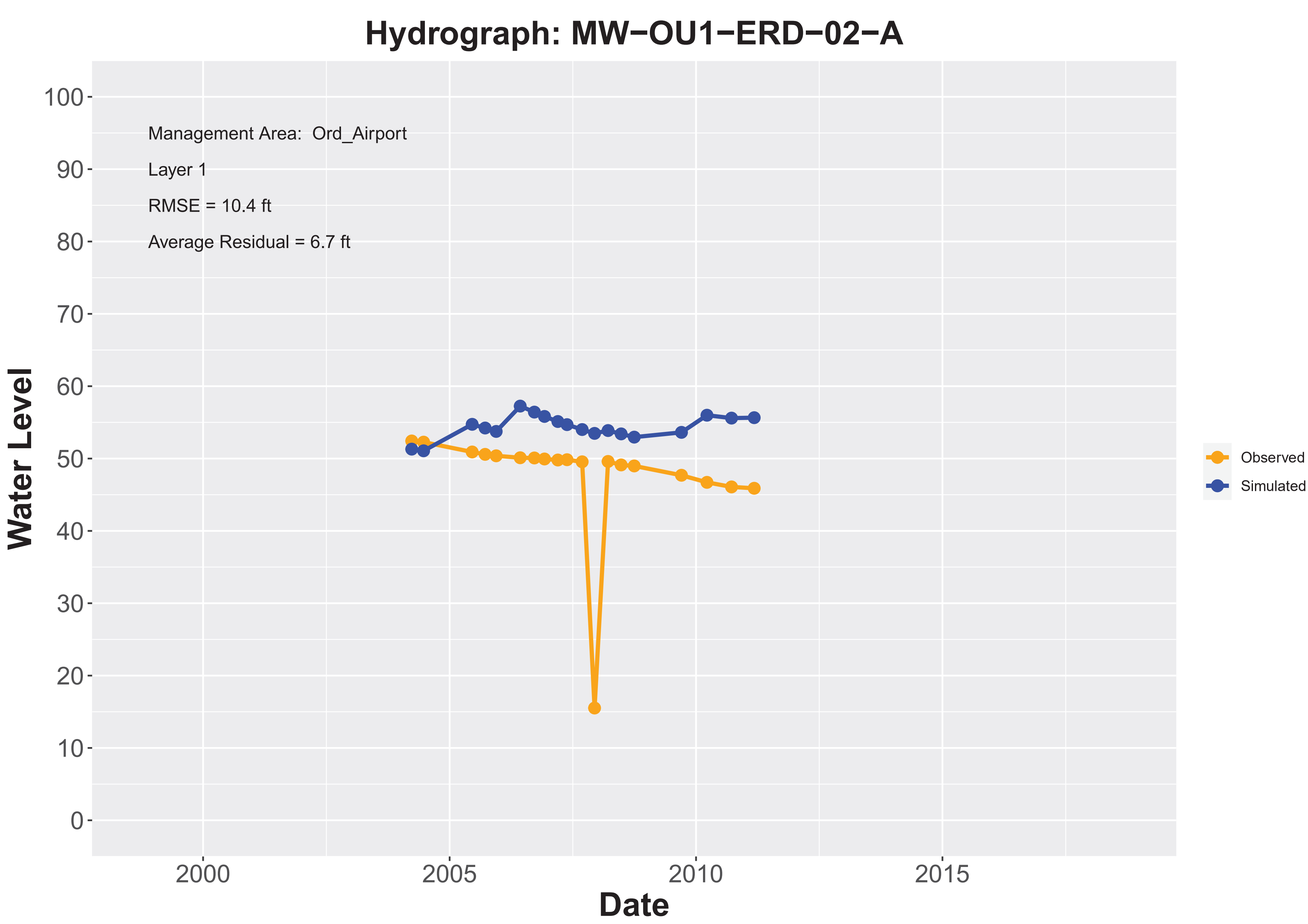


Hydrograph: MW−OU1−91−A
Management Area: Marina
Layer 1
RMSE = 8.5 ft
Average Residual = 8.3 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

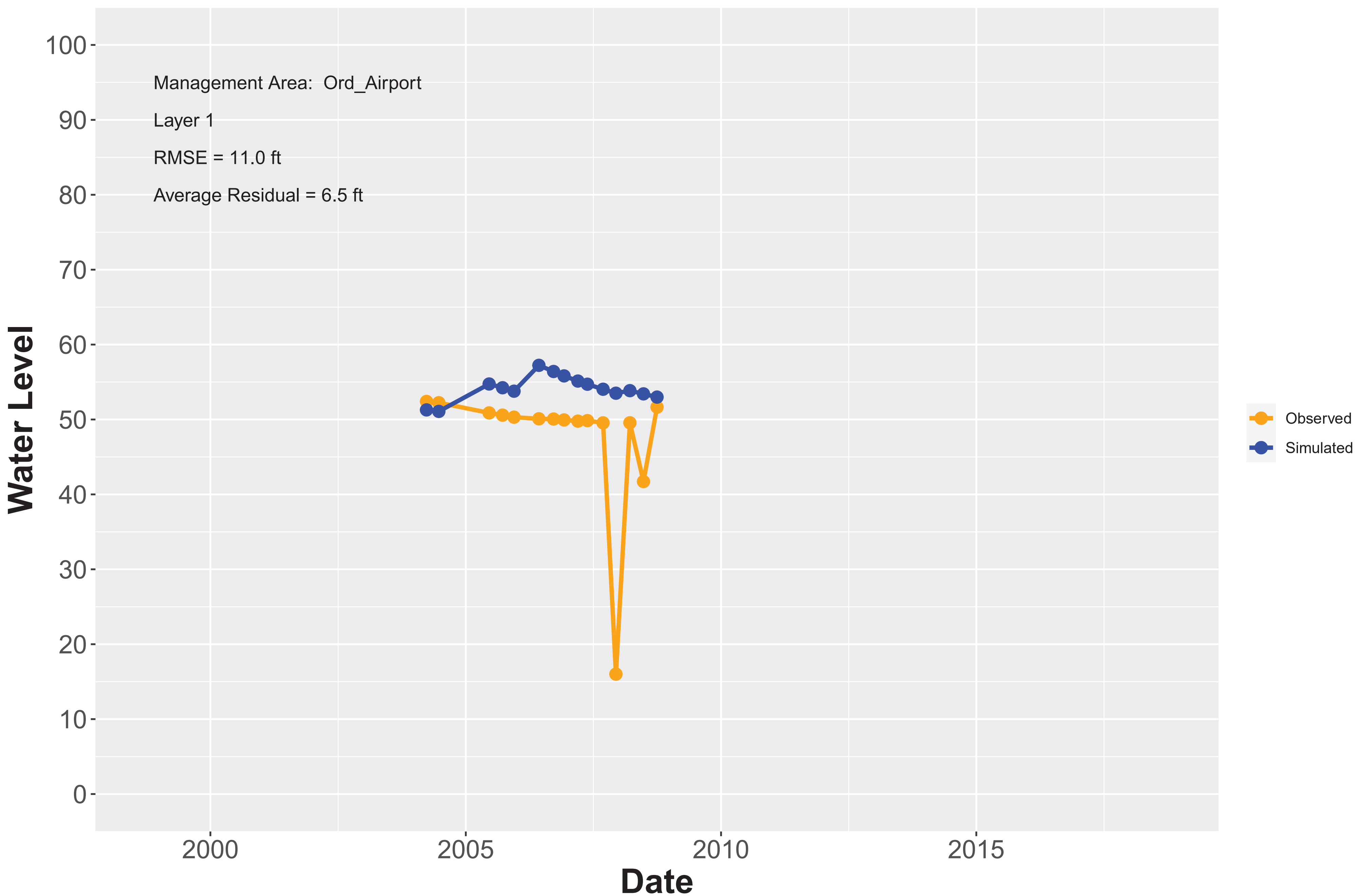


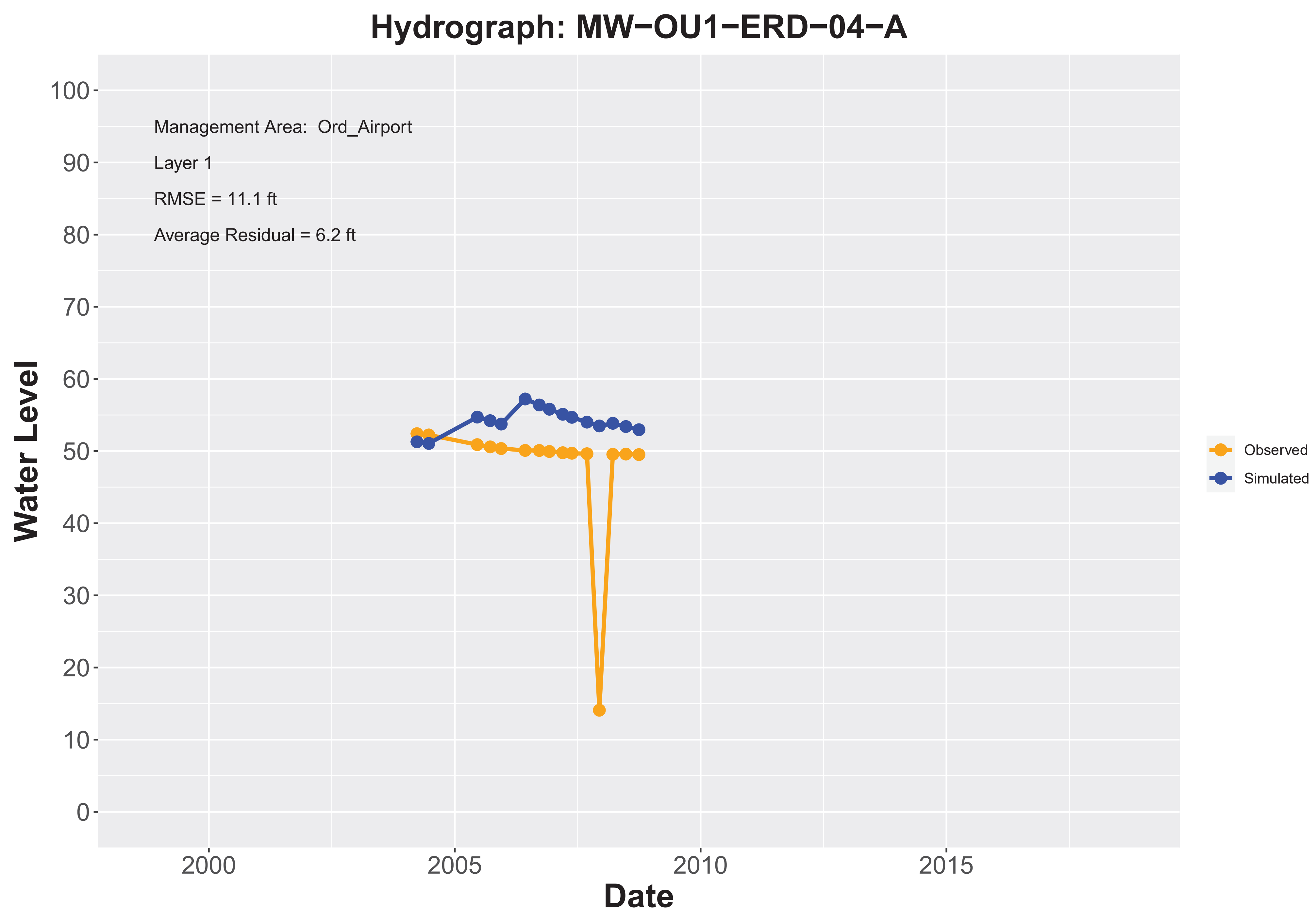
Hydrograph: MW−OU1−94−A
Management Area: Marina
Layer 1
RMSE = 11.0 ft
Average Residual = 10.8 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU1−ERD−01−A
Management Area: Ord_Airport
Layer 1
RMSE = 10.6 ft
Average Residual = 6.0 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

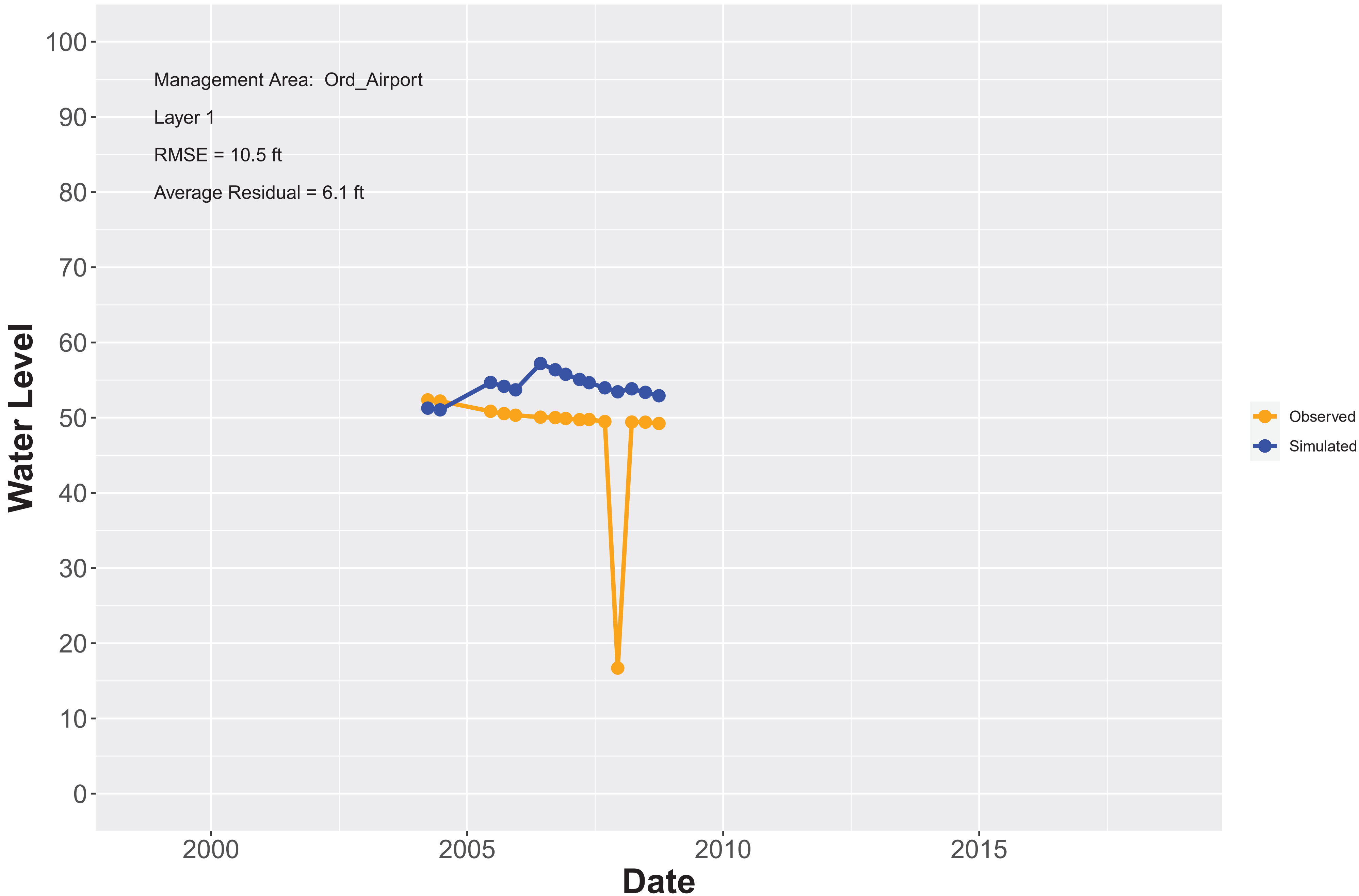

Hydrograph: MW−OU1−ERD−02−A
Management Area: Ord_Airport
Layer 1
RMSE = 10.4 ft
Average Residual = 6.7 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

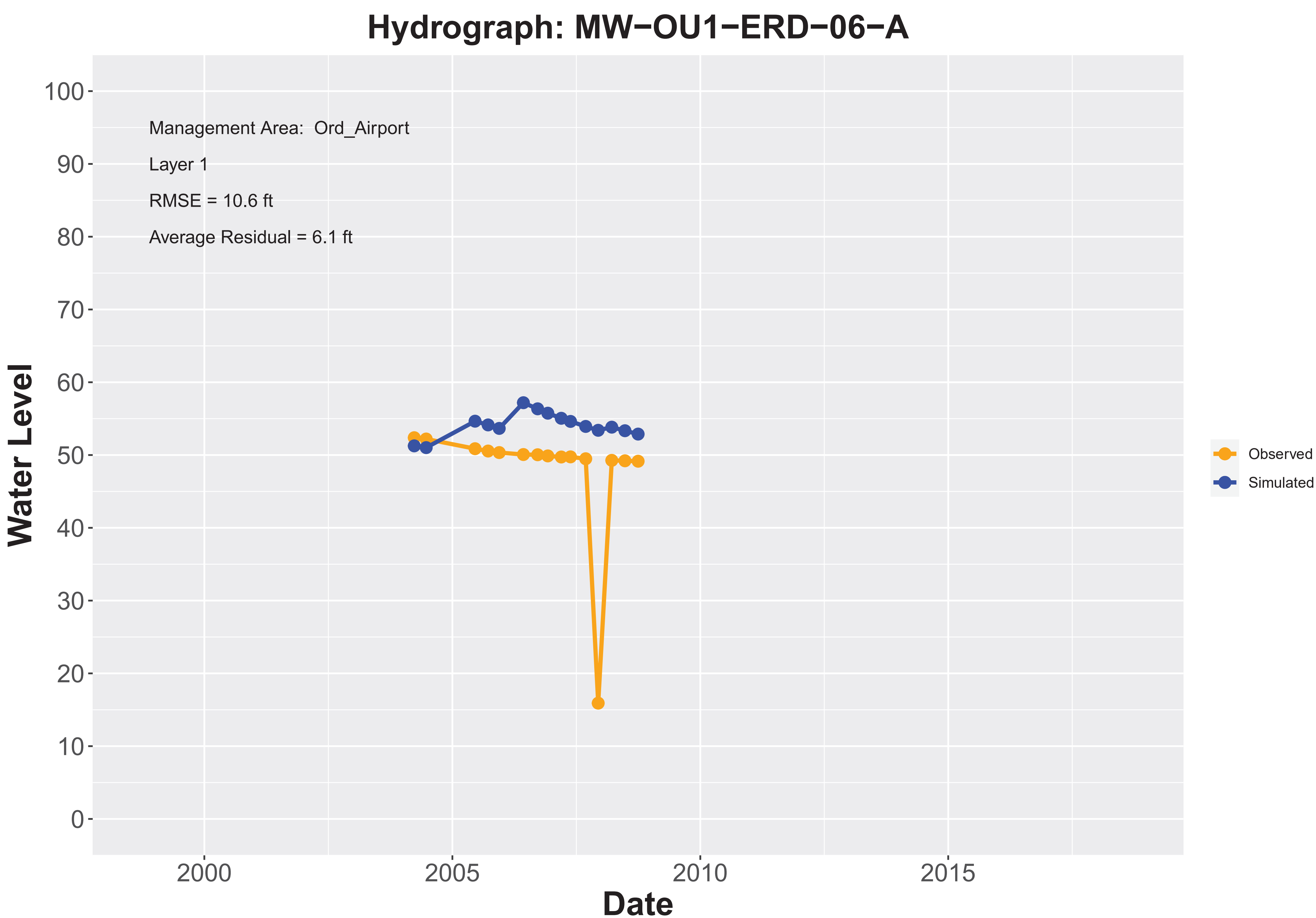
Hydrograph: MW−OU1−ERD−03−A

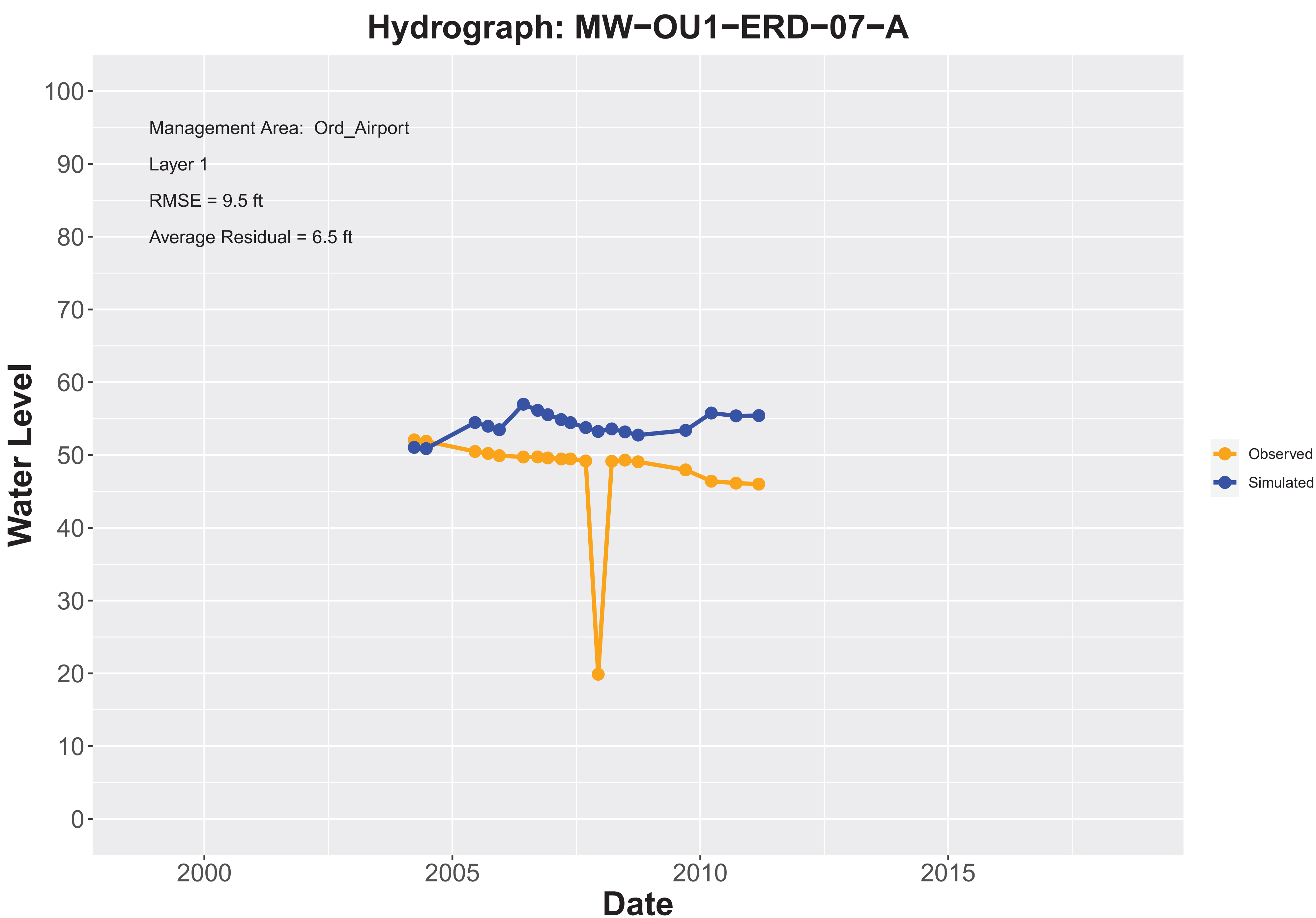


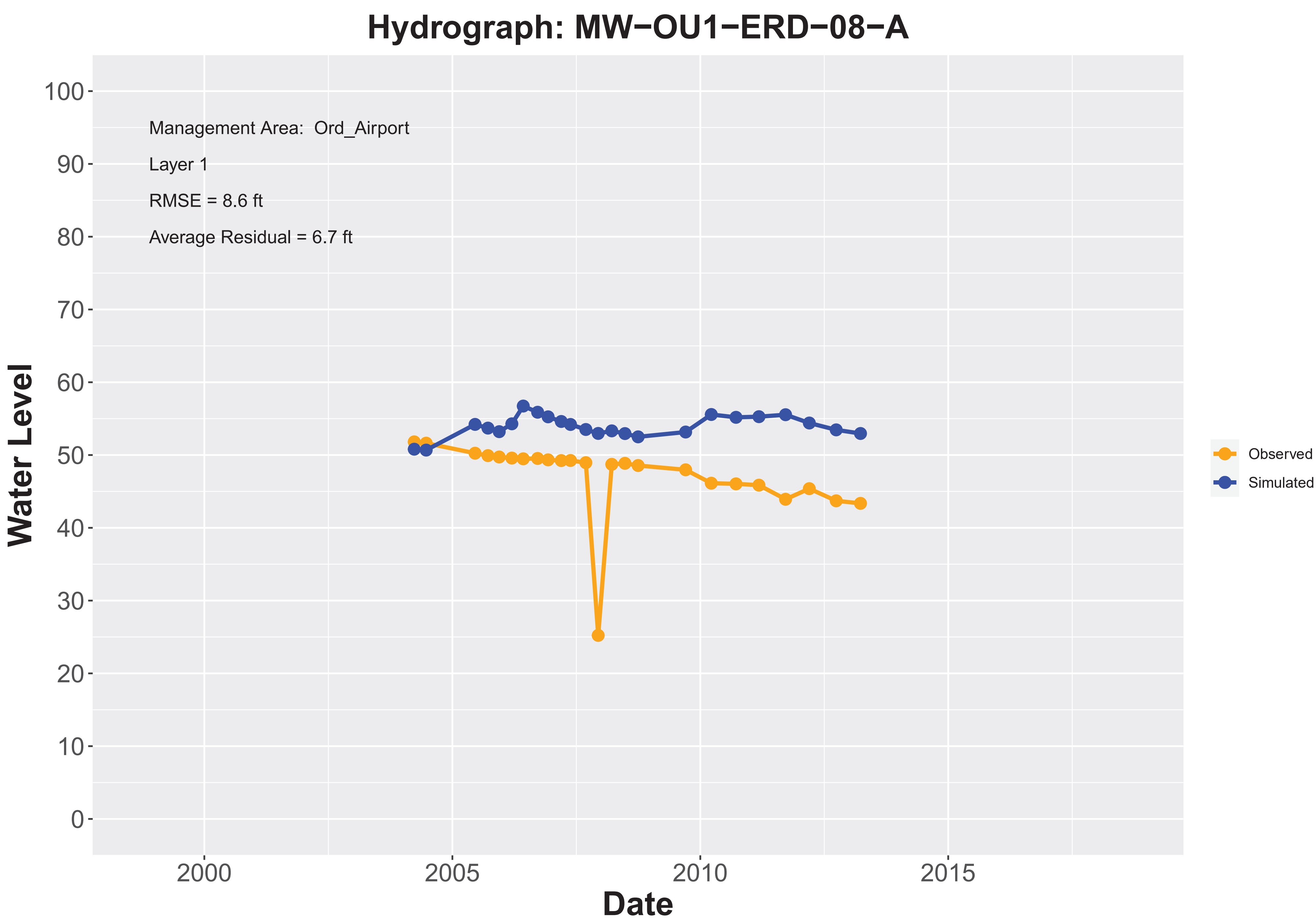

Hydrograph: MW−OU1−ERD−04−A
Management Area: Ord_Airport
Layer 1
RMSE = 11.1 ft
Average Residual = 6.2 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−OU1−ERD−05−A

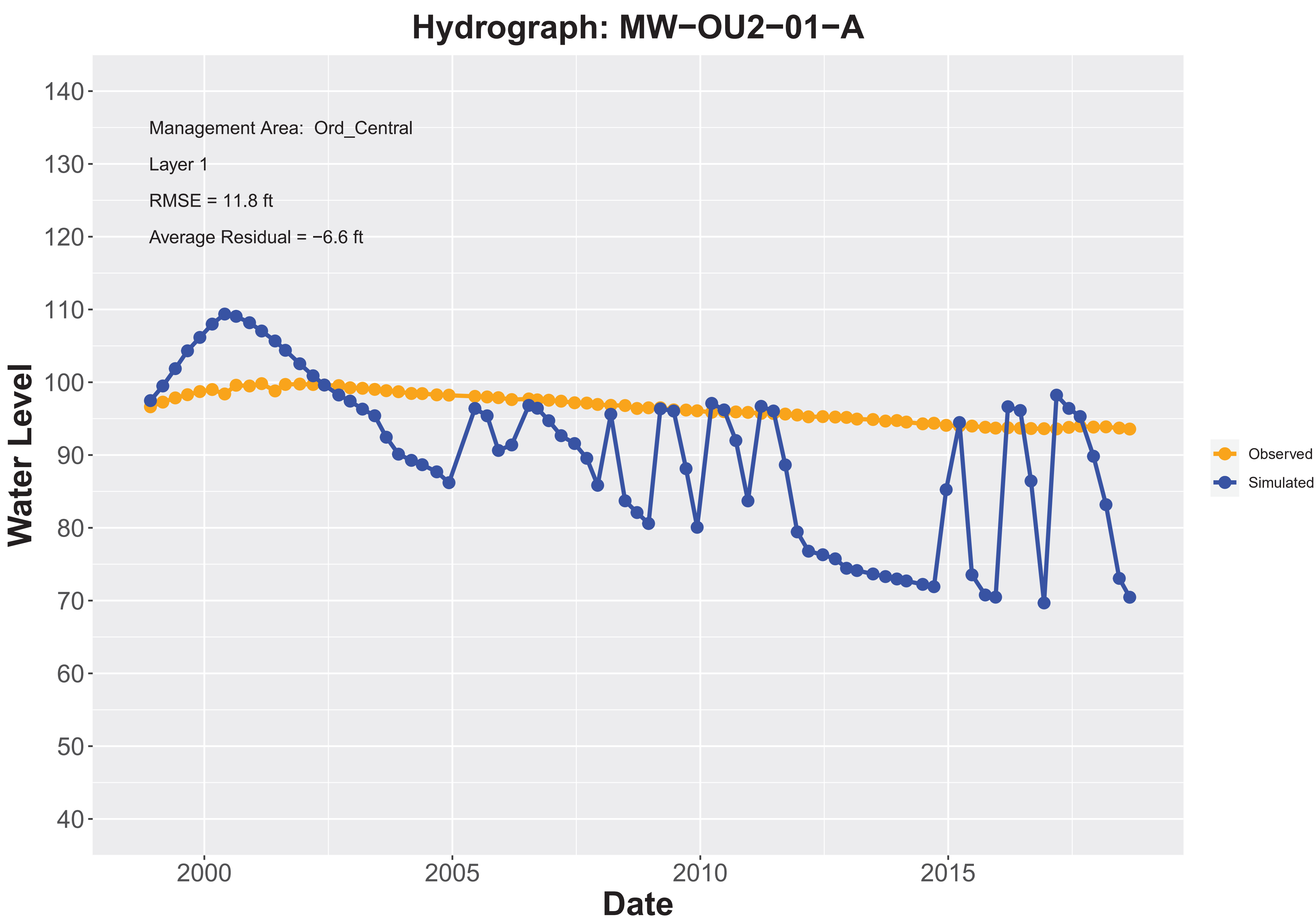


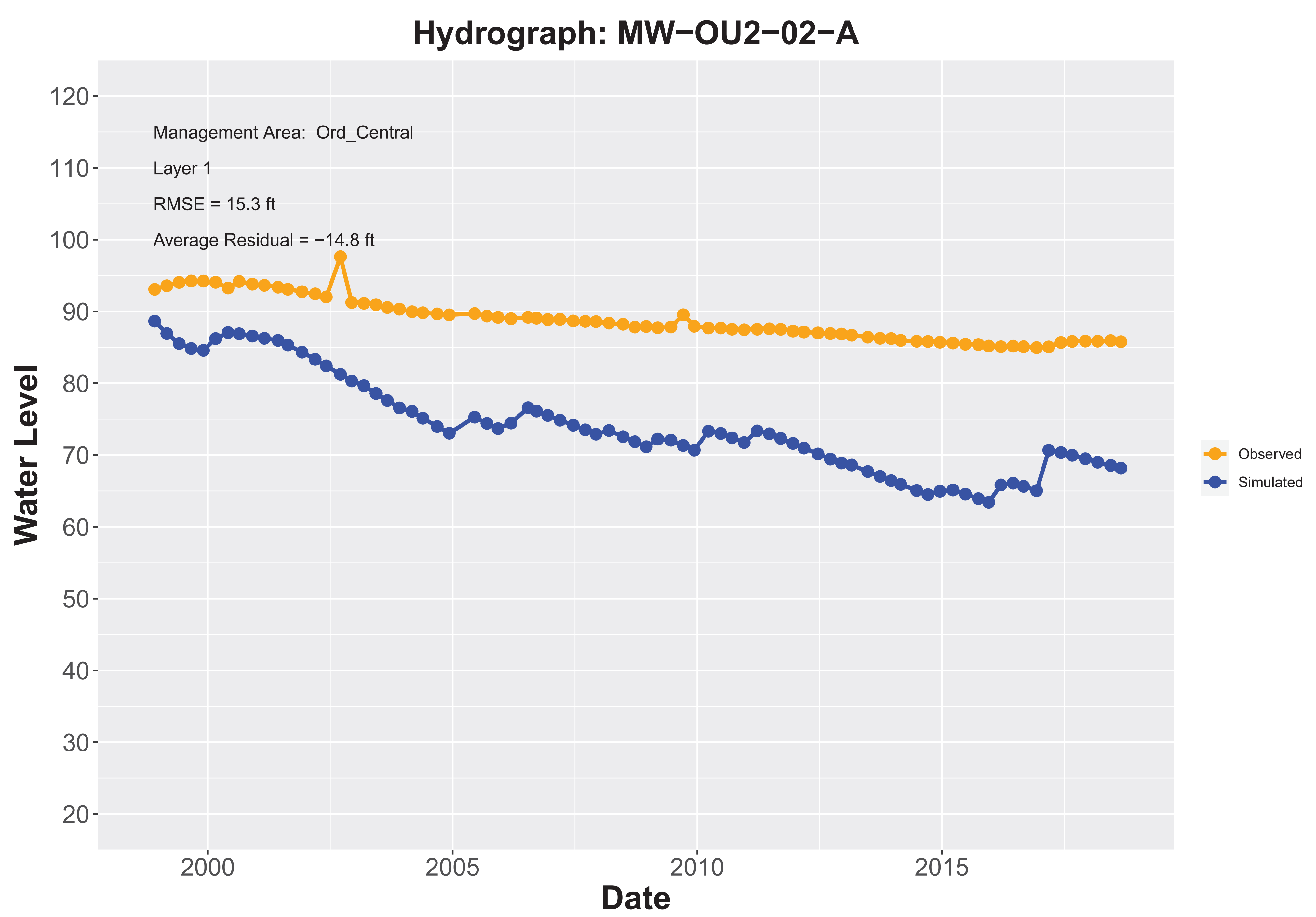

Hydrograph: MW−OU1−ERD−06−A
Management Area: Ord_Airport
Layer 1
RMSE = 10.6 ft
Average Residual = 6.1 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU1−ERD−07−A
Management Area: Ord_Airport
Layer 1
RMSE = 9.5 ft
Average Residual = 6.5 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

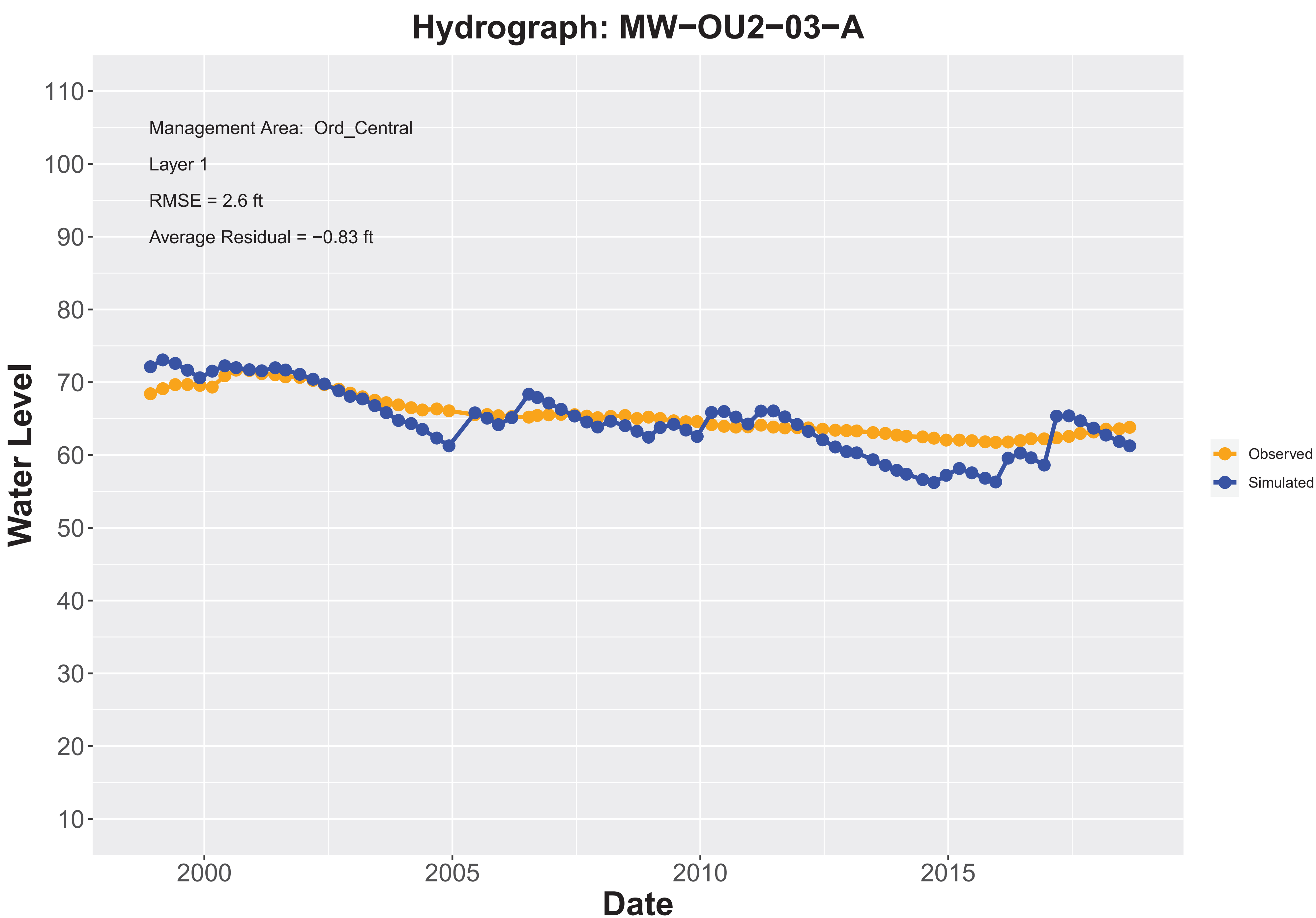


Hydrograph: MW−OU1−ERD−08−A
Management Area: Ord_Airport
Layer 1
RMSE = 8.6 ft
Average Residual = 6.7 ft
Water Level
Date
0
10
20
30
40
50
60
70
80
90
100
2000
2005
2010
2015
Observed
Simulated

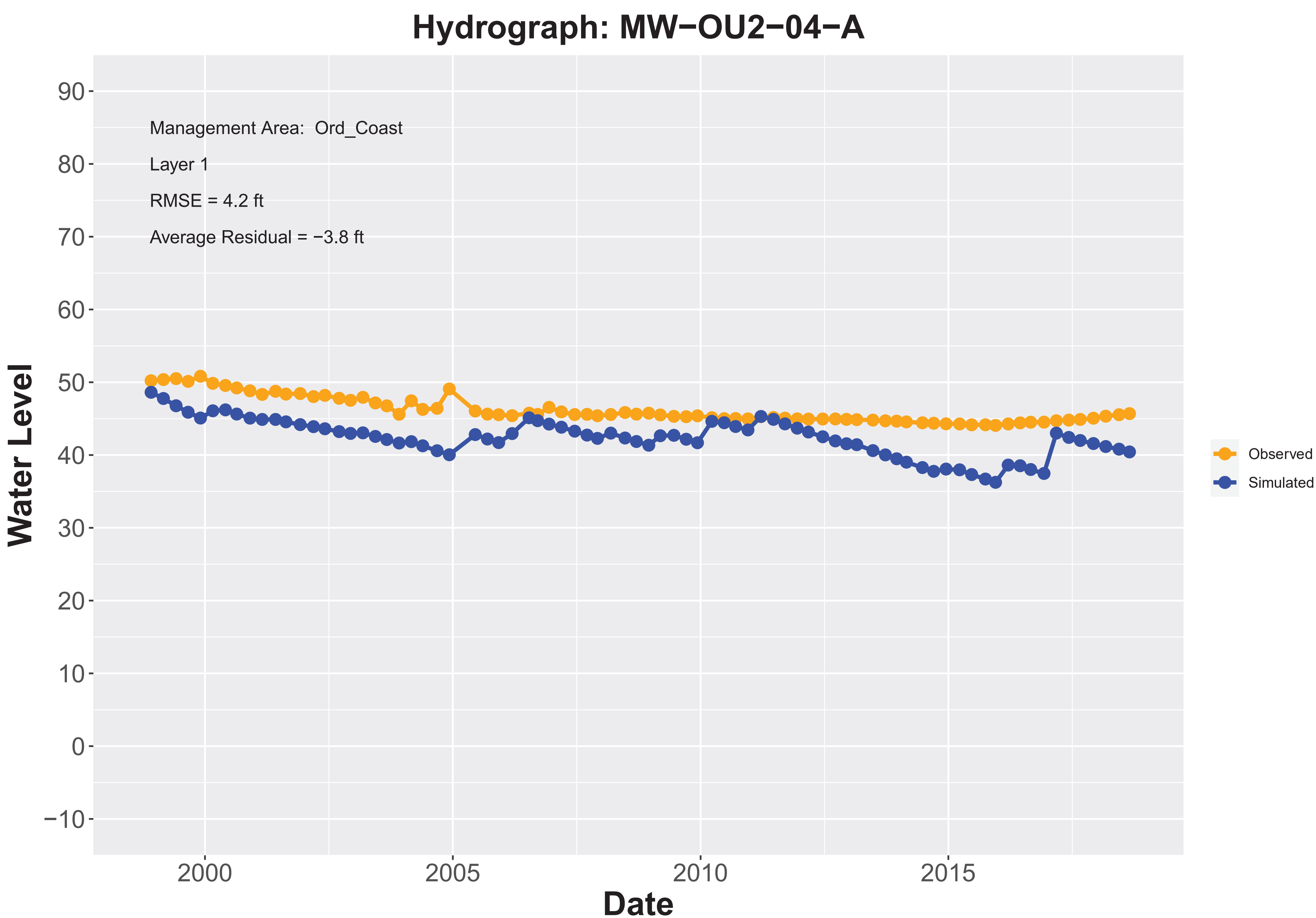

Hydrograph: MW−OU2−01−A
Management Area: Ord_Central
Layer 1
RMSE = 11.8 ft
Average Residual = −6.6 ft
Water Level
140
130
120
110
100
90
80
70
60
50
40
2000
2005
2010
2015
Date
Observed
Simulated



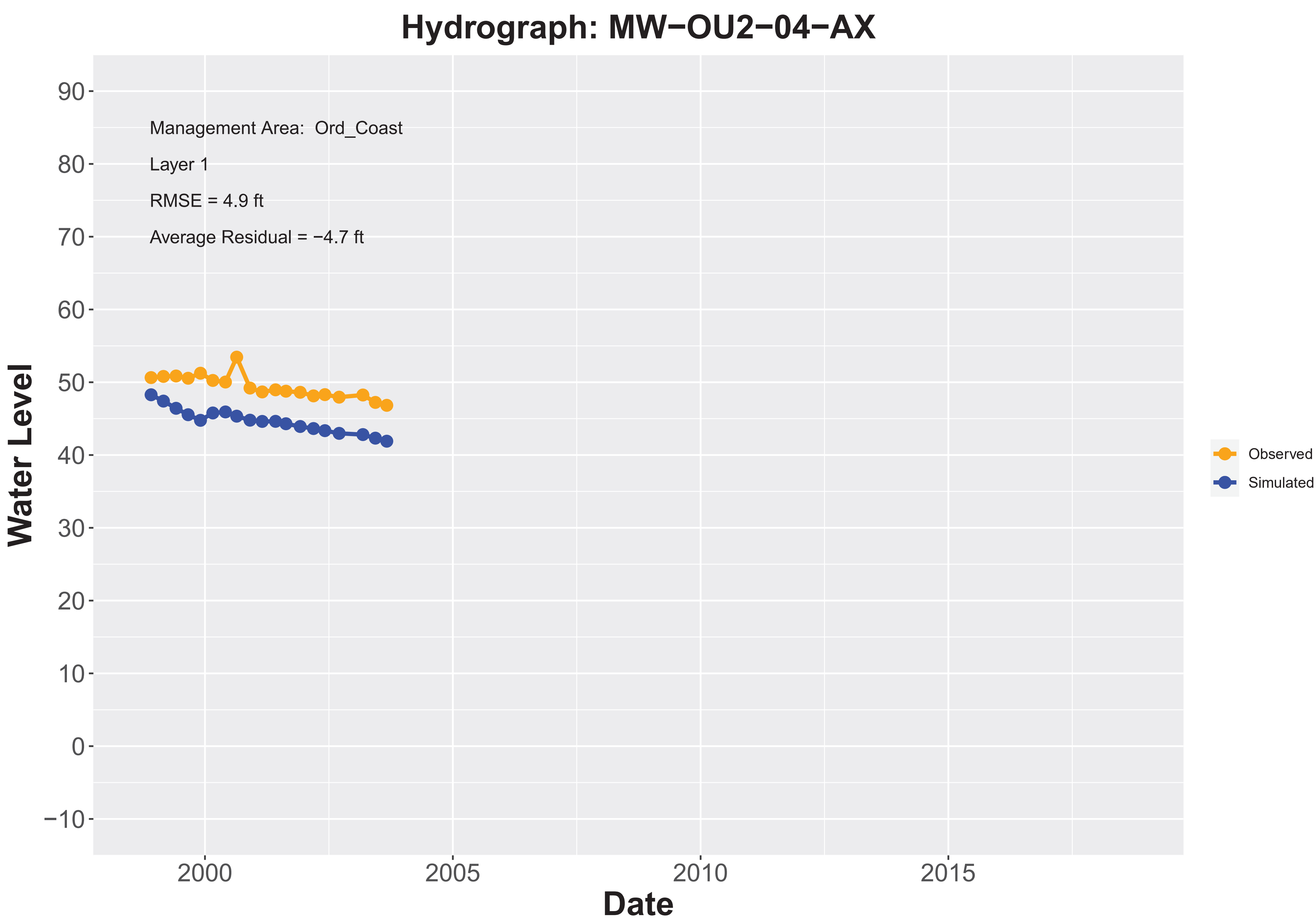
Hydrograph: MW−OU2−02−A
Management Area: Ord_Central
Layer 1
RMSE = 15.3 ft
Average Residual = −14.8 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated



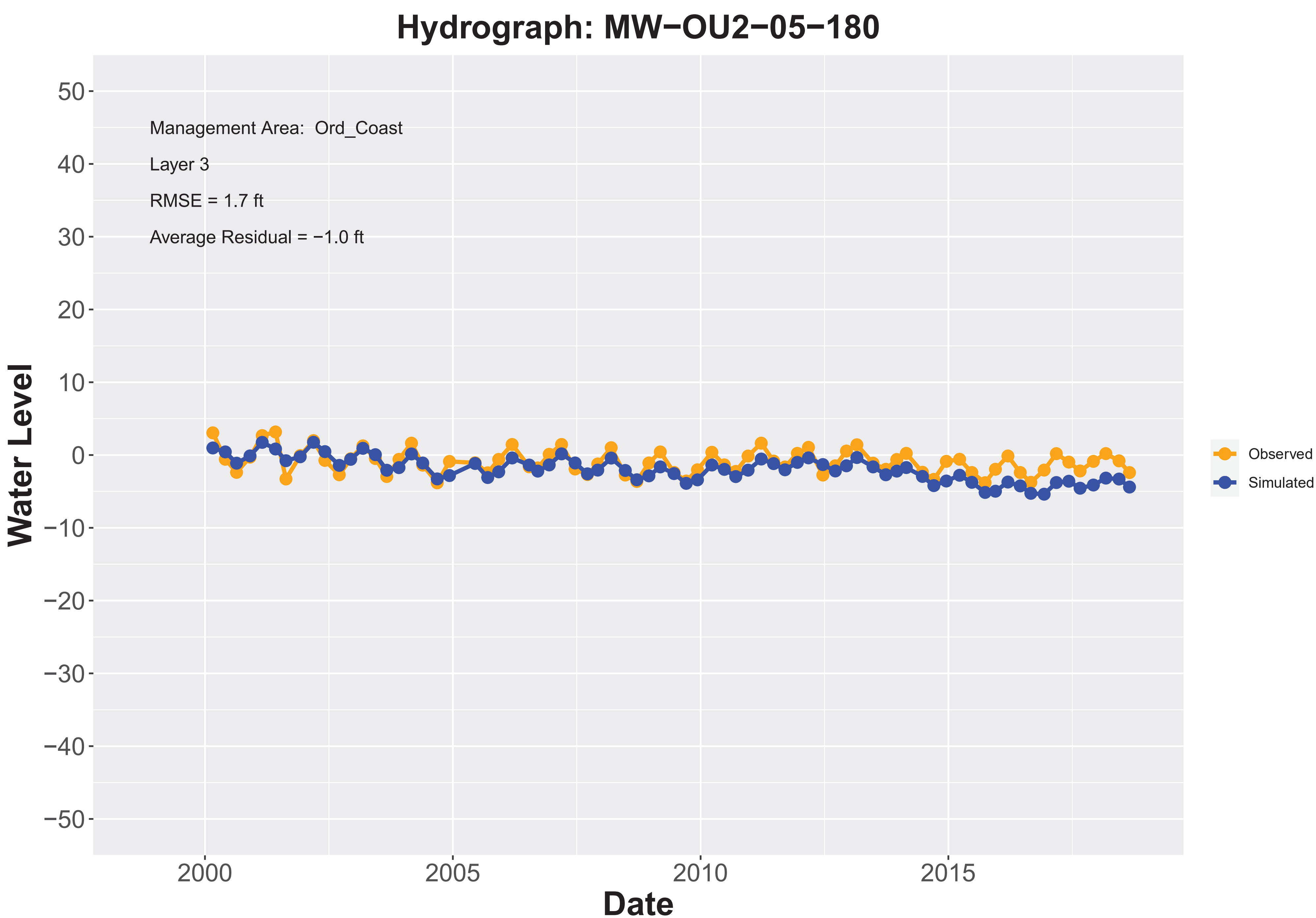
Hydrograph: MW−OU2−03−A
Management Area: Ord_Central
Layer 1
RMSE = 2.6 ft
Average Residual = −0.83 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

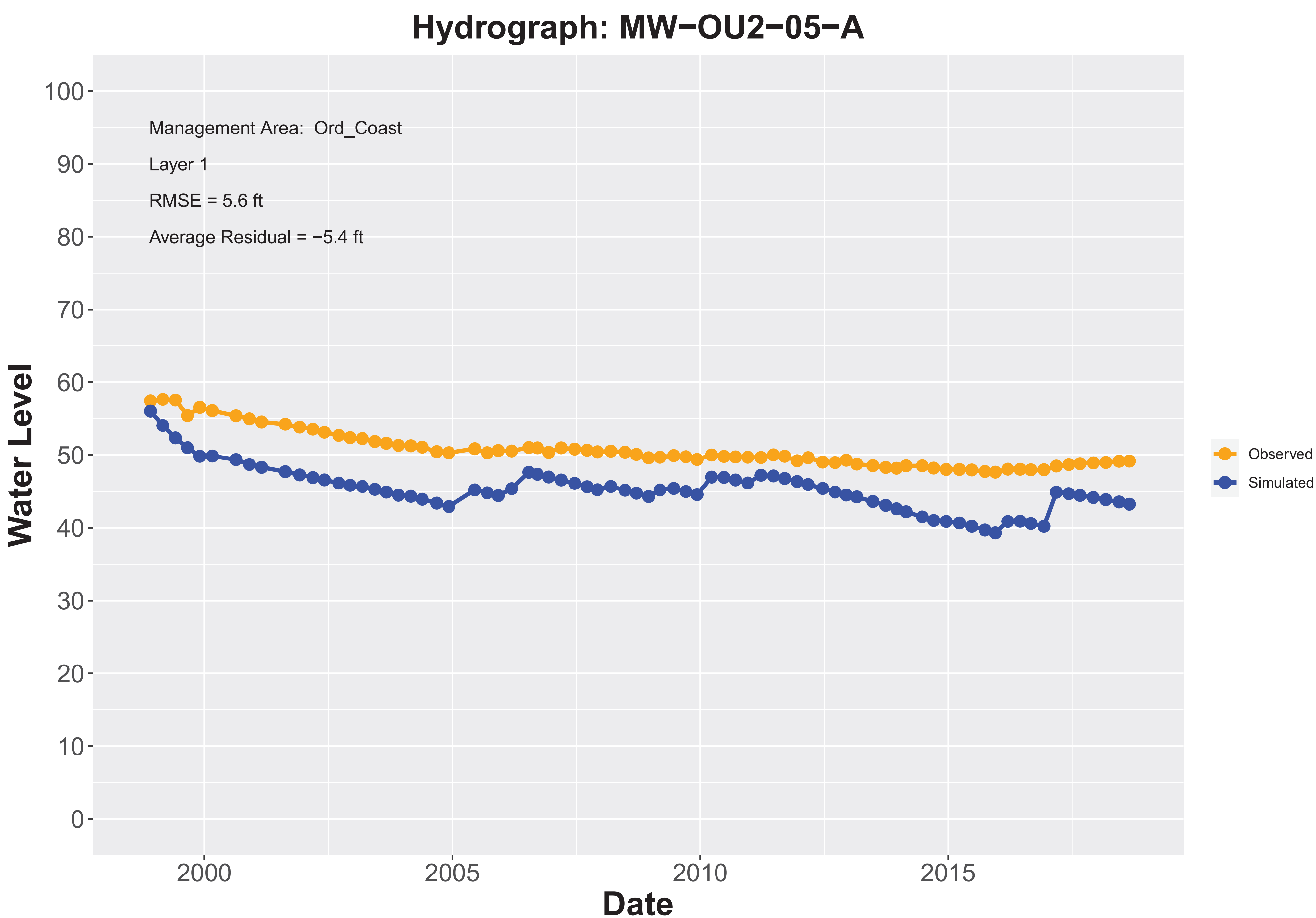


Hydrograph: MW−OU2−04−A
Management Area: Ord_Coast
Layer 1
RMSE = 4.2 ft
Average Residual = −3.8 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

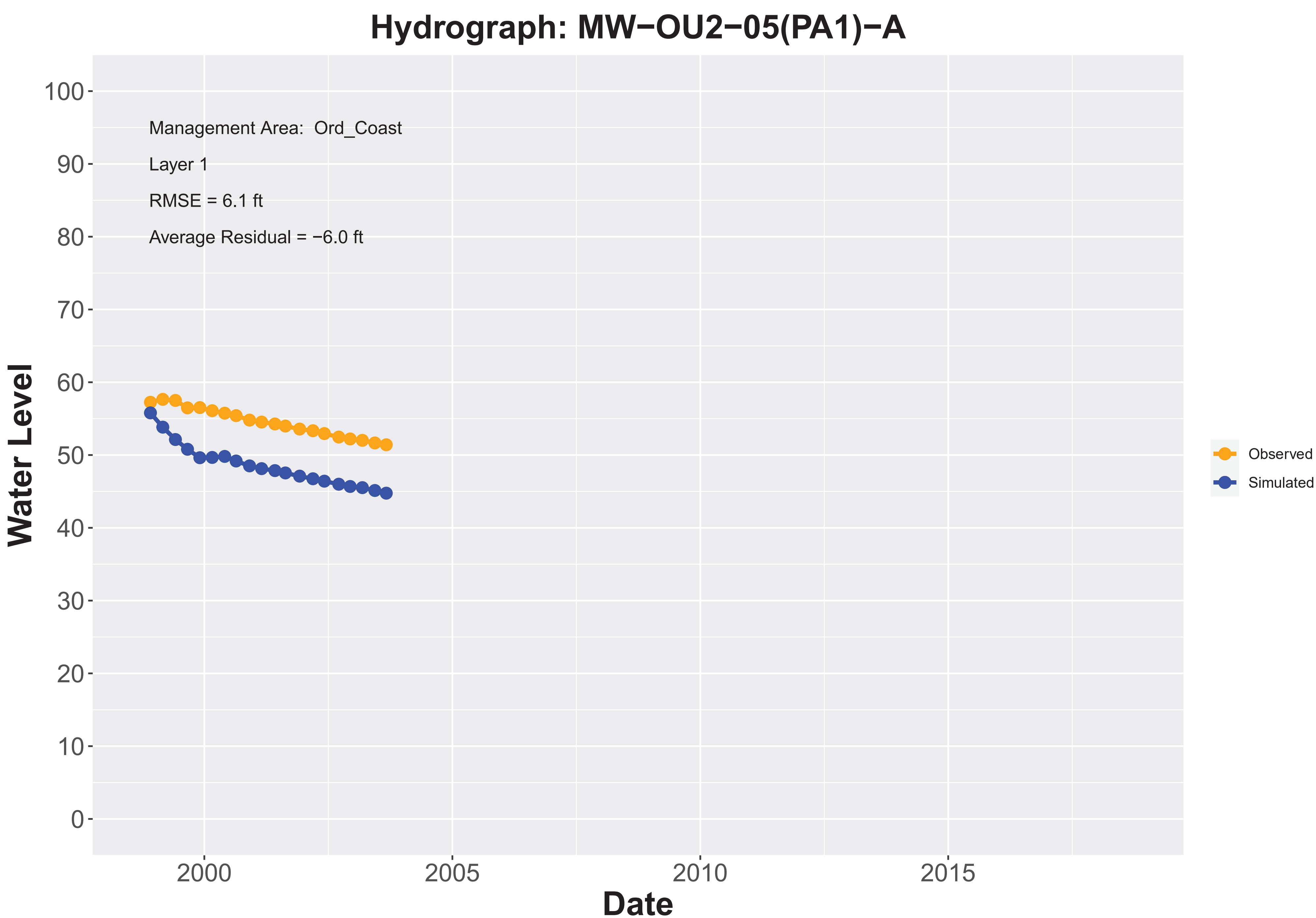


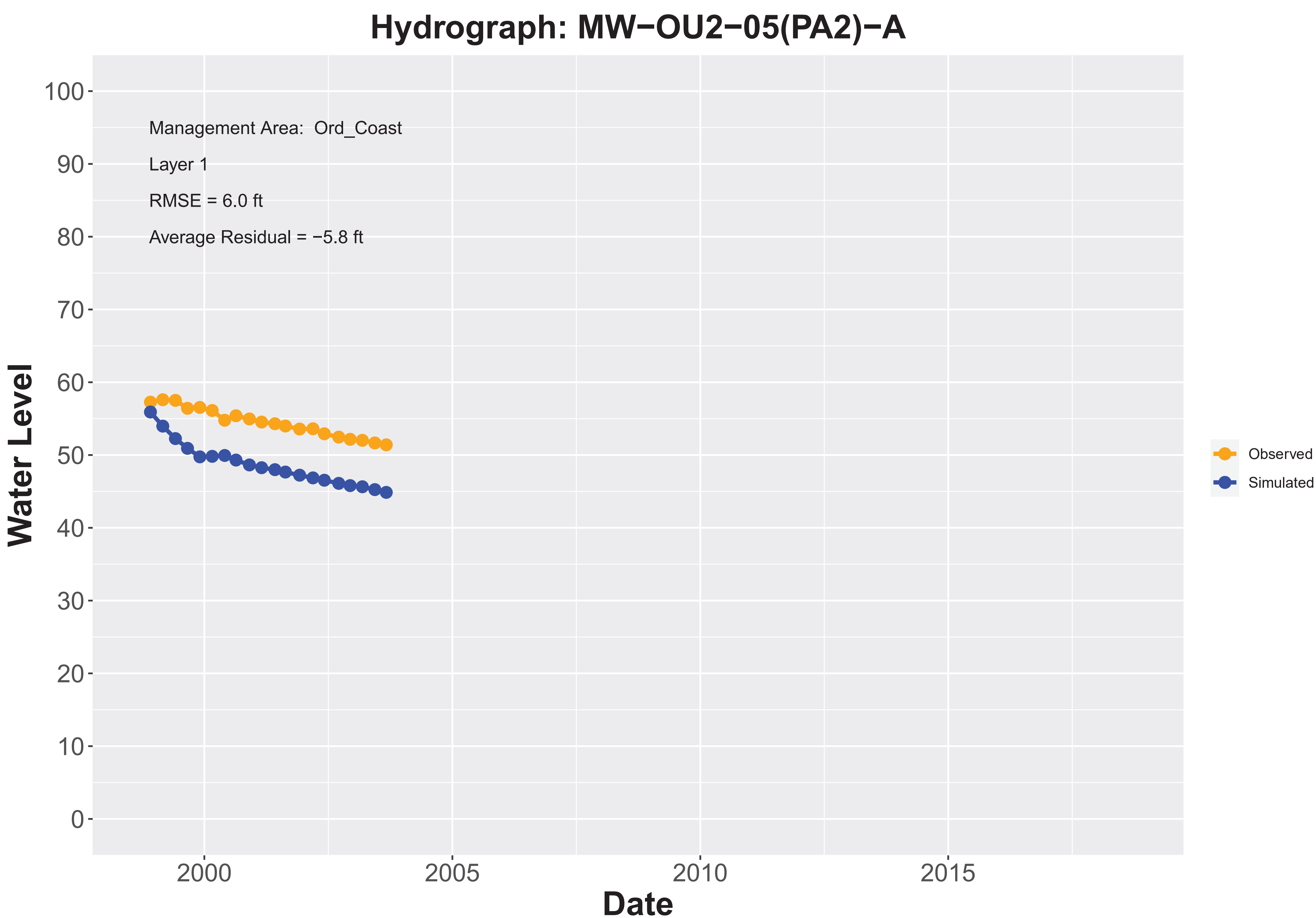
Hydrograph: MW−OU2−04−AX
Management Area: Ord_Coast
Layer 1
RMSE = 4.9 ft
Average Residual = −4.7 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

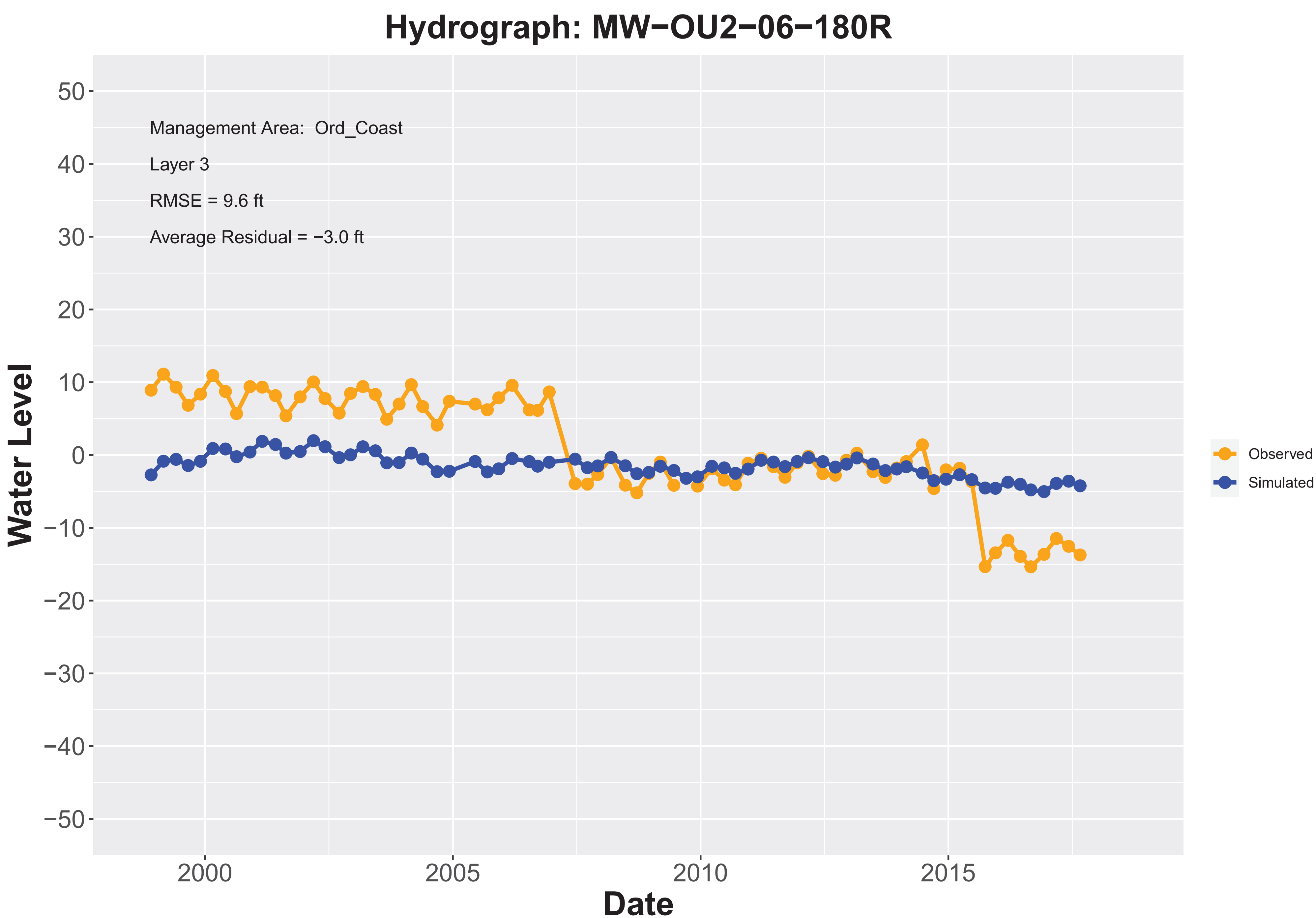

Hydrograph: MW−OU2−05−180
Management Area: Ord_Coast
Layer 3
RMSE = 1.7 ft
Average Residual = −1.0 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



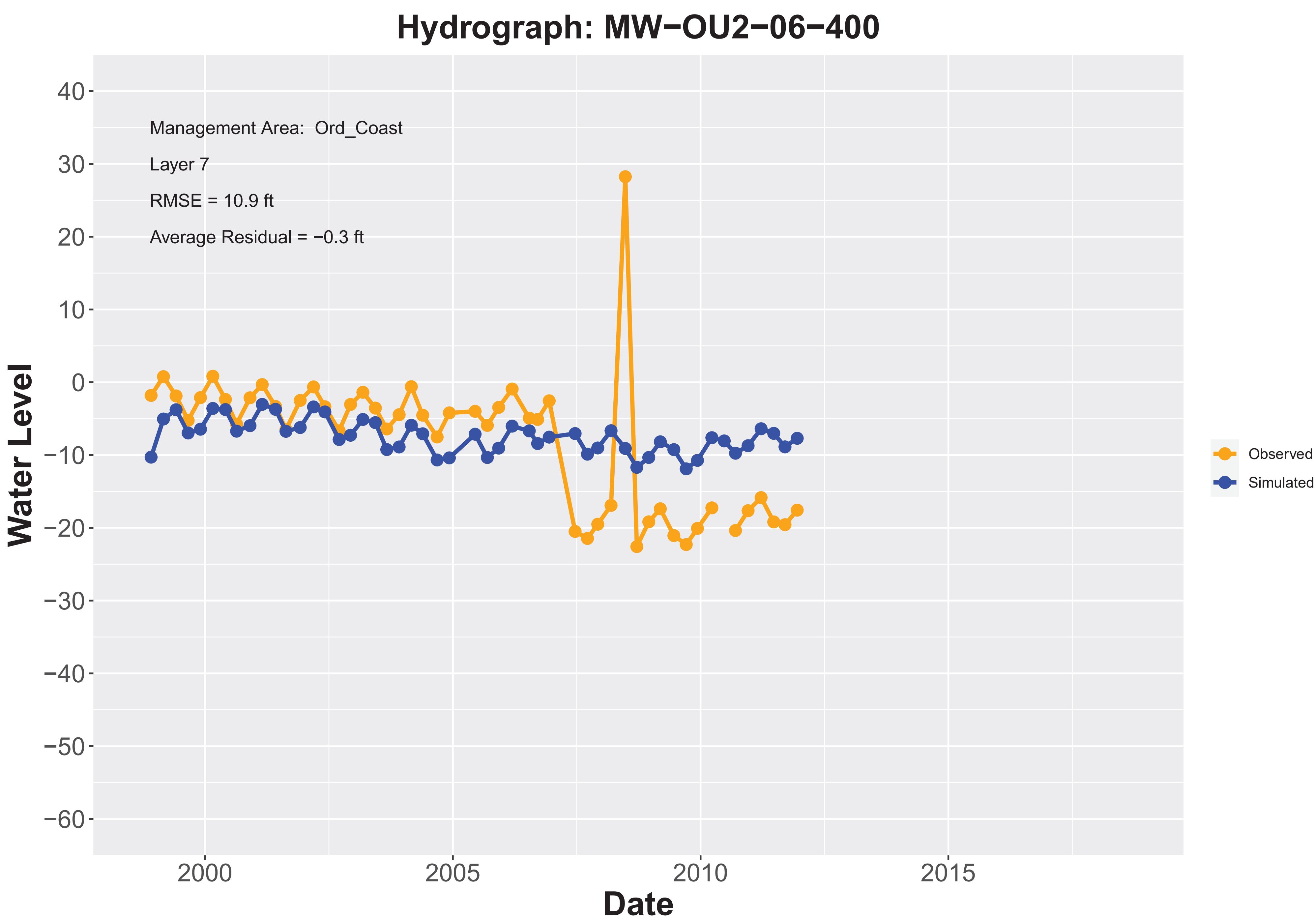
Hydrograph: MW−OU2−05−A
Management Area: Ord_Coast
Layer 1
RMSE = 5.6 ft
Average Residual = −5.4 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU2−05(PA1)−A
Management Area: Ord_Coast
Layer 1
RMSE = 6.1 ft
Average Residual = −6.0 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

