The State of New Jersey
Department of Environmental Protection

NEW JERSEY WATER SUPPLY PLAN 2017-2022

APPENDIX A

CHARACTERIZATION OF CONFINED AND UNCONFINED GROUNDWATER AND SURFACE WATER SUPPLIES

WATER SUPPLY MANAGEMENT OPTIONS AND RECOMMENDATIONS

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INTRODUCTION

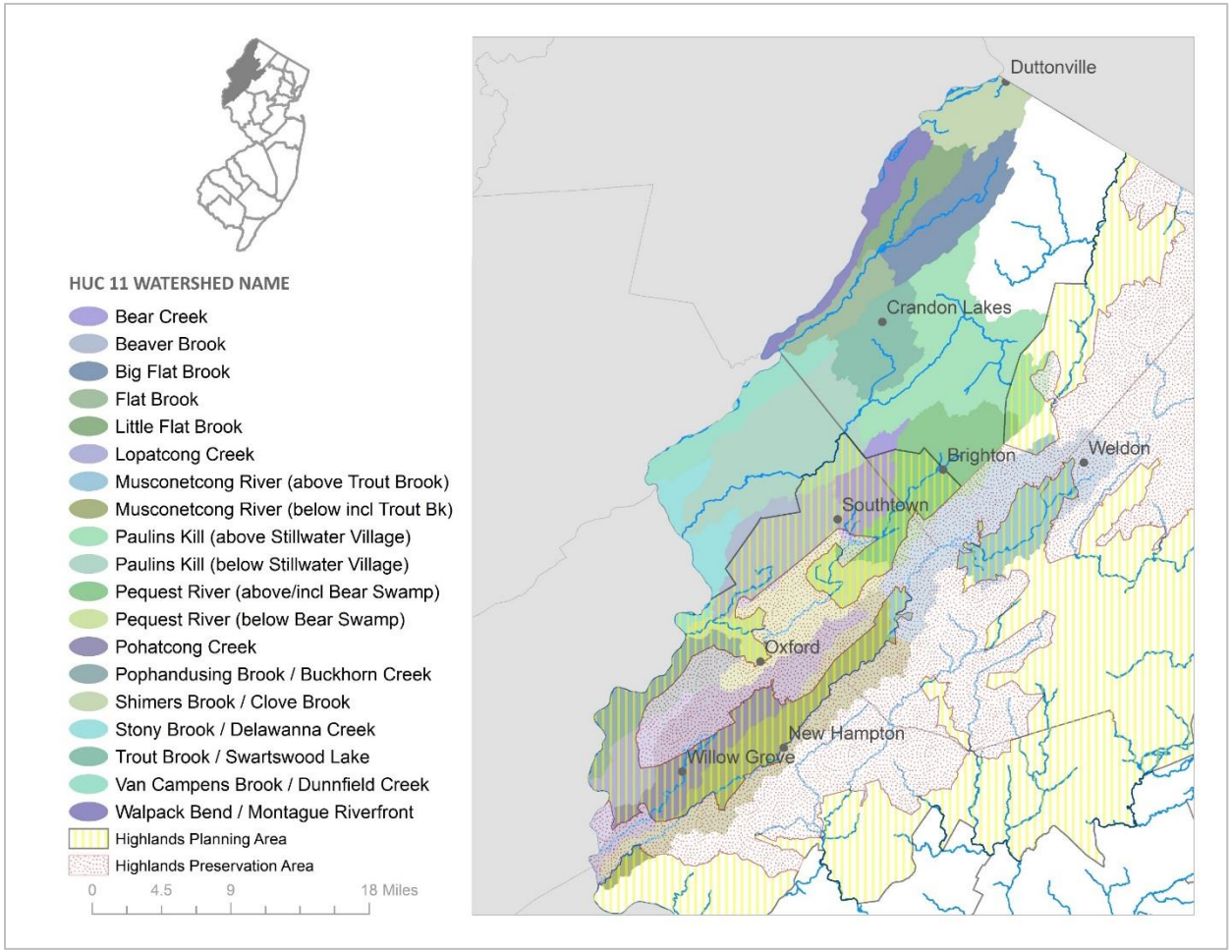
DEP analyzed data available from 1990 through 2015 to determine a period of time representing peak consumptive demand in New Jersey and determined that the 16-year period from 2000-2015 was the best available period. It includes the drought of 2001-2002 as well as the peak water use years in the mid-2000s. This became the period of analysis for water availability. The overall decrease in total and consumptive use in recent years would result in an overall decrease in stressed watersheds if more recent years were used as the analysis baseline. These results were used to generate the summaries in Chapter 3. HUC11 specific trends may be different than these watershed management area and statewide trends. Data summaries include the 1990 to 2015 period.

Each WMA section that follows has the same format with corresponding data summaries and resource analyses. Each recommendation section is tailored to the specific conditions observed in that WMA

NJDEP intends to update the Summary and Management Options of each HUC11 and WMA with new data, policies, and scientific methods as they become available. This will be part of the dynamic, "living document" approach to keeping the Plan up-to-date with changing conditions and thus best able to protect the water supply of New Jersey.

WATERSHED MANAGEMENT AREA 1

UPPER DELAWARE



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 1, the Upper Delaware, is in the northwestern corner of the State within New Jersey's Valley and Ridge and Highlands physiographic provinces. WMA 1 encompasses 739.8 square miles and contains all or portions of 54 municipalities, including all of Warren County and portions of Sussex, Morris and Hunterdon Counties. WMA 1 consists of nineteen (19) HUC11 watersheds (as depicted above), all of which generally flow in a southwesterly direction towards the Delaware River. The NJ Highlands Region intersects the WMA on its eastern and southern borders.

Table A.1.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02040104090	Shimers Brook / Clove Brook
02040104110	Walpack Bend / Montague Riverfront
02040104130	Little Flat Brook
02040104140	Big Flat Brook
02040104150	Flat Brook
02040104240	Van Campens Brook / Dunnfield Creek
02040105030	Trout Brook / Swartswood Lake
02040105040	Paulins Kill (above Stillwater Village)
02040105050	Paulins Kill (below Stillwater Village)
02040105060	Stony Brook / Delawanna Creek
02040105070	Pequest River (above/incl Bear Swamp)
02040105080	Bear Creek
02040105090	Pequest River (below Bear Swamp)
02040105100	Beaver Brook
02040105110	Pophandusing Brook / Buckhorn Creek
02040105120	Lopatcong Creek
02040105140	Pohatcong Creek
02040105150	Musconetcong River (above Trout Brook)
02040105160	Musconetcong River (below incl Trout Bk)

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 01 surface water withdrawals comprise 85% of the total withdraw and unconfined groundwater comprises 15%. There are no major confined aquifers or surface water supply reservoir systems in this WMA. Power generation is 81% of the total withdrawal, with 100% coming from surface water sources. Potable supply is 10% of the total withdrawal, with 98% coming from unconfined groundwater sources and the remaining 2% from surface water sources. Combined commercial, industrial and mining make up 6% of the total withdrawal, with 66% coming from surface water sources and 34% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 4% of total water withdrawals, with 93% coming from unconfined groundwater sources and 7% from surface water sources. Figure A.1.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.1.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 1990 and show a declining to flat trend from 1990 to 2015. Annual withdrawals by source and use sector are shown in table A.1.2.

Annual consumptive loss peaked in 1999 with annual use less in the 2000s than in the 1990s, but with a slightly increasing trend from 2000 to 2015. In 1999 consumptive losses were approximately equally split between potable supply, ag and non-ag irrigation, and commercial/industrial/mining uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2012. Refer to figures A.1.3 and A.1.4.

Almost all (98%) of the total sanitary sewer discharges are to fresh surface water sources. The remaining 2% of the discharges are to groundwater. Discharges average about 8-10 mgd over the period of record. Refer to Figure A.1.5.

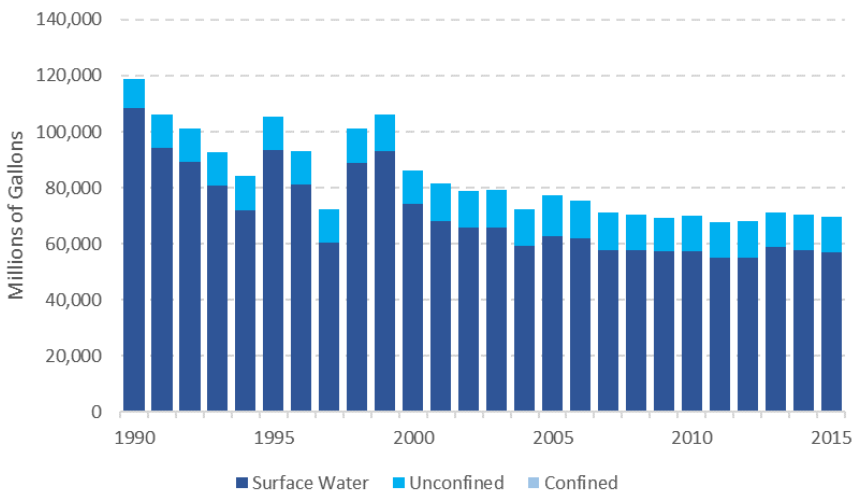


Figure A.1.1. Annual withdrawals by source.

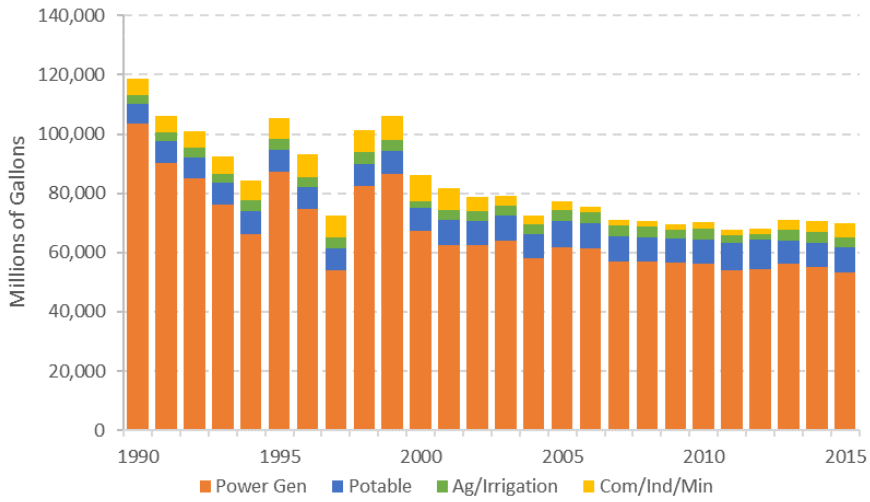


Figure A.1.2. Annual withdrawals by use sector.

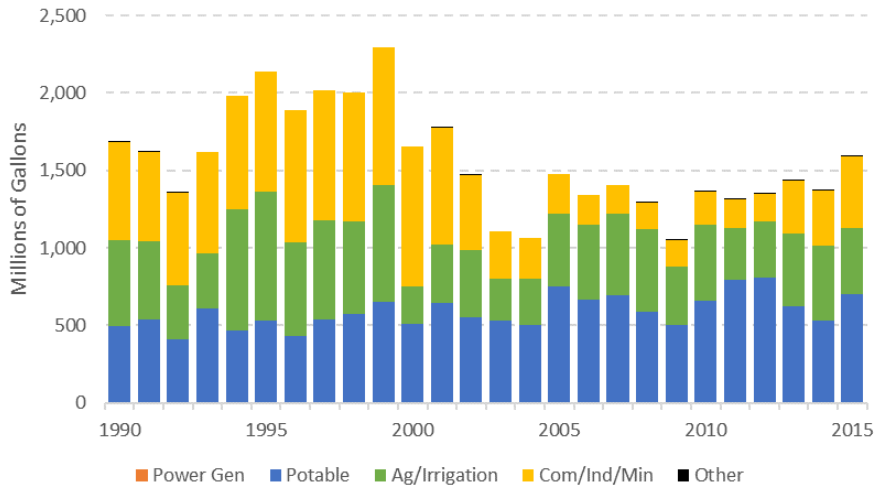


Figure A.1.3. Annual consumptive loss by use sector.

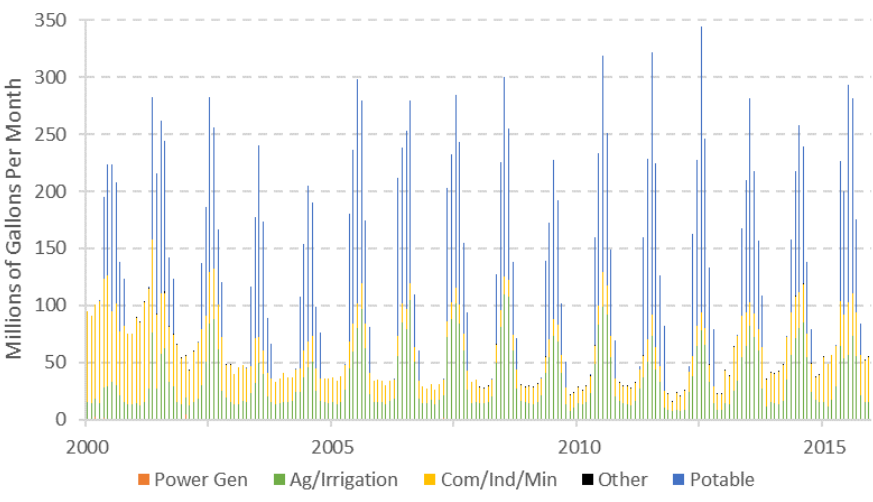


Figure A.1.4. Monthly consumptive loss by use sector.

Table A.1.2. Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min		Potable Supply		Power Generation
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Surface Water	Unconfined	Surface Water
1990	326	2,430		4,233	1,601	354	6,425	103,497
1991	251	2,909		3,691	1,729	230	7,074	90,182
1992	143	3,043		3,910	1,719	197	6,920	85,129
1993	150	3,010		4,369	1,622	218	7,006	76,228
1994	249	3,493		4,994	1,723	282	7,123	66,375
1995	534	3,255		5,328	1,706	211	7,055	87,231
1996	339	3,108		5,833	1,802	139	6,994	74,811
1997	381	3,254		5,878	1,674	205	7,022	54,086
1998	326	3,415		5,735	1,755	178	7,317	82,505
1999	477	3,273		6,047	2,094	200	7,516	86,510
2000	97	2,398		6,924	1,971	200	7,566	67,145
2001	185	3,125		5,443	2,026	176	8,367	62,363
2002	225	3,138		3,217	1,649	13	8,086	62,518
2003	69	3,273		1,407	1,843	255	8,323	63,989
2004	102	3,187		873	1,932	174	8,185	57,949
2005	172	3,499		669	2,262	157	8,799	61,595
2006	257	3,434		342	1,632	202	8,301	61,352
2007	248	3,486		505	1,296	95	8,318	57,075
2008	255	3,465		401	1,345	94	8,143	56,822
2009	156	2,921		534	1,226	7	7,989	56,620
2010	211	3,481		782	1,299	10	8,080	56,220
2011	151	2,236		831	1,057	1	9,228	54,076
2012	161	1,922		556	1,294	62	9,738	54,420
2013	214	3,357		2,397	1,018	0	7,964	56,130
2014	190	3,549		2,516	996	0	8,133	55,222
2015	159	3,343		3,714	898	0	8,386	53,222

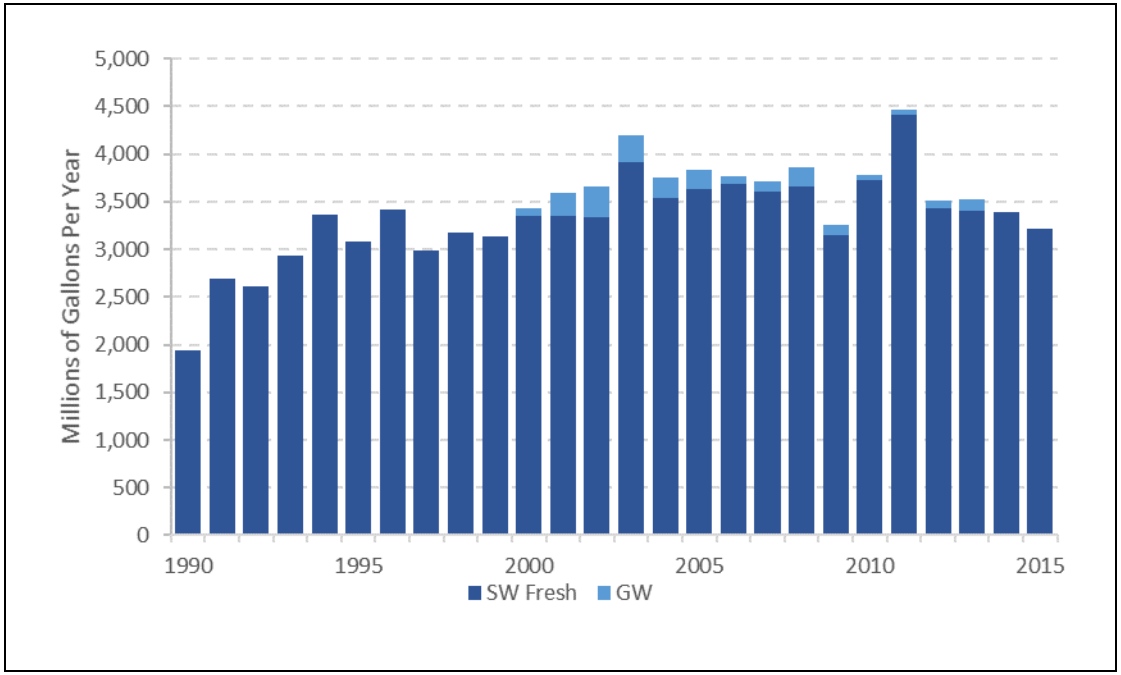


Figure A.1.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Twenty-seven water purveyors which serve more than 1,000 people provide potable water to one or more of the 19 HUC11s in WMA 01. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.1.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 43% of the total potable supply in WMA 01 is from private domestic wells.

Potable water demand is expected to increase by 1.12, 2.24, 3.36, 4.48, and 5.60 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.1.4 contains demand estimates by HUC11. 125 gpcd is assumed for all the increased demand and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.1.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02040104090	02040104110	02040105040	02040105060	02040105070	02040105090	02040105110	02040105120	02040105140	02040105150	02040105160
NJ1013001	Hampton Borough WD											X
NJ1414011	Jefferson Twp Water Utility - Lake Hopatcong										X	
NJ1426002	Mount Arlington DPW Kadel Sys.										X	
NJ1426005	Mount Arlington Boro DWP Main										X	
NJ1427007	Mt Olive Twp - Village Green										X	
NJ1427017	NJ American - ITC										X	
NJ1427018	Morris Chase/ Morris Hunt PCWS										X	
NJ1428001	Netcong WD										X	
NJ1436002	Roxbury WC										X	
NJ1436003	Roxbury Twp WD - Shore Hills										X	
NJ1436004	Roxbury Twp WD - Skyview										X	
NJ1438004	Washington Twp MUA - Schooleys Mountain										X	X
NJ1902003	Lake Lenape WC					X						
NJ1903001	Branchville WD			X								
NJ1904001	Brookwood Musconetcong River POA										X	
NJ1904003	Forest Lakes WC					X					X	
NJ1912001	Hopatcong WD										X	
NJ1914002	Montague WC	X	X									
NJ1915001	Newton Water and Sewer Utility			X		X						
NJ1918004	Sparta Twp WU- Lake Mohawk			X		X					X	
NJ1919001	Stanhope Water Dept.										X	

Table A.1.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02040104090	02040104110	02040105040	02040105060	02040105070	02040105090	02040105110	02040105120	02040105140	02040105150	02040105160
NJ1920001	Stillwater Water District 1			X								
NJ2101001	Allamuchy Twp Water and Sewer					X	X					
NJ2102001	Alpha Municipal Water Works								X	X		
NJ2103001	NJ American - Belvidere				X		X	X				
NJ2108001	Hackettstown MUA						X				X	X
NJ2119001	Aqua NJ - Phillipsburg							X	X	X		X
NJ2121001	NJ American - Washington/Oxford						X			X		X

Table A.1.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02040104090	0.02	0.04	0.07	0.09	0.11
02040104110	0.01	0.02	0.03	0.04	0.05
02040104130	0.01	0.03	0.04	0.05	0.07
02040104140	0.03	0.06	0.08	0.11	0.14
02040104150	0.00	0.01	0.01	0.01	0.02
02040104240	0.00	0.00	0.01	0.01	0.01
02040105030	0.03	0.07	0.10	0.14	0.17
02040105040	0.21	0.42	0.63	0.84	1.06
02040105050	0.04	0.07	0.11	0.15	0.18
02040105060	0.01	0.02	0.03	0.05	0.06
02040105070	0.12	0.25	0.37	0.49	0.62
02040105080	0.02	0.04	0.06	0.08	0.10

Table A.1.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02040105090	0.06	0.12	0.19	0.25	0.31
02040105100	0.02	0.04	0.06	0.08	0.10
02040105110	0.05	0.10	0.15	0.19	0.24
02040105120	0.07	0.13	0.20	0.27	0.33
02040105140	0.12	0.24	0.36	0.48	0.61
02040105150	0.19	0.38	0.56	0.75	0.94
02040105160	0.10	0.20	0.30	0.39	0.49
Total	**1.12**	**2.24**	**3.36**	**4.48**	**5.60**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.1.8 and A.1.9 indicate that there is a total of 30 mgd of natural resource availability in WMA 01 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 18 mgd of available water remaining and at full allocation rates 1.1 mgd of water is remaining. Table A.1.5 shows that of the 19 HUC11s in the WMA, 2 have used all the available water and 5 would have used all the available water if full allocation diversion rates were used. One HUC11 has a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, potable supply uses are the major loss in 15 HUC11s and under full allocation diversion rates potable supply is the largest loss in 16 HUC11s. See tables A.1.5, A.1.6 and A.1.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Notes for Table A.1.5:

1) A "Yes" in the "Major SW Potable Supply" column indicates that the HUC contains or is upstream on a major (>10 mgd) surface water supply reservoir system and additional limitations may apply.
2) A "Yes" in the "Potentially 7Q10 Limited" column indicates a HUC11 where the LFM water availability exceeds 50% of the HUC's 7Q10 and additional availability analysis may be required.

Table A.1.5 Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02040104090	3.93			Yes	25%	2002	0.98	0.62	0.63	0.37	0.41	0.42	0.57	Non Ag Irr	Potable
02040104110	2.45			Yes	25%	2007	0.61	0.02	0.04	0.59	0.11	0.18	0.50	Potable	Potable
02040104130	2.29			Yes	25%	2005	0.57	0.02	0.03	0.56	0.11	0.19	0.46	Potable	Potable
02040104140	4.28			Yes	25%	2012	1.07	0.04	0.03	1.03	0.23	0.21	0.84	Potable	Potable
02040104150	2.40				25%	2013	0.60	0.01	0.01	0.59	0.03	0.05	0.57	Potable	Potable
02040104240	3.63			Yes	25%	2004	0.91	0.01	0.02	0.89	0.09	0.10	0.82	Potable	Potable
02040105030	3.91			Yes	25%	2003	0.98	0.06	0.06	0.91	0.36	0.37	0.62	Potable	Potable
02040105040	15.24	Partial			25%	2007	3.81	1.58	0.41	2.23	3.48	0.91	0.33	Potable	Potable
02040105050	13.64	Partial		Yes	25%	2002	3.41	0.22	0.07	3.19	0.96	0.28	2.45	Potable	Potable
02040105060	2.95	Partial		Yes	25%	2005	0.74	0.05	0.06	0.69	0.50	0.67	0.24	I/c/m	Ag-Irr
02040105070	9.82	Partial		Yes	25%	2008	2.45	1.43	0.58	1.03	2.84	1.16	0.00	Potable	Potable
02040105080	2.96	Partial		Yes	25%	2007	0.74	0.16	0.21	0.58	0.30	0.41	0.44	Potable	Potable
02040105090	7.18	All		Yes	25%	2012	1.79	4.11	2.29	0.00	5.67	3.16	0.00	Potable	Potable
02040105100	4.46	Partial		Yes	25%	2006	1.12	0.17	0.15	0.95	1.15	1.03	0.00	Potable	Ag-Irr
02040105110	3.95	All		Yes	25%	2010	0.99	0.45	0.46	0.53	1.45	1.47	0.00	Potable	Potable
02040105120	3.36	All			25%	2009	0.84	-1.72	Net Gain	2.56	-0.61	Net Gain	1.46	Non ag Irr	A-Irr
02040105140	9.38	All		Yes	25%	2005	2.35	0.86	0.37	1.49	1.99	0.85	0.36	Potable	Potable
02040105150	10.45	All		Yes	25%	2005	2.61	3.26	1.25	0.00	6.93	2.65	0.00	Potable	Potable
02040105160	14.03	All		Yes	25%	2010	3.51	0.19	0.06	3.31	2.94	0.84	0.57	Non ag Irr	Potable

Table A.1.6 Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02040104090	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.3	0.5	0.0	0.8	0.0
02040104110	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0
02040104130	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0
02040104140	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0
02040104150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02040104240	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0
02040105030	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0
02040105040	2.3	0.0	1.4	0.1	0.0	0.0	0.0	0.1	0.3	0.0	0.0	3.5	0.3	0.0	3.8	0.0
02040105050	0.1	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.8	0.1	0.0	0.9	0.9
02040105060	0.0	0.0	0.3	0.8	0.0	0.0	0.0	0.0	0.0	0.0	147.0	1.0	147.0	0.0	147.9	1.7
02040105070	1.0	0.0	1.1	0.0	0.0	0.6	0.1	0.0	0.0	0.0	0.0	2.5	0.1	0.0	2.6	0.0
02040105080	0.1	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.3	0.0
02040105090	4.7	0.0	0.9	0.4	0.0	5.0	0.1	0.0	0.0	0.0	0.0	10.0	0.1	0.0	10.1	0.0
02040105100	0.0	0.0	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.5	0.0
02040105110	0.6	0.0	0.4	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.1	0.0	3.0	3.0
02040105120	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.3	0.1
02040105140	1.3	0.0	0.7	0.5	0.0	0.3	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	2.6	0.0
02040105150	5.0	0.0	2.8	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	7.1	0.1	0.0	7.2	0.4
02040105160	1.7	0.0	1.2	0.5	0.0	0.1	0.0	0.1	0.2	0.0	0.0	3.3	0.2	0.0	3.5	0.0

Table A.1.7 Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02040104090	0.00	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.2
02040104110	0.00	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
02040104130	0.00	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
02040104140	0.00	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2
02040104150	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02040104240	0.00	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
02040105030	0.00	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
02040105040	0.06	1.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.0	2.2
02040105050	0.01	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.7
02040105060	0.00	0.0	0.0	0.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0	147.0	0.9	147.0	147.9
02040105070	0.01	0.2	0.0	0.8	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.9	0.3	1.2
02040105080	0.02	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2
02040105090	0.01	0.2	0.0	0.7	0.4	0.0	4.6	0.0	0.0	0.0	0.0	0.0	5.7	0.3	5.9
02040105100	0.00	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.4
02040105110	0.00	0.3	0.0	0.3	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.3	2.5
02040105120	0.00	1.8	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.8	2.1
02040105140	0.00	0.7	0.0	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.7	1.7
02040105150	0.04	1.7	0.0	2.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.8	3.9
02040105160	0.04	1.9	0.0	0.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.9	3.3

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

There are no major reservoirs located in WMA 01. Some smaller reservoir systems may be present and while critical to the residents that rely of them, they are not covered in this statewide plan.

AVAILABLE WATER FROM CONFINED AQUIFERS

There are no significant regionally confined aquifers or withdrawals from confined aquifer in WMA 01. Some locally confined wells may be present, but the extent of the confined aquifer is relatively small compared to NJ's coastal plain confined aquifers

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SUMMARY AND MANAGEMENT OPTIONS

Tables A.1.8 and A.1.9 summarize natural resource availability, current peak and full allocation use, projected potable demand, remaining availability, water availability allocations, and options for additional supply

Table A.1.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
1	Upper Delaware	NA	30	NA	30	NA	12	NA	12	NA	18	NA	18	1.1	16.9

Table A.1.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
1	Upper Delaware	2,530	44	NA	NA	1.1	NA	1.1	NA	0.6	40

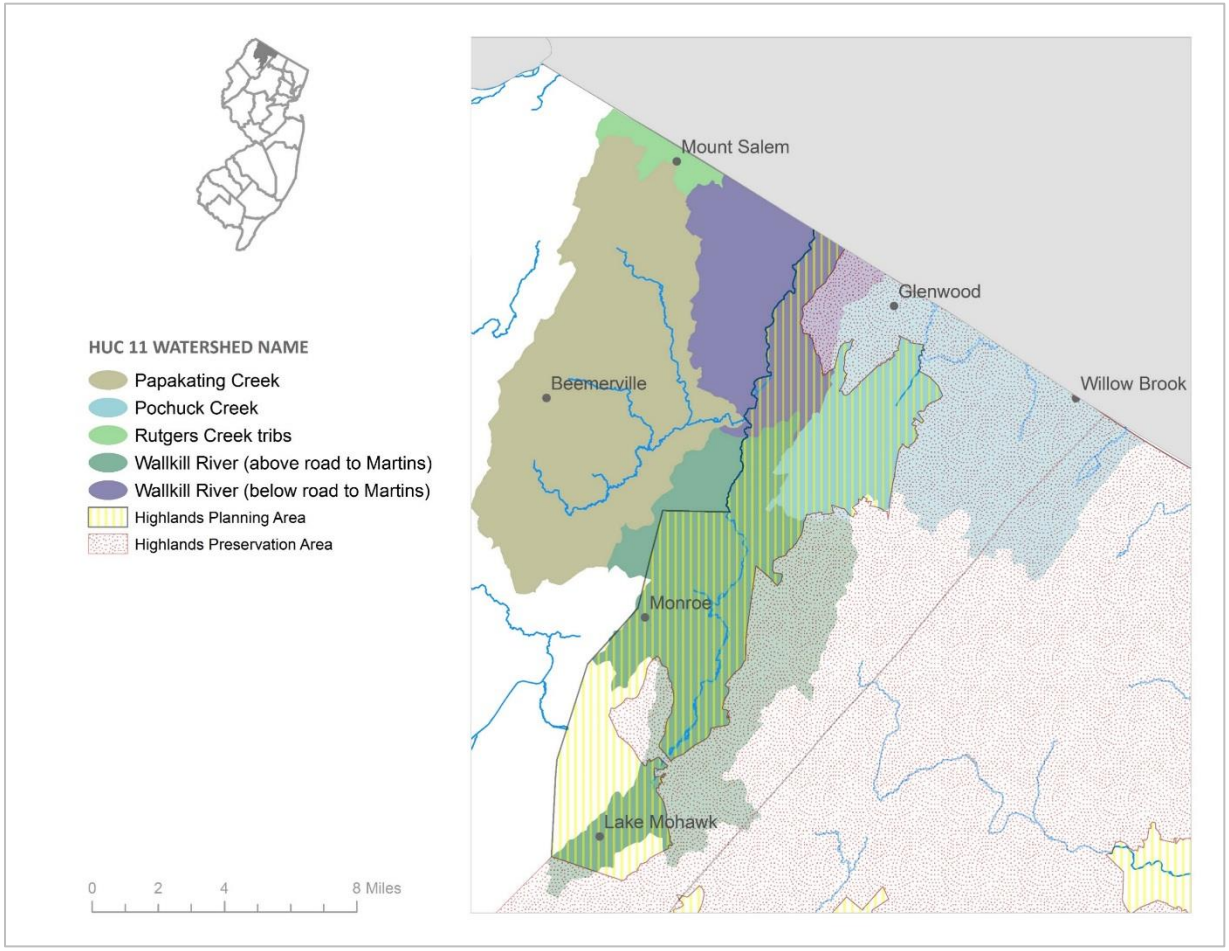
Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for all agricultural facilities located in WMA 1. This is particularly important for the Upper Pequest River and Beaver Brook HUC11 watersheds.
- The State of New Jersey should retain the previously acquired Hackettstown Reservoir properties, and the Department should continue to reevaluate the feasibility of developing the site as a future capital water supply project (Policy Item # 4).
- For HUC11 watersheds that are located wholly within the Highlands Region, please refer to the Highlands Regional Master Plan at http://www.nj.gov/njhighlands/master/ .

WATERSHED MANAGEMENT AREA 2

WALLKILL



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 2 (Wallkill River) is located within the Valley and Ridge and Highlands physiographic provinces and encompasses approximately 263 square miles. WMA 2 includes 11 municipalities in Sussex County and a small portion of Passaic County. WMA 2 has a variety of different land uses including rural and centralized residential development, agriculture, commercial, recreational and industrial. WMA 2 is formed by five HUC11 watersheds: the Upper Wallkill River Lower Wallkill River, Pochuck Creek, Papakating Creek and Rutgers Creek Tributaries.

The Wallkill River Watershed is unique in that its headwater begins at Lake Mohawk in Sparta Township and then flow north into New York, eventually emptying into the Hudson River.

Table A.2.1 HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02020007000	Rutgers Creek tribs
02020007010	Wallkill River (above road to Martins)
02020007020	Papakating Creek
02020007030	Wallkill River (below road to Martins)
02020007040	Pochuck Creek

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 02 surface water withdrawals comprise 21% of the total withdraw and unconfined groundwater comprises 79%. There are no major confined aquifers or surface water supply reservoir systems in WMA 02. Potable supply is 90% of the total withdrawal, with 83% coming from unconfined groundwater sources and the remaining 17% from surface water sources. Combined commercial, industrial and mining make up 6% of the total withdrawal, with 49% coming from surface water sources and 51% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 3% of total water withdrawals, with 42% coming from unconfined groundwater sources and 58% from surface water sources. Figure A.2.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.2.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 2005 and show a declining to flat trend to 2015. Annual withdrawals by source and use sector are shown in table A.2.2.

Annual consumptive loss peaked in 2007 with annual use variable, but showing an increasing trend from 2011 through 2015. In 2007 consumptive losses were primarily from potable use sector. For the 2000 through 2015 period monthly consumptive use peaked in July of 2007. Refer to figures A.2.3 and A.2.4.

Almost all (98%) of the total sanitary sewer discharges are to fresh surface water sources. The remaining 2% of the discharges are to groundwater. Discharges average about 4 mgd over the period of record. Refer to Figure A.2.5.