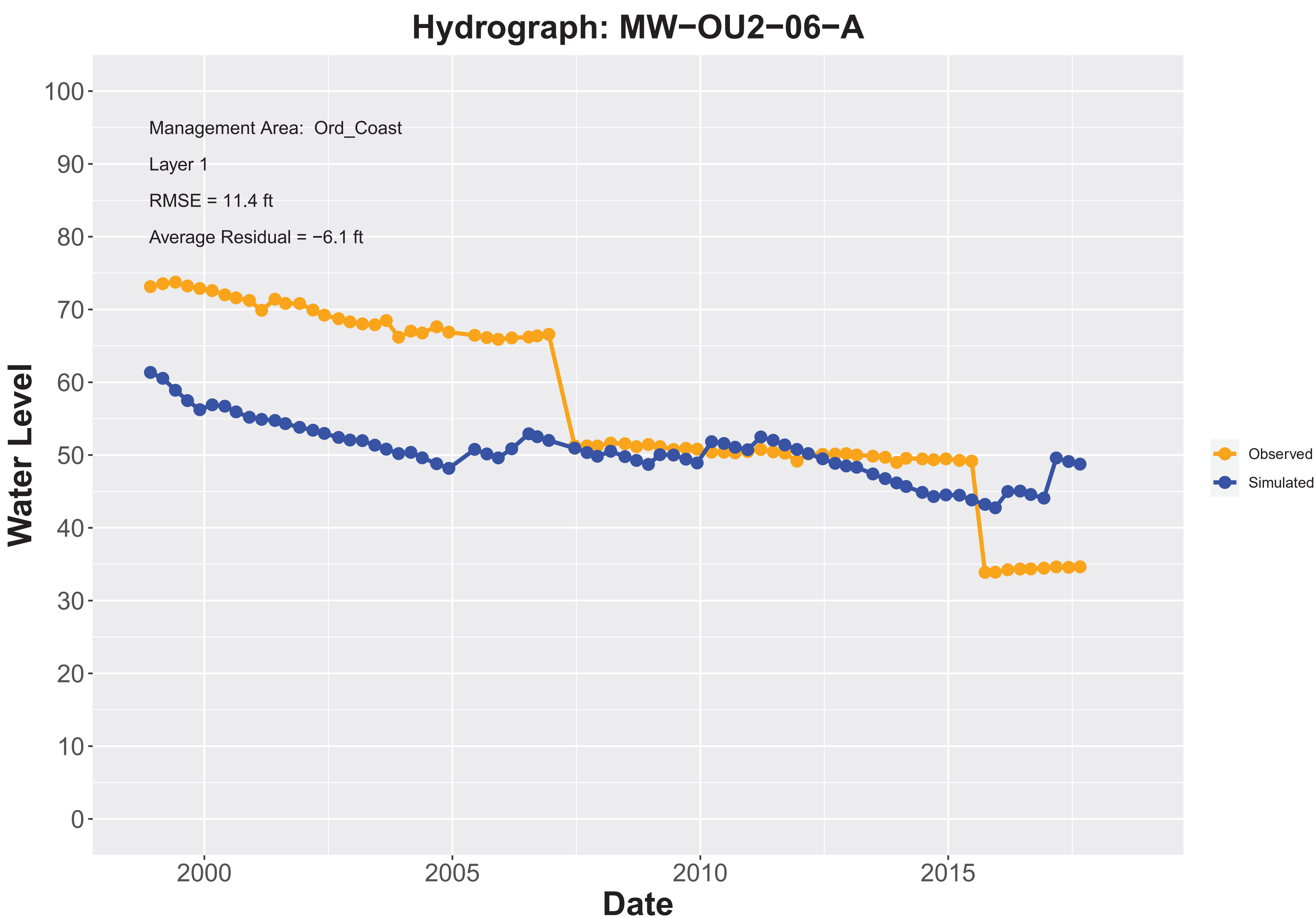

Hydrograph: MW−OU2−05(PA2)−A
Management Area: Ord_Coast
Layer 1
RMSE = 6.0 ft
Average Residual = −5.8 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

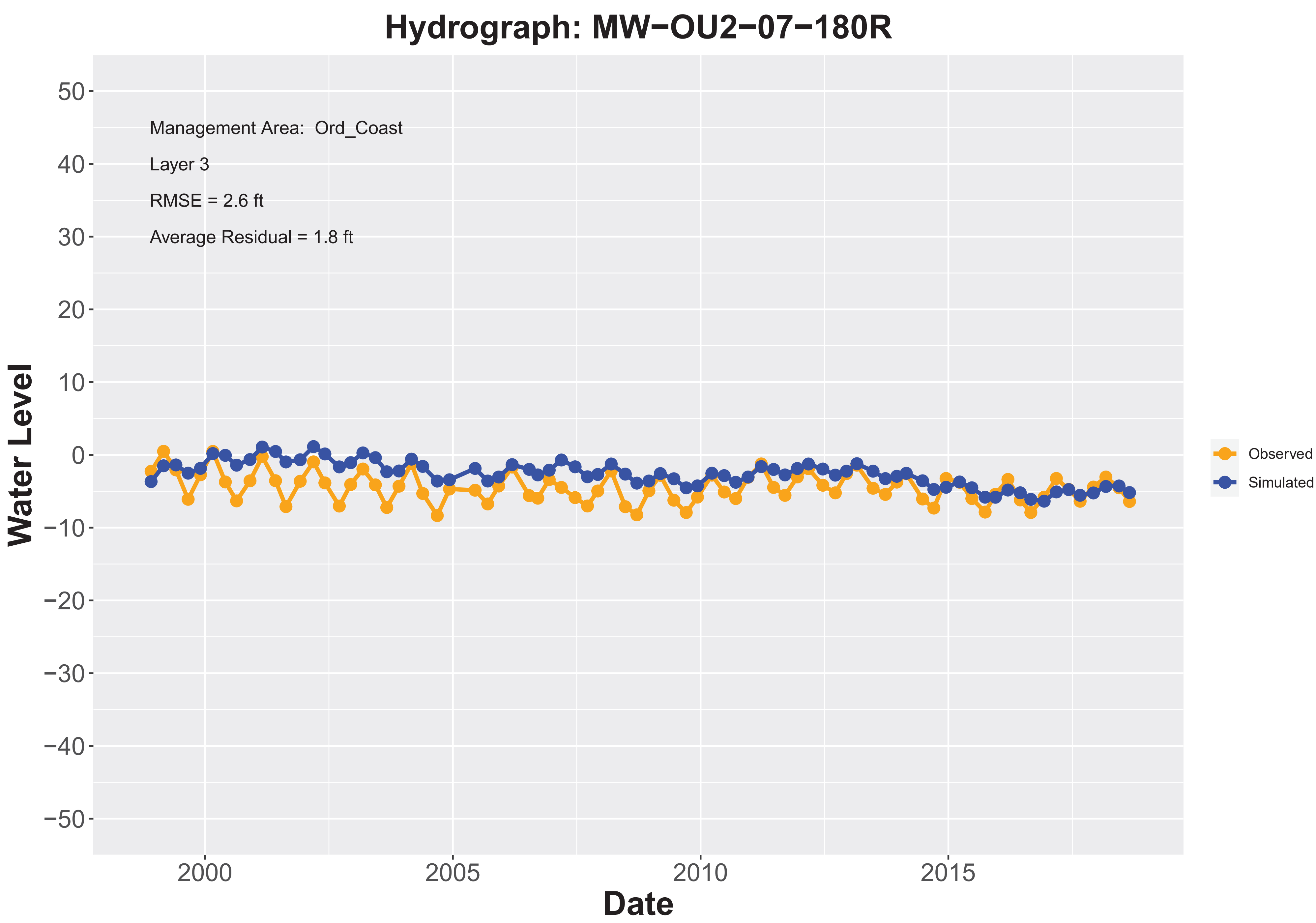


Hydrograph: MW−OU2−06−180R
Management Area: Ord_Coast
Layer 3
RMSE = 9.6 ft
Average Residual = −3.0 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

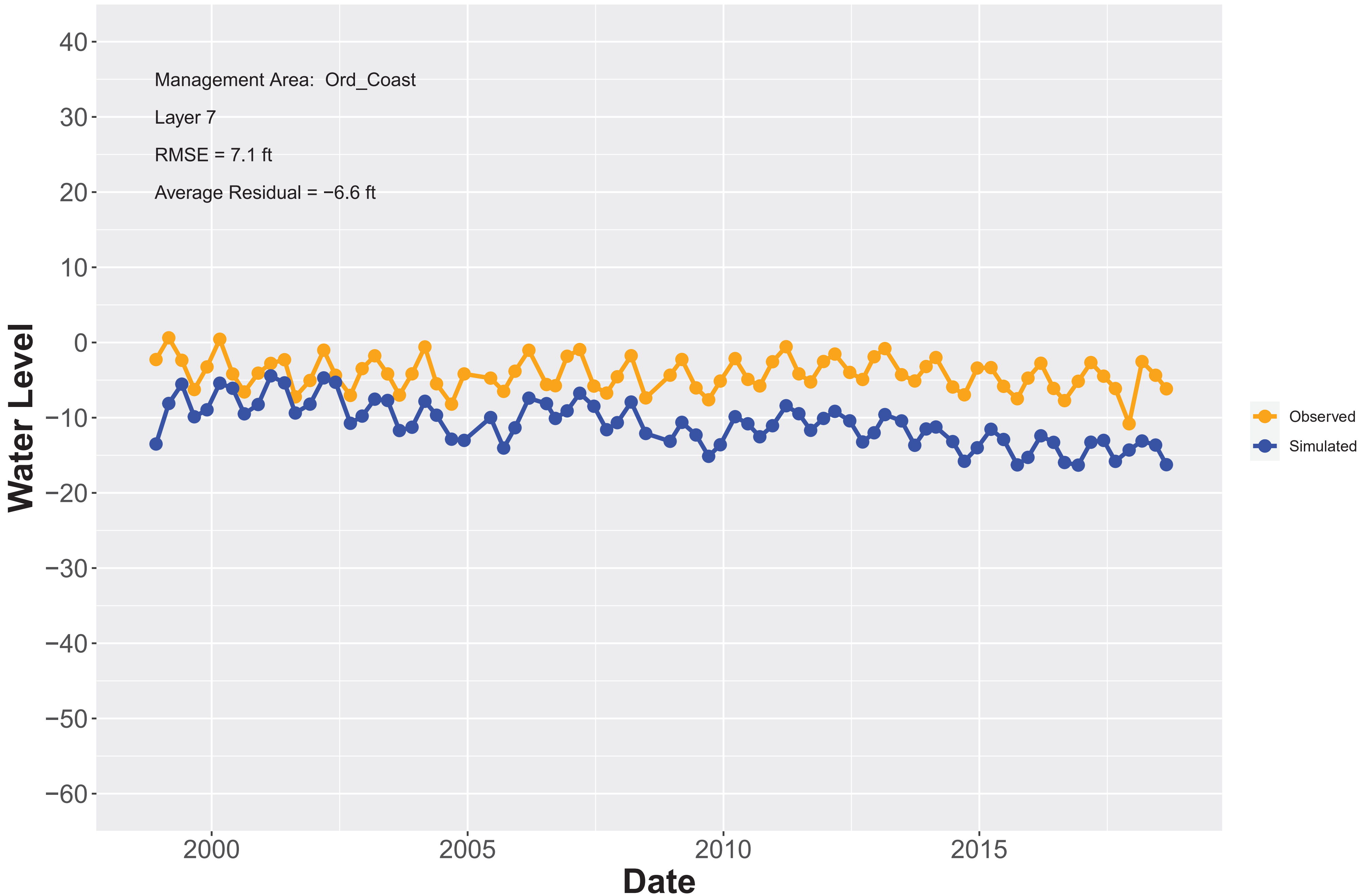


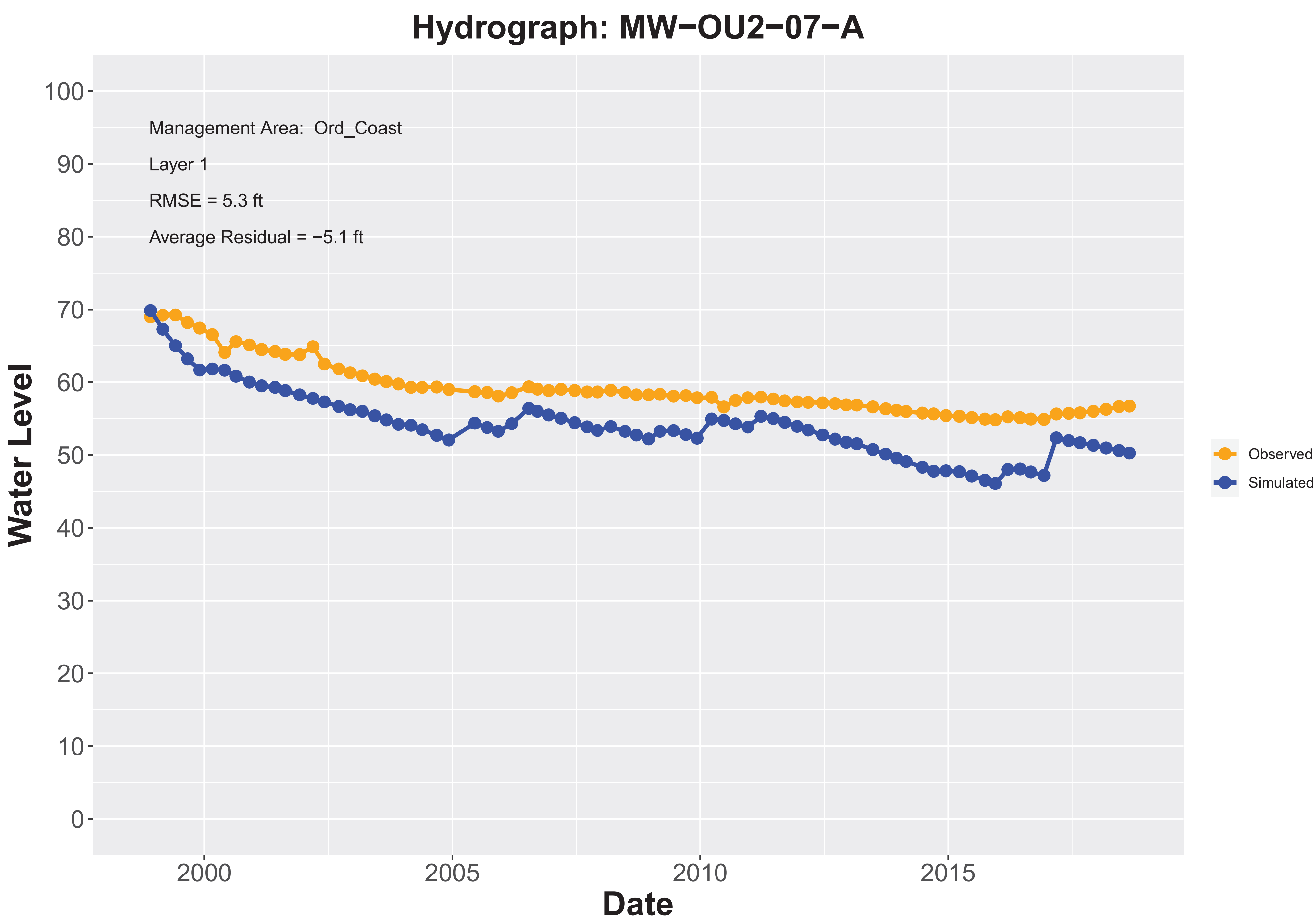
Hydrograph: MW−OU2−06−400
Management Area: Ord_Coast
Layer 7
RMSE = 10.9 ft
Average Residual = −0.3 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

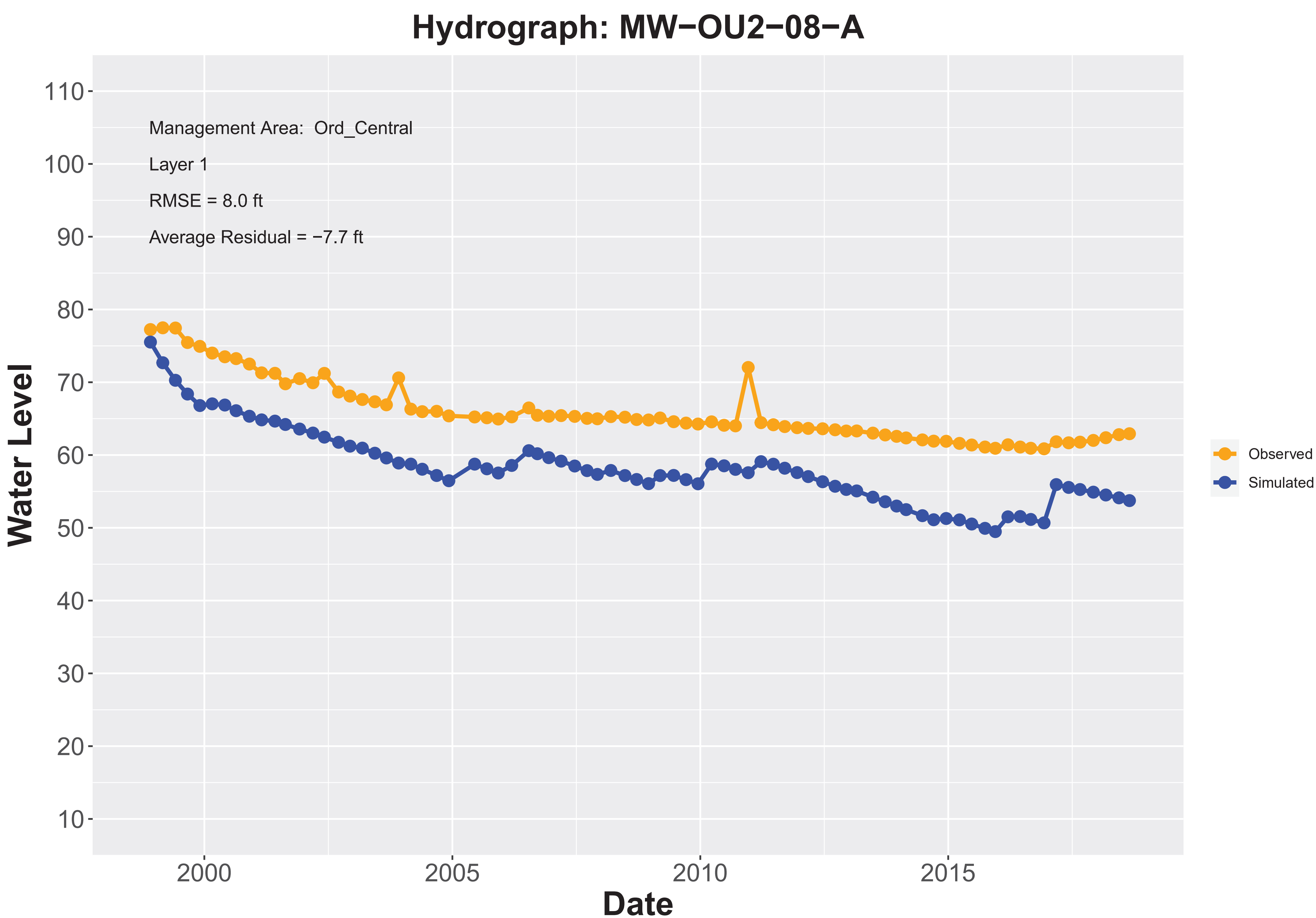

Hydrograph: MW−OU2−06−A
Management Area: Ord_Coast
Layer 1
RMSE = 11.4 ft
Average Residual = −6.1 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU2−07−180R
Management Area: Ord_Coast
Layer 3
RMSE = 2.6 ft
Average Residual = 1.8 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

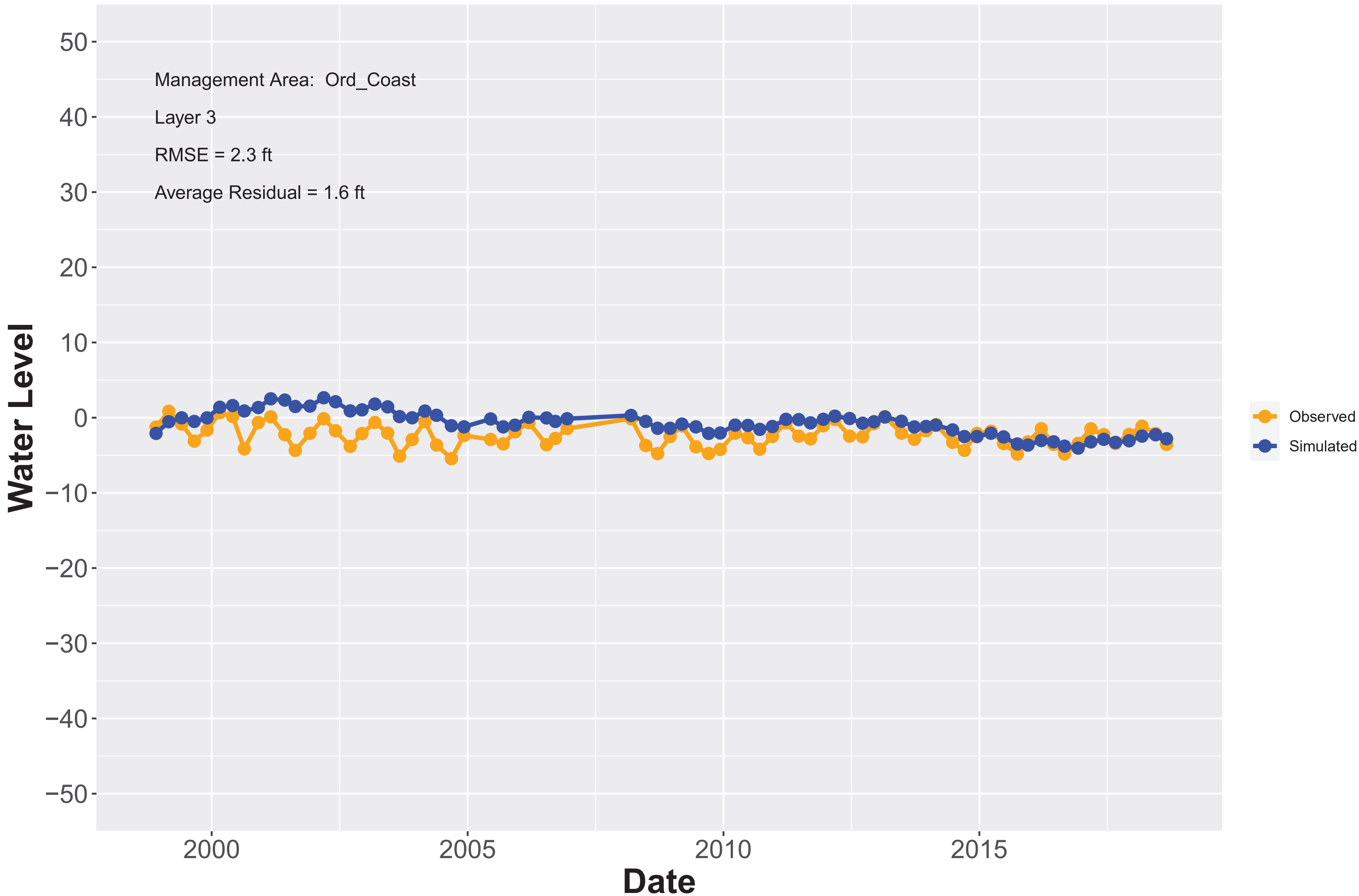
Hydrograph: MW−OU2−07−400

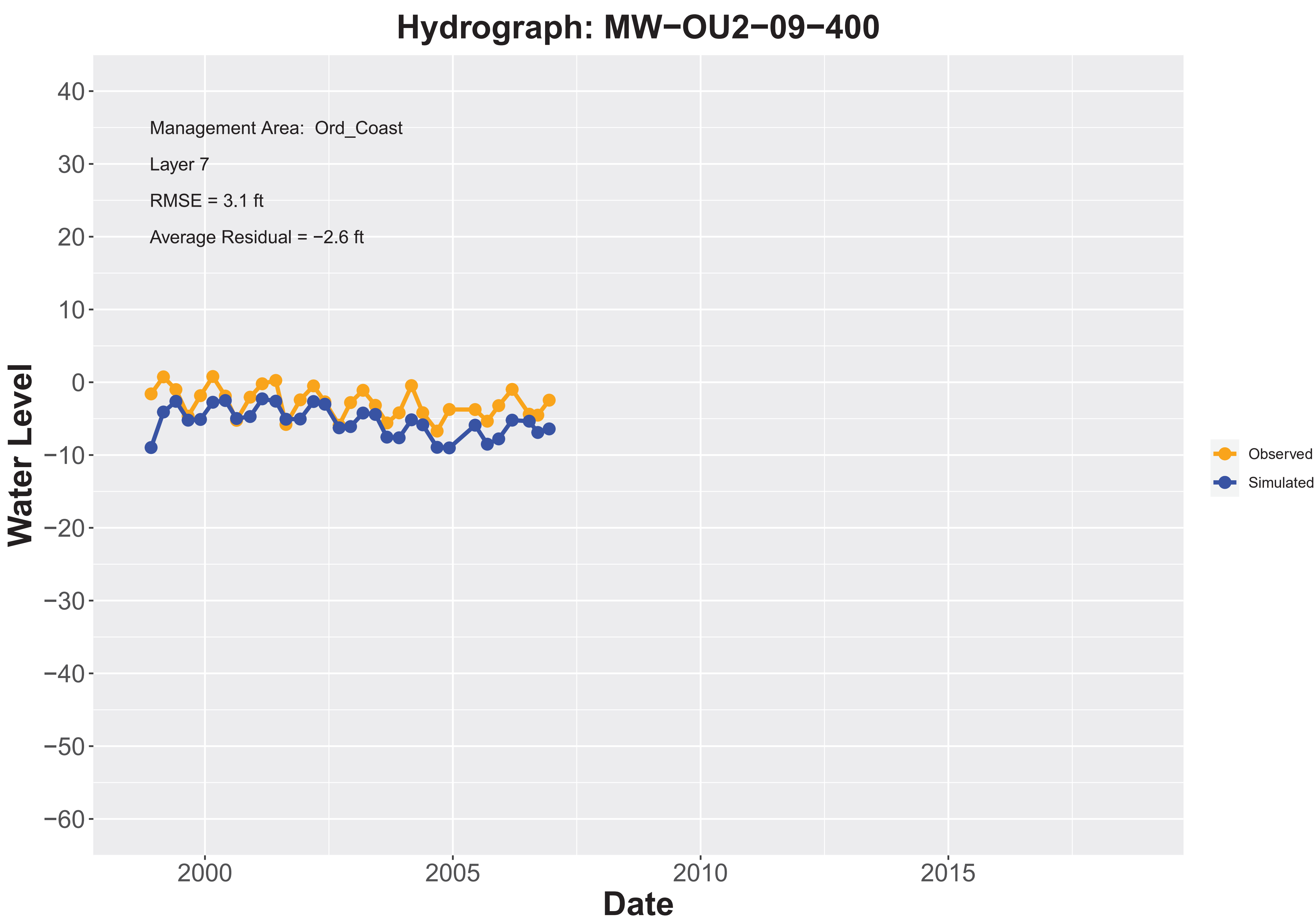


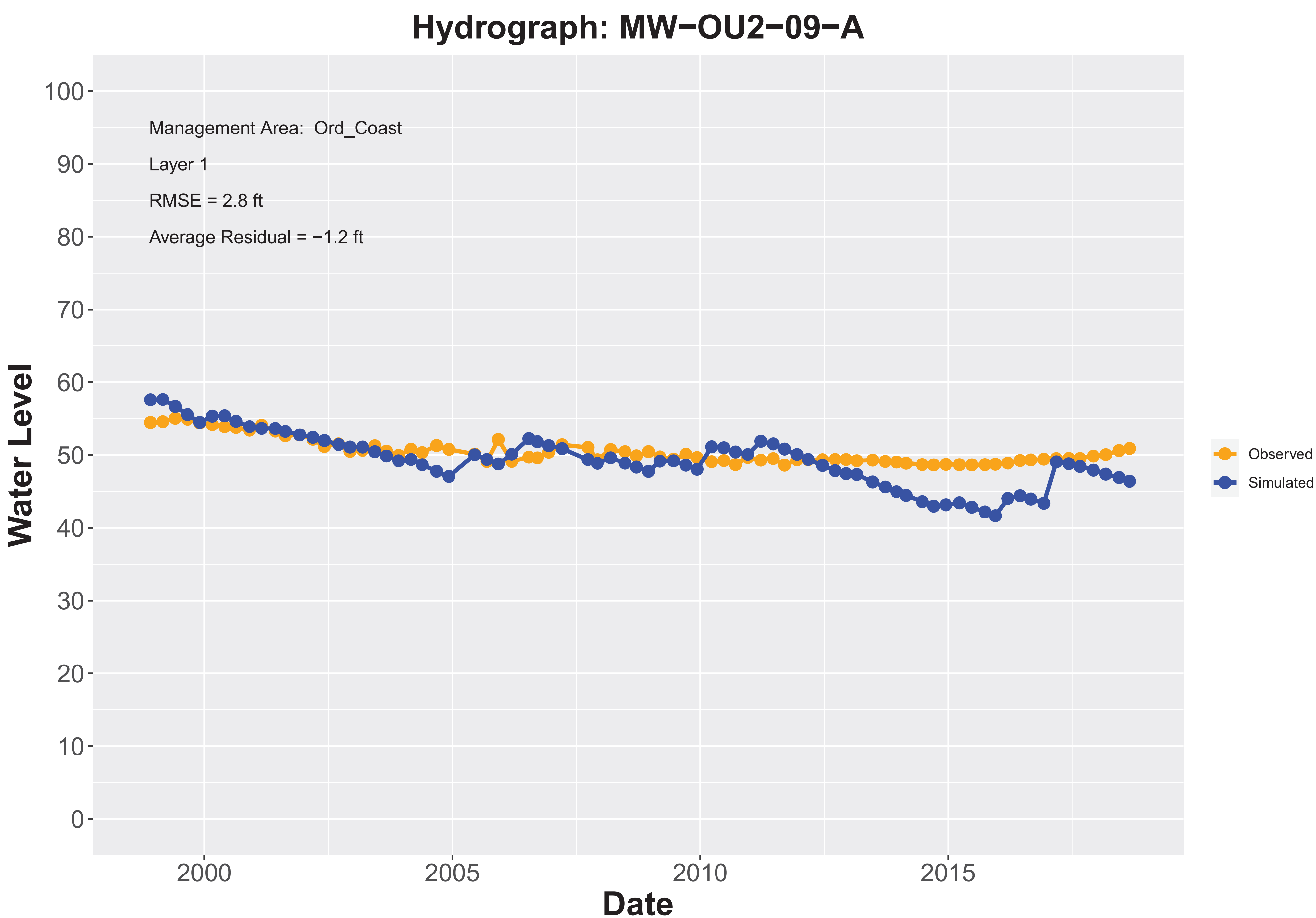

Hydrograph: MW−OU2−07−A
Management Area: Ord_Coast
Layer 1
RMSE = 5.3 ft
Average Residual = −5.1 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

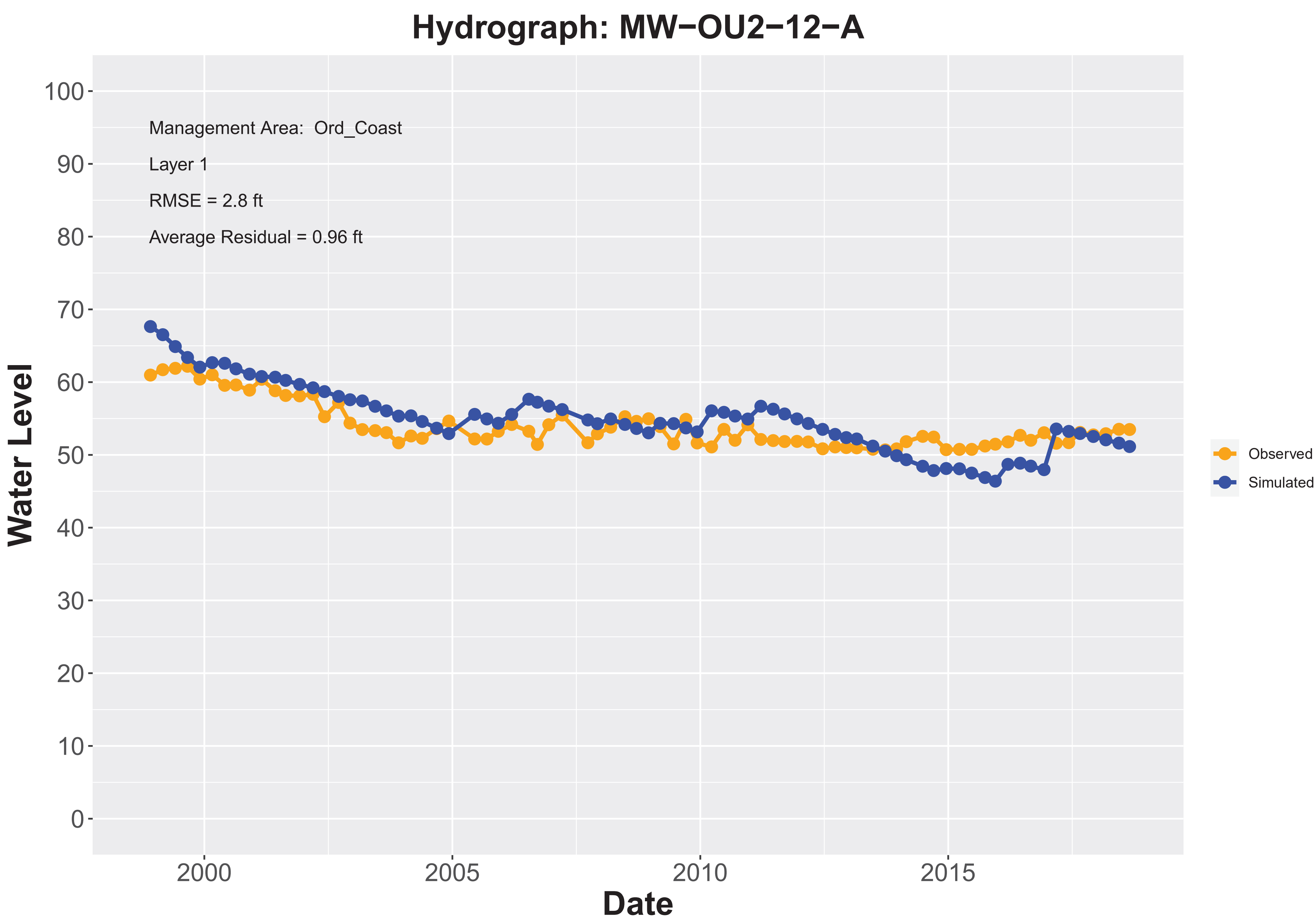

Hydrograph: MW−OU2−08−A
Management Area: Ord_Central
Layer 1
RMSE = 8.0 ft
Average Residual = −7.7 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−OU2−09−180R

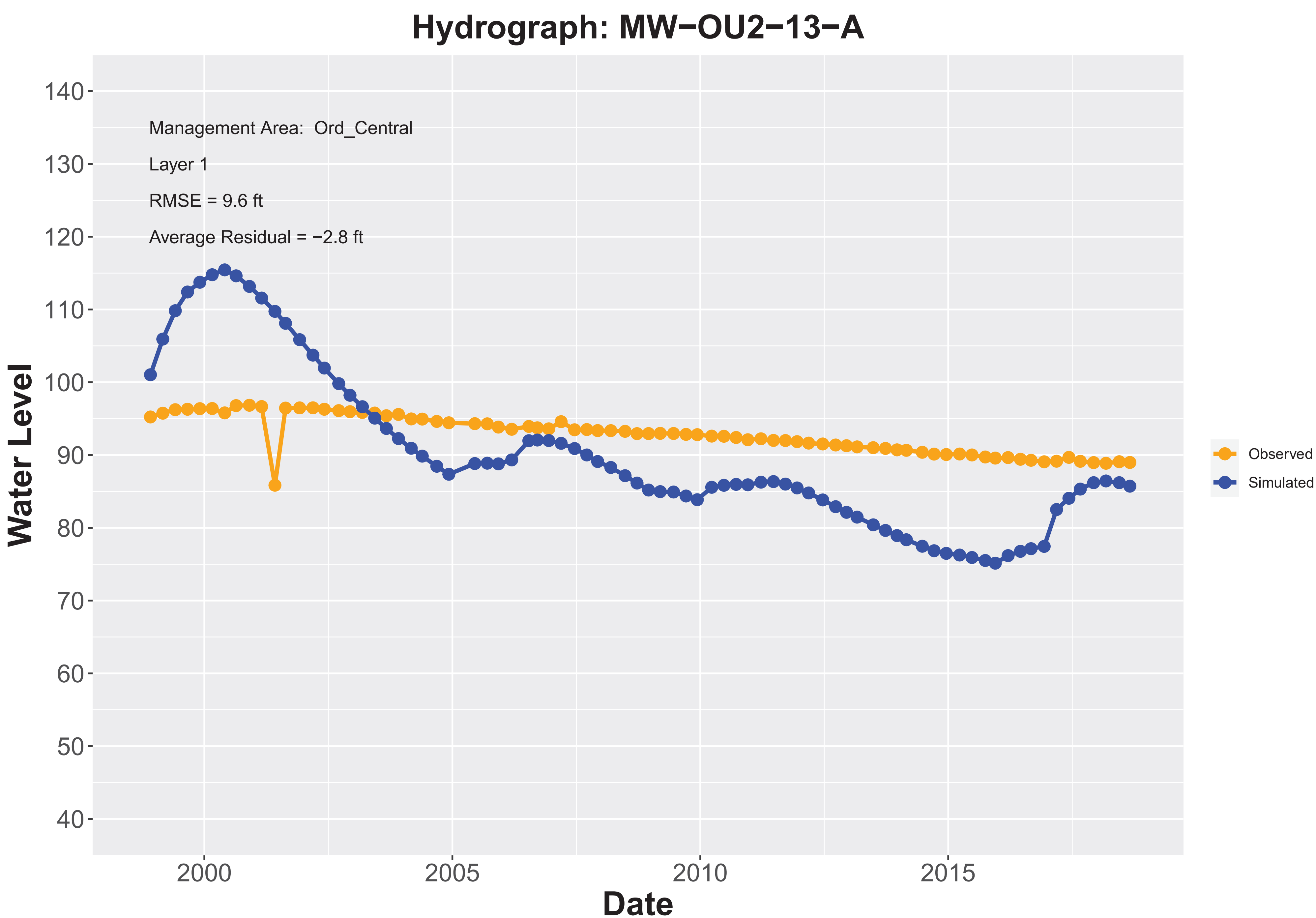



Hydrograph: MW−OU2−09−400
Management Area: Ord_Coast
Layer 7
RMSE = 3.1 ft
Average Residual = −2.6 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU2−09−A
Management Area: Ord_Coast
Layer 1
RMSE = 2.8 ft
Average Residual = −1.2 ft
Water Level
0
10
20
30
40
50
60
70
80
90
100
Date
2000
2005
2010
2015
Observed
Simulated

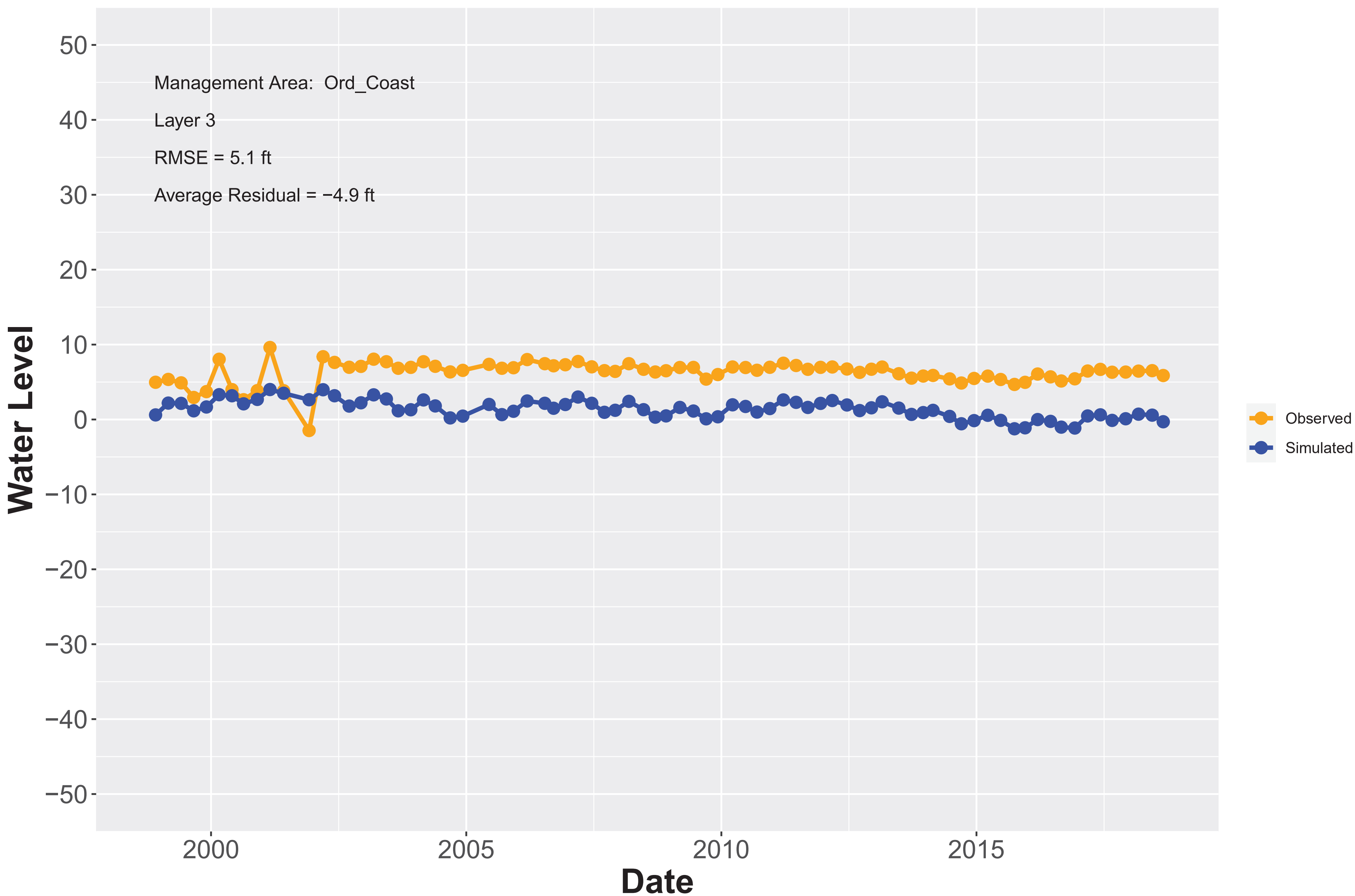


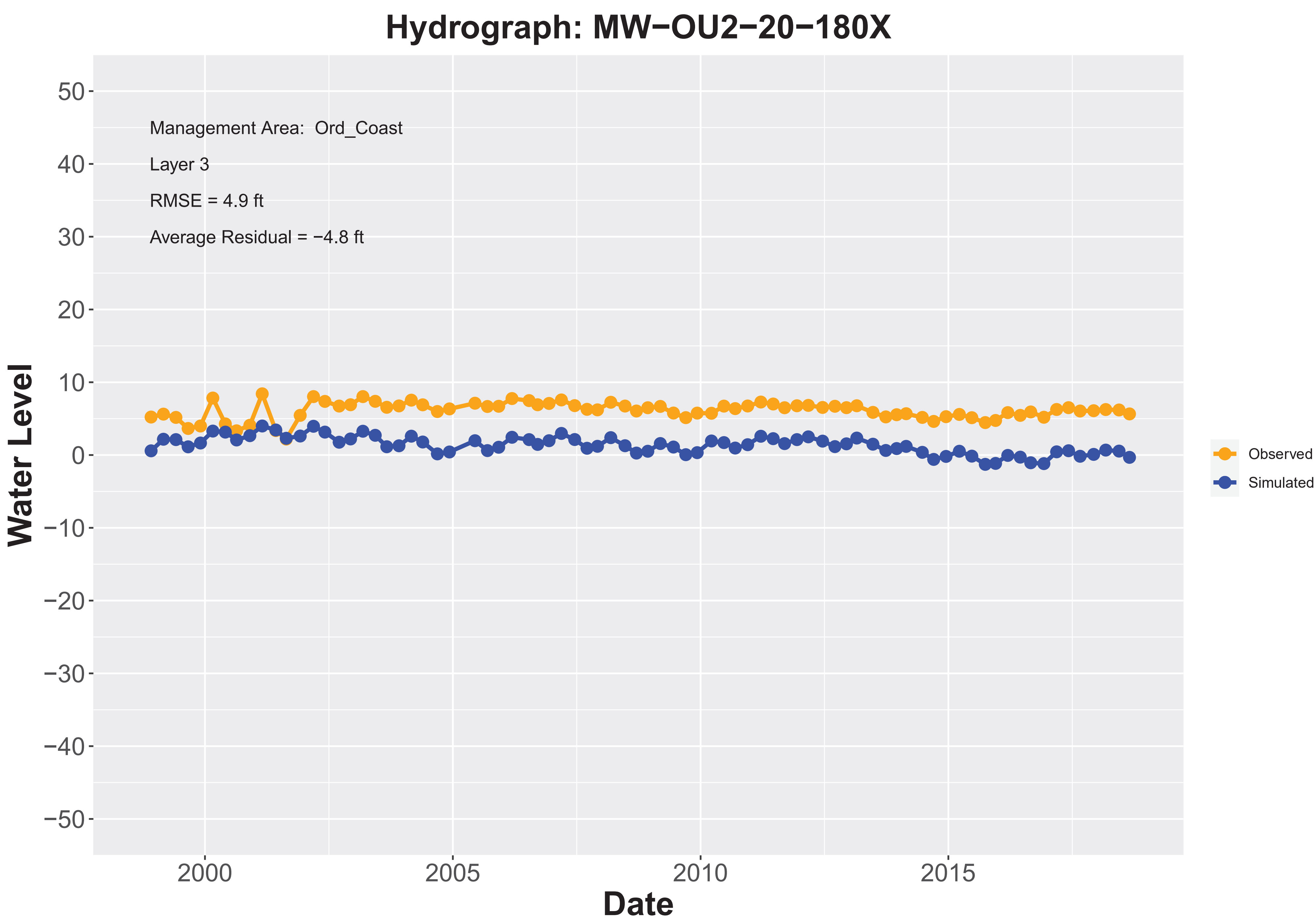
Hydrograph: MW−OU2−12−A
Management Area: Ord_Coast
Layer 1
RMSE = 2.8 ft
Average Residual = 0.96 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

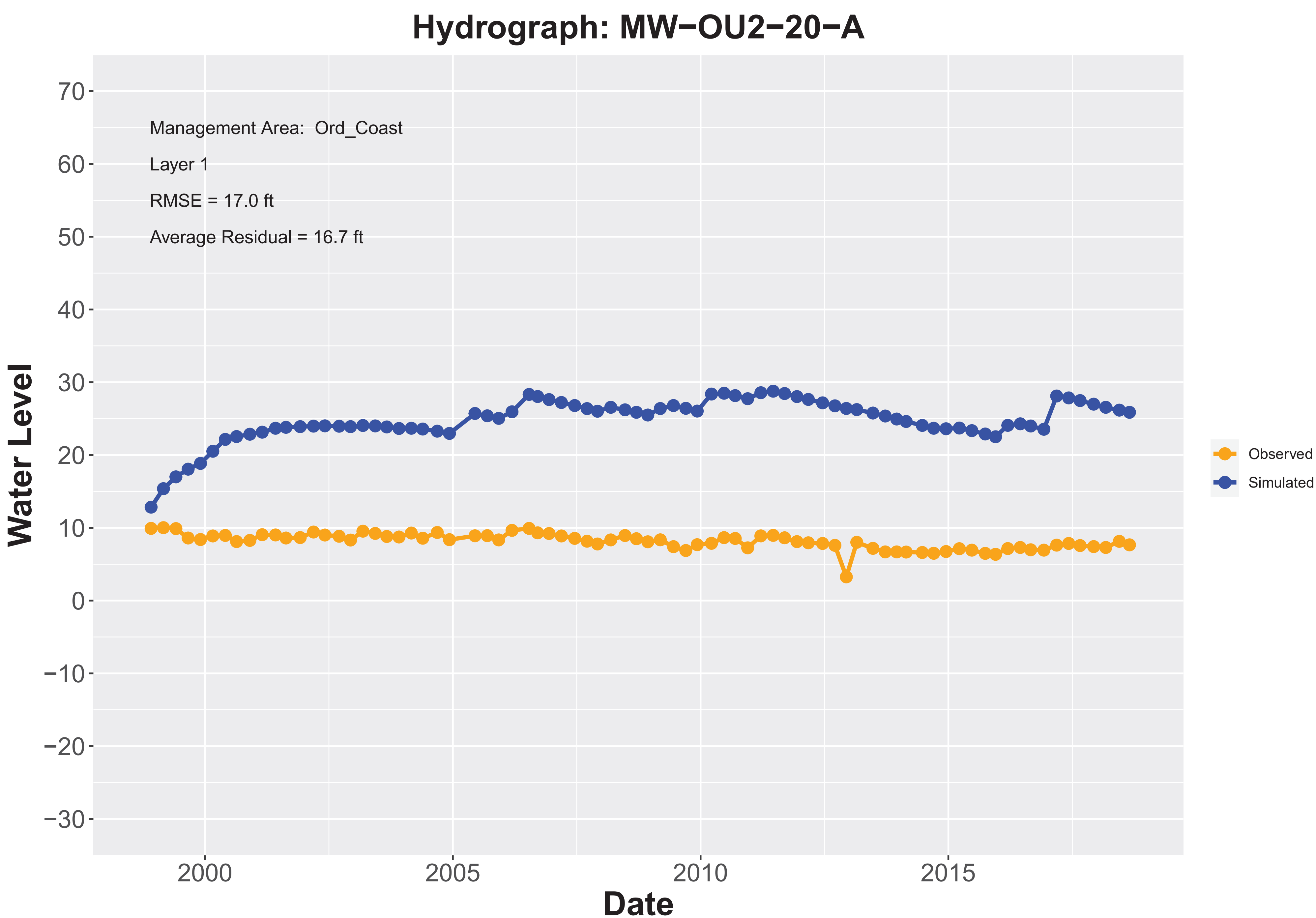


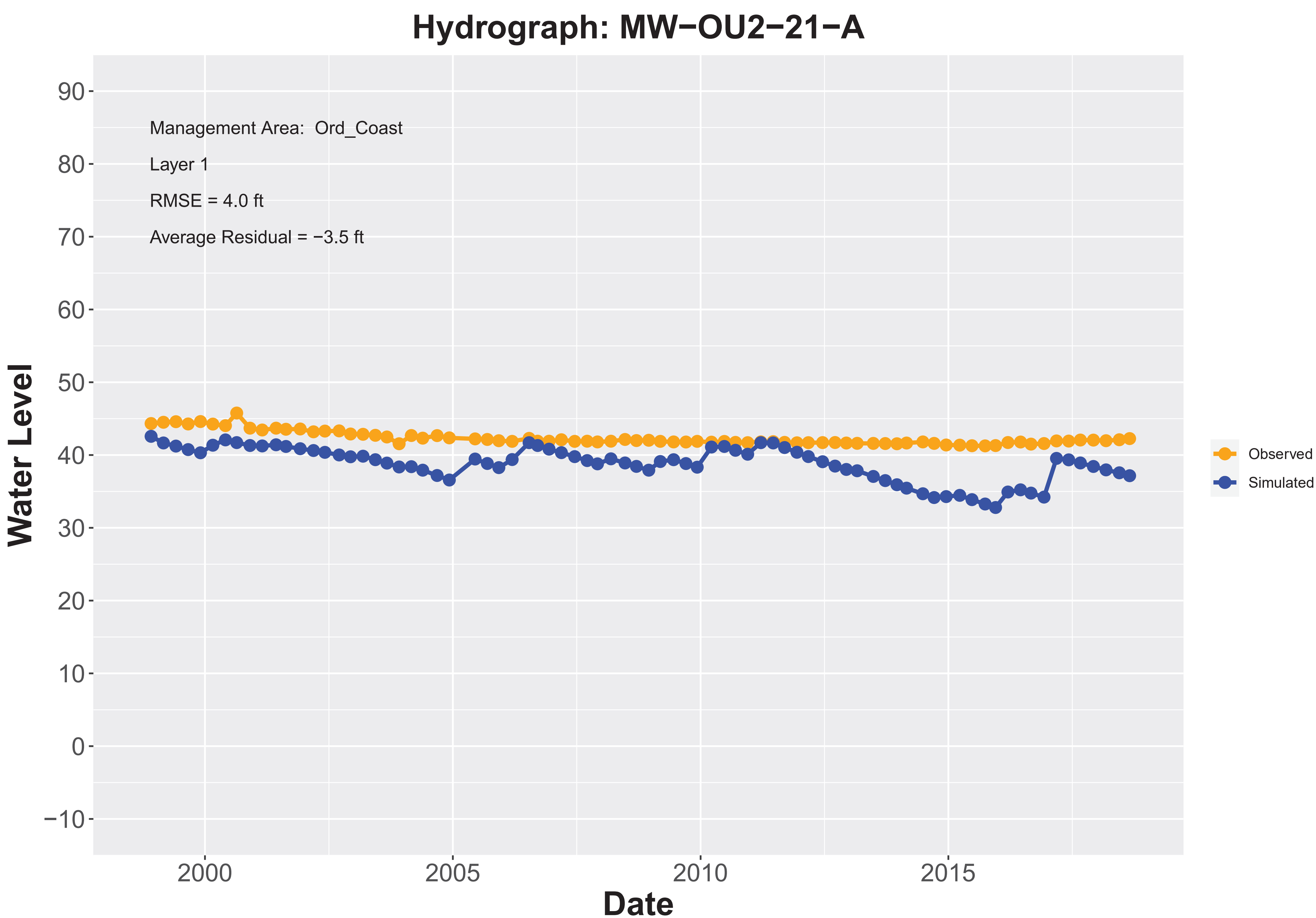
Hydrograph: MW−OU2−13−A
Management Area: Ord_Central
Layer 1
RMSE = 9.6 ft
Average Residual = −2.8 ft
Water Level
140
130
120
110
100
90
80
70
60
50
40
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−OU2−20−180

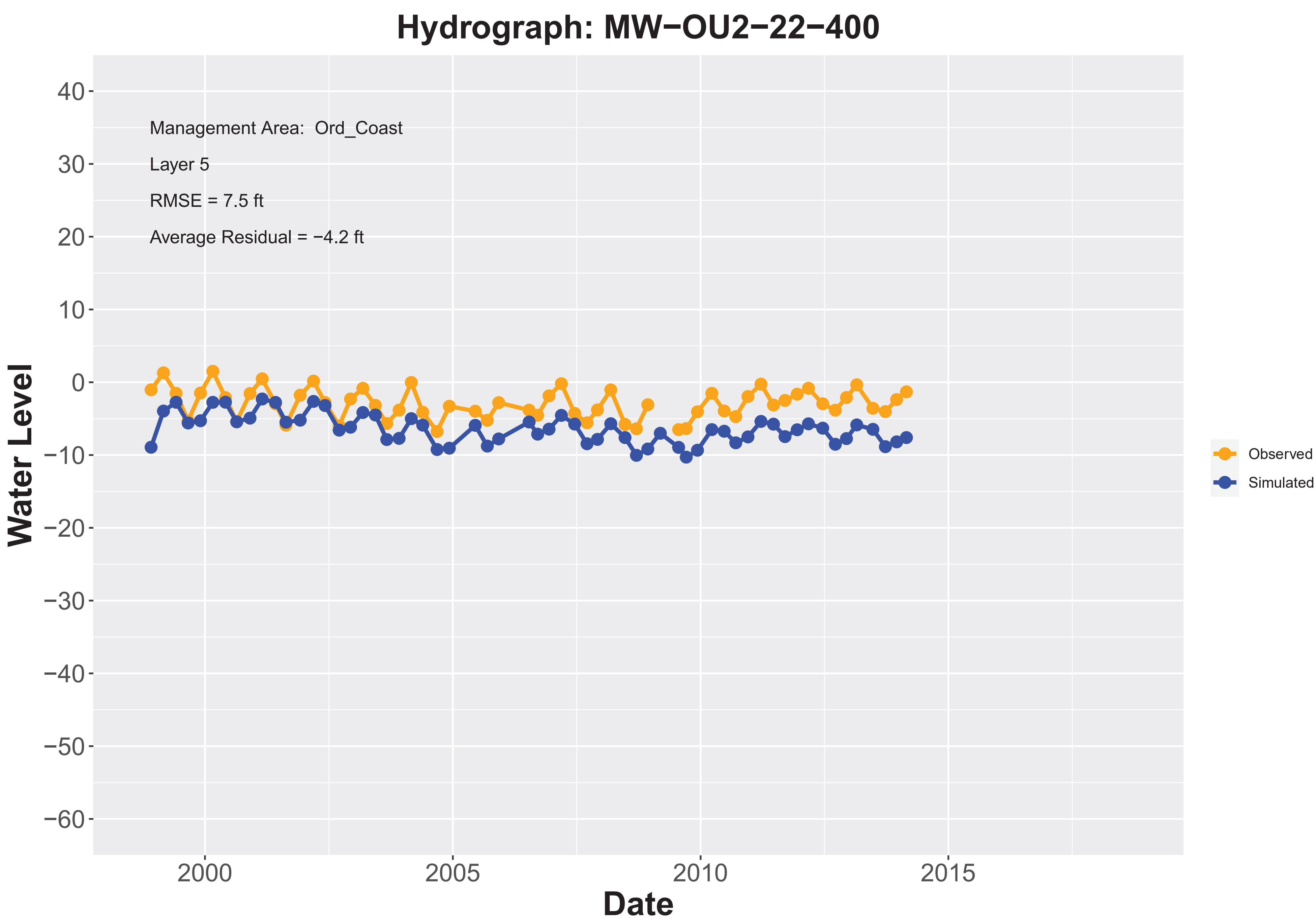


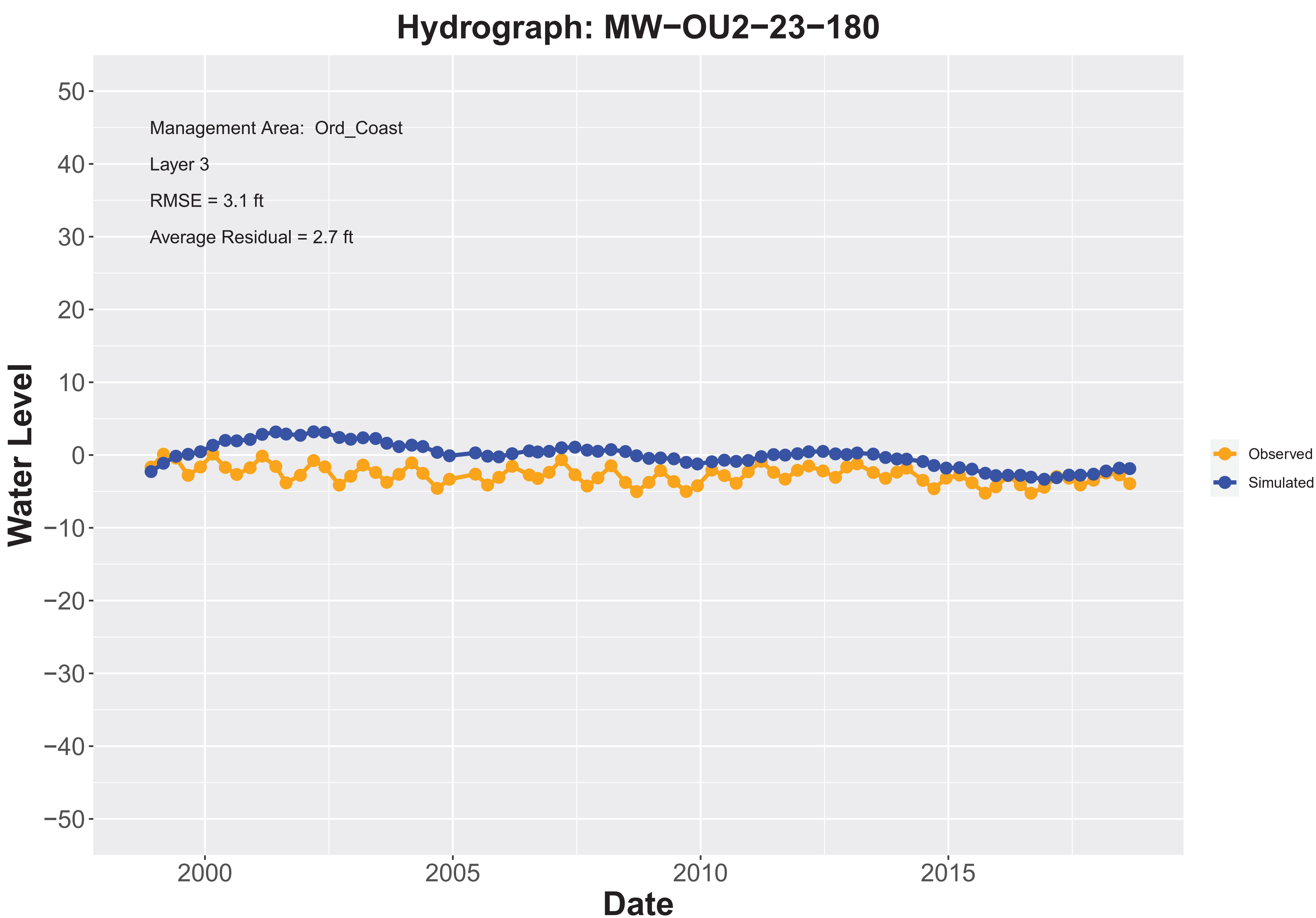

Hydrograph: MW−OU2−20−180X
Management Area: Ord_Coast
Layer 3
RMSE = 4.9 ft
Average Residual = −4.8 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU2−20−A
Management Area: Ord_Coast
Layer 1
RMSE = 17.0 ft
Average Residual = 16.7 ft
Water Level
70
60
50
40
30
20
10
0
−10
−20
−30
2000
2005
2010
2015
Date
Observed
Simulated

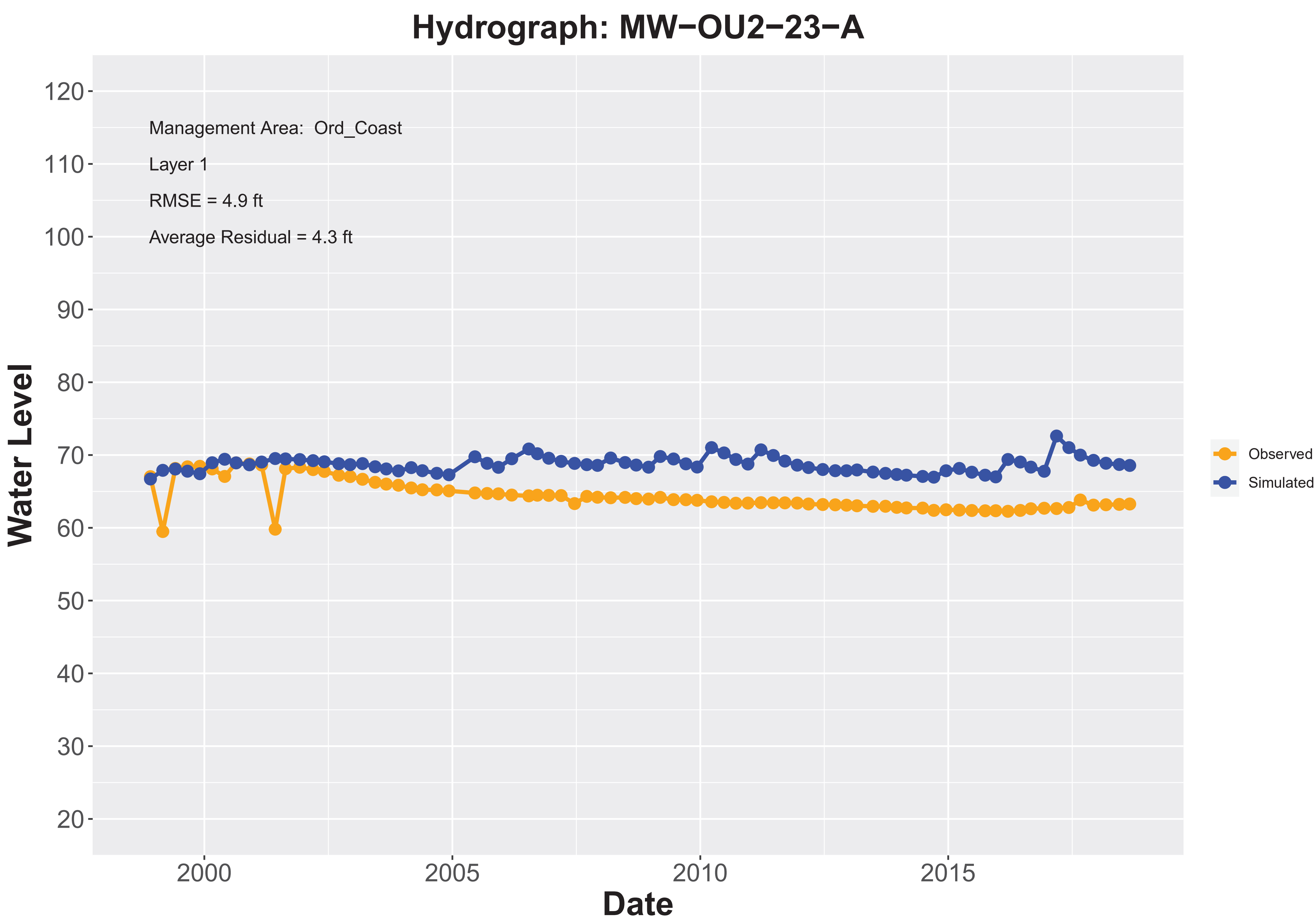


Hydrograph: MW−OU2−21−A
Management Area: Ord_Coast
Layer 1
RMSE = 4.0 ft
Average Residual = −3.5 ft
Water Level
90
80
70
60
50
40
30
20
10
0
−10
2000
2005
2010
2015
Date
Observed
Simulated

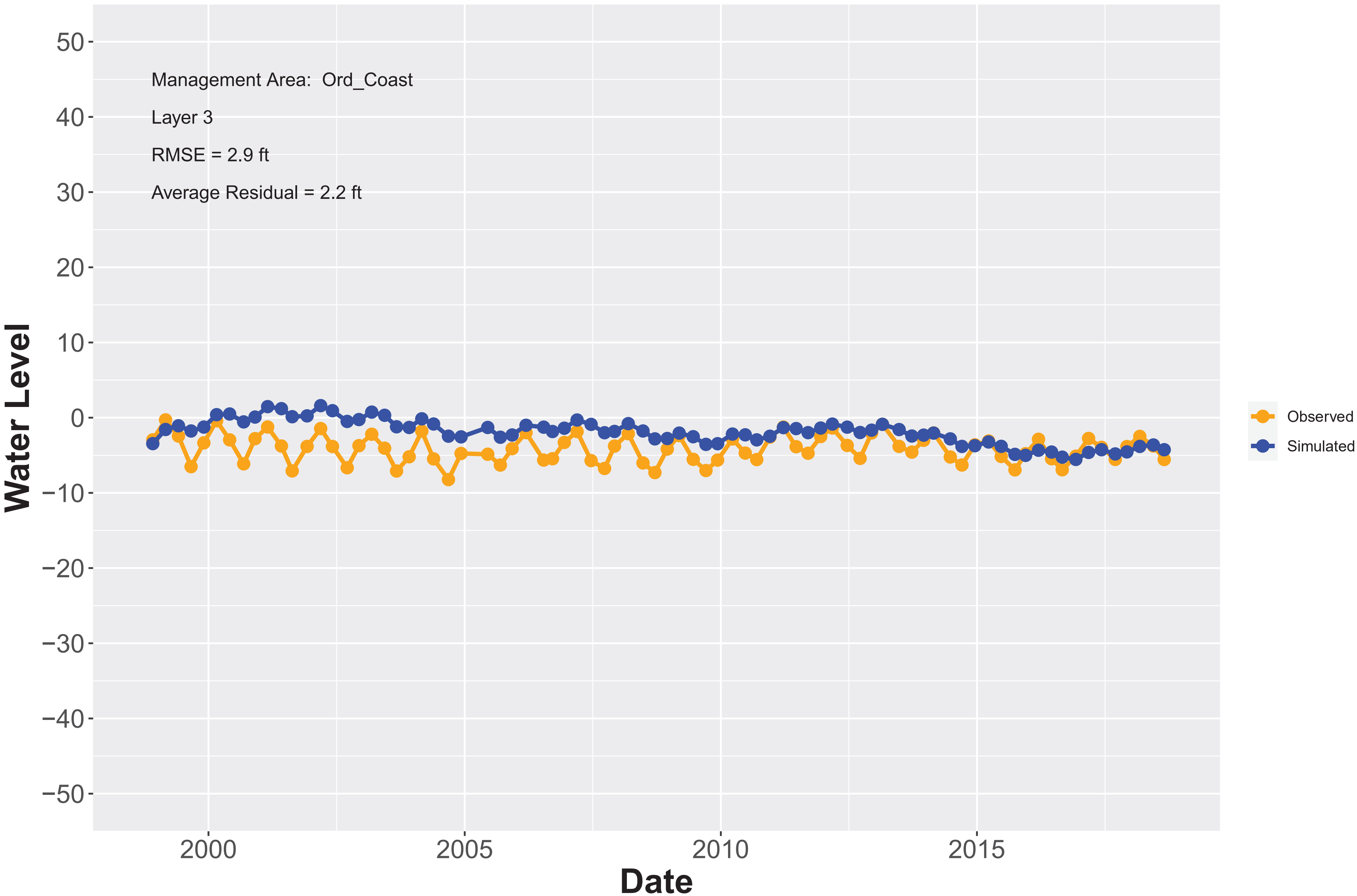

Hydrograph: MW−OU2−22−400
Management Area: Ord_Coast
Layer 5
RMSE = 7.5 ft
Average Residual = −4.2 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

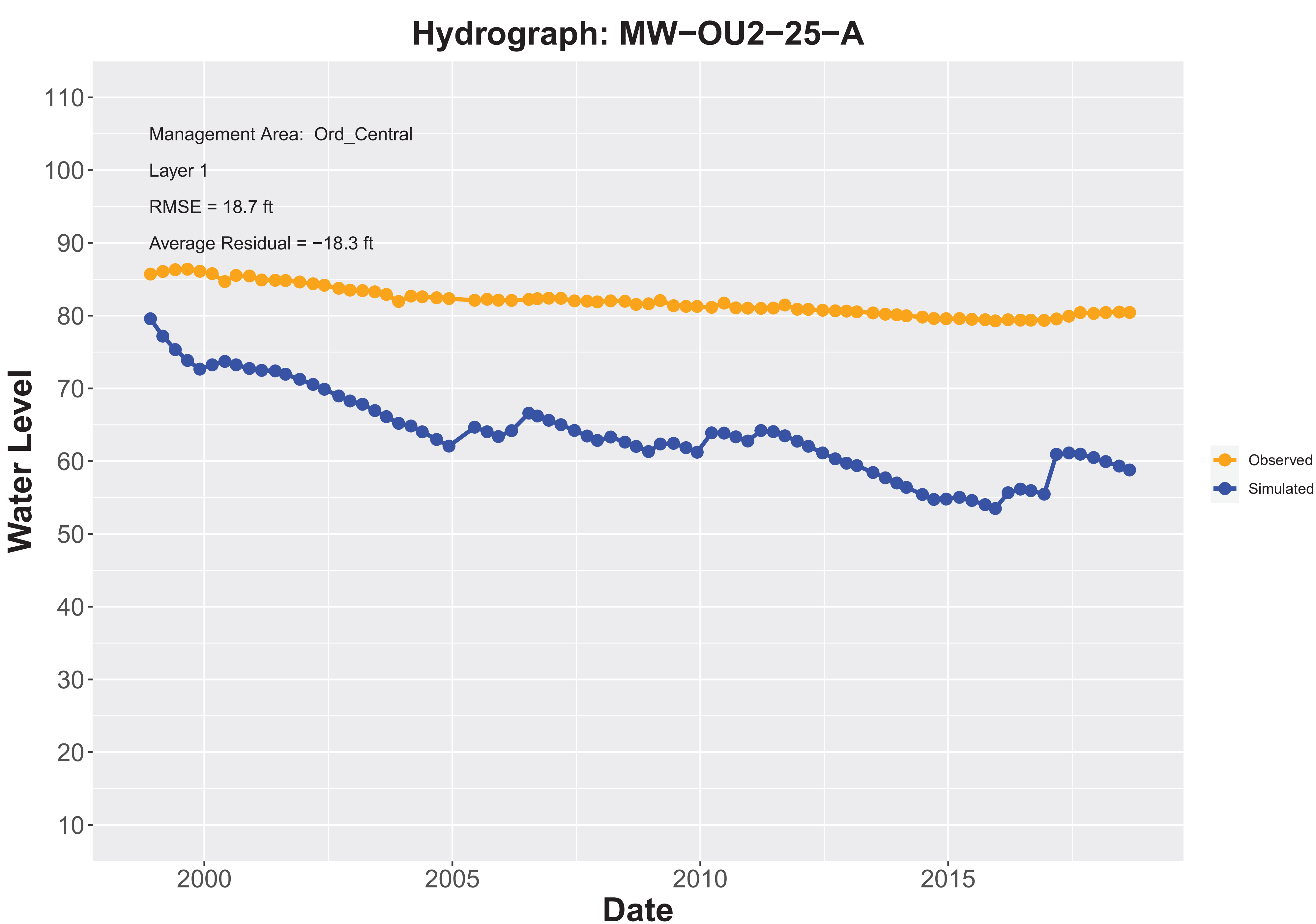


Hydrograph: MW−OU2−23−180
Management Area: Ord_Coast
Layer 3
RMSE = 3.1 ft
Average Residual = 2.7 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU2−23−A
Management Area: Ord_Coast
Layer 1
RMSE = 4.9 ft
Average Residual = 4.3 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated

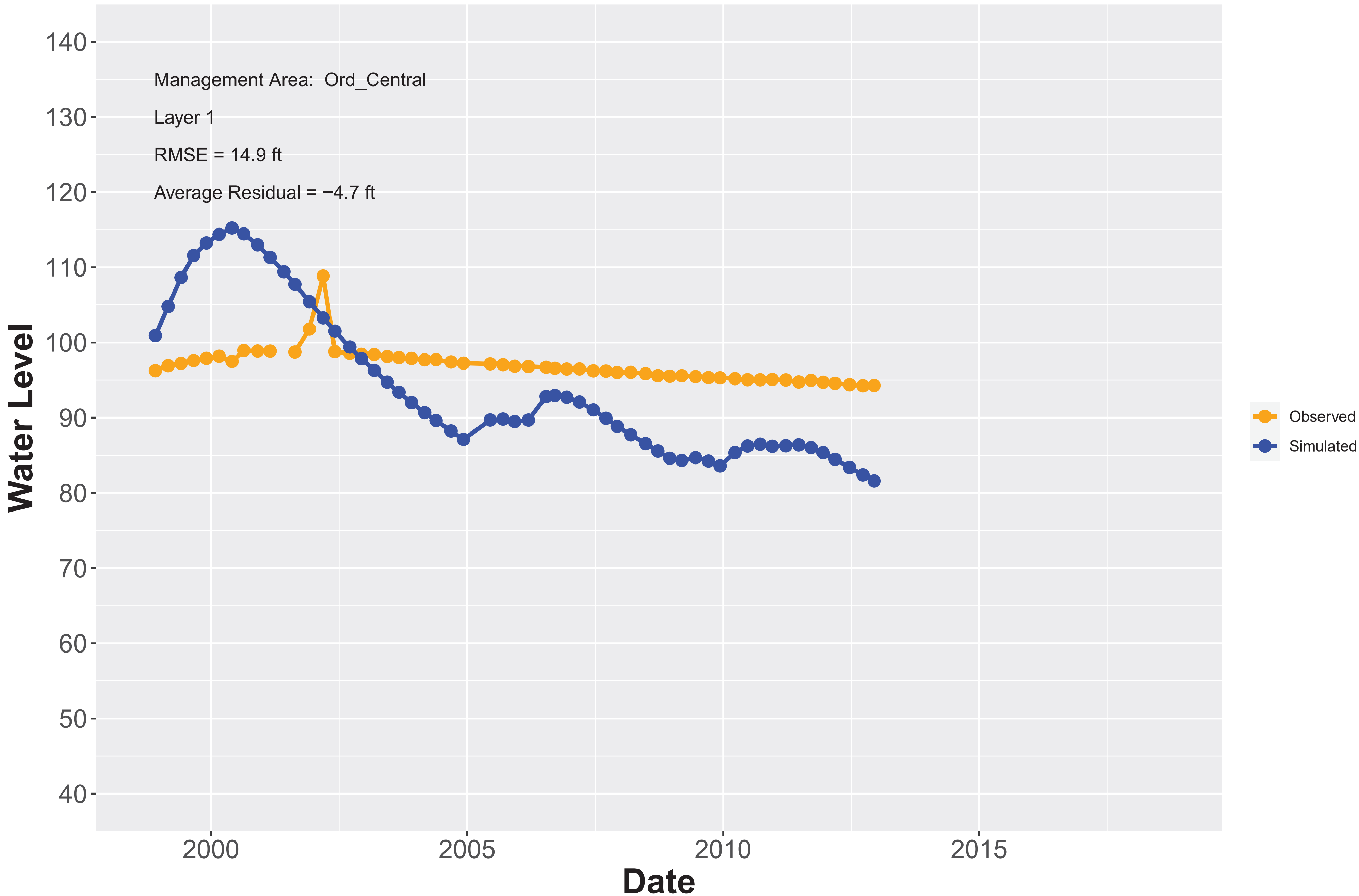
Hydrograph: MW−OU2−24−180



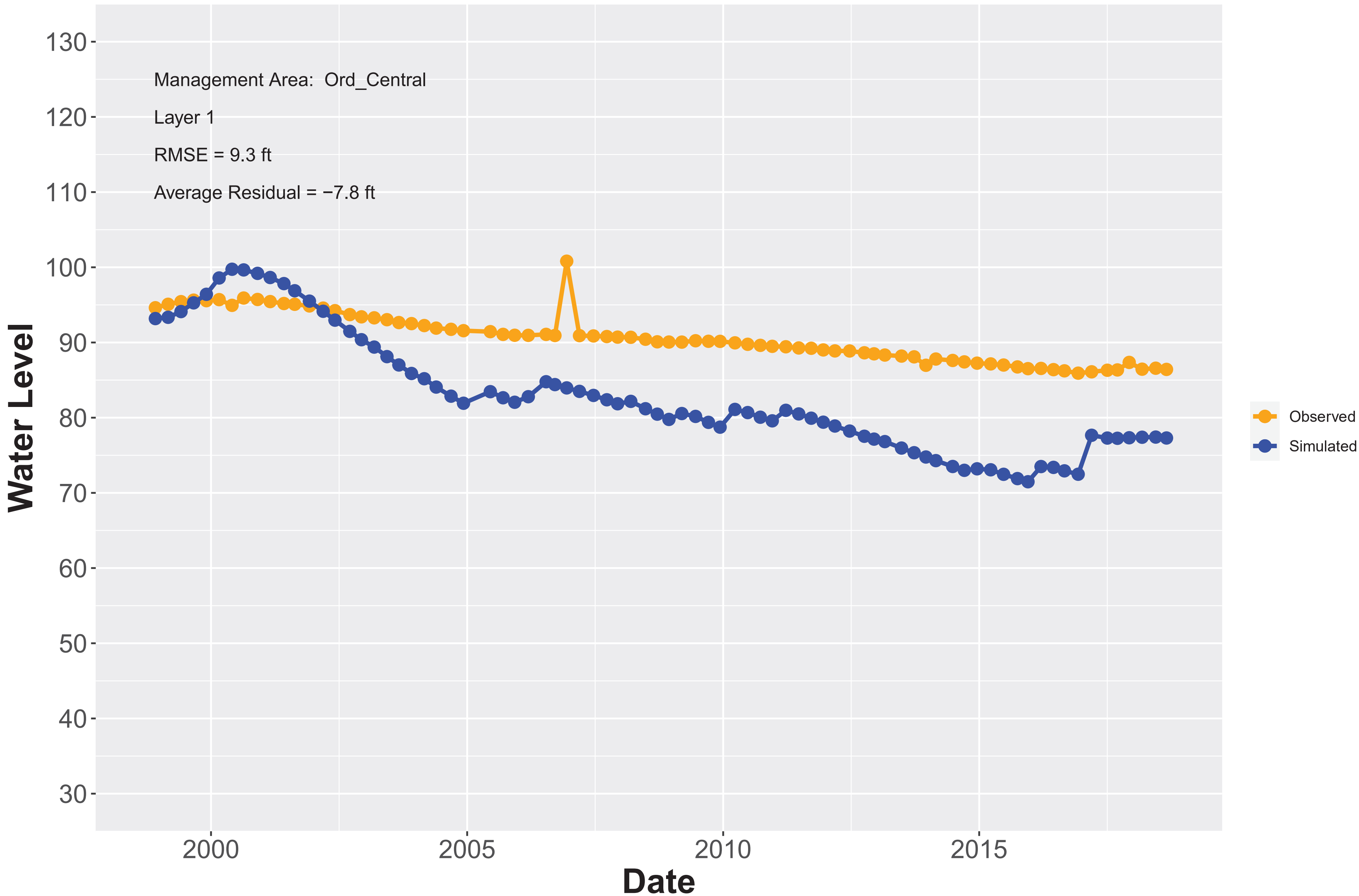


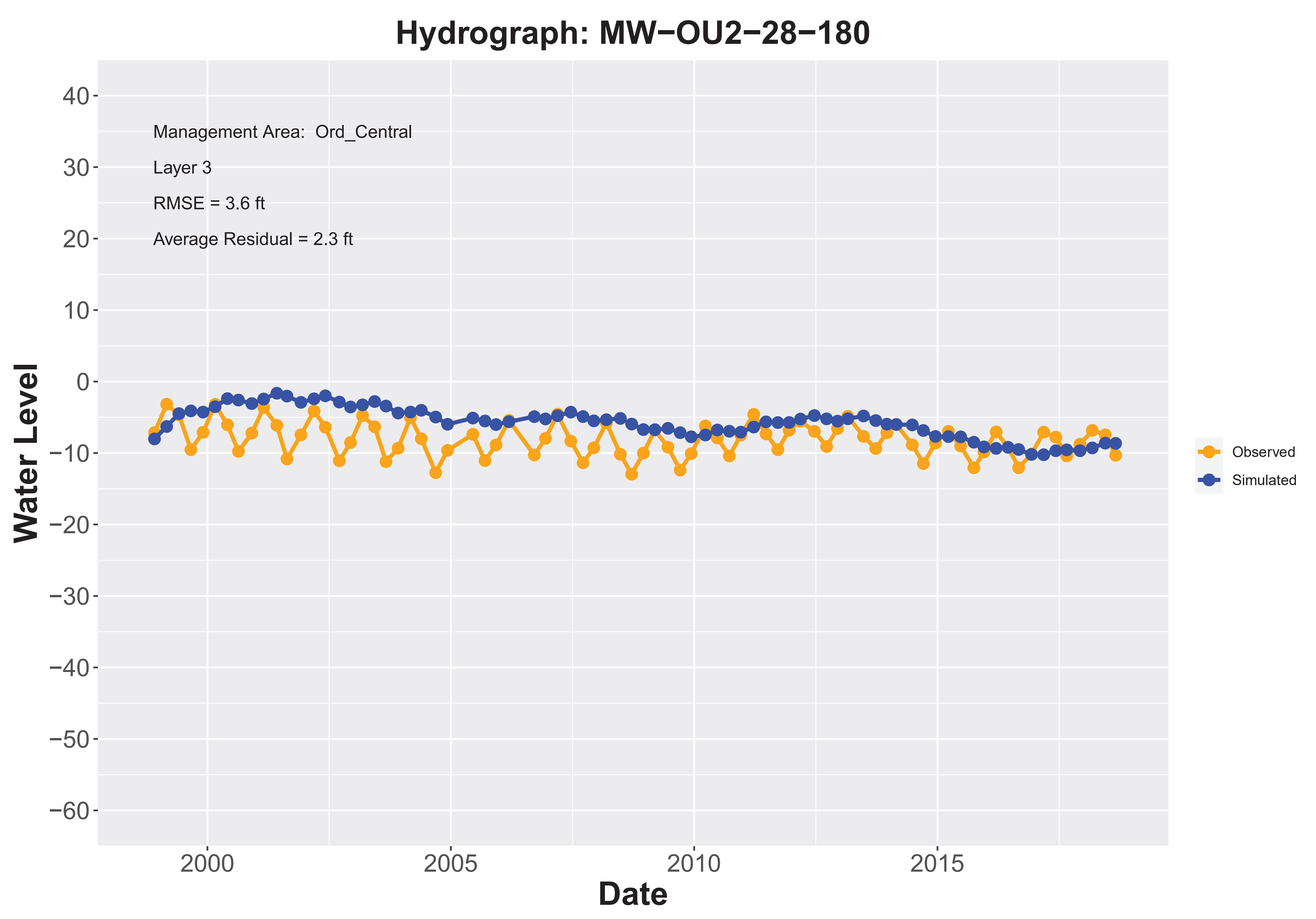
Hydrograph: MW−OU2−25−A
Management Area: Ord_Central
Layer 1
RMSE = 18.7 ft
Average Residual = −18.3 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

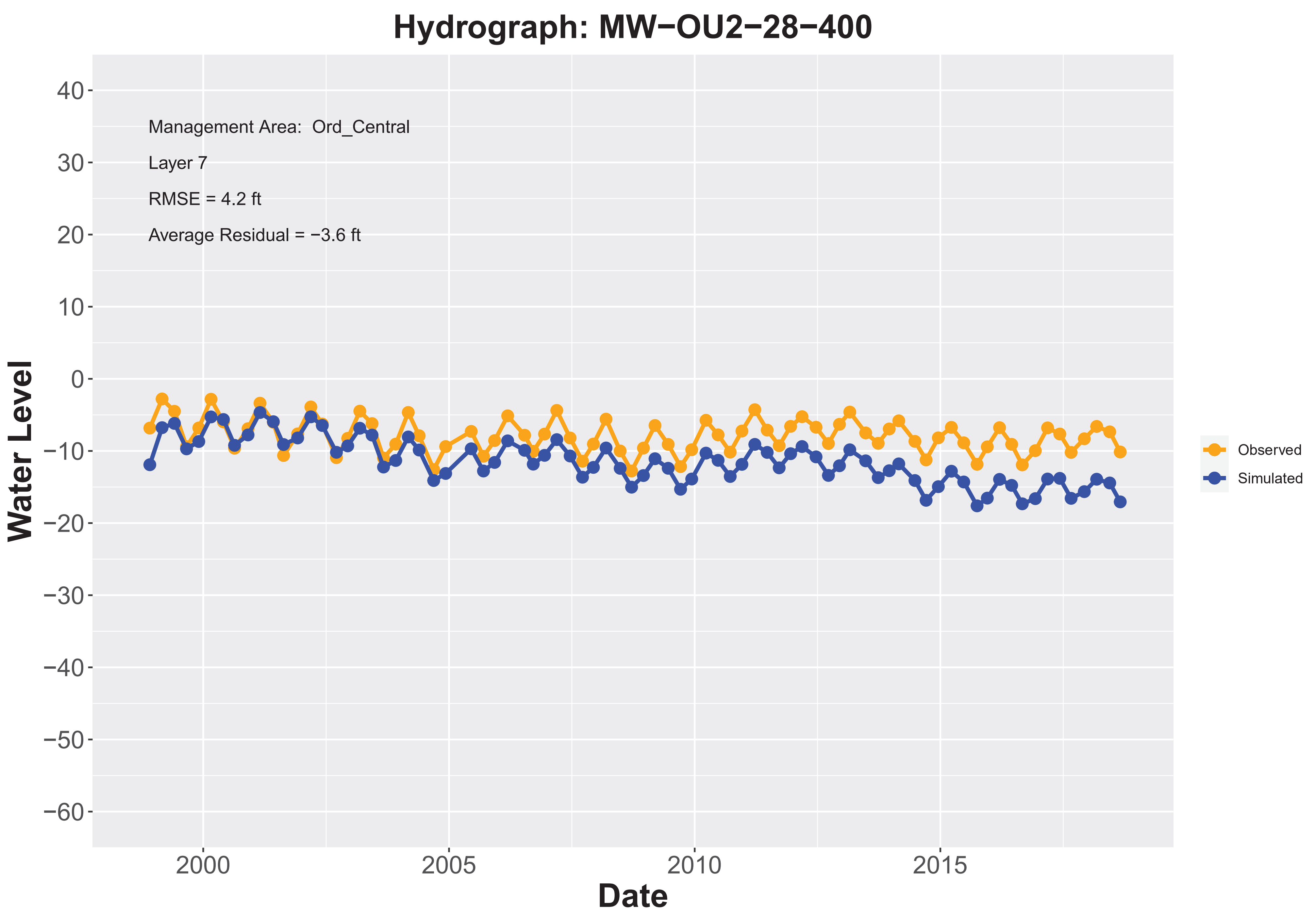
Hydrograph: MW−OU2−26−A



Hydrograph: MW−OU2−27−A

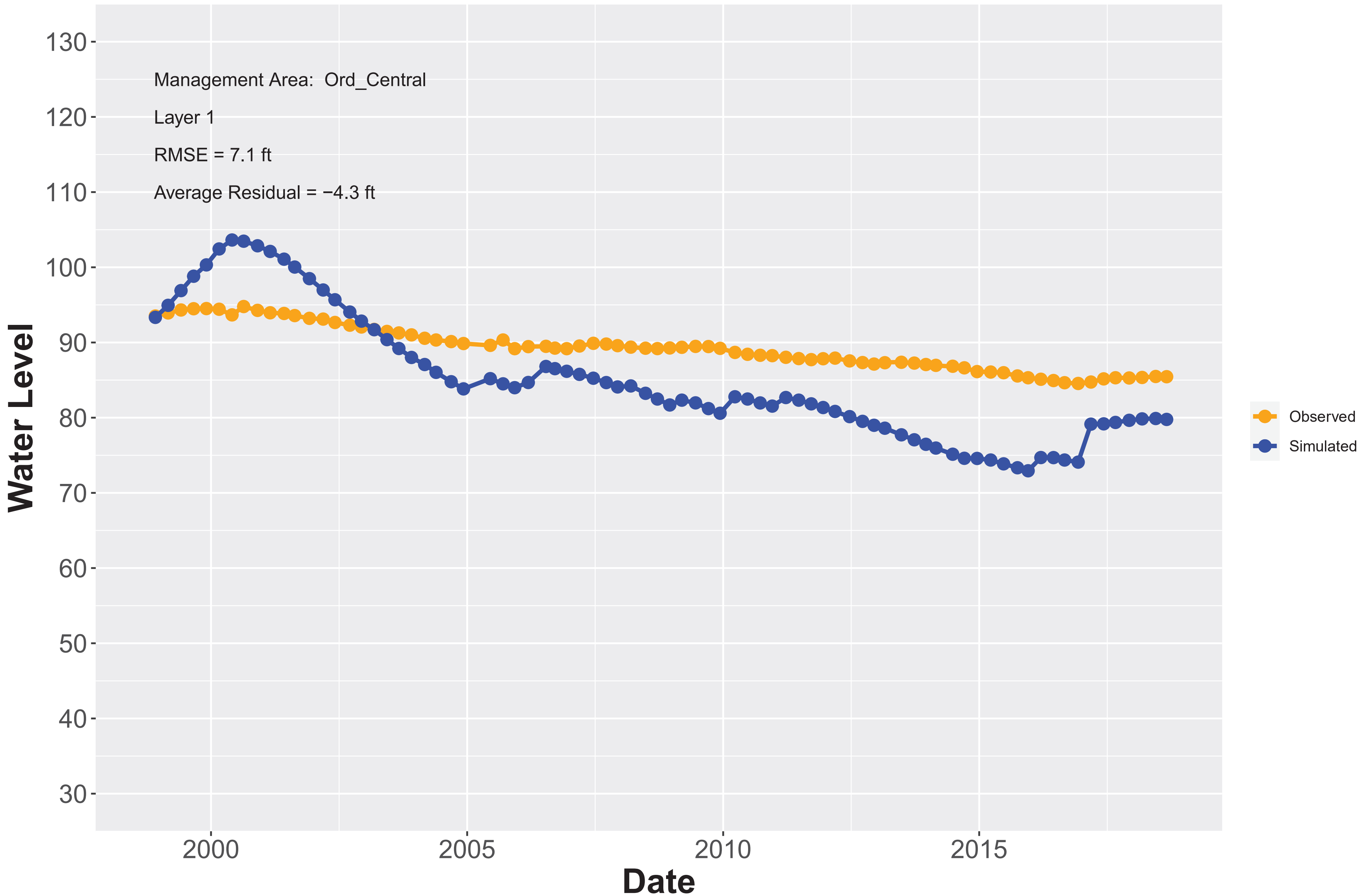


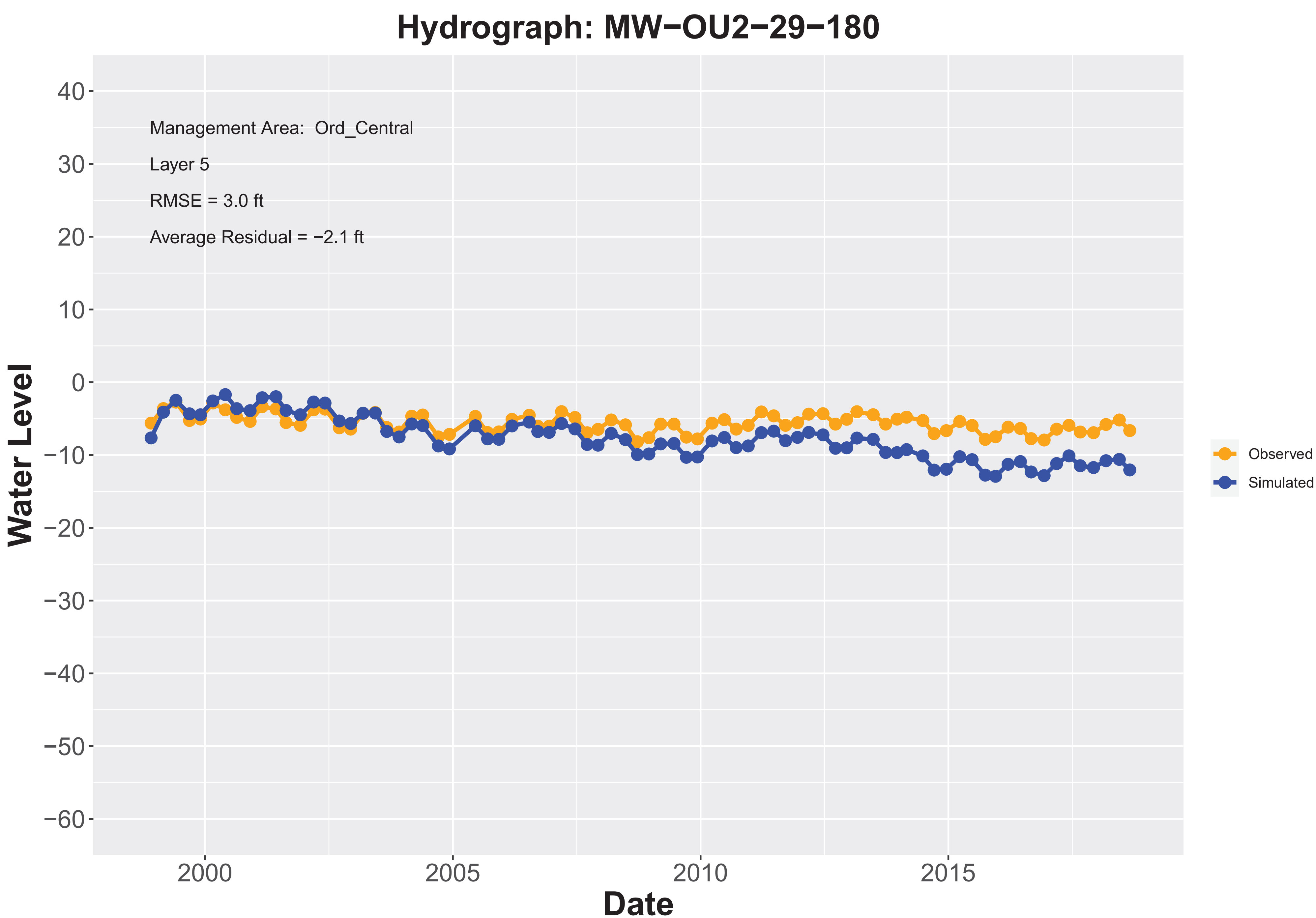

Hydrograph: MW−OU2−28−180
Management Area: Ord_Central
Layer 3
RMSE = 3.6 ft
Average Residual = 2.3 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated



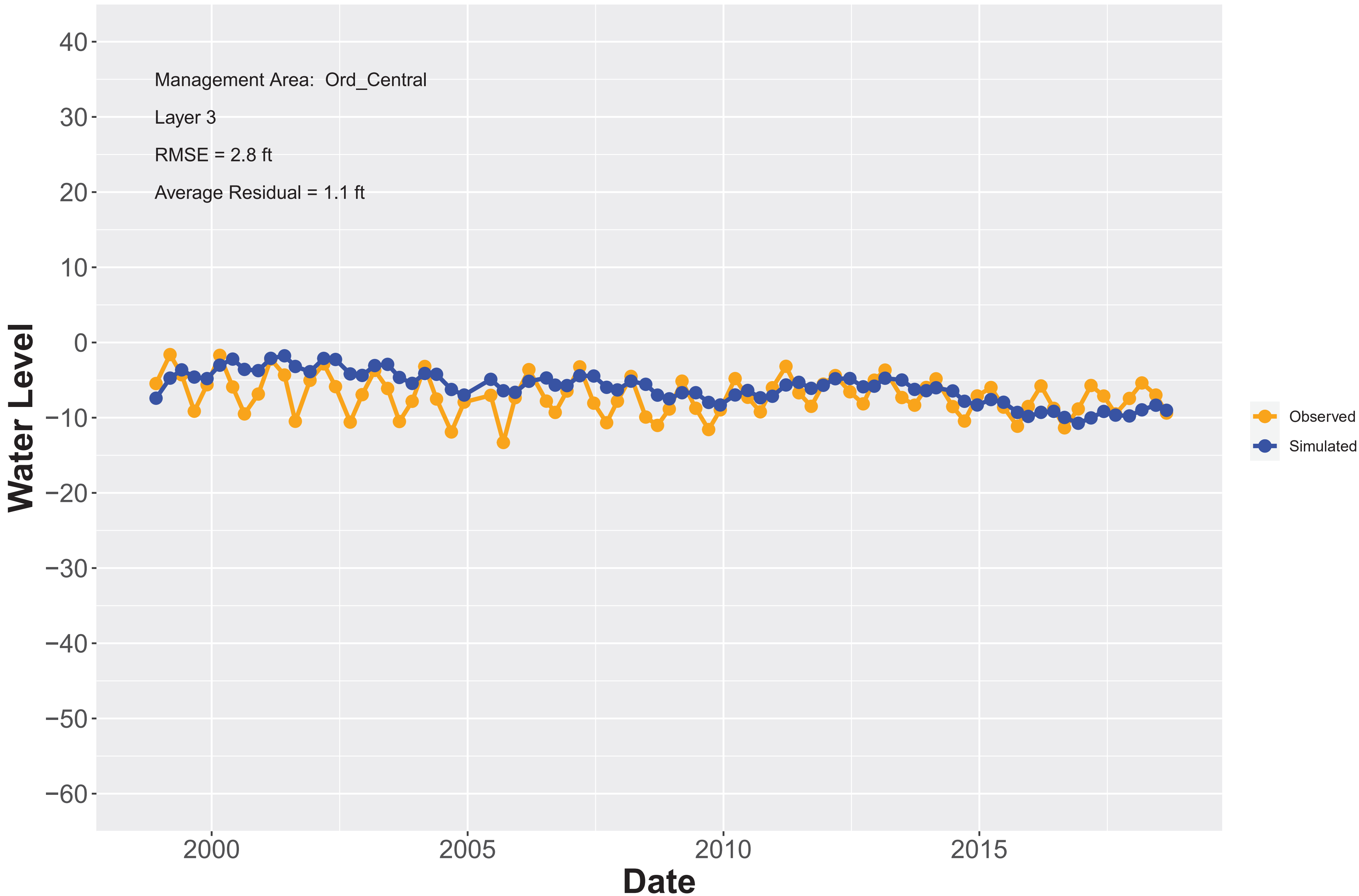
Hydrograph: MW−OU2−28−400
Management Area: Ord_Central
Layer 7
RMSE = 4.2 ft
Average Residual = −3.6 ft
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Water Level
2000
2005
2010
2015
Date
Observed
Simulated

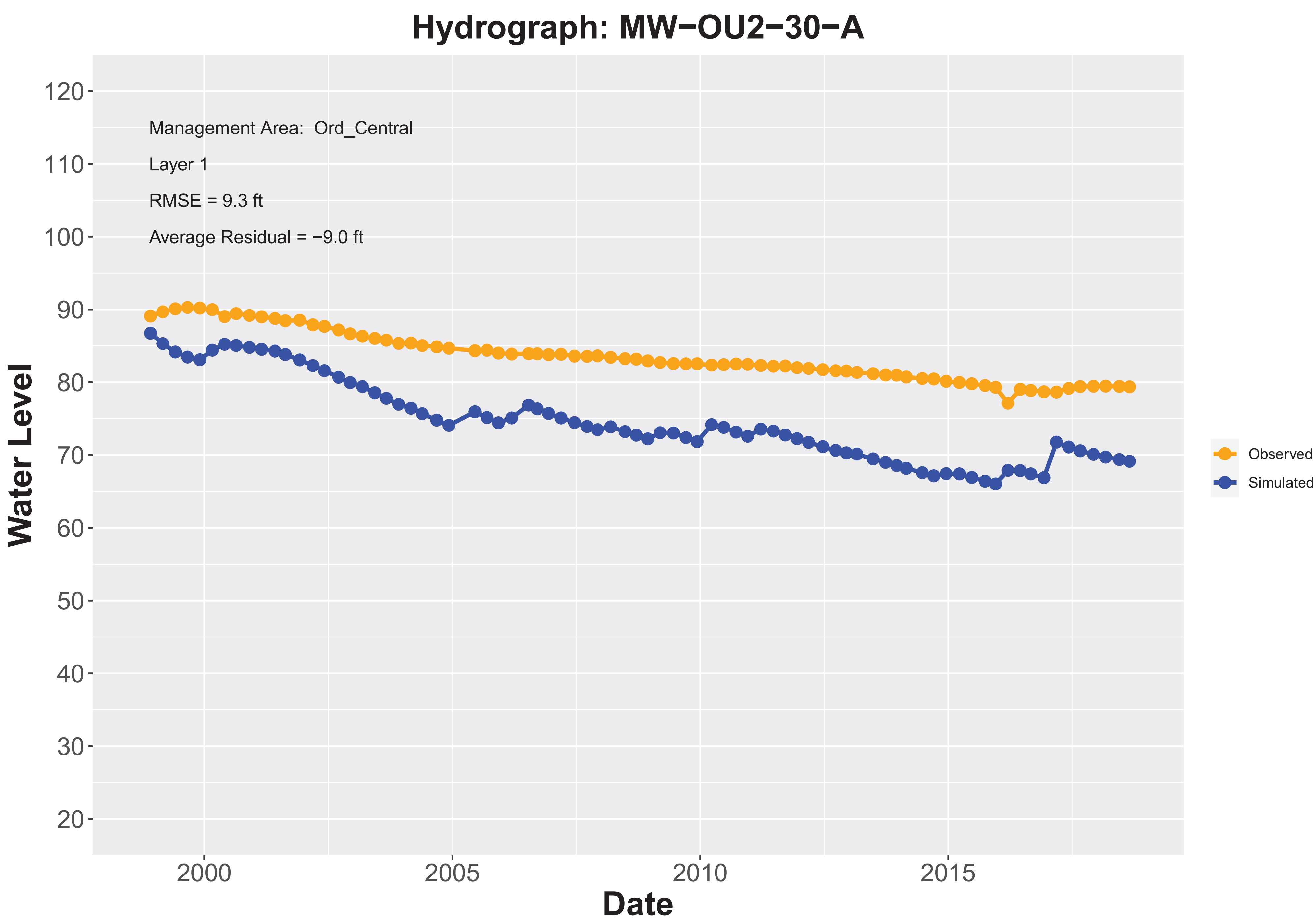
Hydrograph: MW−OU2−28−A



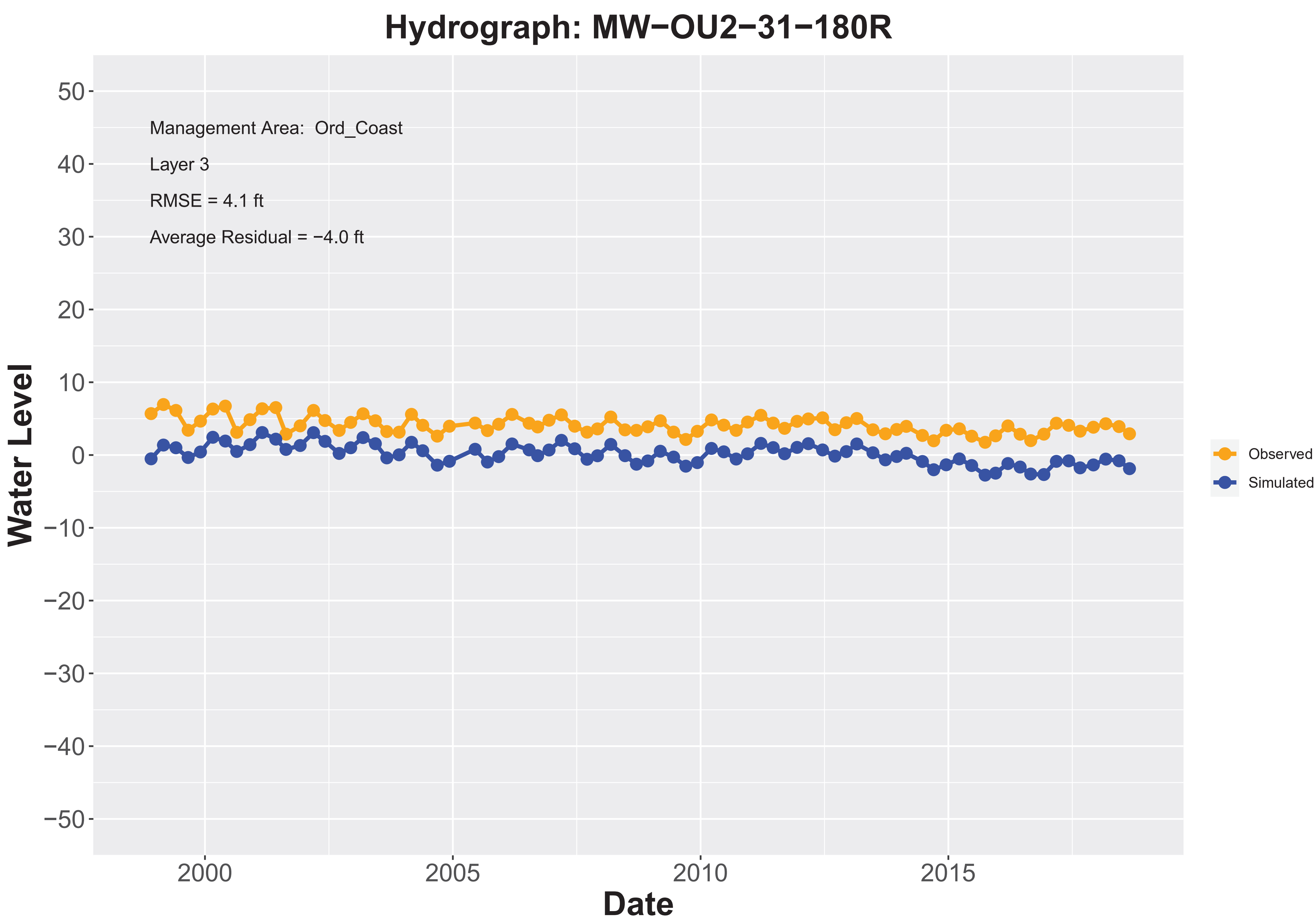

Hydrograph: MW−OU2−29−180
Management Area: Ord_Central
Layer 5
RMSE = 3.0 ft
Average Residual = −2.1 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

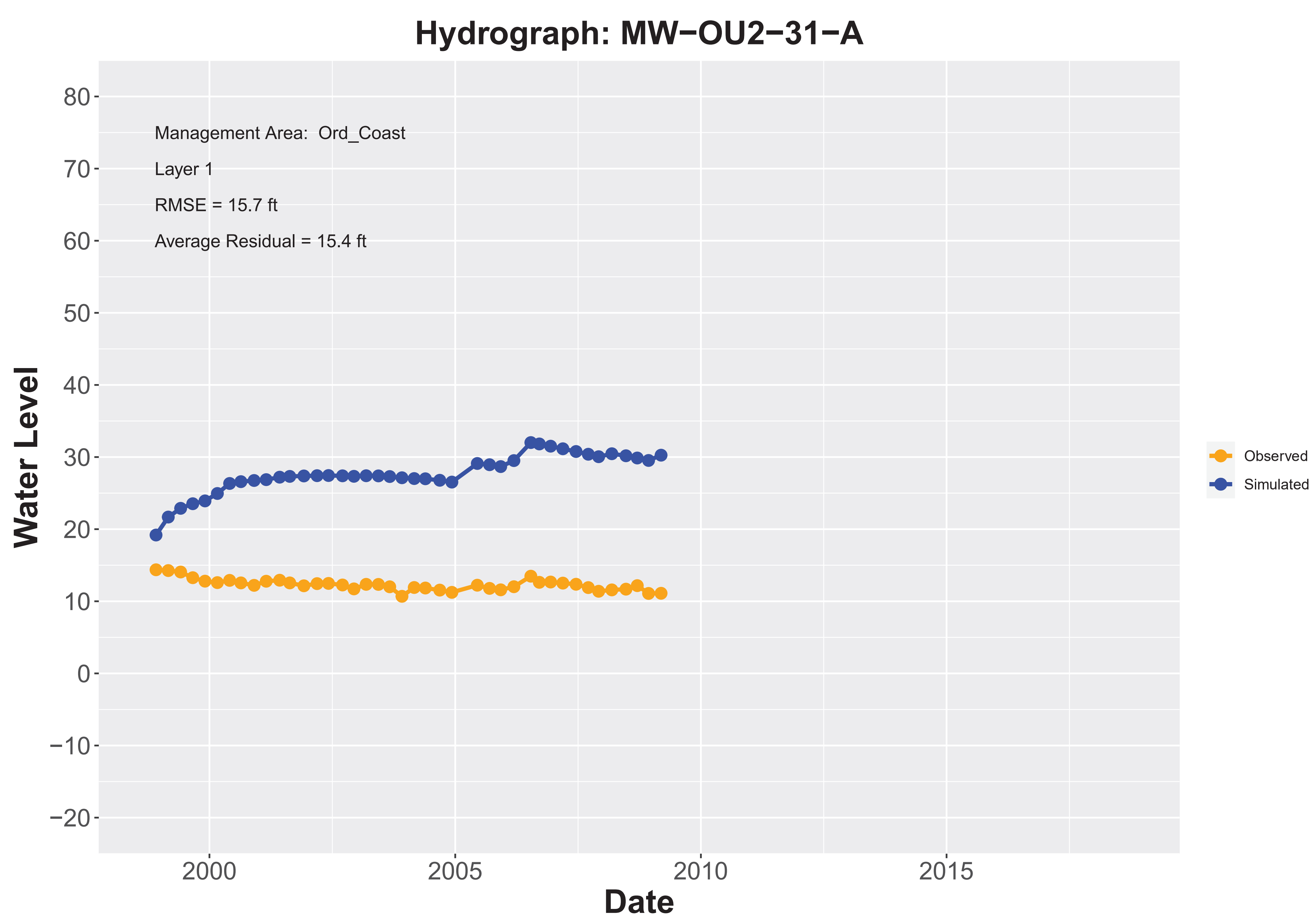
Hydrograph: MW−OU2−30−180

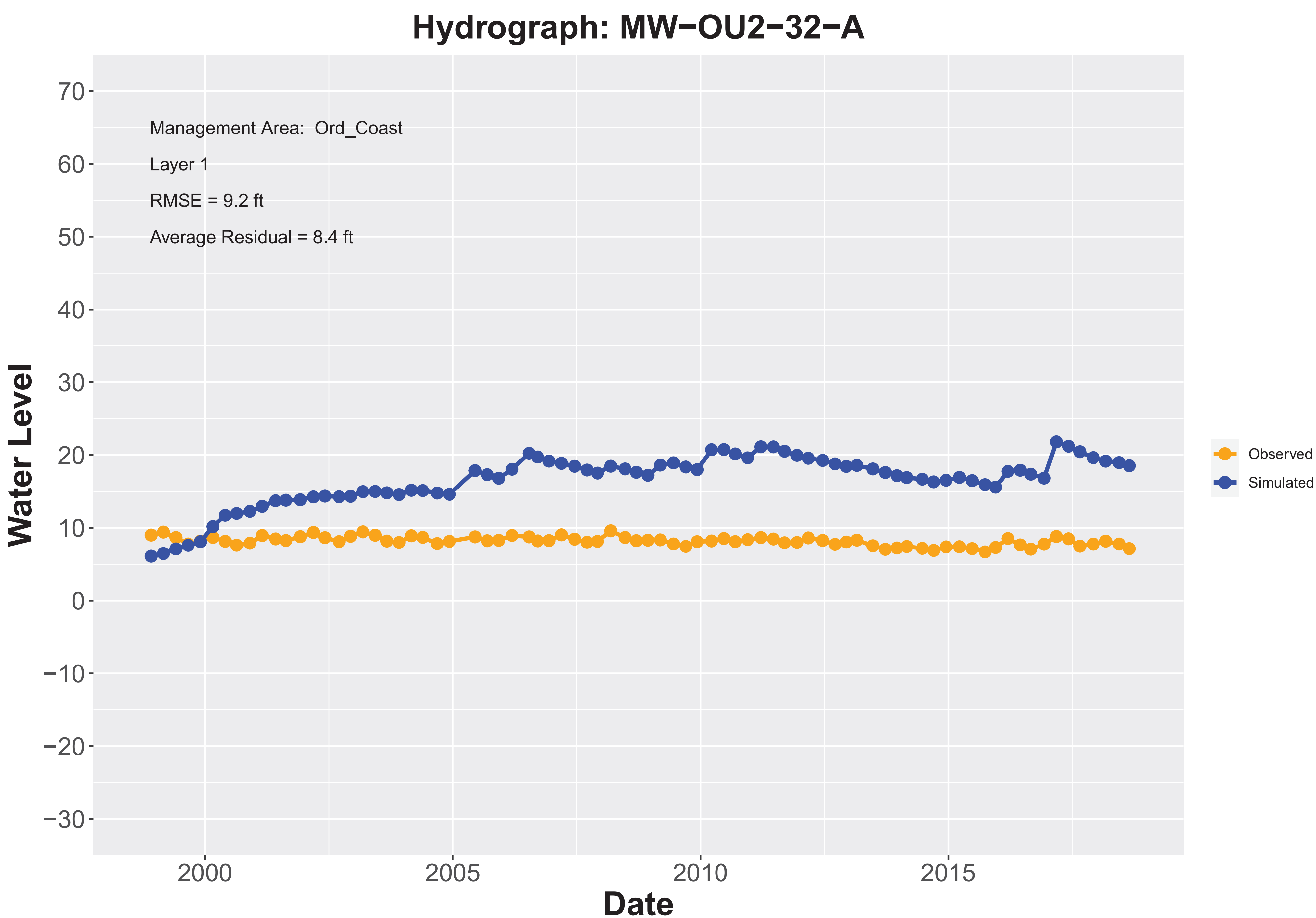




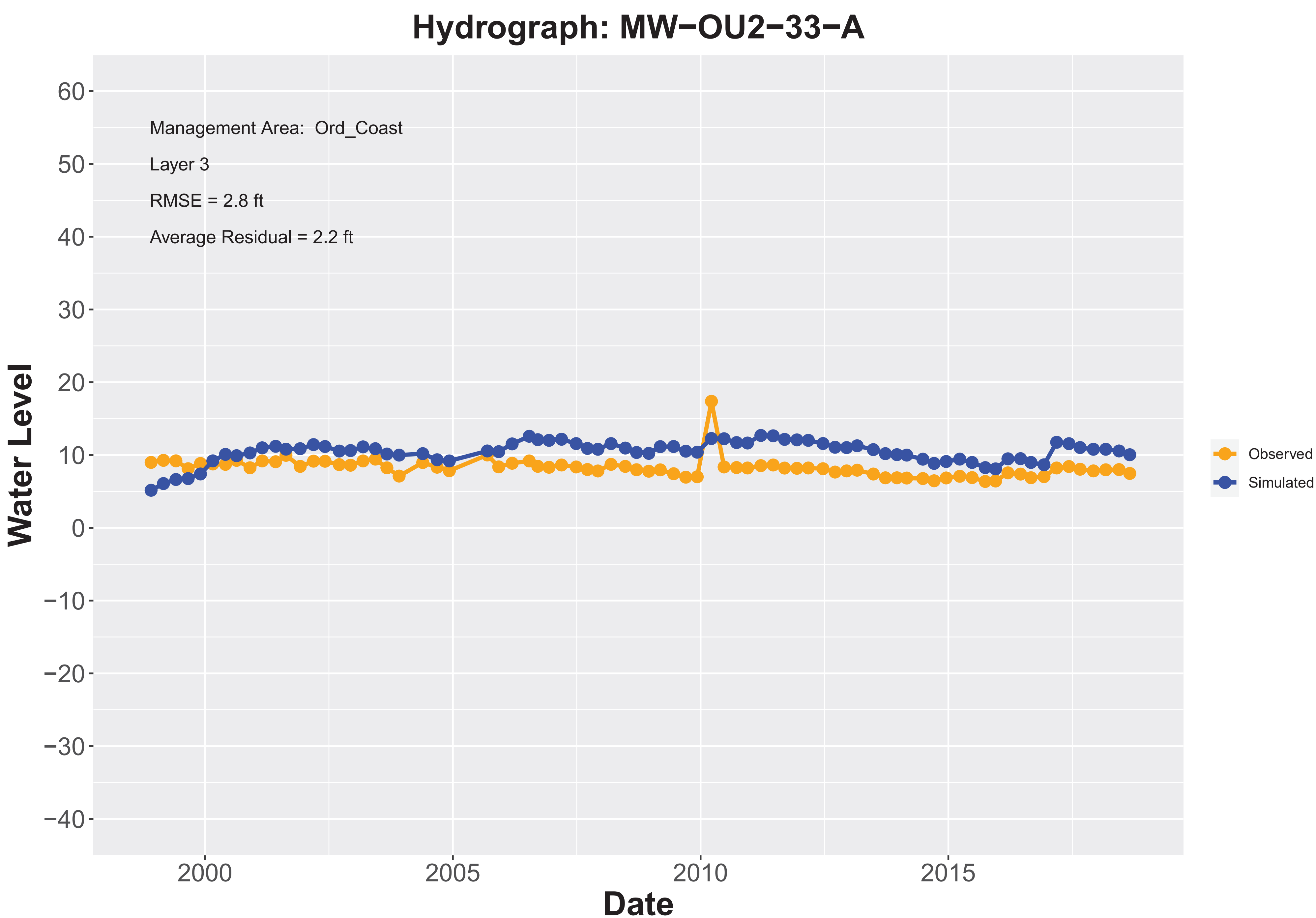
Hydrograph: MW−OU2−30−A
Management Area: Ord_Central
Layer 1
RMSE = 9.3 ft
Average Residual = −9.0 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU2−31−180R
Management Area: Ord_Coast
Layer 3
RMSE = 4.1 ft
Average Residual = −4.0 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
Date
2000
2005
2010
2015
Observed
Simulated

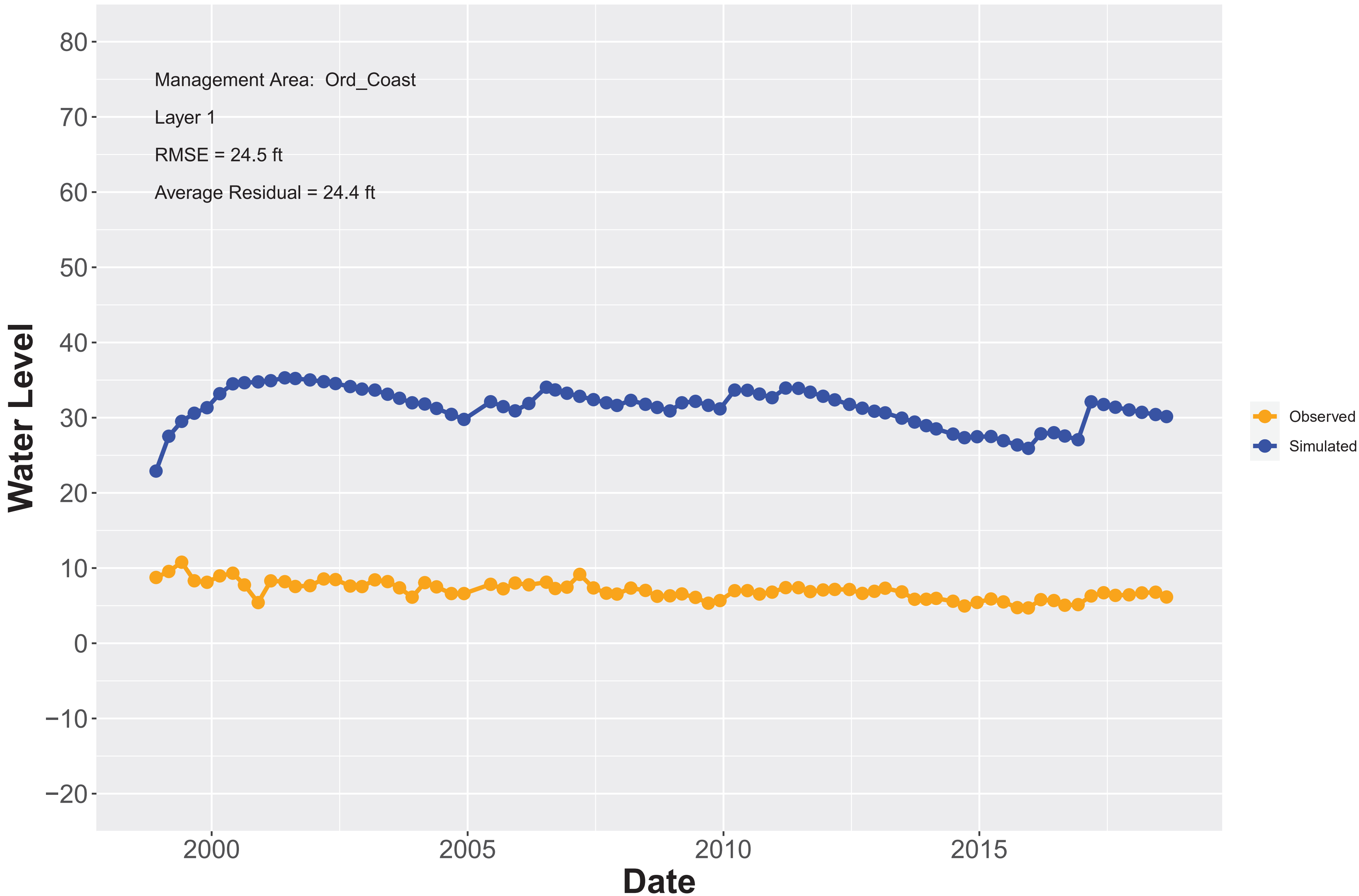

Hydrograph: MW−OU2−31−A
Management Area: Ord_Coast
Layer 1
RMSE = 15.7 ft
Average Residual = 15.4 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated

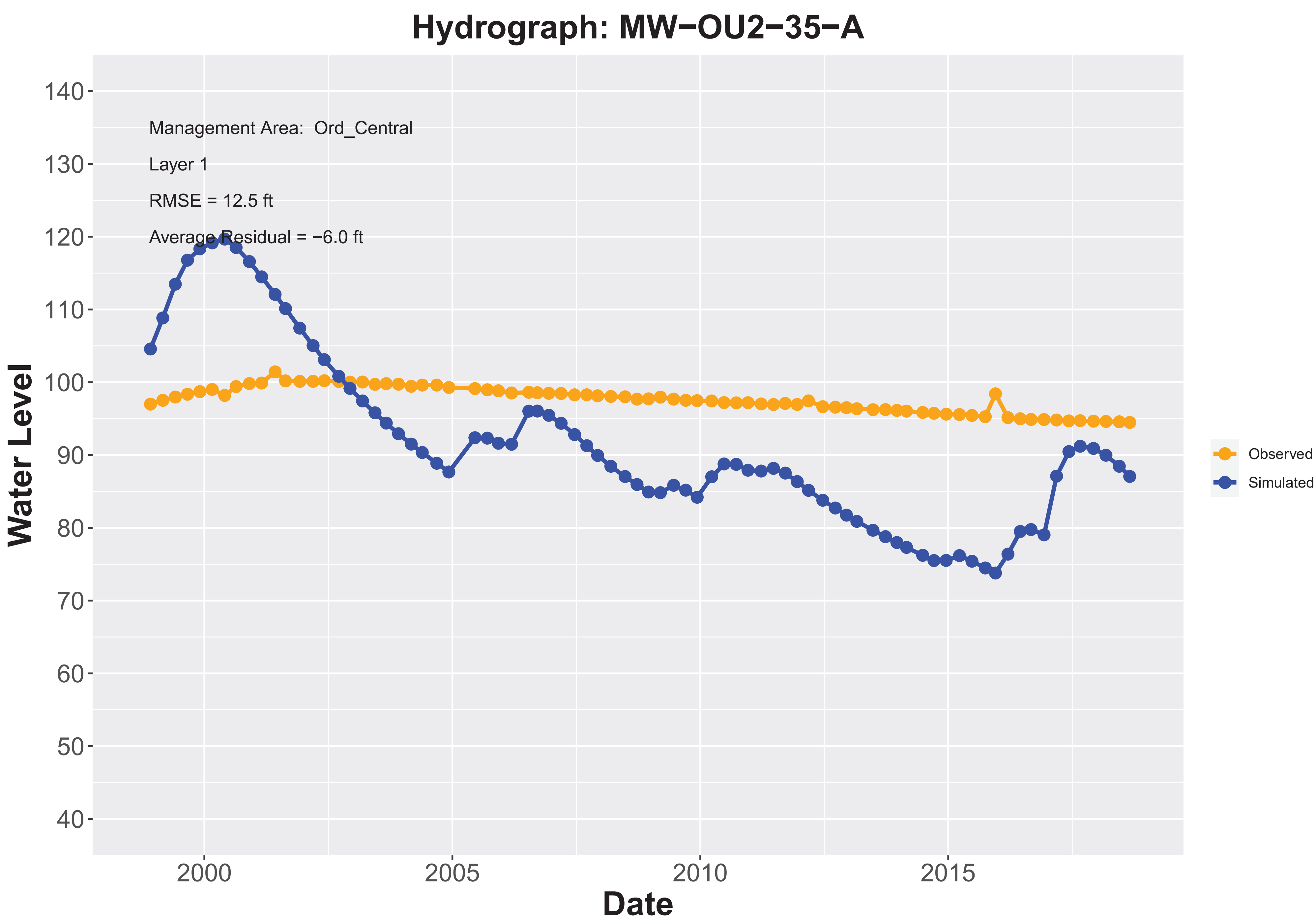


Hydrograph: MW−OU2−32−A
Management Area: Ord_Coast
Layer 1
RMSE = 9.2 ft
Average Residual = 8.4 ft
Water Level
70
60
50
40
30
20
10
0
−10
−20
−30
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU2−33−A
Management Area: Ord_Coast
Layer 3
RMSE = 2.8 ft
Average Residual = 2.2 ft
Water Level
Date
Observed
Simulated
60
50
40
30
20
10
0
−10
−20
−30
−40
2000
2005
2010
2015

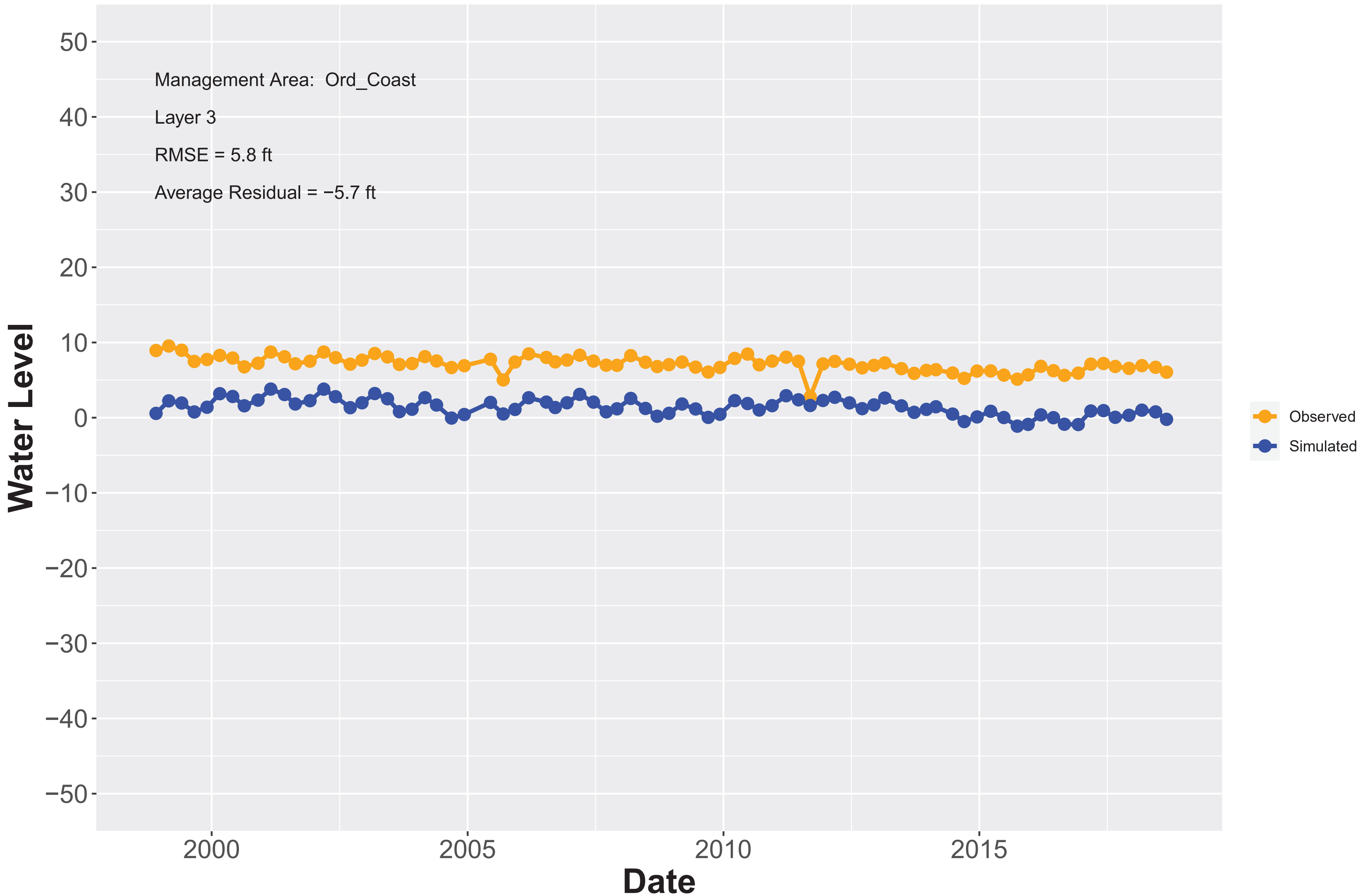
Hydrograph: MW−OU2−34−A

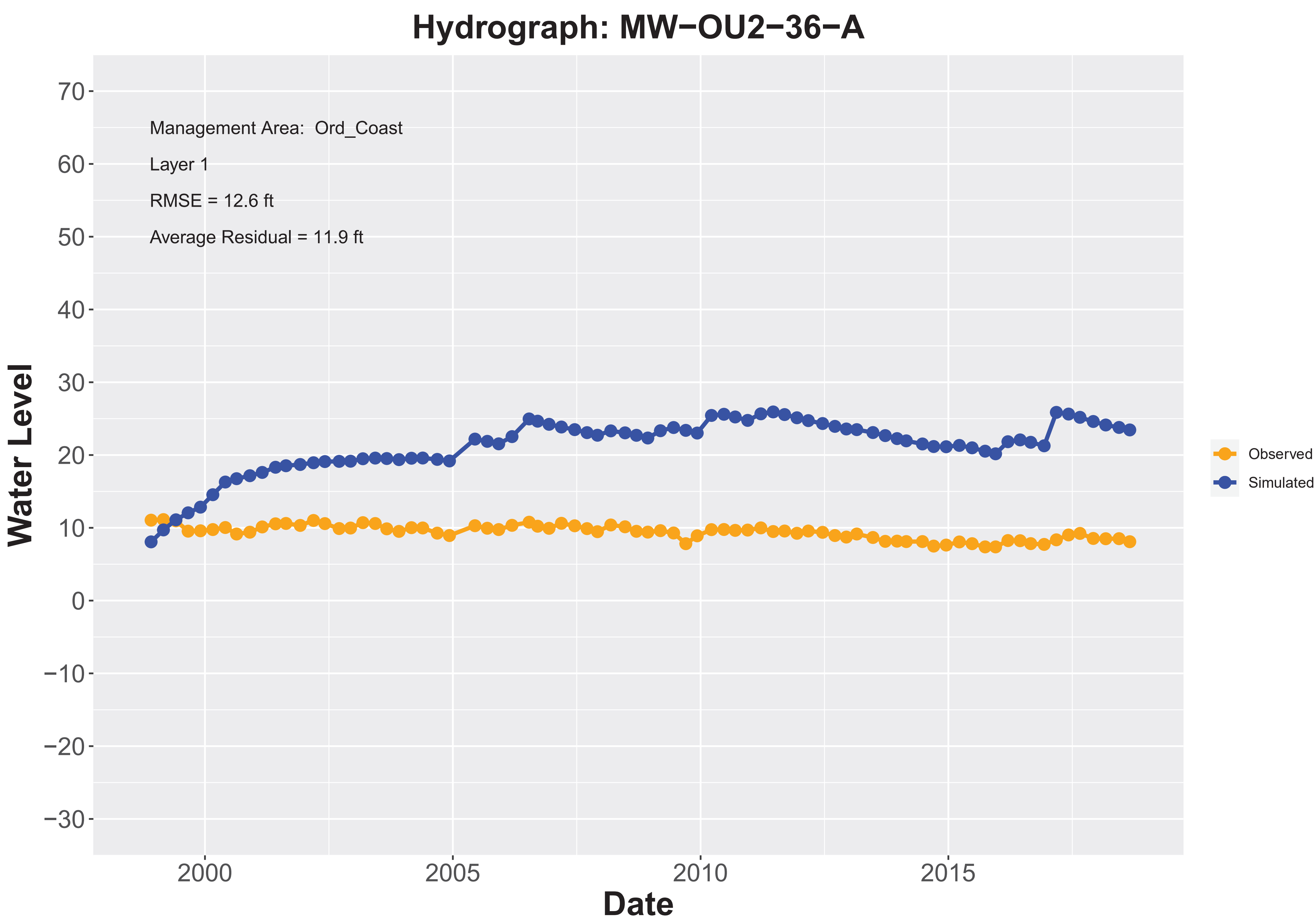


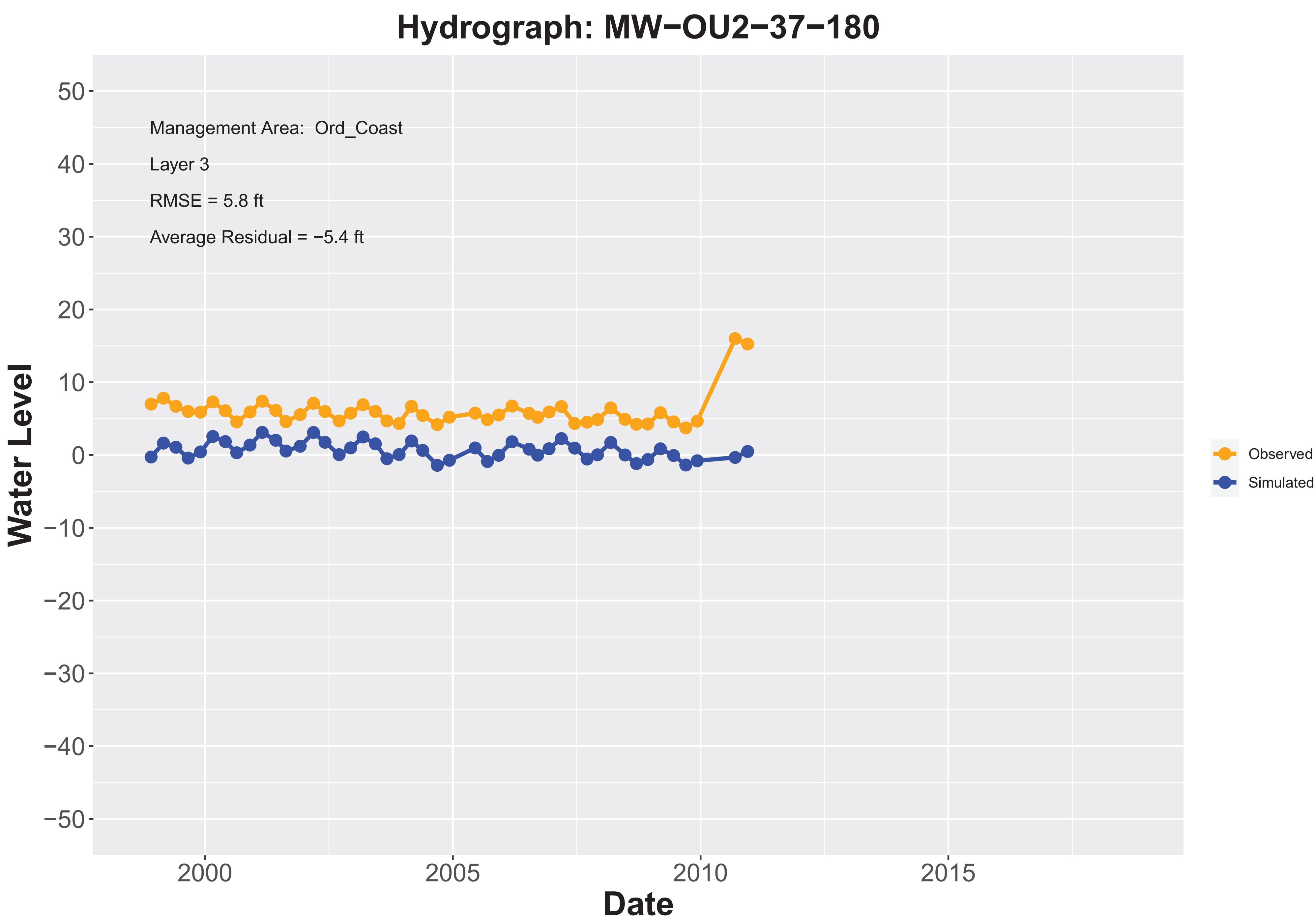


Hydrograph: MW−OU2−35−A
Management Area: Ord_Central
Layer 1
RMSE = 12.5 ft
Average Residual = −6.0 ft
Water Level
140
130
120
110
100
90
80
70
60
50
40
2000
2005
2010
2015
Date
Observed
Simulated

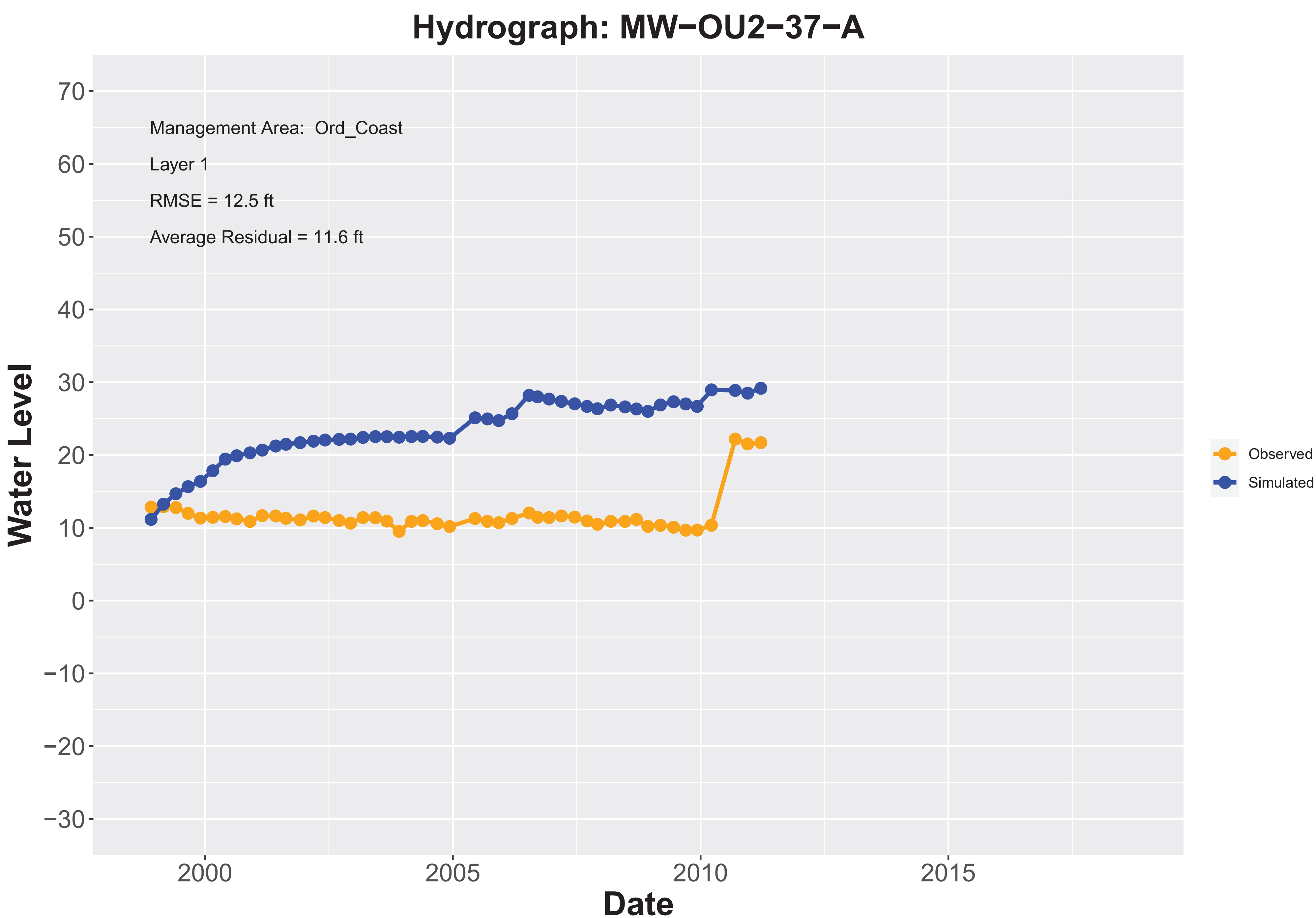
Hydrograph: MW−OU2−36−180



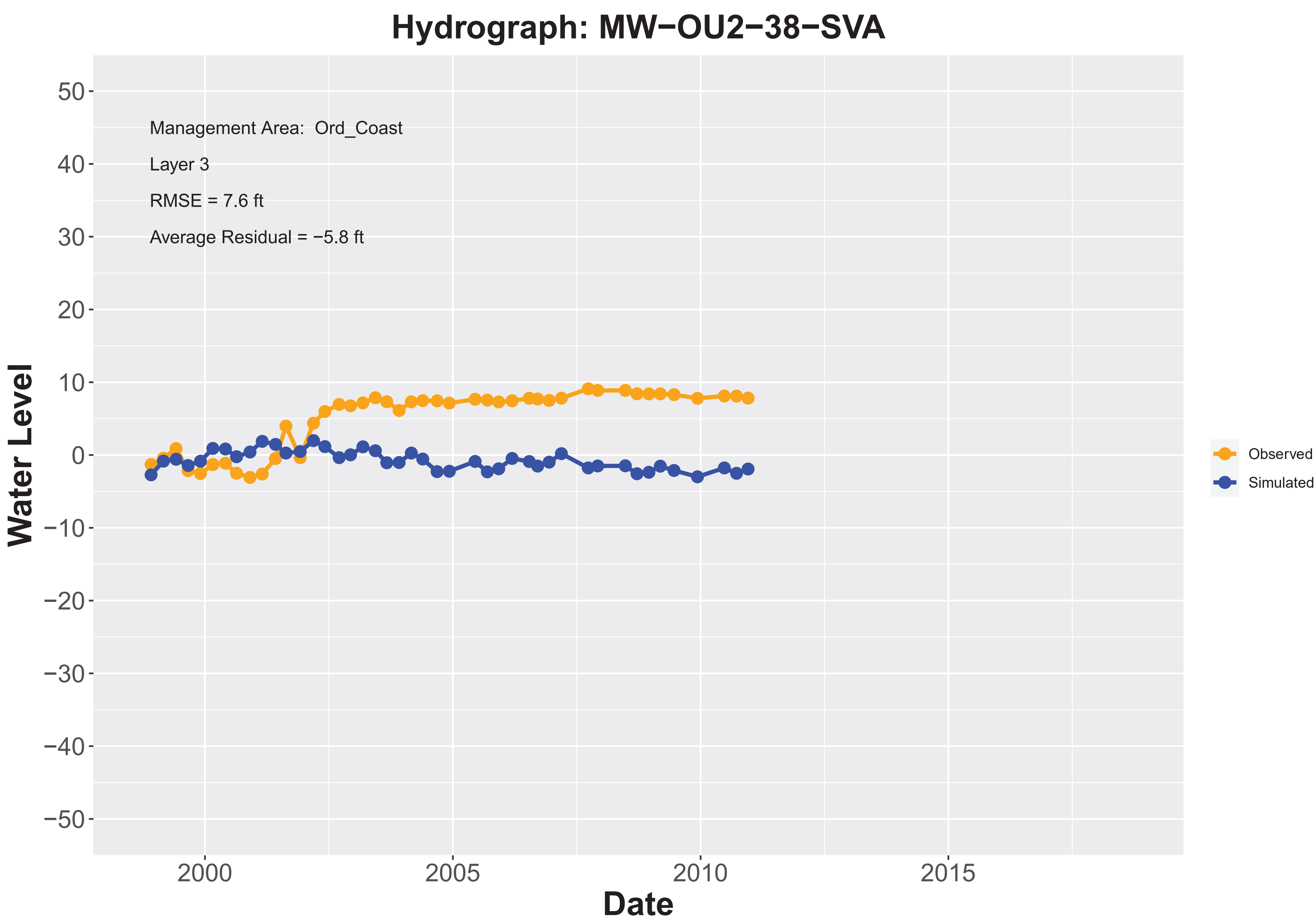

Hydrograph: MW−OU2−36−A
Management Area: Ord_Coast
Layer 1
RMSE = 12.6 ft
Average Residual = 11.9 ft
Water Level
70
60
50
40
30
20
10
0
−10
−20
−30
2000
2005
2010
2015
Date
Observed
Simulated