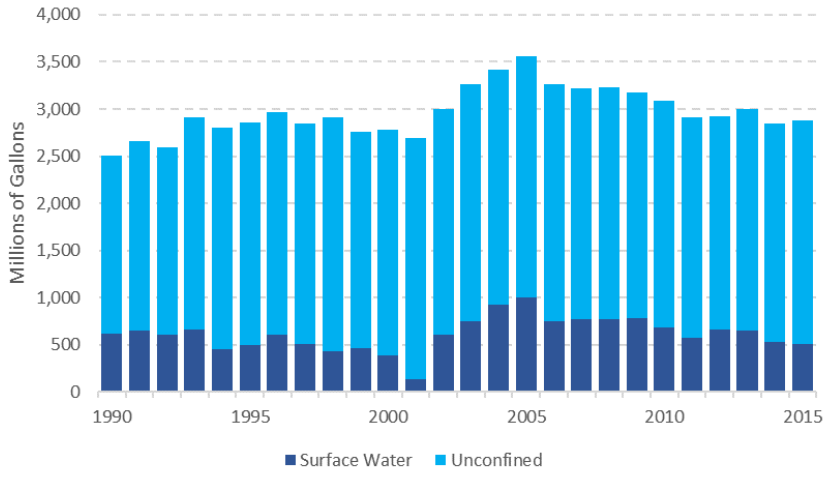


Figure A.2.1. Annual withdrawals by source.

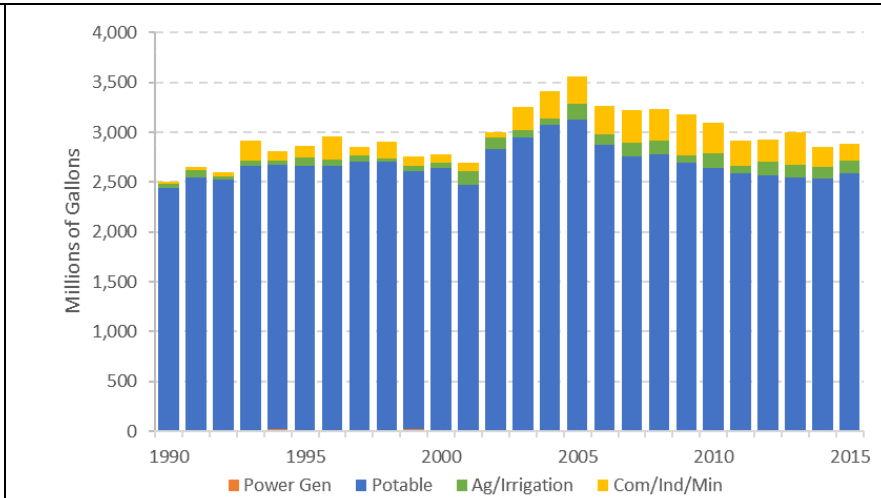


Figure A.2.2. Annual withdrawals by use sector.

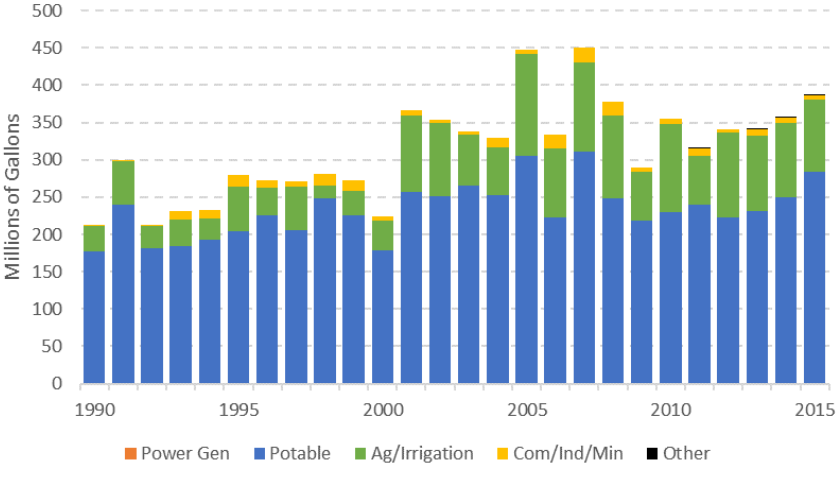


Figure A.2.3. Annual consumptive loss by use sector.

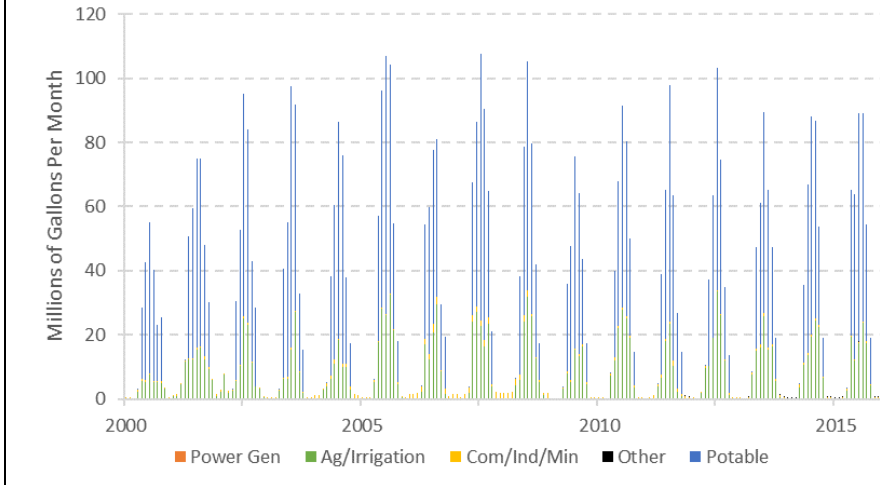


Figure A.2.4. Monthly consumptive loss by use sector.

Table A.2.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	36	3			24		581	1,858			2	
1991	52	16			39		604	1,942			2	
1992	23	14		2	35		579	1,935			10	
1993	30	18			206		634	2,014			14	
1994	22	14			92		434	2,226			18	
1995	49	36		6	115		447	2,200			11	
1996	28	34		144	96		431	2,220			9	
1997	44	24		9	67		451	2,243			9	
1998	2	33		11	156		421	2,272			13	
1999	0	54		2	100		461	2,125			19	
2000	12	44		0	89		373	2,266				
2001	19	113			83		116	2,359				
2002	40	72		0	49		569	2,263			4	
2003	39	37		154	83		558	2,384			4	
2004	46	26		161	112		722	2,344			4	
2005	119	33		182	101		698	2,427			4	
2006	76	27		157	124		520	2,353			4	
2007	103	30		191	132		481	2,277			4	
2008	92	38		200	118		483	2,294			5	
2009	51	28		333	75		399	2,287			3	
2010	85	57		185	120		418	2,223			3	
2011	50	28		135	119		395	2,191				
2012	89	46		162	62		406	2,164				
2013	78	45		245	85		333	2,214				
2014	80	44		135	58		314	2,218				
2015	73	51		112	53		325	2,265				

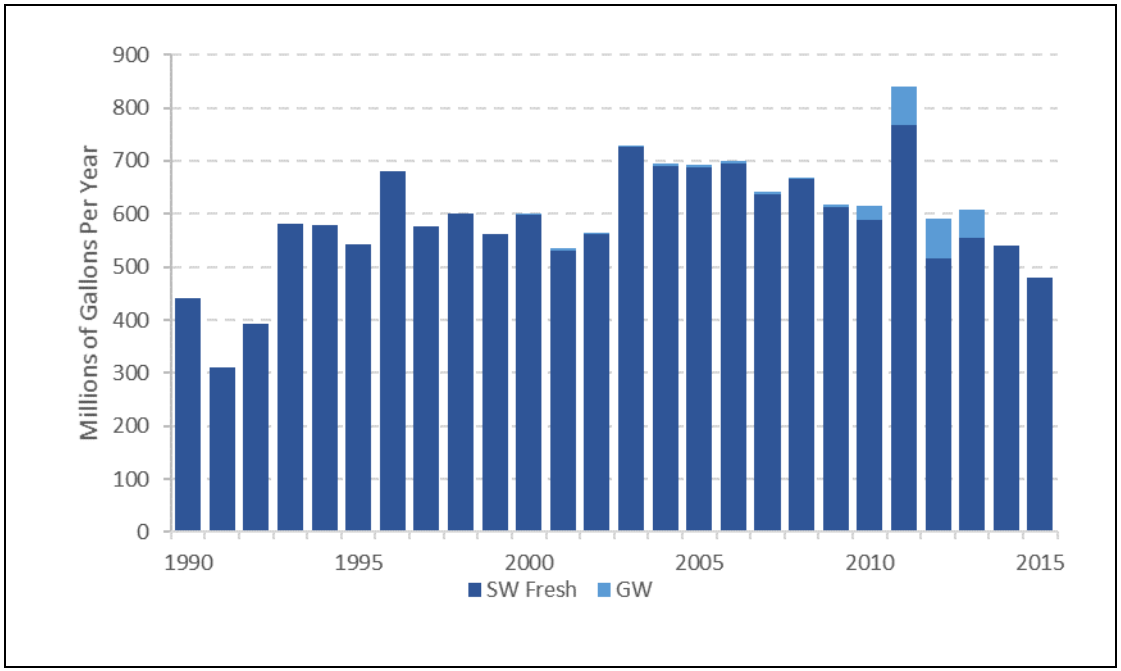


Figure A.2.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Ten water purveyors which serve more than 1,000 people provide potable water to one or more of the 5 HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.2.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 48% of the total potable supply in WMA 02 is from private domestic wells.

Potable water demand is expected to increase by 0.45, 0.89, 1.34, 1.79 and 2.23 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.2.4 contains the demand estimates by HUC11. 125 gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.2.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02020007010	02020007020	02020007030	02020007040
NJ1906002	Franklin Board of Public Works	X			
NJ1909001	Hamburg Board of Public Utilities	X			
NJ1911001	Aqua NJ - Wallkill	X			
NJ1911003	Lake Tamarak Water Company	X			
NJ1911006	Hardyston Twp MUA	X			X
NJ1916001	Ogdensburg WD	X			
NJ1918003	Sparta Twp WU - Highlands	X			
NJ1918004	Sparta Twp WU- Lake Mohawk	X			
NJ1921001	Sussex WD		X	X	
NJ1922026	Suez Water NJ Vernon Valley				X

Table A.2.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02020007000	0.01	0.01	0.02	0.03	0.03
02020007010	0.16	0.32	0.48	0.64	0.81
02020007020	0.15	0.29	0.44	0.58	0.73
02020007030	0.06	0.11	0.17	0.22	0.28
02020007040	0.08	0.15	0.23	0.31	0.39
Total	**0.45**	**0.89**	**1.34**	**1.79**	**2.23**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.2.8 and A.2.9 indicate that there is a total of 6 mgd of natural resource availability in WMA 2 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 2 mgd of available water remaining and at full allocation rates 0 mgd of water is remaining. Table A.2.5 shows that of the 5 HUC11s in the WMA, none have used all the available water and 5 would have used all the available water if full allocation diversion rates were used. Under current and full allocation conditions, potable supply uses are the major loss in all 5 HUC11s. See tables A.2.5, A.2.6 and A.2.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.2.5 Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02020007000	0.3				25%	2003	0.1	0.0	9%	0.1	0.0	60%	0.0	Potable	Potable
02020007010	8.4	Partial		Yes	25%	2002	2.1	1.8	84%	0.3	2.8	135%	0.0	Potable	Potable
02020007020	5.0			Yes	25%	2004	1.2	1.0	84%	0.2	1.8	148%	0.0	Potable	Potable
02020007030	3.0	Partial		Yes	25%	2009	0.7	0.2	31%	0.5	0.9	124%	0.0	Potable	Potable
02020007040	8.1	All		Yes	25%	2005	2.0	1.0	52%	1.0	3.5	171%	0.0	Potable	Potable

Table A.2.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02020007000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02020007010	2.4	0.5	0.9	0.2	0.0	0.0	0.0	0.3	0.1	0.0	0.0	3.4	0.6	0.0	4.0	0.5
02020007020	0.0	0.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.0	1.8	0.0
02020007030	0.1	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.9	0.0
02020007040	0.8	0.0	1.7	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	2.5	0.1	0.0	2.6	0.0

Table A.2.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02020007000	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02020007010	0.00	1.3	0.0	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.3	2.2
02020007020	0.00	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.7
02020007030	0.00	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.6
02020007040	0.01	0.0	0.0	1.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	1.6

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

There are no major reservoirs located in WMA 02. Some smaller reservoir systems may be present and while critical to the residents that rely of them, they are not covered in this statewide plan.

AVAILABLE WATER FROM CONFINED AQUIFERS

There are no significant regionally confined aquifers or withdrawals from confined aquifer in WMA 01. Some locally confined wells may be present, but the extent of the confined aquifer is relatively small compared to NJ's coastal plain confined aquifers

SUMMARY AND MANAGEMENT OPTIONS

Table A.2.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
2	Wallkill		6		6		4		4		2		2	0.4	1.6

Table A.2.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
2	Wallkill	5	9			-2.9				0.3	

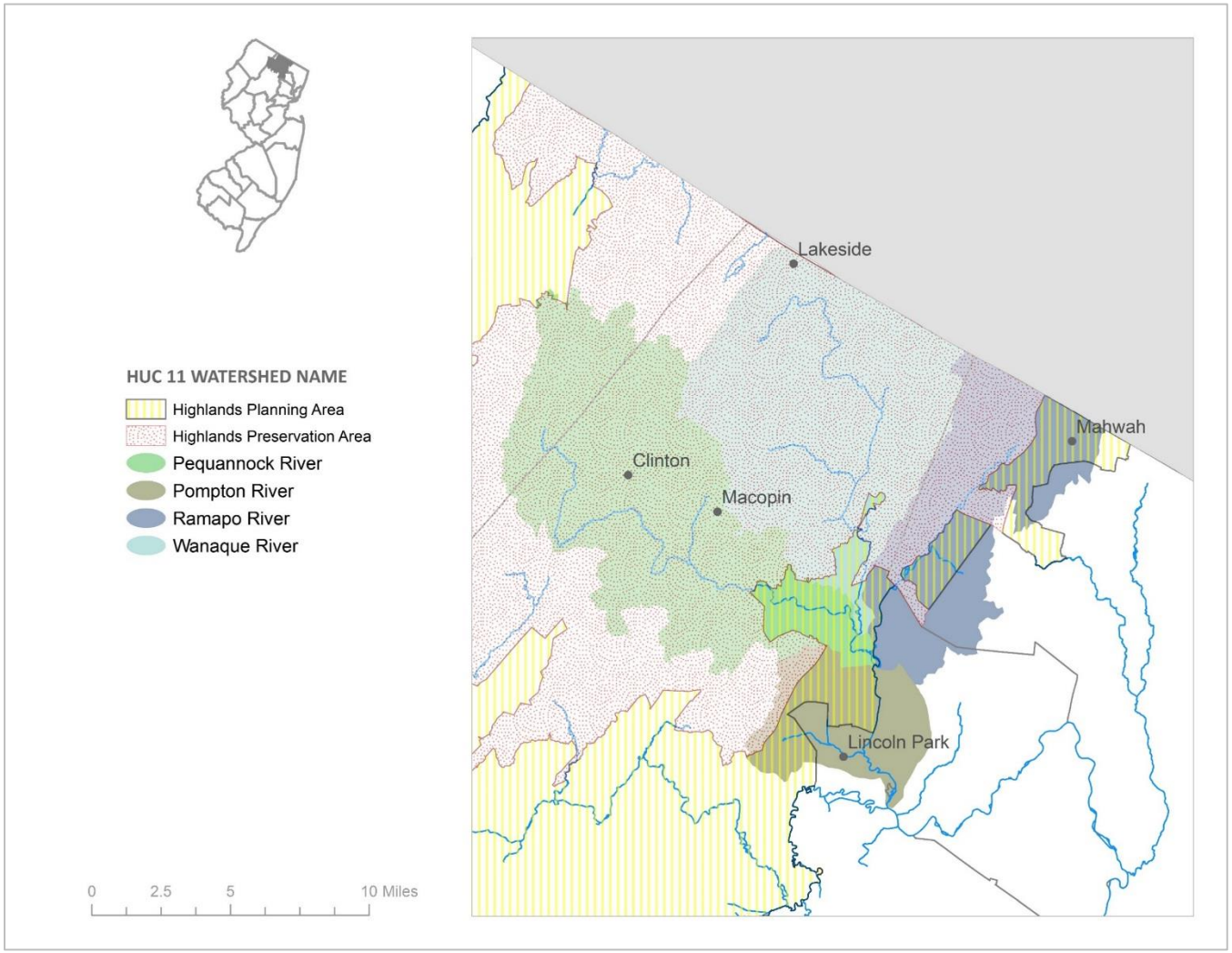
Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3 for all agricultural facilities located in WMA 2. This is particularly important for the Papakating Creek HUC11 watershed.
- NJDEP will continue to monitor the Wallkill River (above road to Martins), Papakating Creek, Wallkill River (below road to Martins) and Pochuck CreekHUC11 watersheds as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
    - If a deficit occurs, additional depletive/consumptive uses should be offset through mitigation.
    - Types of mitigation include: the permanent removal/reduction of an existing depletive/consumptive use, increased storage or increased recharge.
- For HUC11 watersheds that are located wholly within the Highlands, please refer to the HRMP at http://www.nj.gov/njhighlands/master/

WATERSHED MANAGEMENT AREA 3

POMPTON, PEQUANNOCK, WANAQUE AND RAMAPO



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 3 is located in the Highlands physiographic province of New Jersey, and includes four HUC11 watersheds: Pompton, Ramapo, Pequannock and Wanaque River. WMA 3 lies predominantly in Passaic County but also extends into parts of Bergen, Morris and Sussex Counties. The Pequannock, Wanaque and Ramapo Rivers all flow into the Pompton River. The Pompton River is, in turn, a major tributary to the Upper Passaic River. WMA 3 is 378.6 square miles and includes some of the State's major water supply reservoir systems, including the Wanaque and Monksville Reservoirs as well as several reservoirs that serve the City of Newark.

Table A.3.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02030103050	Pequannock River
02030103070	Wanaque River
02030103100	Ramapo River
02030103110	Pompton River

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 03 surface water withdrawals comprise 93% of the total withdraw and unconfined groundwater comprises 7%. There are no major confined aquifers in this WMA. Potable supply is almost all the withdrawal in this WMA, with 93% coming from unconfined groundwater sources and the remaining 7% from surface water sources. Combined commercial, industrial and mining make up <1% of the total withdrawal, with 50% coming from surface water sources and 50% from unconfined groundwater sources. Agricultural and non-agricultural irrigation are also <1% of total water withdrawals, with 66% coming from unconfined groundwater sources and 34% from surface water sources. There are no significant power generation withdrawals. Figure A.3.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.3.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 1995 are highly variable. Annual withdrawals by source and use sector are shown in table A.3.2.

Annual consumptive loss peaked in 2015 with a variable but increasing trend from 1990 to 2015. Consumptive losses were primarily from the potable use sector. For the 2000 through 2015 period monthly consumptive use peaked in July of 2010. Refer to figures A.3.3 and A.3.4.

Almost all (99%) of the total sanitary sewer discharges are to fresh surface water sources. The remaining 1% of the discharges are to groundwater. Discharges average about 20 mgd over the period of record. Refer to Figure A.3.5.

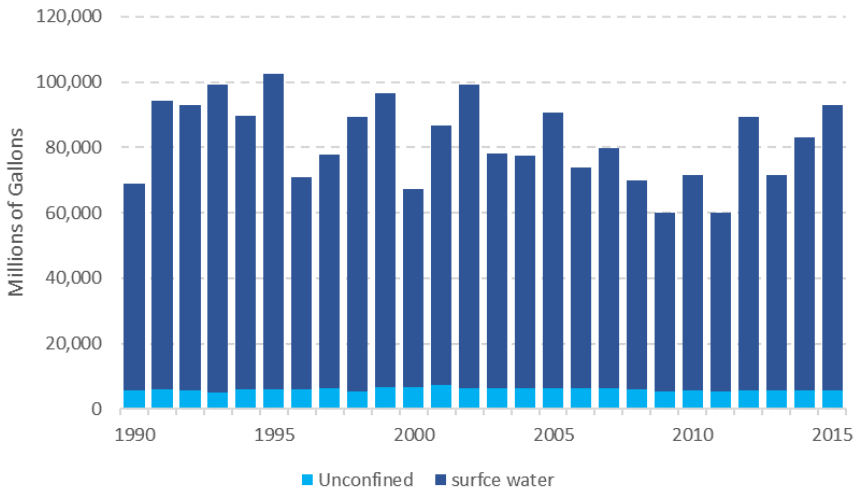


Figure A.3.1. Annual withdrawals by source.

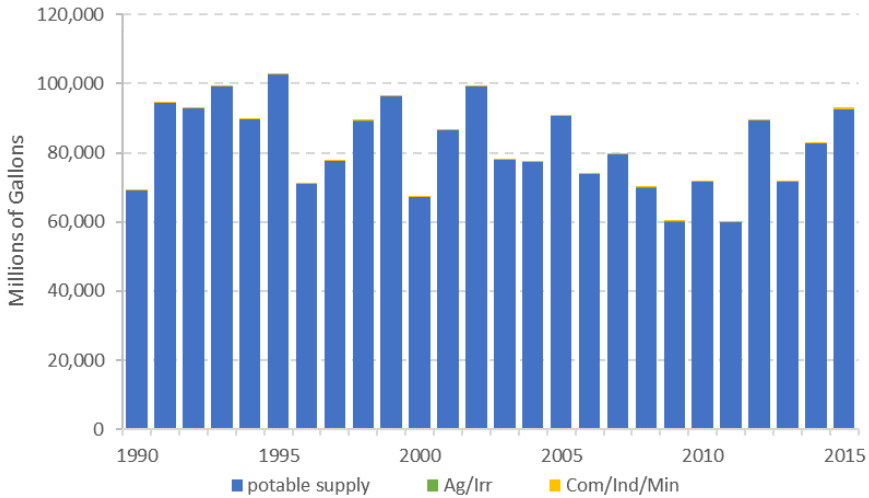


Figure A.3.2. Annual withdrawals by use sector.

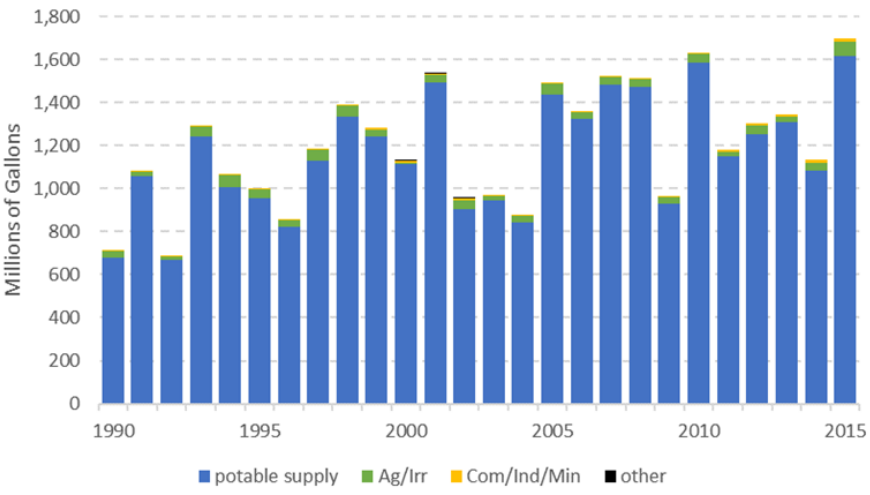


Figure A.3.3. Annual consumptive loss by use sector

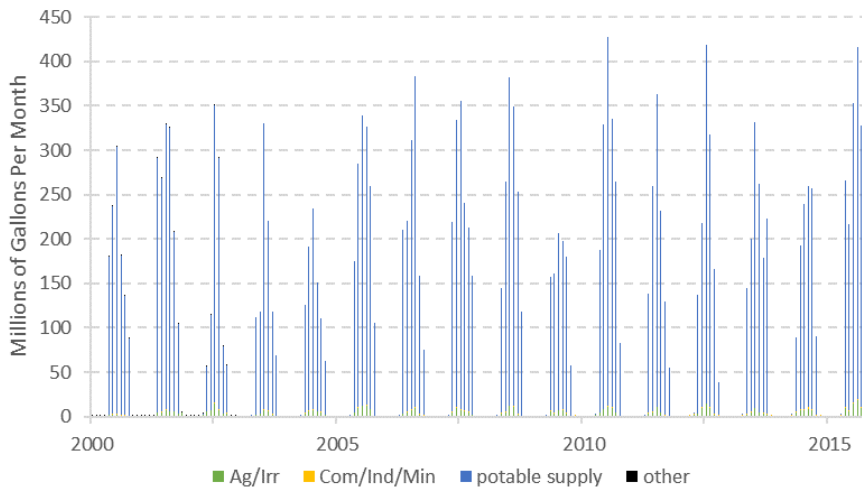


Figure A.3.4. Monthly consumptive loss by use sector

Table A.3.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	20	14			35		63,272	5,750				
1991	12	9			51		88,203	6,123				
1992	13	5			43		87,162	5,694				
1993	19	32			39		94,075	5,132				
1994	22	43			10		83,725	5,917				
1995	28	17			14		96,416	6,133				
1996	14	17			6		64,896	5,989				
1997	30	27			1		71,402	6,246				
1998	14	39			40		84,011	5,182				
1999	9	27			91		89,618	6,690				
2000	3	5		15	70		60,432	6,753				
2001	12	29			62		79,255	7,260				
2002	17	32		15	58		92,910	6,267				
2003	18	5		9	88		71,752	6,311				
2004	25	8		12	65		71,075	6,293				
2005	34	19		16	79		84,170	6,358				
2006	21	11		11	71		67,630	6,295				
2007	23	17		14	102		73,450	6,214				
2008	17	22		14	101		63,855	6,005				
2009	13	20		8	72		54,752	5,309				
2010	30	15		4	85		65,924	5,584				
2011	14	14		0	85		54,477	5,355				
2012	26	22		6	78		83,773	5,607				
2013	17	13		12	81		65,957	5,590				
2014	22	17		149	127		77,146	5,514				
2015	41	31		570	69		86,777	5,648				

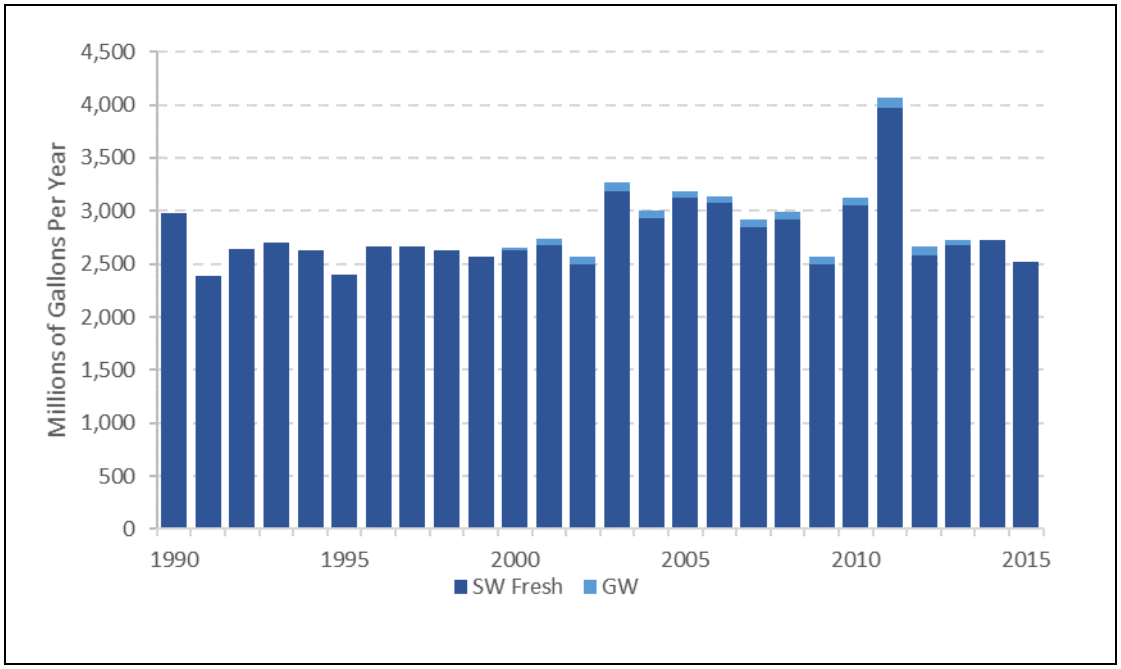


Figure A.3.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Twenty-four water purveyors which serve more than 1,000 people provide potable water to one or more of the 4 HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.3.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 2% of the total potable supply in this WMA is from private domestic wells.

Potable water demand is expected to increase by 0.66, 1.32, 1.98, 2.63 and 3.29 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.3.4 contains the demand estimates by HUC11. 125 gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.3.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030103050	02030103070	02030103100	02030103110
NJ0220001	Suez Water NJ Franklin Lakes			X	
NJ0233001	Mahwah WD			X	
NJ0242001	Oakland WD			X	
NJ0248001	Ramsey WD			X	
NJ1403001	Butler WD	X			
NJ1414003	Jefferson Twp W U Milton System	X			
NJ1415001	Fayson Lakes WC	X			X
NJ1415002	Kinnelon WD	X			X
NJ1416001	Borough of Lincoln Park WD				X
NJ1421003	Montville Twp MUA				X
NJ1431001	Pequannock Twp WD	X			X
NJ1431002	Pequannock Twp WD - Cedar Crest	X			X
NJ1433001	Riverdale Boro WD	X			
NJ1601001	Bloomingdale WD	X	X		
NJ1609001	Pompton Lakes MUA	X	X	X	
NJ1611002	Ringwood WD		X		
NJ1613002	Wanaque WD		X	X	
NJ1614001	Wayne Twp Division of Water	X		X	X
NJ1615003	Passaic Valley WC High Crest	X			
NJ1615016	West Milford Twp MUA - Olde Milford Estates	X	X		
NJ1615018	West Milford Twp Bald Eagle Village		X		
NJ1615020	Suez Water NJ West Milford		X		

Table A.3.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030103050	02030103070	02030103100	02030103110
NJ1911003	Lake Tamarak Water Company	X			
NJ0220001	Suez Water NJ Franklin Lakes			X	

Table A.3.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02030103050	0.15	0.31	0.46	0.62	0.77
02030103070	0.18	0.36	0.54	0.71	0.89
02030103100	0.23	0.45	0.68	0.90	1.13
02030103110	0.10	0.20	0.30	0.40	0.50
Total	**0.66**	**1.32**	**1.98**	**2.63**	**3.29**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.3.8 and A.3.9 indicate that there is a total of 8 mgd of natural resource availability in WMA XX using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 0 mgd of available water remaining and at full allocation rates 0 mgd of water is remaining. Table A.3.5 shows that of the 4 HUC11s in the WMA, none have used all the available water and 3 would have used all the available water if full allocation diversion rates were used. 1 HUC11 has a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, potable supply uses are the major loss in 3 HUC11s and under full allocation diversion rates potable supply is the largest loss in the same 3 HUC11s. See tables A.3.5, A.3.6 and A.3.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.3.5 Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02030103050	13.5	All	Yes	Yes	25%	2001	3.4	2.8	82%	0.6	4.2	125%	0.0	Potable	Potable
02030103070	11.2	All	Yes	Yes	25%	2010	2.8	2.0	72%	0.8	3.4	122%	0.0	Potable	Potable
02030103100	5.0	Partial	Yes		25%	2001	1.3	8.8	703%	0.0	7.7	611%	0.0	Potable	Potable
02030103110	3.7	Partial	Yes	Yes	25%	2001	0.9	-0.6	Net Gain	1.5	-0.5	Net Gain	1.5	Non-Ag Irr	Ag Irr

Table A.3.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02030103050	2.8	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0	4.4	47.3
02030103070	3.2	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0	4.3	93.6
02030103100	10.6	0.0	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	0.0	0.0	10.4	0.0
02030103110	3.8	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	3.8	0.0	0.0	3.9	55.2

Table A.3.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02030103050	0.03	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	1.7
02030103070	0.16	1.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.0	2.3
02030103100	0.01	0.9	0.0	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.9	1.6
02030103110	0.00	4.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	4.2	4.5

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

Two of the State's largest surface water systems are located in WMA 3. Those systems are the North Jersey District Water Supply Commission (NJDWSC)) and the City of Newark, with safe yields of 190 MGD and 49.1 MGD, respectively. The NJDWSC provides finished surface water to Newark, Kearney, Bayonne, Wayne, Bloomfield, Montclair, Cedar Grove, Nutley and Glen Ridge and the Passaic Valley Water Commission (PVWC). Suez Water NJ is currently permitted to take up to 48 mgd on an annual average from NJDWSC. For accounting purposes, the 48 mgd is counted in WMA 5 available water and not WMA3. PVWC is owned by the Cities of Paterson, Clifton, and Passaic, each of whom has an allotment of supply from NJDWSC. In addition, NJDWSC delivers raw water to United Water New Jersey in Bergen County.

Aside from NJDWSC, the City of Newark's water system lies within the Pequannock River HUC11 watershed. In addition to their own water demands, the City of Newark also provides bulk water to the communities of Elizabeth, Belleville, Nutley, Bloomfield, Pequannock, Wayne and East Orange. Newark also sells small amounts of water on a wholesale basis to the Essex County Utilities Authority and to New Jersey American Water – Elizabethtown.

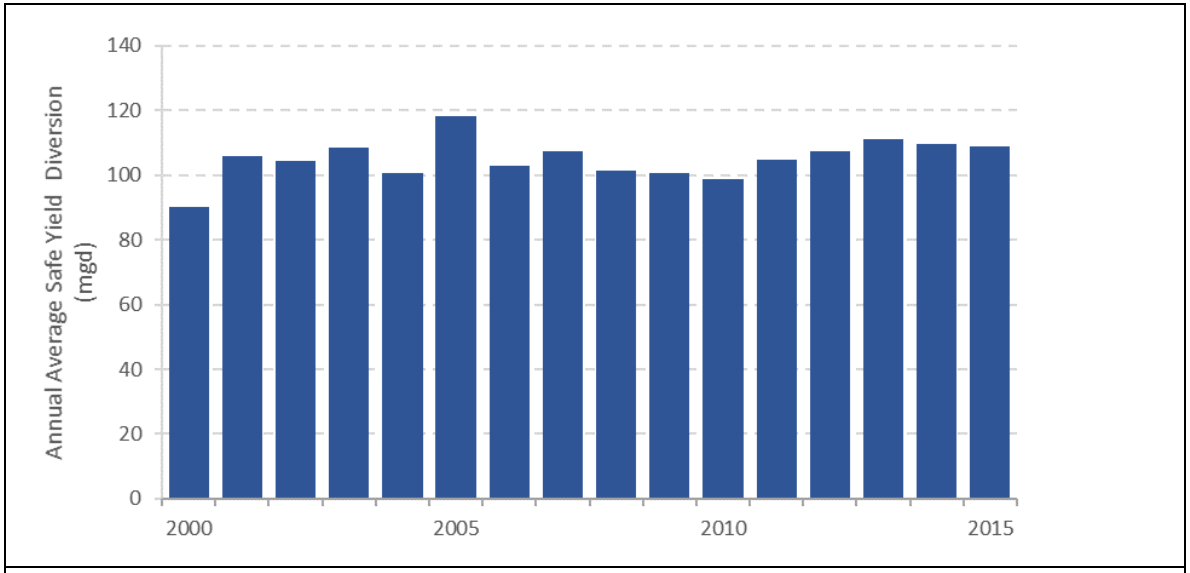


Figure 3.6. NJDWSC Wanaque system annual average safe yield withdrawals.

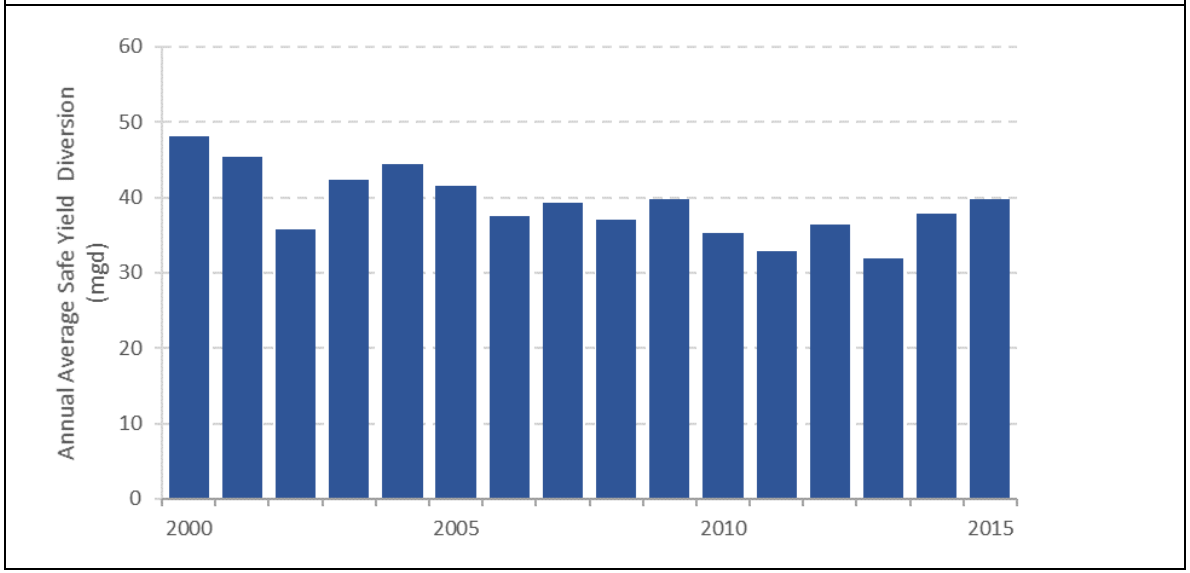


Figure 3.7. Newark Pequannock system annual average safe yield withdrawals.

AVAILABLE WATER FROM CONFINED AQUIFERS

There are no significant regionally confined aquifers or withdrawals from confined aquifer in WMA 03. Some locally confined wells may be present, but the extent of the confined aquifer is relatively small compared to NJ's coastal plain confined aquifers

SUMMARY AND MANAGEMENT OPTIONS

Table A.3.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
3	Pompton, Pequannock, Wanaque, and Ramapo	191.1	8		199.1	160	13		173	31.1	-5		26.1	0.7	25.4

Table A.3.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
3	Pompton, Pequannock, Wanaque, and Ramapo	521	19		0	-6.4				0.9	

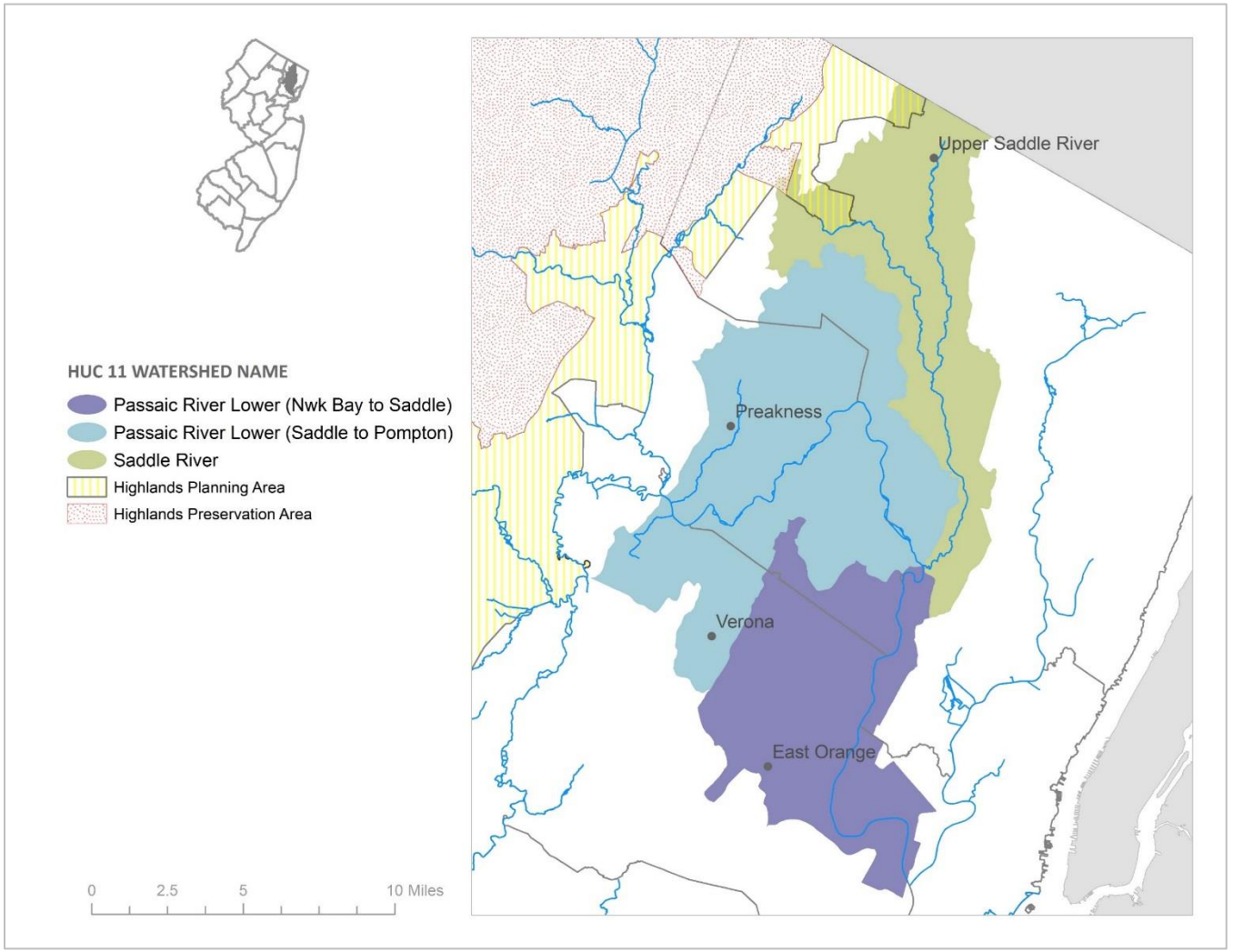
Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Ramapo River HUC11 watershed will be evaluated prior to Department approvals associated with future water supply and wastewater decisions. If a deficit continues, additional depletive/consumptive uses should be offset through mitigation, which includes: permanent removal/reduction of an existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Pompton River HUC11 watershed as it approaches the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
- Allow no additional depletive/consumptive uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield.
- Complete "Development of Reconstructed Streamflows in the Passaic and Hackensack River Basins, Water Years 1922-2007" in coordination with stakeholders.
- Consider utilization of unused existing safe yield from NJDWSC and/or Newark to offset existing and/or potential future depletive/consumptive losses associated with unconfined groundwater uses.
- Continue to coordinate with New York Department of Environmental Conservation (NJSDEC) and other applicable agencies to address depletive/consumptive activities upstream of this WMA that would affect the sustainability of New Jersey's water resources.
- For HUC11 watersheds that are located wholly within the New Jersey Highlands, please refer to the HRMP at http://www.nj.gov/njhighlands/master/.
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Ramapo River HUC11 watershed should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.

WATERSHED MANAGEMENT AREA 4

LOWER PASSAIC AND SADDLE



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 4 is located within the Piedmont physiographic province, and consists of three HUC11 watersheds: Lower Passaic River (Saddle to Pompton), Saddle River and Lower Passaic River (Newark Bay to Saddle). The WMA 4 drainage area is approximately 196.4 square miles and is spread across parts of Passaic, Bergen, Essex and Hudson Counties in the northeastern corner of New Jersey.

The major tributaries to the Lower Passaic River are the Saddle River, Preakness Brook, Second River and Third River, with the Saddle River being the largest. The Saddle River HUC11 Watershed has a drainage area of approximately 59.5 square miles which also includes area (headwaters) that extends into New York State. WMA 4 is extensively developed and includes many older cities and industrial centers including Newark, Paterson, Clifton and East Orange.

Table A.4.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02030103120	Passaic River Lower (Saddle to Pompton)
02030103140	Saddle River
02030103150	Passaic River Lower (Nwk Bay to Saddle)

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 04 surface water withdrawals comprise 94% of the total withdraw and unconfined groundwater comprises 6%. There are no major confined aquifers in this WMA. Power generation is 81% of the total withdrawal, with 100% coming from surface water sources. Potable supply is 16% of the total withdrawal, with 35% coming from unconfined groundwater sources and the remaining 65% from surface water sources. Combined commercial, industrial and mining make up 3% of the total withdrawal, with 76% coming from surface water sources and 24% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining <% of total water withdrawals, with 30% coming from unconfined groundwater sources and 70% from surface water sources. Figure A.4.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.4.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 2003 and show a declining to flat trend from 2003 to 2015. Annual withdrawals by source and use sector are shown in table A.4.2.

Annual consumptive loss peaked in 2005 with annual use less in the variable but remaining flat. In 2003 consumptive losses were primarily from potable supply. For the 2000 through 2015 period monthly consumptive use peaked in July of 2005. Refer to figures A.4.3 and A.4.4.

Almost all (100%) of the total sanitary sewer discharges are to fresh surface water sources. The remaining <1% of the discharges are to groundwater. Discharges average about 61 mgd over the period of record. Refer to Figure A.4.5.

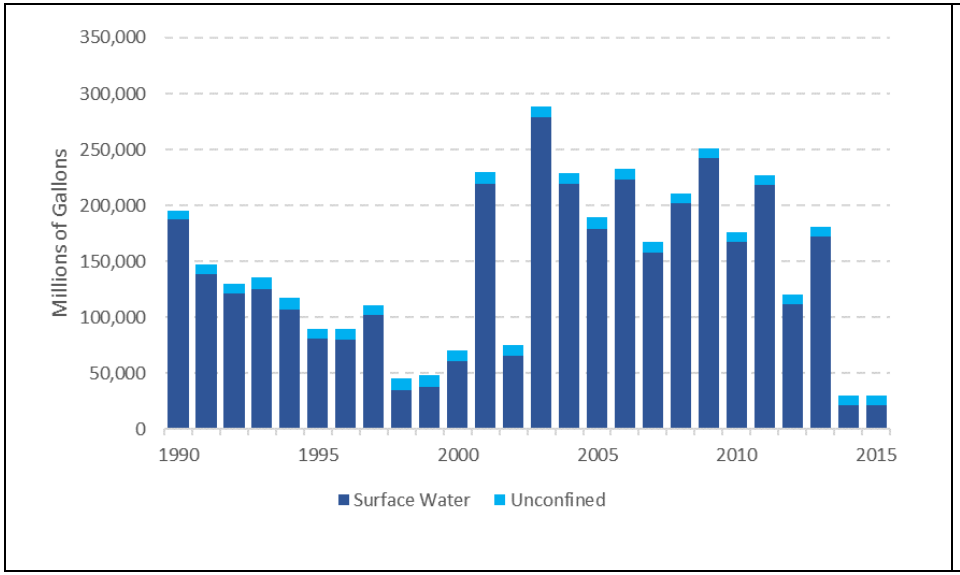


Figure A.4.1. Annual withdrawals by source.

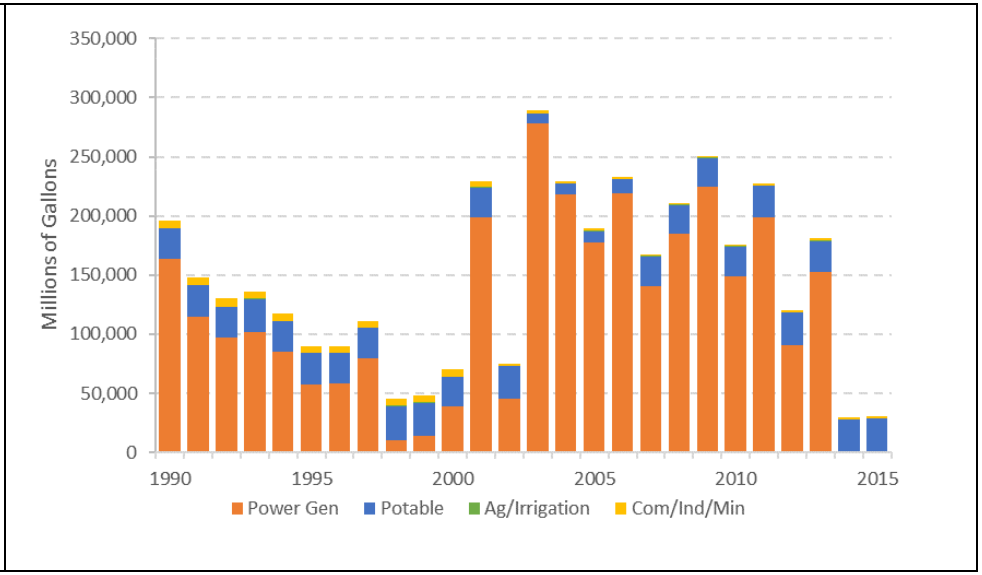


Figure A.4.2. Annual withdrawals by use sector.

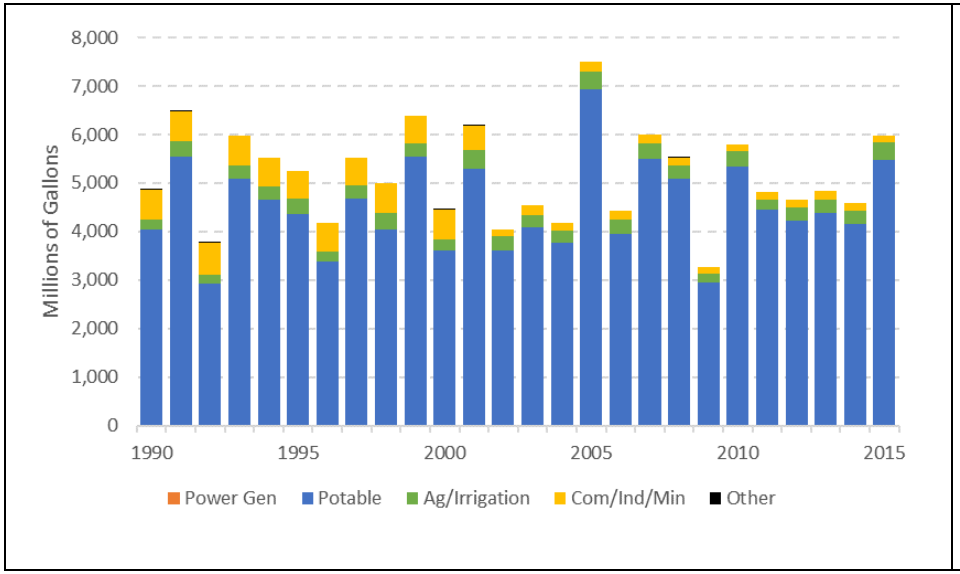


Figure A.4.3. Annual consumptive loss by use sector

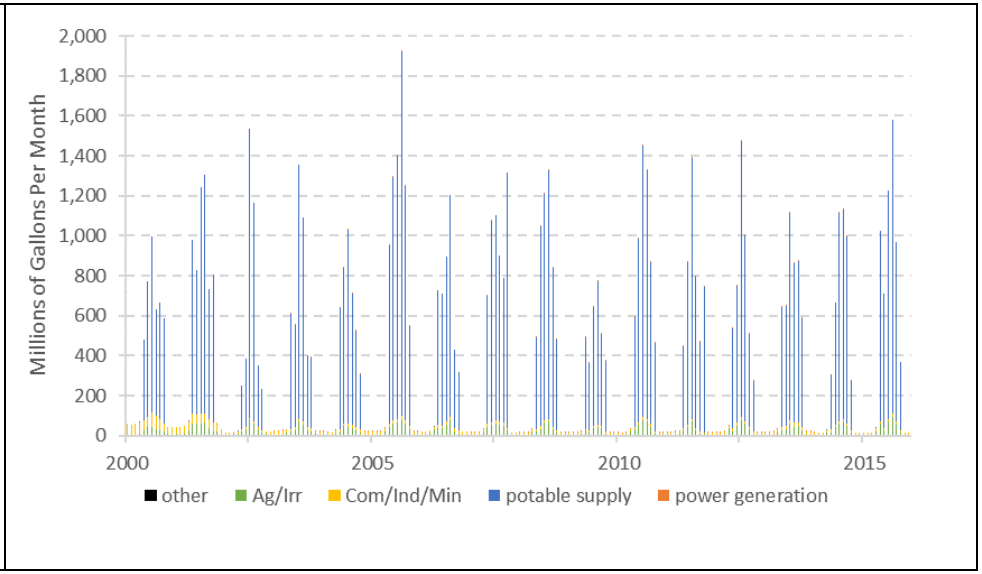


Figure A.4.4. Monthly consumptive loss by use sector

Table A.4.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	63	163		4,989	1,267		18,687	6,917		163,687		
1991	109	235		5,075	1,060		19,194	7,500		114,547		
1992	59	136		5,553	971		18,829	7,635		96,737		
1993	112	216		4,742	1,363		18,408	9,610		101,610		
1994	106	201		4,505	1,484		17,473	8,002		85,320		
1995	117	250		4,752	908		19,180	7,628		56,954		
1996	35	189		4,658	1,297		17,098	8,291		58,568		
1997	55	265		4,789	914		17,081	8,073		79,930		
1998	94	287		5,136	927		18,785	9,967		10,558		
1999	75	219		4,903	967		19,490	8,683		13,717		
2000	38	224		5,350	915		16,065	8,313		39,223		
2001	113	305		4,081	1,020		15,985	9,349		198,809		
2002	46	269		512	890		19,848	8,072		45,220		
2003	85	200		978	938		0	8,757		277,900	27	
2004	69	193		867	904		1	8,794		218,284	26	
2005	129	293		1,306	786		293	9,055		177,416	39	
2006	130	191		1,205	781		2,956	8,639		219,200		
2007	141	216		978	674		16,755	8,713		140,092	42	
2008	151	168		1,000	577		15,789	8,412		184,878		
2009	75	128		868	606		16,386	7,840		224,801	42	
2010	116	234		846	654		17,883	7,516		148,567	51	
2011	64	161		985	584		18,969	7,395		198,809	43	
2012	104	215		1,146	641		19,681	7,712		90,480	42	
2013	106	206		1,403	590		18,257	7,855		152,533	25	
2014	96	207		1,153	495		19,912	7,682		143	2	
2015	112	289		1,154	387		20,486	7,779		79		

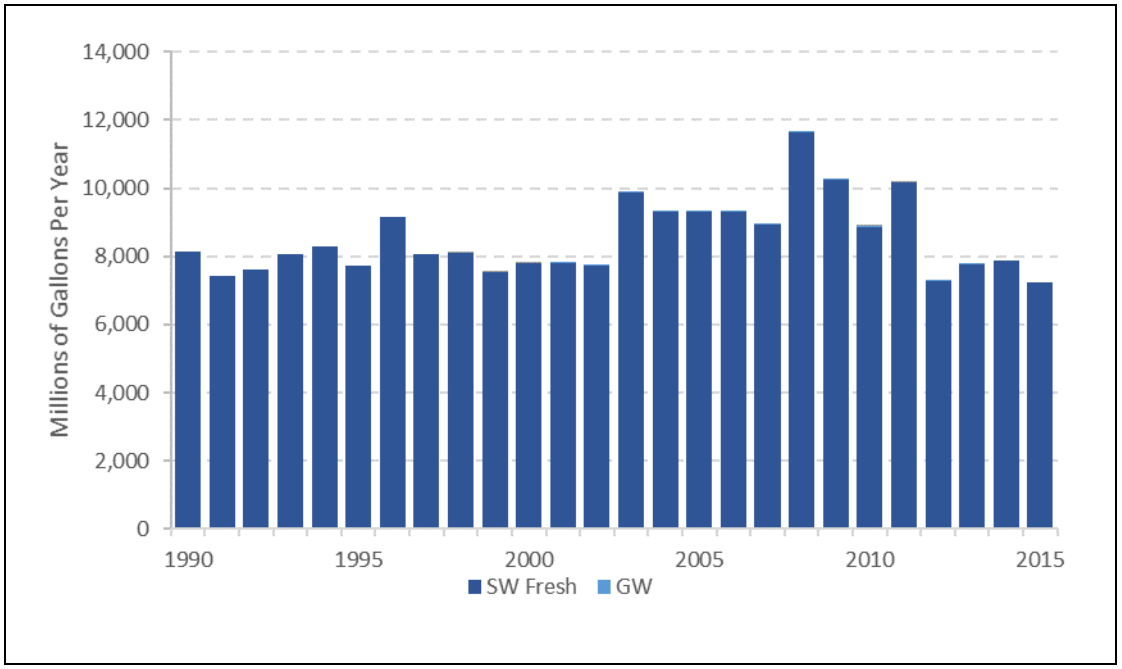


Figure A.4.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Forty-three water purveyors which serve more than 1,000 people provide potable water to one or more of the 4 HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.4.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 3% of the total potable supply in this WMA is from private domestic wells.

Potable water demand is expected to increase by 4.30, 8.60, 12.89, 17.19 and 21.49 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.4.4 contains the demand estimates by HUC11. 125 gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.4.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030103120	02030103140	02030103150
NJ0201001	Allendale WD		X	
NJ0211001	Elmwood Park WD	X		
NJ0217001	Fair Lawn WD	X	X	
NJ0220001	Suez Water NJ Franklin Lakes	X	X	
NJ0221001	Garfield WD	X	X	
NJ0228001	Ho-Ho-Kus Boro WD		X	
NJ0231001	Passaic Valley WC - Lodi	X	X	
NJ0232001	Lyndhurst WD			X
NJ0233001	Mahwah WD		X	
NJ0238001	Suez Water NJ Hackensack		X	X
NJ0239001	Passaic Valley WC - North Arlington			X
NJ0247001	Park Ridge WD		X	
NJ0248001	Ramsey WD		X	
NJ0251001	Ridgewood Water	X	X	
NJ0257001	Saddle Brook WD	X	X	
NJ0264001	Waldwick Boro WD	X	X	
NJ0265001	Wallington WD	X	X	X
NJ0701001	Bellville WD			X
NJ0702001	Bloomfield WD			X
NJ0703001	Caldwell WD	X		
NJ0704001	Cedar Grove WD	X		X
NJ0705001	East Orange WC			X

Table A.4.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030103120	02030103140	02030103150
NJ0706001	Essex Fells WD	X		
NJ0707001	Fairfield WD	X		
NJ0708001	Glen Ridge WD			X
NJ0712001	NJ American - Passaic	X		X
NJ0713001	Montclair Water Bureau	X		X
NJ0714001	Newark WD			X
NJ0715001	North Caldwell WD	X		
NJ0716001	Nutley Twp WD			X
NJ0717001	Orange WD			X
NJ0719001	South Orange WD			X
NJ0720001	Verona WD	X		X
NJ0721001	West Caldwell WD	X		
NJ0902001	East Newark WD			X
NJ0904001	Harrison WD			X
NJ0907001	Kearny WD			X
NJ1603001	Manchester Utilities Authority			
NJ1604001	Hawthorne WD			
NJ1605001	NJ American - Little Falls			
NJ1605002	Passaic Valley Water Commission PWVC			
NJ1612001	Totowa WC			
NJ1614001	Wayne Twp Division of Water			
NJ1616001	Woodland Park Water Dept.			

Table A.4.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02030103120	1.79	3.58	5.36	7.15	8.94
02030103140	0.56	1.11	1.67	2.22	2.78
02030103150	1.95	3.91	5.86	7.82	9.77
02030103120	1.79	3.58	5.36	7.15	8.94
Total	**4.30**	**8.60**	**12.89**	**17.19**	**21.49**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.4.8 and A.4.9 indicate that there is a total of 9 mgd of natural resource availability in WMA 4 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 0 mgd of available water remaining and at full allocation rates 0 mgd of water is remaining. Table A.4.5 shows that of the 3 HUC11s in the WMA, 2 have used all the available water and 3 would have used all the available water if full allocation diversion rates were used. Under current and full allocation conditions, potable supply uses are the major loss in all the HUC11s. See tables A.4.5, A.4.6 and A.4.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.4.5 Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02030103120	10.3		Yes		25%	2001	2.6	7.6	294%	0.0	10.1	391%	0.0	Potable	Potable
02030103140	15.0	Partial	Yes		25%	2005	3.7	1.4	37%	2.4	6.1	163%	0.0	Potable	Potable
02030103150	10.5				25%	2010	2.6	2.7	103%	0.0	4.1	157%	0.0	Potable	Potable

Table A.4.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02030103120	13.9	1.4	0.9	1.9	10.4	0.0	0.0	0.7	0.2	0.0	87.5	15.7	99.5	0.0	115.2	37.4
02030103140	11.2	0.0	1.3	0.6	0.9	0.0	0.0	0.7	0.2	0.1	0.0	12.5	1.1	0.0	13.6	1.6
02030103150	2.6	0.0	0.1	0.2	0.0	0.0	0.0	0.2	0.3	0.0	0.0	2.7	0.3	0.0	3.0	0.0

Table A.4.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02030103120	0.00	8.2	0.0	0.7	1.7	9.4	0.0	0.0	0.1	0.0	0.0	87.5	2.5	105.1	107.6
02030103140	0.01	9.7	0.0	1.0	0.5	0.8	0.0	0.0	0.1	0.0	0.1	0.0	1.7	10.5	12.3
02030103150	0.01	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.3

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

The Passaic Valley Water Commission (PVWC) is the largest provider of surface water for potable supply in WMA 4. PVWC provides water to Paterson, Clifton, Passaic, West Paterson, Hawthorne, Harrison, Bloomingdale, Cedar Grove, Elmwood Park, Fairfield, Fair Lawn, Garfield, Haledon, Nutley, Verona, Totowa, Lincoln Park, Lodi, North Caldwell, West Caldwell, NJAW Little Falls, NJAW-Short Hills, North Arlington, Ringwood, Riverdale, Wallington, West Milford, and SE Morris County MUA.

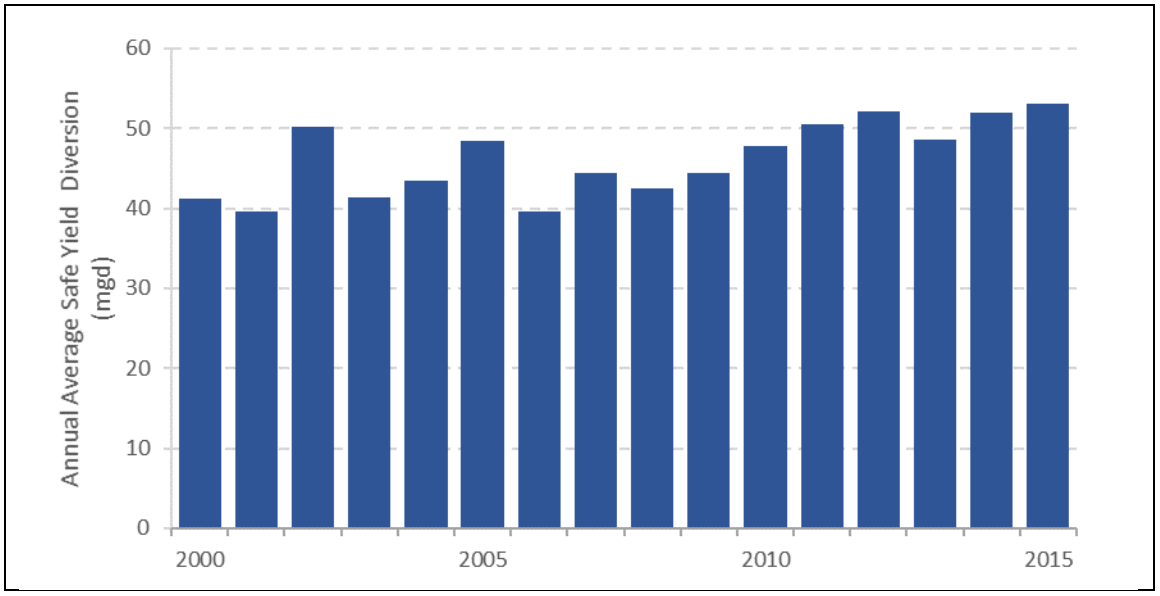


Figure 4.6. PVWC Passaic system annual average safe yield withdrawals

AVAILABLE WATER FROM CONFINED AQUIFERS

There are no significant regionally confined aquifers or withdrawals from confined aquifer in WMA 04. Some locally confined wells may be present, but the extent of the confined aquifer is relatively small compared to NJ's coastal plain confined aquifers.

SUMMARY AND MANAGEMENT OPTIONS

Table A.4.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
4	Lower Passaic and Saddle	75	9		84	53	12		65	22	-3		19	4.3	14.7

Table A.4.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
4	Lower Passaic and Saddle	1,509	42		0	-11.4				3.6	

Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

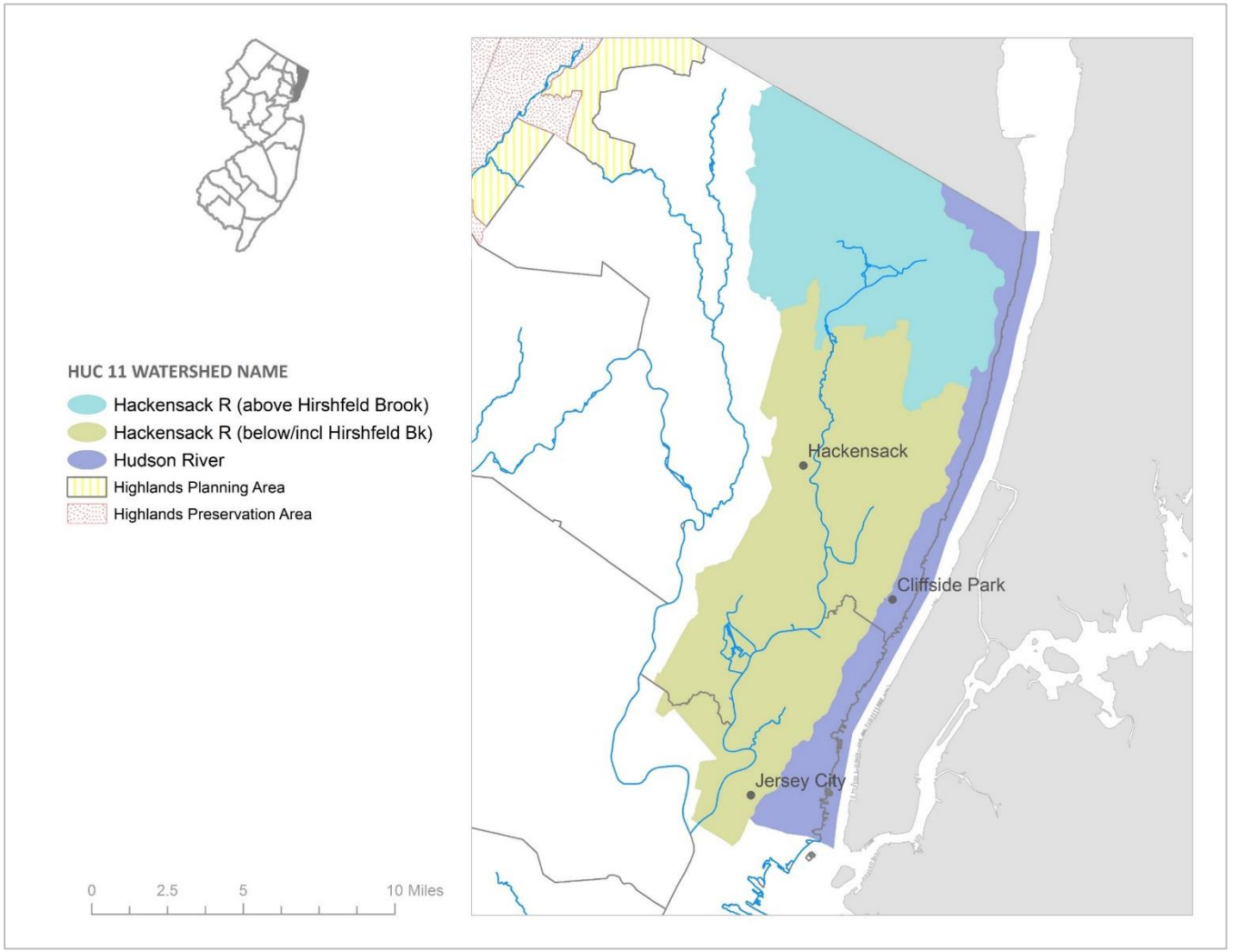
DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).

- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Passaic River Lower (Saddle to Pompton) and Passaic River Lower (Newark Bay to Saddle) HUC11 watersheds will be evaluated prior to Department approvals associated with future water supply and wastewater decisions.

    - If a deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Forms of mitigation include: permanent removal/reduction of an existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Saddle River HUC11 watershed as it approaches the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
- Allow no additional depletive/consumptive uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield.
- Consider utilization of available safe yield and/or interconnections to offset existing and potential future depletive/consumptive losses associated with unconfined groundwater uses.
- Complete "Development of Reconstructed Streamflows in the Passaic and Hackensack River Basins, Water Years 1922-2007" in coordination with stakeholders.
- Continue to coordinate with New York Department of Environmental Conservation (NJDEC) and other applicable agencies to address depletive/consumptive activities upstream of this WMA that would affect the sustainability of New Jersey's water resources

WATERSHED MANAGEMENT AREA 5

HACKENSACK, HUDSON AND PASCACK



DESCRIPTION OF PLANNING AREA

Watershed Management Area 5 lies mostly in Bergen County but also includes part of Hudson County. It is located in the extreme northeastern corner of New Jersey, extending from the southern New York border, where the Hackensack River enters New Jersey, to Newark Bay. WMA 5 also includes the portion of New Jersey that stretches along the Hudson River. WMA 5 is comprised of three HUC11 watersheds -- Hudson, Upper Hackensack River and Lower Hackensack River. The surface water supply sources in this planning area consist of Suez New Jersey's Lake Tappan, Woodcliff Lake, Lake Deforest and Oradell Reservoirs. For additional information pertaining to these reservoirs, please refer to Chapter 3.

Although WMA 5 is the most populous WMA in the State, approximately 50% of the land is undeveloped. This is because much of the lower Hackensack River Watershed is tidal marsh and proposed land uses are governed by the environmental standards administered by the Hackensack Meadowlands Development Commission. Thirty percent of the developed land in WMA 5 is residential while the remainder is dedicated to commercial/industrial uses.