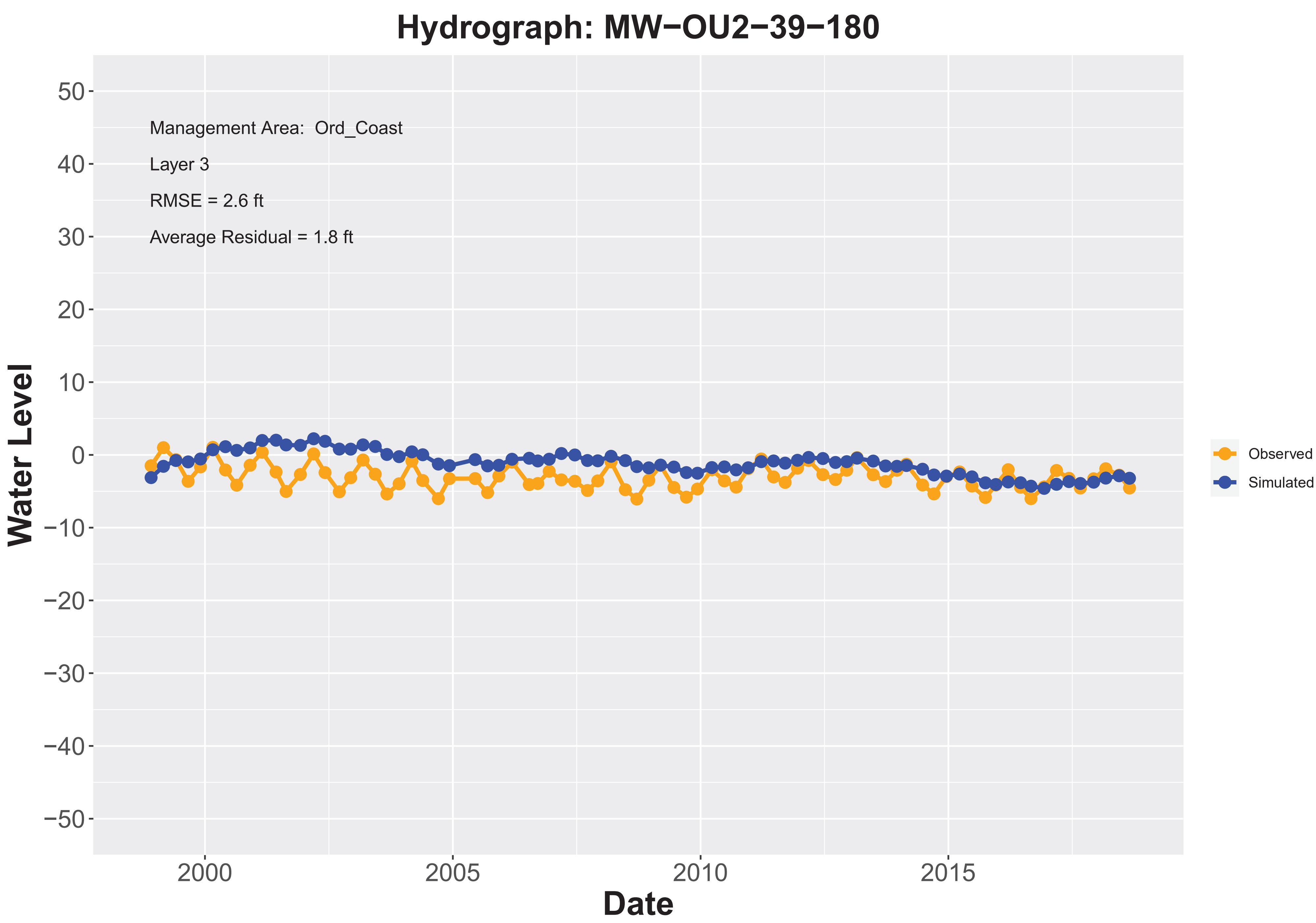


Hydrograph: MW−OU2−37−180
Management Area: Ord_Coast
Layer 3
RMSE = 5.8 ft
Average Residual = −5.4 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

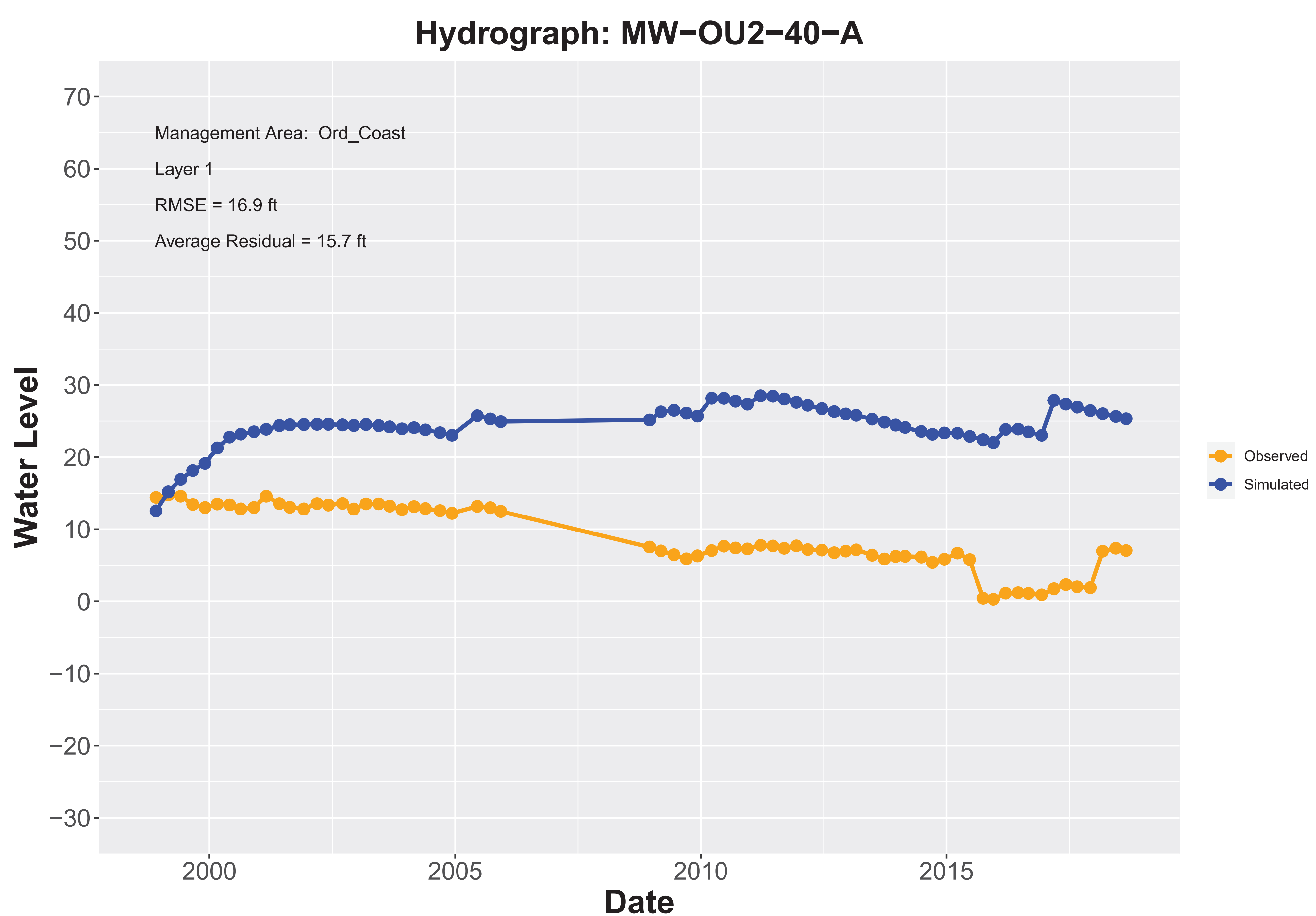


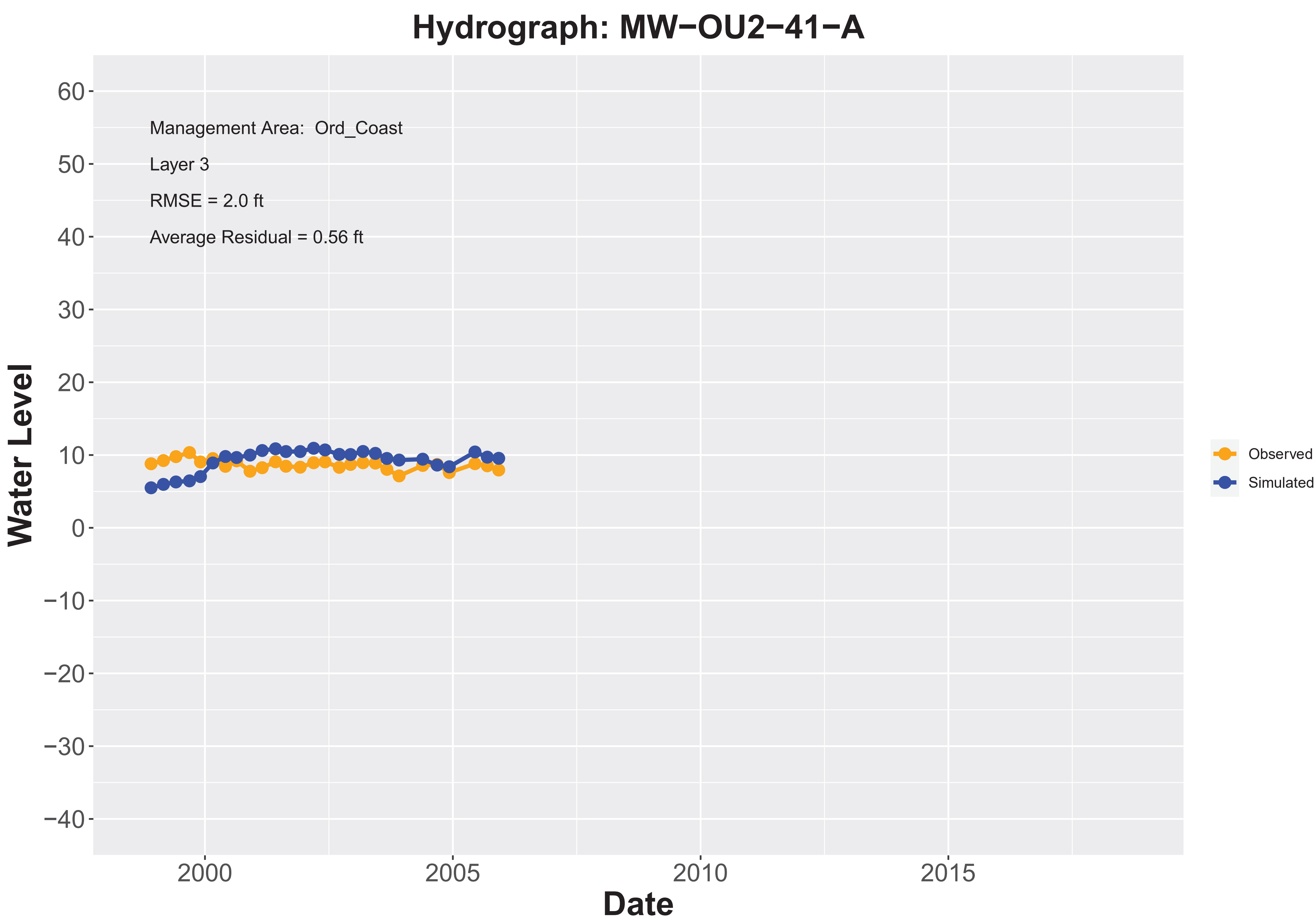
Hydrograph: MW−OU2−37−A
Management Area: Ord_Coast
Layer 1
RMSE = 12.5 ft
Average Residual = 11.6 ft
Water Level
70
60
50
40
30
20
10
0
−10
−20
−30
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU2−38−SVA
Management Area: Ord_Coast
Layer 3
RMSE = 7.6 ft
Average Residual = −5.8 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

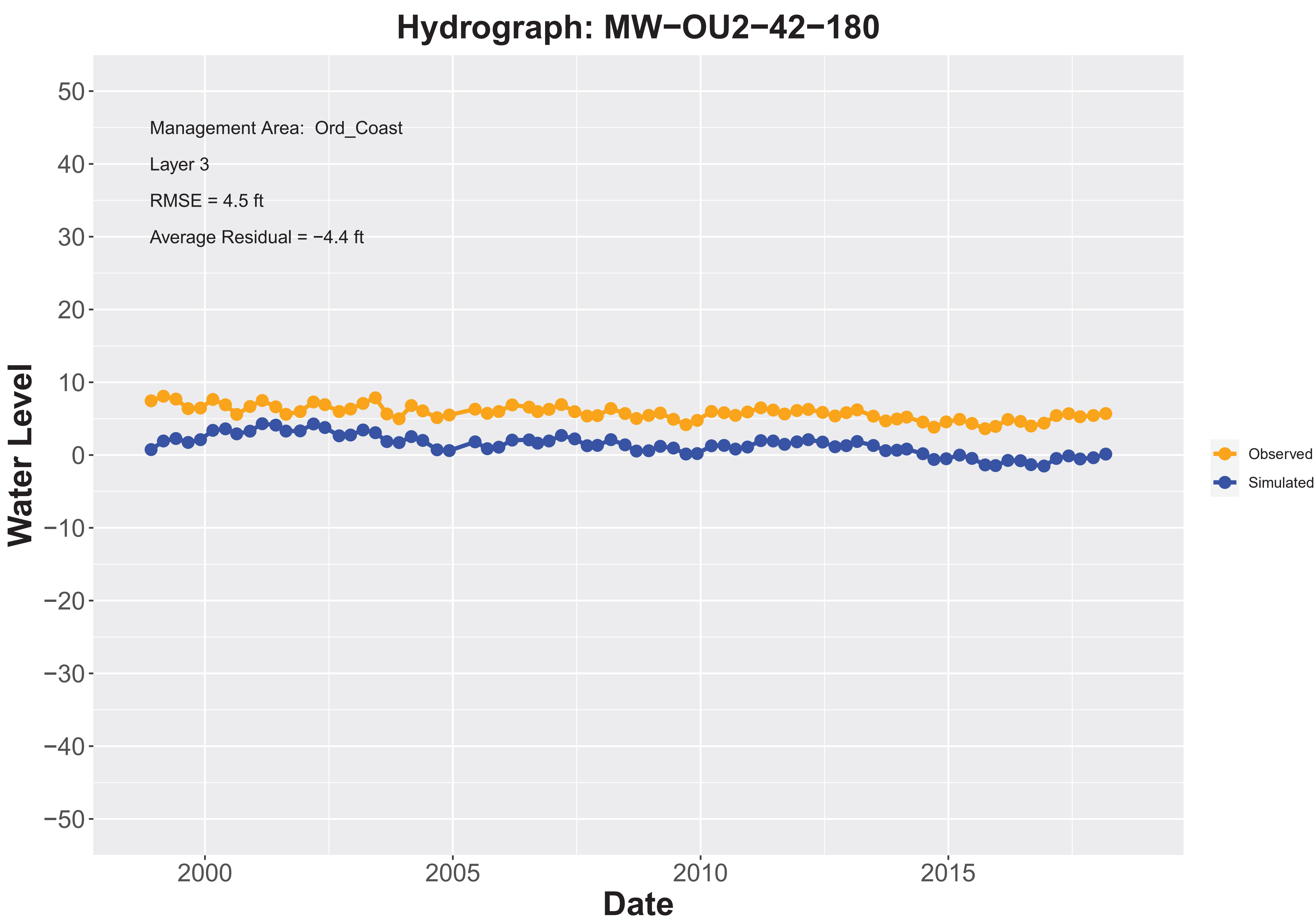


Hydrograph: MW−OU2−39−180
Management Area: Ord_Coast
Layer 3
RMSE = 2.6 ft
Average Residual = 1.8 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

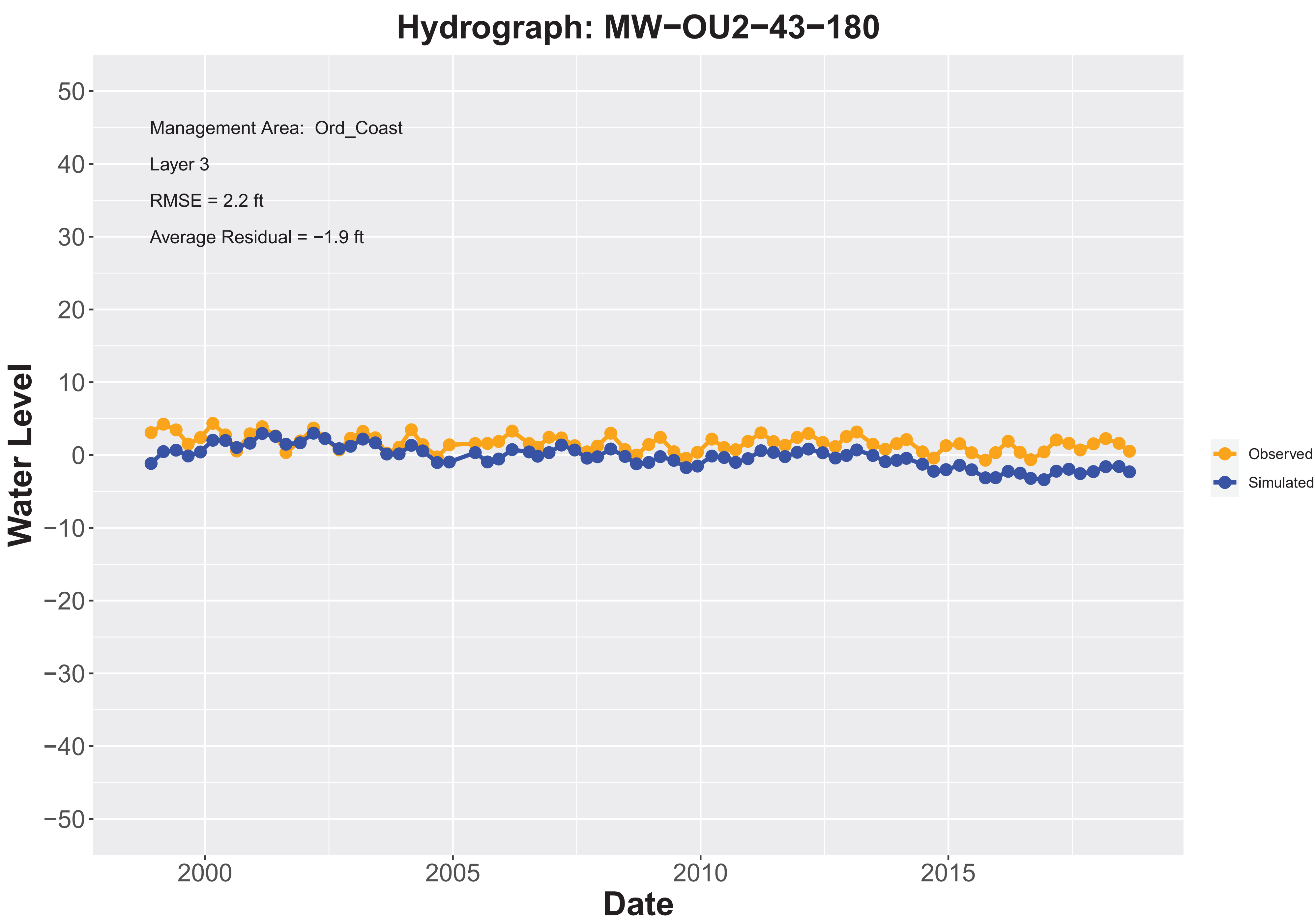

Hydrograph: MW−OU2−40−A
Management Area: Ord_Coast
Layer 1
RMSE = 16.9 ft
Average Residual = 15.7 ft
Water Level
70
60
50
40
30
20
10
0
−10
−20
−30
2000
2005
2010
2015
Date
Observed
Simulated



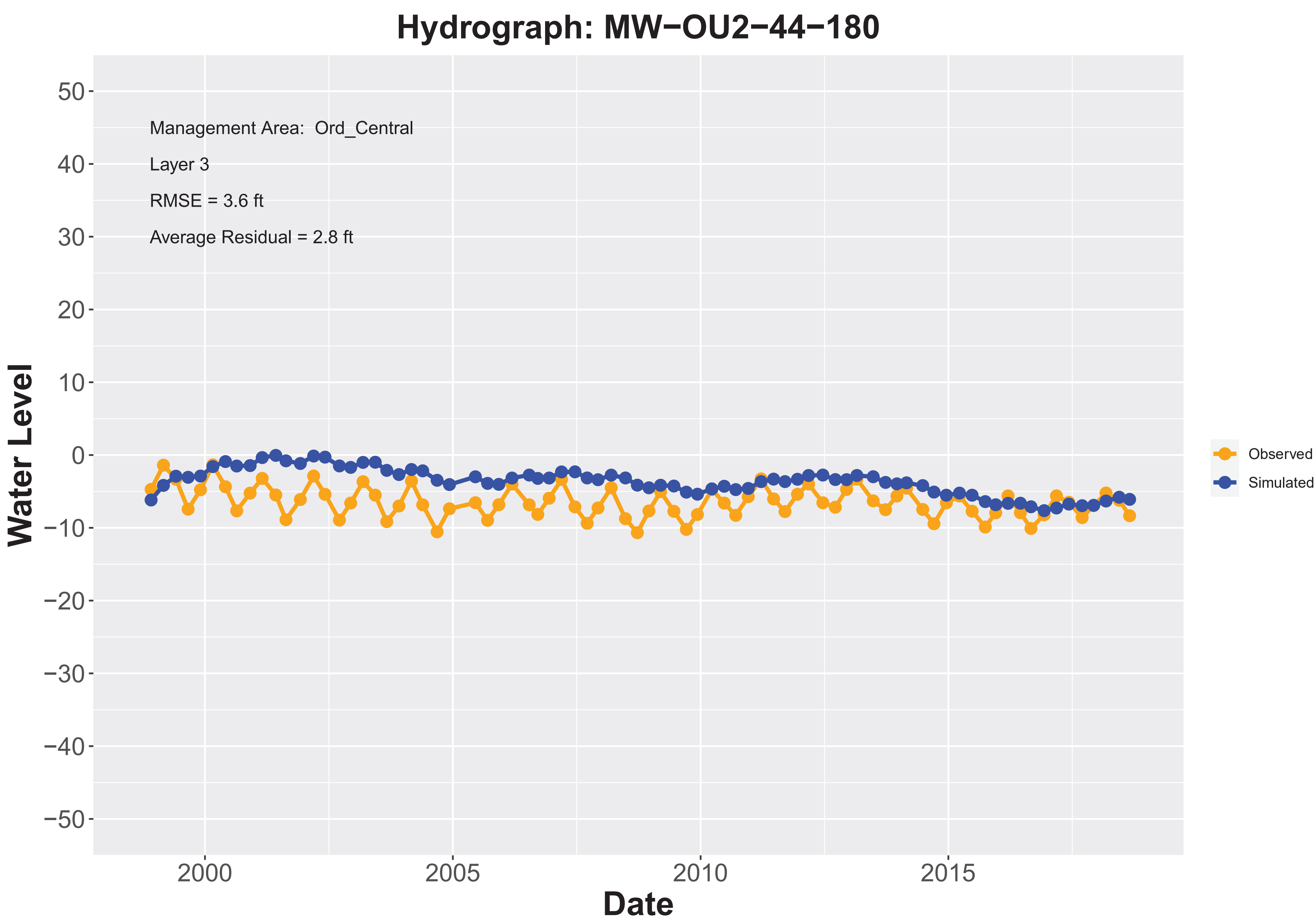
Hydrograph: MW−OU2−41−A
Management Area: Ord_Coast
Layer 3
RMSE = 2.0 ft
Average Residual = 0.56 ft
Water Level
60
50
40
30
20
10
0
−10
−20
−30
−40
Date
2000
2005
2010
2015
Observed
Simulated

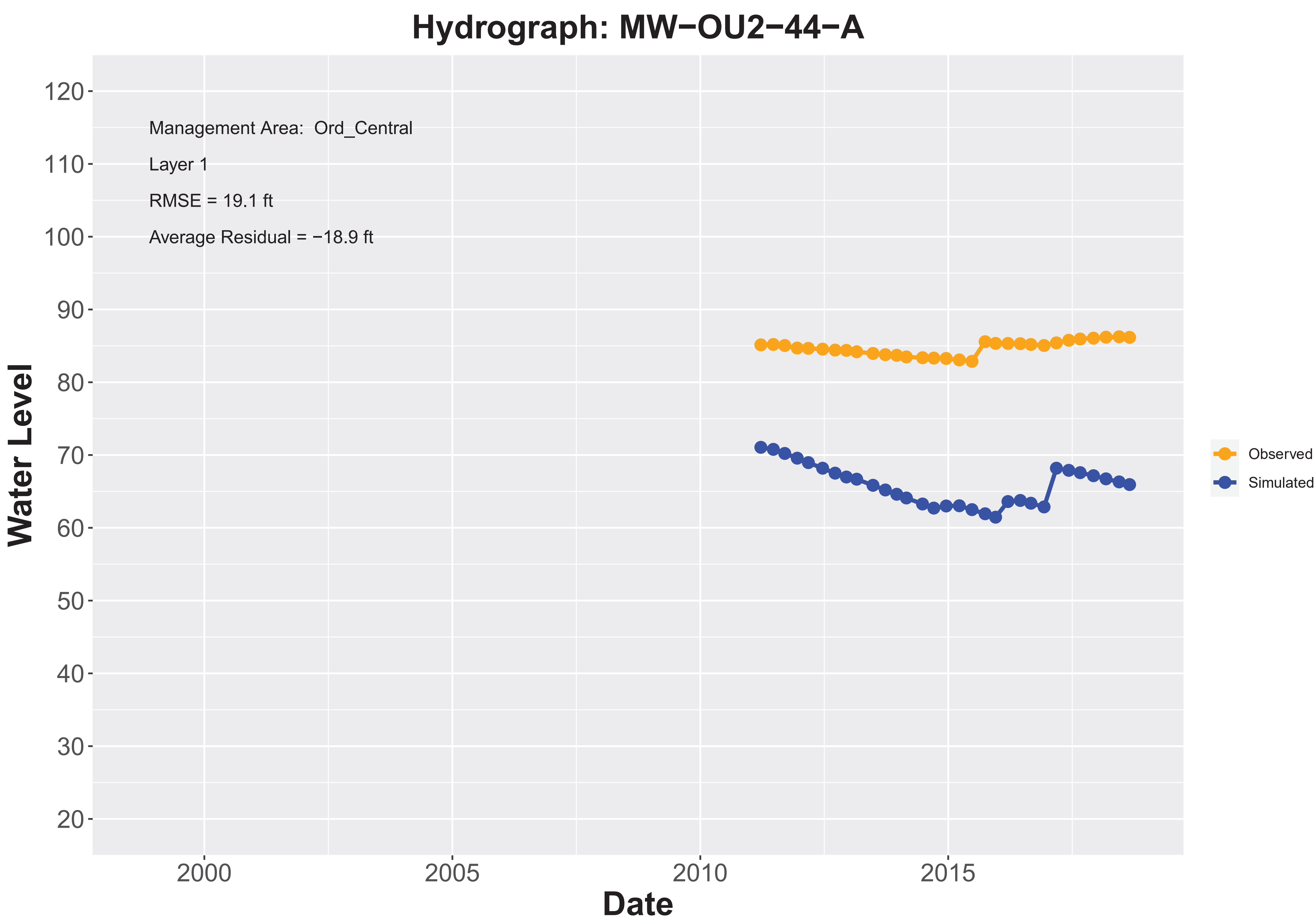


Hydrograph: MW−OU2−42−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.5 ft
Average Residual = −4.4 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

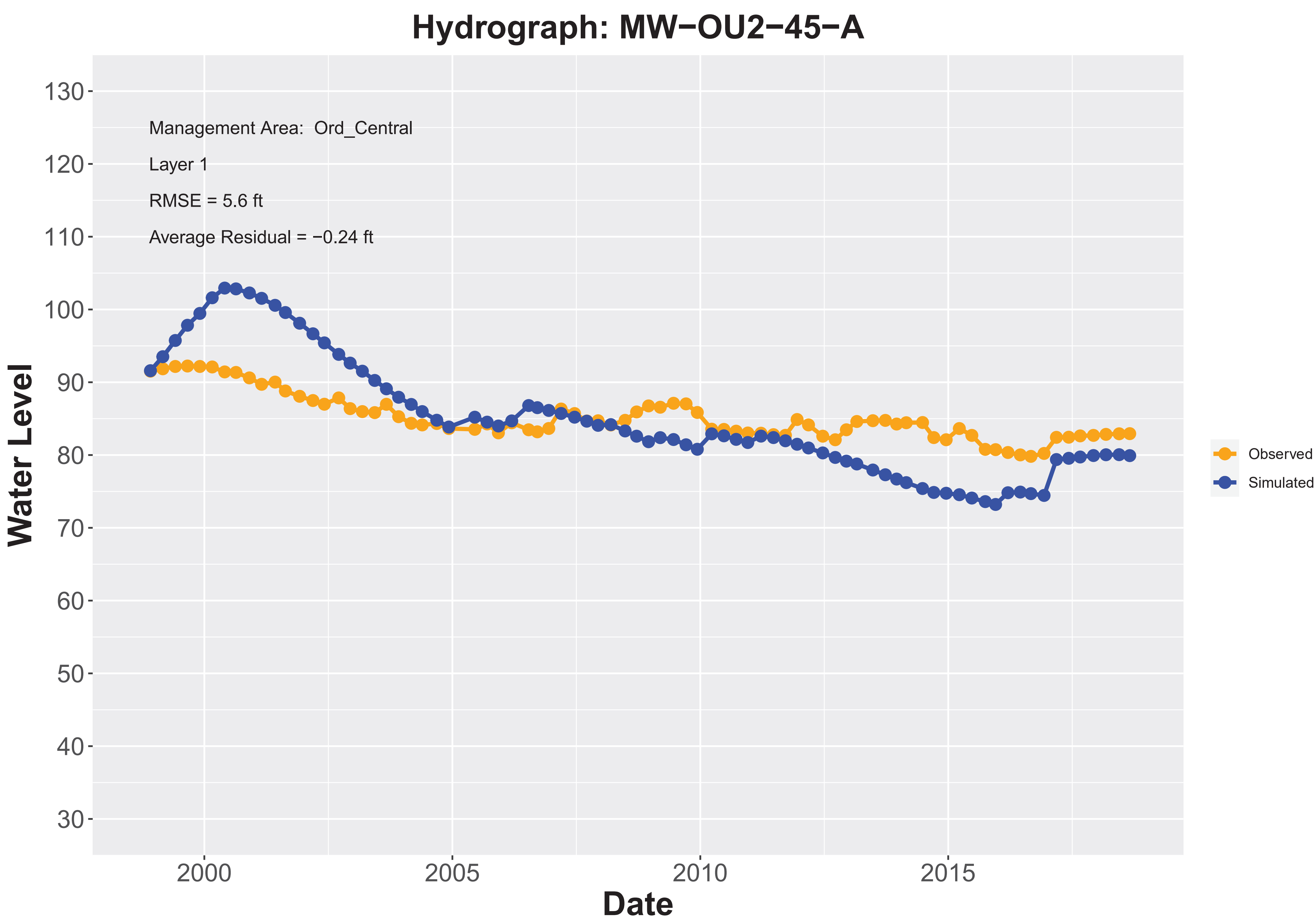


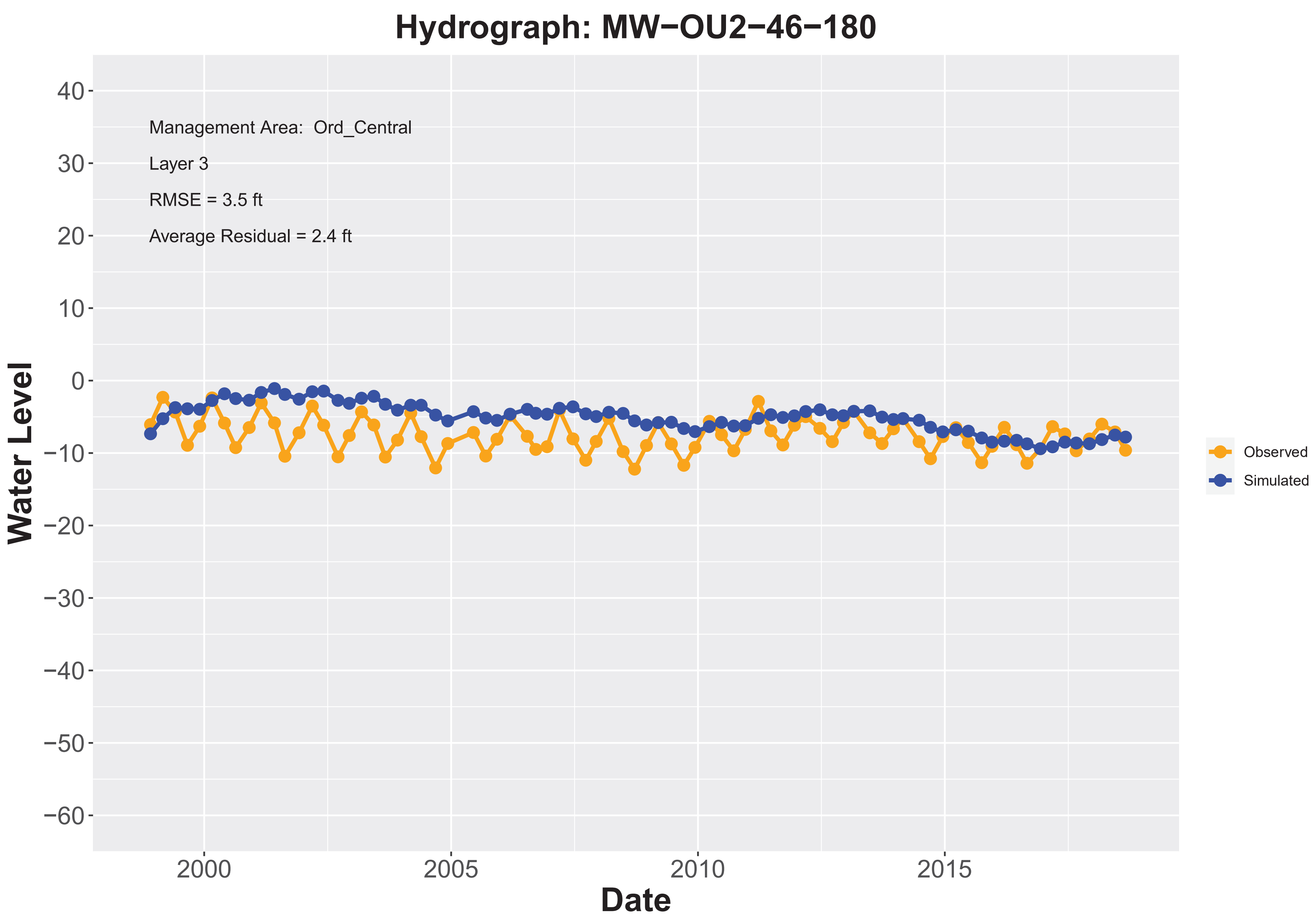
Hydrograph: MW−OU2−43−180
Management Area: Ord_Coast
Layer 3
RMSE = 2.2 ft
Average Residual = −1.9 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU2−44−180
Management Area: Ord_Central
Layer 3
RMSE = 3.6 ft
Average Residual = 2.8 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

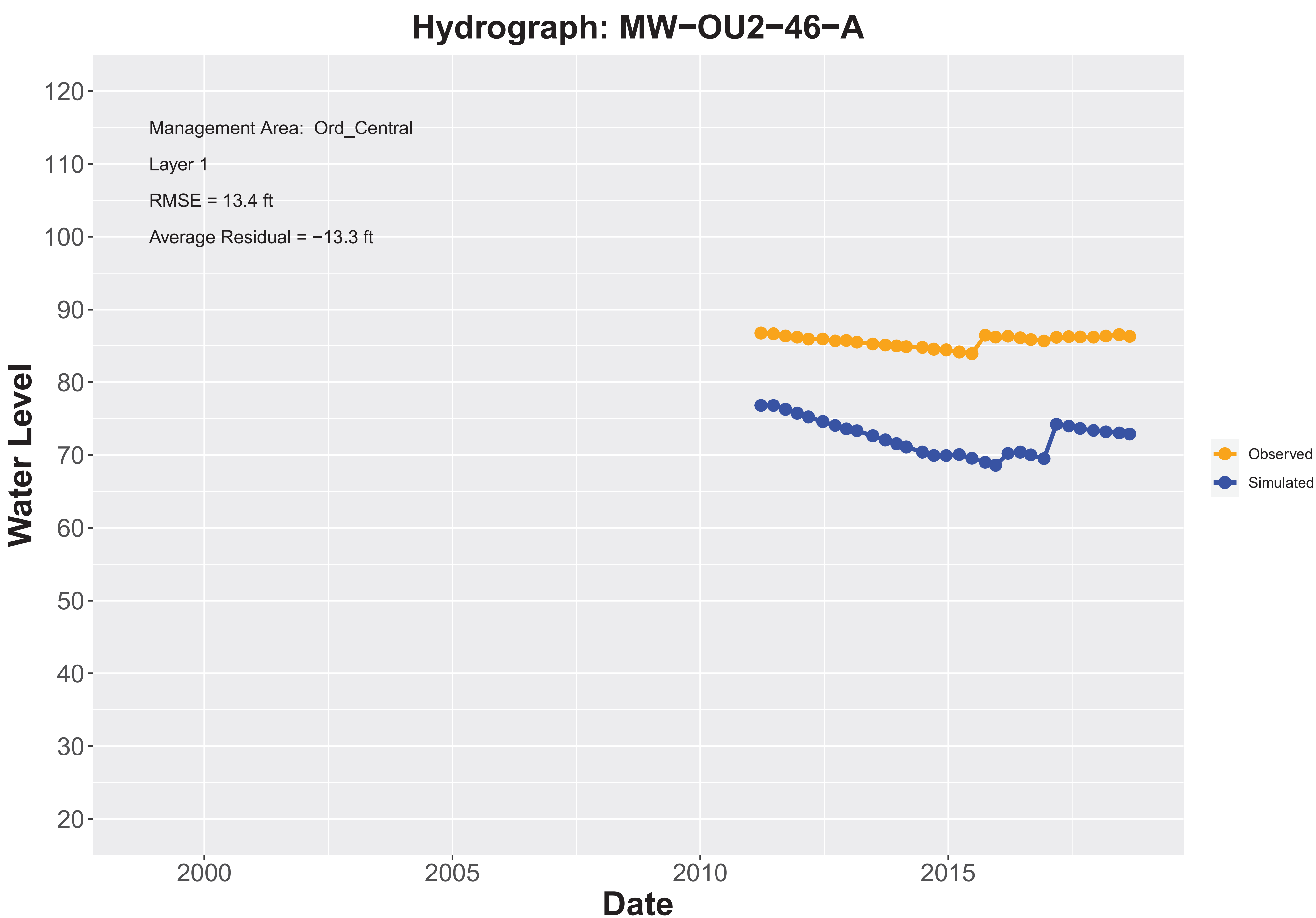


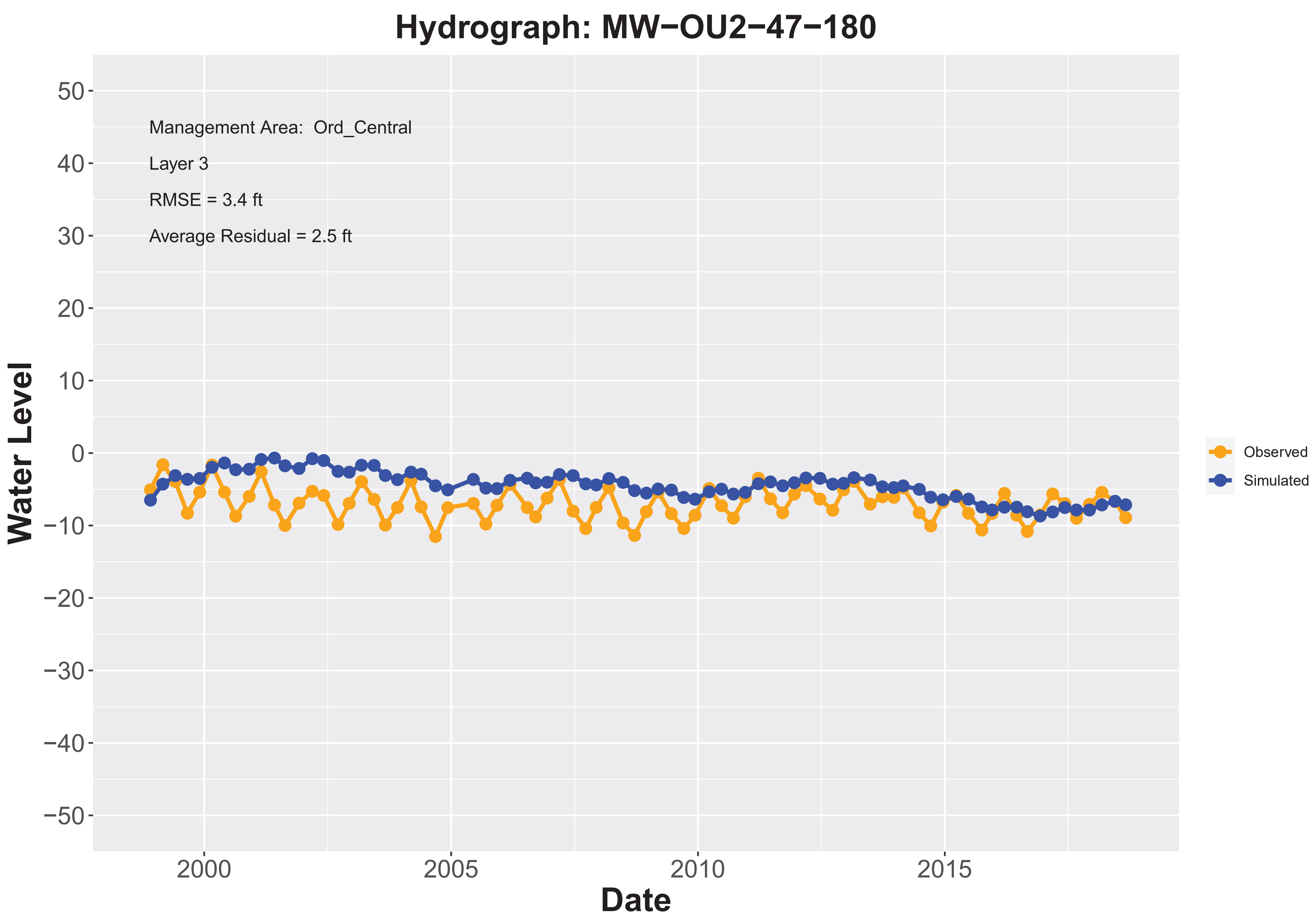
Hydrograph: MW−OU2−44−A
Management Area: Ord_Central
Layer 1
RMSE = 19.1 ft
Average Residual = −18.9 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU2−45−A
Management Area: Ord_Central
Layer 1
RMSE = 5.6 ft
Average Residual = −0.24 ft
Water Level
130
120
110
100
90
80
70
60
50
40
30
2000
2005
2010
2015
Date
Observed
Simulated

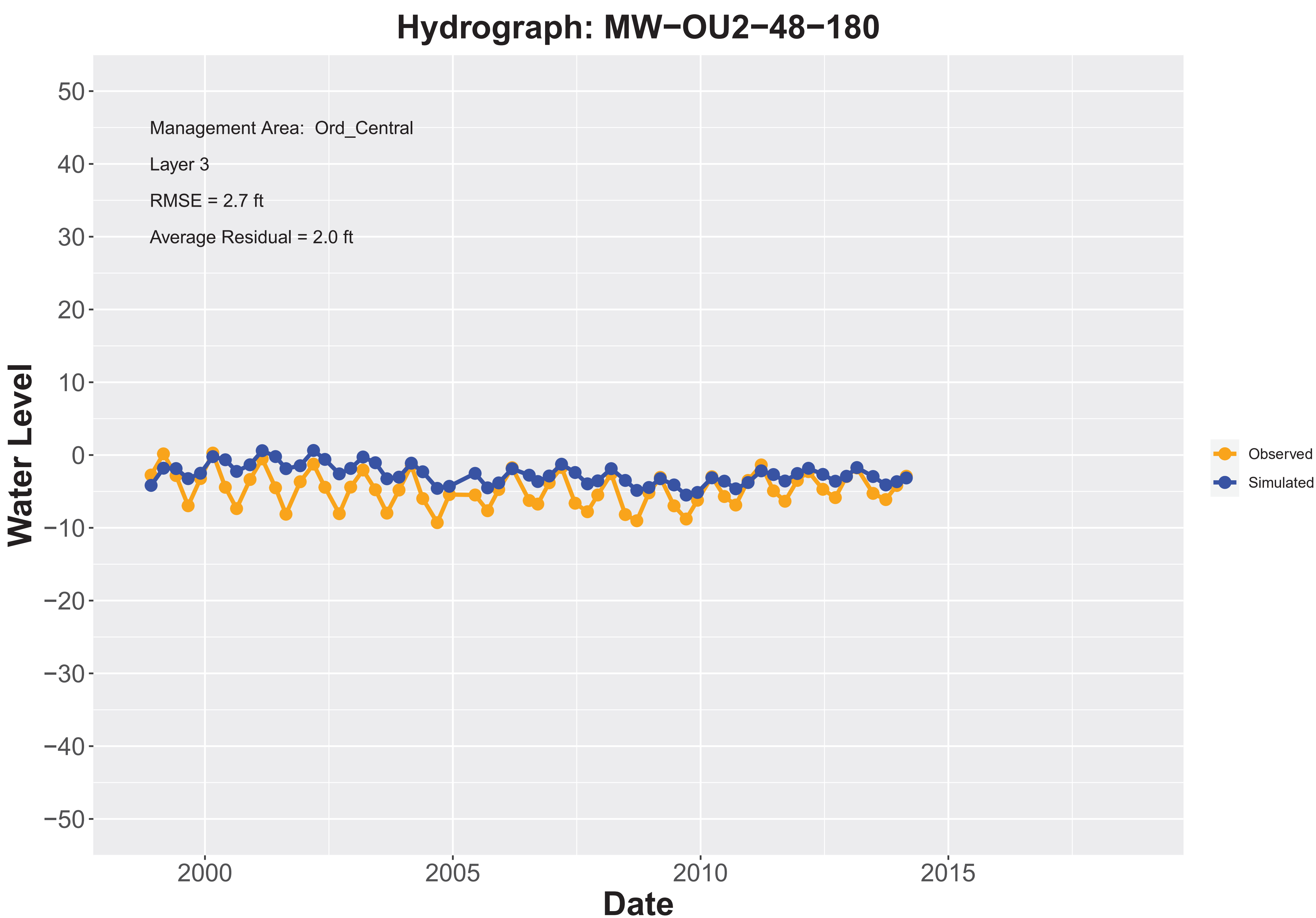


Hydrograph: MW−OU2−46−180
Management Area: Ord_Central
Layer 3
RMSE = 3.5 ft
Average Residual = 2.4 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

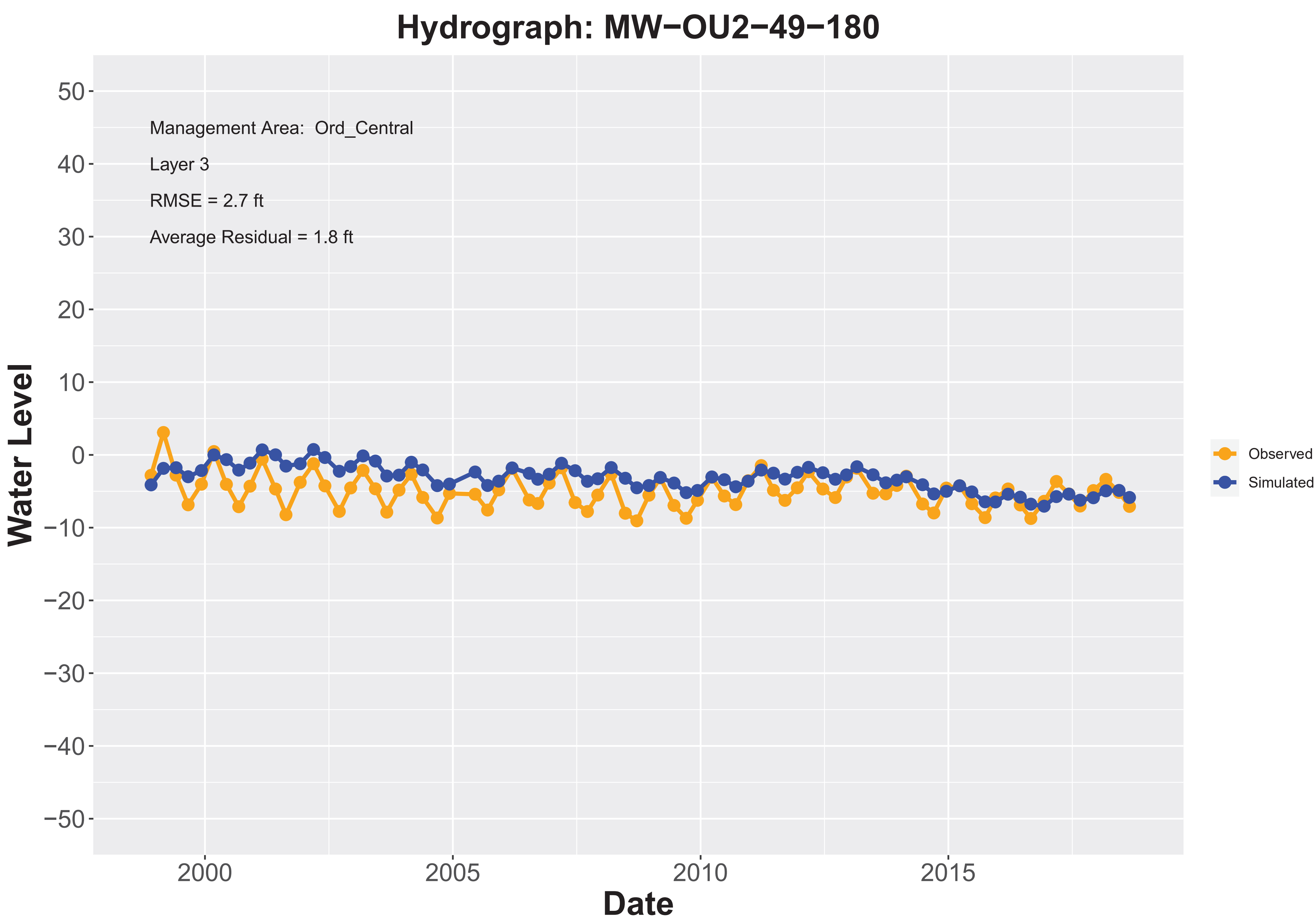

Hydrograph: MW−OU2−46−A
Management Area: Ord_Central
Layer 1
RMSE = 13.4 ft
Average Residual = −13.3 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated

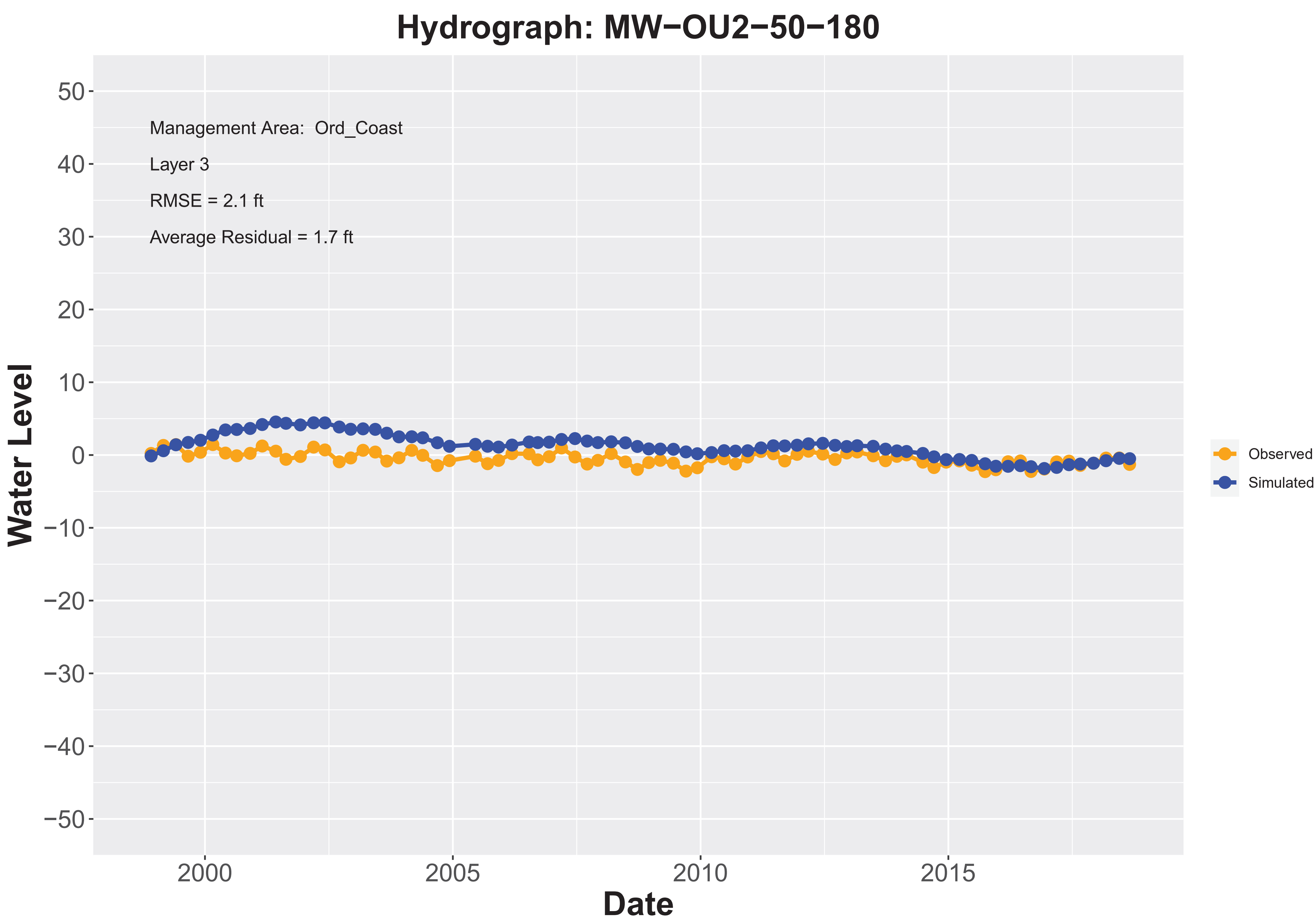


Hydrograph: MW−OU2−47−180
Management Area: Ord_Central
Layer 3
RMSE = 3.4 ft
Average Residual = 2.5 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

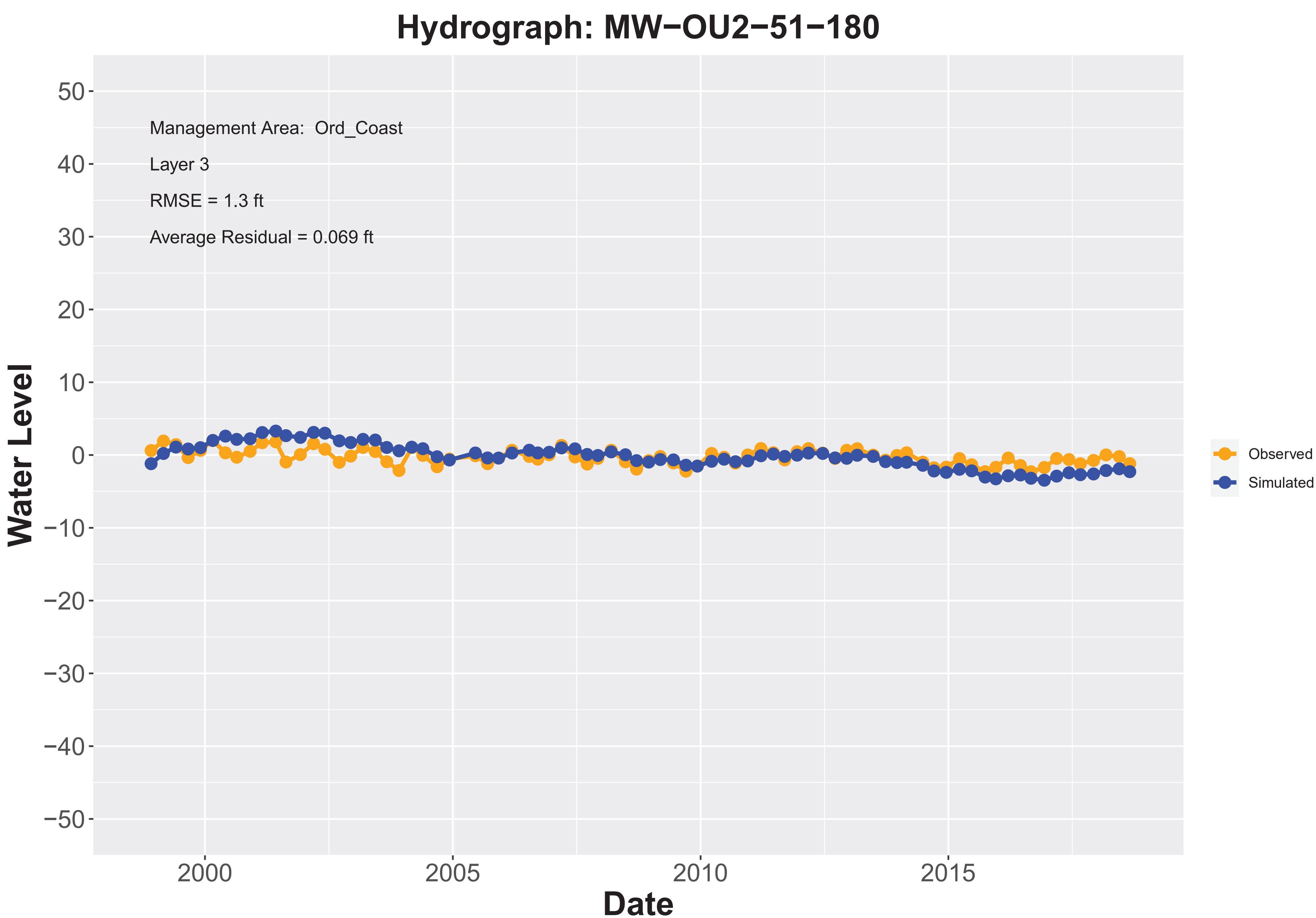


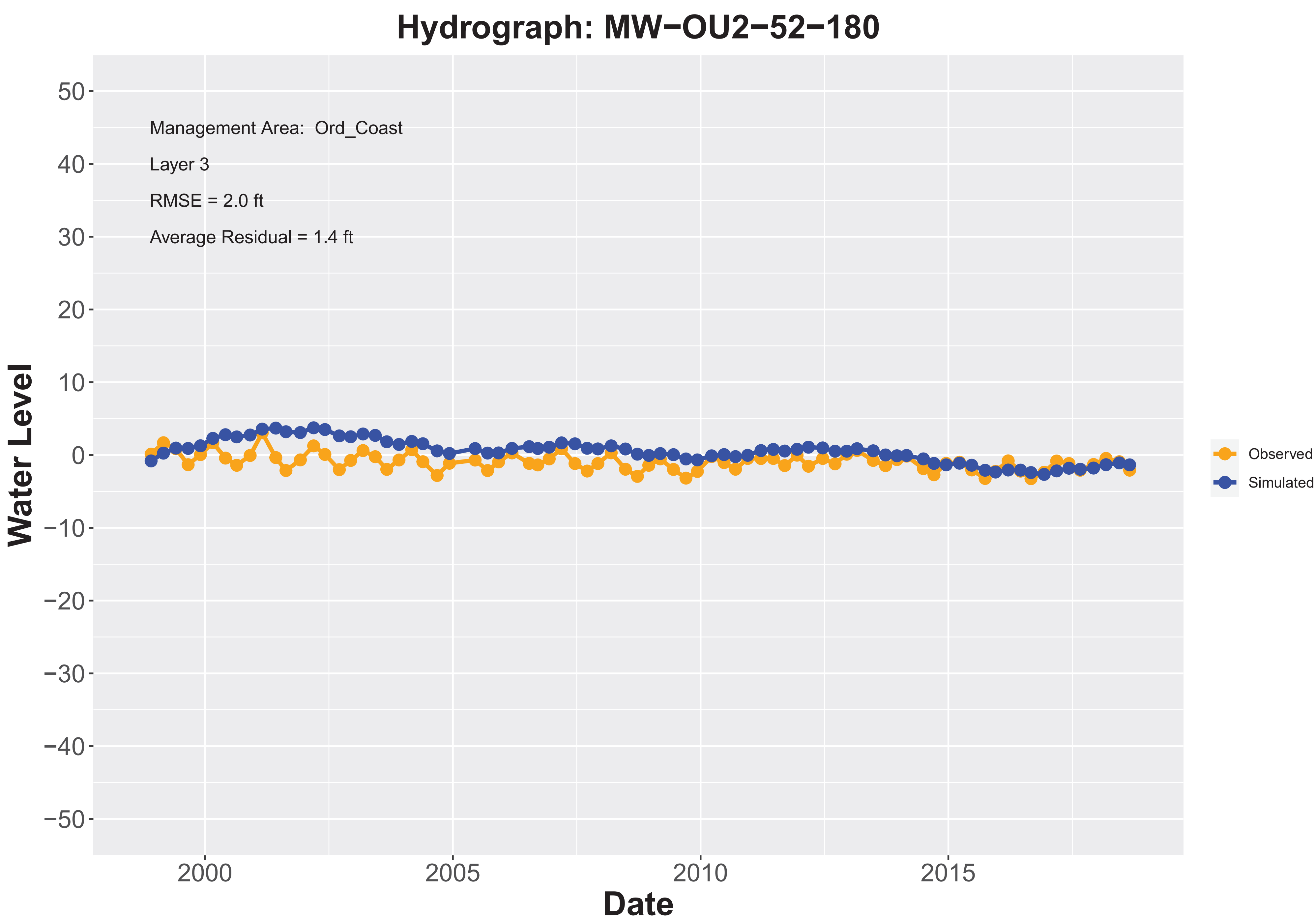
Hydrograph: MW−OU2−48−180
Management Area: Ord_Central
Layer 3
RMSE = 2.7 ft
Average Residual = 2.0 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

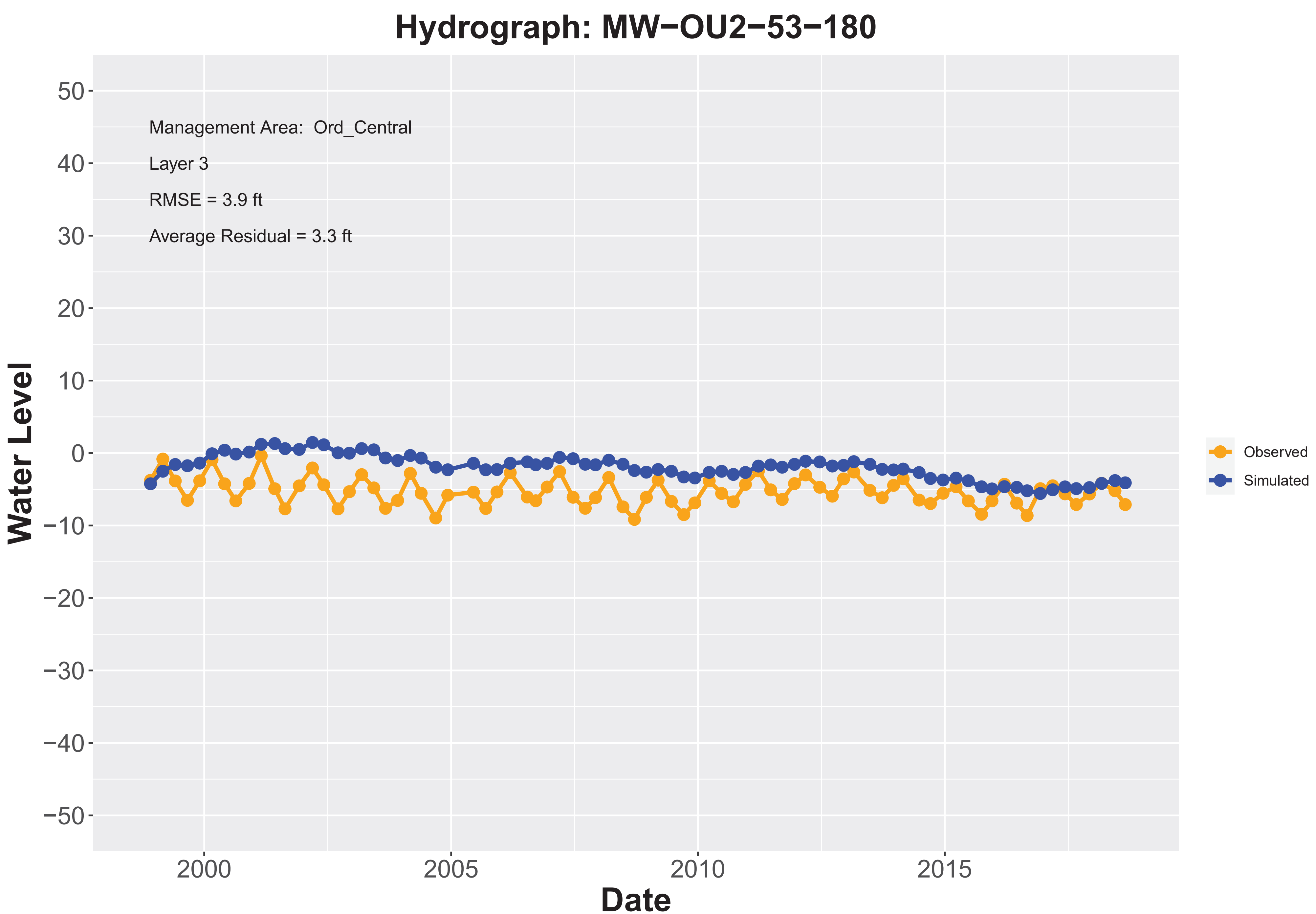

Hydrograph: MW−OU2−49−180
Management Area: Ord_Central
Layer 3
RMSE = 2.7 ft
Average Residual = 1.8 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
Date
2000
2005
2010
2015
Observed
Simulated



Hydrograph: MW−OU2−50−180
Management Area: Ord_Coast
Layer 3
RMSE = 2.1 ft
Average Residual = 1.7 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