Table A.5.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02030101170	Hudson River
02030103170	Hackensack R (above Hirshfeld Brook)
02030103180	Hackensack R (below/incl Hirshfeld Bk)

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 05 surface water withdrawals comprise 95% of the total withdraw and unconfined groundwater comprises 5%. There are no major confined aquifers in this WMA. Power generation is <1% of the total withdrawal, with most coming from surface water sources. Potable supply is 98% of the total withdrawal, with 97% coming from unconfined groundwater sources and the remaining 3% from surface water sources. Combined commercial, industrial and mining make up 1% of the total withdrawal, with 100% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining <1% of total water withdrawals, with 58% coming from unconfined groundwater sources and 42% from surface water sources. Figure A.5.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.X.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 1990 and show a declining to flat trend from 1990 to 2015. Annual withdrawals by source and use sector are shown in table A.5.2.

Annual consumptive loss peaked in 2002 with a variable slightly downward trend from 2002 to 2015. In 2002 consumptive losses were primarily from potable supply sources. For the 2000 through 2015 period monthly consumptive use peaked in July of 2002. Refer to figures A.5.3 and A.5.4.

Almost all (97%) of the total sanitary sewer discharges are to fresh surface water sources. The remaining 3% of the discharges are to groundwater. Discharges average about 292 mgd over the period of record. Refer to Figure A.5.5.

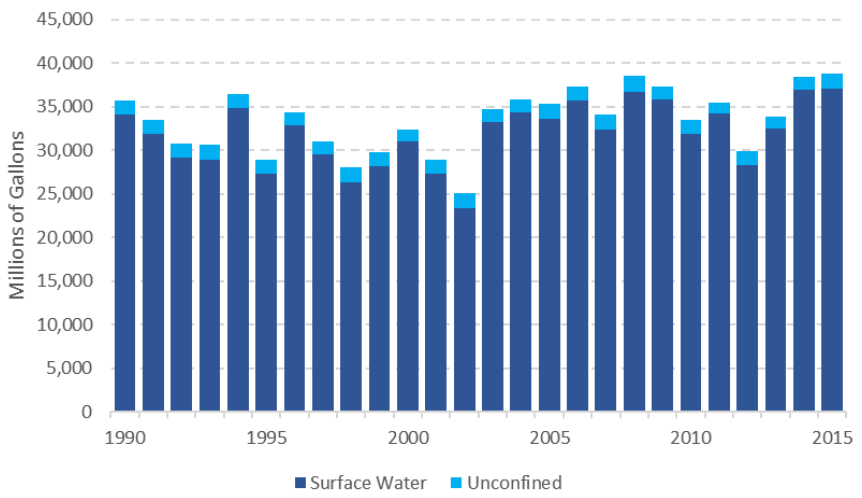


Figure A.5.1. Annual withdrawals by source.

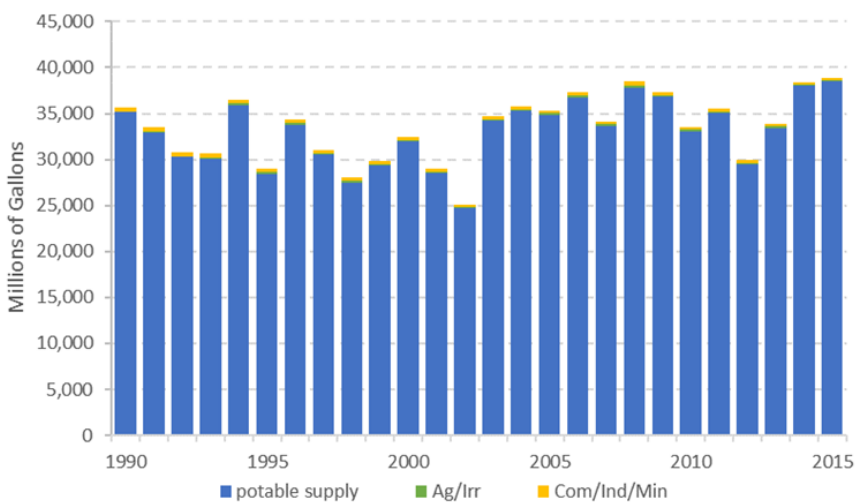


Figure A.5.2. Annual withdrawals by use sector.

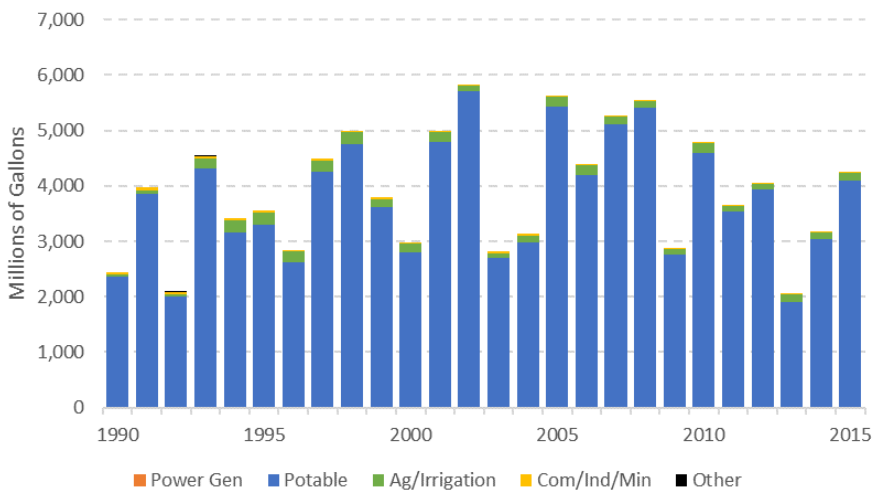


Figure A.5.3. Annual consumptive loss by use sector

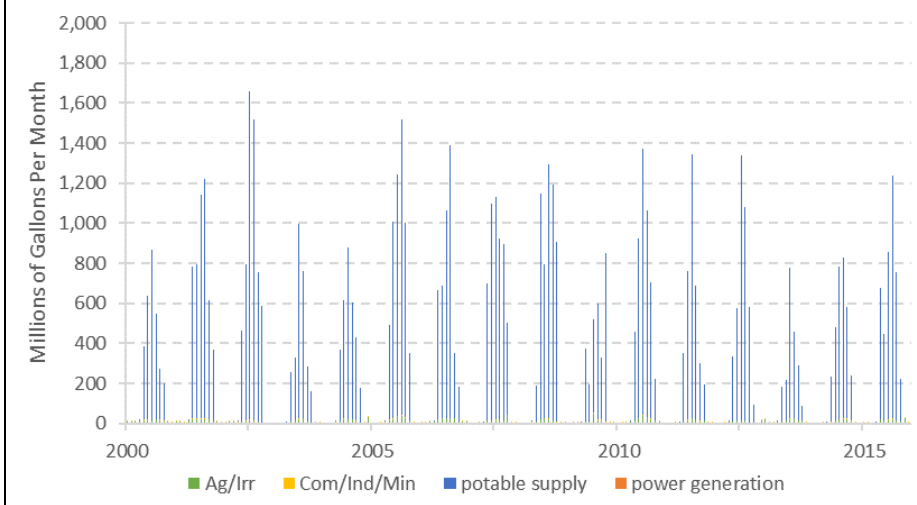


Figure A.5.4. Monthly consumptive loss by use sector

Table A.5.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	0	38			498		34,148	1,002				
1991	0	64			507		31,912	1,036				
1992	0	37			478		29,224	1,052				
1993	94	103			472		28,785	1,267				
1994	107	120			424		34,751	1,097				
1995	102	150			363		27,179	1,173				
1996	92	124			355		32,766	989				
1997	111	110			348		29,473	1,019				
1998	135	97			373		26,219	1,223				
1999	96	71			326		28,083	1,250				
2000	114	49			310		30,915	1,043				
2001	107	88			320		27,278	1,197				
2002	41	57			302		23,378	1,332				
2003	52	51			333		33,178	1,093				
2004	70	60			371		34,292	1,011		0		
2005	87	97			328		33,542	1,298		0		
2006	67	120			333		35,703	1,051		0		
2007	90	67			295		32,301	1,382		0		
2008	73	48			584		36,702	1,152		0		
2009	100	30			337		35,760	1,064		0		
2010	122	71			327		31,771	1,273		0		
2011	87	38			330		34,098	981		0		
2012	44	52			320		28,307	1,196		0		
2013	105	50			232		32,370	1,073		0		
2014	79	44			230		36,844	1,191		0		
2015	77	80			137		37,071	1,440		0		

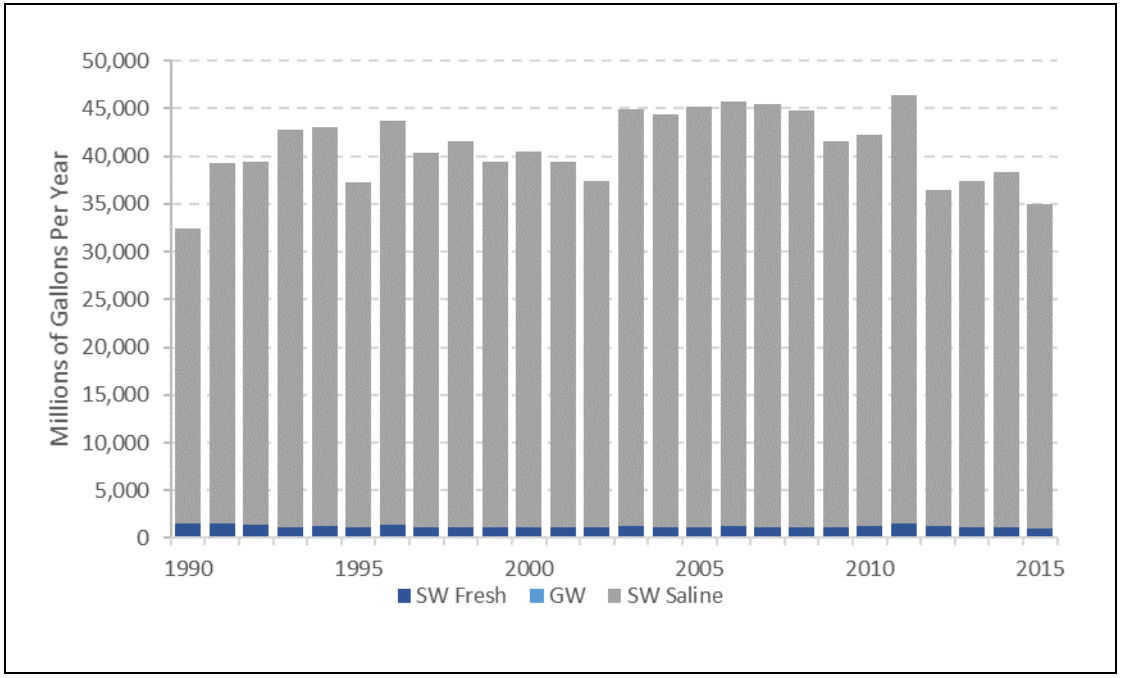


Figure A.5.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Eight water purveyors which serve more than 1,000 people provide potable water to one or more of the 3 HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.5.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that <1% of the total potable supply in this WMA is from private domestic wells.

Potable water demand is expected to increase by 3.73, 7.45, 1.18, 14.90 and 18.63 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.5.4 contains the demand estimates by HUC11. 125 gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.5.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030101170	02030103170	02030103180
NJ0231001	Passaic Valley WC - Lodi			X
NJ0232001	Lyndhurst WD			X
NJ0238001	Suez Water NJ Hackensack	X	X	X
NJ0239001	Passaic Valley WC - North Arlington			X
NJ0247001	Park Ridge WD		X	
NJ0905001	Hoboken Water Services	X		
NJ0906001	Jersey City MUA	X		X
NJ0907001	Kearny WD			X

Table A.5.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02030101170	1.19	2.39	3.58	4.78	5.97
02030103170	0.37	0.74	1.11	1.48	1.85
02030103180	2.16	4.32	6.49	8.65	10.81
Total	**3.73**	**7.45**	**11.18**	**14.90**	**18.63**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.5.8 and A.5.9 indicate that there is a total of 6 mgd of natural resource availability in WMA 5 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 3 mgd of available water remaining and at full allocation rates 13.9 mgd of water is remaining. Table A.5.5 shows that of the 3 HUC11s in the WMA, one has used all the available water and one would have used all the available water if full allocation diversion rates were used. 2 HUC11 has a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, potable supply uses are the major loss in 1 HUC11 and under full allocation diversion rates potable supply is the largest loss in 1 HUC11. See tables A.5.5, A.5.6 and A.5.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.5.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02030101170	4.2				25%	2005	1.0	-22.9	Net Gain	23.9	-21.9	Net Gain	22.9	Non-Ag Irr	Non-Ag Irr
02030103170	9.0		Yes		25%	2010	2.3	4.8	214%	0.0	4.7	209%	0.0	Potable	Potable
02030103180	10.0		Yes		25%	2013	2.5	-60.4	Net Gain	62.9	-72.5	Net Gain	75.0	Non-Ag Irr	Non-Ag Irr

Table A.5.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02030101170	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0
02030103170	4.8	0.0	0.6	0.2	0.0	0.0	0.0	0.1	0.4	0.0	0.0	5.1	0.4	0.0	5.5	71.3
02030103180	0.3	0.0	0.1	0.5	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.9	0.1	0.0	1.1	0.8

Table A.5.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02030101170	0.00	0.0	22.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.9	23.0
02030103170	0.01	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.6
02030103180	0.00	2.3	58.6	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	60.9	61.4

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

Suez Water New Jersey (UWNJ) is the largest provider of surface water (safe yield = 126.5 MGD) for potable supply in WMA 5. Suez NJ provides water to the municipalities of Secaucus, Guttenberg, Ridgewood, Wallington, Cliffside Park, Edgewater, Saddle Brook, Wood Ridge, North Bergen, Westwood, Bergenfield, Bogota, Carlstadt, Cliffside, Closter, Cresskill, Demarest, Dumont, East Rutherford, Emerson, Englewood, Englewood Cliffs, Fairview, Fort Lee, Hackensack City, Harrington Park, Hasbrouck Heights, Haworth, Hillsdale, Leonia, Little Ferry, Maywood, Montvale, Moonachie, New Milford, Northvale, Norwood, Oradell, Palisades Park, Paramus, Ridgefield, Ridgefield Park, River Edge, River Vale, Rochelle Park, Rutherford, Teaneck, Tenafly, Teterboro and Washington along with West New York (New Jersey).

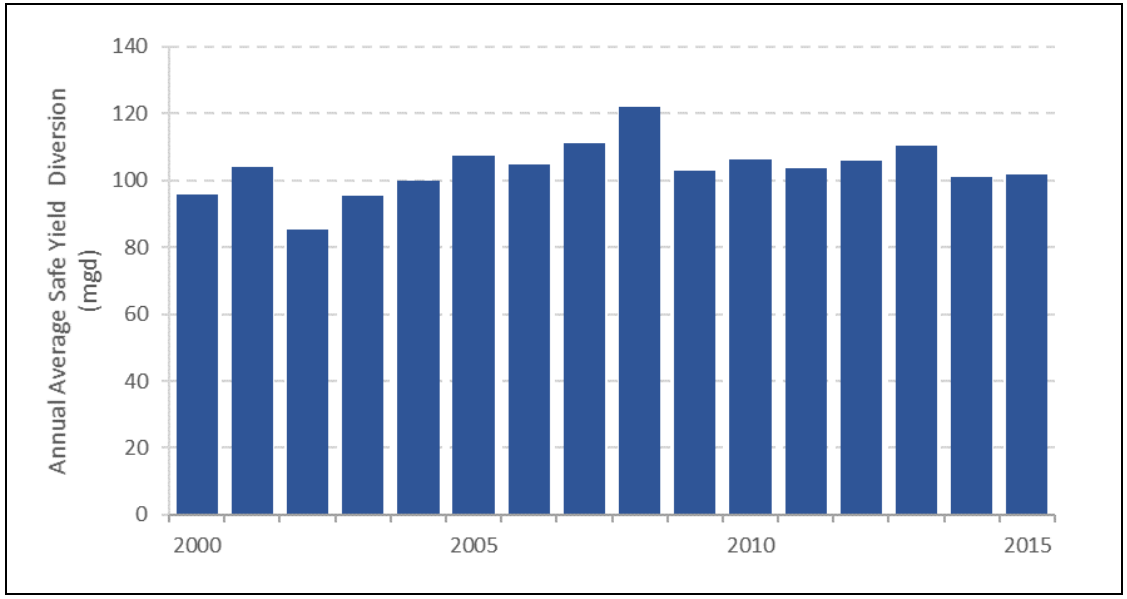


Figure 5.6. Suez NJ Hackensack average annual safe yield withdrawals

AVAILABLE WATER FROM CONFINED AQUIFERS

There are no significant regionally confined aquifers or withdrawals from confined aquifer in WMA 05. Some locally confined wells may be present, but the extent of the confined aquifer is relatively small compared to NJ's coastal plain confined aquifers.

SUMMARY AND MANAGEMENT OPTIONS

Table A.5.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
5	Hackensack, Hudson and Pascack	126.5	6		132.5	122	3		125	4.5	3		7.5	3.7	3.8

Table A.5.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
5	Hackensack, Hudson and Pascack	150	8		0	13.9			82	4.1	

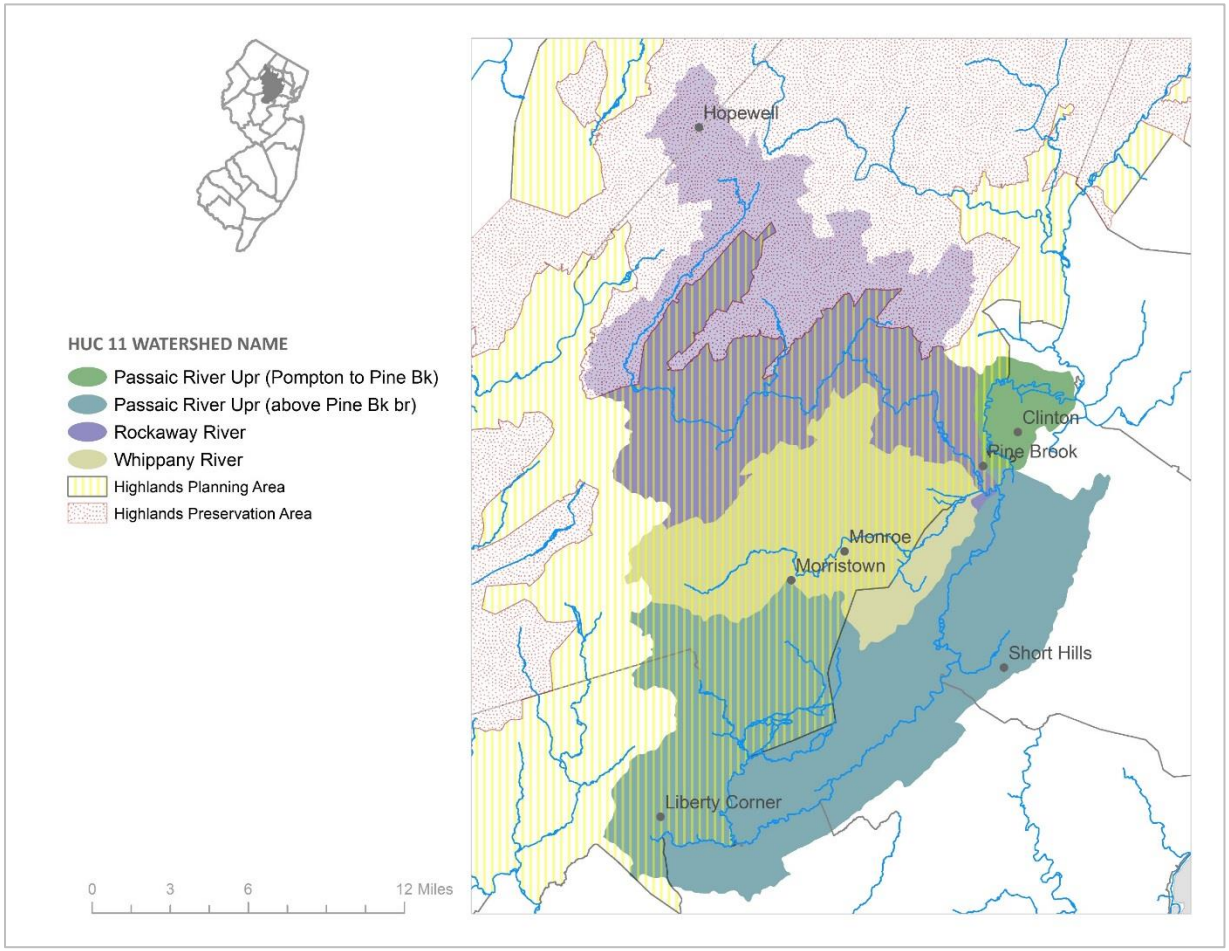
Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- Suez NJ delivers the vast majority of public supply water to individuals in WMA 5 via surface water supplies and this system has repeatedly experienced new peak summer demands as outdoor irrigation (and therefore consumptive losses) continues to increase. Consumptive water losses in this system tend to have a negative impact on the sustainability of UWNJ's safe yield, thereby causing the decrease in storage of other surface water systems, mainly NJDWSC. While the LFM methodology indicates that the unconfined groundwater resources of the HUC11 watersheds in WMA 5 may be sustainable, the following management options are still warranted to maximize water use efficiency. As such, NJDEP recommends the following items be implemented in WMA 5:
- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Allow no additional depletive/consumptive uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield.
- Consider utilization of available safe yield and/or interconnections to offset existing and potential future depletive/consumptive losses associated with unconfined groundwater uses.
- Continue to coordinate with UWNY regarding the releases of waters from Lake DeForest that should be taking place when the combined levels of the Suez New Jersey's reservoirs (i.e. Oradell Reservoir, Woodcliff Lake and Lake
- Tappan) are less than 50% of capacity regardless of water being transferred into the Oradell from the Wanaque South project.
- Continue to coordinate with New York Department of Environmental Conservation (NJDEC) and other applicable agencies to address depletive/consumptive activities upstream of this WMA that would affect the sustainability of New Jersey's water resources.
- Complete "Development of Reconstructed Streamflows in the Passaic and Hackensack River Basins, Water Years 1922-2007" in coordination with stakeholders.
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Hackensack R (above Hirshfeld Brook) HUC11 watershed should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.

WATERSHED MANAGEMENT AREA 6

UPPER AND MIDDLE PASSAIC, WHIPPANY AND ROCKAWAY



DESCRIPTION OF PLANNING AREA

Watershed Management Area 6 represents the area drained by waters from the upper reaches of the Passaic River Basin (from the Passaic River headwaters in Morris County to its confluence with the Pompton River in Passaic County), and includes the following four HUC11 watersheds – Upper and Middle Passaic River, Whippany River and Rockaway River. Portions of Morris, Somerset, Sussex and Essex Counties lie within WMA 6, and, despite substantial surface water withdrawals here (which water is exported predominantly to WMAs 4 and 7), the area is largely reliant on groundwater sources for water supply.

Table A.6.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02030103010	Passaic River Upr (above Pine Bk br)
02030103020	Whippany River
02030103030	Rockaway River
02030103040	Passaic River Upr (Pompton to Pine Bk)

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 06 surface water withdrawals comprise 84% of the total withdraw and unconfined groundwater comprises 16%. There are no major confined aquifers. Power generation is not significant here. Potable supply is 96% of the total withdrawal, with 49% coming from unconfined groundwater sources and the remaining 51% from surface water sources. Combined commercial, industrial and mining make up 3% of the total withdrawal, with 11% coming from surface water sources and 89% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 1% of total water withdrawals, with 53% coming from unconfined groundwater sources and 47% from surface water sources. Figure A.6.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.6.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 1990 and flat trend from 1990 to 2015. Annual withdrawals by source and use sector are shown in table A.6.2.

Annual consumptive loss peaked in 1993, with comparable rates in 1998, 1999, 2001, 2005, 2010 and 2015. In 1999 consumptive losses were primarily from potable supply uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2015. Refer to figures A.6.3 and A.6.4.

Almost all (99%) of the total sanitary sewer discharges are to fresh surface water sources. The remaining 1% of the discharges are to groundwater. Discharges average about 120 mgd over the period of record. Refer to Figure A.6.5.

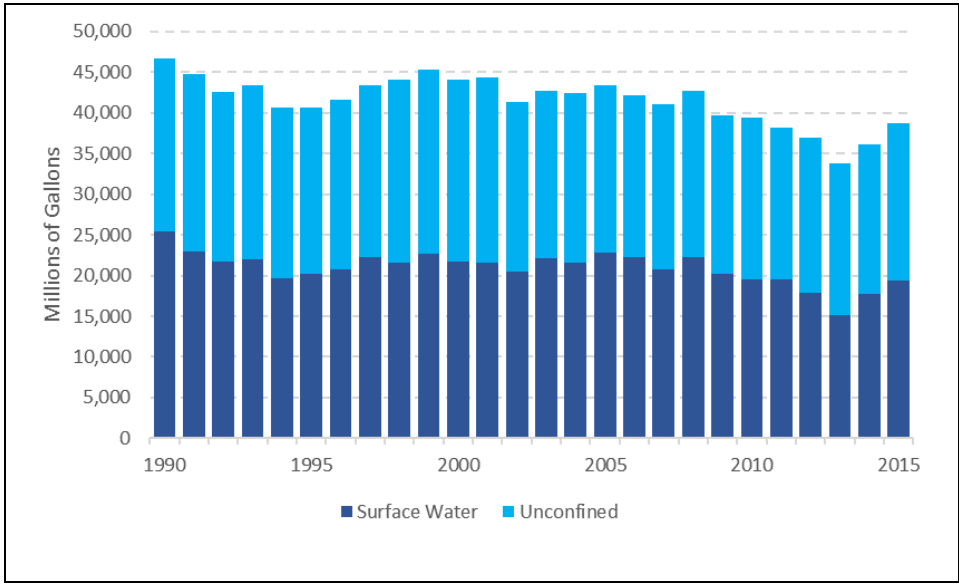


Figure A.6.1. Annual withdrawals by source.

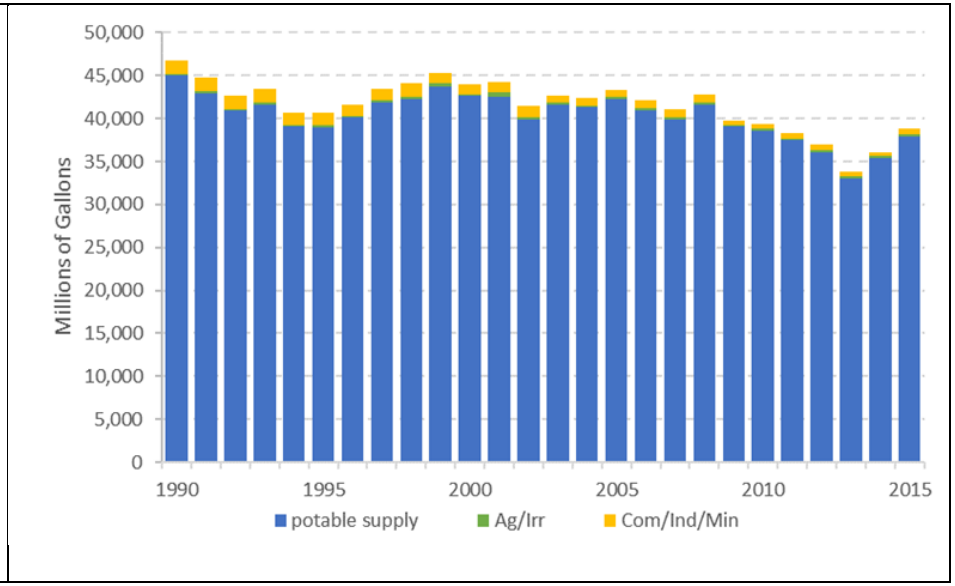


Figure A.6.2. Annual withdrawals by use sector.

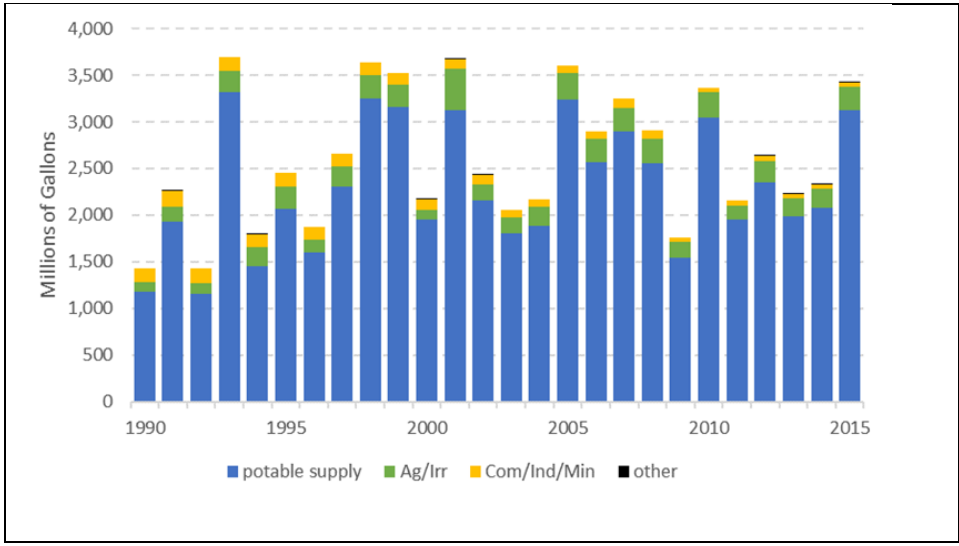


Figure A.6.3. Annual consumptive loss by use sector

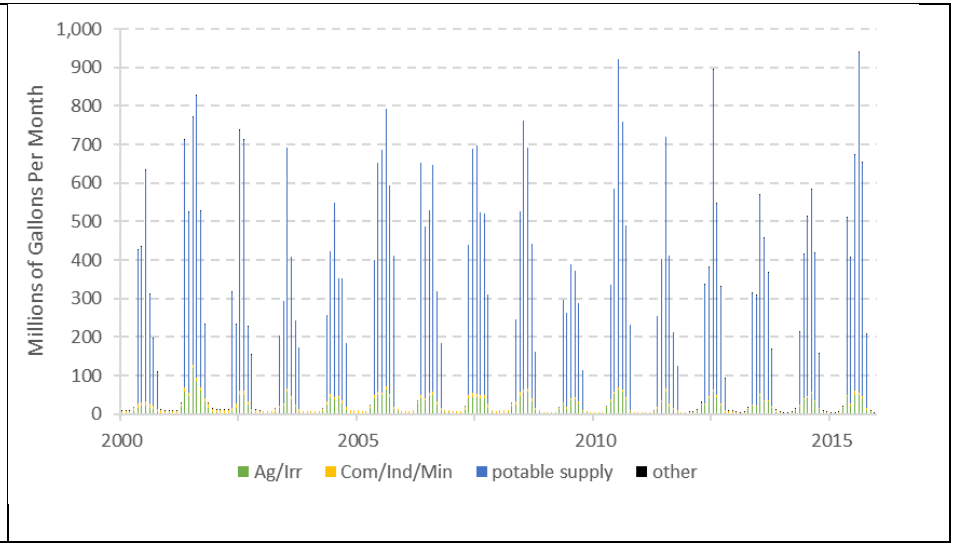


Figure A.6.4. Monthly consumptive loss by use sector

Table A.6.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	33	78		136	1,359		25,259	19,818				
1991	51	126		237	1,381		22,707	20,250				
1992	35	92		146	1,427		21,539	19,407				
1993	107	150		264	1,259		21,571	20,045				
1994	82	144		278	1,131		19,320	19,740				
1995	105	169		177	1,239		19,951	19,024				
1996	60	90		96	1,254		20,615	19,544				
1997	112	128		36	1,280		22,078	19,782				
1998	112	163		72	1,490		21,464	20,788				
1999	154	120		81	1,172		22,519	21,251				
2000	66	48		233	1,048		21,417	21,209				
2001	145	347		269	976		21,116	21,444				
2002	94	91		269	1,010		20,160	19,783				
2003	113	77		83	720		21,934	19,722				
2004	126	95		77	847		21,333	19,939				
2005	149	171		81	775		22,527	19,677				
2006	130	143		67	830		22,094	18,889				
2007	136	142		40	924		20,529	19,305				
2008	145	147		35	896		22,095	19,461				
2009	86	104		29	480		20,106	18,952				
2010	177	125		35	494		19,323	19,224				
2011	95	65		39	545		19,437	18,059				
2012	146	108		41	561		17,715	18,364				
2013	105	101		39	495		15,045	18,019				
2014	137	102		39	471		17,588	17,776				
2015	153	121		45	557		19,248	18,671				

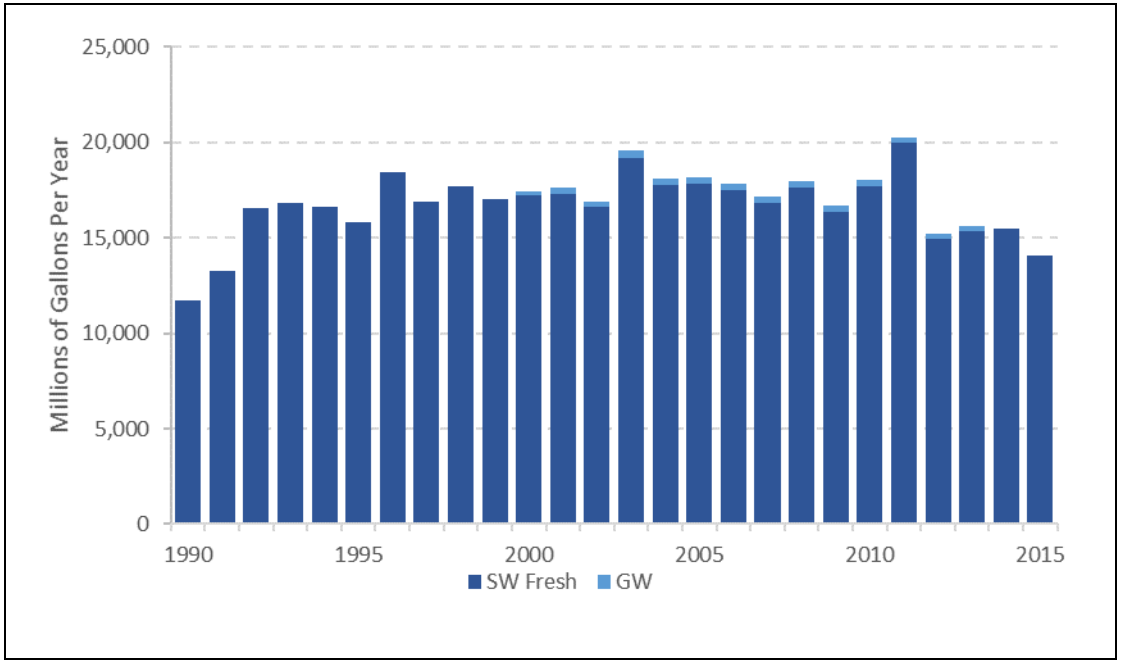


Figure A.6.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Thirty-six water purveyors which serve more than 1,000 people provide potable water to one or more of the 4 HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.6.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 3% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by 1.00, 2.01, 3.01, 4.02 and 5.02 mgd by 2020, 2025, 2030, 2035 and 2040, respectively. Table A.6.4 contains the demand estimates by HUC11. One hundred twenty-five (125) gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.6.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030103010	02030103020	02030103030	02030103040
NJ0703001	Caldwell WD	X			
NJ0706001	Essex Fells WD	X			
NJ0707001	Fairfield WD	X			X
NJ0710001	Livingston Twp DW	X			
NJ0712001	NJ American - Passaic	X	X		
NJ0715001	North Caldwell WD	X			
NJ0718001	Roseland WD	X			
NJ0720001	Verona WD	X			
NJ0721001	West Caldwell WD	X			
NJ1401001	Boonton Town WD		X	X	
NJ1404001	Chatham WD	X			
NJ1408001	Denville Twp WD		X	X	
NJ1409001	Dover Water Commission			X	
NJ1410001	East Hanover Twp WD	X	X	X	
NJ1411001	Florham Park Water Department	X	X		
NJ1414003	Jefferson Twp W U Milton System			X	
NJ1414011	Jefferson Twp Water Utility - Lake Hopatcong			X	
NJ1415001	Fayson Lakes WC			X	
NJ1416001	Borough of Lincoln Park WD				X
NJ1417001	Madison WD	X	X		
NJ1420001	Mine Hill WD			X	

Table A.6.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030103010	02030103020	02030103030	02030103040
NJ1421003	Montville Twp MUA	X		X	X
NJ1422001	Sisters of Charity of South Elizabeth		X		
NJ1424001	South East Morris County MUA	X	X	X	
NJ1425001	Mountain Lakes WD		X	X	
NJ1426005	Mount Arlington Boro DWP Main			X	
NJ1429001	Parsippany-Troy Hills WD		X	X	
NJ1432003	Randolph Twp Public Works Dept		X	X	
NJ1434001	Rockaway Boro WD			X	
NJ1435002	Rockaway Twp WD			X	
NJ1435003	AWO&M - Picatinny Arsenal			X	
NJ1436002	Roxbury WC			X	
NJ1436004	Roxbury Twp WD - Skyview			X	
NJ1439001	Wharton Water Dept.			X	
NJ1918003	Sparta Twp WU - Highlands			X	
NJ2004002	NJ American - Raritan	X			

Table A.6.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02030103010	0.51	1.03	1.54	2.06	2.57
02030103020	0.26	0.53	0.79	1.06	1.32
02030103030	0.20	0.41	0.61	0.81	1.02
02030103040	0.02	0.05	0.07	0.09	0.11
Total	**1.00**	**2.01**	**3.01**	**4.02**	**5.02**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.6.8 and A.6.9 indicate that there is a total of 15 mgd of natural resource availability in WMA 6 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 0 mgd of available water remaining and at full allocation rates 0 mgd of water is remaining. Table A.6.5 shows that of the 4 HUC11s in the WMA, 2 have used all the available water and 3 would have used all the available water if full allocation diversion rates were used. One HUC11 has a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, potable supply uses are the major loss in 3 HUC11s and under full allocation diversion rates potable supply is the largest loss in 3 HUC11s. See tables A.6.5, A.6.6 and A.6.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.6.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02030103010	22.7	Partial	Yes	Yes	25%	2007	5.7	11.3	200%	0.0	22.9	404%	0.0	Potable	Potable
02030103020	12.2	Partial	Yes	Yes	25%	2001	3.0	15.1	494%	0.0	11.7	385%	0.0	Potable	Potable
02030103030	22.5	All	Yes	Yes	25%	2012	5.6	-5.8	Net Gain	11.4	-0.5	Net Gain	6.1	Non-Ag Irr	Non-Ag Irr
02030103040	2.0	Partial	Yes	Yes	25%	2010	0.5	0.2	36%	0.3	0.5	104%	0.0	Potable	Potable

Table A.6.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02030103010	24.7	0.0	1.1	1.2	0.0	0.0	0.0	0.6	0.4	0.0	0.0	25.0	0.5	0.0	25.4	2.3
02030103020	22.3	0.0	0.4	1.4	0.0	0.0	0.0	1.3	0.0	0.0	0.0	22.8	0.0	0.0	22.8	0.4
02030103030	10.1	0.8	2.7	0.5	0.1	0.0	0.0	0.1	0.1	0.0	0.0	12.0	1.0	0.0	13.0	51.4
02030103040	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.4	0.0

Table A.6.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02030103010	0.02	12.0	0.0	0.8	1.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	2.1	12.0	14.1
02030103020	0.00	6.1	0.0	0.3	1.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	1.6	6.1	7.7
02030103030	0.00	16.2	0.0	2.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	2.5	16.3	18.8
02030103040	0.00	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

There are two large surface water supply reservoir systems in this WMA; Jersey City MUA (Suez) and NJ American. In addition to bulk purchases, Jersey City gets all of its own water from its reservoir system. NJ American utilizes its Canoe Brook reservoir system along with several wellfields.

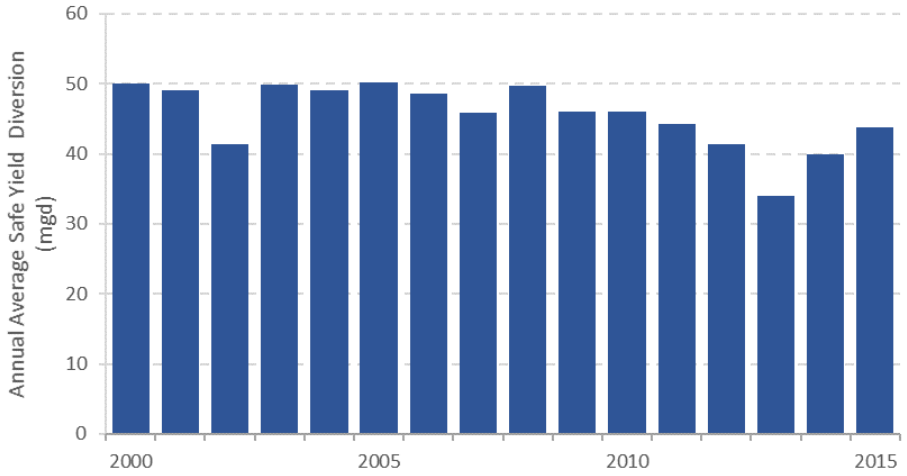


Figure A.6.6. Jersey City's Rockaway system average annual safe yield withdrawals

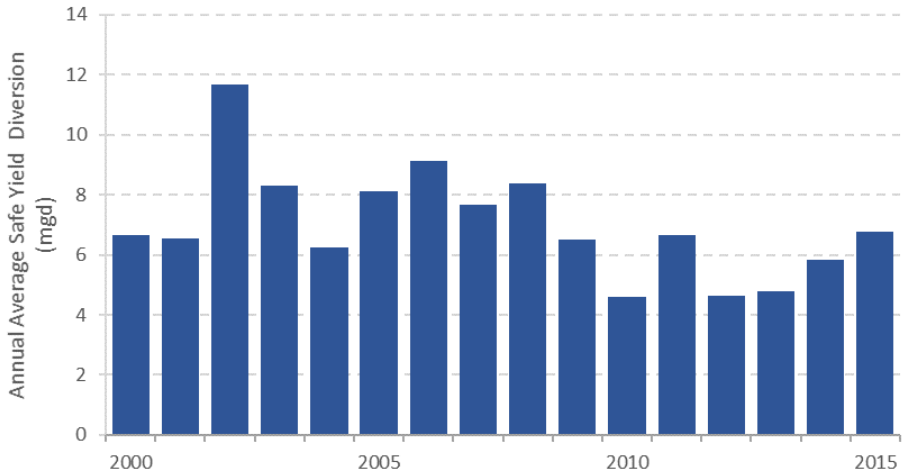


Figure A.6.7. NJ American's Canoe Brook system average annual safe yield withdrawals

AVAILABLE WATER FROM CONFINED AQUIFERS

There are no significant regionally confined aquifers or withdrawals from confined aquifer in WMA 6. Some locally confined wells may be present, but the extent of the confined aquifer is relatively small compared to NJ's coastal plain confined aquifers.

SUMMARY AND MANAGEMENT OPTIONS

Table A.6.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
6	Upper and Middle Passaic, Whippany and Rockaway	67.6	15		82.6	58	21		79	9.6	-6		3.6	1	2.6

Table A.6.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
6	Upper and Middle Passaic, Whippany and Rockaway	81	79		0	-19.8				2.5	30

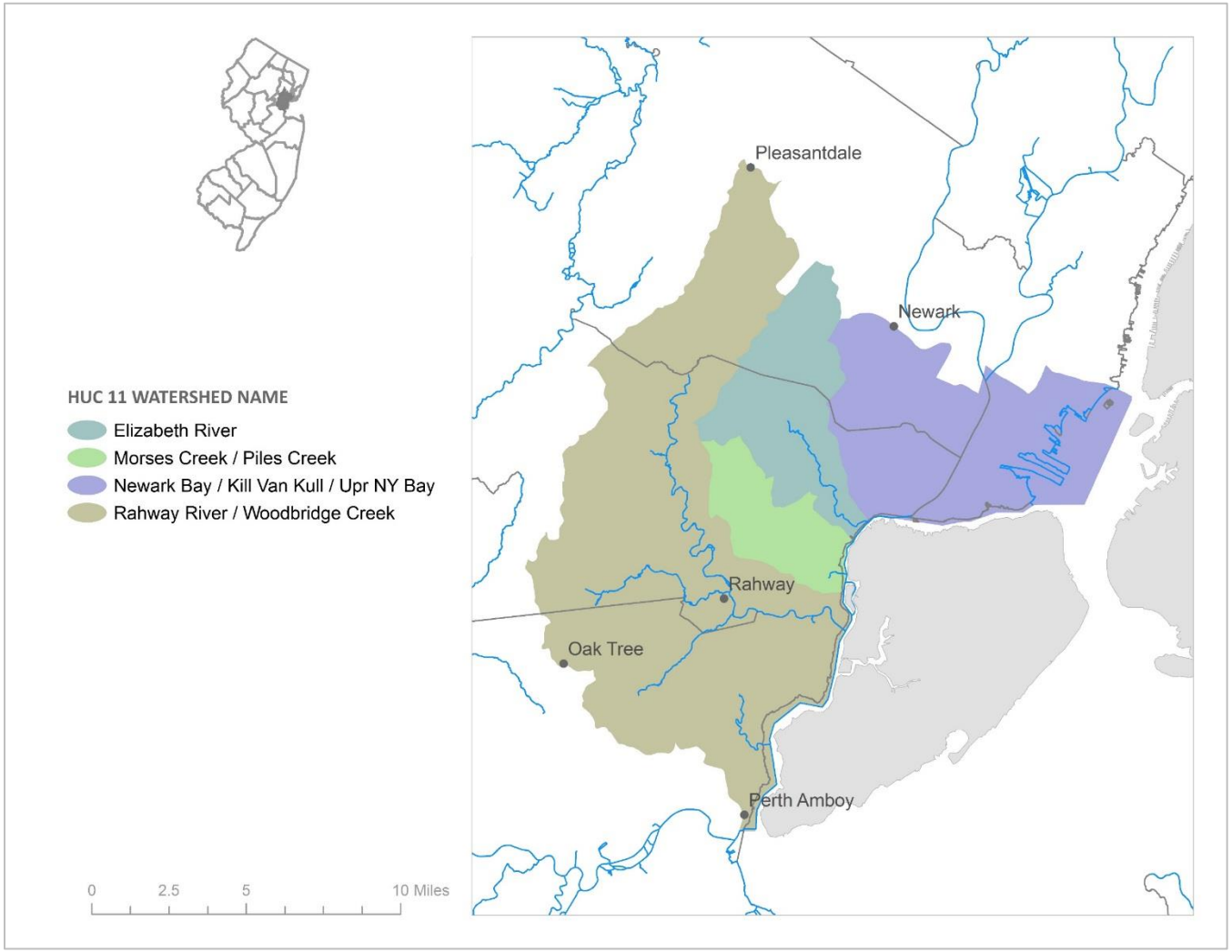
Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Allow no additional D/C uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield.
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Upper Passaic River (above Pine Brook) and Whippany River HUC11s will be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of an existing depletive/consumptive use, increased storage; or increased recharge.
- Complete "Development of Reconstructed Streamflows in the Passaic and Hackensack River Basins, Water Years 1922-2007" in coordination with stakeholders.
- Consider utilizing available safe yield and/or interconnections to offset existing and potential future depletive/consumptive losses associated with unconfined groundwater uses.
- For HUC11 watersheds that are located wholly within the New Jersey Highlands, please refer to the Highlands Regional Master Plan at http://www.nj.gov/njhighlands/master/

WATERSHED MANAGEMENT AREA 7

ARTHUR KILL



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 7 lies in portions of Middlesex, Union and Essex Counties and has a drainage area of 197.4 square miles. Land uses found in the Rahway and Elizabeth HUC11 watersheds are primarily residential, commercial and industrial. The main stem of the Rahway River flows from Union County into the Arthur Kill near Linden and is tidal from the Pennsylvania Railroad Bridge in Rahway to the mouth of the Newark Bay. Major tributaries include the East Branch Rahway River, Woodbridge River and Robinson's Branch. The following surface water impoundments are located within WMA 7: Middlesex Reservoir; Orange Reservoir; Lower and Upper Echo Lakes; and Diamond Mill Pond.

Table A.7.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02030104010	Newark Bay / Kill Van Kull / Upr NY Bay
02030104020	Elizabeth River
02030104030	Morses Creek / Piles Creek
02030104050	Rahway River / Woodbridge Creek

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 07 surface water withdrawals comprise 40% of the total withdraw and unconfined groundwater comprises 60%. There are no major confined aquifers in this WMA. Power generation is 19% of the total withdrawal, with 100% coming from surface water sources. Potable supply is 69% of the total withdrawal, with 70% coming from unconfined groundwater sources and the remaining 30% from surface water sources. Combined commercial, industrial and mining make up 10% of the total withdrawal, 100% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 2% of total water withdrawals, with 76% coming from unconfined groundwater sources and 24% from surface water sources. Figure A.7.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.7.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 1991 and show a declining to flat trend from 1991 to 2015. Annual withdrawals by source and use sector are shown in table A.7.2.

Annual consumptive loss peaked in 1997 with similar rates in 2007. In 2007 consumptive losses were almost all from potable supply uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2010. Refer to figures A.7.3 and A.7.4.

All (100%) of the total sanitary sewer discharges are to saline surface water sources. Discharges average about 984 mgd over the period of record. Refer to Figure A.7.5.

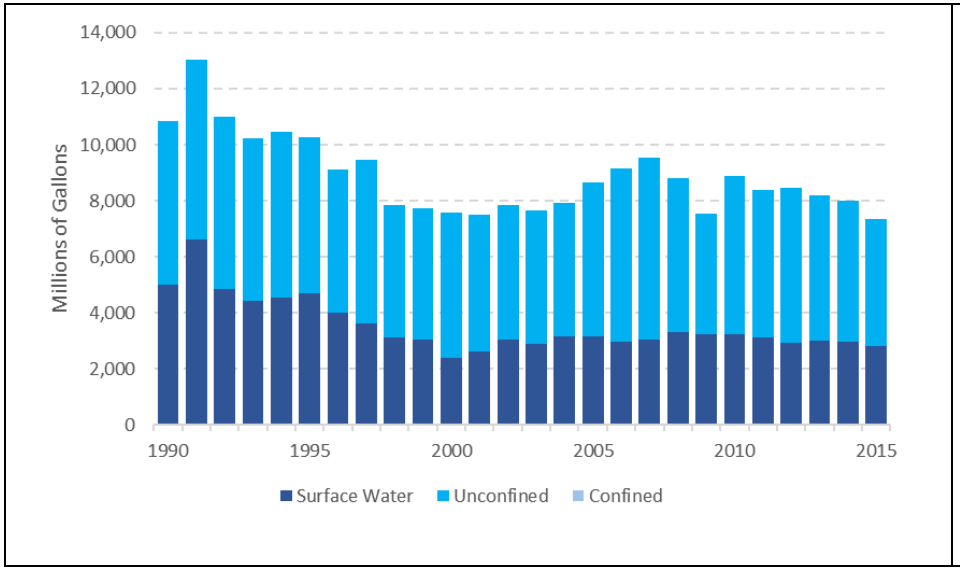


Figure A.7.1. Annual withdrawals by source.

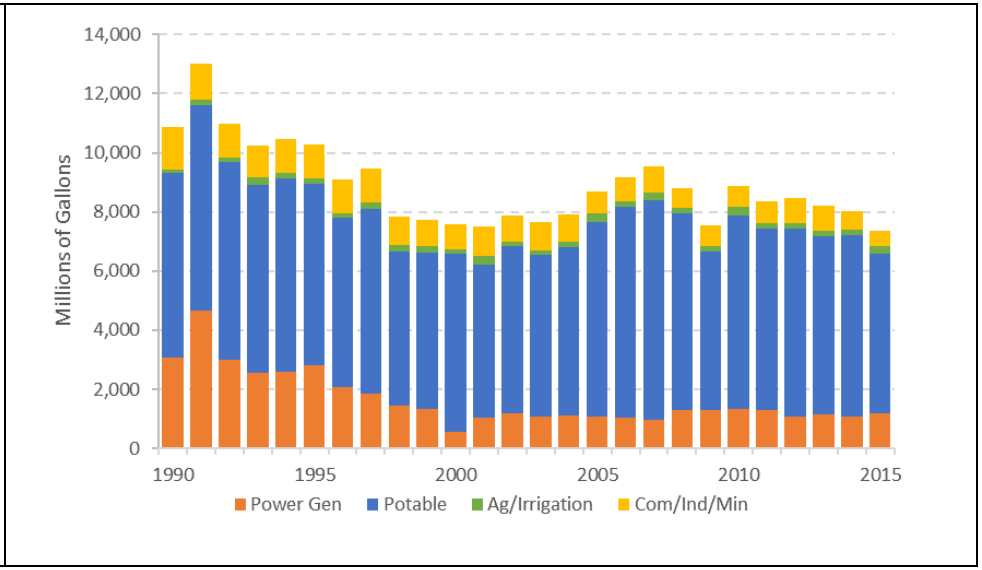


Figure A.7.2. Annual withdrawals by use sector.

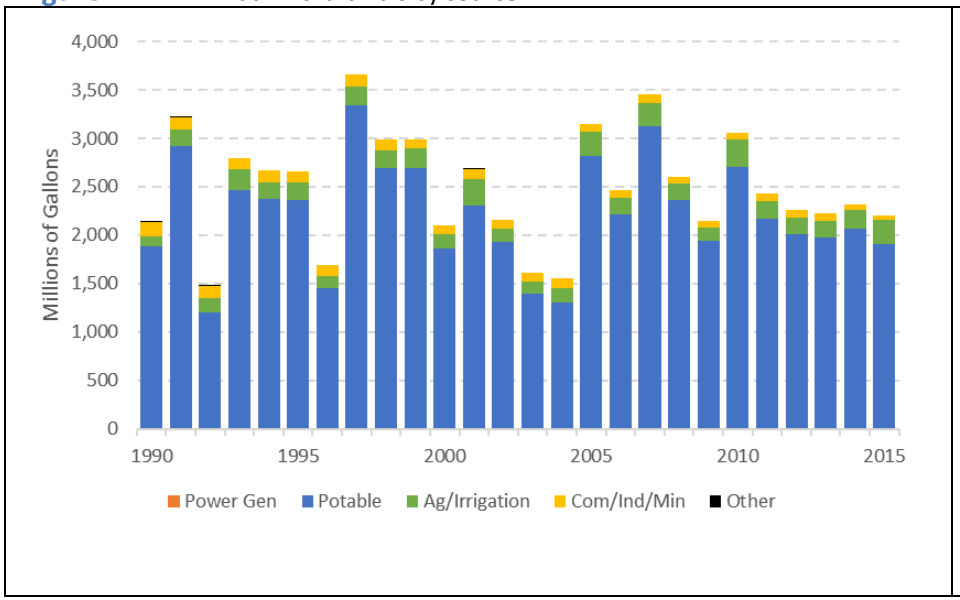


Figure A.7.3. Annual consumptive loss by use sector

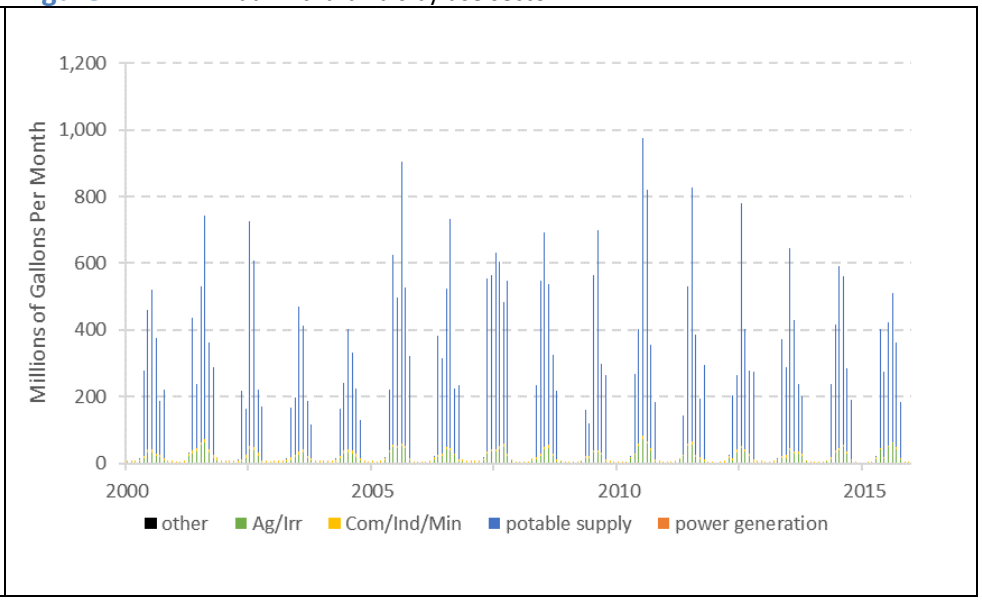


Figure A.7.4. Monthly consumptive loss by use sector

Table A.7.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	14	97			1,441		1,911	4,327		3,065		
1991	19	166			1,227		1,922	5,026		4,666		
1992	18	146			1,154		1,840	4,847		2,984		
1993	20	226			1,073		1,890	4,497		2,535		
1994	24	175			1,129		1,954	4,593		2,577		
1995	12	184			1,138		1,906	4,249		2,794		
1996	6	131			1,151		1,941	3,797		2,078		
1997	14	203			1,168		1,767	4,479		1,840		
1998	19	183			976		1,660	3,544		1,460		
1999	56	177			882		1,668	3,613		1,327		
2000	26	141			824		1,814	4,201		559		
2001	57	248			988		1,541	3,627		1,040		
2002	41	115			875		1,808	3,825		1,202		
2003	32	108			965		1,796	3,670		1,072		
2004	60	107			931		1,969	3,716		1,124		
2005	104	179			735		1,999	4,579		1,077		
2006	56	139			793		1,888	5,271		1,021		
2007	115	154			881		1,964	5,443		976		
2008	62	129			651		1,987	4,689		1,279		
2009	60	96		2	694		1,867	3,501		1,306		
2010	102	207			715		1,801	4,738		1,327		
2011	62	144			741		1,791	4,343		1,287		
2012	76	116			845		1,775	4,586		1,074		
2013	69	116			830		1,787	4,242		1,156		
2014	69	136			612		1,814	4,312		1,077		
2015	80	193			497		1,542	3,851		1,185		

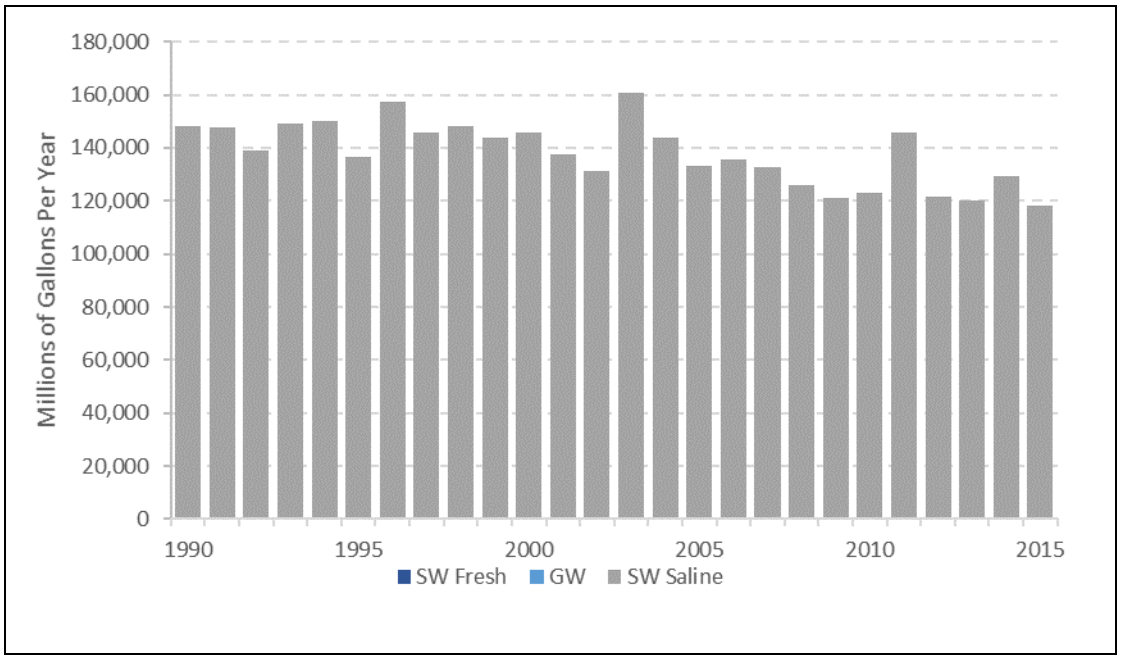


Figure A.7.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Fourteen water purveyors which serve more than 1,000 people provide potable water to one or more of the 4 HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.7.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 2% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by 4.90, 9.80, 14.69, 19.59 and 24.49 mgd by 2020, 2025, 2030, 2035 and 2040, respectively. Table A.7.4 contains the demand estimates by HUC11. One hundred twenty-five (125) gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.7.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030104010	02030104020	02030104030	02030104050
NJ0705001	East Orange WC		X		
NJ0712001	NJ American - Passaic		X		X
NJ0714001	Newark WD	X	X		X
NJ0717001	Orange WD				X
NJ0719001	South Orange WD		X		X
NJ0901001	Bayonne MUA	X			
NJ0906001	Jersey City MUA	X			
NJ0907001	Kearny WD	X			
NJ1216001	Perth Amboy WD				X
NJ1225001	Middlesex WC				X
NJ2004001	Liberty WC/ NJ American	X	X	X	
NJ2004002	NJ American - Raritan	X	X	X	X
NJ2013001	Rahway City WD				X
NJ2021001	Winfield Mutual Housing				X

Table A.7.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02030104010	2.22	4.43	6.65	8.87	11.08
02030104020	0.77	1.55	2.32	3.10	3.87
02030104030	0.24	0.48	0.72	0.96	1.20
02030104050	1.67	3.34	5.00	6.67	8.34
Total	**4.90**	**9.80**	**14.69**	**19.59**	**24.49**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.7.8 and A.7.9 indicate that there is a total of 6 mgd of natural resource availability in WMA 7 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 0 mgd of available water remaining and at full allocation rates 0 mgd of water is remaining. Table A.7.5 shows that of the 4 HUC11s in the WMA, 0 have used all the available water and 0 would have used all the available water if full allocation diversion rates were used. Three HUC11 has a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, industrial/commercial/mining uses are the major loss in 2 HUC11s and under full allocation diversion rates nan-ag irrigation is the largest loss in 4 HUC11s. See tables A.7.5, A.7.6 and A.7.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.7.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)***	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)***	Largest Dep-Con	
														Current	Full Allocation
02030104010	8.7				25%	2013	2.2	-198.5	Net Gain	200.7	-209.1	Net Gain	211.3	Ind-Com-Min	Non-Ag Irr
02030104020	4.7				25%	2010	1.2	-42.7	Net Gain	43.9	-48.9	Net Gain	50.1	Non-Ag Irr	Non-Ag Irr
02030104030	1.4				25%	2000	0.3	0.1	21%	0.3	0.1	26%	0.3	Ind-Com-Min	Non-Ag Irr
02030104050	9.5				25%	2005	2.4	-13.9	Net Gain	16.3	-4.9	Net Gain	7.3	Non-Ag Irr	Non-Ag Irr

*** Remaining available water for depletive/consumptive uses

Table A.7.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02030104010	0.0	0.0	0.1	1.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	1.0	0.1	0.0	1.1	0.0
02030104020	3.6	0.0	0.0	0.3	0.0	0.0	0.0	0.2	0.1	0.0	0.0	3.7	0.1	0.0	3.9	0.0
02030104030	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.9	0.0	0.0	0.9	0.0
02030104050	11.7	5.8	0.2	0.8	0.0	0.0	0.0	0.9	0.3	0.0	0.0	12.3	6.1	0.0	18.4	0.0

Table A.7.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02030104010	0.00	0.0	198.6	0.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	198.6	199.6
02030104020	0.00	0.0	46.3	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	46.3	46.6
02030104030	0.00	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.8
02030104050	0.00	0.0	31.4	0.2	0.7	0.0	0.0	0.0	0.1	0.0	0.0	0.0	1.0	31.4	32.4

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

There are no major reservoirs located in WMA 7. Some smaller reservoir systems may be present and while critical to the residents that rely of them, they are not covered in this statewide plan.

AVAILABLE WATER FROM CONFINED AQUIFERS

There are no significant regionally confined aquifers or withdrawals from confined aquifer in WMA 7. Some locally confined wells may be present, but the extent of the confined aquifer is relatively small compared to NJ's coastal plain confined aquifers.

SUMMARY AND MANAGEMENT OPTIONS

Table A.7.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
7	Arthur Kill		6		6		21		21		-15		-15	4.9	-19.9

Table A.7.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
7	Arthur Kill	17	27			-7.3			276	2.2	20

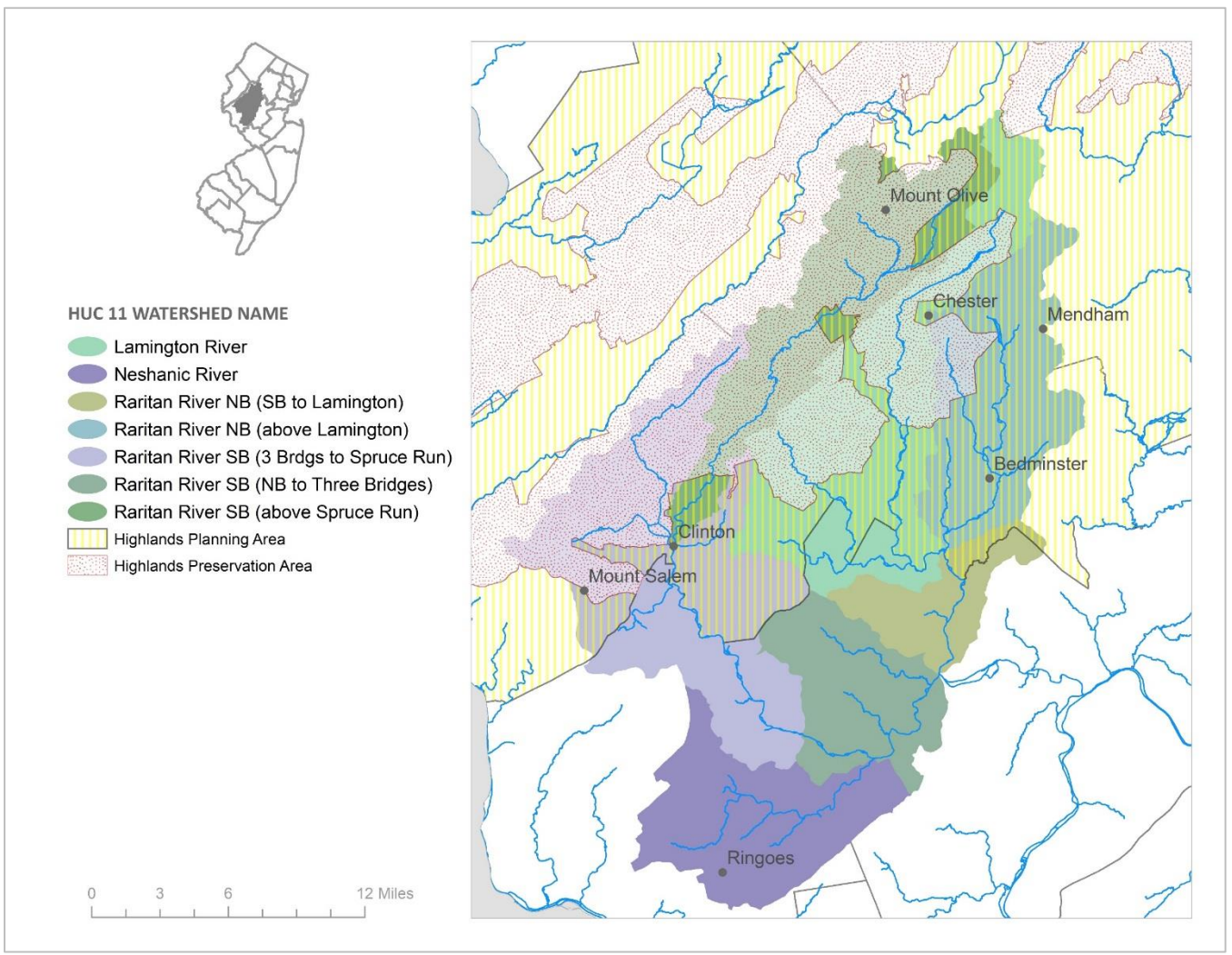
Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).

WATERSHED MANAGEMENT AREA 8

NORTH AND SOUTH BRANCH RARITAN



DESCRIPTION OF PLANNING AREA

Watershed Management Area 8 (WMA 8) is located in the Highlands and Piedmont Physiographic Provinces. There are seven HUC11 watersheds in WMA 8 including: South Branch Raritan River (above Spruce Run), South Branch Raritan River (Three Bridges to Spruce Run), South Branch Raritan River (North Branch to Three Bridges), North Branch Raritan River (above Lamington), North Branch Raritan River (South Branch to Lamington), Lamington River and Neshanic River. WMA 8 lies in portions of Somerset, Hunterdon and Morris Counties.