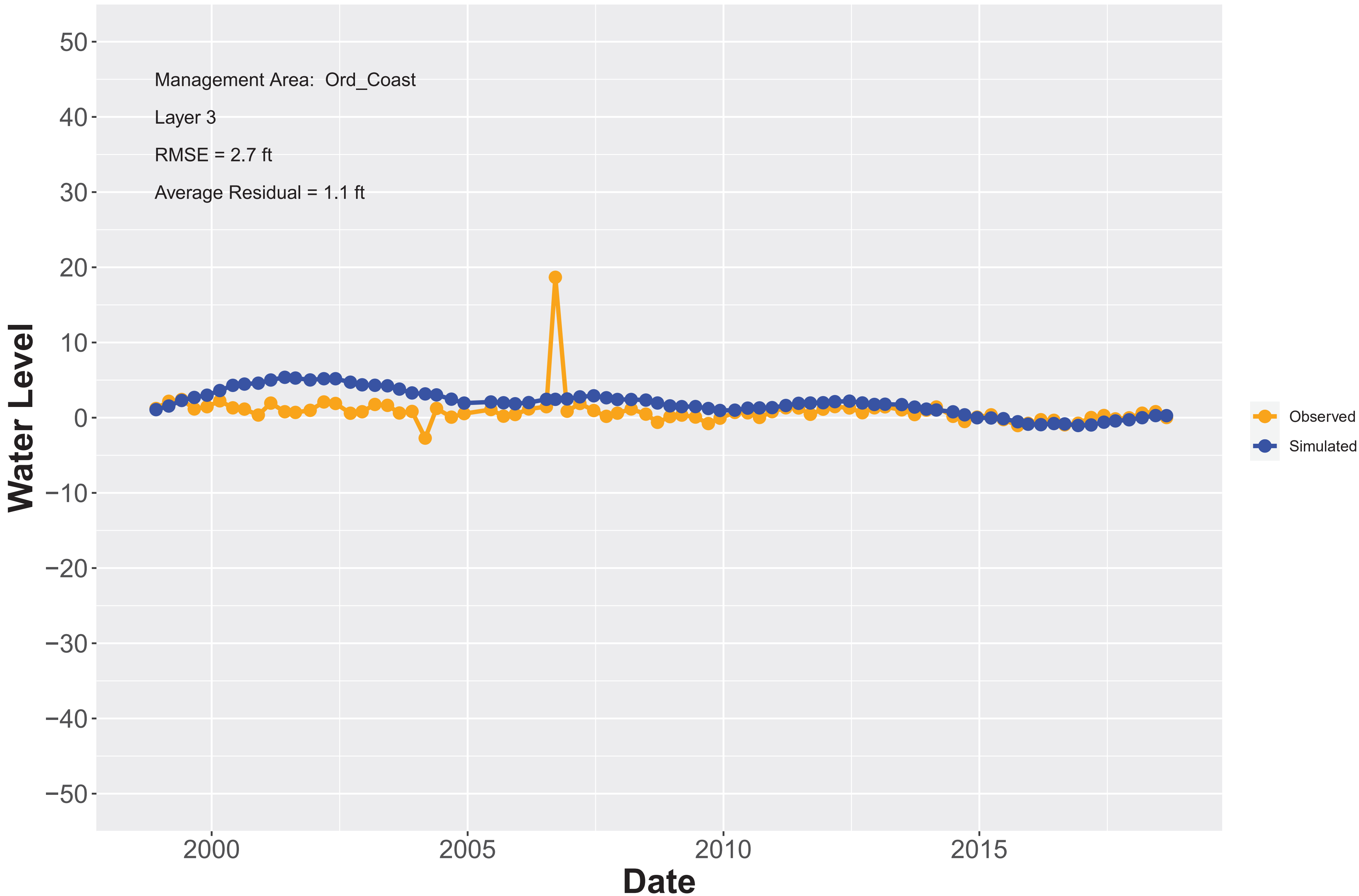

Hydrograph: MW−OU2−51−180
Management Area: Ord_Coast
Layer 3
RMSE = 1.3 ft
Average Residual = 0.069 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

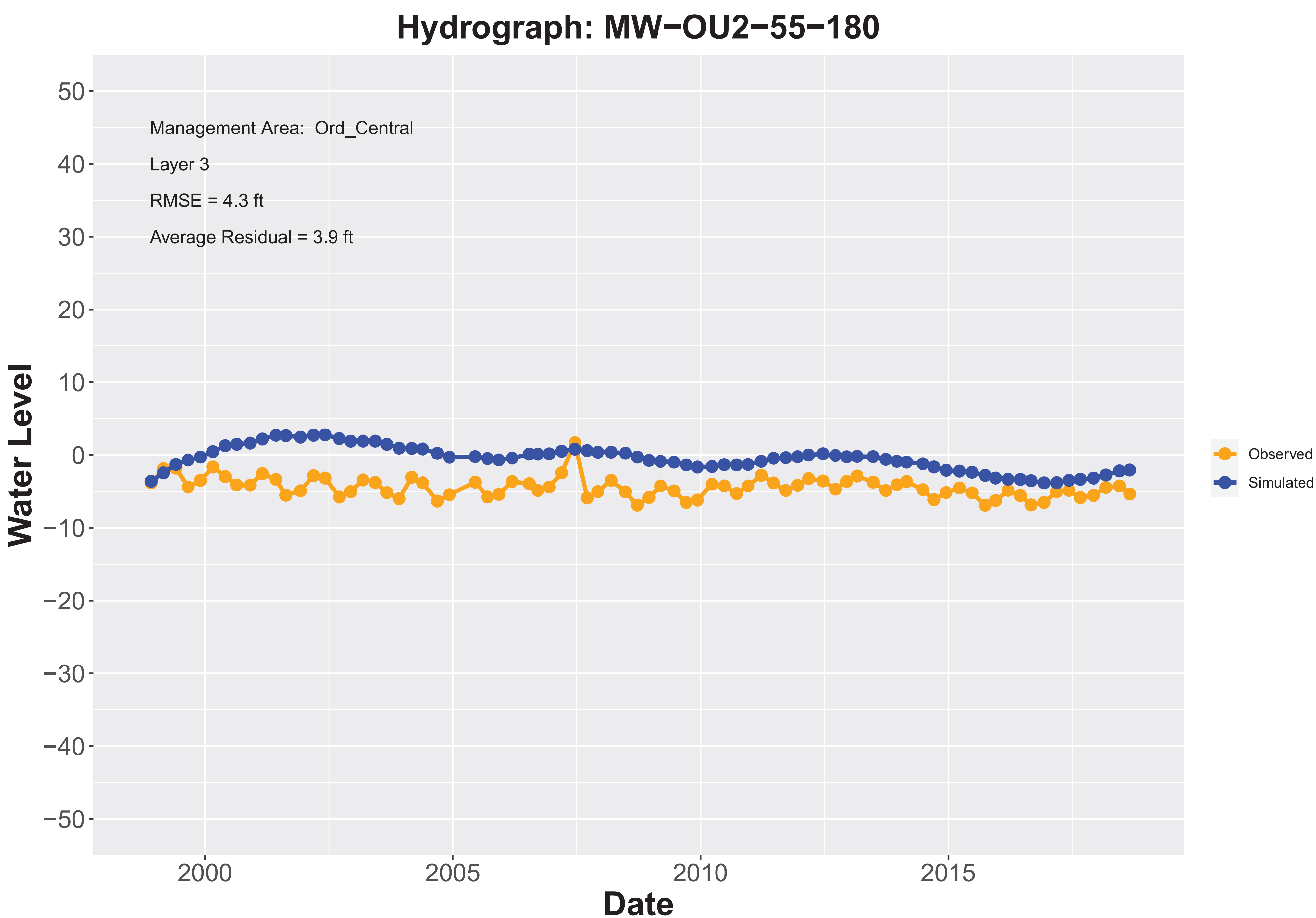

Hydrograph: MW−OU2−52−180
Management Area: Ord_Coast
Layer 3
RMSE = 2.0 ft
Average Residual = 1.4 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



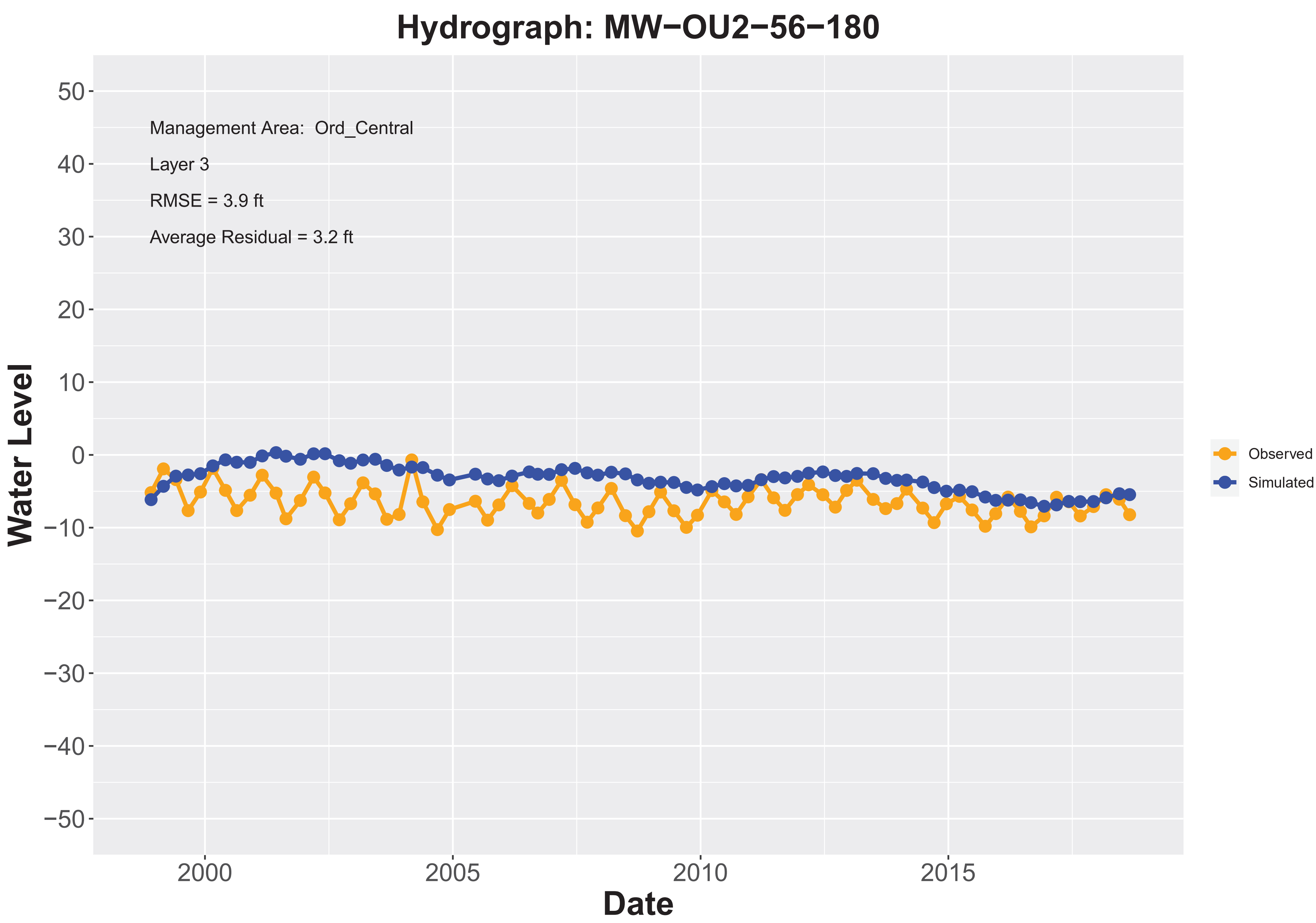
Hydrograph: MW−OU2−53−180
Management Area: Ord_Central
Layer 3
RMSE = 3.9 ft
Average Residual = 3.3 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

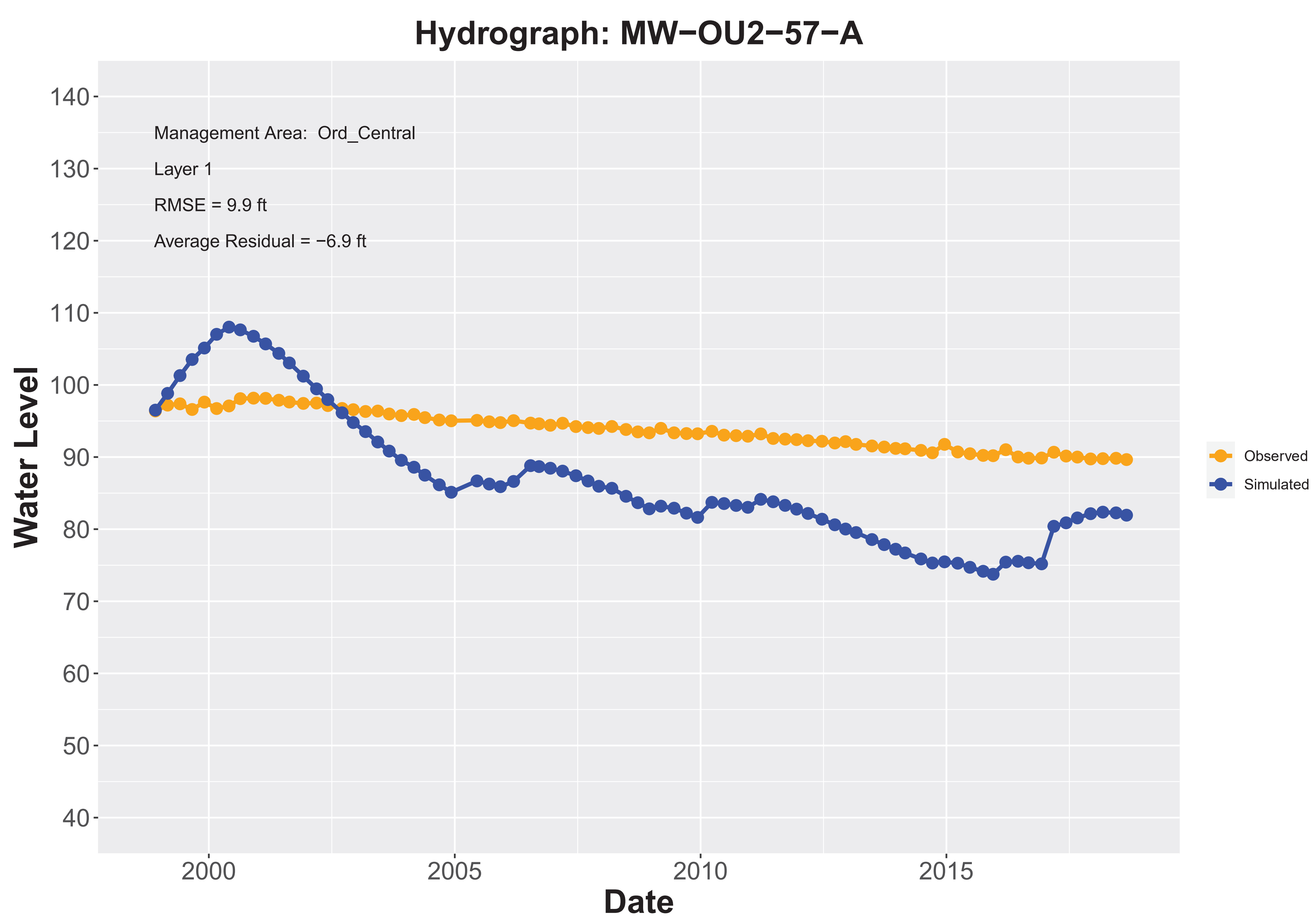
Hydrograph: MW−OU2−54−180



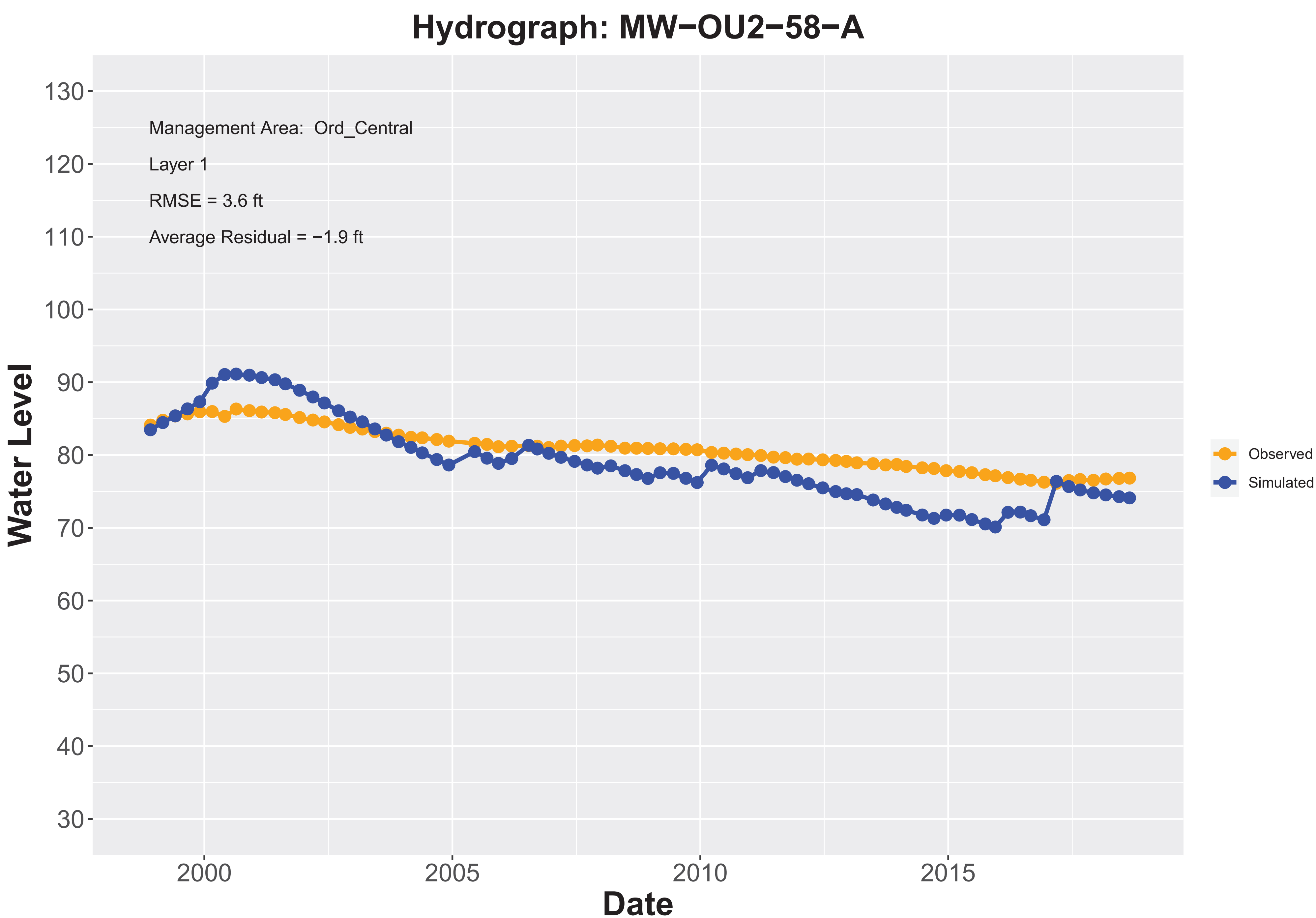


Hydrograph: MW−OU2−55−180
Management Area: Ord_Central
Layer 3
RMSE = 4.3 ft
Average Residual = 3.9 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

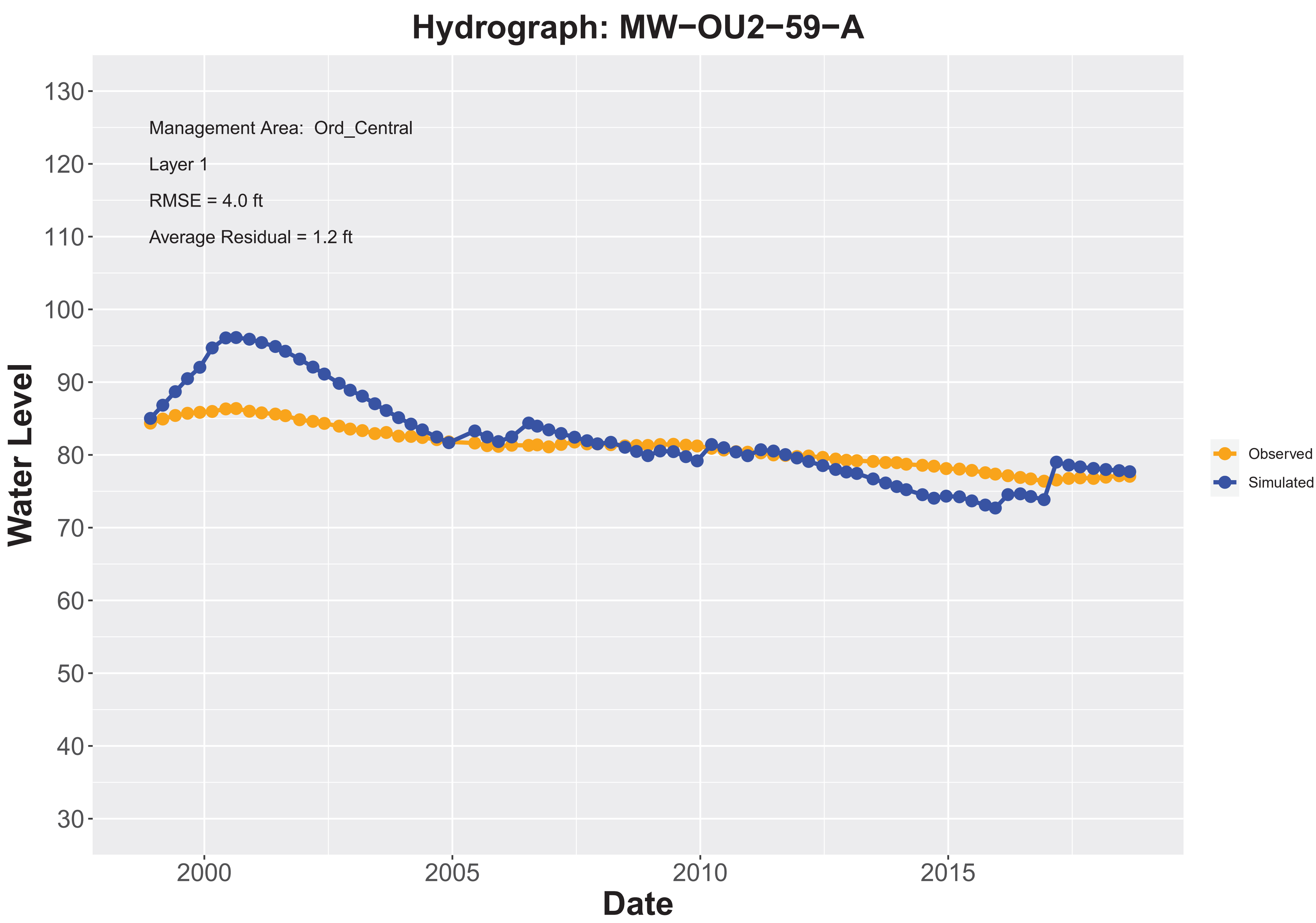

Hydrograph: MW−OU2−56−180
Management Area: Ord_Central
Layer 3
RMSE = 3.9 ft
Average Residual = 3.2 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
Date
2000
2005
2010
2015
Observed
Simulated

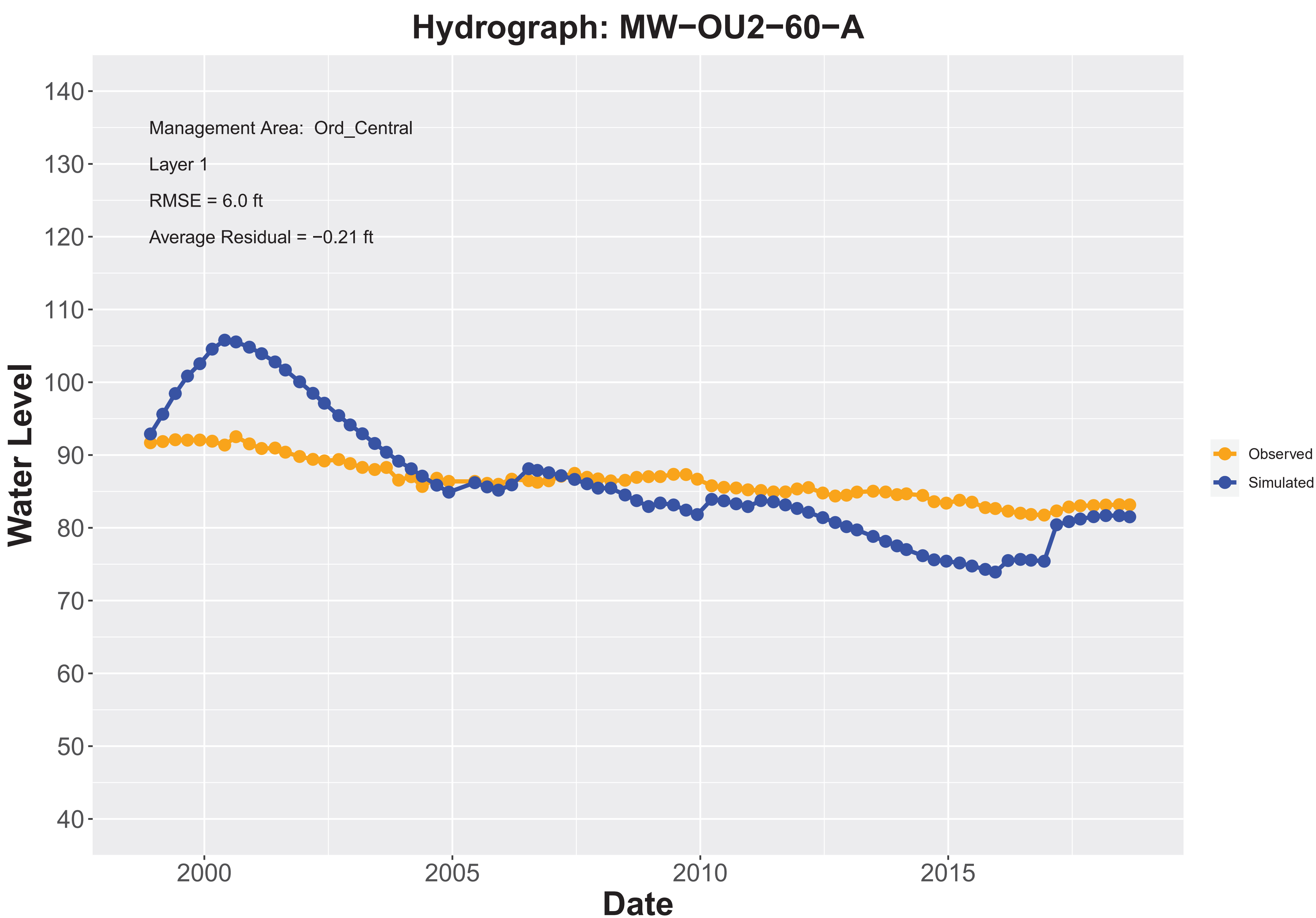


Hydrograph: MW−OU2−57−A
Management Area: Ord_Central
Layer 1
RMSE = 9.9 ft
Average Residual = −6.9 ft
Water Level
140
130
120
110
100
90
80
70
60
50
40
2000
2005
2010
2015
Date
Observed
Simulated

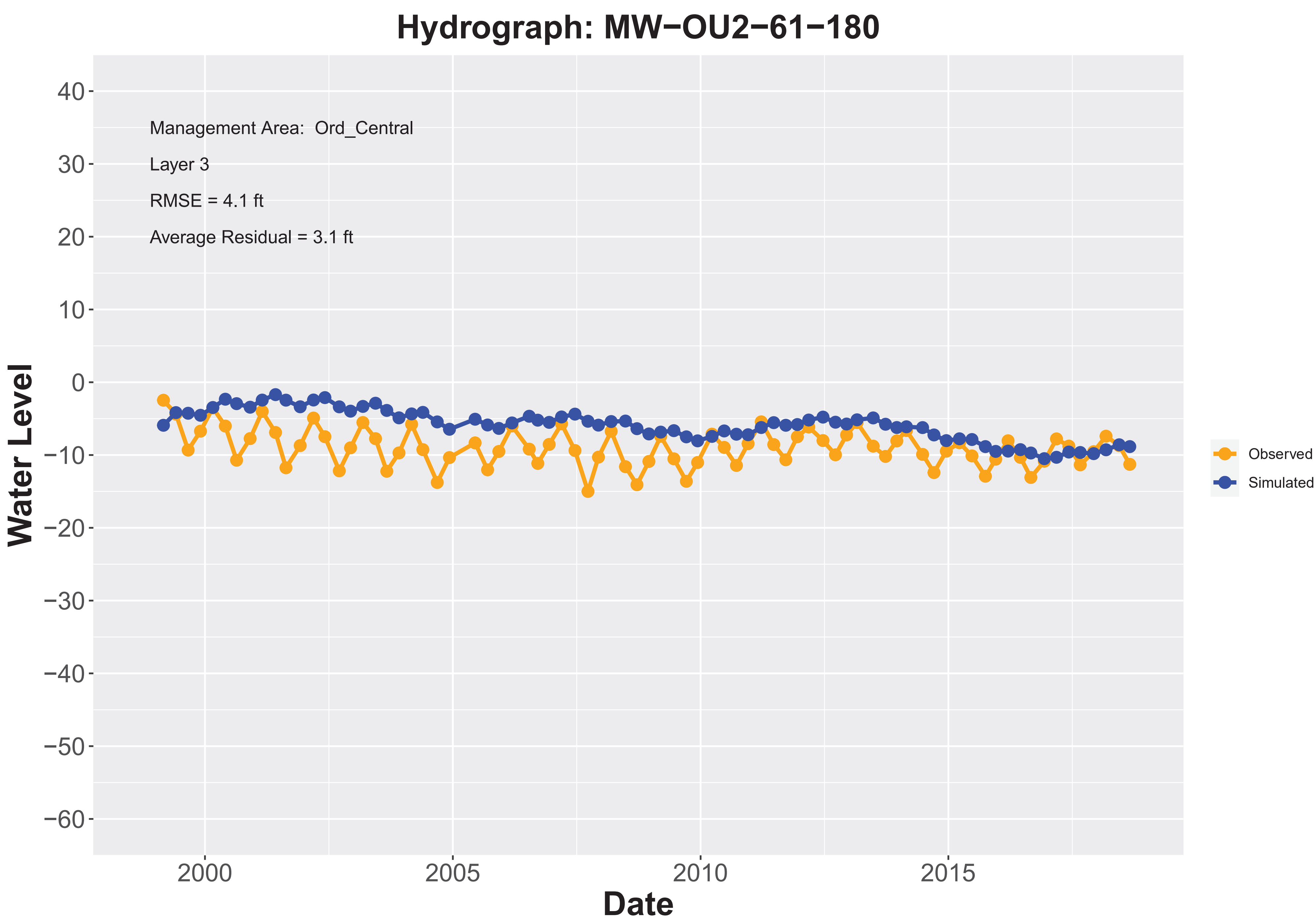


Hydrograph: MW−OU2−58−A
Management Area: Ord_Central
Layer 1
RMSE = 3.6 ft
Average Residual = −1.9 ft
Water Level
130
120
110
100
90
80
70
60
50
40
30
2000
2005
2010
2015
Date
Observed
Simulated

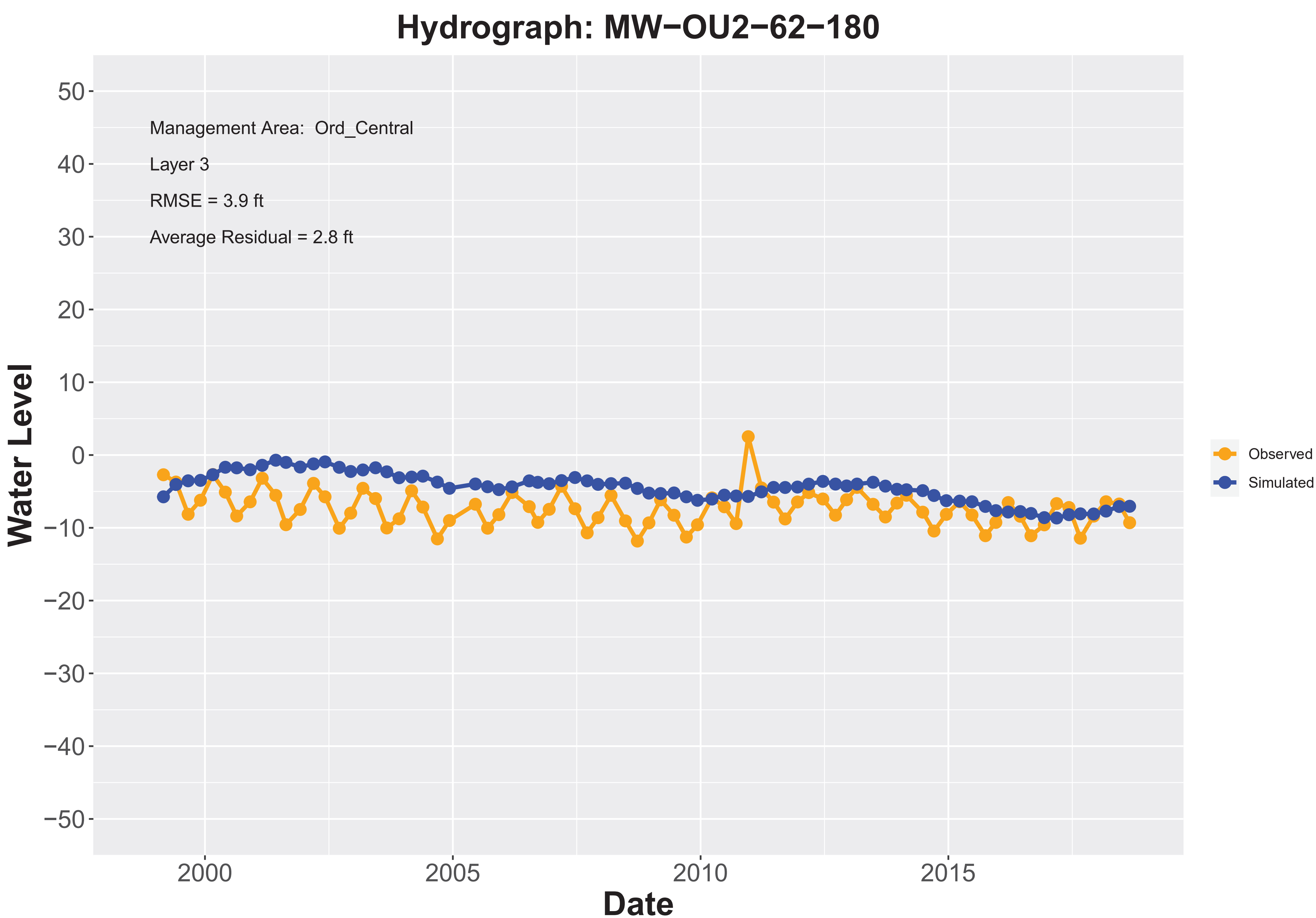

Hydrograph: MW−OU2−59−A
Management Area: Ord_Central
Layer 1
RMSE = 4.0 ft
Average Residual = 1.2 ft
Water Level
130
120
110
100
90
80
70
60
50
40
30
2000
2005
2010
2015
Date
Observed
Simulated

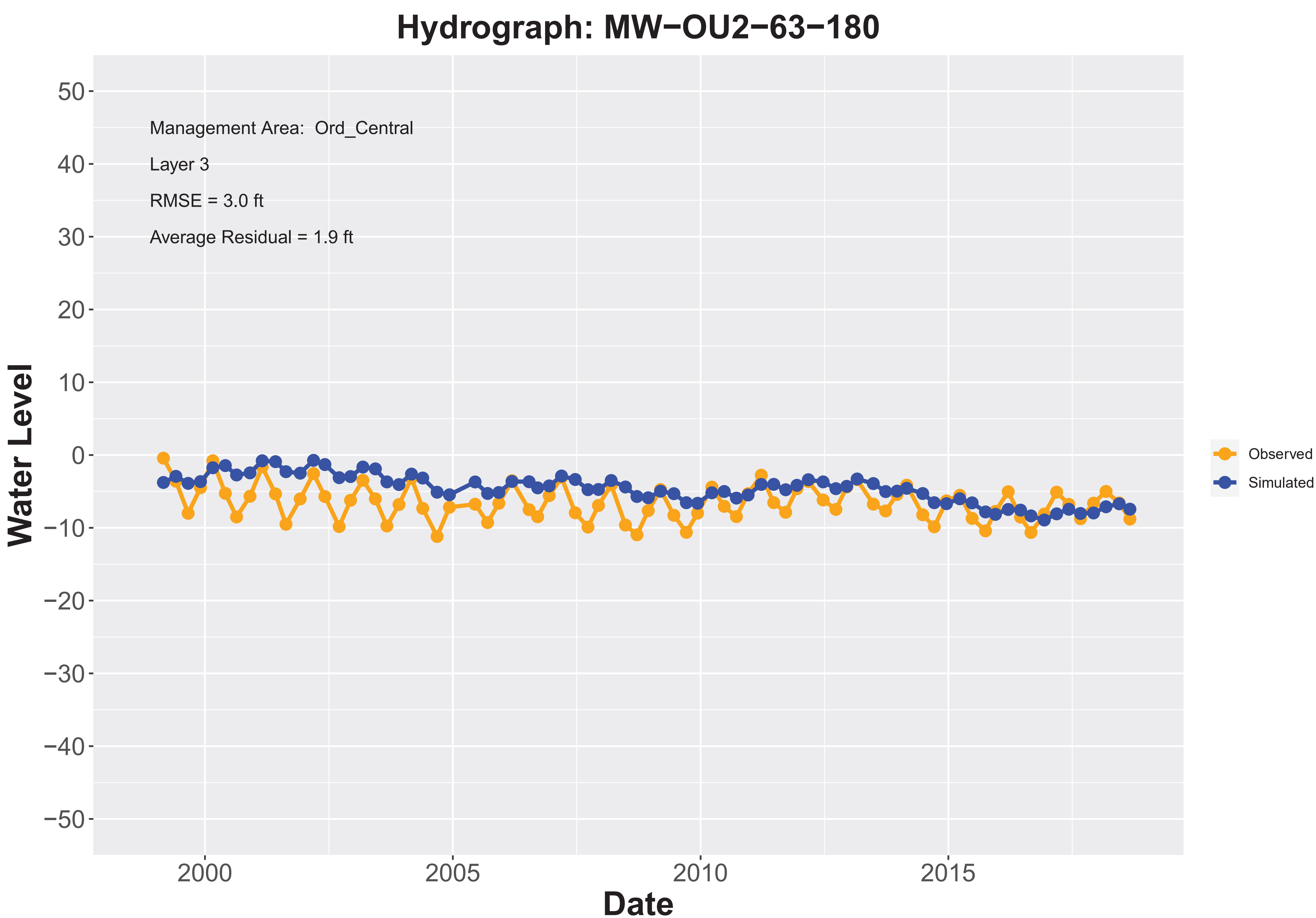


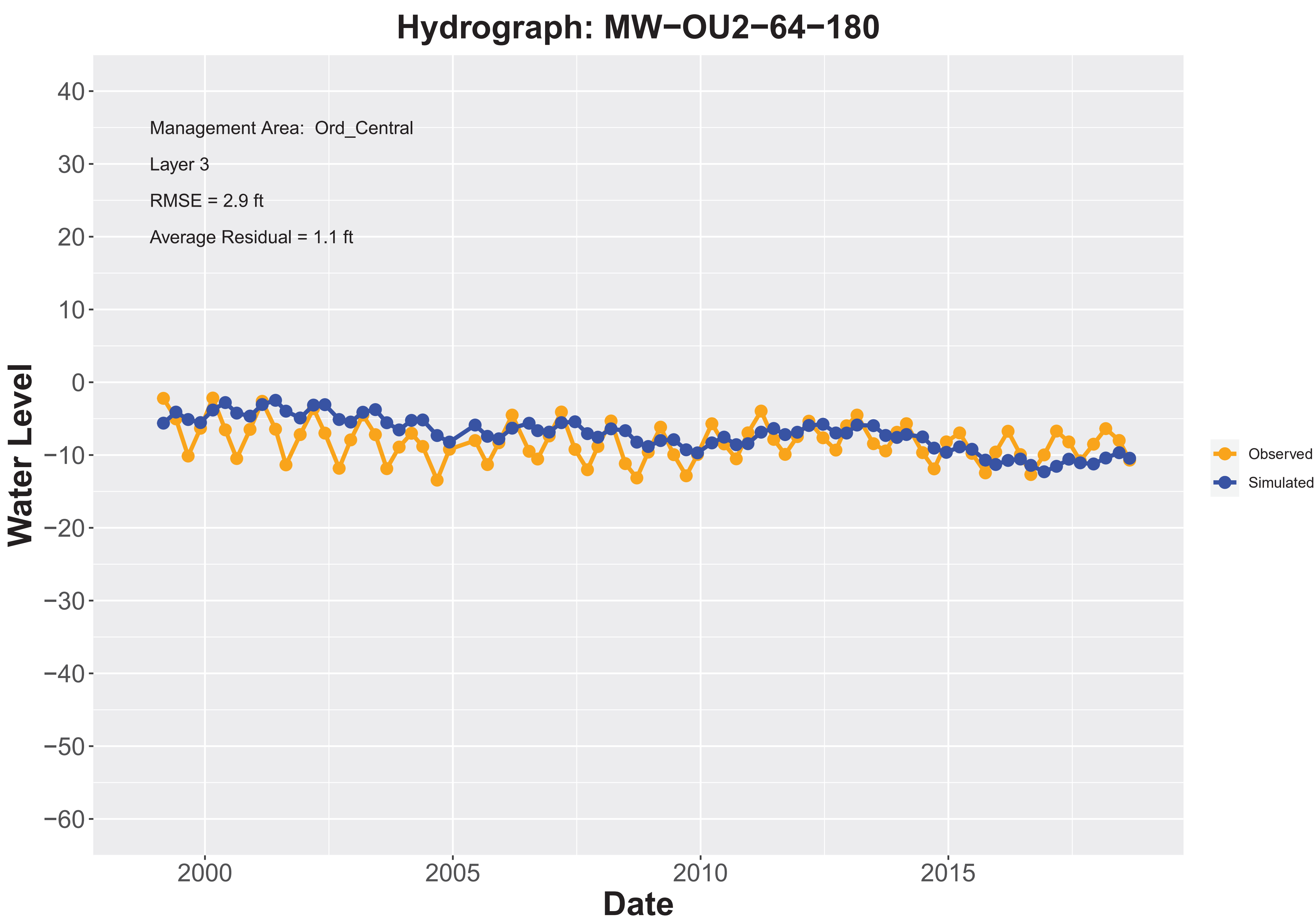
Hydrograph: MW−OU2−60−A
Management Area: Ord_Central
Layer 1
RMSE = 6.0 ft
Average Residual = −0.21 ft
Water Level
140
130
120
110
100
90
80
70
60
50
40
Date
2000
2005
2010
2015
Observed
Simulated

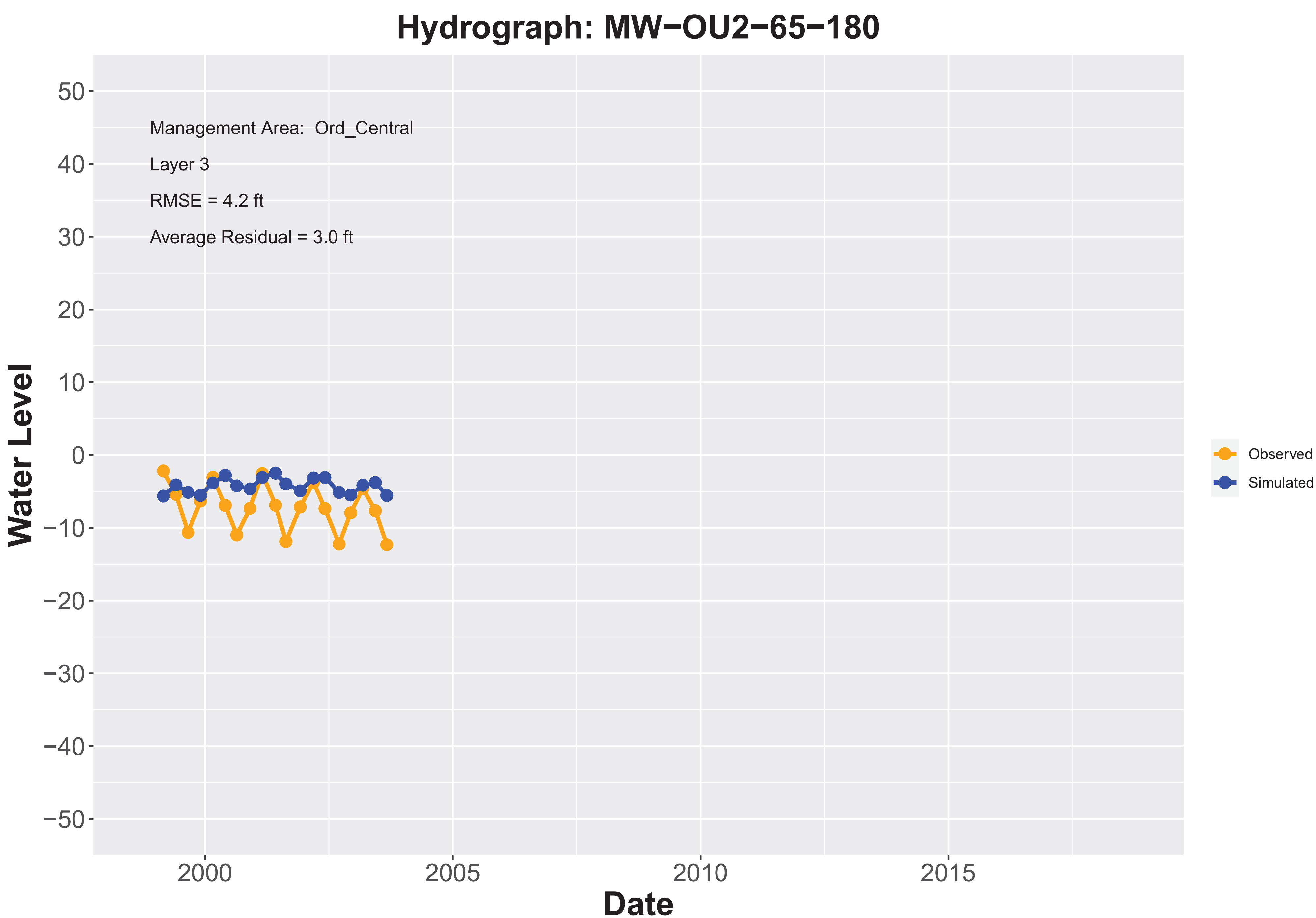


Hydrograph: MW−OU2−61−180
Management Area: Ord_Central
Layer 3
RMSE = 4.1 ft
Average Residual = 3.1 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

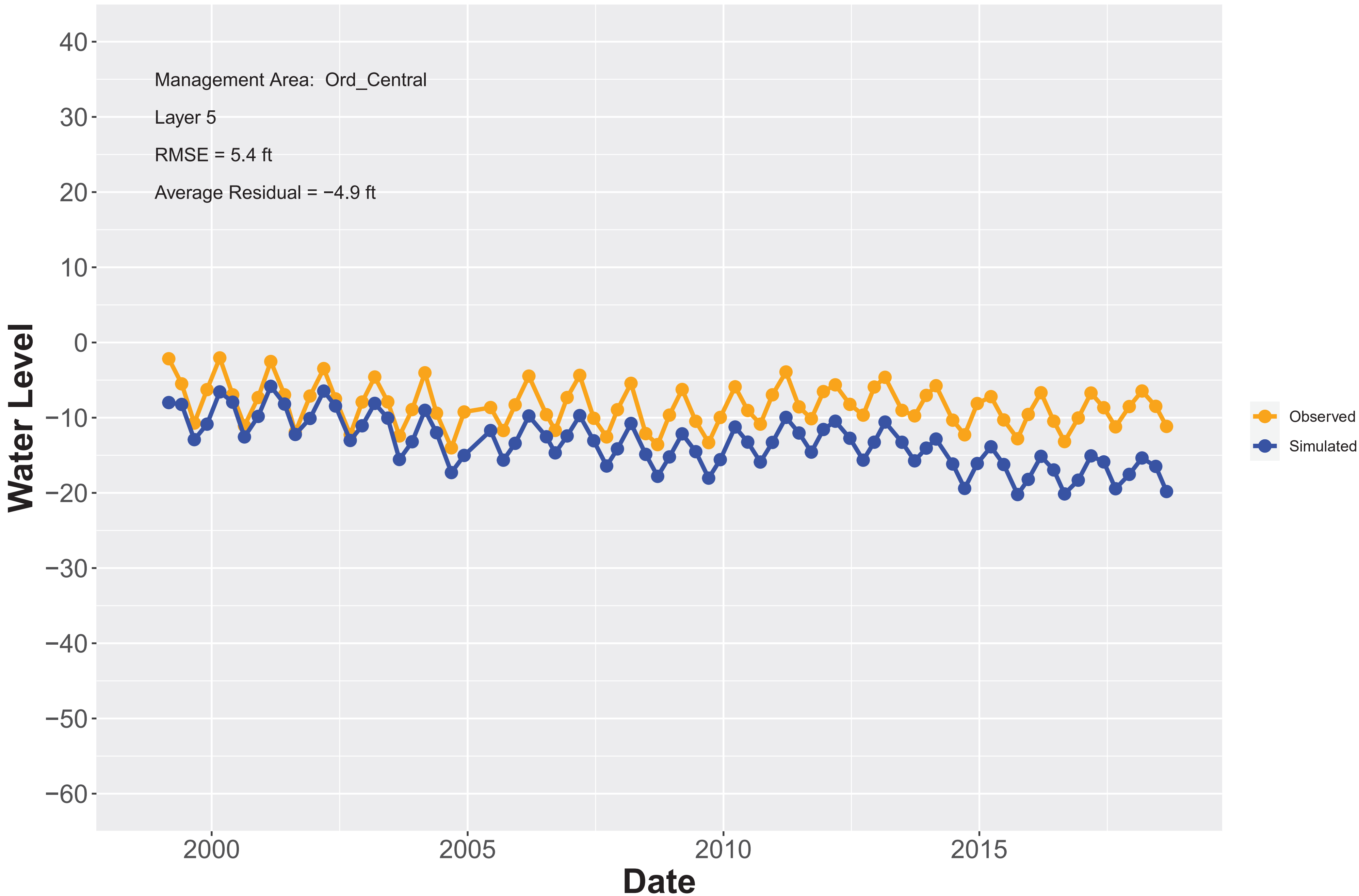

Hydrograph: MW−OU2−62−180
Management Area: Ord_Central
Layer 3
RMSE = 3.9 ft
Average Residual = 2.8 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

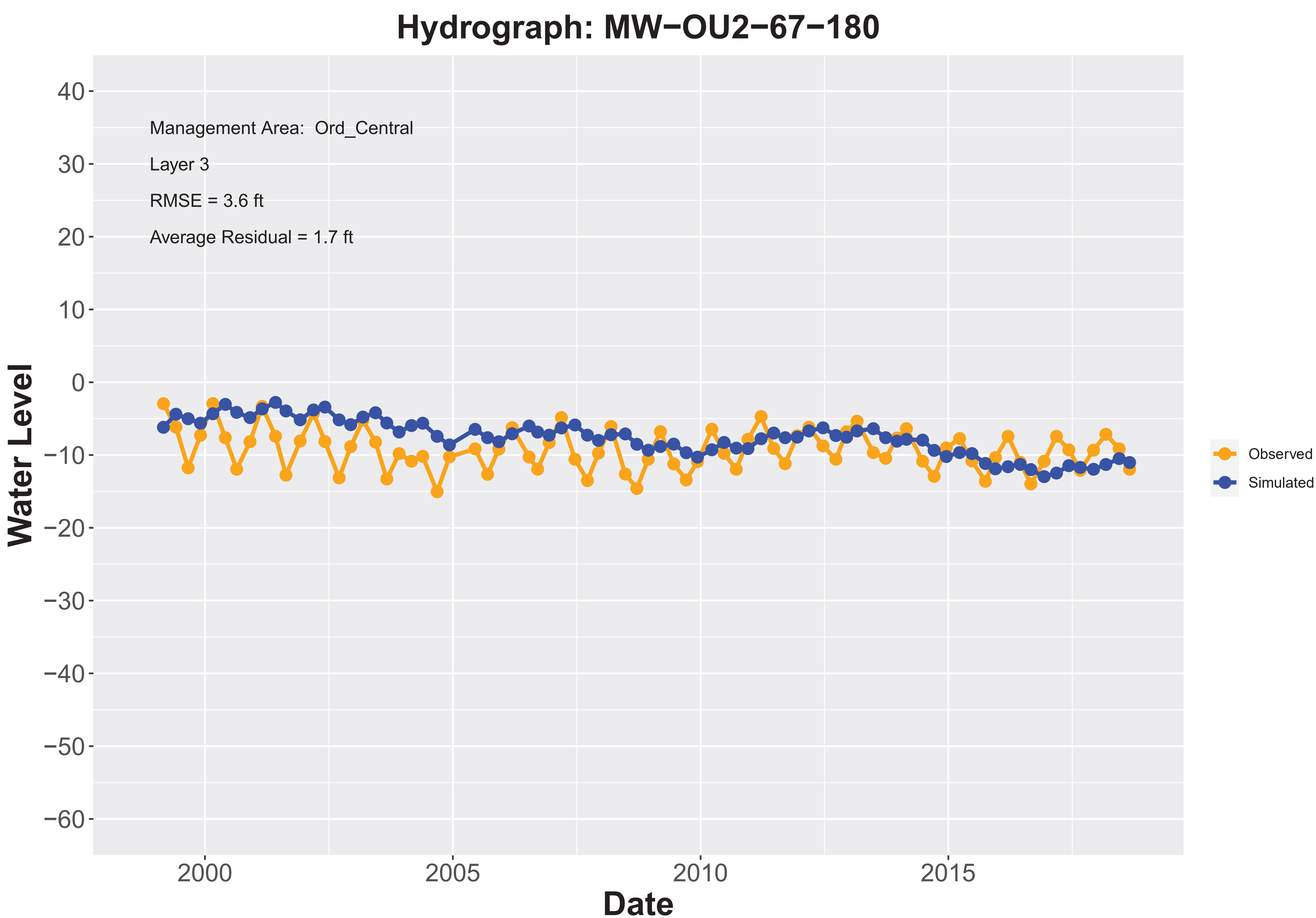

Hydrograph: MW−OU2−63−180
Management Area: Ord_Central
Layer 3
RMSE = 3.0 ft
Average Residual = 1.9 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU2−64−180
Management Area: Ord_Central
Layer 3
RMSE = 2.9 ft
Average Residual = 1.1 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

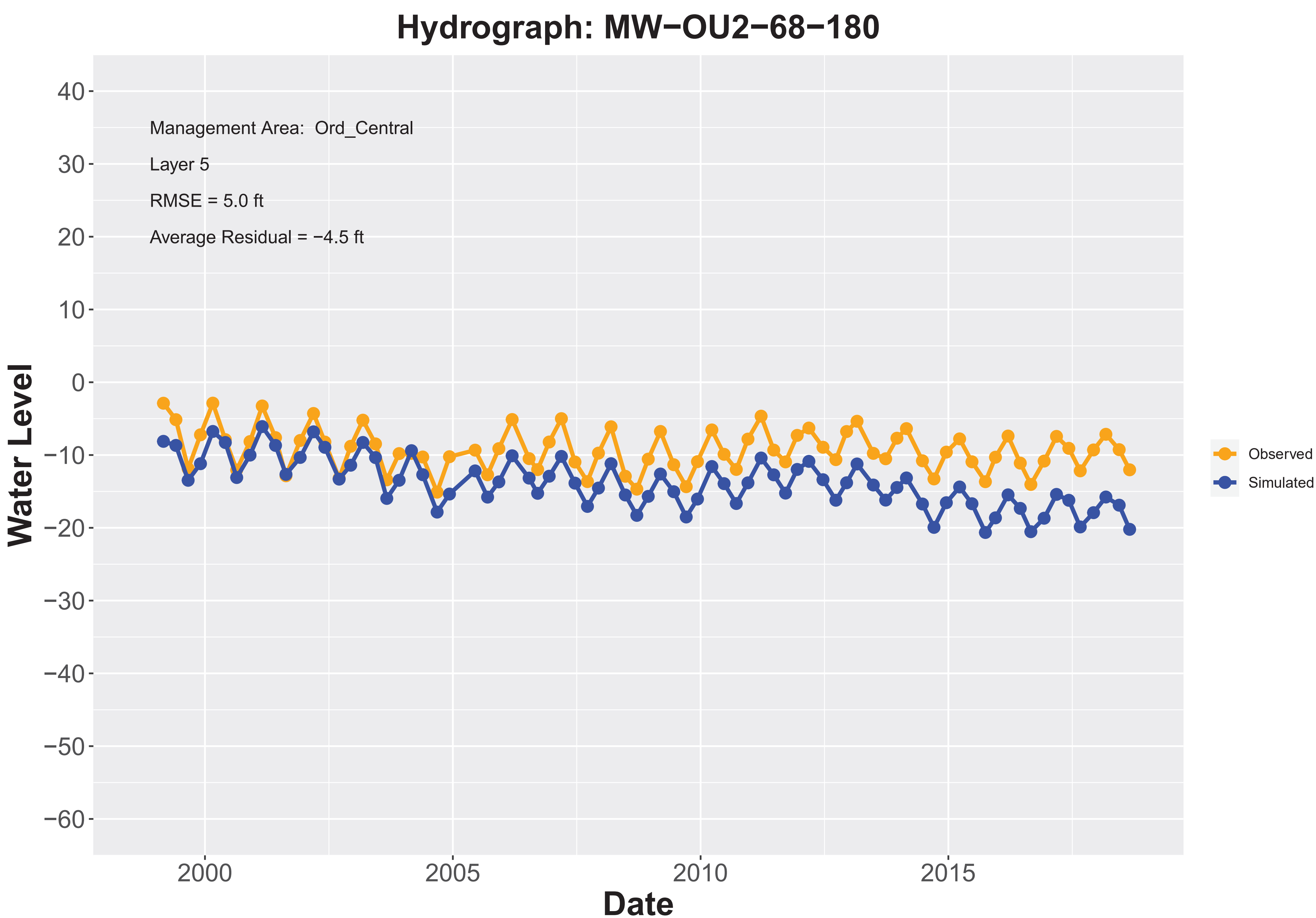

Hydrograph: MW−OU2−65−180
Management Area: Ord_Central
Layer 3
RMSE = 4.2 ft
Average Residual = 3.0 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−OU2−66−180



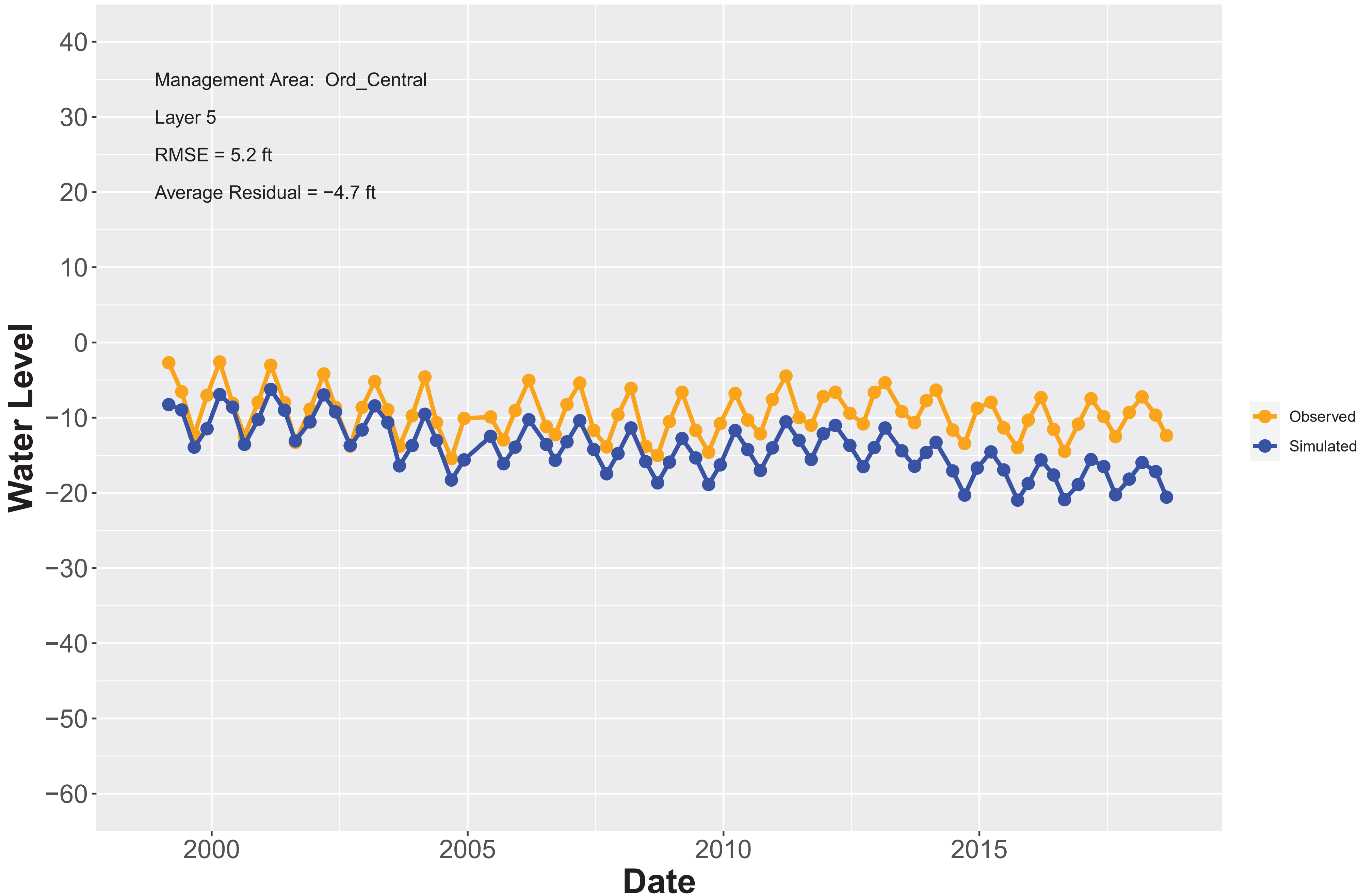


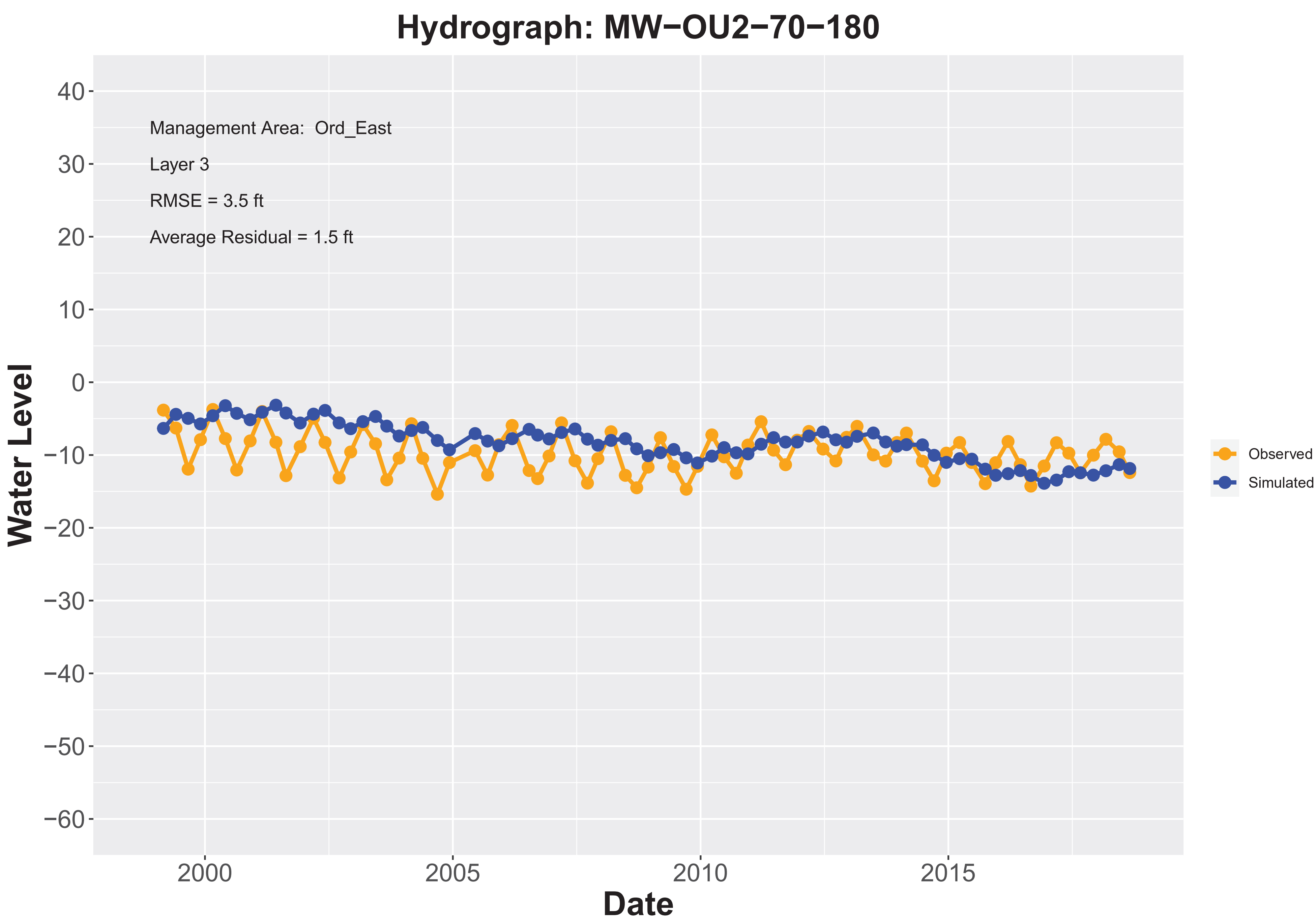
Hydrograph: MW−OU2−67−180
Management Area: Ord_Central
Layer 3
RMSE = 3.6 ft
Average Residual = 1.7 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated



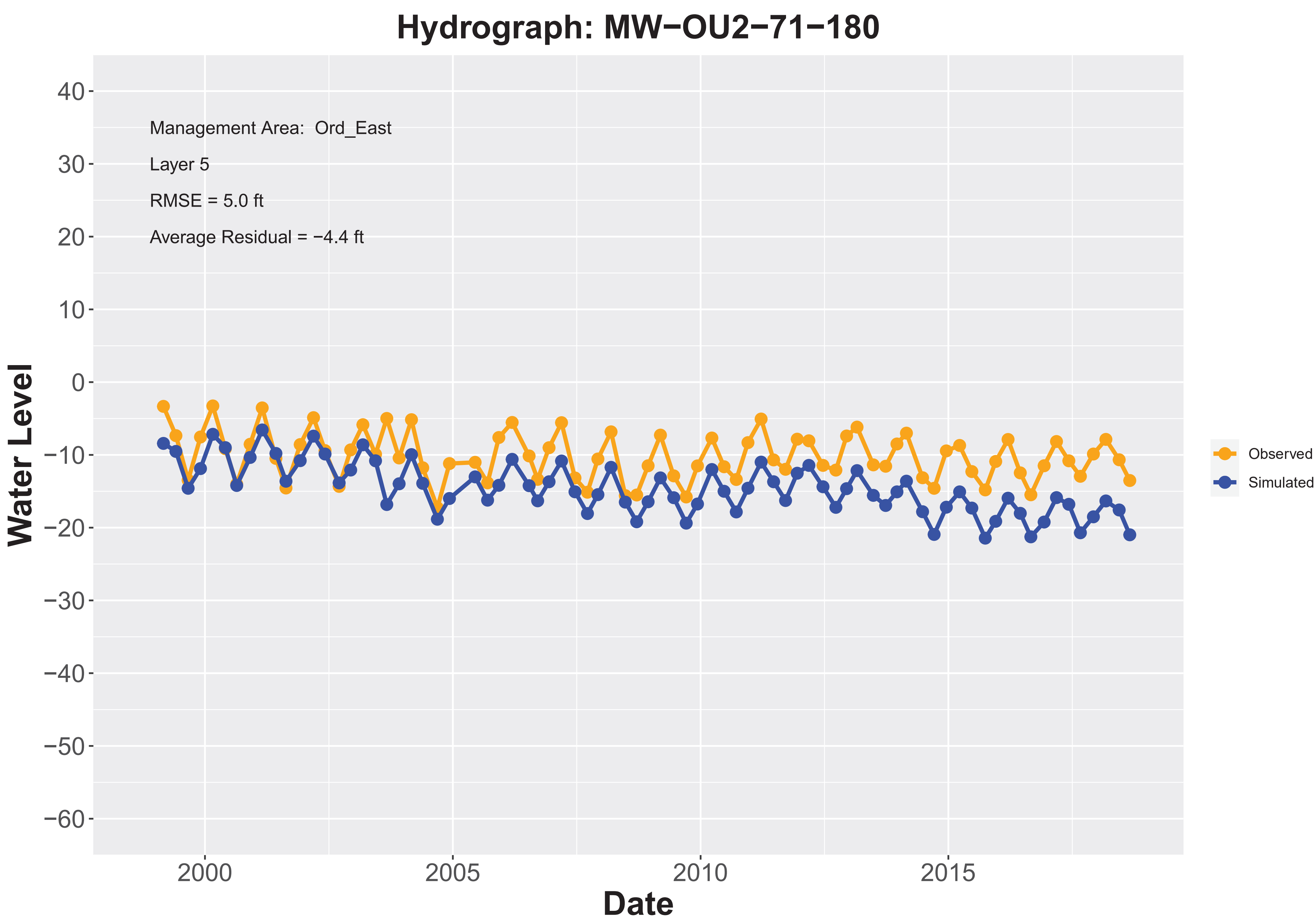
Hydrograph: MW−OU2−68−180
Management Area: Ord_Central
Layer 5
RMSE = 5.0 ft
Average Residual = −4.5 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−OU2−69−180