Major tributaries to the North Branch Raritan River include Peapack Brook, Rockaway Creek and Lamington River. The North Branch of the Raritan River is 23 miles long and flows from northwestern Morris County through Somerset County to its confluence with the South Branch Raritan River between the towns of Branchburg and Raritan. The watershed land use characteristics include a mixture of rural, woodland and agriculture interspersed with areas of commercial and residential development (some of which is intensive along the major roadway corridors).

Major tributaries to the South Branch Raritan River include the Neshanic River, Spruce Run Creek, Mulhockaway Creek and Cakepoulin Creek. Major surface water impoundments are the Spruce Run and Round Valley Reservoirs. For additional information pertaining to these reservoirs, please refer to Chapter 3. The South Branch of the Raritan River is 51 miles long and flows from western Morris County through central Hunterdon County into western Somerset County before joining the North Branch and forming the main stem of the Raritan River. Agriculture remains the predominant land use type in the South Branch Raritan River Watershed, although suburban-commercial development is increasing at a rapid rate.

Table A.8.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02030105010	Raritan River SB (above Spruce Run)
02030105020	Raritan River SB (3 Brdgs to Spruce Run)
02030105030	Neshanic River
02030105040	Raritan River SB (NB to Three Bridges)
02030105050	Lamington River
02030105060	Raritan River NB (above Lamington)
02030105070	Raritan River NB (SB to Lamington)

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 8 surface water withdrawals comprise 15% of the total withdraw and unconfined groundwater comprises 85%. There are no major confined aquifers in this WMA. There are no significant power generation water sources. Potable supply is 90% of the total withdrawal, with 90% coming from unconfined groundwater sources and the remaining 10% from surface water sources. Combined commercial, industrial and mining make up 6% of the total withdrawal, with 55% coming from surface water sources and 45% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 4% of total water withdrawals, with 39% coming from unconfined groundwater sources and 61% from surface water sources. Figure A.8.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.8.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 2002-2003 with relatively stable and lower rates before and after. Annual withdrawals by source and use sector are shown in table A.8.2.

Annual consumptive loss peaked in 2014 with an overall increasing trend from 1990 to 2015. Consumptive losses were almost entirely from potable supply uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2010. Refer to figures A.8.3 and A.8.4.

Almost all (97%) of the total sanitary sewer discharges are to fresh surface water sources. The remaining 3% of the discharges are to groundwater. Discharges average about 27 mgd over the period of record. Refer to Figure A.8.5.

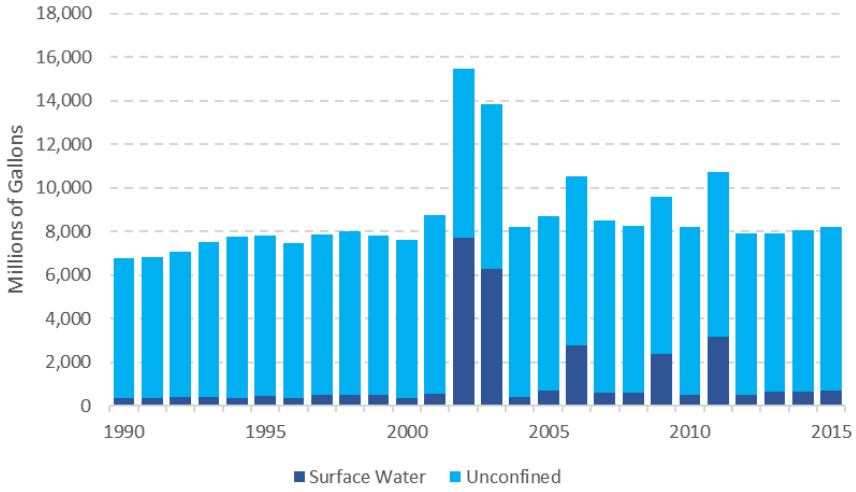


Figure A.8.1. Annual withdrawals by source.

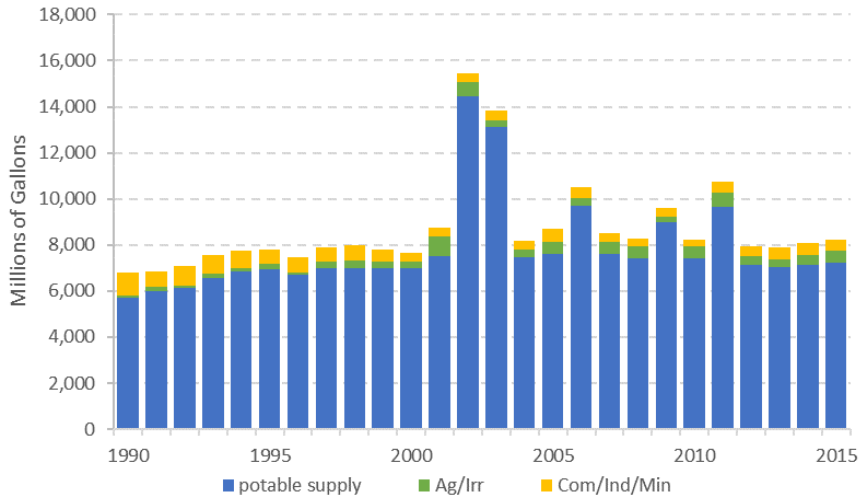


Figure A.8.2. Annual withdrawals by use sector.

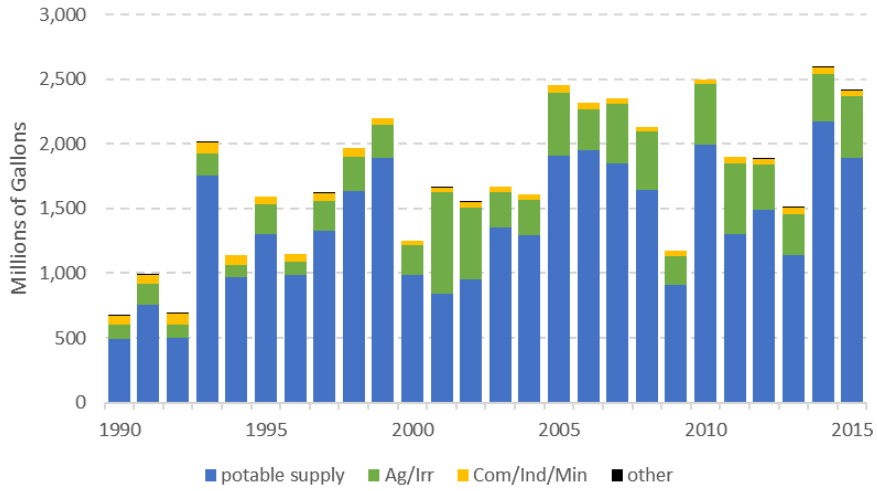


Figure A.8.3. Annual consumptive loss by use sector

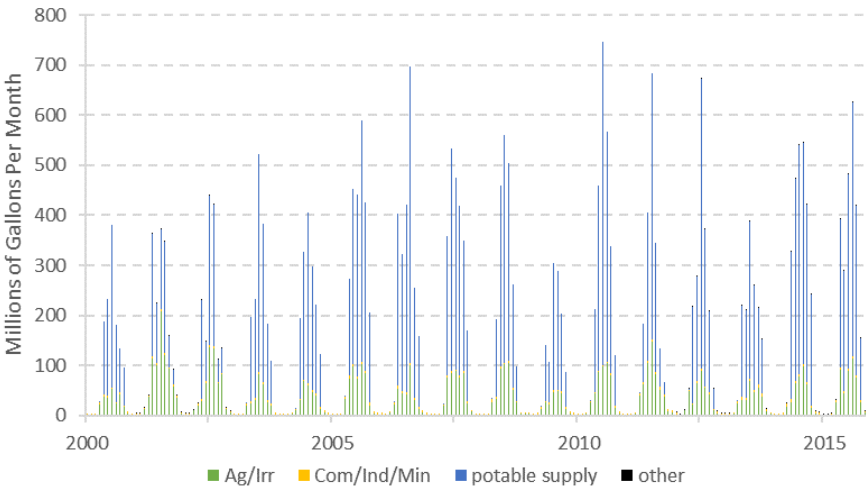


Figure A.8.4. Monthly consumptive loss by use sector

Table A.8.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	93	30		270	707		0	5,691				
1991	143	40		240	443		0	5,981				
1992	64	46		326	529		1	6,121				
1993	108	80		320	482		1	6,552				
1994	47	62		314	461		0	6,865				
1995	155	100		314	304		1	6,943				
1996	64	58		310	349		0	6,691				
1997	179	69		310	310		1	7,010				
1998	194	98		330	371		0	7,012				
1999	228	60		268	279		0	6,969				
2000	209	53		170	190		10	7,001				
2001	356	517		200	181		0	7,514				
2002	259	361		207	180		7,233	7,214				
2003	202	100		214	211		5,855	7,250				
2004	189	120		241	164		0	7,478				
2005	366	178		363	181		0	7,602				
2006	213	143		366	112		2,197	7,487				
2007	358	160		274	121		0	7,601				
2008	348	154		239	106		0	7,427				
2009	153	96		304	87		1,909	7,070				
2010	295	224		231	85		0	7,405				
2011	427	182		367	94		2,400	7,254				
2012	223	162		293	88		4	7,147				
2013	226	119		435	84		4	7,037				
2014	239	175		427	84		5	7,151				
2015	319	213		373	88		6	7,210				

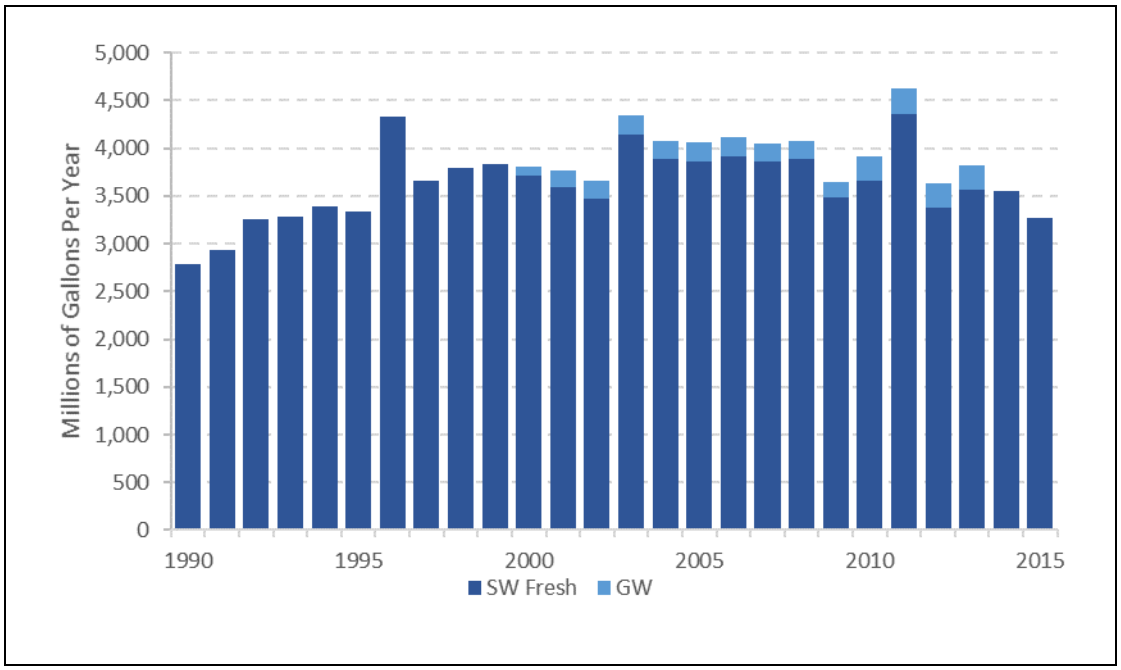


Figure A.8.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Twenty-three water purveyors which serve more than 1,000 people provide potable water to one or more of the 7 HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.8.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 38% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by 0.55, 1.09, 1.64, 2.19 and 2.73 mgd by 2020, 2025, 2030, 2035 and 2040, respectively. Table A.8.4 contains the demand estimates by HUC11. One hundred twenty-five (125) gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.8.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030105010	02030105020	02030105030	02030105040	02030105050	02030105060	02030105070
NJ0712001	NJ American - Passaic					X	X	X
NJ1004001	Aqua NJ – Califon	X						
NJ1005001	Clinton WD	X	X			X		
NJ1009001	Flemington WD		X	X				
NJ1012001	Glen Gardner WD		X					
NJ1013001	Hampton Borough WD		X					
NJ1014001	High Bridge WD	X	X					
NJ1025001	Edna Mahan Correctional		X					
NJ1420001	Mine Hill WD					X		
NJ1426004	Suez Water NJ Arlington Hills					X		
NJ1426005	Mount Arlington Boro DWP Main	X				X		
NJ1427001	Mt Olive Villages WC	X						
NJ1427005	Mt Olive Twp - Flanders	X						
NJ1427007	Mt Olive Twp - Village Green	X						
NJ1427018	Morris Chase/ Morris Hunt PCWS	X						
NJ1432003	Randolph Twp Public Works Dept					X	X	
NJ1436002	Roxbury WC	X				X		
NJ1436003	Roxbury Twp WD - Shore Hills	X				X		
NJ1436004	Roxbury Twp WD - Skyview	X				X		
NJ1438003	Washington Twp MUA - Hager	X				X		
NJ1438004	Washington Twp MUA - Schooleys Mountain	X				X		

Table A.8.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030105010	02030105020	02030105030	02030105040	02030105050	02030105060	02030105070
NJ2004002	NJ American - Raritan		X	X	X	X		X
NJ2108001	Hackettstown MUA	X						

Table A.8.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02030105010	0.07	0.13	0.20	0.26	0.33
02030105020	0.11	0.22	0.32	0.43	0.54
02030105030	0.08	0.17	0.25	0.34	0.42
02030105040	0.11	0.22	0.33	0.44	0.55
02030105050	0.09	0.18	0.28	0.37	0.46
02030105060	0.03	0.06	0.09	0.12	0.15
02030105070	0.06	0.11	0.17	0.22	0.28
Total	**0.55**	**1.09**	**1.64**	**2.19**	**2.73**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.8.8 and A.8.9 indicate that there is a total of 21 mgd of natural resource availability in WMA 8 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 9 mgd of available water remaining and at full allocation rates 0 mgd of water is remaining. Table A.8.5 shows that of the 7 HUC11s in the WMA, 2 have used all the available water and 3 would have used all the available water if full allocation diversion rates were used. Under current conditions, potable supply uses are the major loss in 3 HUC11s and under full allocation

diversion rates potable supply is the largest loss in 6 HUC11s. See tables A.8.5, A.8.6 and A.8.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.8.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02030105010	15.7	All	Yes		25%	2001	3.9	5.9	151%	0.0	8.4	215%	0.0	Potable	Potable
02030105020	18.1	Partial	Yes	Yes	25%	2012	4.5	-0.6	Net Gain	5.1	2.8	61%	1.8	Ag Irr	Potable
02030105030	3.1		Yes	Yes	25%	2001	0.8	1.5	197%	0.0	3.0	389%	0.0	Non-Ag Irr	Potable
02030105040	6.1	Partial	Yes	Yes	25%	2002	1.5	1.5	100%	0.0	1.5	95%	0.1	Ag Irr	Potable
02030105050	23.2	Partial	Yes	Yes	25%	2001	5.8	4.2	72%	1.6	7.5	130%	0.0	Potable	Potable
02030105060	14.3	All	Yes	Yes	25%	2010	3.6	-1.2	Net Gain	4.7	-0.2	Net Gain	3.8	Non-Ag Irr	Non-Ag Irr
02030105070	1.8	Partial	Yes	Yes	25%	2005	0.4	0.4	88%	0.1	1.2	262%	0.0	Potable	Potable

*** Remaining available water for depletive/consumptive uses

Table A.8.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02030105010	6.0	0.0	1.6	0.1	0.0	1.6	0.0	0.0	0.2	0.0	0.0	8.3	0.2	0.0	8.5	0.0
02030105020	2.8	0.0	2.3	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	4.8	0.1	0.0	4.9	0.0
02030105030	0.5	0.0	1.2	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	2.5	0.0	0.0	2.5	0.0
02030105040	0.0	0.0	1.1	0.0	0.0	1.7	0.0	0.0	0.1	0.0	0.0	2.5	0.1	0.0	2.5	0.0
02030105050	5.3	0.0	2.1	0.2	0.6	0.8	0.0	0.0	0.3	0.0	0.0	7.5	0.9	0.0	8.5	0.0
02030105060	0.3	0.0	1.0	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	1.4	0.2	0.0	1.6	0.0
02030105070	0.3	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.9	0.0

Table A.8.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02030105010	0.27	0.9	0.0	1.2	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	1.7	0.9	2.6
02030105020	0.04	3.6	0.0	1.7	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.8	3.7	5.5

Table A.8.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02030105030	0.00	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	1.0	0.0	1.0
02030105040	0.03	0.0	0.0	0.8	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0
02030105050	0.08	1.8	0.0	1.5	0.2	0.6	0.1	0.0	0.0	0.0	0.0	0.0	1.9	2.4	4.3
02030105060	0.05	2.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	2.0	2.8
02030105070	0.00	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

The major surface water reservoirs in WMA 8 are the Spruce Run and Round Valley Reservoirs which are owned and operated by the New Jersey Water Supply Authority. These are discussed in WMA 9.

AVAILABLE WATER FROM CONFINED AQUIFERS

There are no significant regionally confined aquifers or withdrawals from confined aquifer in WMA 8. Some locally confined wells may be present, but the extent of the confined aquifer is relatively small compared to NJ's coastal plain confined aquifers.

SUMMARY AND MANAGEMENT OPTIONS

Table A.8.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
8	North and South Branch Raritan		21		21		12		12		9		9	0.5	8.5

Table A.8.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
8	North and South Branch Raritan	431	22			-3.6				3.4	

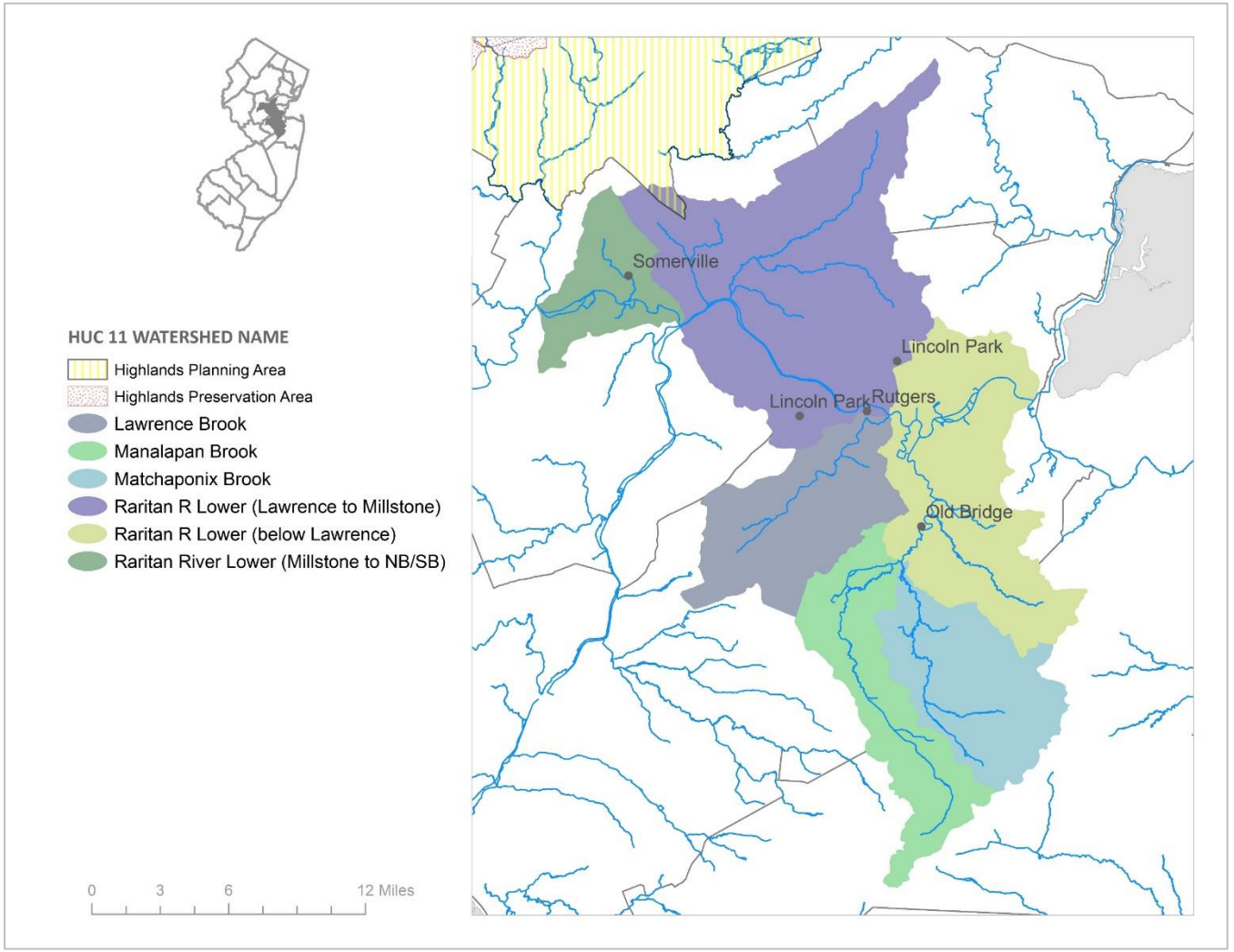
Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Raritan River SB (above Spruce Run) and Neshanic River HUC11 watersheds should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Lamington River and the North Branch Raritan River (South Branch to Lamington) HUC11 as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
- Allow no additional depletive/consumptive uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield or entering a contract with the New Jersey Water Supply Authority.
- Utilize available safe yield and/or interconnections to offset existing and potential depletive/consumptive losses associated with unconfined groundwater uses.
- Retain properties associated with the Six Mile Run and the Confluence Pump Station and reevaluate the feasibility of developing these properties as a future capital water supply projects (Policy Item # 4).
- For HUC11 watersheds that are located wholly within the New Jersey Highlands, please refer to the Highlands Regional Master Plan at http://www.nj.gov/njhighlands/master/

WATERSHED MANAGEMENT AREA 9

LOWER RARITAN, SOUTH AND LAWRENCE



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 9 is located in the state's Piedmont and Coastal Plain physiographic provinces. Six individual HUC11 watersheds comprise WMA 9, as depicted above. Major water bodies include the main stem of the Raritan River, the South River and Lawrence Brook within Middlesex, Somerset and Monmouth Counties.

The main stem of the Raritan River extends generally eastward from the confluence of the North and South Branches of the Raritan to the Raritan Bay. For the most part, this drainage area is a densely populated mixed urban/suburban landscape characterized primarily by residential and commercial/industrial water usage. Among the many small recreational lakes and ponds in this area are Watchung Lake, Surprise Lake, Spring Lake and Green Brook Pond (all manmade).

The South River begins at Duhernal Lake in Spotswood and flows to the Raritan River at Sayreville. It is formed by the confluence of the Manalapan and Matchaponix Brooks along with tributaries that include Deep River and Tennants Brook. Land use in the upper part of the Manalapan and Matchaponix Brooks HUC11 watersheds is predominantly agricultural and forested, while in the South River HUC11 commercial/industrial and residential development is progressively being introduced amid existing, established development centers.

Table A.9.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02030105080	Raritan River Lower (Millstone to NB/SB)
02030105120	Raritan R Lower (Lawrence to Millstone)
02030105130	Lawrence Brook
02030105140	Manalapan Brook
02030105150	Matchaponix Brook
02030105160	Raritan R Lower (below Lawrence)

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 9 surface water withdrawals comprise 71%, unconfined groundwater withdrawals comprise 23% and confined aquifer withdrawals comprise 6% of the total withdraw. Power generation is not significant use. Potable supply is 95% of the total withdrawal, with 22% coming from unconfined groundwater sources, 4% coming from confined aquifer sources, and the remaining 74% from surface water sources. Combined commercial, industrial and mining make up 4% of the total withdrawal, with 13% coming from surface water sources, 47% from confined aquifer sources, and 40% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 1% of total water withdrawals, with 22% coming from unconfined groundwater sources, 18% from confined aquifer sources, and 61% from surface water sources. Figure A.9.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.9.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 2002 and show a flat trend from 1990 to 2013 and a steep drop in 2014 and 2015. Annual withdrawals by source and use sector are shown in table A.9.2.

Annual consumptive loss peaked in 2010 with an overall slightly upward trend from 1990 to 2015. Almost all consumptive loss is from potable supply uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2010. Refer to figures A.9.3 and A.9.4.

Almost all (97%) of the total sanitary sewer discharges are to fresh surface water sources. The remaining 3% of the discharges are to groundwater. Discharges average about 62 mgd over the period of record. Refer to Figure A.9.5.

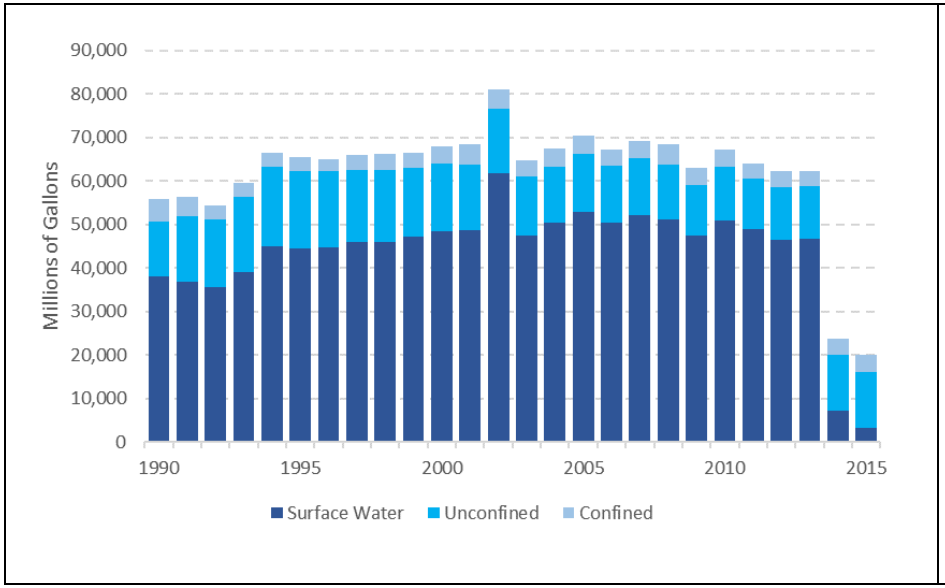


Figure A.9.1. Annual withdrawals by source.

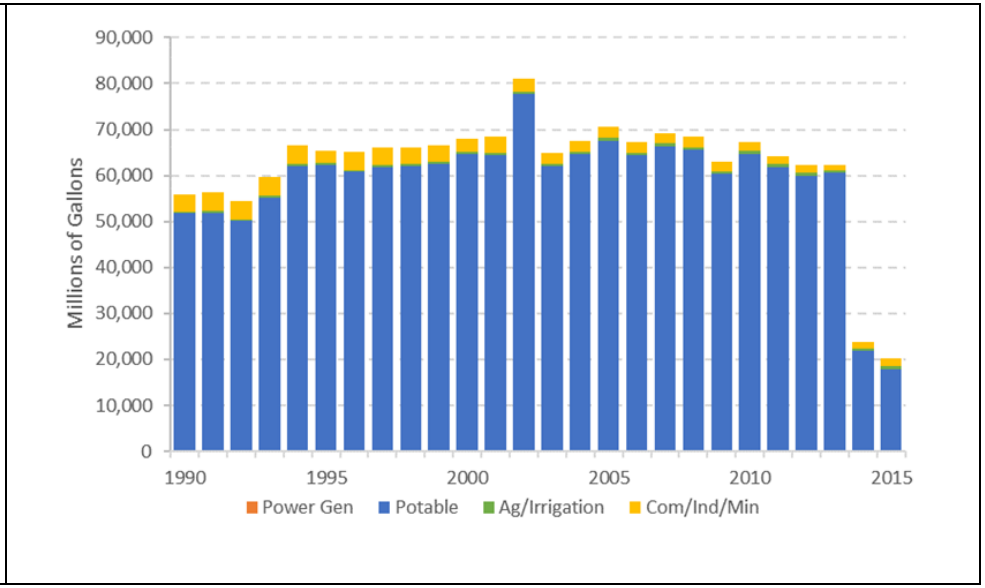


Figure A.9.2. Annual withdrawals by use sector.

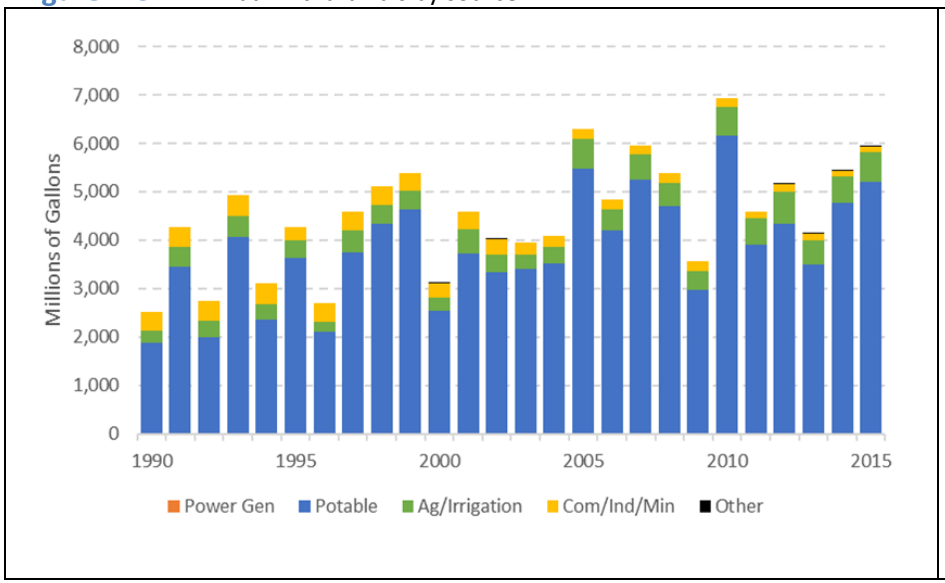


Figure A.9.3. Annual consumptive loss by use sector

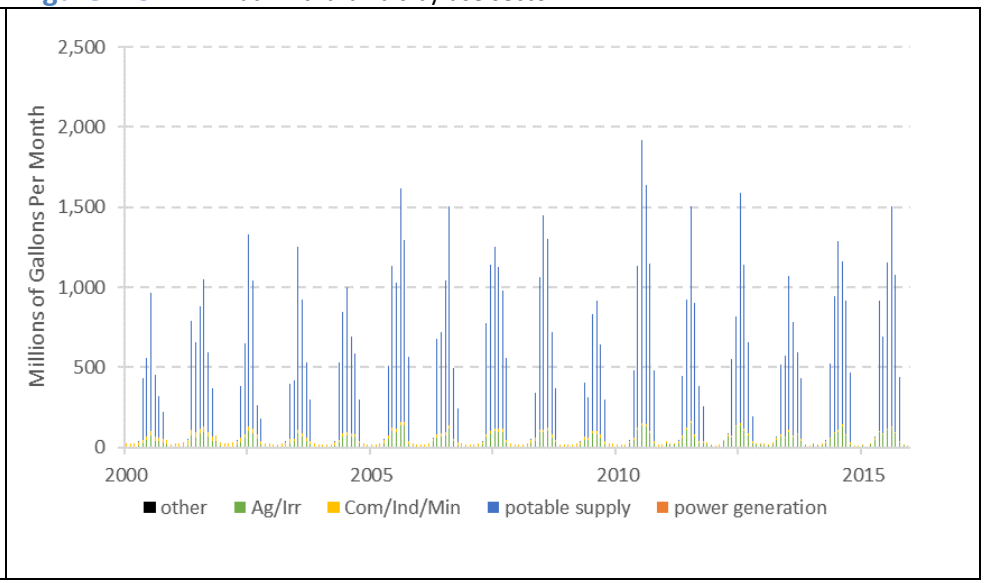


Figure A.9.4. Monthly consumptive loss by use sector

Table A.9.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	128	61	79	764	2,609	413	37,292	9,969	4,513			
1991	245	95	112	773	1,919	1,177	35,947	13,032	2,952		10	
1992	166	92	108	884	1,694	1,315	34,539	13,752	1,825		1	
1993	252	132	108	961	1,727	1,249	37,838	15,421	1,888			
1994	194	91	62	1,232	1,528	1,386	43,683	16,573	1,864		8	
1995	203	104	83	518	1,223	915	43,859	16,501	2,004		8	
1996	134	61	15	1,051	1,833	1,036	43,616	15,657	1,649		6	
1997	338	131	34	855	1,509	1,256	44,700	15,082	2,061		5	
1998	267	138	14	807	1,389	1,475	44,941	14,910	2,203		4	
1999	279	154	7	592	1,499	1,432	46,429	14,144	2,022			
2000	194	62	58	39	1,504	1,371	48,237	13,880	2,614			
2001	319	123	94	528	1,595	1,390	47,829	13,455	3,034			
2002	258	77	94	191	1,473	1,378	61,312	13,344	3,041			
2003	193	57	80	59	792	1,577	47,147	12,707	2,284		0	
2004	238	66	97	27	710	1,676	50,124	12,167	2,478		0	
2005	375	133	162	46	707	1,617	52,483	12,439	2,540		0	
2006	314	75	92	9	716	1,561	50,190	12,126	2,078		0	
2007	333	107	144	23	591	1,645	51,781	12,375	2,209		0	
2008	295	107	124	9	623	1,690	50,989	11,711	2,886		0	
2009	264	83	83	16	527	1,590	47,285	10,883	2,289			
2010	372	159	127	13	568	1,284	50,509	11,577	2,634			
2011	455	91	73	13	511	1,147	48,503	11,012	2,286			
2012	550	109	89	14	501	1,191	45,867	11,461	2,578			
2013	385	102	76	15	457	795	46,320	11,634	2,590			
2014	385	135	74	14	467	916	6,955	12,088	2,732			
2015	414	170	105	17	423	1,051	2,906	12,108	2,937			

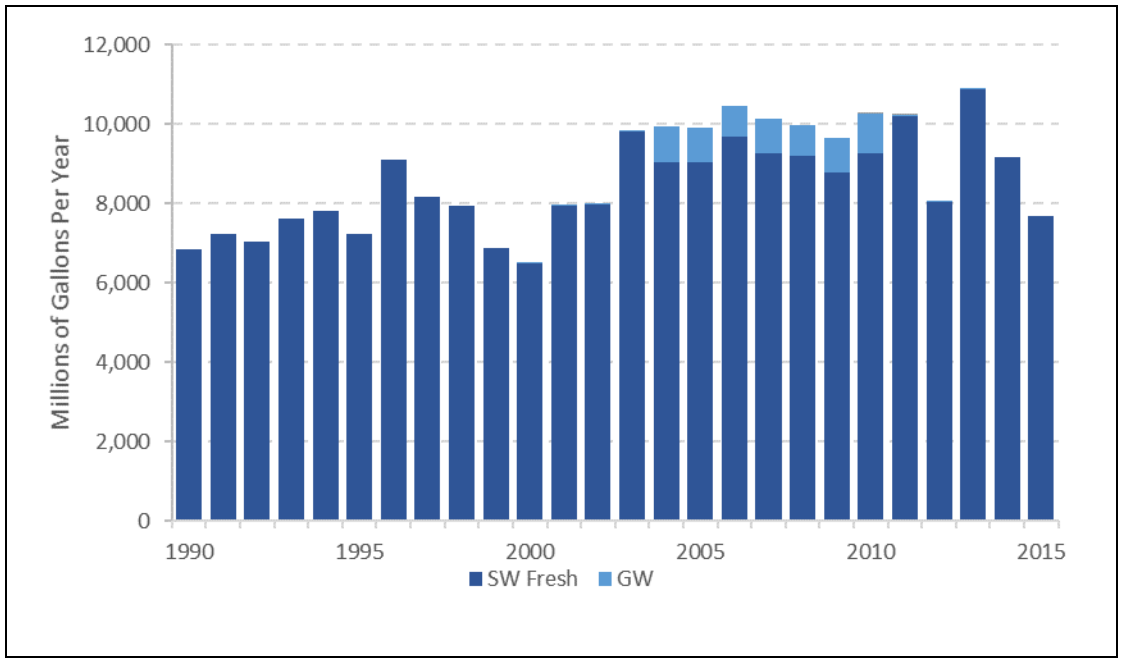


Figure A.9.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Twenty-five water purveyors which serve more than 1,000 people provide potable water to one or more of the 6 HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.9.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 2% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by 3.92, 7.83, 11.75, 15.66 and 19.58 mgd by 2020, 2025, 2030, 2035 and 2040, respectively. Table A.9.4 contains the demand estimates by HUC11. One hundred twenty-five (125) gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.9.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030105080	02030105120	02030105130	02030105140	02030105150	02030105160
NJ0712001	NJ American - Passaic		X				
NJ1204001	East Brunswick Water and Sewer Utility		X	X	X		X
NJ1205001	NJ American - Edison		X				X
NJ1206001	Helmetta WD				X		
NJ1207001	Highland Park WD		X				
NJ1209002	Old Bridge MUA					X	X
NJ1212001	Milltown WD			X			
NJ1213002	Monroe Twp UD				X	X	
NJ1214001	New Brunswick WD		X	X			
NJ1215001	North Brunswick WD		X	X			
NJ1216001	Perth Amboy WD						X
NJ1219001	Sayreville WD						X
NJ1221004	South Brunswick WD			X	X		
NJ1223001	South River WD			X			X
NJ1224001	Spotswood WD				X	X	X
NJ1225001	Middlesex WC		X				X
NJ1312001	Englishtown WD				X	X	
NJ1315001	Freehold Boro WD					X	
NJ1316001	Freehold Twp WD				X	X	
NJ1326001	Gordon's Corner WC				X	X	
NJ1326002	Suez Water Manalapan - Knob Hill				X	X	

Table A.9.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030105080	02030105120	02030105130	02030105140	02030105150	02030105160
NJ1326005	Suez Water Manalapan - Milhurst				X	X	
NJ1328002	Marlboro Twp MUA					X	X
NJ1808001	Franklin Twp DPW		X	X			
NJ2004002	NJ American - Raritan	X	X				

Table A.9.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02030105080	0.22	0.44	0.66	0.88	1.11
02030105120	1.73	3.46	5.18	6.91	8.64
02030105130	0.65	1.29	1.94	2.58	3.23
02030105140	0.25	0.49	0.74	0.99	1.23
02030105150	0.20	0.40	0.60	0.81	1.01
02030105160	0.87	1.74	2.62	3.49	4.36
Total	**3.92**	**7.83**	**11.75**	**15.66**	**19.58**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.9.8 and A.9.9 indicate that there is a total of 13 mgd of natural resource availability in WMA 9 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 0 mgd of available water remaining and at full allocation rates 0 mgd of water is remaining. Table A.9.5 shows that of the 6 HUC11s in the WMA, 4 have used all the available water and 3 would have used all the available water if full

allocation diversion rates were used. One HUC11 has a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, potable supply uses are the major loss in 5 HUC11s and under full allocation diversion rates potable supply is the largest loss in 5 HUC11s. See tables A.9.5, A.9.6 and A.9.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.9.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02030105080	1.2		Yes	Yes	25%	2013	0.3	0.1	51%	0.1	-8.1	Net Gain	8.4	Potable	Ag Irr
02030105120	13.6	Partial	Yes	Yes	25%	2001	3.4	17.3	510%	0.0	59.0	1738%	0.0	Potable	Potable
02030105130	5.3			Yes	25%	2005	1.3	6.2	462%	0.0	1.1	85%	0.2	Potable	Ag Irr
02030105140	10.3				25%	2001	2.6	4.0	156%	0.0	2.4	93%	0.2	Con Aq Leak	Potable
02030105150	10.1				25%	2003	2.5	2.5	98%	0.1	7.7	304%	0.0	Potable	Potable
02030105160	12.4			Yes	25%	2011	3.1	13.6	437%	0.0	14.1	453%	0.0	Potable	Potable

Table A.9.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02030105080	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.6	0.1	0.0	0.7	0.0
02030105120	18.2	0.0	2.0	1.8	0.0	0.0	0.0	0.4	0.3	0.0	0.0	20.1	0.3	0.0	20.5	120.1
02030105130	0.0	4.5	0.2	0.1	0.0	0.0	0.4	0.3	0.1	0.0	0.0	0.5	5.0	1.0	6.4	0.0
02030105140	1.5	0.0	0.5	0.0	0.0	0.0	0.1	0.0	0.4	0.0	0.0	1.8	0.5	2.1	4.4	0.0
02030105150	4.3	2.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	2.7	1.2	8.1	0.0
02030105160	12.9	3.9	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	4.0	0.5	16.4	0.0

Table A.9.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02030105080	0.02	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5
02030105120	0.00	0.0	0.0	1.5	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0	3.1
02030105130	0.00	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.3
02030105140	0.00	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.4

Table A.9.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
HUC11	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02030105150	0.00	5.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	5.3	5.6
02030105160	0.00	0.0	0.0	0.2	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	2.9

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

In WMAs 8, 9 and 10, the New Jersey Water Supply Authority (NJWSA) owns and operates a surface water supply complex that supplies a large quantity of water to customers in Middlesex, Hunterdon, Mercer, Somerset, Union, and Monmouth Counties. This complex is composed of three facilities: Spruce Run Reservoir (WMA 8), Round Valley Reservoir (WMA 8) and the Delaware & Raritan Canal (WMAs 9 and 10). Together, these resources operated by the NJWSA have a combined safe yield of 241 MGD (Spruce Run and Round Valley reservoirs = 176 MGD) and (Delaware & Raritan Canal = 65 MGD). Spruce Run Reservoir is located on the Spruce Run just north of Clinton, New Jersey. It has a drainage area of 41 square miles and a storage capacity of 11 billion gallons. It is filled through natural flow from its two largest tributaries – Spruce Run and Mulhockaway Creek – and discharges into the South Branch of the Raritan River near Clinton. Statutory passing flows of 40 MGD at the USGS gaging station at Stanton and 70 MGD at the USGS stream gage at Manville are required. The Round Valley Reservoir is located just east of Spruce Run Reservoir. It has a storage capacity of 55 BG and is almost entirely reliant on water pumped from the South Branch of the Raritan River at the Hamden Pumping Station, since its drainage area is a mere 5.7 square miles. Water can be released as needed to either the Hamden Pumping Station or the South Branch of Rockaway Creek (a tributary of the Lamington River) by gravity lines. Water released from either reservoir travels downstream to maintain flow at the intake of New Jersey American Water Raritan System and at the intakes of other users. There is also a required statutory passing flow of 90 MGD at the USGS stream gage at Bound Brook. New Jersey American Water(NJAW) – Raritan system owns and operates a public community water supply system that serves a large portion of central New Jersey, including 48 municipalities within the counties of Hunterdon, Mercer, Middlesex, Somerset and Union. NJAW diverts a substantial amount of water from surface water intakes located within WMA 9 at the confluence of the Raritan and Millstone Rivers.

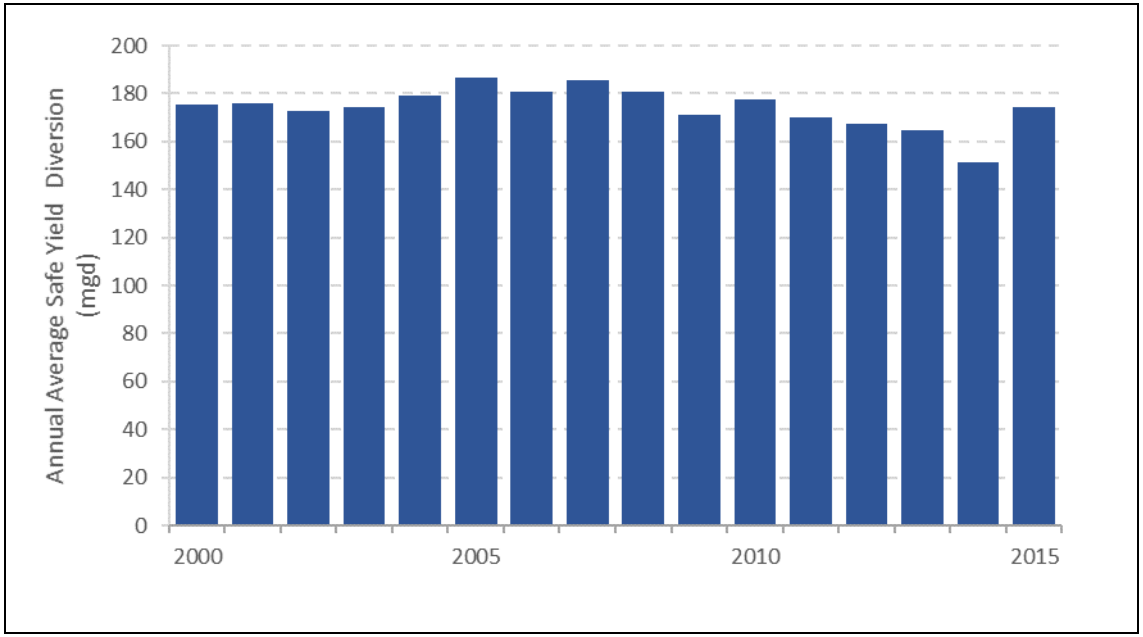


Figure A.9.6. NJWSA Raritan system average annual safe yield withdrawals

AVAILABLE WATER FROM CONFINED AQUIFERS

On the southern and eastern regions of the WMA several confined aquifers are present. These aquifers dip to east and eventually become the critical area 1 aquifers of WMA 13. Where these aquifer outcrop some recharge is occurring. See Appendix B for more details. Ground-water flow in confined aquifers is driven by the regional hydrostratigraphy and water elevation gradients and therefore does not typically follow surface watershed boundaries. Impacts to confined aquifers below a surface watershed may be caused by withdrawals outside of the surface watershed.

Table A.9.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
9	Lower Raritan, South, and Lawrence	241	13	21.7	275.7	187	44	14	245	54	-31	7.7	30.7	3.9	26.8

Table A.9.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
9	Lower Raritan, South, and Lawrence	251	63	22	0	-62.9	0			2.9	135

Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA

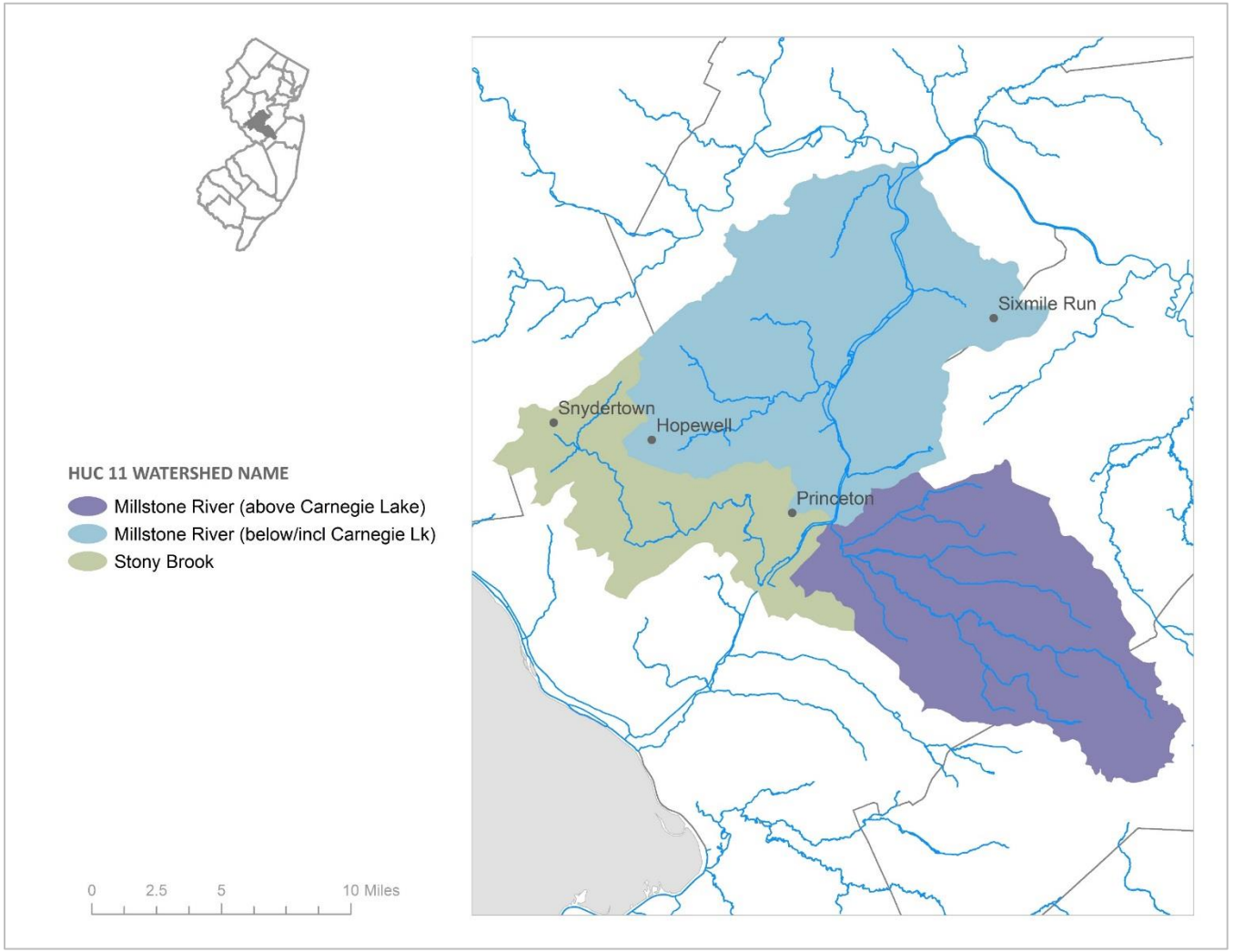
Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1). This is particularly critical throughout this WMA since nearly all HUC11 watersheds are stressed.

- Continue to utilize available safe yield from the New Jersey Water Supply Authority and/or interconnections to offset existing and potential depletive/consumptive losses associated with unconfined groundwater uses.
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in WMA 9 should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - As long as the deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- Allow no additional depletive/consumptive uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield or entering a contract with the New Jersey Water Supply Authority.
- Seek to make the Delaware and Raritan Canal diversion of 85 mgd (applicable under Delaware River Basin Commission- designated drought emergencies) allocable per NJ regulations. Currently the one-year Flexible Flow Management Plan (FFMP) program allows the 85 mgd diversion, but without a permanent Decree Party agreement this diversion would revert to the 65 mgd contained in the 1983 Good Faith Agreement.
- Coordinate with Middlesex Water Company to identify the estimated timeframe for initiating the final stage of construction for Middlesex Water Company's South River Basin Pipeline (Policy Item #3).
- Retain properties associated with the Six Mile Run and the Confluence Pump Station and reevaluate the feasibility of developing these properties as a future capital water supply projects (Policy Item # 4).

WATERSHED MANAGEMENT AREA 10

MILLSTONE



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 10 is located in New Jersey's Piedmont and Coastal Plain physiographic provinces, and includes the Millstone River and its tributaries. The Millstone River itself is a tributary to the Raritan River. WMA 10 lies in parts of Hunterdon, Somerset, Middlesex, Mercer and Monmouth Counties and is 284.4 square miles in size.

The Millstone River is 38 miles long and flows from Millstone Township in Monmouth County to its confluence with the Raritan River near Manville and Bound Brook. Approximately three-quarters of the Millstone River parallels the Delaware and Raritan Canal (D&R Canal) – an important transportation corridor during the 19th century. Both the Millstone River and D&R Canal provide drinking water to portions of central New Jersey. Major tributaries include the Stony Brook, Cranbury Brook, Bear Brook, Ten Mile River, Six Mile Run and Bedens Brook, and the largest impoundment is Carnegie Lake in Princeton. Traditional land uses in the Millstone Watershed primarily have been suburban development and scattered agriculture; however, extensive development is progressively altering the upper portion of the watershed.

Table A.10.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02030105090	Stony Brook
02030105100	Millstone River (above Carnegie Lake)
02030105110	Millstone River (below/incl Carnegie Lk)

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 10 surface water withdrawals comprise 6%, unconfined groundwater withdrawals comprise 62% and confined aquifer withdrawals comprise 32% of the total withdraw. Power generation is not significant use. Potable supply is 80% of the total withdrawal, with 62% coming from unconfined groundwater sources, 36% coming from confined aquifer sources, and the remaining 1% from surface water sources. Combined commercial, industrial and mining make up 9% of the total withdrawal, with 2% coming from surface water sources, 10% from confined aquifer sources, and 88% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 11% of total water withdrawals, with 38% coming from unconfined groundwater sources, 19% from confined aquifer sources, and 43% from surface water sources. Figure A.10.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.10.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 2011 and show a flat trend from 1990 to 2015. Annual withdrawals by source and use sector are shown in table A.10.2.

Annual consumptive loss peaked in 2010 with an overall slightly upward trend from 1990 to 2015. Almost all consumptive loss is from potable supply uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2010. Refer to figures A.9.3 and A.9.4.

Almost all (97%) of the total sanitary sewer discharges are to fresh surface water sources. The remaining 3% of the discharges are to groundwater. Discharges average about 62 mgd over the period of record. Refer to Figure A.9.5.

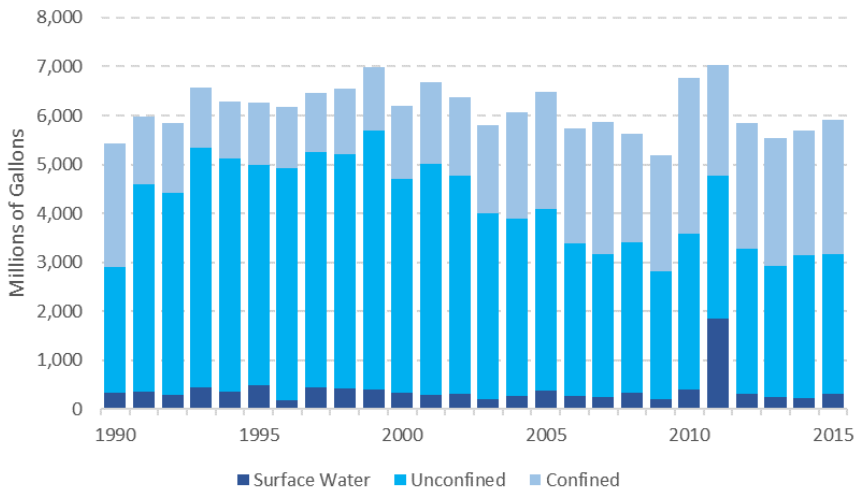


Figure A.9.1. Annual withdrawals by source.

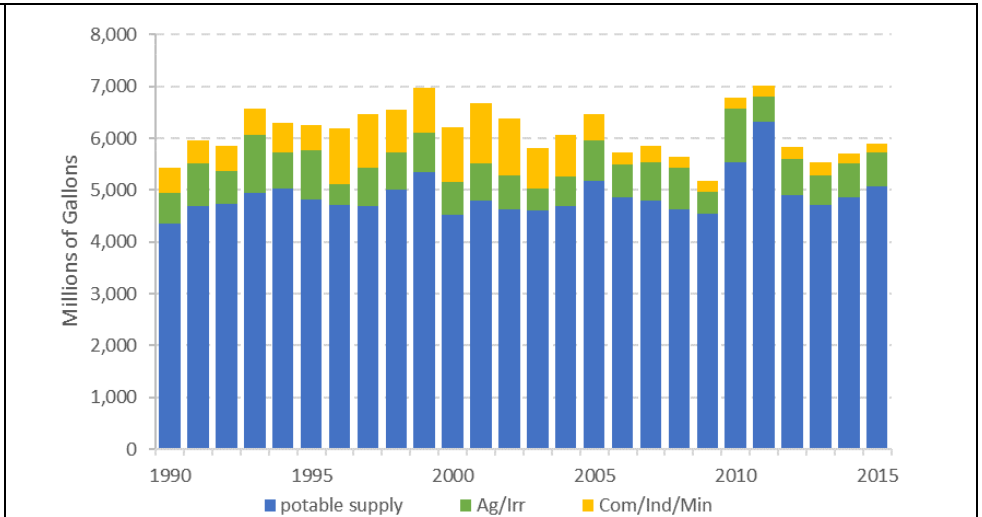


Figure A.9.2. Annual withdrawals by use sector.

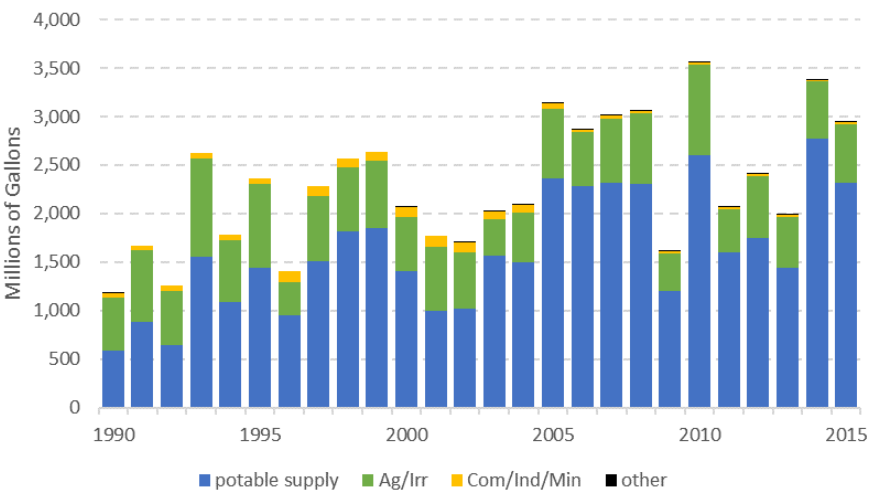


Figure A.9.3. Annual consumptive loss by use sector

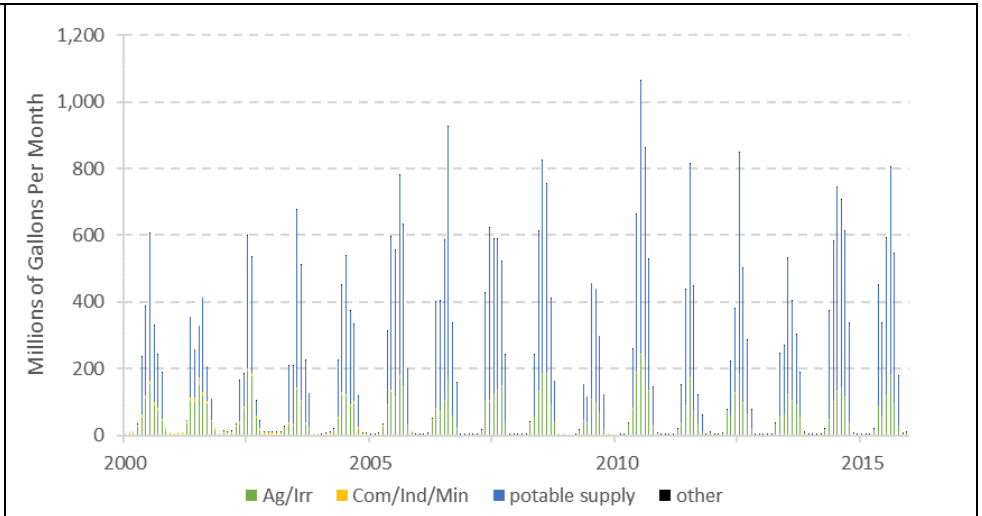


Figure A.9.4. Monthly consumptive loss by use sector

Table A.10.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	269	151	181		368	107	60	2,053	2,237			
1991	359	199	267		356	100	0	3,675	1,013			
1992	282	118	231		380	101	0	3,639	1,094			
1993	435	508	175		431	84	12	3,954	977			
1994	359	218	124	0	473	90	0	4,069	962			
1995	497	279	180	0	402	93	0	3,820	990			
1996	175	125	86	0	995	86	0	3,625	1,093			
1997	437	179	137	0	943	75	0	3,685	1,001			
1998	367	232	126	1	764	55	51	3,788	1,167			
1999	413	259	94	0	834	37	0	4,180	1,163			
2000	308	219	99	11	1,014	34	8	3,154	1,361			
2001	281	338	114	16	1,082	54	0	3,297	1,489			
2002	251	325	69	63	976	58	8	3,136	1,493			
2003	169	193	57	36	701	35	0	2,892	1,719			
2004	239	245	79	28	749	37	4	2,637	2,053			
2005	346	307	131	34	443	45	0	2,967	2,200			
2006	244	278	93	18	183	42	0	2,660	2,209			
2007	225	380	127	16	271	45	0	2,281	2,519			
2008	306	371	130	11	162	37	9	2,548	2,063			
2009	179	158	91	6	187	21	27	2,256	2,259			
2010	375	468	193	18	158	34	0	2,575	2,954			
2011	230	152	100	11	191	26	1,607	2,569	2,135			
2012	271	323	98	8	191	34	28	2,465	2,419			
2013	252	194	126	6	198	38	0	2,268	2,453			
2014	228	298	118	5	153	34	0	2,472	2,391			
2015	278	195	180	9	146	30	20	2,515	2,530			

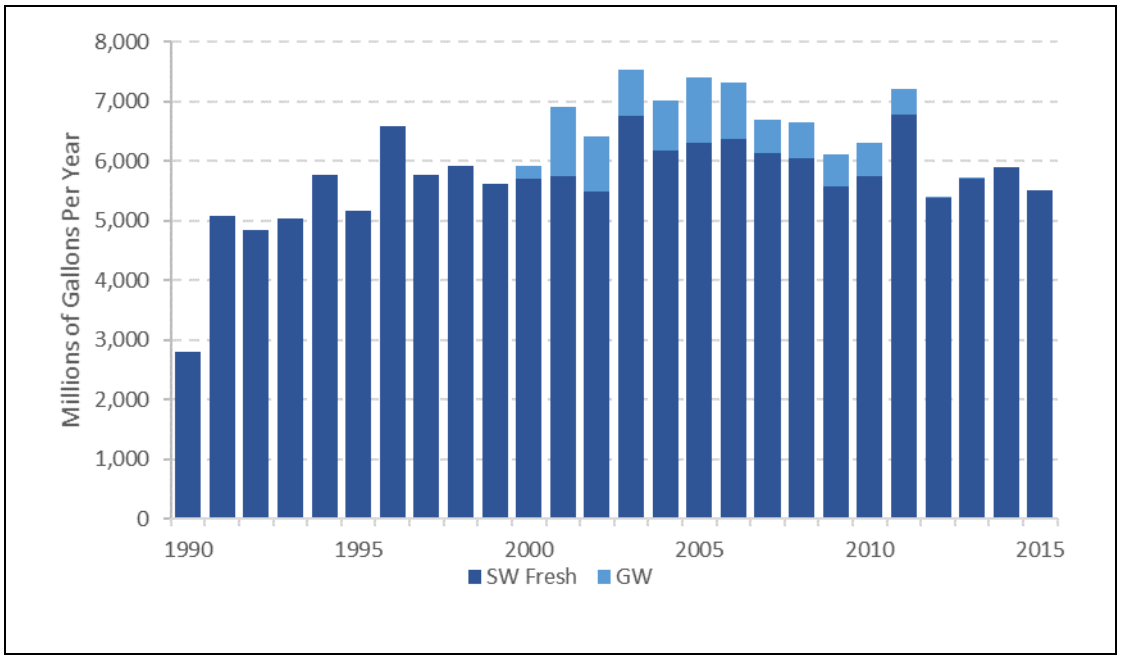


Figure A.10.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Twelve water purveyors which serve more than 1,000 people provide potable water to one or more of the 3 HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.10.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 3% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by 1.03, 2.23, 3.44, 4.55 and 5.59 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.10.4 contains the demand estimates by HUC11. 125 gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.10.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030105090	02030105100	02030105110
NJ1101002	East Windsor MUA		X	
NJ1103001	Aqua NJ - Hamilton Square		X	
NJ1104001	Hightstown WD		X	
NJ1105001	Hopewell Boro WD	X		X
NJ1108001	Pennington WD	X		
NJ1111001	Trenton Water Works	X		
NJ1213002	Monroe Twp UD		X	
NJ1215001	North Brunswick WD			X
NJ1221004	South Brunswick WD		X	X
NJ1326002	Suez Water Manalapan - Knob Hill		X	
NJ1808001	Franklin Twp DPW			X
NJ2004002	NJ American - Raritan	X	X	X

Table A.10.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02030105090	0.06	0.19	0.32	0.44	0.54
02030105100	0.36	0.80	1.24	1.61	1.94
02030105110	0.61	1.24	1.87	2.50	3.11
Total	**1.03**	**2.23**	**3.44**	**4.55**	**5.59**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.10.8 and A.10.9 indicate that there is a total of 8 mgd of natural resource availability in WMA XX using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 8 mgd of available water remaining and at full allocation rates 0 mgd of water is remaining. Table A.10.5 shows that of the 3 HUC11s in the WMA, 2 have used all the available water and 2 would have used all the available water if full allocation diversion rates were used. 1 HUC11 has a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, potable supply uses are the major loss in 1 HUC11s and under full allocation diversion rates potable supply is the largest loss in 1 HUC11s. See tables A.10.5, A.10.6 and A.10.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.10.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02030105090	3.2		Yes	Yes	25%	2001	0.8	1.5	188%	0.0	4.0	500%	0.0	Potable	Potable
02030105100	14.3		Yes	Yes	25%	2010	3.6	5.3	150%	0.0	13.4	375%	0.0	Con Aq Leak	Ag Irr
02030105110	13.0		Yes	Yes	25%	2010	3.2	-6.4	Net Gain	9.6	-4.1	Net Gain	7.4	Non-Ag Irr	Non-Ag Irr

Table A.10.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02030105090	1.4	0.0	0.8	0.3	0.1	0.0	0.0	0.2	0.2	0.0	0.0	2.4	0.3	0.0	2.7	0.0
02030105100	5.1	0.0	1.0	0.1	0.0	2.7	0.2	0.2	0.4	0.0	0.0	8.2	0.6	3.2	12.0	0.0
02030105110	0.2	0.0	2.0	0.2	0.0	0.3	0.0	0.6	0.4	0.0	0.0	3.0	0.4	0.0	3.3	0.0

Table A.10.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02030105090	0.00	0.2	0.0	0.6	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.3	1.2
02030105100	1.37	3.8	0.0	0.7	0.3	0.0	0.3	0.0	0.1	0.0	0.0	0.0	2.8	3.9	6.7
02030105110	0.01	7.9	0.0	1.5	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	1.8	8.0	9.7

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

There are no major reservoirs located in WMA 01. Some smaller reservoir systems may be present and while critical to the residents that rely of them, they are not covered in this statewide plan.

AVAILABLE WATER FROM CONFINED AQUIFERS

On the southern and eastern regions of the WMA several confined aquifers are present. These aquifers dip to east and eventually become the Critical Area 1 aquifers of WMA 13. Where these aquifer outcrop some recharge is occurring. See Appendix B for more details. Ground-water flow in confined aquifers is driven by the regional hydrostratigraphy and water elevation gradients and therefore does not typically follow surface watershed boundaries. Impacts to confined aquifers below a surface watershed may be caused by withdrawals outside of the surface watershed.

SUMMARY AND MANAGEMENT OPTIONS

Table A.10.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
10	Millstone		8	9.2	17.2		0	9	9		8	0.2	8.2	1	7.2

Table A.10.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
10	Millstone	69	17	9		-5.6	0			0.5	

Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

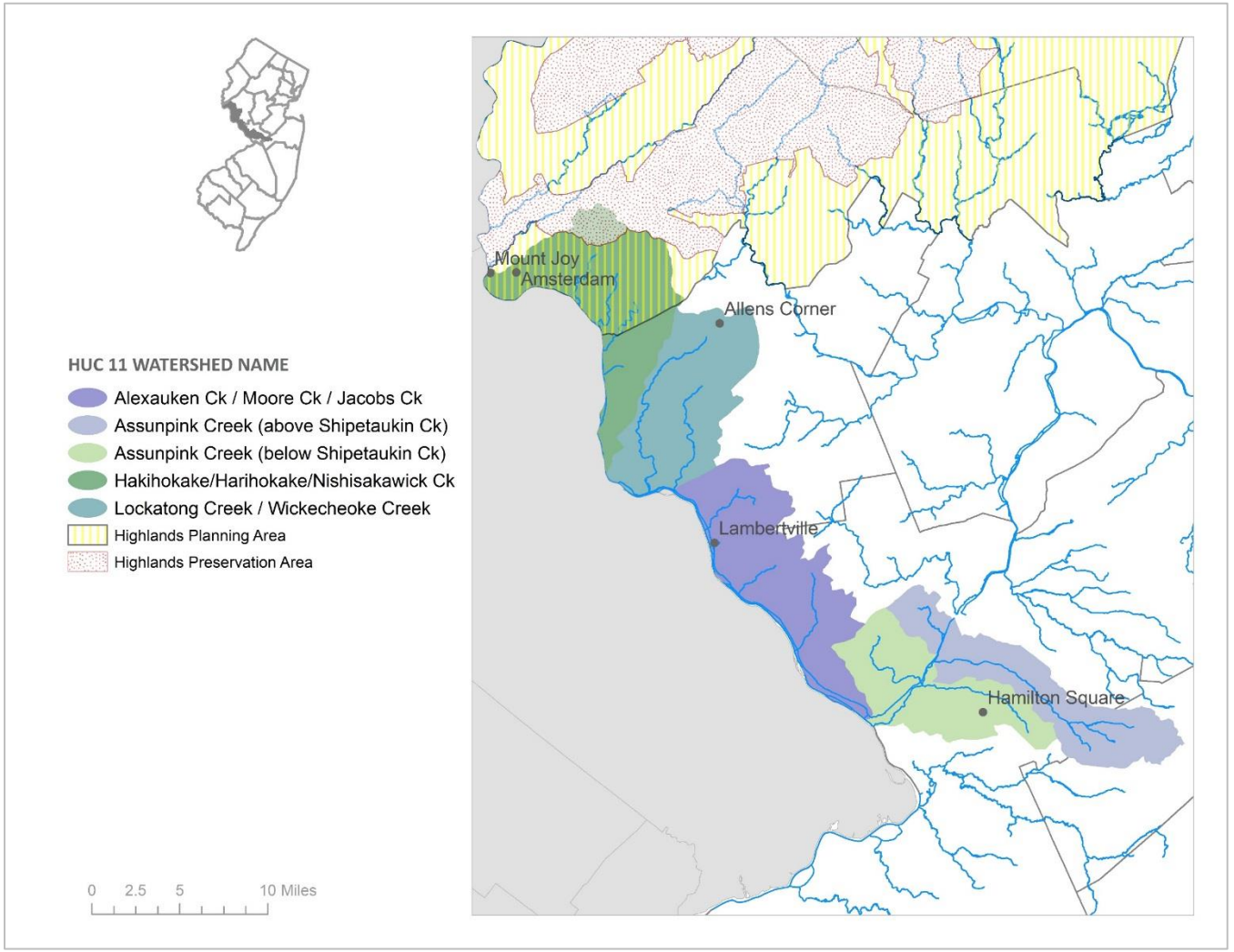
Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for facilities located in the Millstone River (above Carnegie Lake) HUC11.