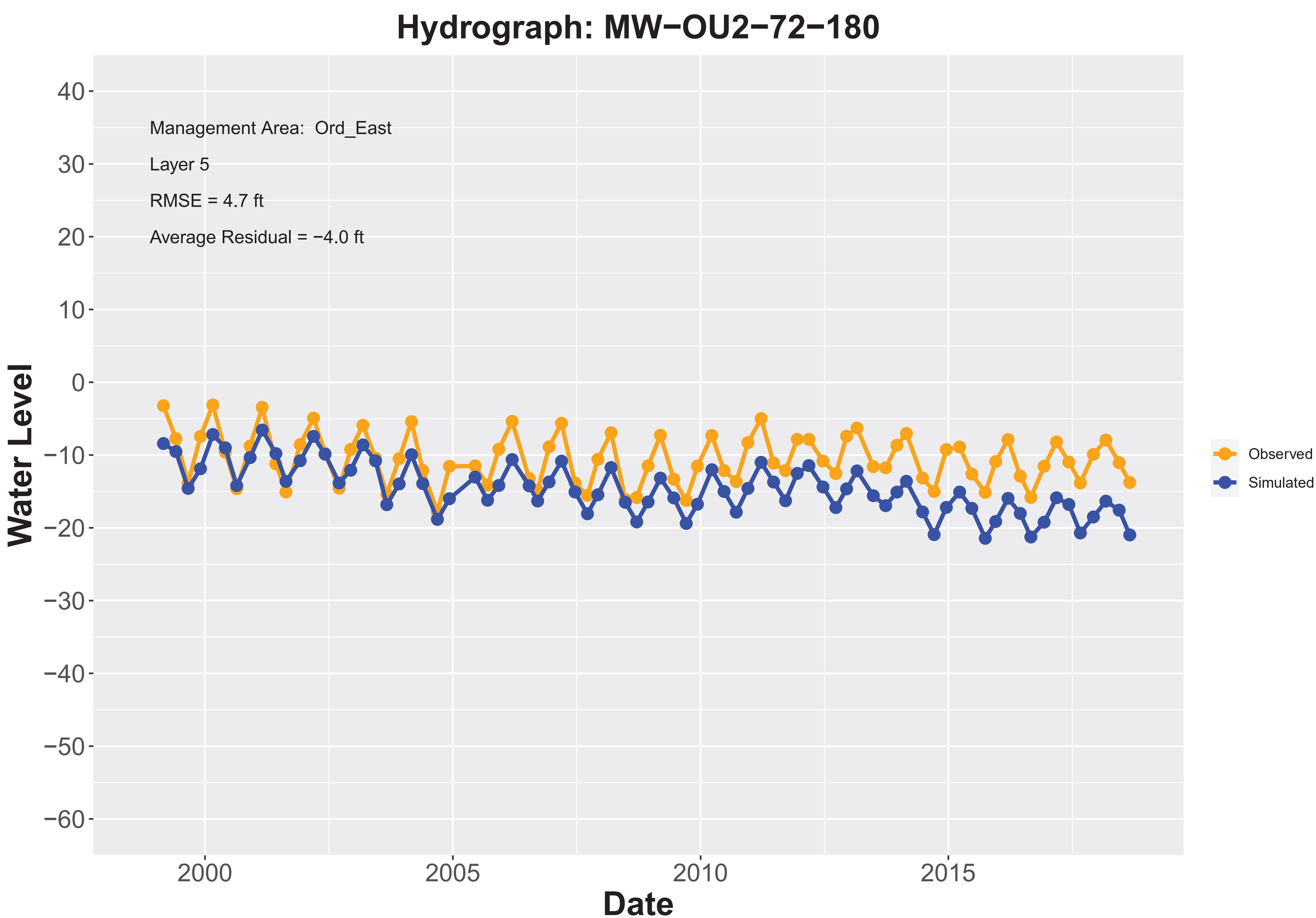


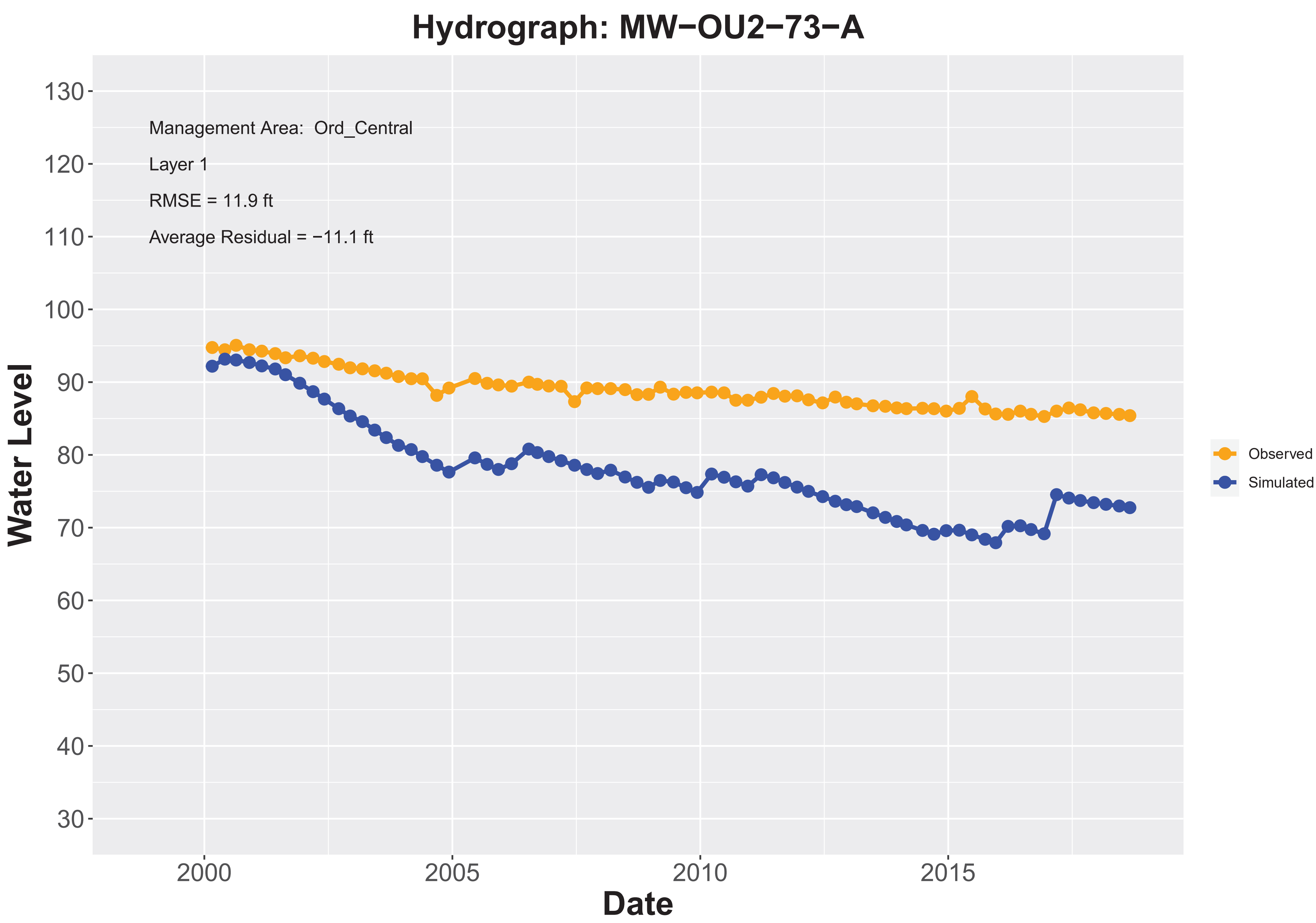


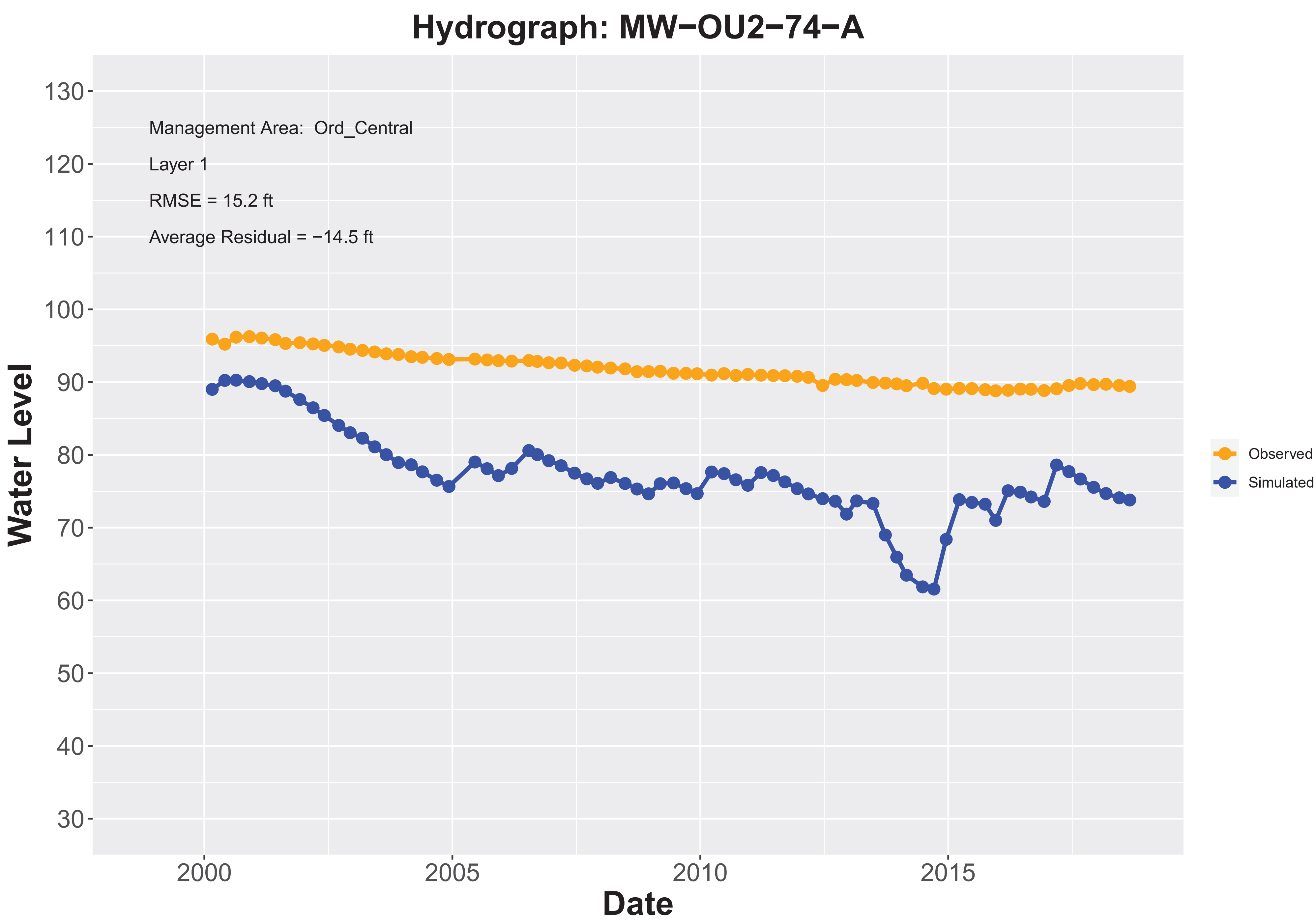
Hydrograph: MW−OU2−70−180
Management Area: Ord_East
Layer 3
RMSE = 3.5 ft
Average Residual = 1.5 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

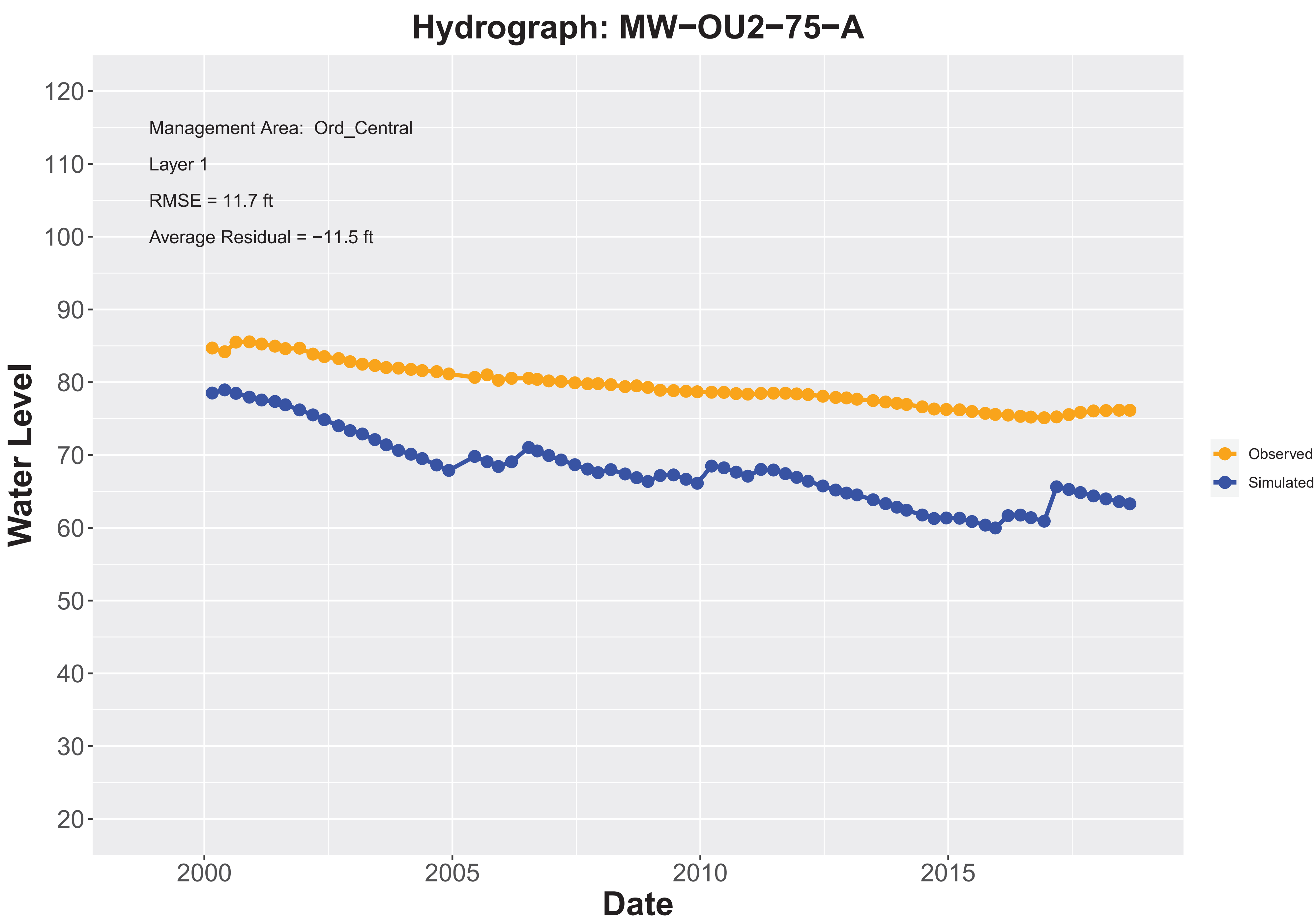


Hydrograph: MW−OU2−71−180
Management Area: Ord_East
Layer 5
RMSE = 5.0 ft
Average Residual = −4.4 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

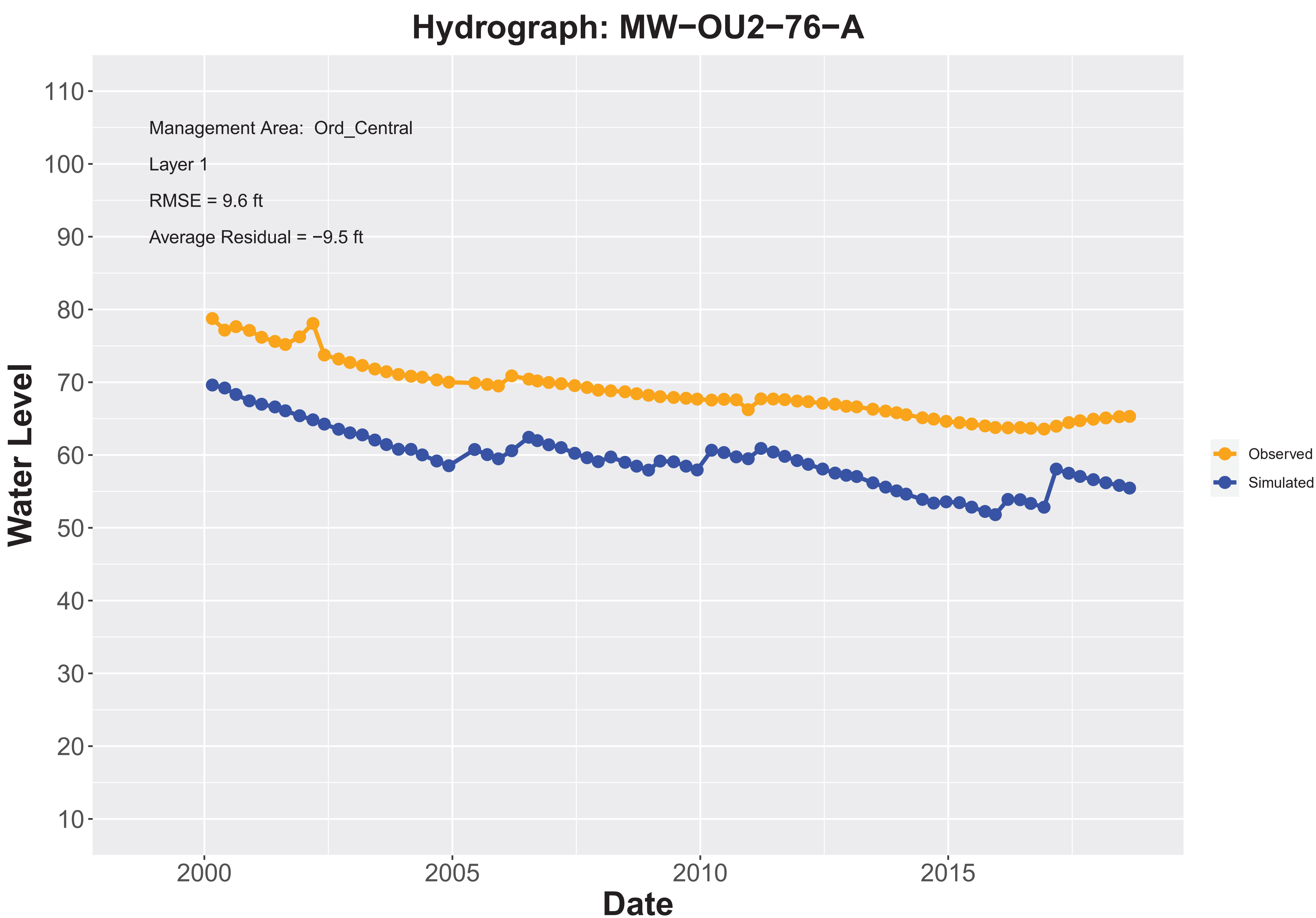

Hydrograph: MW−OU2−72−180
Management Area: Ord_East
Layer 5
RMSE = 4.7 ft
Average Residual = −4.0 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated


Hydrograph: MW−OU2−73−A
Management Area: Ord_Central
Layer 1
RMSE = 11.9 ft
Average Residual = −11.1 ft
Water Level
130
120
110
100
90
80
70
60
50
40
30
2000
2005
2010
2015
Date
Observed
Simulated

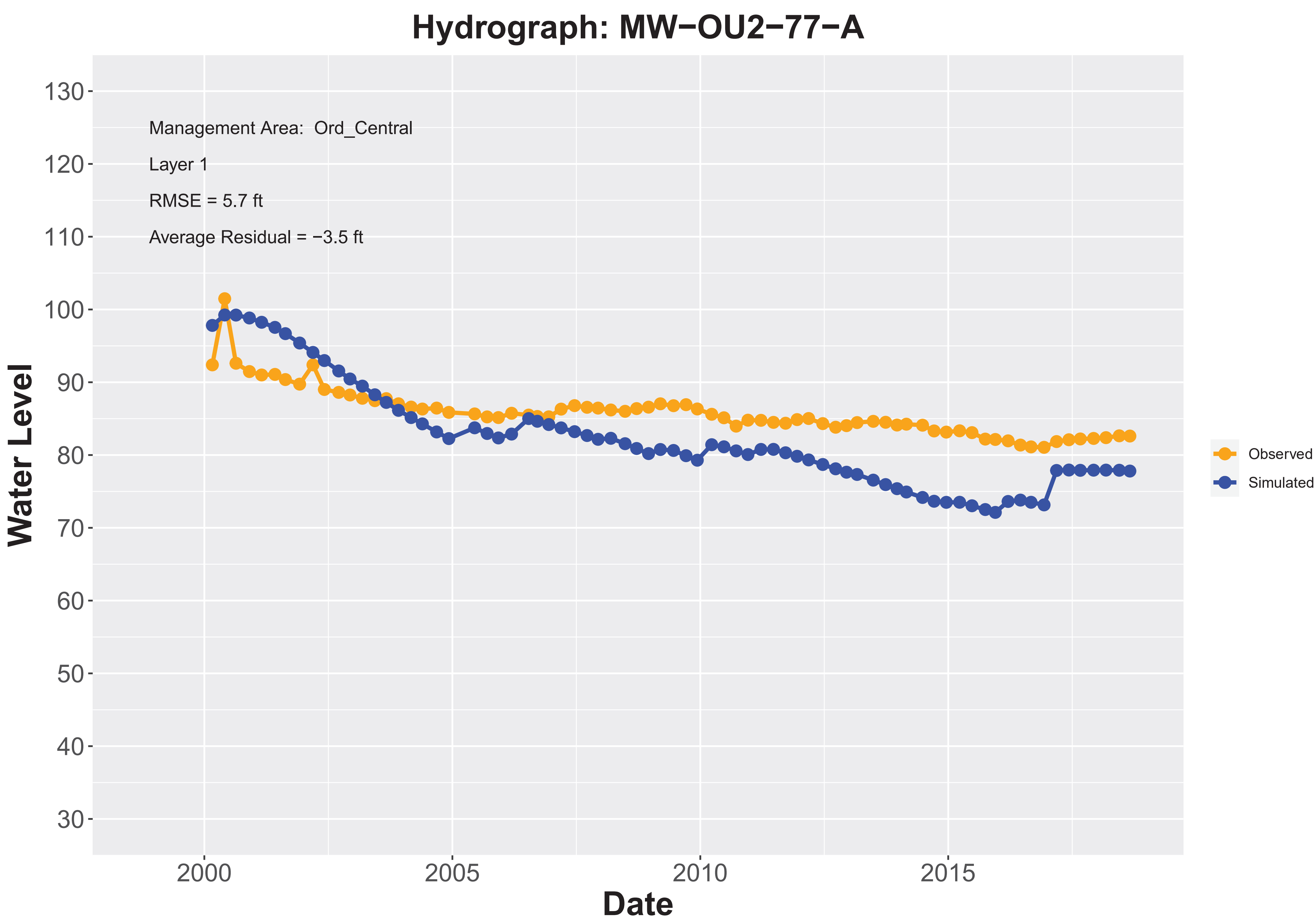

Hydrograph: MW−OU2−74−A
Management Area: Ord_Central
Layer 1
RMSE = 15.2 ft
Average Residual = −14.5 ft
Water Level
130
120
110
100
90
80
70
60
50
40
30
2000
2005
2010
2015
Date
Observed
Simulated

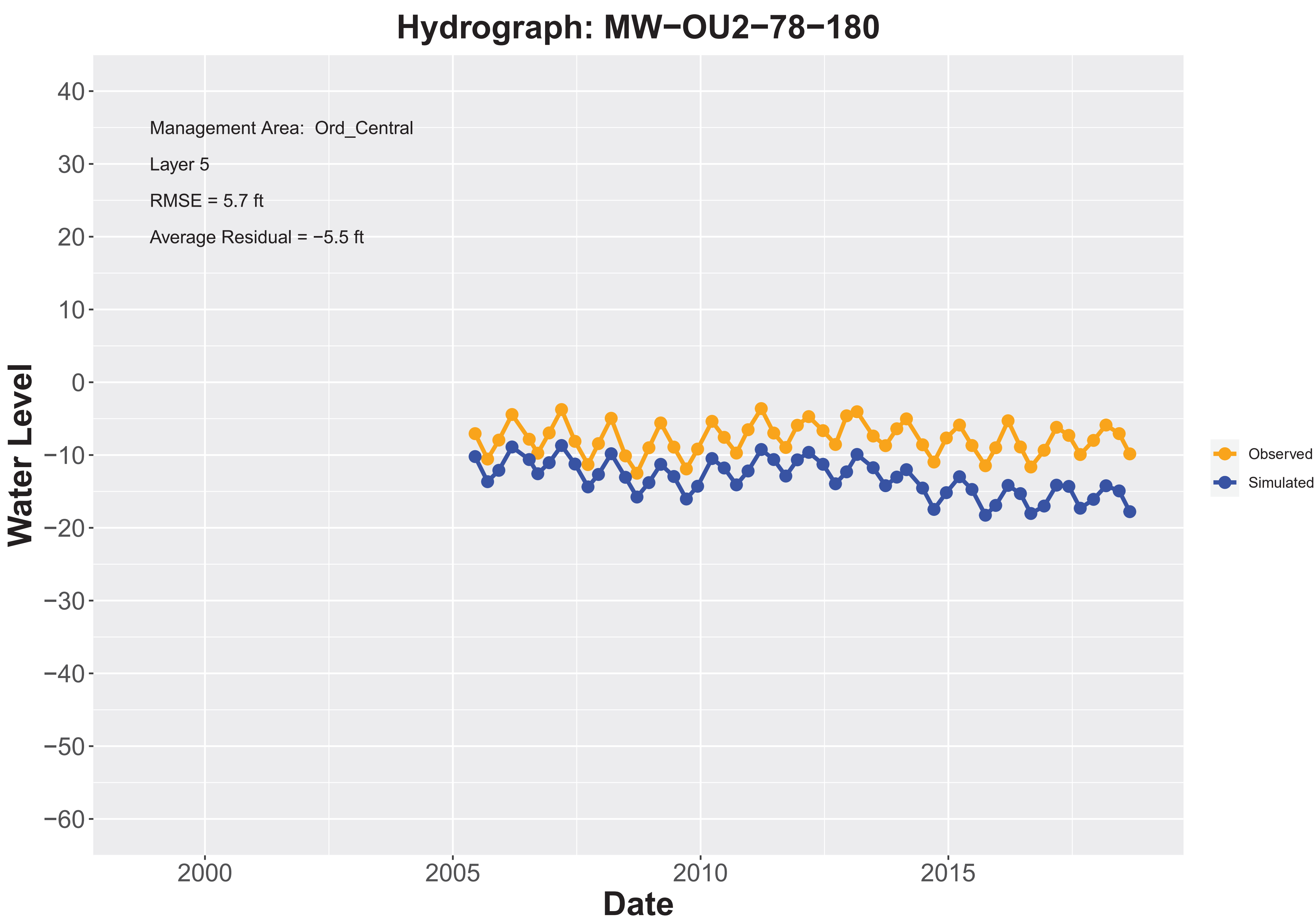


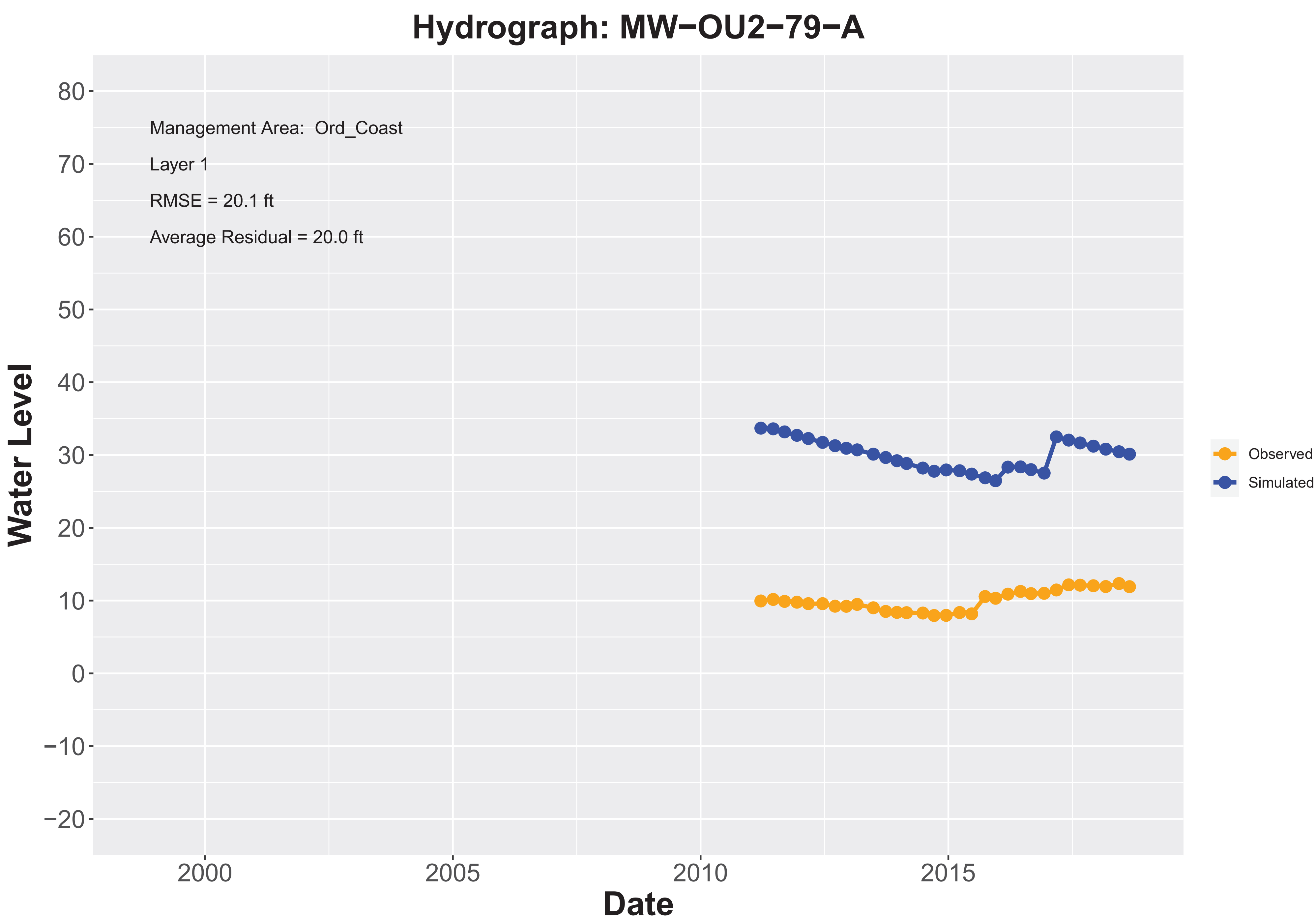
Hydrograph: MW−OU2−75−A
Management Area: Ord_Central
Layer 1
RMSE = 11.7 ft
Average Residual = −11.5 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated

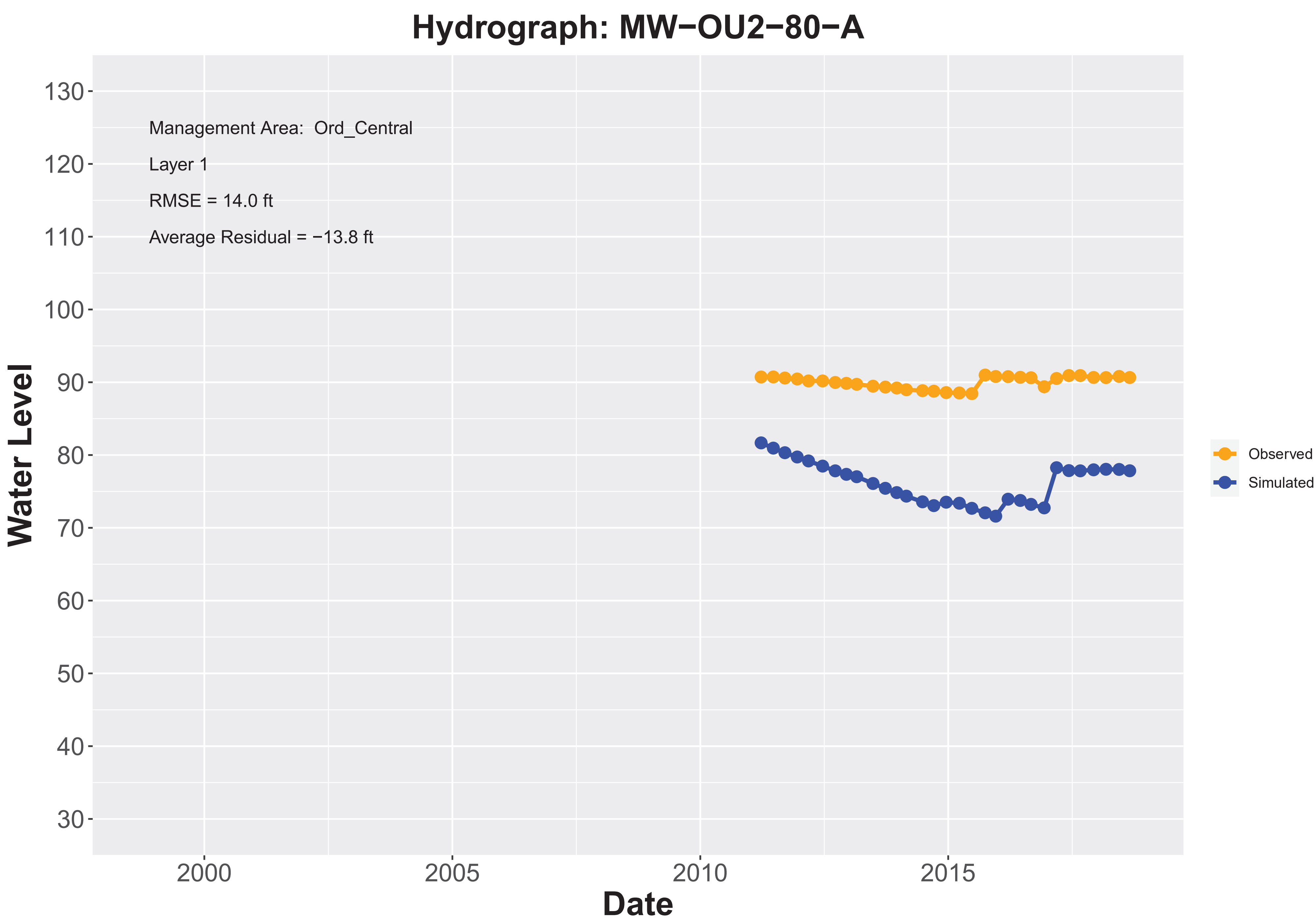


Hydrograph: MW−OU2−76−A
Management Area: Ord_Central
Layer 1
RMSE = 9.6 ft
Average Residual = −9.5 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

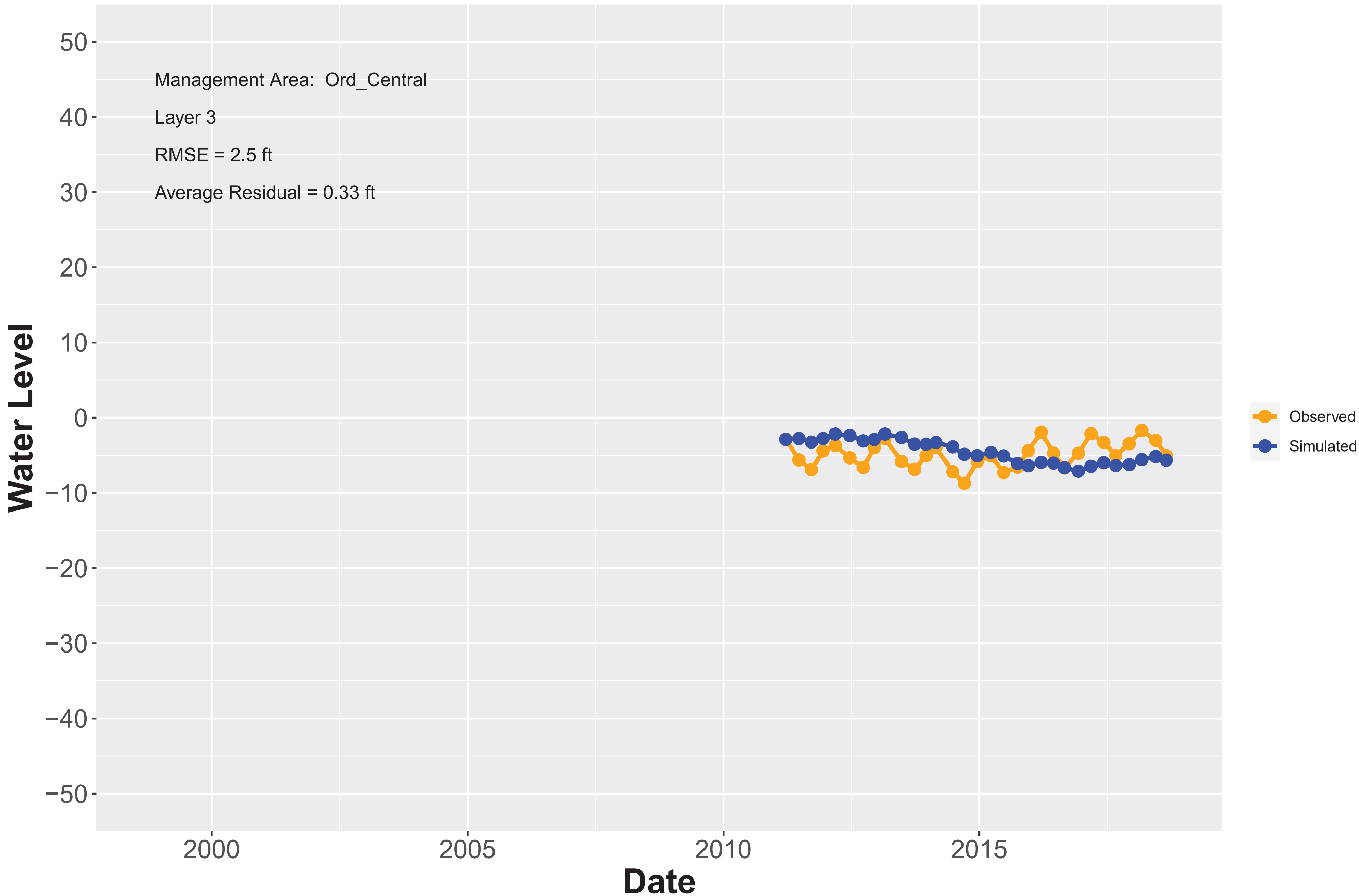

Hydrograph: MW−OU2−77−A
Management Area: Ord_Central
Layer 1
RMSE = 5.7 ft
Average Residual = −3.5 ft
Water Level
130
120
110
100
90
80
70
60
50
40
30
2000
2005
2010
2015
Date
Observed
Simulated

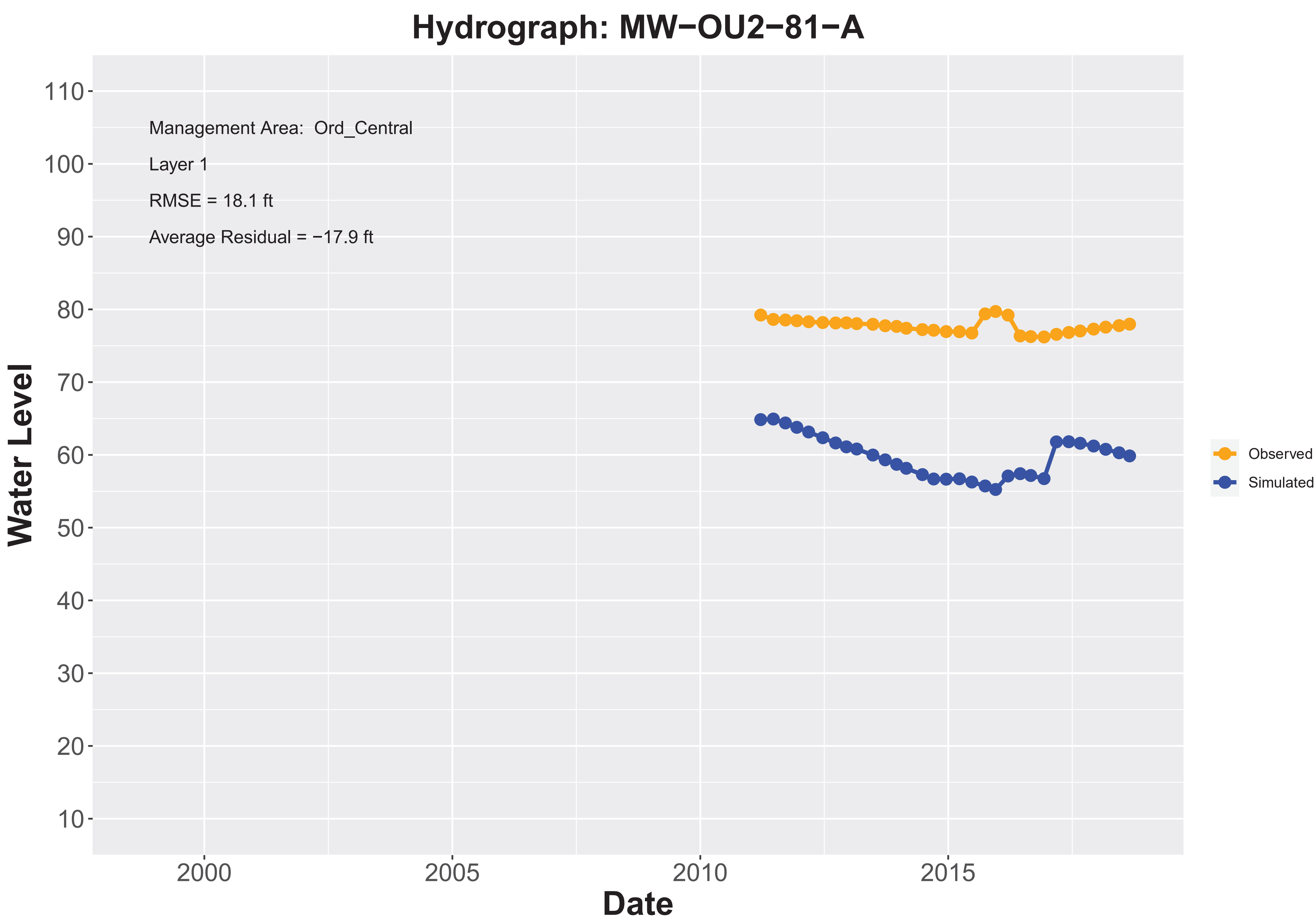

Hydrograph: MW−OU2−78−180
Management Area: Ord_Central
Layer 5
RMSE = 5.7 ft
Average Residual = −5.5 ft
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Water Level
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: MW−OU2−79−A
Management Area: Ord_Coast
Layer 1
RMSE = 20.1 ft
Average Residual = 20.0 ft
Water Level
80
70
60
50
40
30
20
10
0
−10
−20
2000
2005
2010
2015
Date
Observed
Simulated

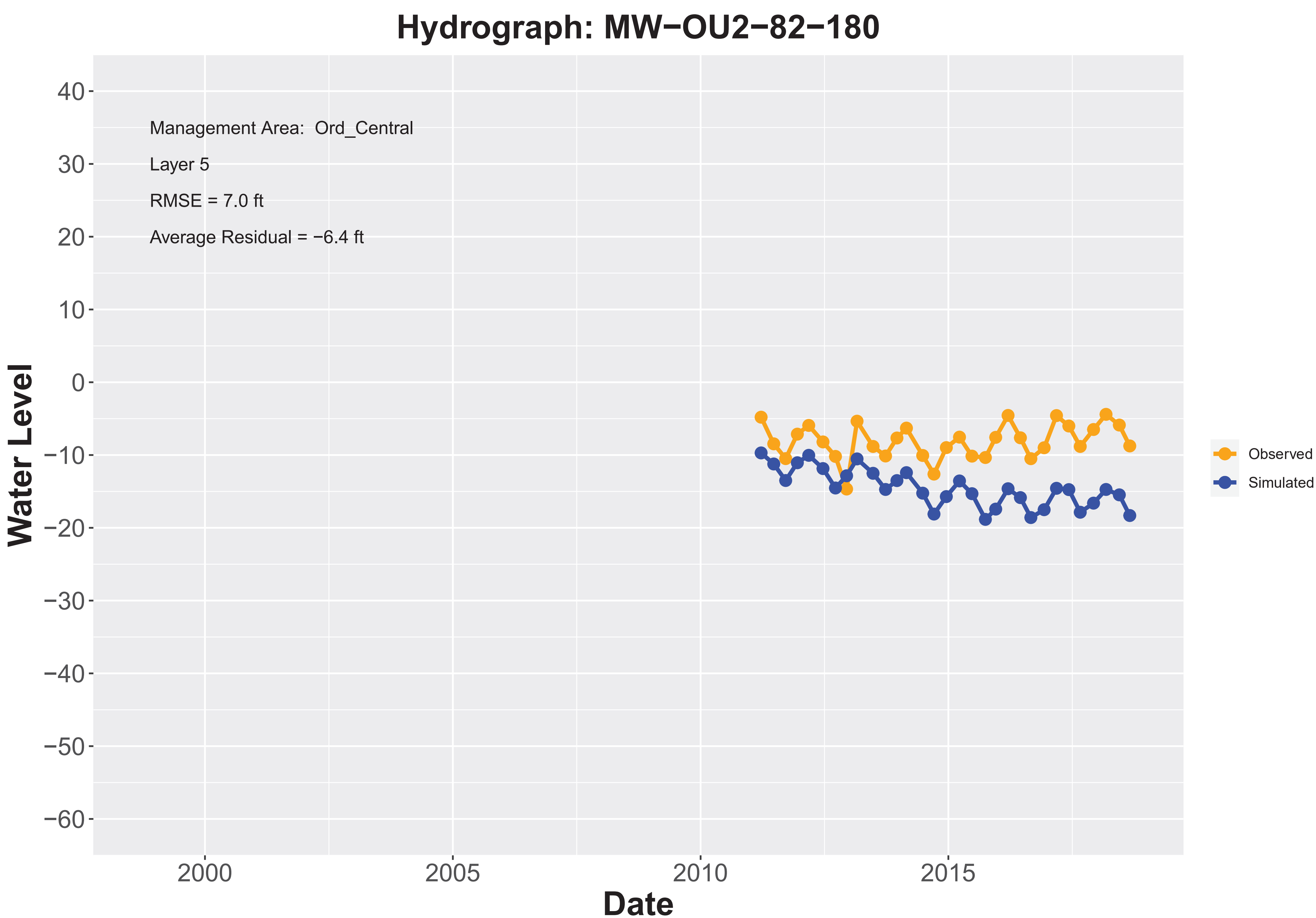

Hydrograph: MW−OU2−80−A
Management Area: Ord_Central
Layer 1
RMSE = 14.0 ft
Average Residual = −13.8 ft
Water Level
130
120
110
100
90
80
70
60
50
40
30
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: MW−OU2−81−180

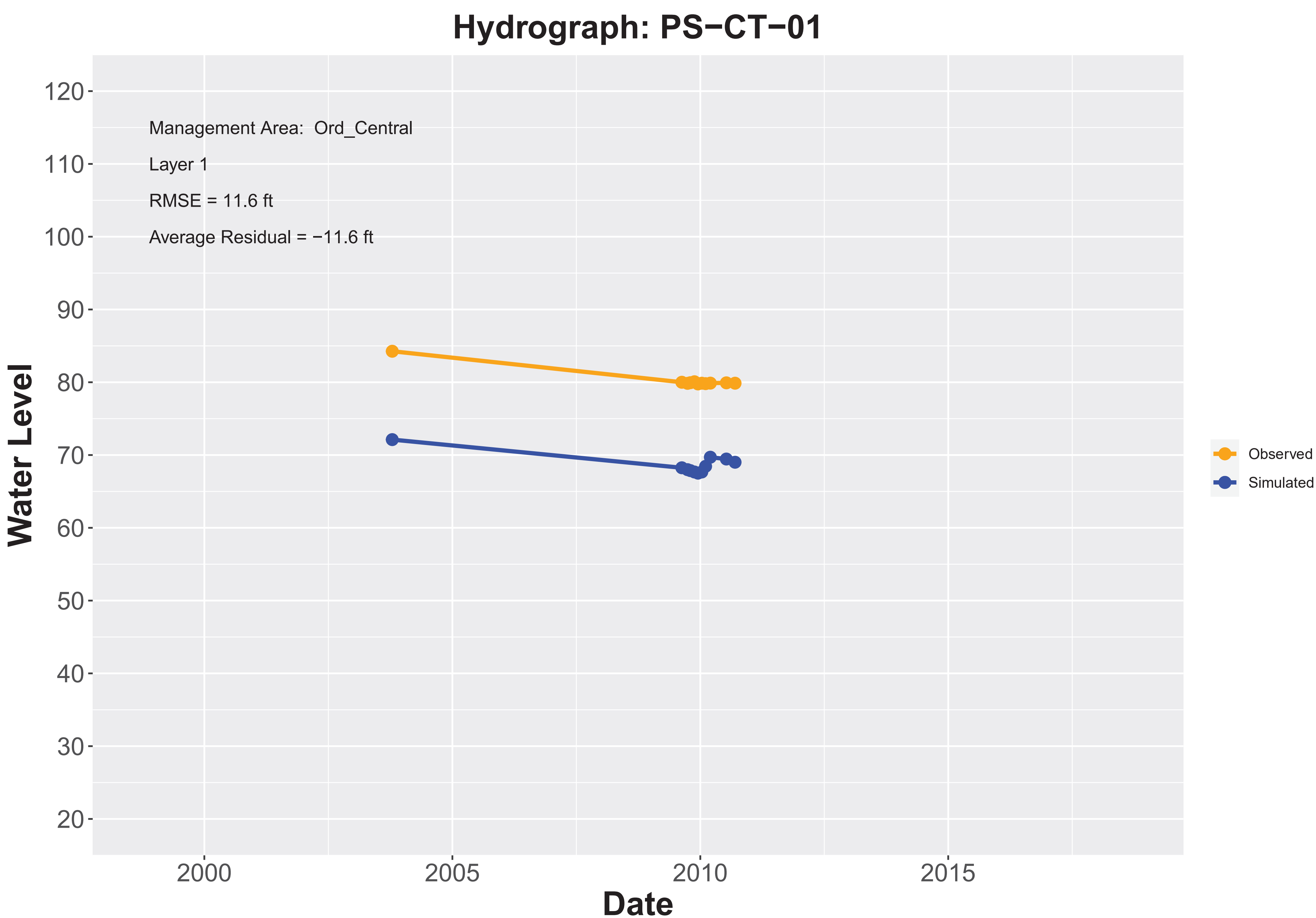




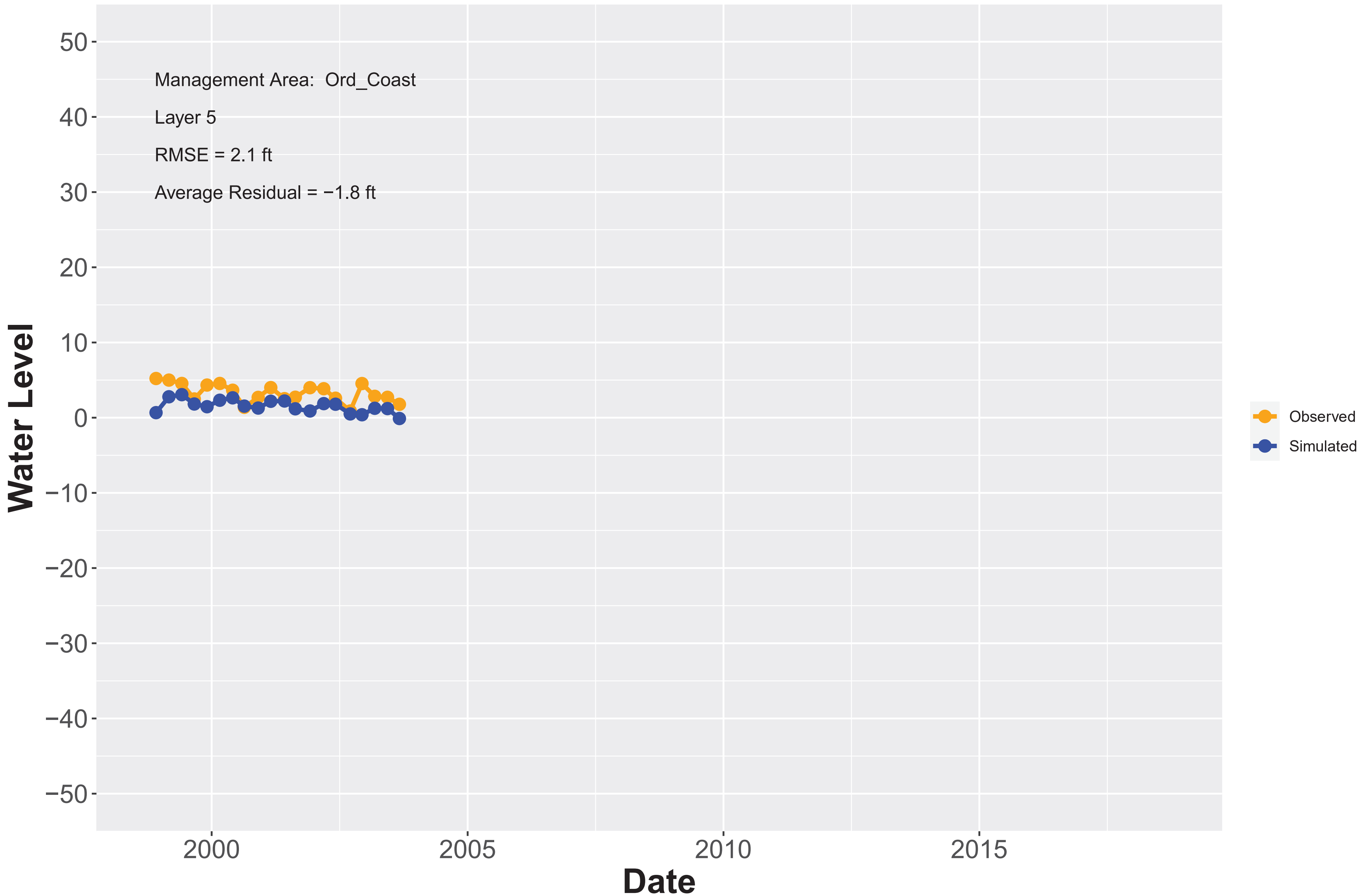
Hydrograph: MW−OU2−81−A
Management Area: Ord_Central
Layer 1
RMSE = 18.1 ft
Average Residual = −17.9 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

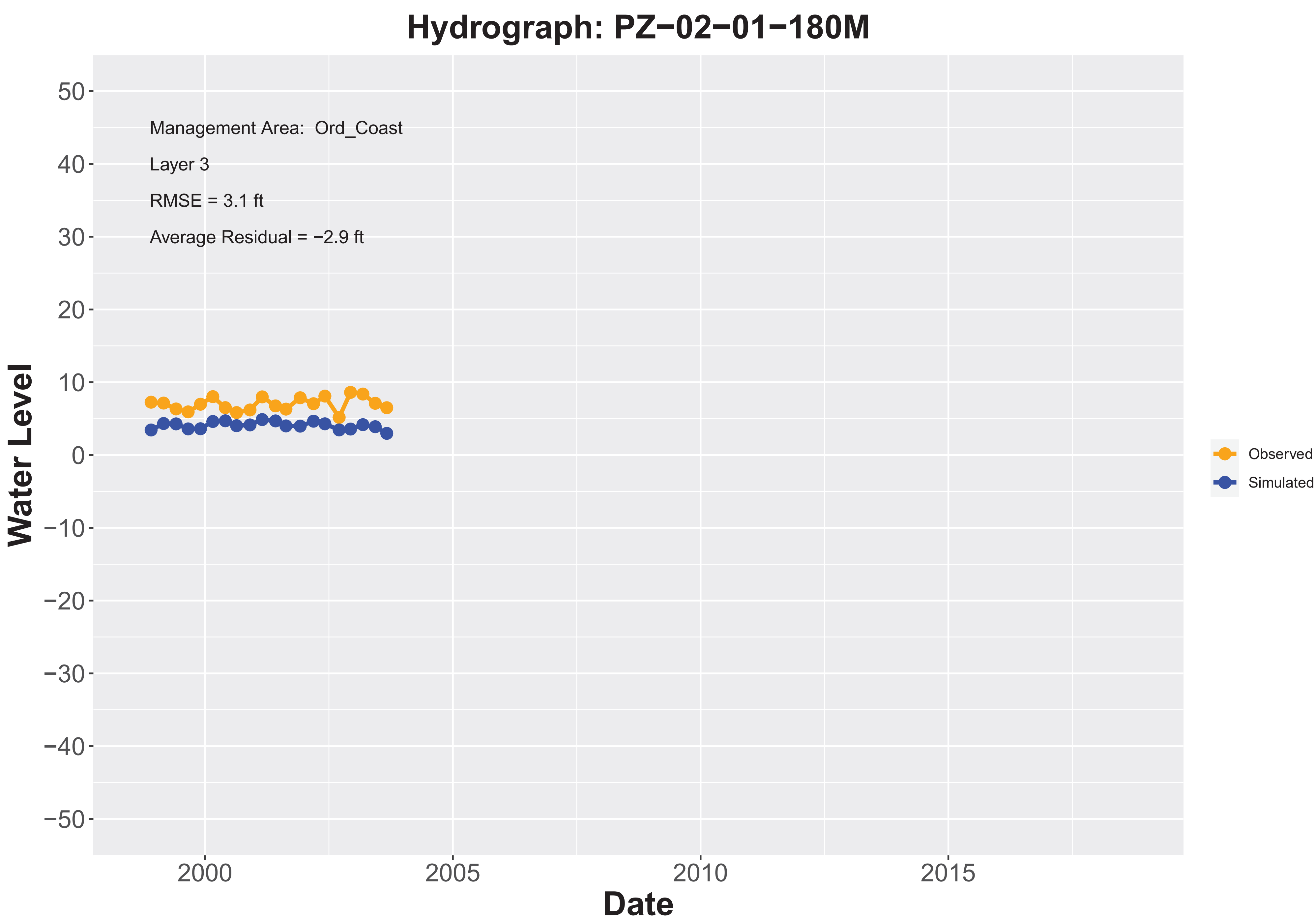


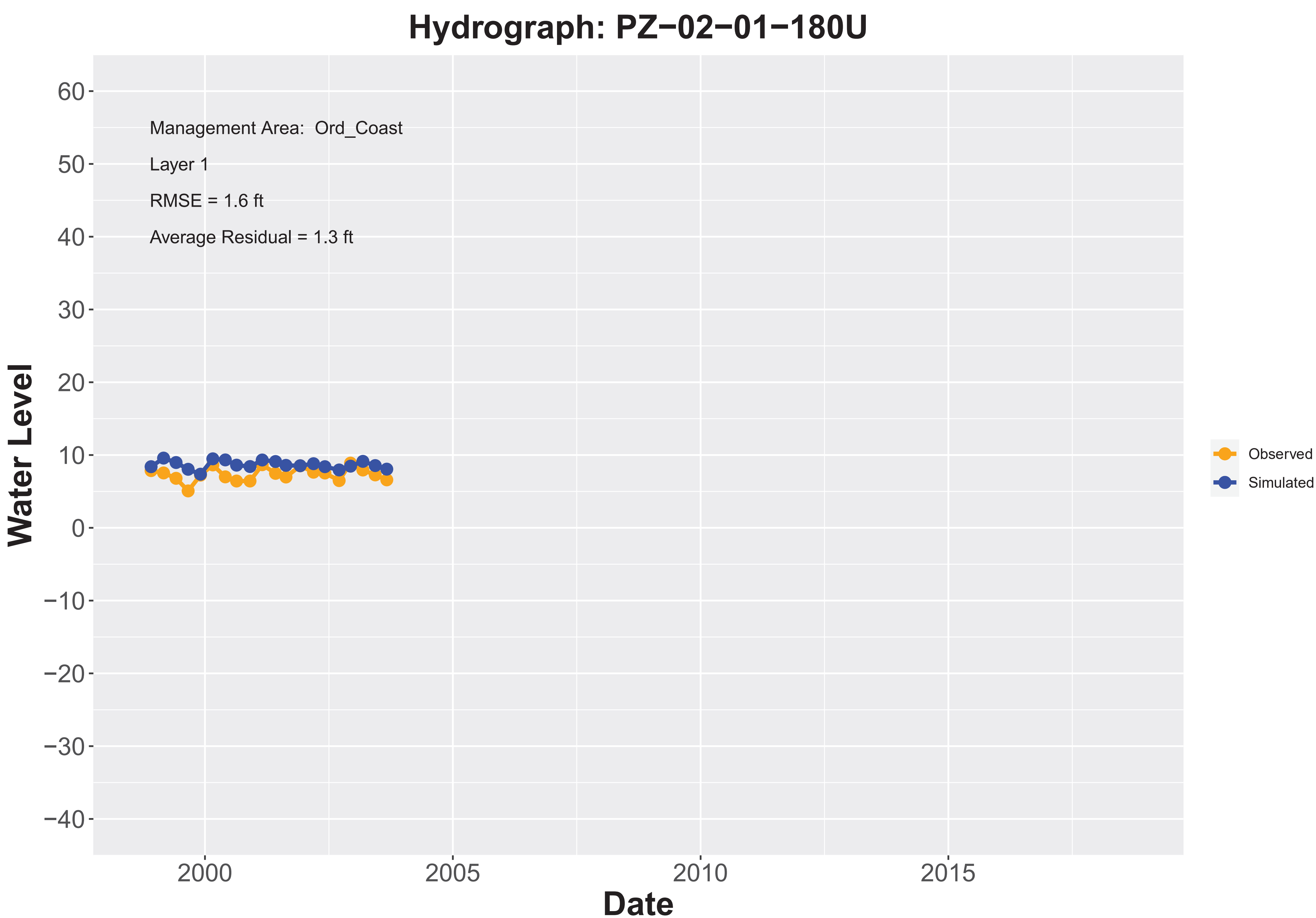
Hydrograph: MW−OU2−82−180
Management Area: Ord_Central
Layer 5
RMSE = 7.0 ft
Average Residual = −6.4 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
Date
2000
2005
2010
2015
Observed
Simulated

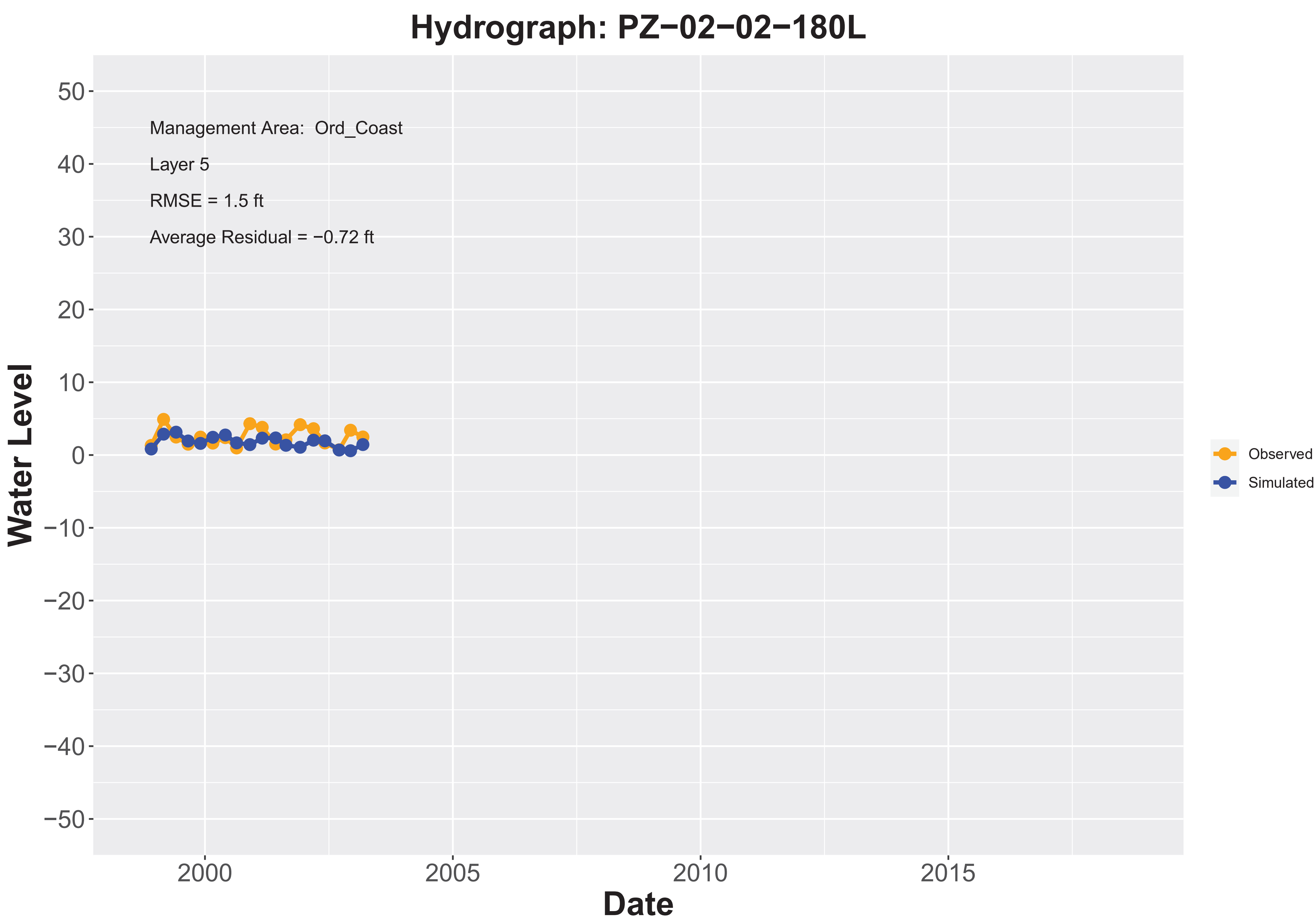

Hydrograph: PS−CT−01
Management Area: Ord_Central
Layer 1
RMSE = 11.6 ft
Average Residual = −11.6 ft
Water Level
120
110
100
90
80
70
60
50
40
30
20
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: PZ−02−01−180L

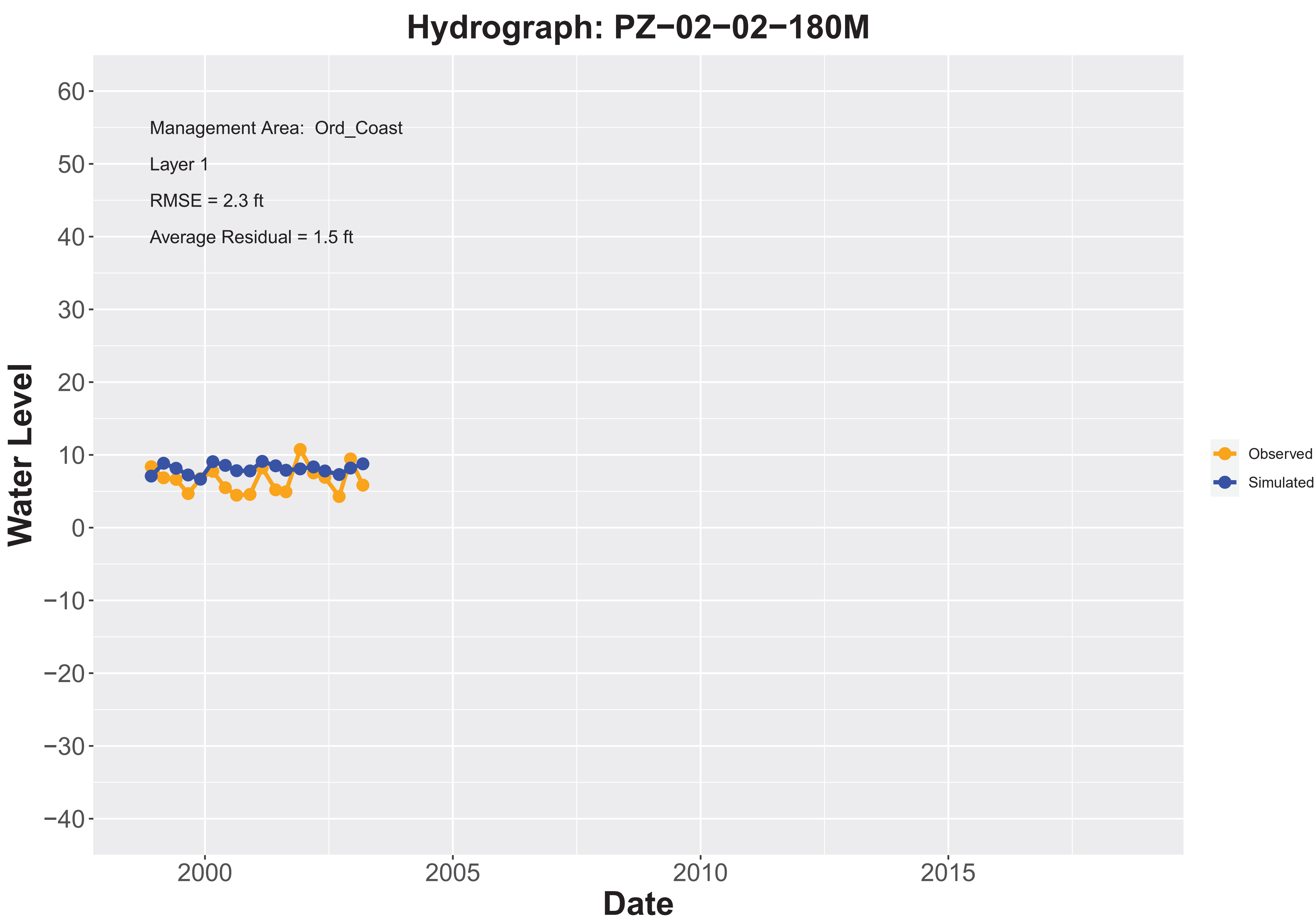


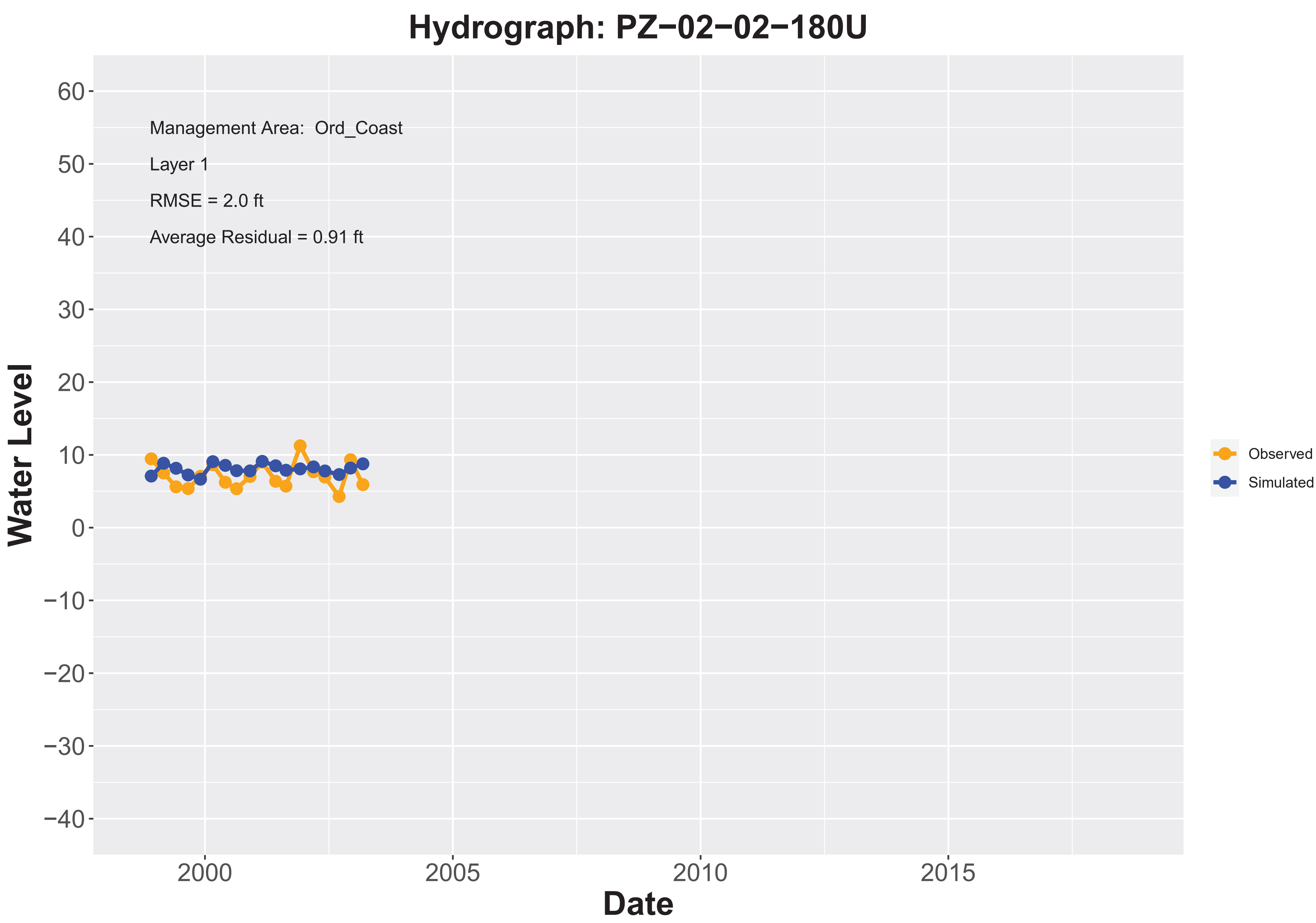

Hydrograph: PZ−02−01−180M
Management Area: Ord_Coast
Layer 3
RMSE = 3.1 ft
Average Residual = −2.9 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: PZ−02−01−180U
Management Area: Ord_Coast
Layer 1
RMSE = 1.6 ft
Average Residual = 1.3 ft
Water Level
60
50
40
30
20
10
0
−10
−20
−30
−40
2000
2005
2010
2015
Date
Observed
Simulated

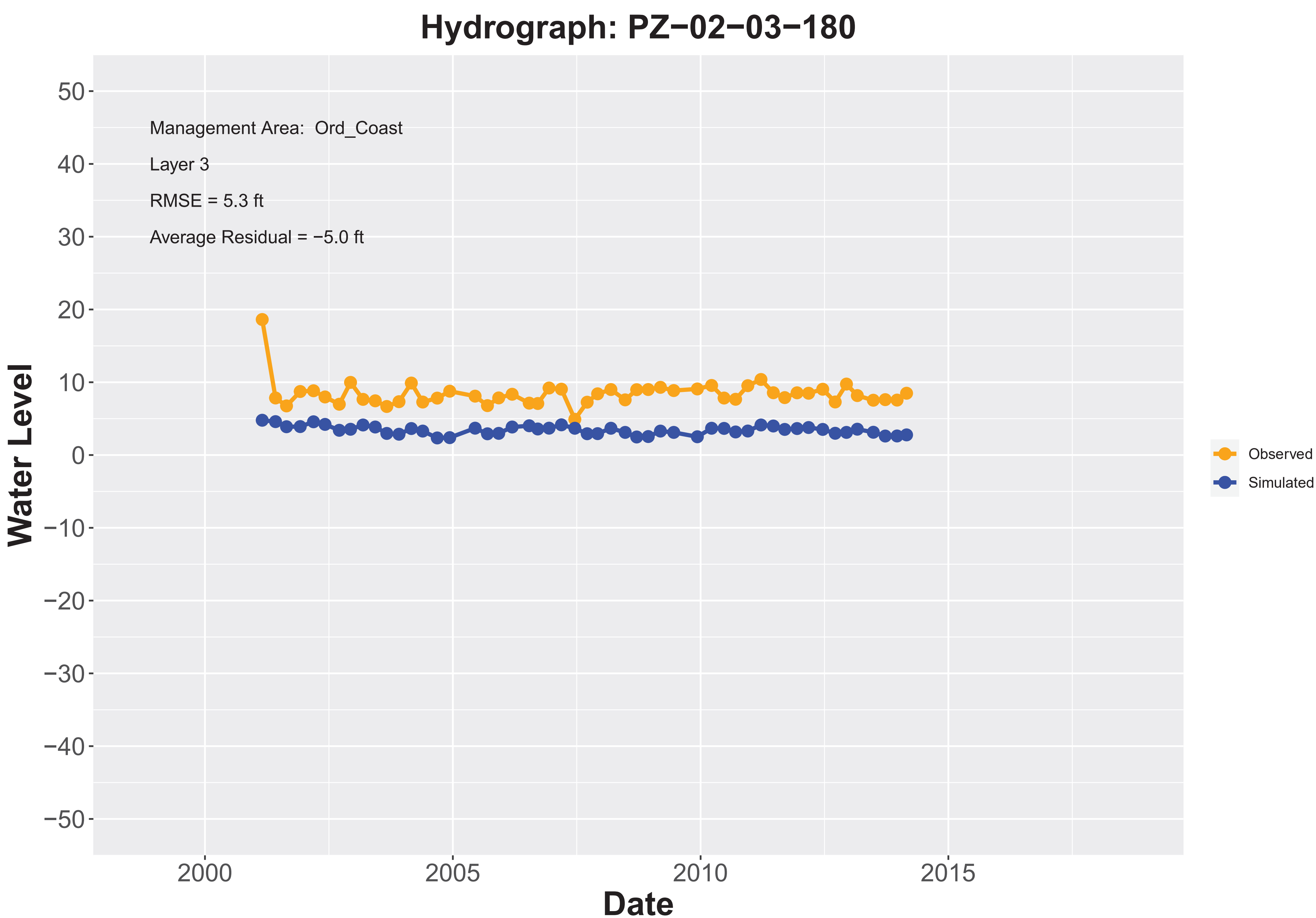


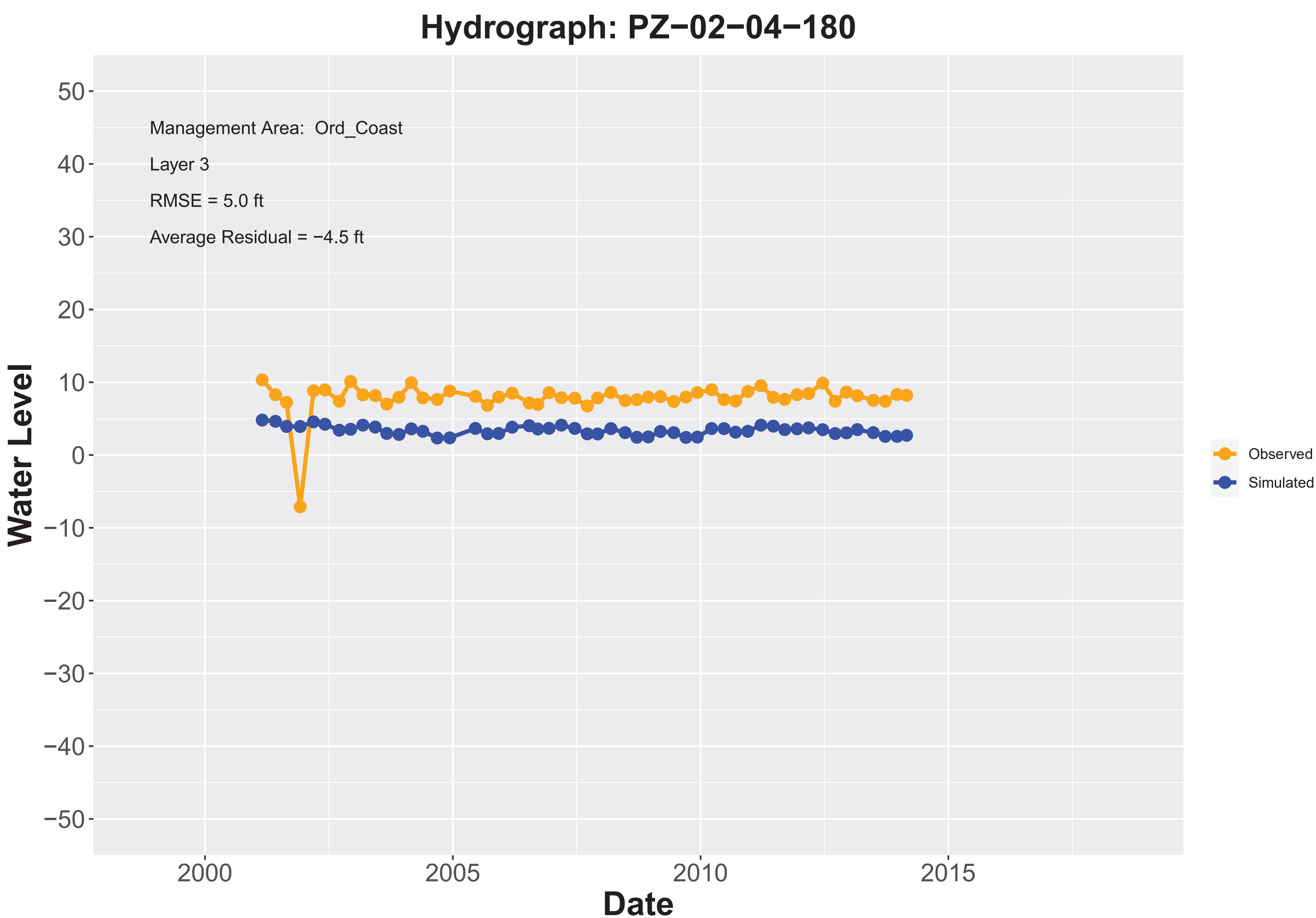
Hydrograph: PZ−02−02−180L
Management Area: Ord_Coast
Layer 5
RMSE = 1.5 ft
Average Residual = −0.72 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

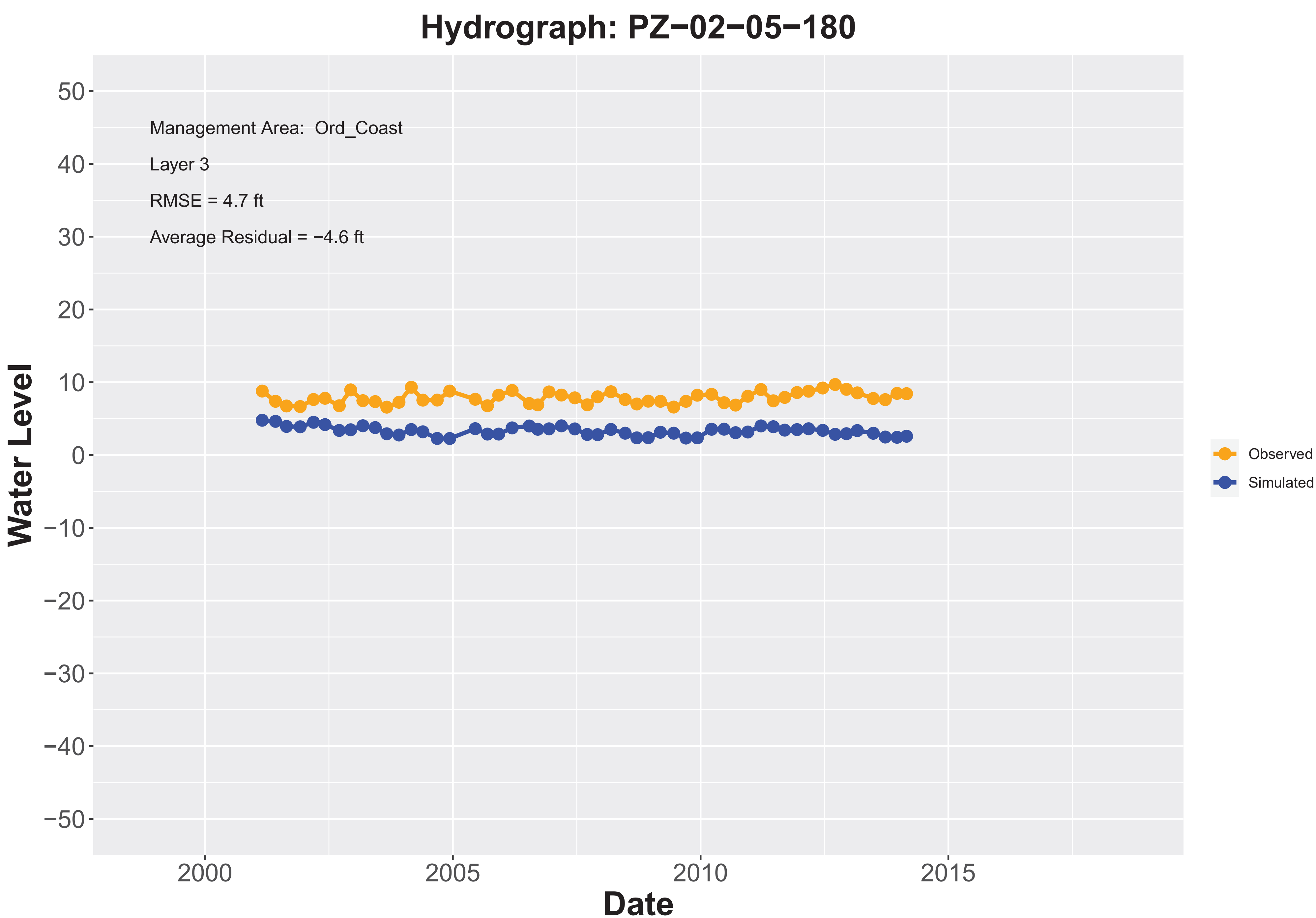

Hydrograph: PZ−02−02−180M
Management Area: Ord_Coast
Layer 1
RMSE = 2.3 ft
Average Residual = 1.5 ft
Water Level
60
50
40
30
20
10
0
−10
−20
−30
−40
Date
2000
2005
2010
2015
Observed
Simulated



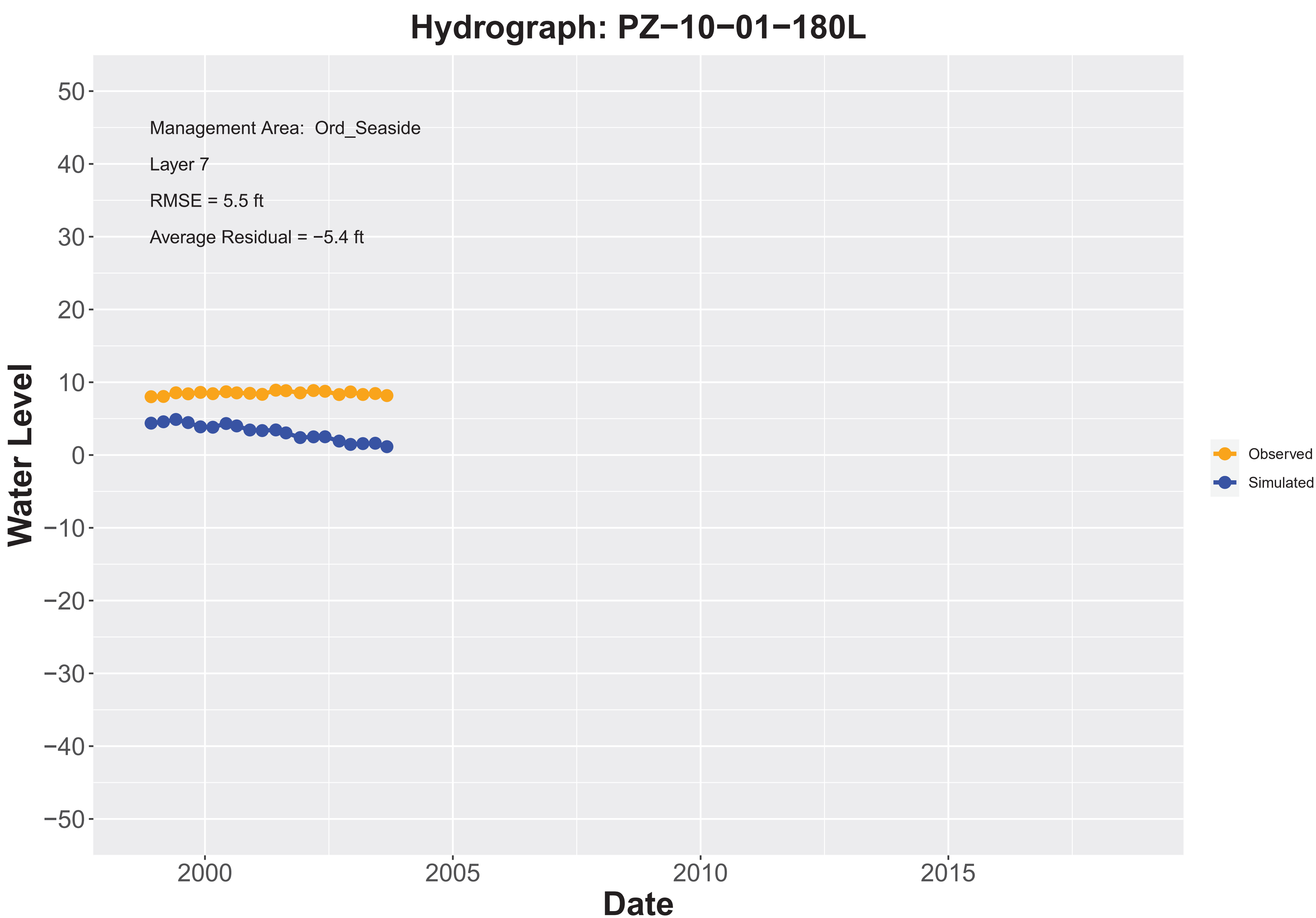
Hydrograph: PZ−02−02−180U
Management Area: Ord_Coast
Layer 1
RMSE = 2.0 ft
Average Residual = 0.91 ft
Water Level
60
50
40
30
20
10
0
−10
−20
−30
−40
Date
2000
2005
2010
2015
Observed
Simulated


Hydrograph: PZ−02−03−180
Management Area: Ord_Coast
Layer 3
RMSE = 5.3 ft
Average Residual = −5.0 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: PZ−02−04−180
Management Area: Ord_Coast
Layer 3
RMSE = 5.0 ft
Average Residual = −4.5 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

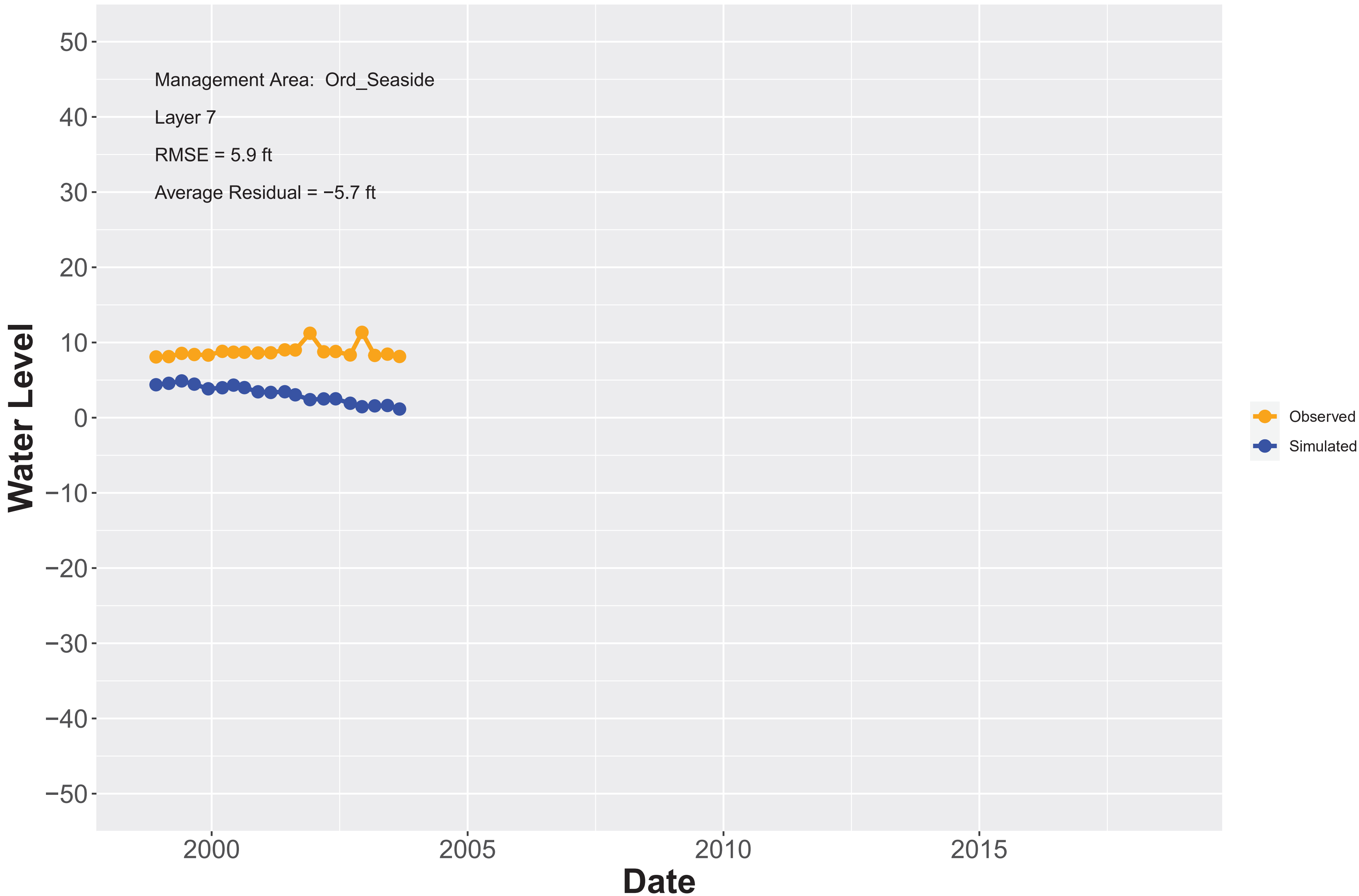


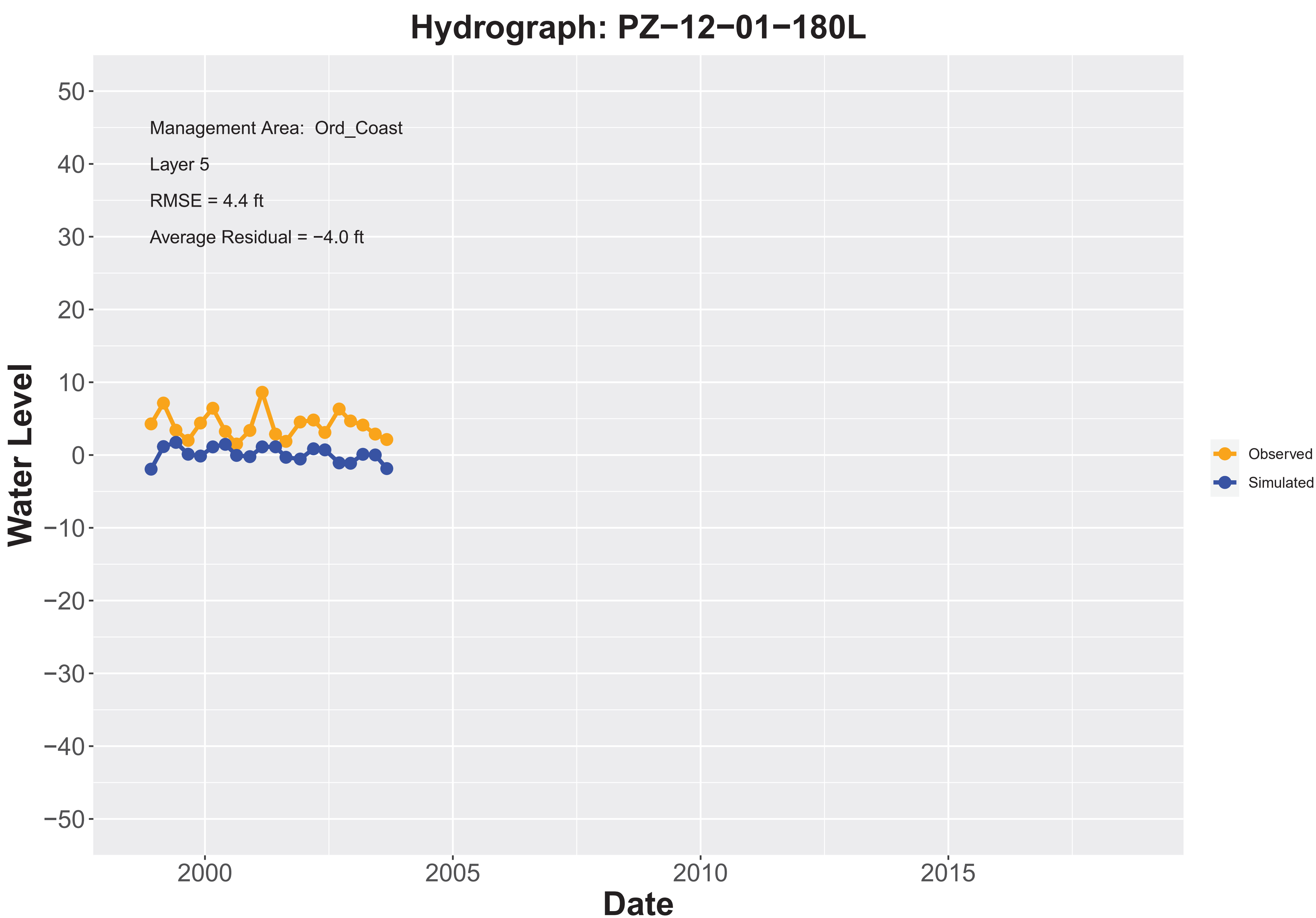
Hydrograph: PZ−02−05−180
Management Area: Ord_Coast
Layer 3
RMSE = 4.7 ft
Average Residual = −4.6 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



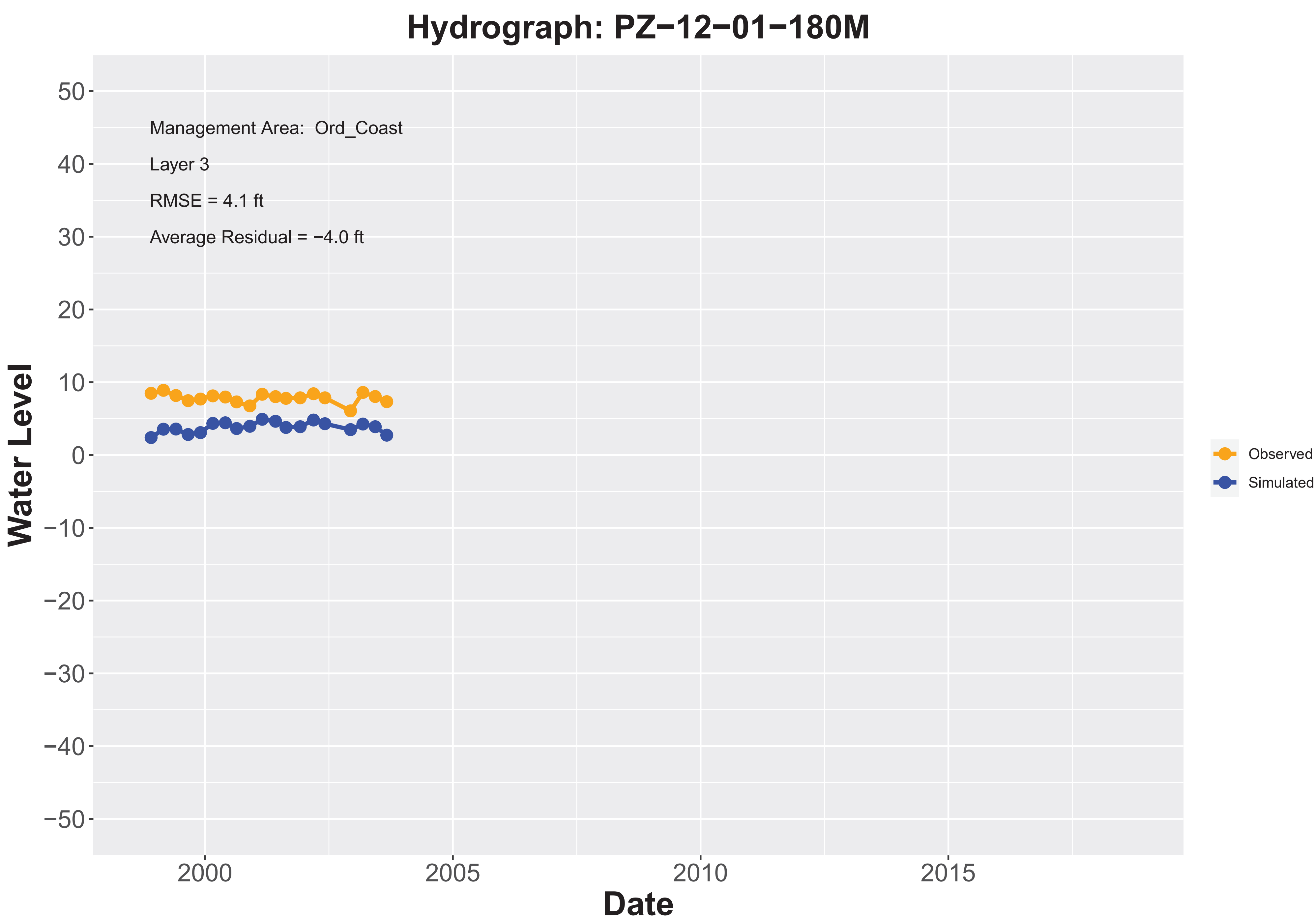
Hydrograph: PZ−10−01−180L
Management Area: Ord_Seaside
Layer 7
RMSE = 5.5 ft
Average Residual = −5.4 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

Hydrograph: PZ−10−01−180U



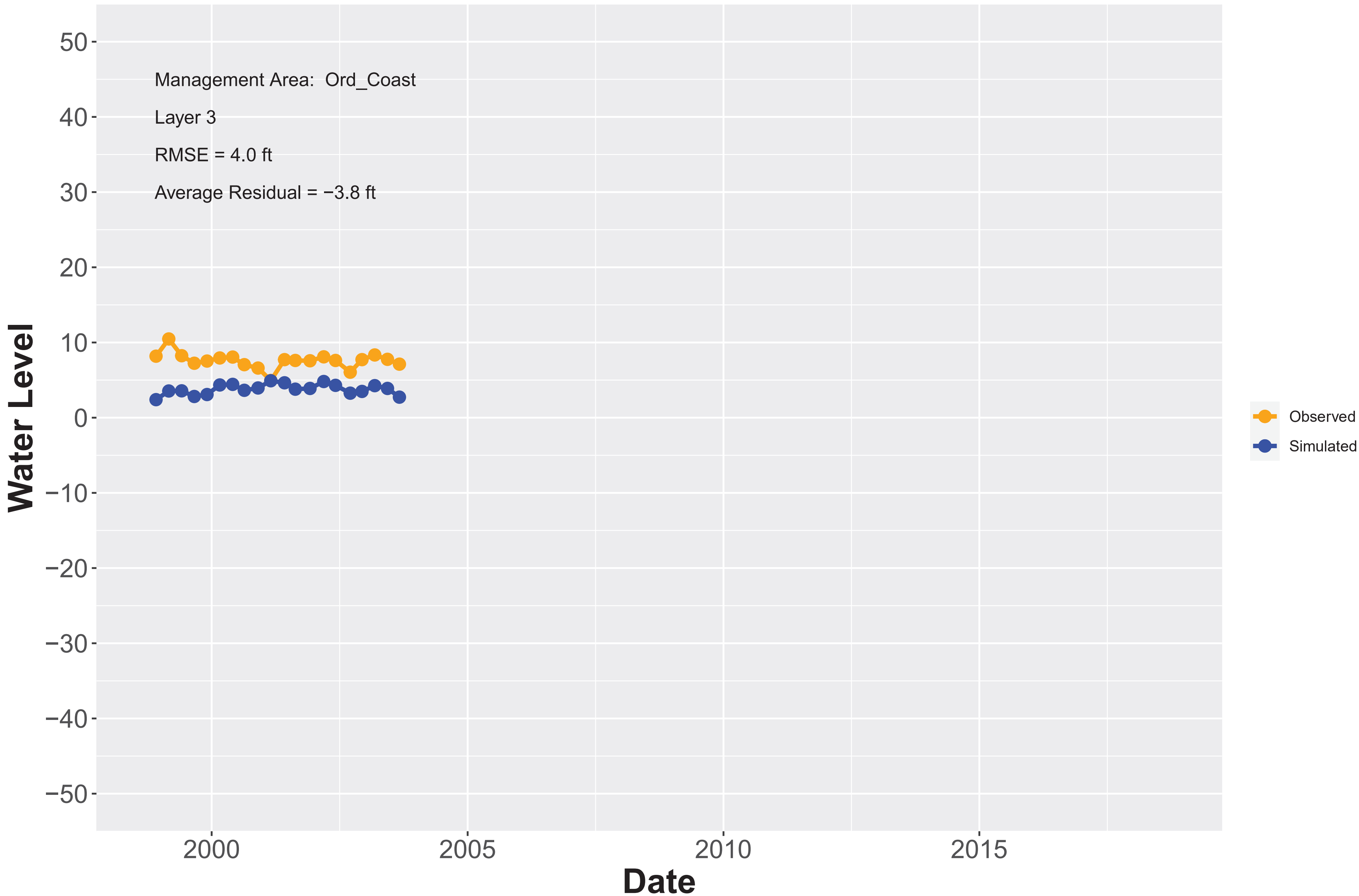


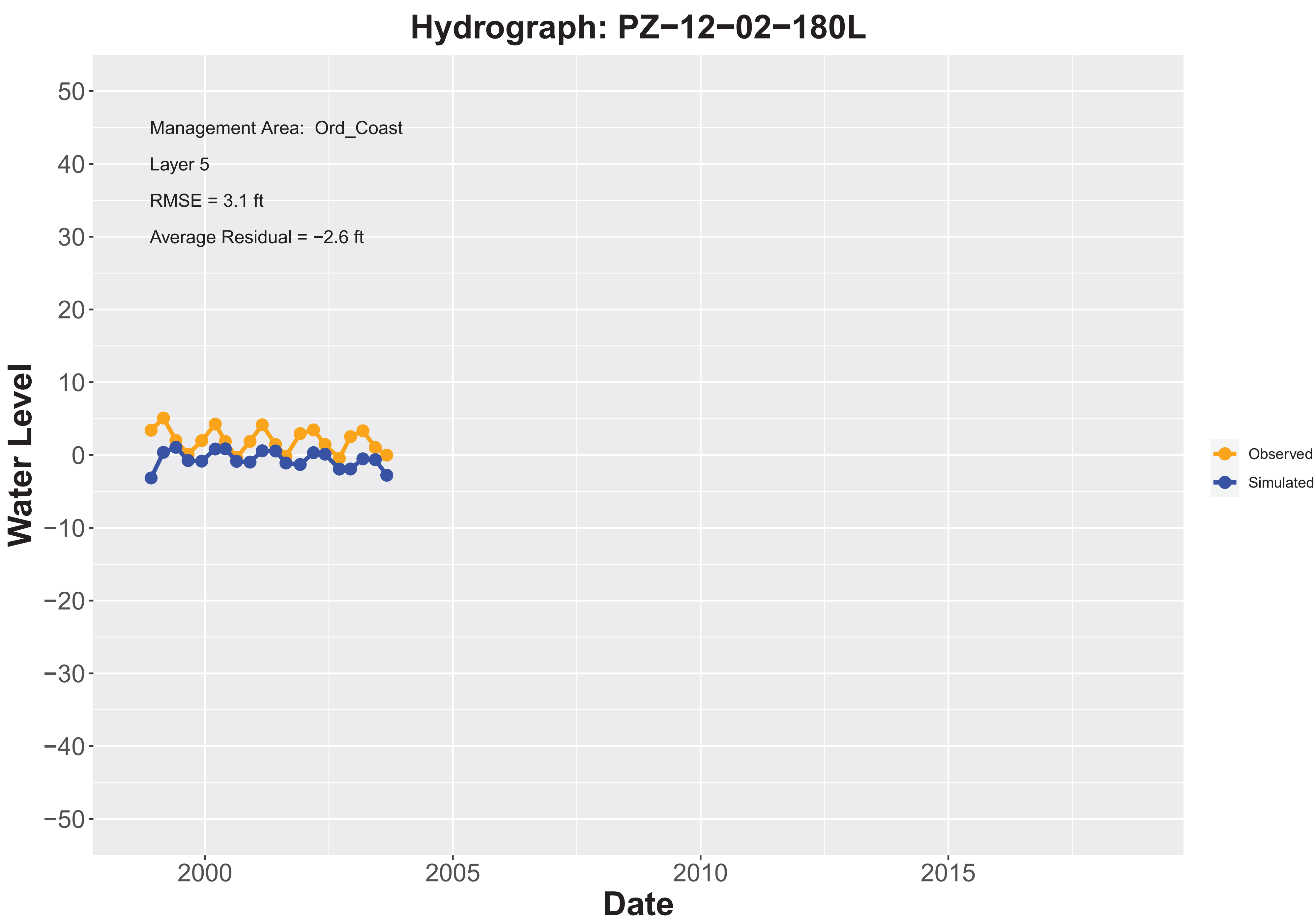
Hydrograph: PZ−12−01−180L
Management Area: Ord_Coast
Layer 5
RMSE = 4.4 ft
Average Residual = −4.0 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

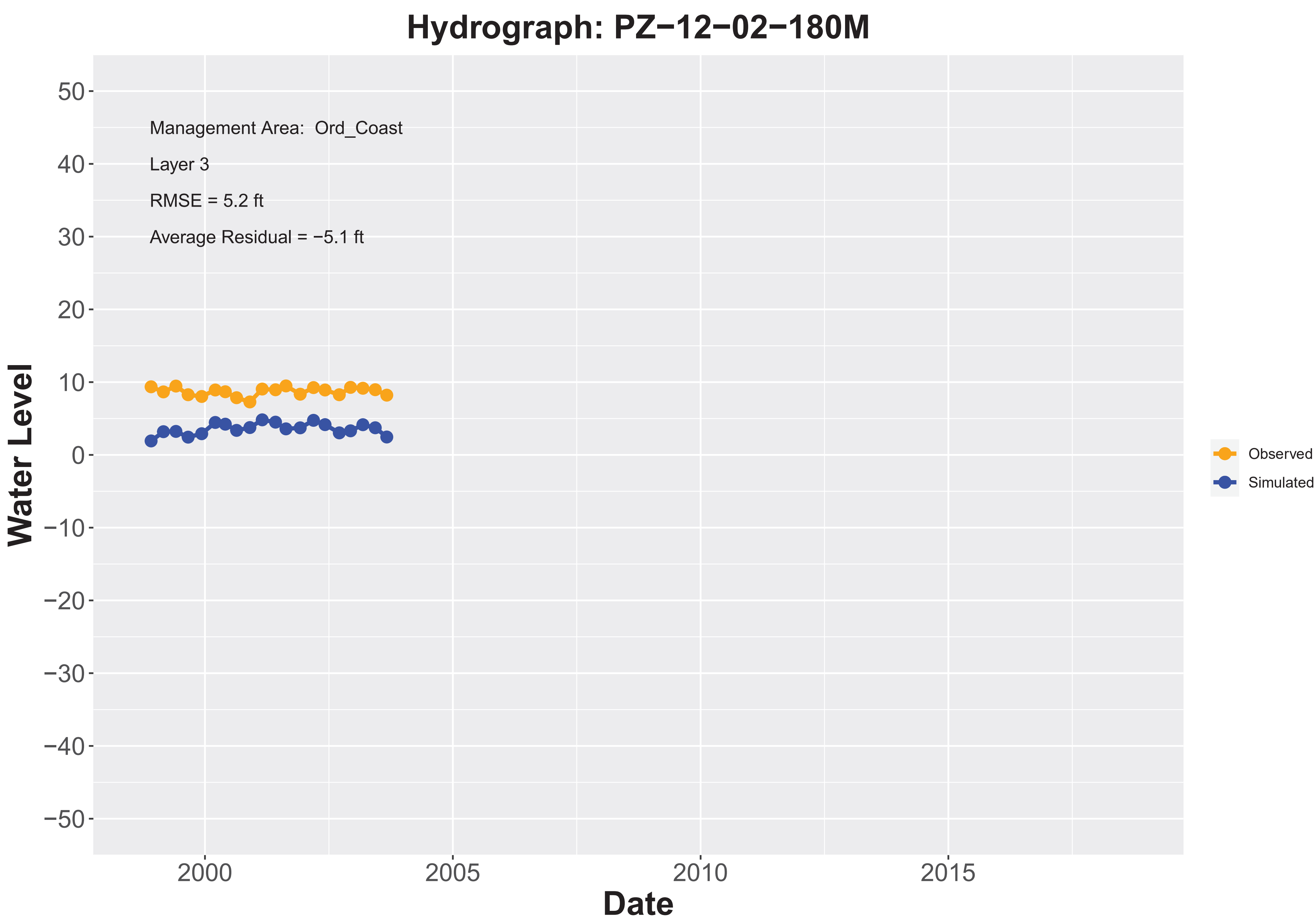


Hydrograph: PZ−12−01−180M
Management Area: Ord_Coast
Layer 3
RMSE = 4.1 ft
Average Residual = −4.0 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

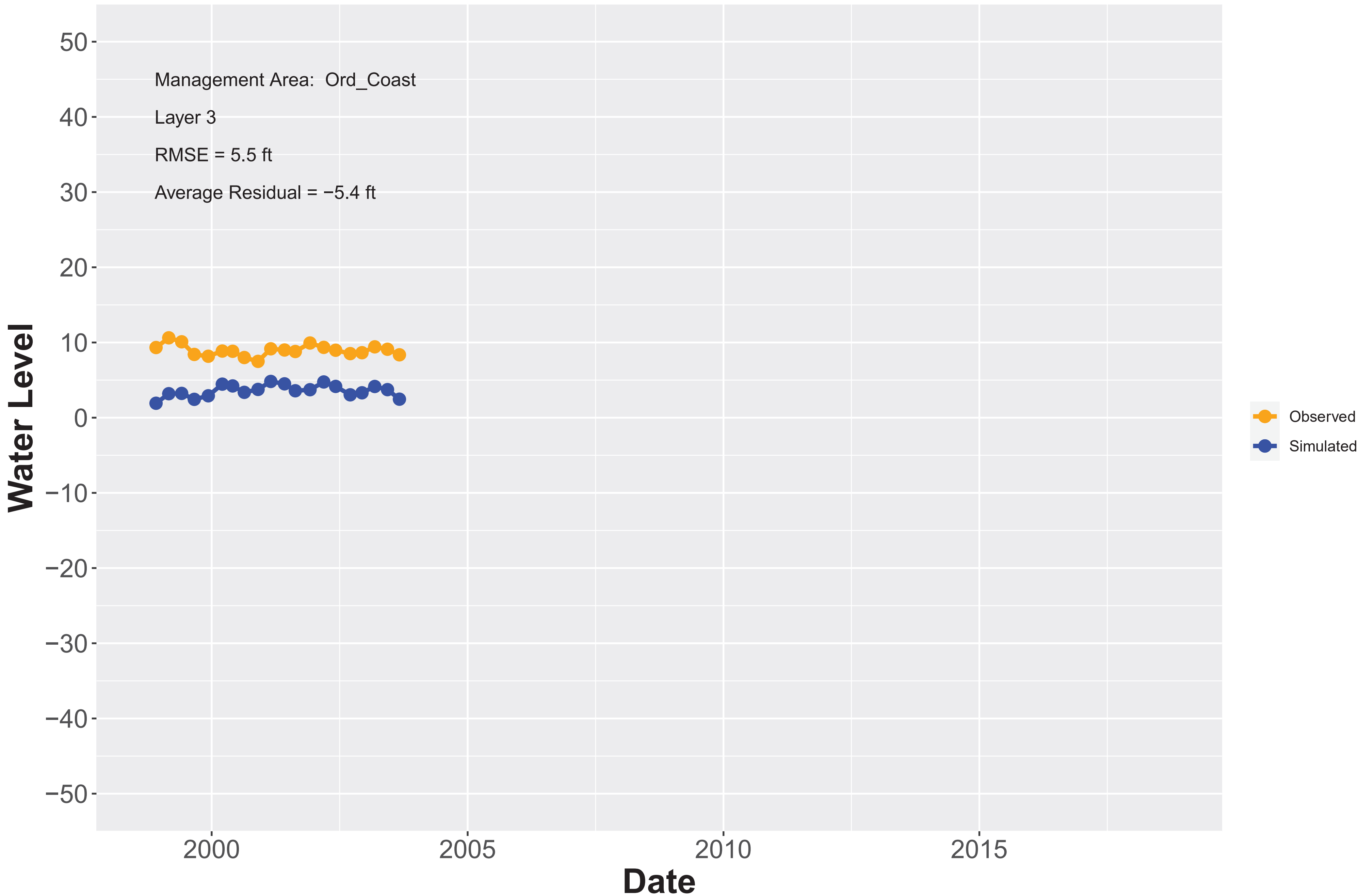
Hydrograph: PZ−12−01−180U

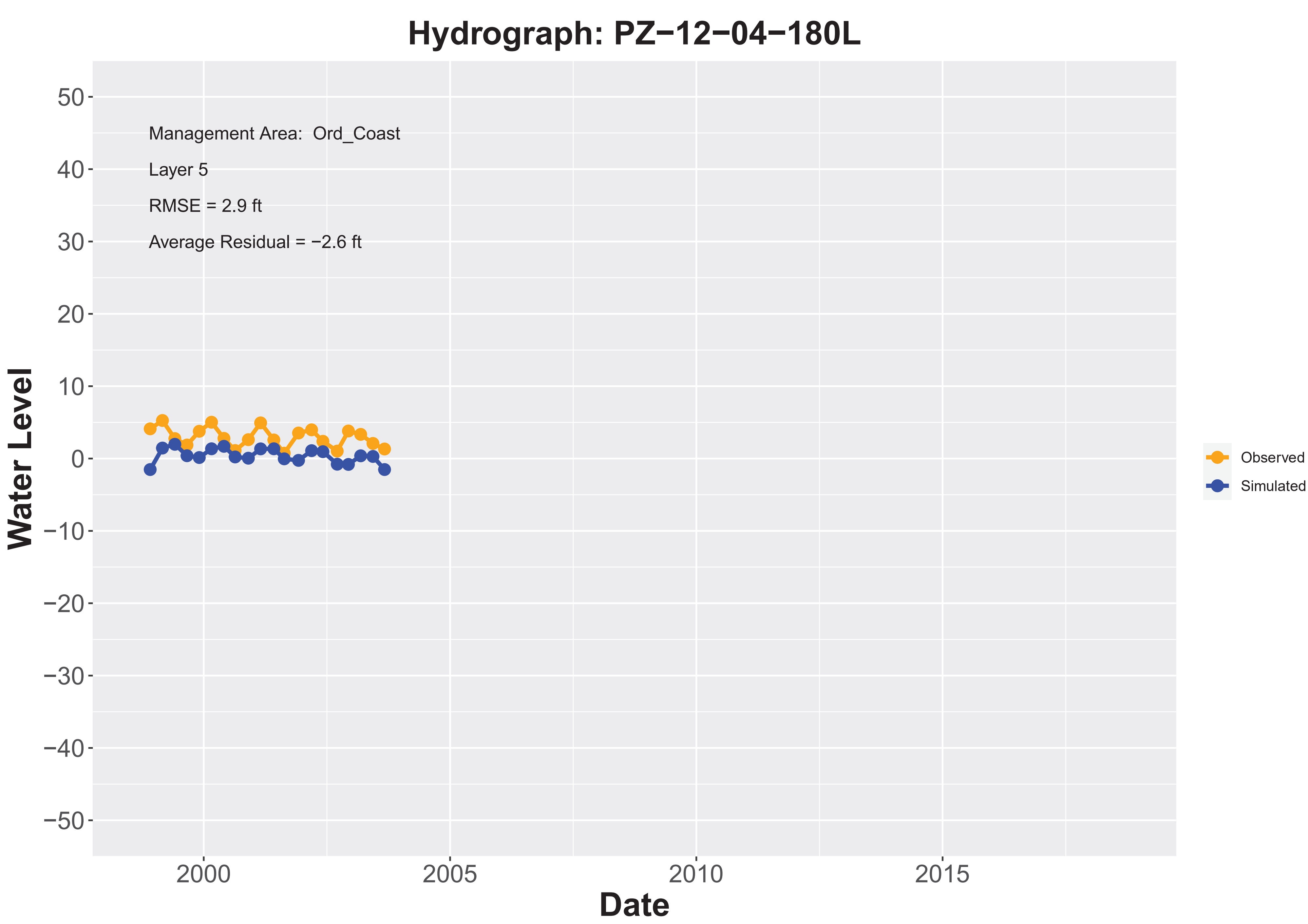



Hydrograph: PZ−12−02−180L
Management Area: Ord_Coast
Layer 5
RMSE = 3.1 ft
Average Residual = −2.6 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: PZ−12−02−180M
Management Area: Ord_Coast
Layer 3
RMSE = 5.2 ft
Average Residual = −5.1 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

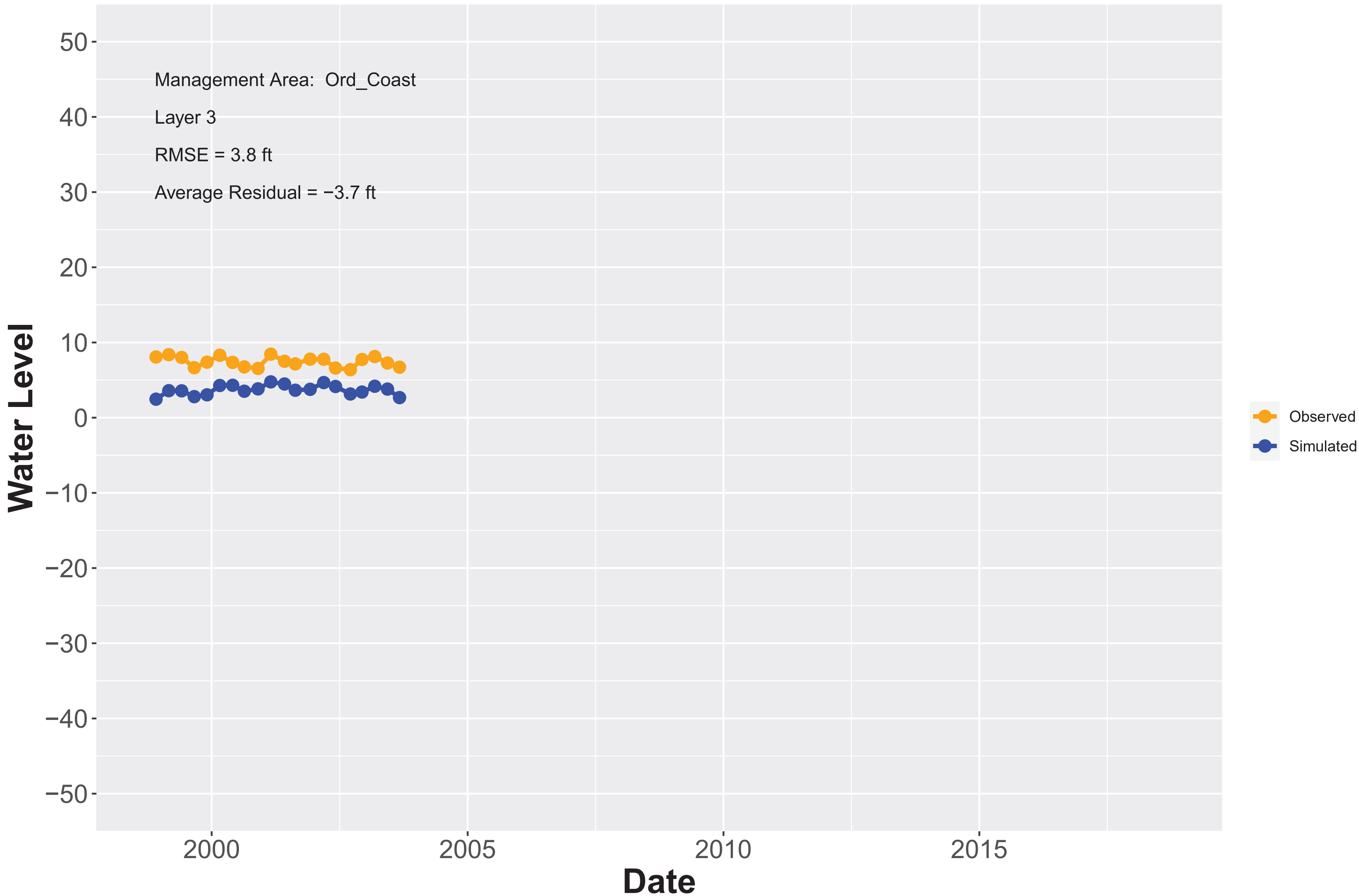
Hydrograph: PZ−12−02−180U

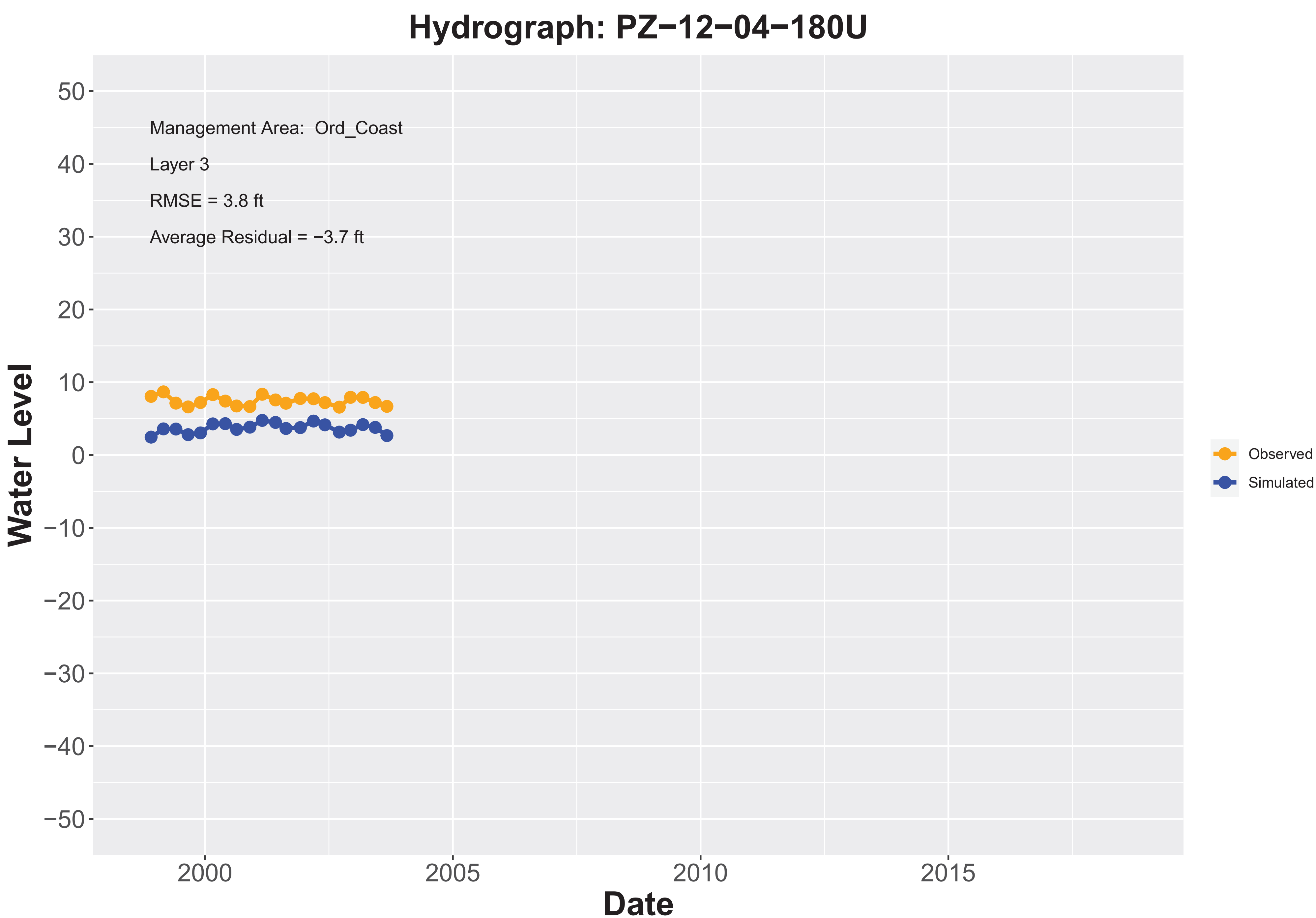




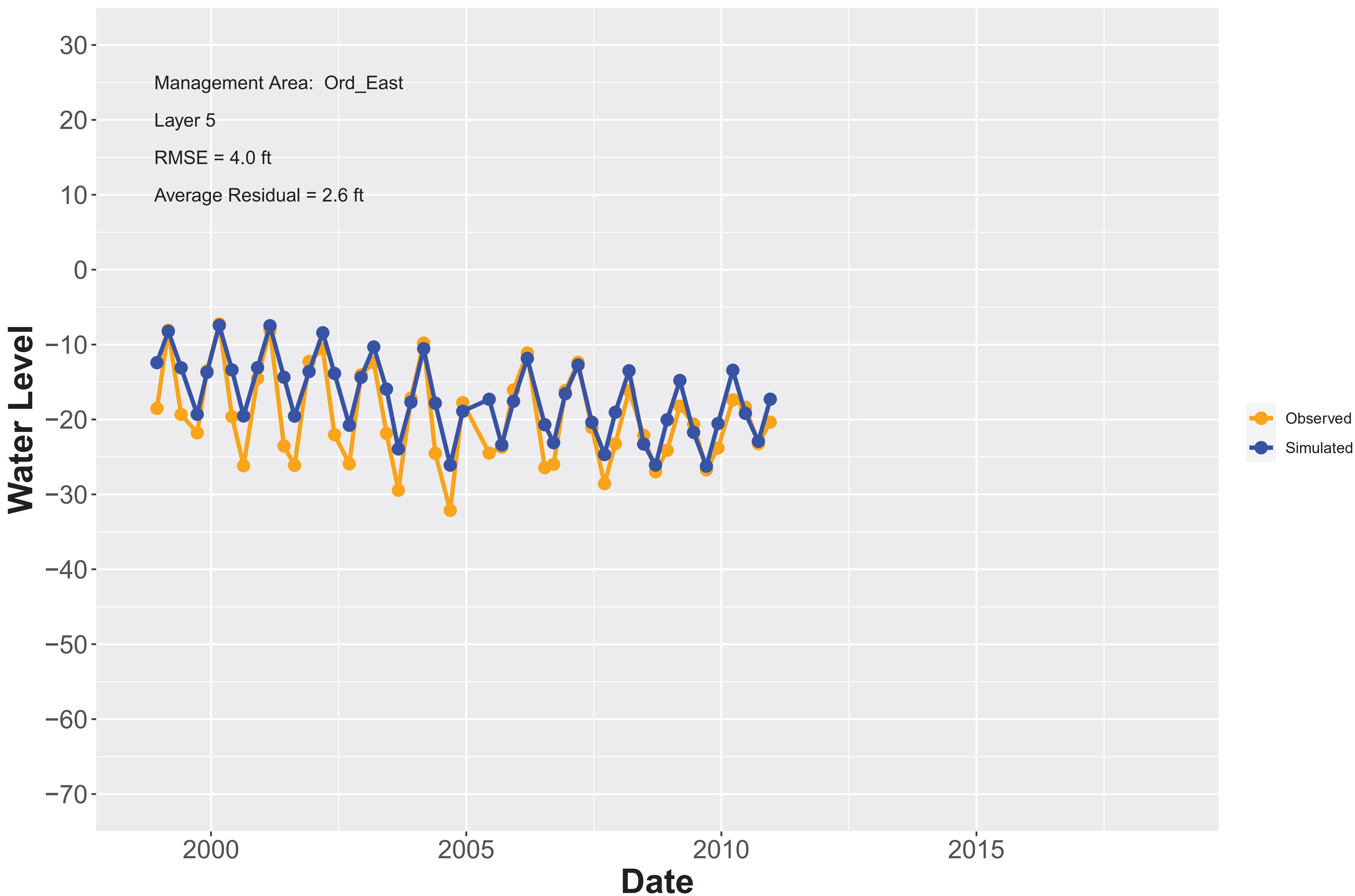
Hydrograph: PZ−12−04−180L
Management Area: Ord_Coast
Layer 5
RMSE = 2.9 ft
Average Residual = −2.6 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

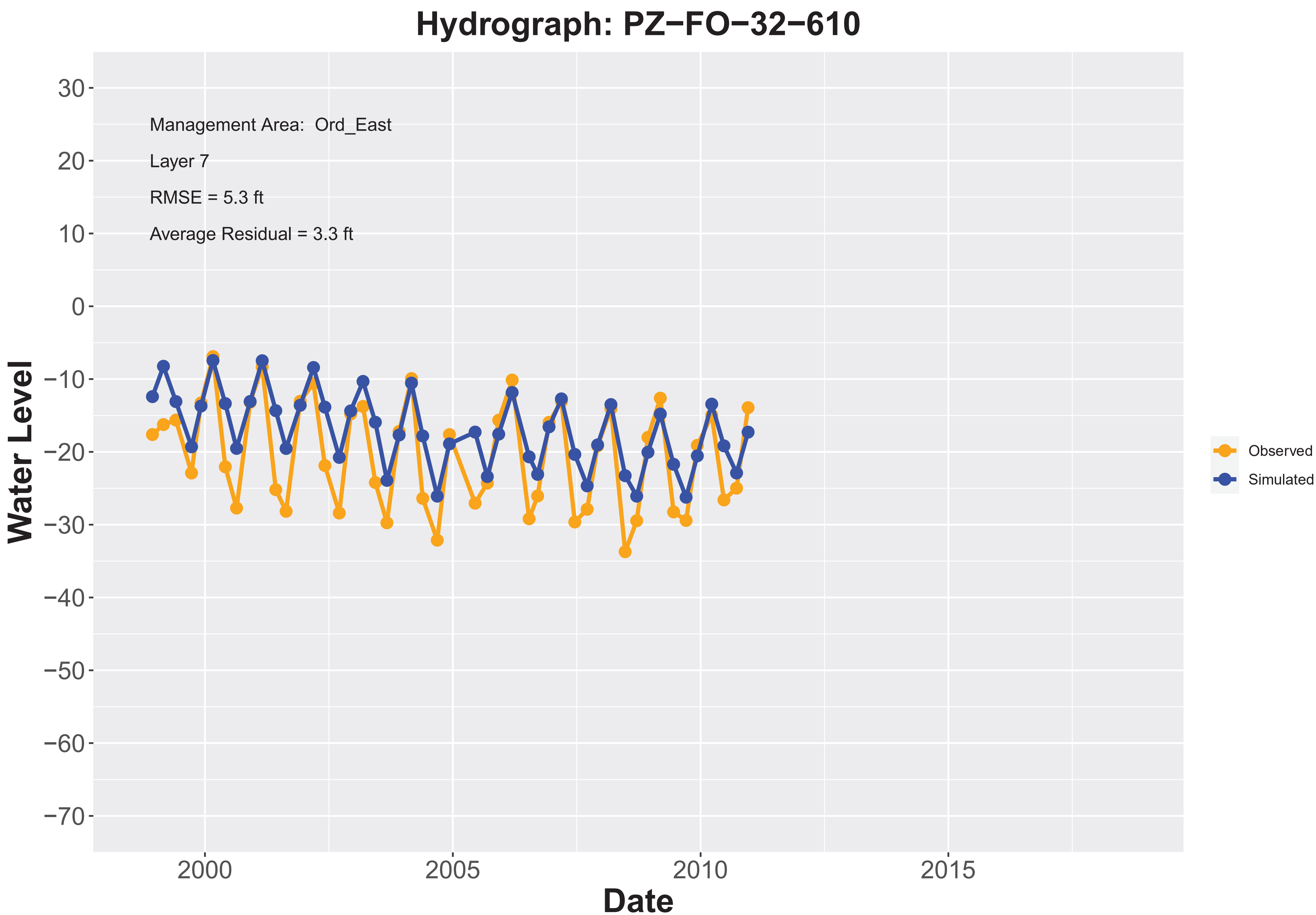
Hydrograph: PZ−12−04−180M

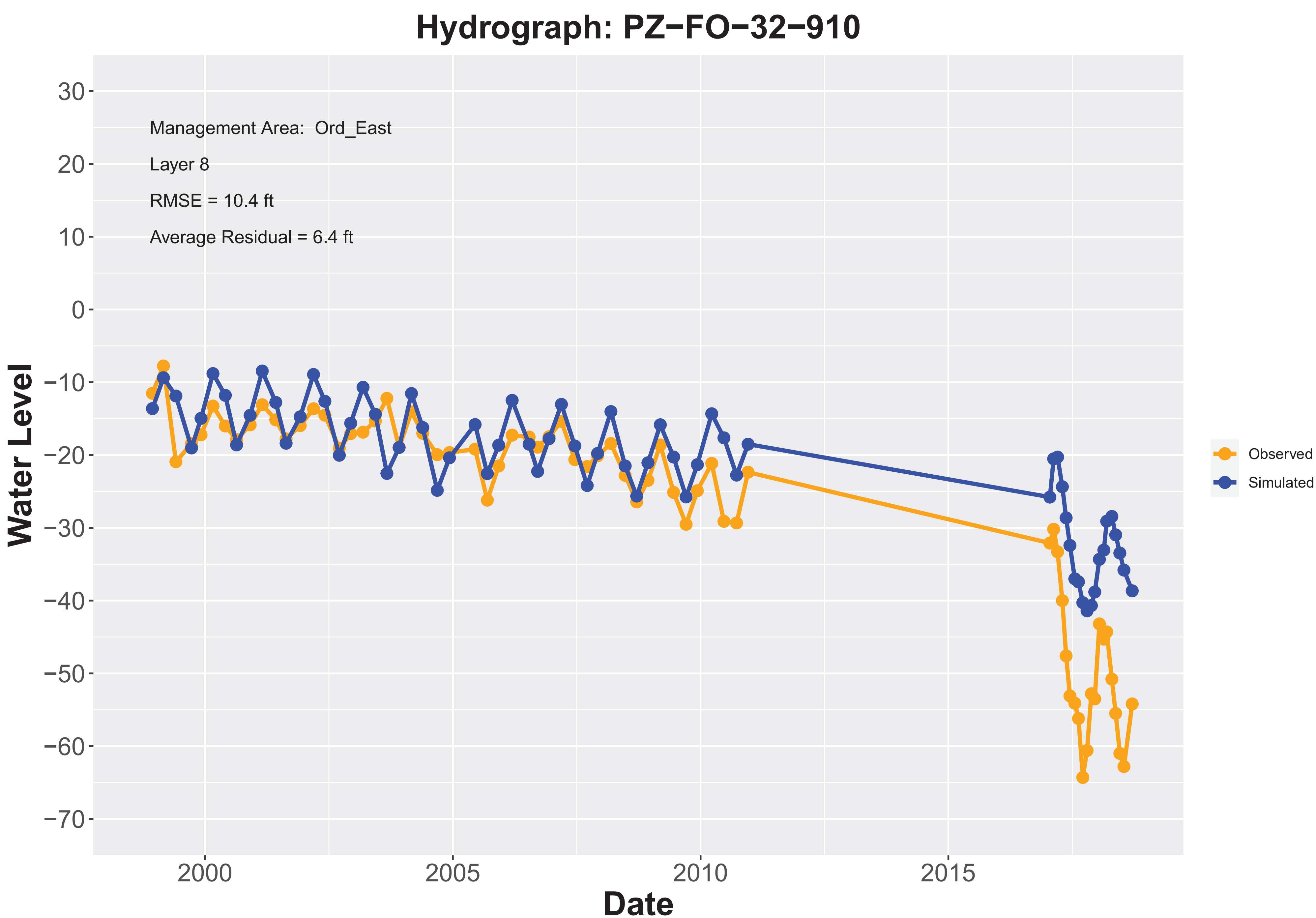


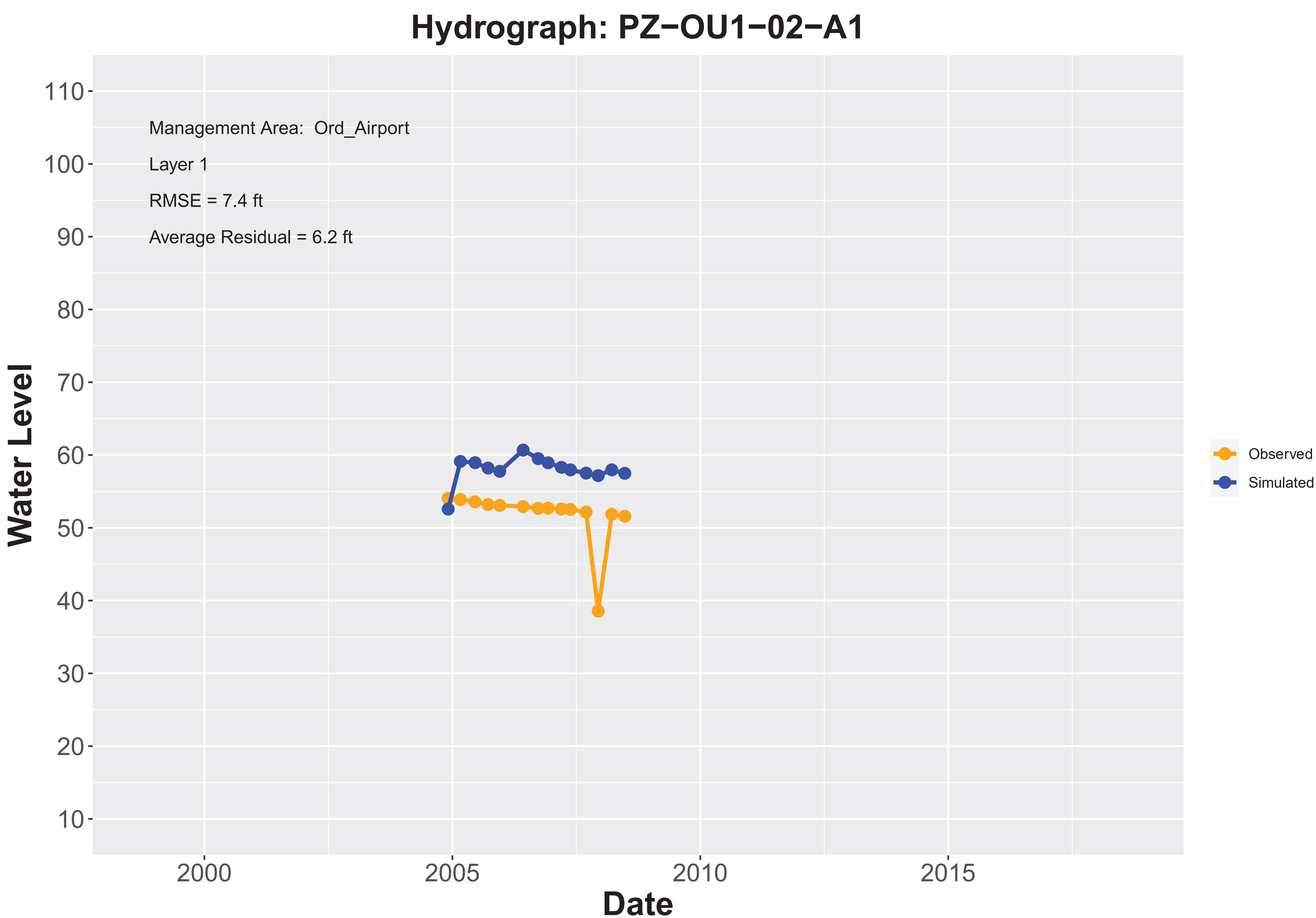

Hydrograph: PZ−12−04−180U
Management Area: Ord_Coast
Layer 3
RMSE = 3.8 ft
Average Residual = −3.7 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated

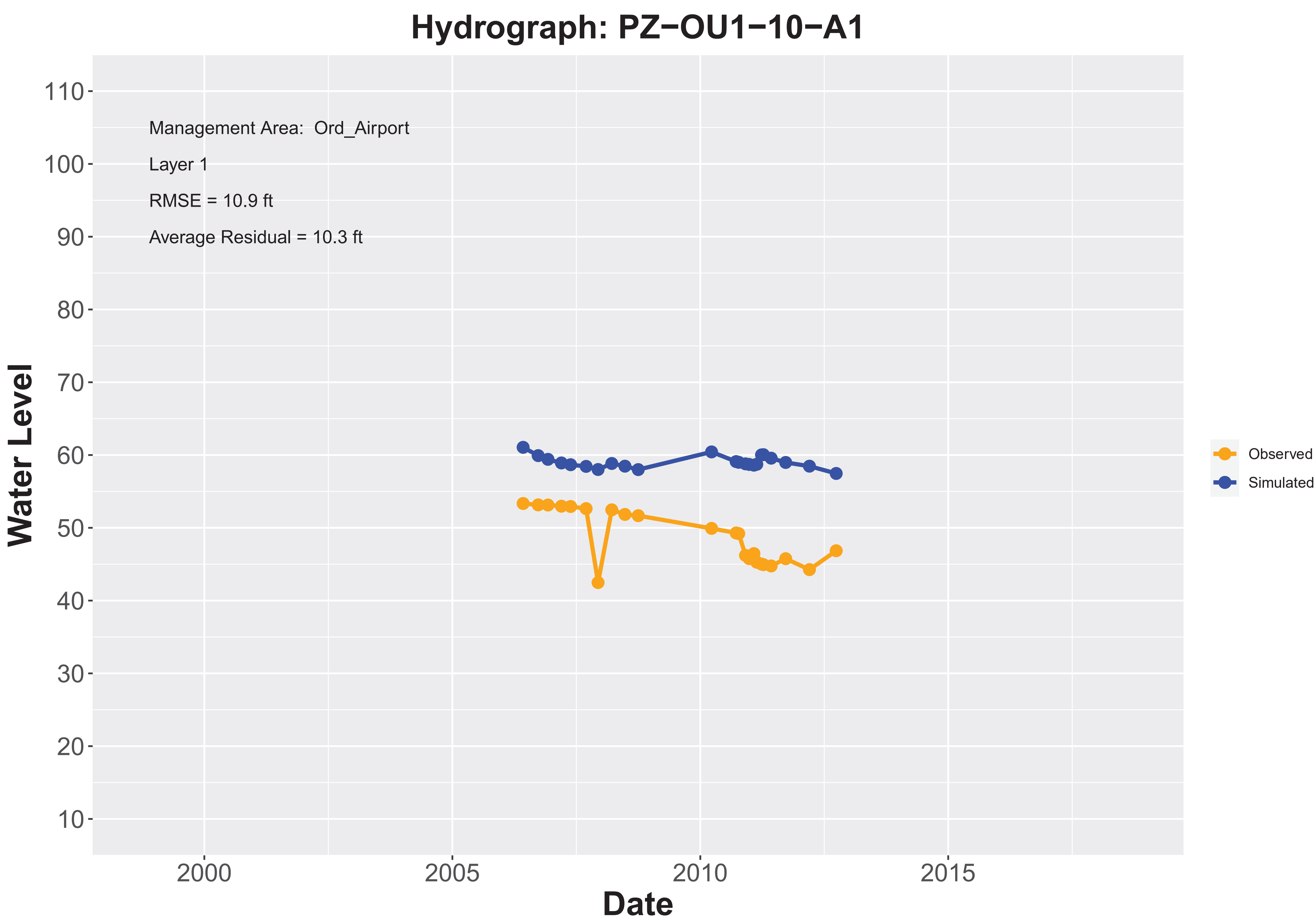
Hydrograph: PZ−FO−32−440

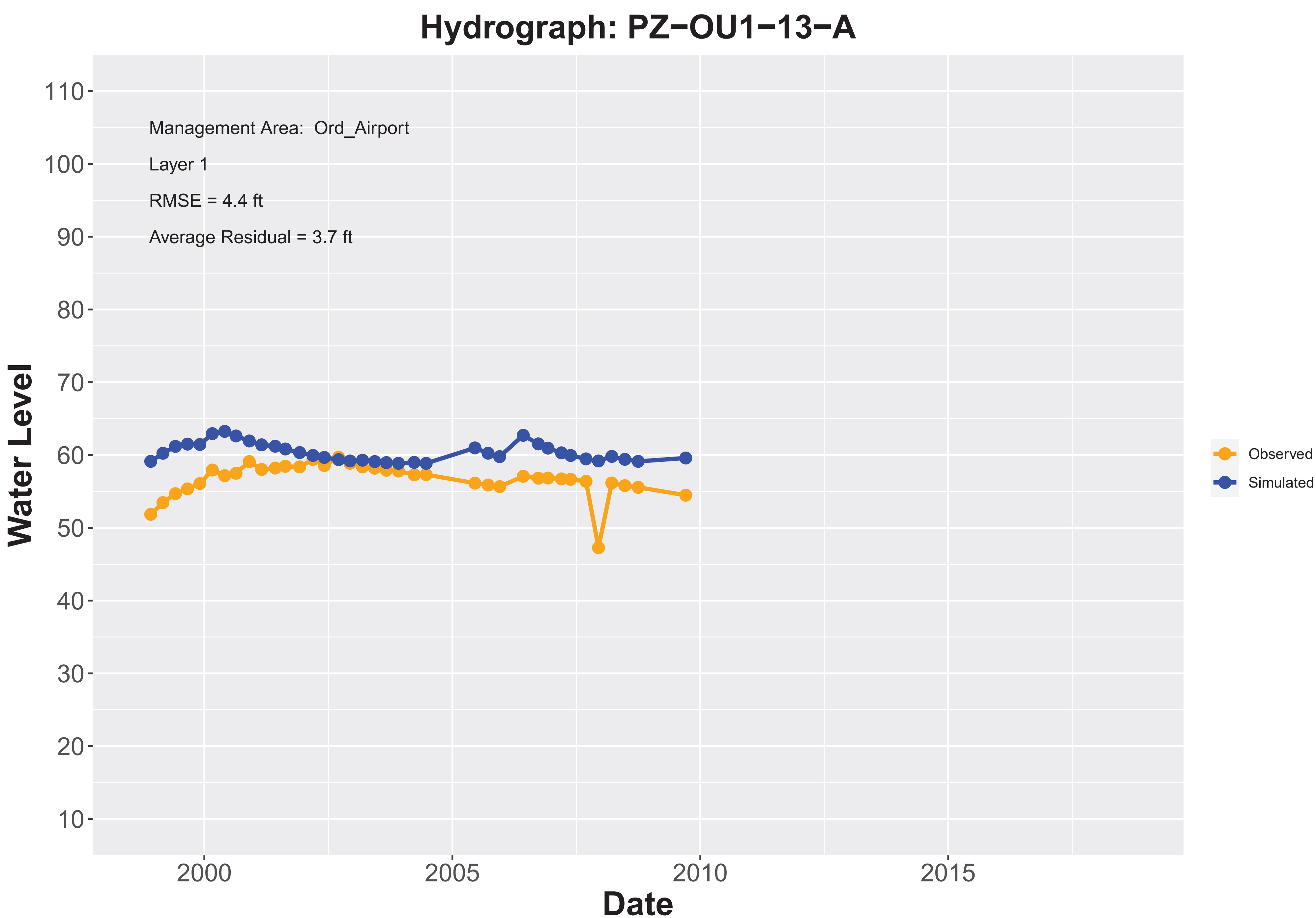



Hydrograph: PZ−FO−32−610
Management Area: Ord_East
Layer 7
RMSE = 5.3 ft
Average Residual = 3.3 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: PZ−FO−32−910
Management Area: Ord_East
Layer 8
RMSE = 10.4 ft
Average Residual = 6.4 ft
Water Level
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
Date
Observed
Simulated

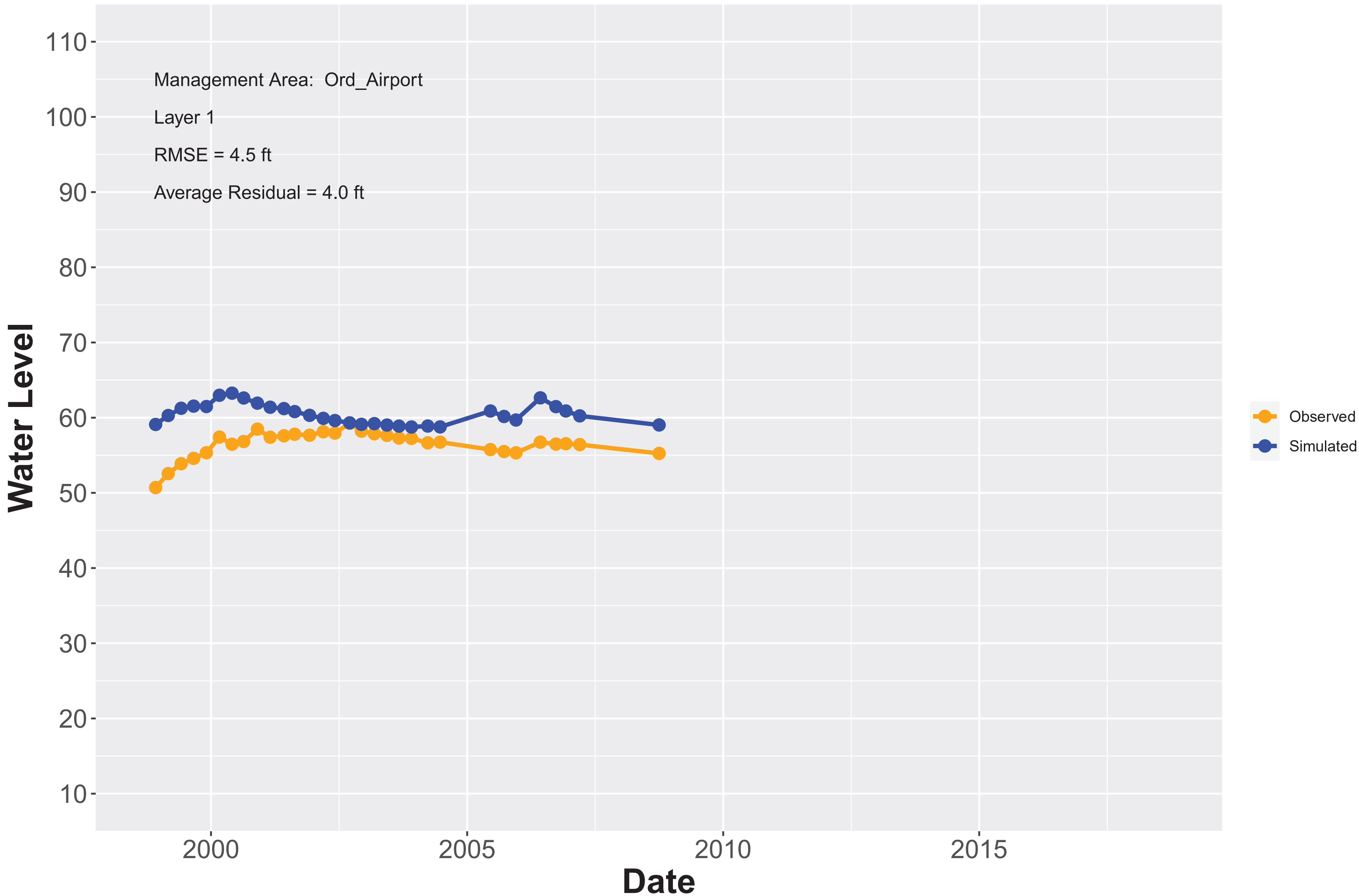

Hydrograph: PZ−OU1−02−A1
Management Area: Ord_Airport
Layer 1
RMSE = 7.4 ft
Average Residual = 6.2 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

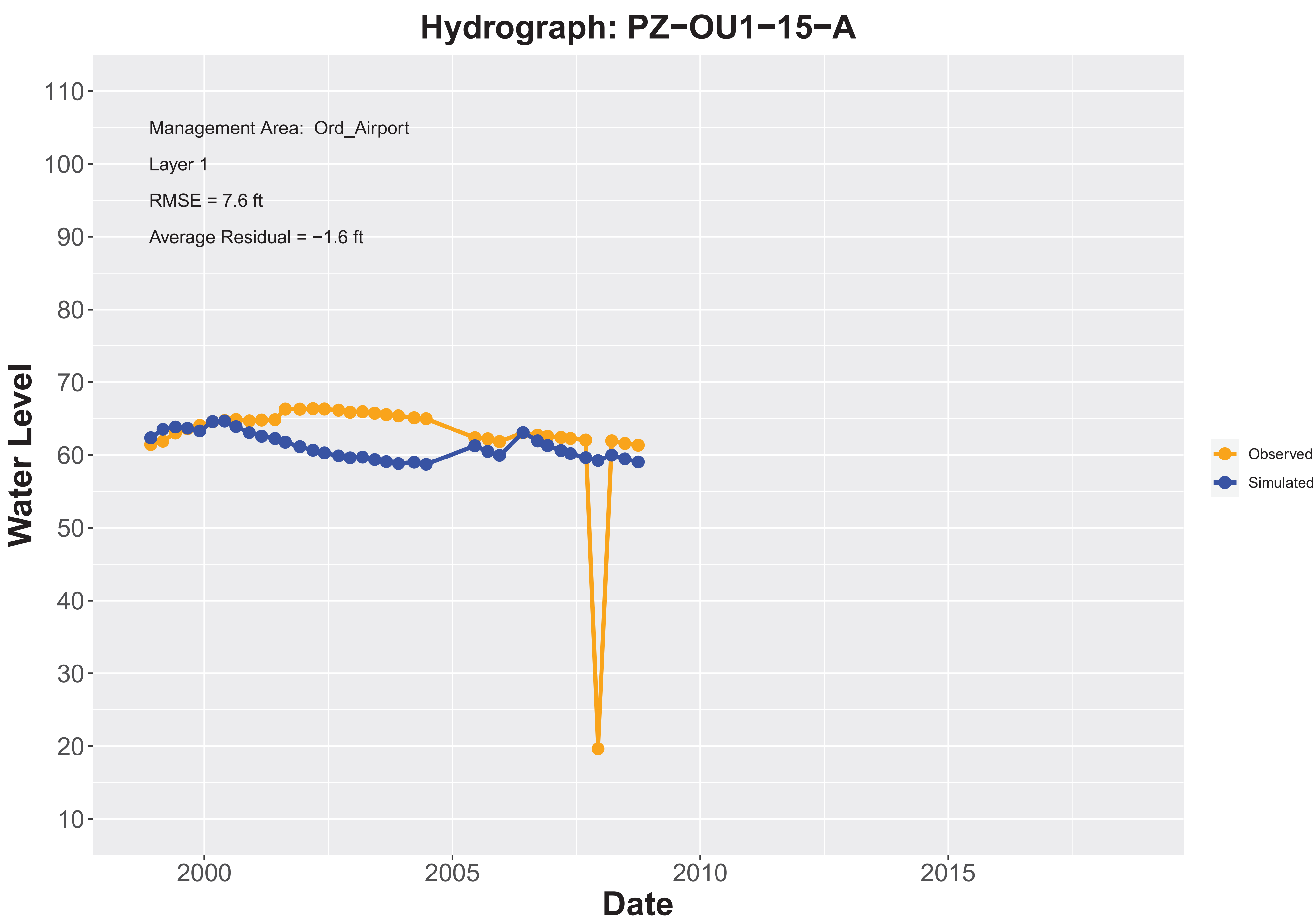

Hydrograph: PZ−OU1−10−A1
Management Area: Ord_Airport
Layer 1
RMSE = 10.9 ft
Average Residual = 10.3 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



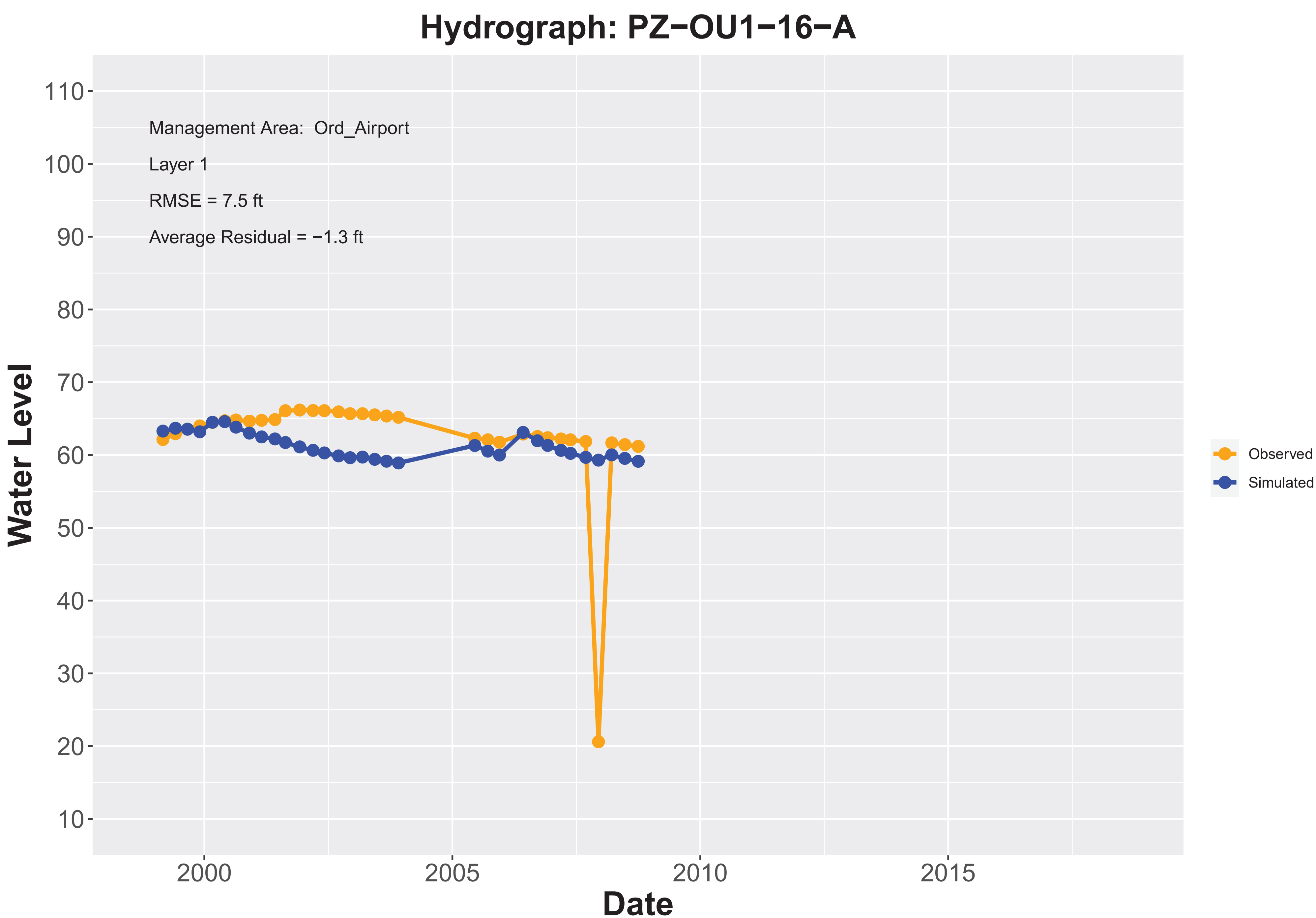
Hydrograph: PZ−OU1−13−A
Management Area: Ord_Airport
Layer 1
RMSE = 4.4 ft
Average Residual = 3.7 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

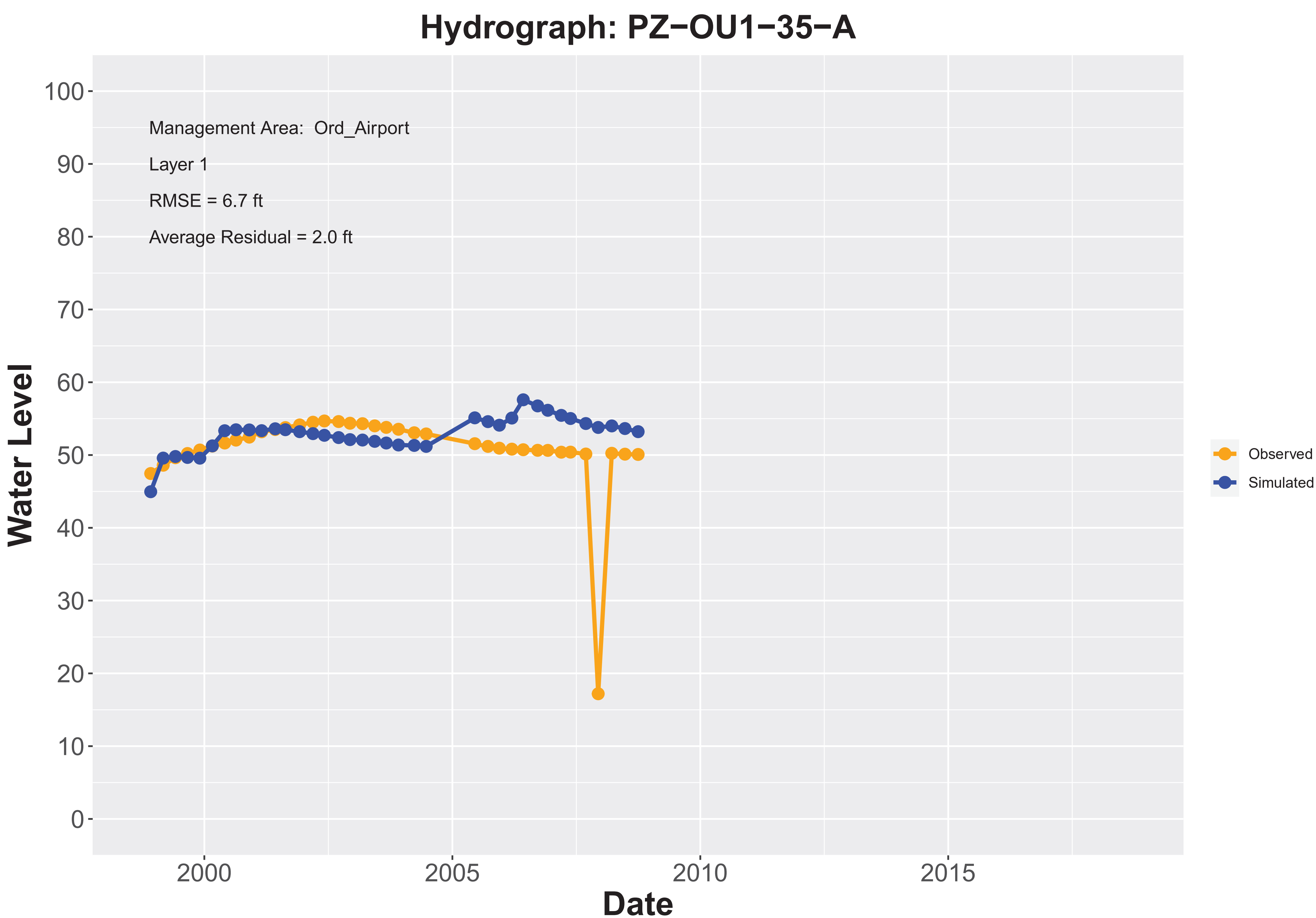
Hydrograph: PZ−OU1−14−A



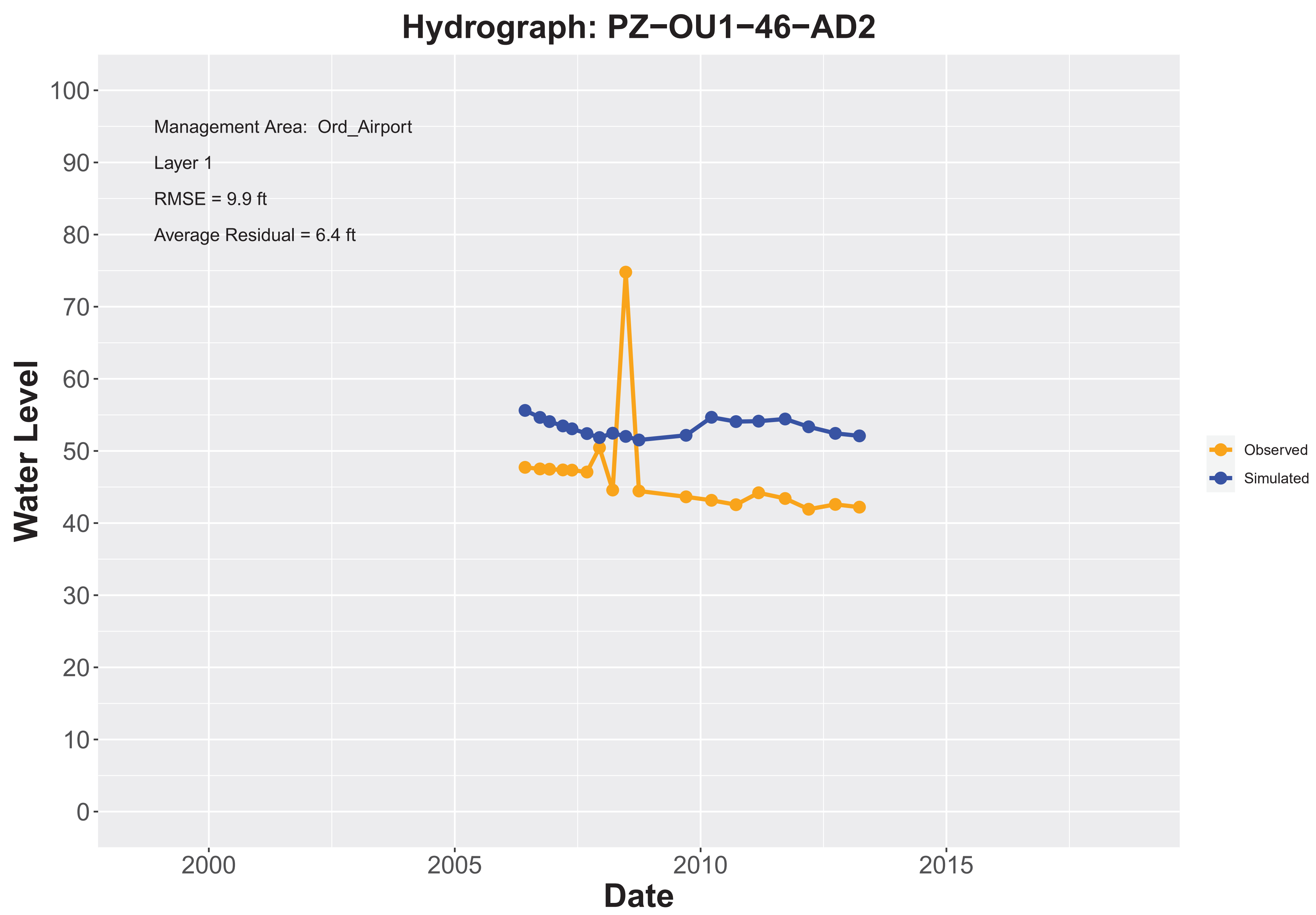


Hydrograph: PZ−OU1−15−A
Management Area: Ord_Airport
Layer 1
RMSE = 7.6 ft
Average Residual = −1.6 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

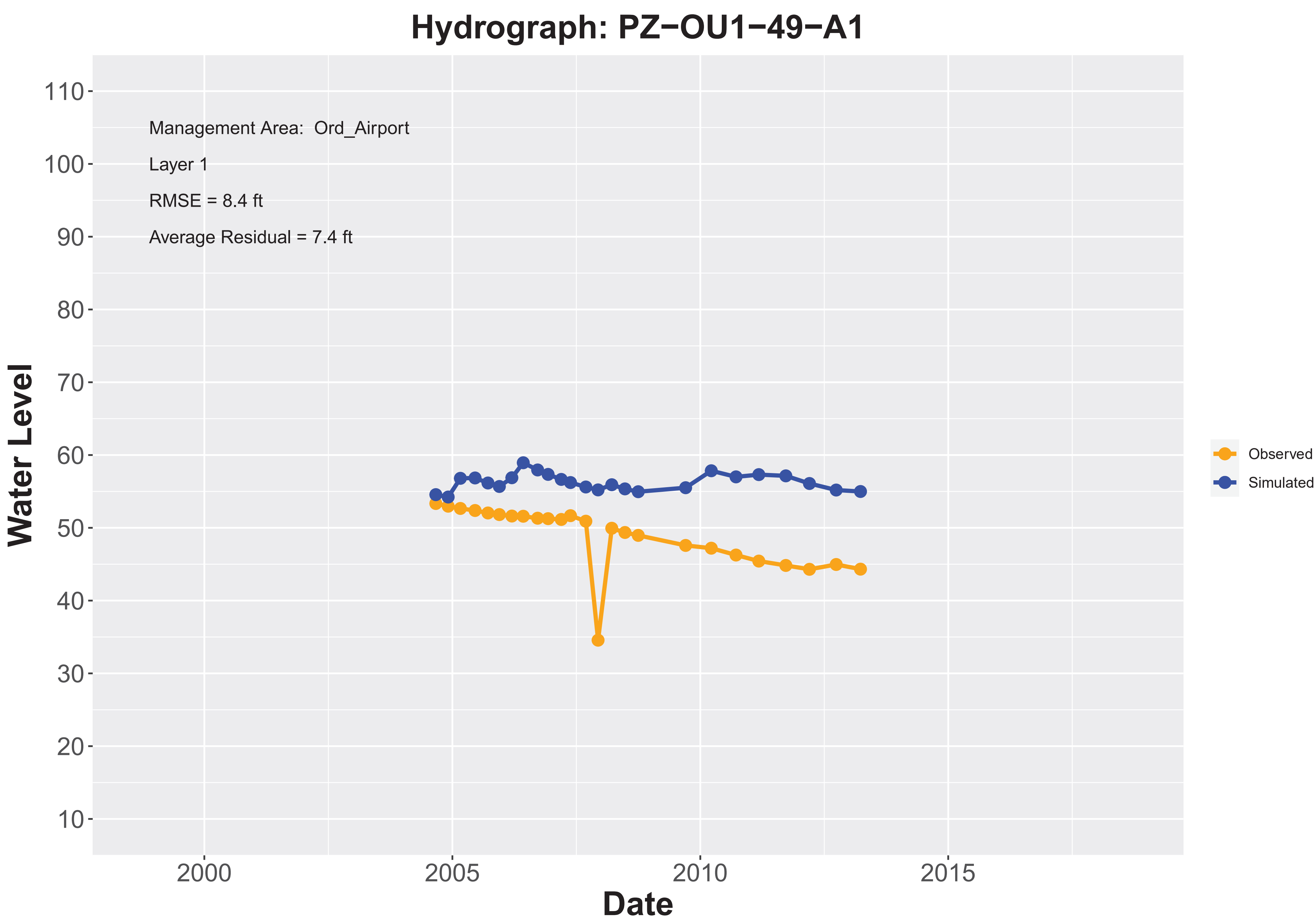

Hydrograph: PZ−OU1−16−A
Management Area: Ord_Airport
Layer 1
RMSE = 7.5 ft
Average Residual = −1.3 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated



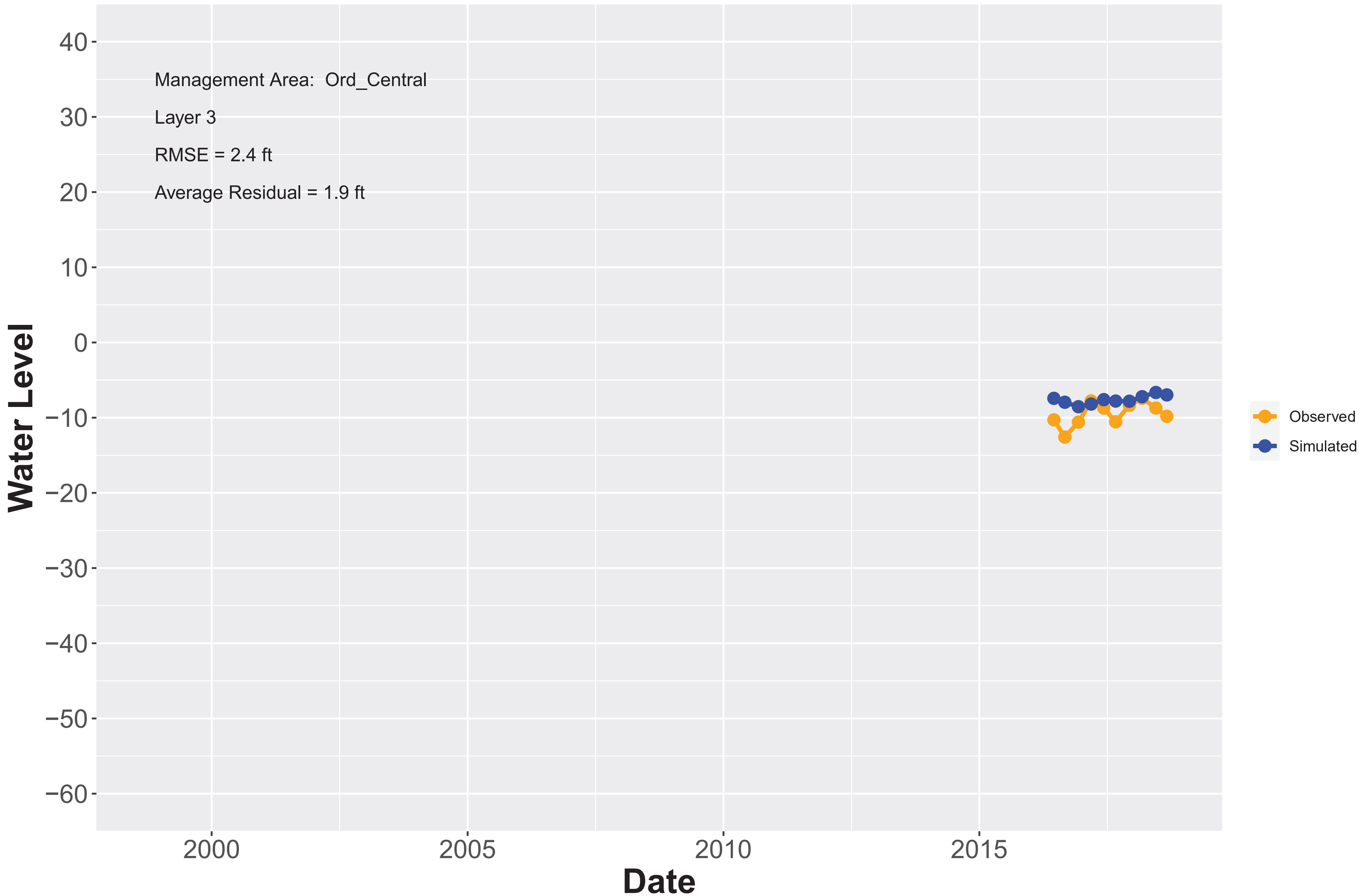
Hydrograph: PZ−OU1−35−A
Management Area: Ord_Airport
Layer 1
RMSE = 6.7 ft
Average Residual = 2.0 ft
Water Level
Date
0
10
20
30
40
50
60
70
80
90
100
2000
2005
2010
2015
Observed
Simulated

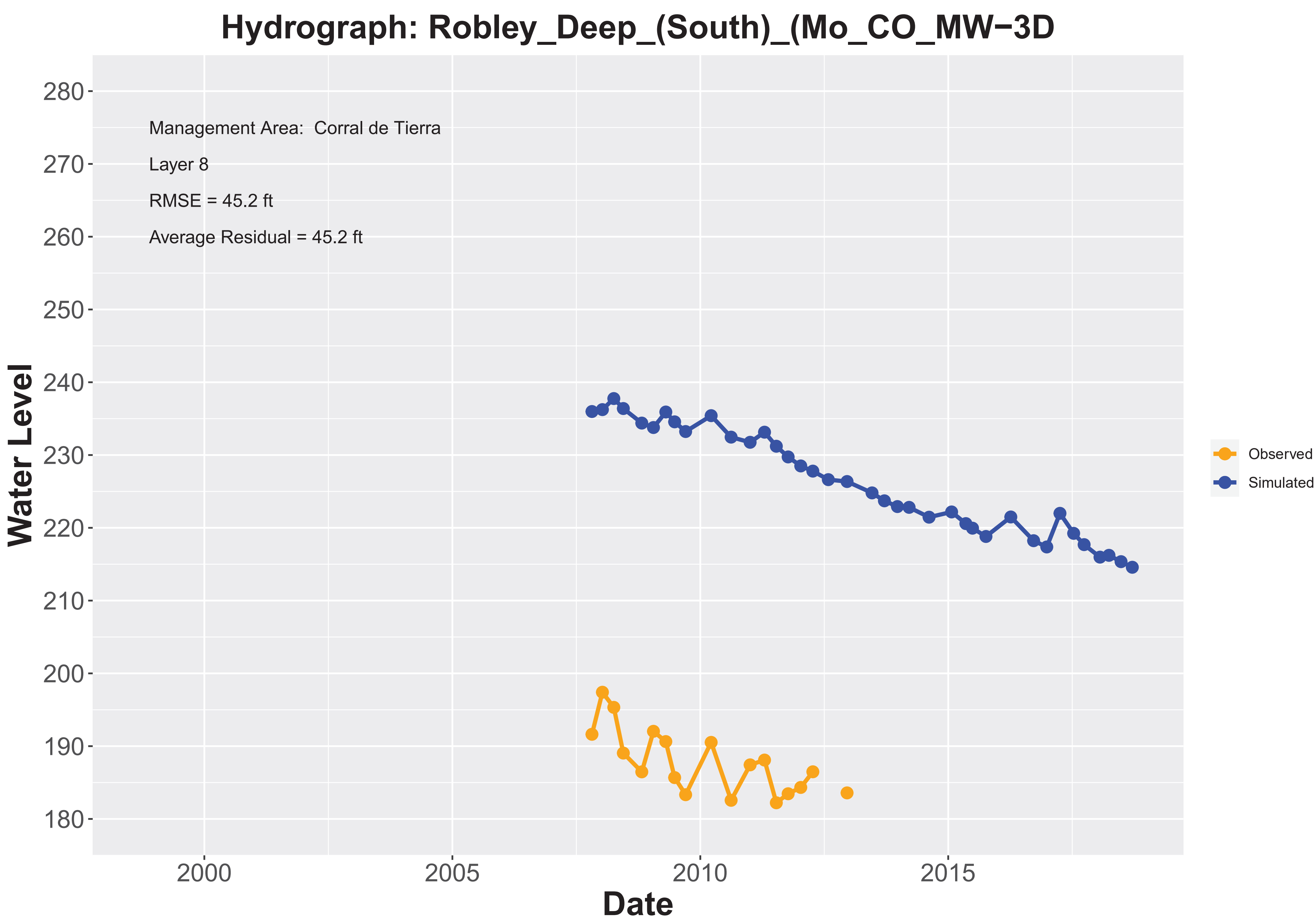


Hydrograph: PZ−OU1−46−AD2
Management Area: Ord_Airport
Layer 1
RMSE = 9.9 ft
Average Residual = 6.4 ft
Water Level
100
90
80
70
60
50
40
30
20
10
0
2000
2005
2010
2015
Date
Observed
Simulated

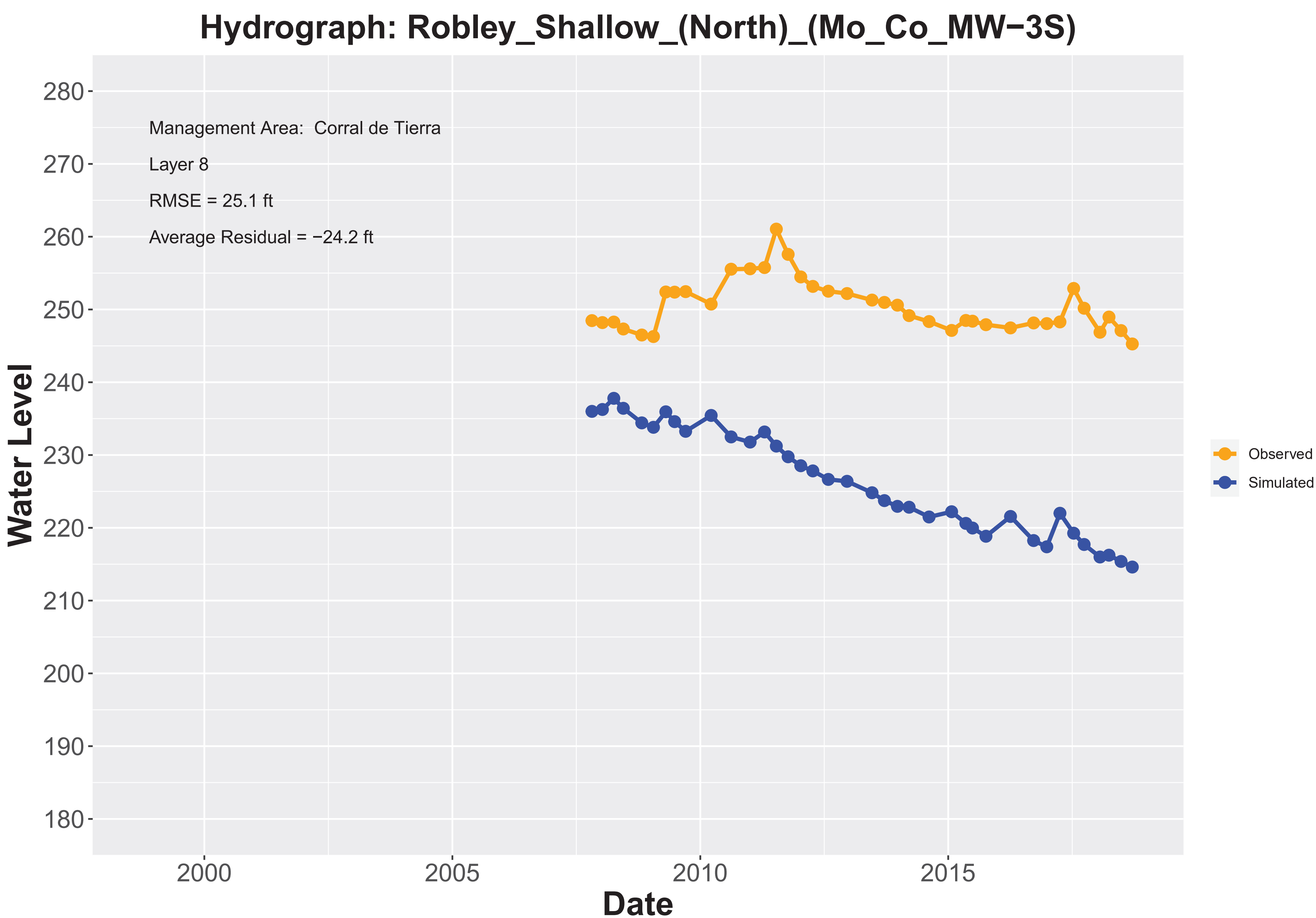

Hydrograph: PZ−OU1−49−A1
Management Area: Ord_Airport
Layer 1
RMSE = 8.4 ft
Average Residual = 7.4 ft
Water Level
110
100
90
80
70
60
50
40
30
20
10
2000
2005
2010
2015
Date
Observed
Simulated

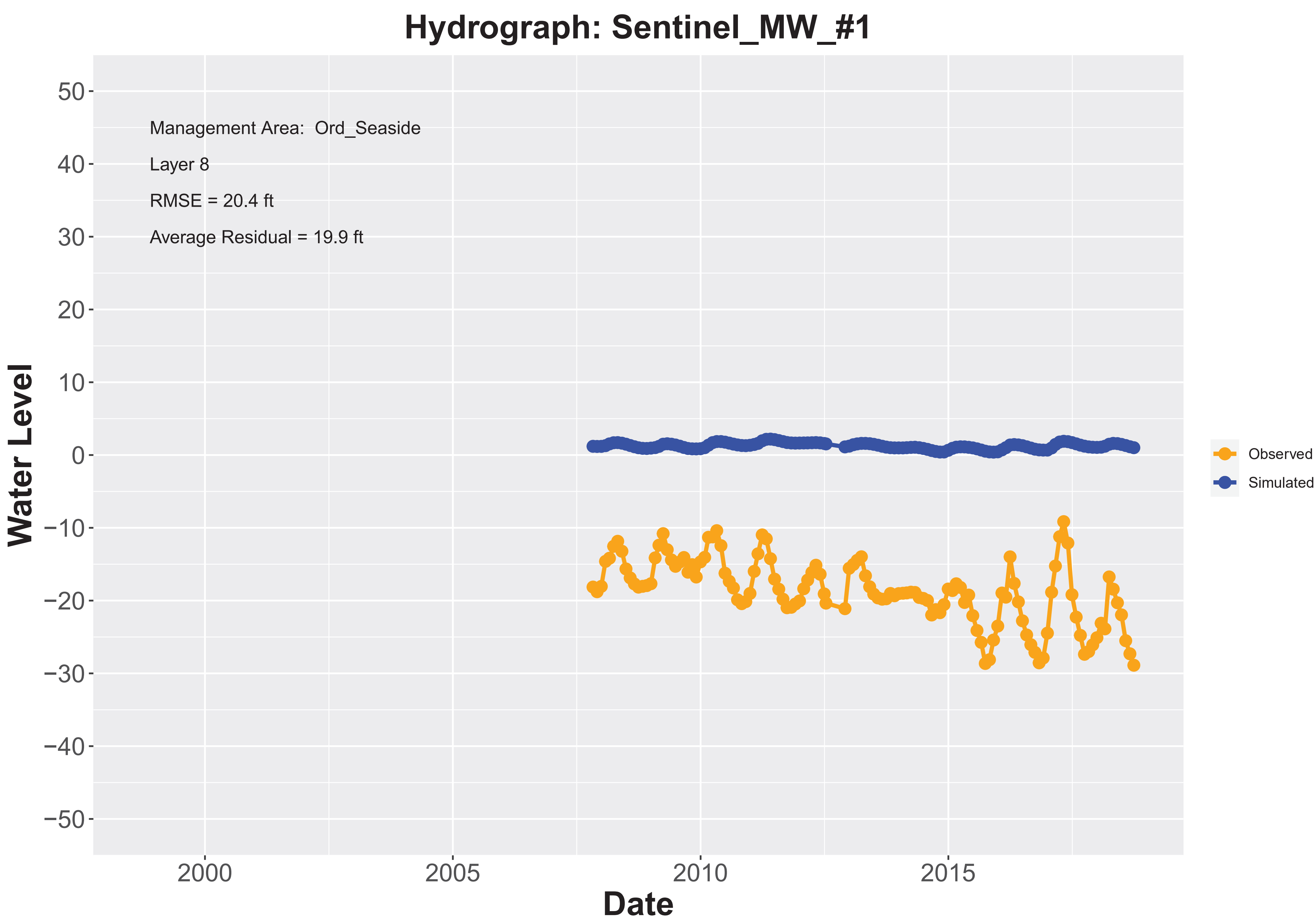
Hydrograph: PZ−OU2−06−180

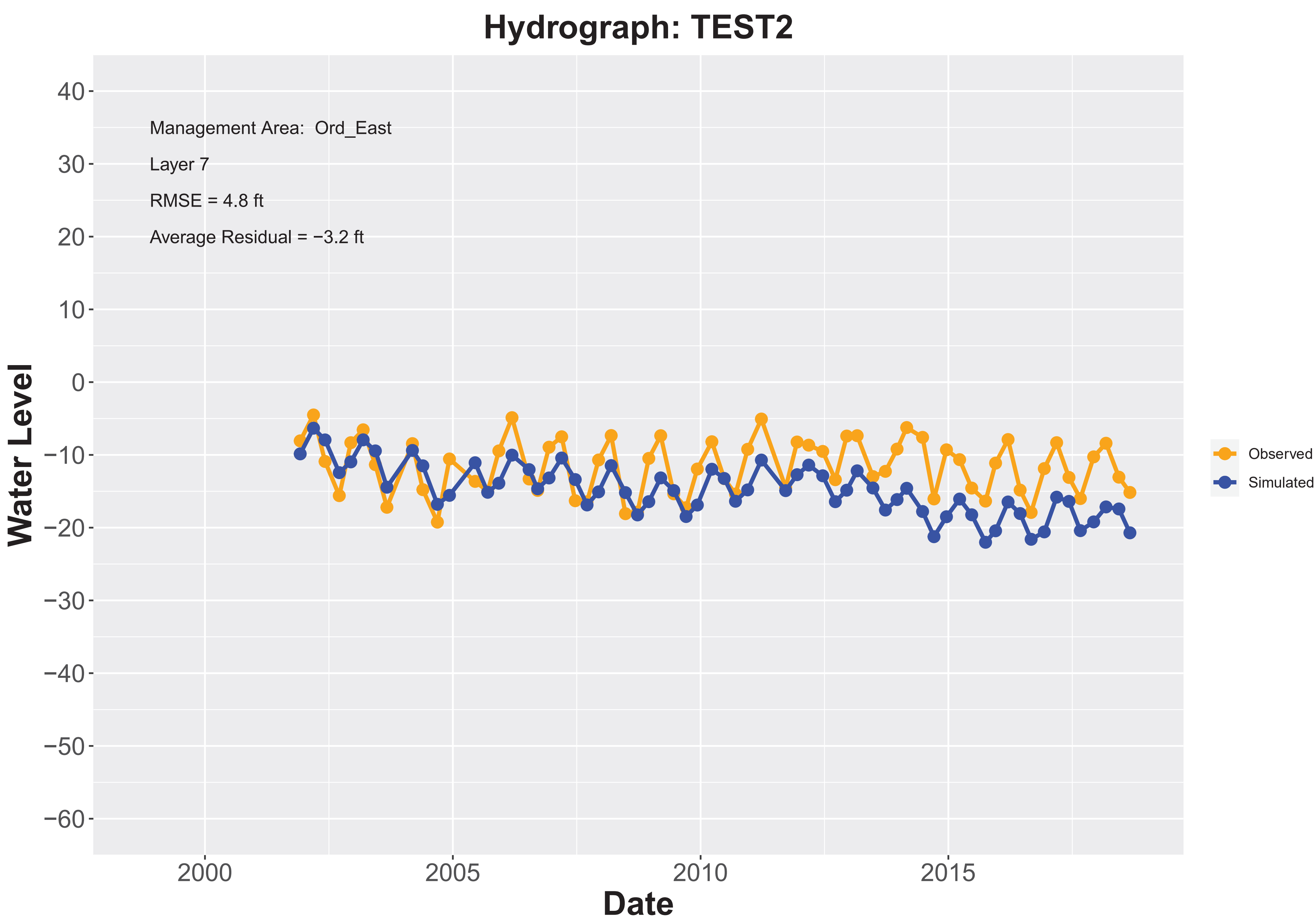




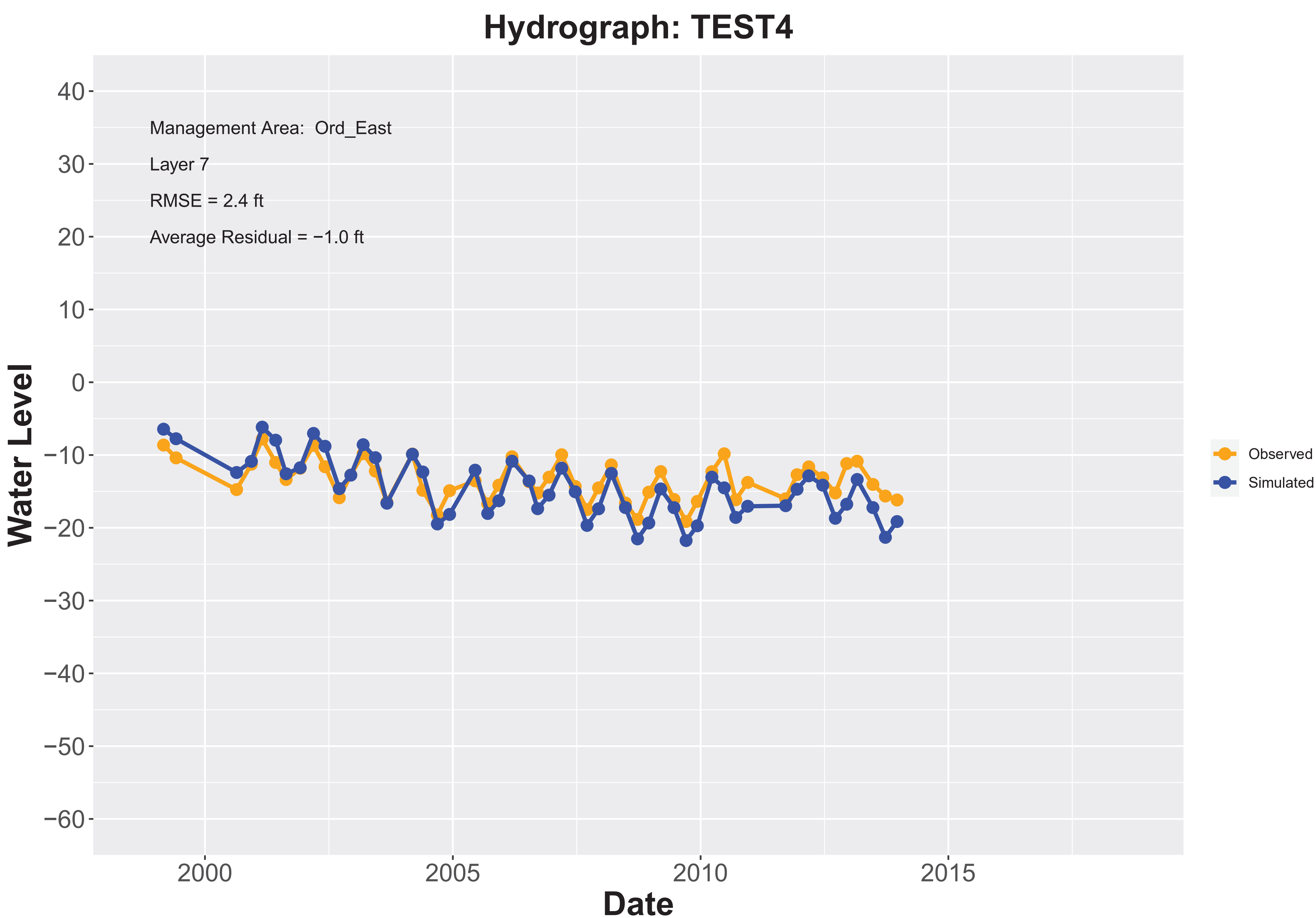
Hydrograph: Robley_Deep_(South)_(Mo_CO_MW−3D
Management Area: Corral de Tierra
Layer 8
RMSE = 45.2 ft
Average Residual = 45.2 ft
Water Level
280
270
260
250
240
230
220
210
200
190
180
Date
2000
2005
2010
2015
Observed
Simulated


Hydrograph: Robley_Shallow_(North)_(Mo_Co_MW−3S)
Management Area: Corral de Tierra
Layer 8
RMSE = 25.1 ft
Average Residual = −24.2 ft
Water Level
280
270
260
250
240
230
220
210
200
190
180
2000
2005
2010
2015
Date
Observed
Simulated


Hydrograph: Sentinel_MW_#1
Management Area: Ord_Seaside
Layer 8
RMSE = 20.4 ft
Average Residual = 19.9 ft
Water Level
50
40
30
20
10
0
−10
−20
−30
−40
−50
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: TEST2
Management Area: Ord_East
Layer 7
RMSE = 4.8 ft
Average Residual = −3.2 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated



Hydrograph: TEST4
Management Area: Ord_East
Layer 7
RMSE = 2.4 ft
Average Residual = −1.0 ft
Water Level
40
30
20
10
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
Date
Observed
Simulated

Attachment 2. Soil Moisture Budget Accounting Model Documentation

SOIL MOISTURE BUDGET ACCOUNTING MODEL DOCUMENTATION

TABLE OF CONTENTS

1. INTRODUCTION

A Soil Moisture Budget (SMB) accounting model (SMB model) was developed to provide groundwater recharge estimates for use as input to the Monterey Subbasin Groundwater Flow Model (MBGWFM). This documentation presents a description of the hydrologic processes included in the SMB model along with the associated calculations/equations, the data requirements, the model calculations/equations, and the model execution process.

1.1 Purpose and Objectives of the Soil Moisture Budget Accounting Model

As described in detail in *Appendix 6-B* of the 2022 Monterey Subbasin Groundwater Sustainability Plan (GSP or Plan), the MBGWFM is a numerical model that calculates the movement of groundwater and surface water into, within, and out of the Monterey Subbasin (Basin) by discretizing the three-dimensional model domain horizontally into a grid of cells and vertically into eight layers. Like all groundwater models, the MBGWFM relies on various user-specified inputs related to aquifer hydraulic properties, initial conditions, and boundary conditions to represent the Basin and its transient hydrologic functioning. One of the main boundary condition inputs required for the MBGWFM is the aerial recharge rate to the Basin as a function of space (location) and time. The purpose of the SMB model described herein is to estimate spatiotemporal recharge rates and generate the associated input datasets for use in the MBGWFM.

1.2 SMB Model Background

1.2.1 Conceptual Approach

The SMB model uses mass-balance principles to quantify and track the movement of water that arrives at the land surface from either precipitation or irrigation into the subsurface or back into the atmosphere, based on the processes and spatially- and temporally variable factors that control recharge and groundwater pumping. The order of calculations is generally consistent with the sequence of hydrologic processes that govern this movement of water, as discussed further in *Section 2* below. At each stage in the calculation for a given time step, the volume of water in the system (consisting of soil moisture in the soil/root zone and canopy/depression storage) is balanced in accordance with the various inflows or outflows associated with the hydrologic process at that stage.

1.2.2 Spatial Approach

The SMB model performs calculations on a grid cell basis using the same spatial grid as the MBGWFM. Within each time step, calculations are performed for all active model grid cells simultaneously using vector operations. As discussed in greater detail in *Section 3* below, spatial properties assigned to grid cells vary depending on location (e.g., within a water service area), land use, and soil type characteristics. The model therefore provides spatially-variable recharge estimates that reflect variable land use, soil conditions, and imported water availability throughout the Basin. The SMB model also calculates spatially-variable private agricultural groundwater pumping demands based on evapotranspiration (ET), surface water deliveries, and irrigation efficiency, for use in calculating residual irrigation requirements and associated total applied water and recharge rates on agricultural lands.

1.2.3 Temporal Approach

The SMB model runs using a daily time step. As discussed in greater detail in *Section 3* below, the various transient input datasets vary in their temporal resolution (e.g., precipitation and potential evapotranspiration data is daily, whereas water deliveries data is monthly, and land use is held constant). The outputs from the model are monthly to be consistent with the stress periods of the MBGWFM. The decision to use a daily time step in the SMB model is driven largely by the need to incorporate the rainfall-runoff process which functions at a relatively high temporal frequency; use of a longer time step would obscure the high frequency behavior of the system.

1.2.4 Code Setup and Execution

The SMB model is written and run in the Octave programming language. During model execution, the model first reads in a set of user-prepared input datasets (discussed further in *Section 3* below) and sets up various variables and parameters. The model then runs through soil moisture budget accounting calculations for each time step in the specified simulation period. The calculations associated with each relevant hydrologic (or water movement) process are presented in *Section 2* below. In addition to the hydrologic processes described below, a set of “bookkeeping” calculations are performed at the start of each time step related to updating the various grid cell properties as needed. After the last time step is completed, the model performs final calculations to sum daily values into monthly values and writes the output data to files.

2. PROCESSES INCLUDED IN THE SMB MODEL

The water movement processes included in the SMB model are (1) precipitation, (2) interception, (3) evaporation from canopy and depression storage,(4) rainfall excess runoff, (5) applied water from District deliveries, (6) applied water from private pumping (deficit pumping), (7) ET by vegetation, (8) recharge, (9) saturation excess runoff, and (10) dynamic soil moisture storage. Each of these processes is described below along with the associated calculations/equations.

2.1 Precipitation

Precipitation is an input to the SMB model rather than a calculated variable. The precipitation data used in the SMB model is gridded daily precipitation from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) dataset developed by the Northwest Alliance for Computational Science and Engineering (NACSE) based at Oregon State University. The spatial resolution of the gridded precipitation data is 4 kilometers (km).

2.2 Interception

Interception occurs when rainfall is caught by the vegetation canopy (leaves, stems, etc.) before reaching the ground. Intercepted rainfall accumulates within the canopy storage and is then subject to evaporation. The similar process of depression storage, where water accumulates in depressions on the soil surface, is treated the same way as interception in the SMB model. The model uses a running canopy storage budget for each grid cell to track the accumulation and evaporation of intercepted rainfall and depression storage, collectively referred to as interception.

$$interception = \max\left(0 \middle| \min\left(rainfall \middle| stor\ cap_{canopy} + stor\ cap_{depr} - CS_0\right)\right) \quad (1)$$

where *stor cap*$_{canopy}$ and *stor cap*$_{depr}$ are the canopy storage capacity and depression storage capacity, respectively.

$$CS_1 = CS_0 + interception \quad (2)$$

where CS is the volume (depth) of canopy and depression storage and the subscripts indicate an order of calculation.

2.3 Evaporation from Canopy and Depression Storage

Evaporation from canopy and depression storage is the removal of water from the vegetation canopy and soil surface through the meteorological process of evaporation. The evaporated water is lost to the atmosphere. This evaporation does not go towards satisfying the vegetation's transpiration demand but does use a portion of the potential evapotranspiration available from meteorological conditions (i.e., temperature, humidity, windspeed, etc.).

$$AET_c = \min(PET | CS_1) \quad (3)$$

where AET_c is the actual evaporation from canopy and depression storage and PET is the potential evapotranspiration. For the MBGWFM SMB, all land use classes rely on California Irrigation Management Information System (CIMIS) reference evapotranspiration (ETo) data and the crop coefficient method to calculate PET, as further described in *Section 2.8* below.

$$CS_2 = CS_1 - AET_c \quad (4)$$

$$PET_{leftover} = PET - AET_c \quad (5)$$

$$rainfall_{leftover} = rainfall - interception \quad (6)$$

The subscript "leftover" indicates that portion of either rainfall or PET that is not yet used at this point in the SMB model calculation.

2.4 Rainfall-Excess Runoff

Precipitation in excess of interception reaches the land surface and under certain conditions can become runoff (i.e., overland surface flow). Rainfall-excess runoff occurs when the rate of precipitation exceeds the rate at which water can move downwards through the soil. In the SMB model, rainfall-excess runoff is estimated using the U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Curve Number approach. Under this approach, runoff is a function of rainfall amount and surface properties including the land cover type and soil hydrologic group.

$$S = \frac{1000}{CN} \quad (7)$$

$$S_{adj} = S * \left(1 - \max\left(0 \middle| \frac{SM_1 - \left(\frac{FC+WP}{2}\right)}{SM_{sat} - \left(\frac{FC+WP}{2}\right)}\right)\right) \quad (8)$$

where S is the maximum retention, CN is the curve number (a function of land cover type and soil hydrologic group), FC is the field capacity and WP is the wilting point (both functions of soil type), SM is the soil moisture (inches) at that grid cell (a transient variable calculated by the model), and SM_{sat} is the soil moisture at saturation. Equation (8) essentially adjusts the S parameter for varying antecedent moisture conditions, and thus the "adj" subscript is applied.

$$Ia_{adj} = 0.2 * CN_{adj} \tag{9}$$

where Ia is the initial abstraction (initial loss).

For cells where $rainfall_{leftover} - Ia_{adj} > 0$ and $rainfall_{leftover} - Ia_{adj} - CN_{adj} > 0$

$$Runoff_{CN} = \frac{\left(rainfall_{leftover} - Ia_{adj}\right)^2}{rainfall_{leftover} - Ia_{adj} - CN_{adj}} \tag{10}$$

$$rainfall_{leftover} = rainfall_{leftover} - Runoff_{CN} \tag{11}$$

where $Runoff_{CN}$ is the volume (depth) of rainfall-excess runoff via the Curve Number approach.

2.5 Applied Water from District Deliveries

District delivery records are used to estimate applied surface water[1] rates to lands within their respective water service areas within the Basin. Deliveries data were provided on a monthly basis and are therefore first normalized to a daily basis by dividing by the number of days in the month.

Within the Monterey Subbasin, all district deliveries are designated for urban use (i.e., there are no deliveries to agricultural customers). Historical distributions of indoor vs. outdoor urban water use were not available at a monthly resolution, and thus a few simplifying assumptions had to be made to parse District delivery records into their indoor and outdoor water use fractions using information obtained from the individual water agencies' Urban Water Management Plans (UWMPs). Ultimately, the applied surface water term ($SW_{applied}$) was calculated by multiplying total deliveries from each district by a user-specified fraction of outdoor water use:

$$SW_{applied} = Total\ Deliveries * Outdoor\ Water\ Use\ Fraction \tag{12}$$

The outdoor water use fraction was set at 25% for all water service areas within the Basin and was held constant throughout the simulation. Given that outdoor urban water use is generally limited to the summer months, applied surface water on urban lands was further constrained to only occur from April through September.

Monthly applied surface water volumes were distributed equally among all cells within each respective water service area.

[1] Not all District-delivered water is surface water; however, for purposes of this documentation, the term $SW_{applied}$ refers to all District-delivered water regardless of the actual source of the water.

2.6 Interim Calculations of Soil Moisture, Soil Water Content, Available Water, ET Stress Function, and Vegetative Water Demand

While not strictly a water movement or hydrologic process, the SMB model performs a set of interim calculations prior to the calculation of applied water from District deliveries. These interim calculations include updating soil moisture (SM), soil water content (SWC, expressed as a percentage of total soil volume), available water (AW), as follows:

$$SM_2 = SM_1 + rainfall_{leftover} + SW_{applied} \quad (13)$$

$$SWC_2 = \frac{SM_2}{rootdepth} \quad (14)$$

$$AW_2 = SWC_2 - WP \quad (15)$$

Calculation of an ET Stress Function ($ETSF$) allows for a reduction in vegetative water demand under dry soil conditions for the grid cells that are not irrigated up to full PET (i.e., the native and urban land cells).

$$ETSF = \max\left(0 \middle| \min\left(1 \middle| \frac{AW_2}{(FC-WP)*ETSF_{mult}}\right)\right) \quad (16)$$

where $ETSF_{mult}$ is the user-specified ETSF multiplier ($ETSF_{mult} = 0.5$ for the Monterey SMB).

As mentioned previously, the Vegetative Water Demand (VWD) is calculated using the crop coefficient method for all land use classes within the Basin. For agricultural land cells, VWD is calculated by multiplying the leftover PET by land use-specific crop coefficients:

$$VWD = PET_{leftover} * crop\ coeff \quad (17)$$

For urban and native land cells, VWD is further constrained by the ET Stress Function, as follows:

$$VWD = PET_{leftover} * crop\ coeff * ETSF \quad (18)$$

2.7 Applied Water from Private Groundwater Pumping

Private groundwater pumping on agricultural lands is estimated in the SMB model as the amount of residual water required to meet the vegetative water demand after accounting for leftover precipitation ($rainfall_{leftover}$) and applied surface water ($SW_{applied}$), adjusted for irrigation efficiency (IE):

$$pumping_{initial} = \max\left(0 \middle| \left(\frac{VWD - rainfall_{leftover}}{IE}\right) - SW_{applied}\right) \quad (19)$$

Pumping can be limited by a user-defined pumping limit applied on a cell basis (allowing for pumping to be turned off, if needed for certain cases), as follows:

$$pumping = \min(pumping_{initial} | pumping\ limit) \quad (20)$$

The difference between the initial pumping estimate and the potentially limited pumping is tracked as a pumping deficit for later use in the actual soil/root zone ET calculation:

$$pumping_{deficit} = pumping_{init} - pumping \quad (21)$$

2.8 Evapotranspiration by Vegetation

As described above, the SMB model uses CIMIS ET and crop coefficients as the basis for PET for all lands within the Monterey Subbasin. CIMIS is a program unit in the Water Use and Efficiency Branch, California Department of Water Resources that manages a network of over 145 automated weather stations in California, which provides reference evapotranspiration (ETo) values based on surface weather stations.

Actual ET from the root/soil zone is calculated differently for agricultural land cells than for urban and native land cells. For agricultural lands (including golf courses), the actual ET is equal to the full VWD and is satisfied by a combination of applied surface water and/or private pumping, minus pumping deficit due to pumping limits:

$$AET_s = \max(0|VWD) \quad (22)$$

For urban and native lands, the actual ET is the lesser of the VWD and the available moisture above the wilting point:

$$AET_s = \min\left(VWD\middle|SM_2 - (WP * root\ depth)\right) \quad (23)$$

For all grid cells, the soil moisture is updated at this point as follows:

$$SM_3 = SM_2 + pumping - AET_s \quad (24)$$

2.9 Aerial Recharge

Aerial recharge is the process of water movement below the bottom of the root zone where it then travels by gravity through the unsaturated zone to the saturated zone, adding to groundwater storage. Additional types of recharge such as stream recharge also occur and are accounted for in the MBGWFM separately from the aerial recharge calculated with the SMB model. Aerial recharge occurs when the soil moisture exceeds the field capacity of the soil, and continues until the soil moisture reaches field capacity. It is also subject to a maximum daily recharge limit.

$$recharge = \max\left(0\middle|\min\left(max\ daily\ recharge\middle|SM_3 - (FC * root\ depth)\right)\right) \quad (25)$$

Soil moisture is once again updated after recharge:

$$SM_4 = SM_3 - recharge \quad (26)$$

2.10 Saturation Excess Runoff

Saturation excess runoff occurs when the soil becomes completely saturated due to high rates of rainfall or applied water exceeding the rate at which recharge can drain water from the soil. This process is relatively common in areas with shallow water tables but is relatively rare in the Basin due to the thick unsaturated zones and relatively permeable soils.

$$Runoff_{SE} = max\left(0\middle|SM_4 - (porosity * root\ depth)\right) \quad (27)$$

Soil moisture and soil water content are updated one final time:

If $Runoff_{SE} > 0$

$$SM_5 = porosity * root\ depth \quad (28)$$

If $Runoff_{SE} = 0$

$$SM_5 = SM_4 \quad (29)$$

$$SWC_5 = \frac{SM_5}{root\ depth} \quad (30)$$

2.11 Soil Moisture Storage

Soil moisture storage provides a short-term reservoir allowing for the relatively continuous outputs to evapotranspiration and transpiration from the discontinuous rainfall and applied water inputs. Soil moisture storage typically varies between field capacity, which is the maximum quantity of water that can be held in the soil against gravity, and wilting point that is the threshold under which vegetation cannot extract water further. During wet periods soil moisture may rise temporarily above field capacity. Soil moisture storage is a key component of the SMB model and is updated at several points during the calculation of each time step, per equations (13), (24), (26), and (29).

3. INPUT DATASETS

This section describes the input datasets used to develop and apply the SMB model for the MBGWFM. These datasets provide the spatial and temporal information on factors that control the movement of water through the SMB model.

3.1 Grid Data

The following attributes are assigned by the SMB model to grid cells, based on input datasets that were developed using a combination of Geographic Information System (GIS) and spreadsheet analysis.

- Active cell: flag specifying whether the grid cell is active (i.e., in the MBGWFM) or inactive
- Grid area: specifies the area of the grid cell (in square feet)
- Soil code: code corresponding to the soil map unit key; soils data were obtained from the United States Department of Agriculture (USDA) Soil Survey Geographic Database (SSURGO)[2]
- District: location within a water service area (if any), based on the boundaries for the five water service areas within the Basin, including MCWD, CalAm (Ambler, Hidden Hills and Toro Units) and California Water Service (CWS)

[2] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2_053627

- Land use (static): based on land use information obtained from the U.S. Department of Agriculture (USDA) Forest Service Region 5 Classification and Assessment with Landsat of Visible Ecological Groupings (CalVeg) dataset for Zone 5 (Central Valley)[3] and from various historical and projected land use surveys conducted by MCWD
- PRISM cell identifier: 4-kilometer PRISM cell identifier for use in linking SMB grid cells to PRISM[4] precipitation data (below)

3.2 Climate Data

The following datasets are used to define the climate characteristics for the SMB model period.

- CIMIS ETo: Daily ETo data from the CIMIS Salinas North #116 and Laguna Seca #229 stations
- PRISM precipitation: gridded daily precipitation data from the PRISM dataset.

3.3 Deliveries Data

Monthly surface water delivery data from the five water agencies within the Basin (MCWD, CWS, Cal Am Ambler, Hidden Hills, and Toro Units) is used to inform applied surface water volumes in each respective water service area

3.4 Other Data

Several other datasets are used as input including the following:

- Soil characteristics: based on SSURGO soils data (see above)
- Curve Number: by land use class and hydrologic soil group, from the USDA (*USDA, 1986*)
- Canopy Storage: from California Polytechnic State University's Irrigation Training and Research Center (*Howes et al., 2015*)
- Stress periods: corresponding to the month and year of the historical simulation

3.5 User-Specified Parameters

In addition to the spatial and temporal datasets described above, the SMB model uses several parameters to modify certain inputs or calculations for purposes of model calibration.

- Depression storage capacity: set at 0.33 inches;
- ETSF multiplier: set at 0.5;
- Irrigation efficiency: set at 85%
- Outdoor water use fraction: set at 25%; only applied from April - September

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[3] https://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5347192
[4] https://prism.oregonstate.edu/recent/

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Appendix 6-C

Technical Memorandum: Monterey Subbasin Modeling, dated April 2, 2021