- All new depletive/consumptive uses associated with unconfined ground water or unregulated (non-safe yield) surface water in the Stony Brook and Millstone River (above Carnegie Lake) HUC11 watershed should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- Allow no additional depletive/consumptive uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield or entering a contract with the New Jersey Water Supply Authority.
- Utilize available safe yield and/or interconnections to offset existing and potential depletive/consumptive losses associated with unconfined ground water uses.

WATERSHED MANAGEMENT AREA 11

CENTRAL DELAWARE



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 11 is located in the state's Piedmont and Coastal Plain physiographic provinces, spanning all or parts of 24 municipalities within the counties of Hunterdon, Mercer and Monmouth. The predominant drainage of WMA 11 is to the Delaware River and the Delaware & Raritan (D&R) Canal.

WMA 11 is approximately 269 square miles and includes five HUC11 watersheds: Hakihokake/Harihokake/Nishisakawick Creek, Lockatong Creek/Wickecheoke Creek, Alexauken Creek/Moore Creek/ Jacobs Creek, Assunpink Creek (above Shipetaukin Creek) and Assunpink Creek (below Shipetaukin Creek). Land uses in WMA 11 range from rural to suburban to urban, including the State Capital, Trenton. Suburban development and the ensuing population growth over the past two decades has progressively strained water resource supply and quality.

Table A.11.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02040105170	Hakihokake/Harihokake/Nishisakawick Ck
02040105200	Lockatong Creek / Wickecheoke Creek
02040105210	Alexauken Ck / Moore Ck / Jacobs Ck
02040105230	Assunpink Creek (above Shipetaukin Ck)
02040105240	Assunpink Creek (below Shipetaukin Ck)

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 11 surface water withdrawals comprise 93%, unconfined groundwater withdrawals comprise 6%, and confined aquifer withdrawals comprise 1% of the total withdraw. Power generation is not a significant use. Potable supply is 91% of the total withdrawal, with 6% coming from unconfined groundwater sources, 1% coming from confined aquifer sources, and the remaining 93% from surface water sources. Combined commercial, industrial and mining make up 8% of the total withdrawal, with 90% coming from surface water sources, <1% from confined aquifer sources, and 10% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining <1% of total water withdrawals, with 42% coming from unconfined groundwater sources, <1% from confined aquifer sources, and 58% from surface water sources. Figure A.11.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.11.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 1993 and show a downward trend from 1990 to 2015. Annual withdrawals by source and use sector are shown in table A.11.2.

Annual consumptive loss peaked in 1993 with similar rates in 2014 with an overall slightly upward trend from 2000 to 2015. Over the last decade, almost all consumptive loss is from potable supply uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2014. Refer to figures A.11.3 and A.11.4.

Almost all (100%) of the total sanitary sewer discharges are to fresh surface water sources. Discharges average about 31 mgd over the period of record. Refer to Figure A.11.5.

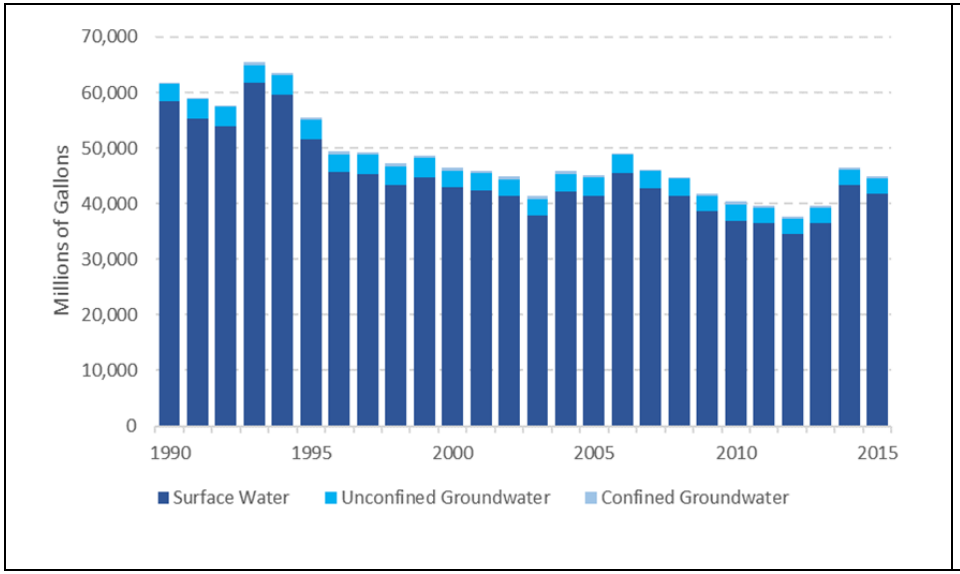


Figure A.11.1. Annual withdrawals by source.

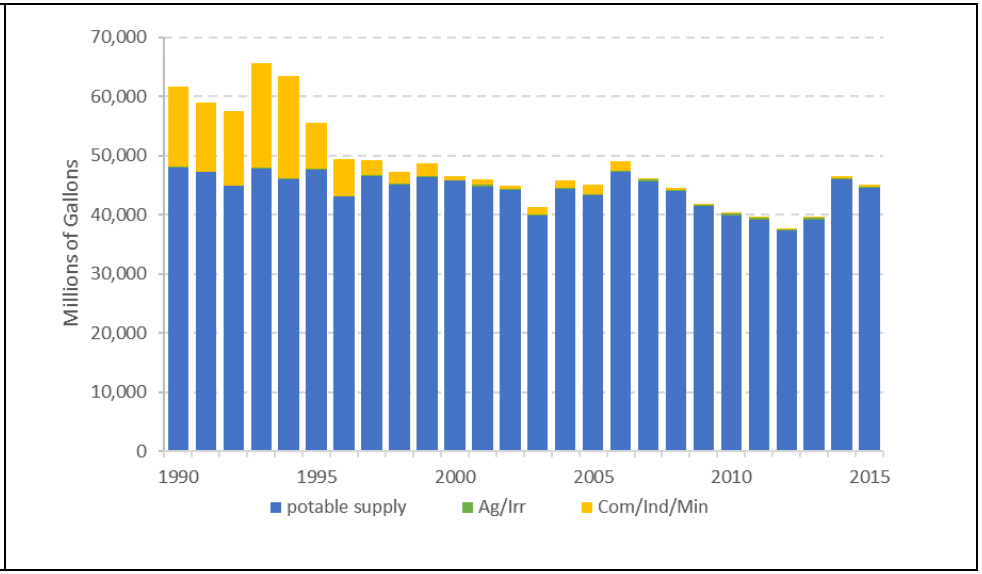


Figure A.11.2. Annual withdrawals by use sector.

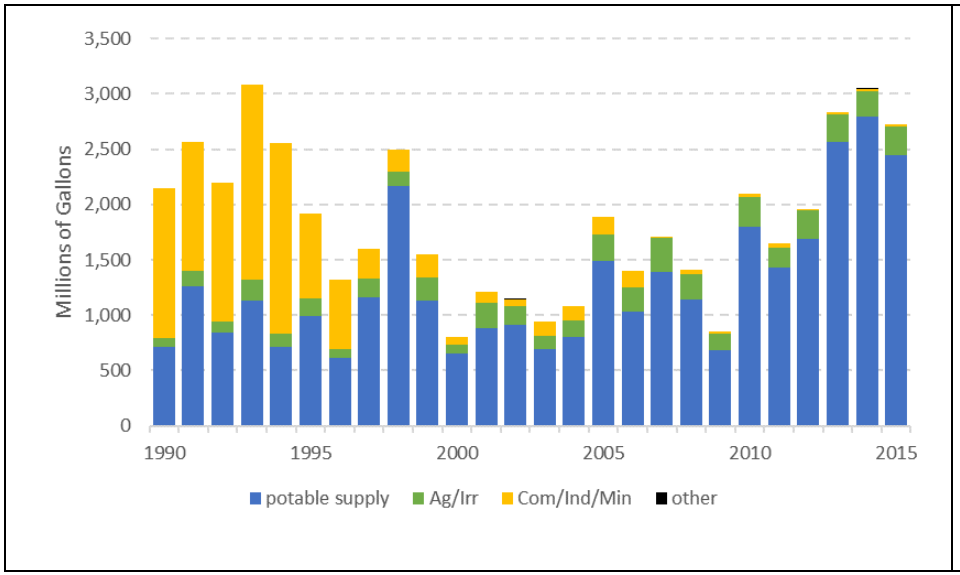


Figure A.11.3. Annual consumptive loss by use sector.

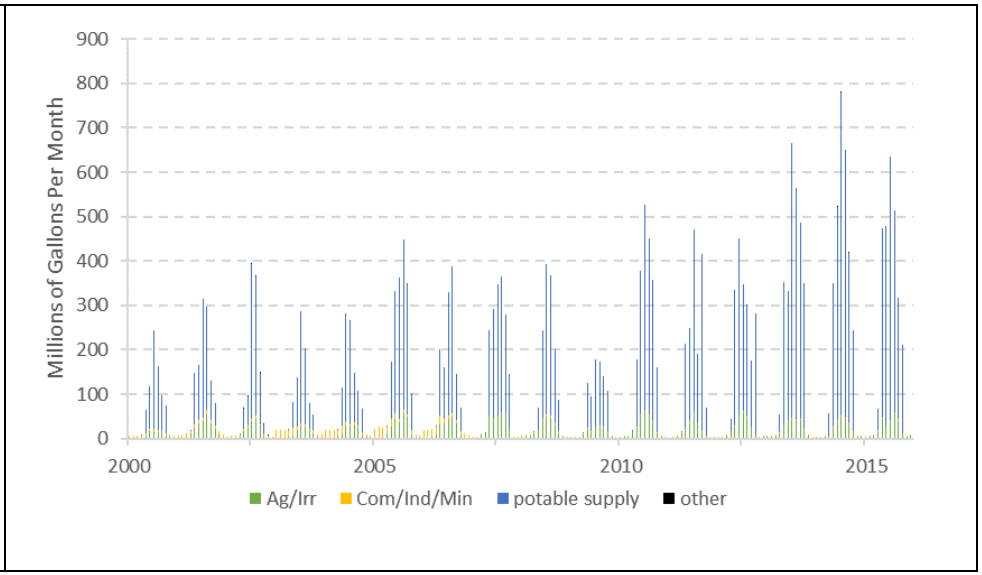


Figure A.11.4. Monthly consumptive loss by use sector.

Table A.11.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	28	70		13,255	301		45,222	2,718	46			
1991	51	111		11,190	406		44,152	2,876	137			
1992	36	76		11,929	619		41,977	2,821	42			
1993	106	100	5	16,862	781		44,734	2,340	651			
1994	31	99	0	16,527	772		43,026	2,587	398			
1995	70	104	5	7,007	688		44,446	2,753	412			
1996	26	70	0	5,478	731		40,143	2,400	495			
1997	97	91	5	1,929	668		43,388	2,577	471			
1998	50	95	0	1,329	653		42,052	2,517	521			
1999	100	142	0	1,409	666		43,292	2,577	476			
2000	37	49	3	70	617		42,905	2,285	519			
2001	179	78		340	606	5	41,839	2,475	481			
2002	105	88		0	541	7	41,311	2,372	454			
2003	78	62	0	869	411	4	37,011	2,443	473			
2004	112	48	0	911	403	6	41,260	2,627	448			
2005	202	63	0	1,200	401	8	40,067	2,806	379			
2006	181	68	0	1,100	415	7	44,220	2,828	200			
2007	262	81	0	42	49	6	42,439	3,088	40			
2008	167	88	0	383	40	5	40,881	2,941	96			
2009	103	61	0	193	38	2	38,450	2,511	492			
2010	166	134	0	190	35	5	36,640	2,717	519			
2011	101	100	0	277	40	5	36,088	2,715	397			
2012	213	73	0	55	26	6	34,209	2,695	402			
2013	202	76	0	117	30	9	36,216	2,624	357			
2014	172	82	0	210	13	11	42,986	2,583	403			
2015	175	118	0	189	12	18	41,381	2,689	427			

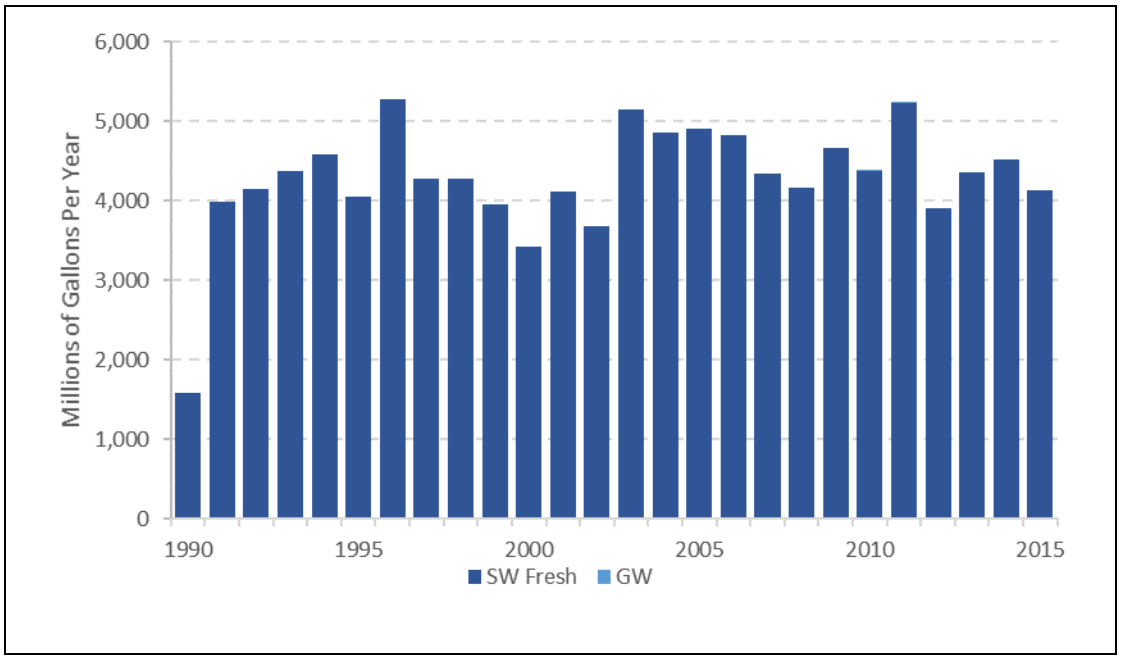


Figure A.11.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Nine water purveyors which serve more than 1,000 people provide potable water to one or more of the five HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.11.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 15% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by 0.26, 0.72, 1.18, 1.50, and 1.75 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.11.4 contains the demand estimates by HUC11. One hundred twenty-five (125) gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.11.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02040105170	02040105210	02040105230	02040105240
NJ1011001	NJ American - Frenchtown	X			
NJ1017001	Suez Water NJ Lambertville		X		
NJ1020001	Milford WD	X			
NJ1103001	Aqua NJ - Hamilton Square			X	X
NJ1107001	Lawrenceville School			X	X
NJ1107002	Aqua NJ - Lawrence			X	X
NJ1108001	Pennington WD		X		
NJ1111001	Trenton Water Works		X	X	X
NJ2004002	NJ American - Raritan			X	X

Table A.11.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02040105170	0.05	0.10	0.15	0.20	0.24
02040105200	0.04	0.08	0.13	0.17	0.21
02040105210	0.07	0.21	0.34	0.47	0.58
02040105230	0.03	0.09	0.16	0.19	0.20
02040105240	0.07	0.24	0.40	0.48	0.51
Total	**0.26**	**0.72**	**1.18**	**1.50**	**1.75**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.11.8 and A.11.9 indicate that there is a total of 8 mgd of natural resource availability in WMA 11 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 7 mgd of available water remaining and at full allocation rates 2.6 mgd of water is remaining. Table A.11.5 shows that of the 5 HUC11s in the WMA, 1 has used all the available water and 2 would have used all the available water if full allocation diversion rates were used. One HUC11 has a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, confined aquifer leakage is the major loss in 2 HUC11s and under full allocation diversion rates potable supply is the largest loss in 4 HUC11s. See tables A.11.5, A.11.6 and A.11.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.11.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02040105170	8.9	Partial		Yes	25%	2005	2.2	0.9	40%	1.3	2.1	94%	0.1	Ag Irr	Potable
02040105200	2.8			Yes	25%	2010	0.7	0.7	96%	0.0	2.0	296%	0.0	Ag Irr	Potable
02040105210	3.0			Yes	25%	2007	0.7	0.2	26%	0.5	1.8	241%	0.0	Potable	Potable
02040105230	10.1			Yes	25%	2005	2.5	1.2	47%	1.3	2.5	98%	0.1	Con Aq Leak	Potable
02040105240	8.8				25%	2010	2.2	-1.4	Net Gain	3.7	-2.6	Net Gain	4.8	Con Aq Leak	Non-Ag Irr

Table A.11.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02040105170	0.4	0.0	1.0	0.2	0.0	0.0	0.6	0.1	0.1	0.0	0.0	1.6	0.6	0.0	2.2	2.1
02040105200	0.1	0.0	0.9	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	1.5	76.6
02040105210	0.2	0.4	1.1	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	1.3	0.6	0.0	1.9	28.3
02040105230	0.2	0.0	0.5	0.0	0.0	0.0	0.2	0.0	0.3	0.0	0.0	0.7	0.5	0.6	1.7	0.0
02040105240	4.4	0.0	0.5	0.0	0.0	0.2	0.0	0.1	0.1	0.0	0.0	4.7	0.1	0.5	5.3	0.0

Table A.11.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02040105170	0.00	0.3	0.0	0.8	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1.0	0.4	1.4
02040105200	0.00	0.0	0.0	0.7	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.8
02040105210	0.00	0.7	0.0	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.8	1.7
02040105230	0.00	0.1	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.5
02040105240	0.00	6.3	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	6.3	6.7

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

There are no major reservoirs for NJ residents located in WMA 11. Some smaller reservoir systems may be present and while critical to the residents that rely of them, they are not covered in this statewide plan. The intake of the Delaware and Raritan Canal operated by the NJ Water Supply Authority is located in WMA 11. Refer to WMA 9 for discussion of this system. WMA 11 is within the multi-state Delaware River watershed. New York City has three reservoirs in the upper Delaware watershed in New York State. Operations of these major surface water supply reservoirs have a hydrologic and regulatory impact on the flows in the river as well as diversion from the Delaware and Raritan Canal. The Flexible Flow Management Program signed by the 1954 Supreme Court Decree Parties of New Jersey, New York City, New York State, Pennsylvania and Delaware and Delaware River Basin Commission regulations govern some water supply operations in the WMA.

AVAILABLE WATER FROM CONFINED AQUIFERS

On the southern and eastern regions of the WMA several confined aquifers are present. These aquifers dip to east and eventually become the Critical Area 1 aquifers of WMA 13. Where these aquifer outcrop some recharge is occurring. See Appendix B Critical Area 1 and Critical Area 2 regions for more details. Ground water flow in confined aquifers is driven by the regional hydrostratigraphy and water elevation gradients and therefore does not typically follow surface watershed boundaries. Impacts to confined aquifers below a surface watershed may be caused by withdrawals outside of the surface watershed.

SUMMARY AND MANAGEMENT OPTIONS

Table A.11.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
11	Central Delaware		8	3.5	11.5		1	2	3		7	1.5	8.5	0.3	8.2

Table A.11.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
11	Central Delaware	151	9	4		2.6	0			1	

Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

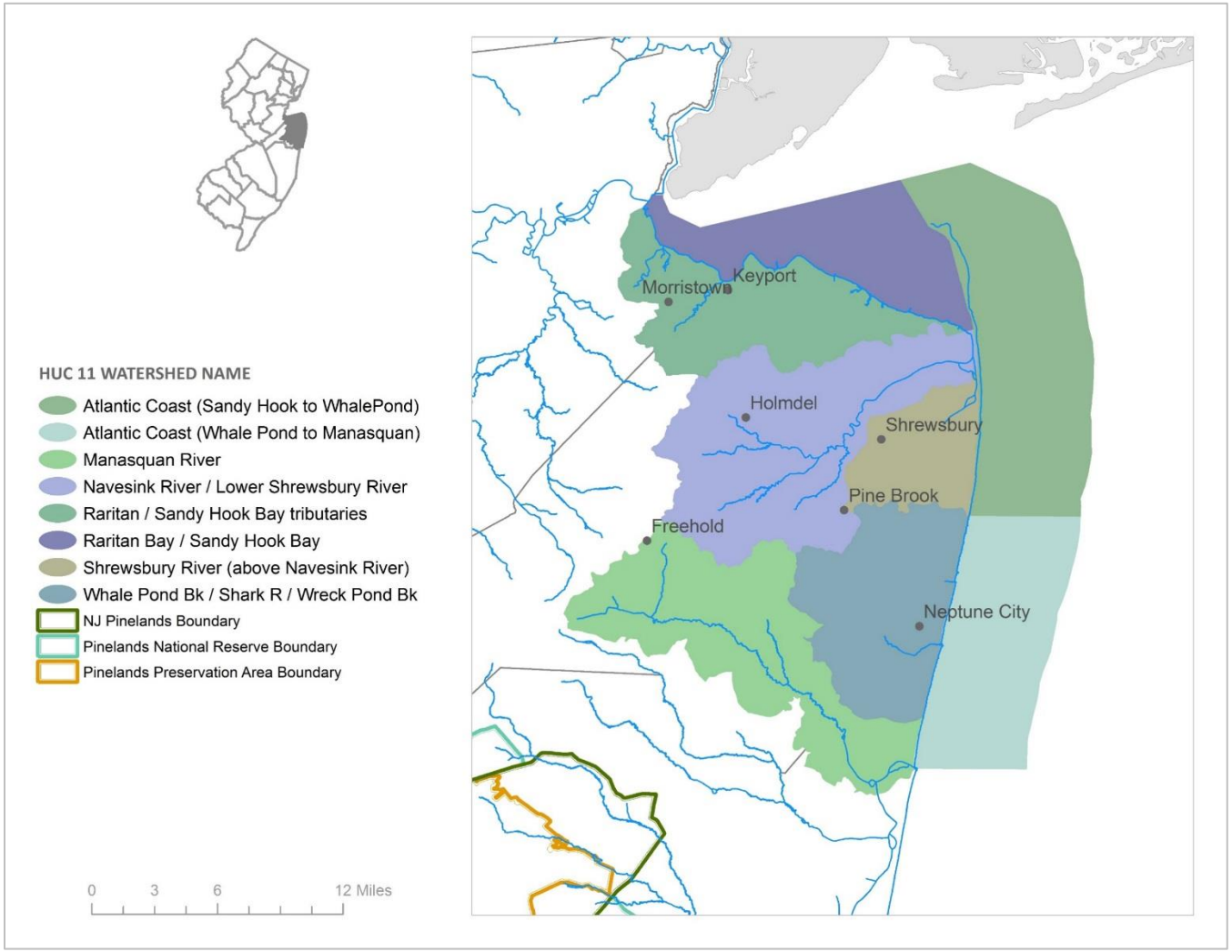
Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for facilities located in the Lockatong Creek/Wickecheoke Creek HUC11 watershed.

- DEP will continue to monitor the Assunpink Creek (above Shipetaukin Ck) and the Alexauken Creek/Moore Creek/Jacobs Creek HUC11 watersheds as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water at full allocation rates.
    - If deficit occurs, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- For HUC11 watersheds that are located wholly within the Highlands Region, please refer to the Highlands Regional Master Plan at http://www.nj.gov/njhighlands/master/ .

WATERSHED MANAGEMENT AREA 12

MONMOUTH



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 12 is located in the Coastal Plain Province, extends from Perth Amboy to Point Pleasant Beach and encompasses approximately 534 square miles. WMA 12 is comprised of an assemblage of coastal sub-watersheds, all or a portion of which fall into 56 municipalities in the Raritan Bay and Atlantic Coastal drainage basins. Although the majority of impacted municipalities are in Monmouth County, several lie within the boundaries of Middlesex and Ocean Counties.

Many major water supply issues were identified and resolved in WMA 12 during the 1990's. Due to excessive water use of the confined aquifers in this region, the Department declared a Critical Water Supply Area in 1985 and required significant cutbacks in withdrawal rates (Chapter 3). These cutbacks in Critical Area No. 1 and near-term demand increases were mitigated by the development of the Manasquan Reservoir in WMA 13 by the NJ Water Supply Authority and the conveyance of surface water supplies from WMA 9 to WMA 12 through the Middlesex Water Company's South River Pipeline.

Table A.12.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02030104060	Raritan / Sandy Hook Bay tributaries
02030104070	Navesink River / Lower Shrewsbury River
02030104080	Shrewsbury River (above Navesink River)
02030104090	Whale Pond Bk / Shark R / Wreck Pond Bk
02030104100	Manasquan River
02030104910	Raritan Bay / Sandy Hook Bay
02030104920	Atlantic Coast (Sandy Hook to WhalePond)
02030104930	Atlantic Coast (Whale Pond to Manasquan)

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 12 surface water withdrawals comprise 74%, unconfined groundwater withdrawals comprise 6% and confined aquifer withdrawals comprise 20% of the total withdraw. Power generation is not significant use. Potable supply is 96% of the total withdrawal, with 6% coming from unconfined groundwater sources, 19% coming from confined aquifer sources, and the remaining 75% from surface water sources. Combined commercial, industrial and mining make up 1% of the total withdrawal, with 94% coming from surface water sources, 5% from confined aquifer sources, and 1% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 2% of total water withdrawals, with 22% coming from unconfined groundwater sources, 35% from confined aquifer sources, and 42% from surface water sources. Figure A.12.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.12.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 1990/2002 and show a flat trend from 1990 to 2015. Annual withdrawals by source and use sector are shown in table A.12.2.

Annual consumptive loss peaked in 2015 with an overall slightly upward trend from 1990 to 2015. Almost all consumptive loss is from potable supply uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2010 and followed closely by July 2015. Refer to figures A.12.3 and A.12.4.

Almost all (100%) of the total sanitary sewer discharges are to saline surface water sources. Discharges average about 438 mgd over the period of record. Refer to Figure A.12.5.

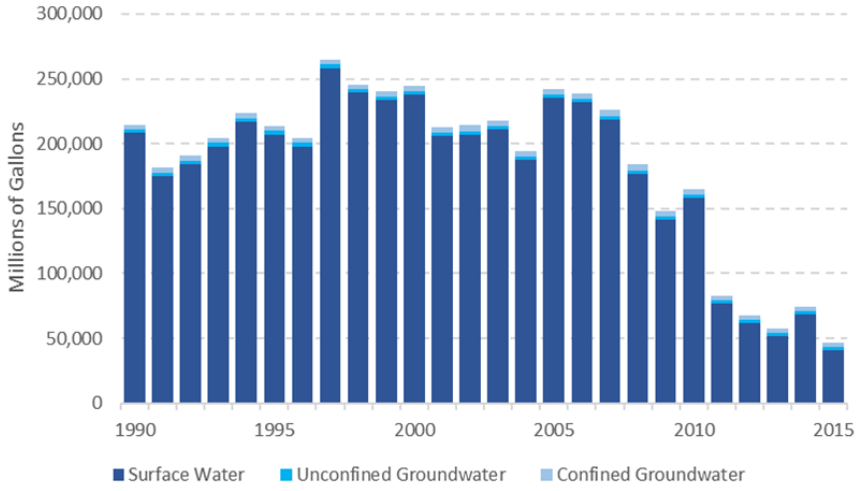


Figure A.12.1. Annual withdrawals by source.

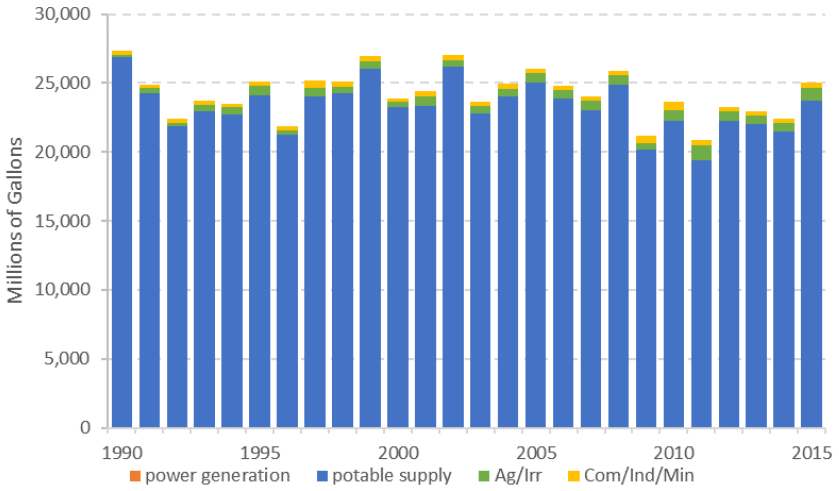


Figure A.12.2. Annual withdrawals by use sector.

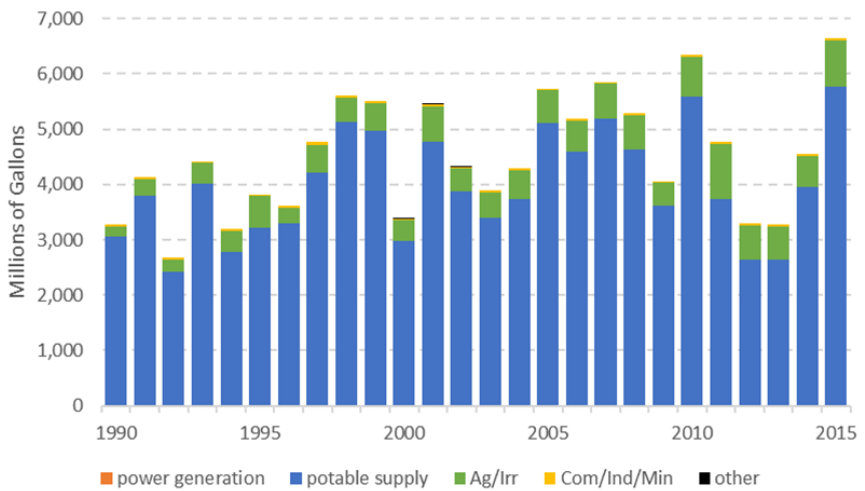


Figure A.12.3. Annual consumptive loss by use sector.

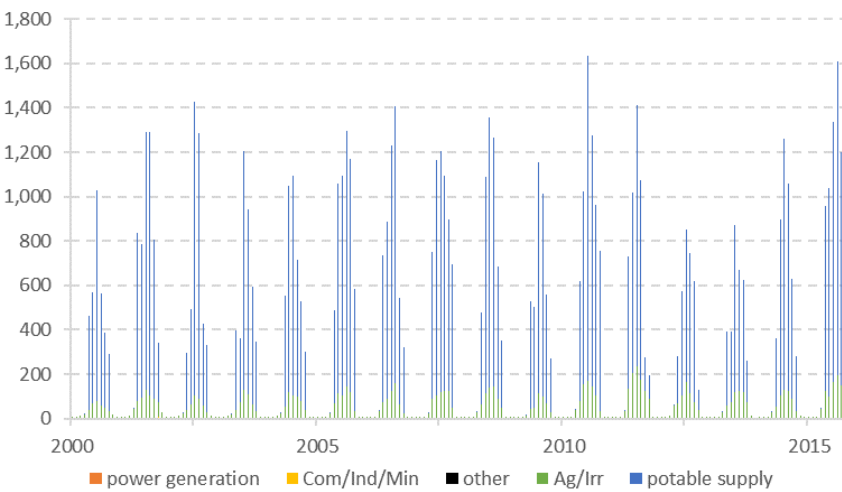


Figure A.12.4. Monthly consumptive loss by use sector.

Table A.12.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	70	67	64		4	259	18,085	2,058	6,709			
1991	165	74	111		0	235	18,148	1,854	4,282			
1992	125	46	88		10	323	16,815	1,692	3,348			
1993	243	73	122	0	11	311	17,087	1,836	4,064			
1994	291	98	94	0	8	267	16,799	1,834	4,113			
1995	429	113	119	0	7	296	18,219	1,718	4,174			0
1996	142	104	72	0	20	319	15,647	1,813	3,780			4
1997	297	123	143	0	2	568	17,761	2,104	4,189			5
1998	218	103	180	0	13	338	17,598	2,274	4,365			6
1999	259	119	181	0	36	312	18,839	2,514	4,697			
2000	190	118	117	12	41	184	17,751	1,453	3,981	38		9
2001	382	181	149	12	44	347	16,730	1,497	5,039		32	7
2002	175	157	143	25	42	275	20,243	1,245	4,669		25	7
2003	197	147	177	0	46	301	17,217	1,050	4,508	29		0
2004	245	152	185	0	27	316	18,700	943	4,323	31		0
2005	304	161	210	0	19	333	19,376	883	4,763	22		0
2006	281	184	173	0	5	285	18,368	889	4,595	32		0
2007	290	175	249	0	19	285	17,356	893	4,727	32		0
2008	314	143	250	0	8	317	19,631	895	4,297	31		
2009	221	100	143	0	3	550	15,614	894	3,611	35		
2010	332	167	317	0	6	609	16,781	896	4,527	34		
2011	225	134	751	0	14	341	14,408	897	4,072	22		
2012	285	149	266	0	9	302	17,365	1,057	3,780	25		
2013	207	163	311	0	19	244	17,285	1,107	3,579	22		
2014	225	149	254	0	5	237	16,747	1,026	3,723	14		
2015	309	161	478	12	22	383	18,160	1,025	4,488	22		

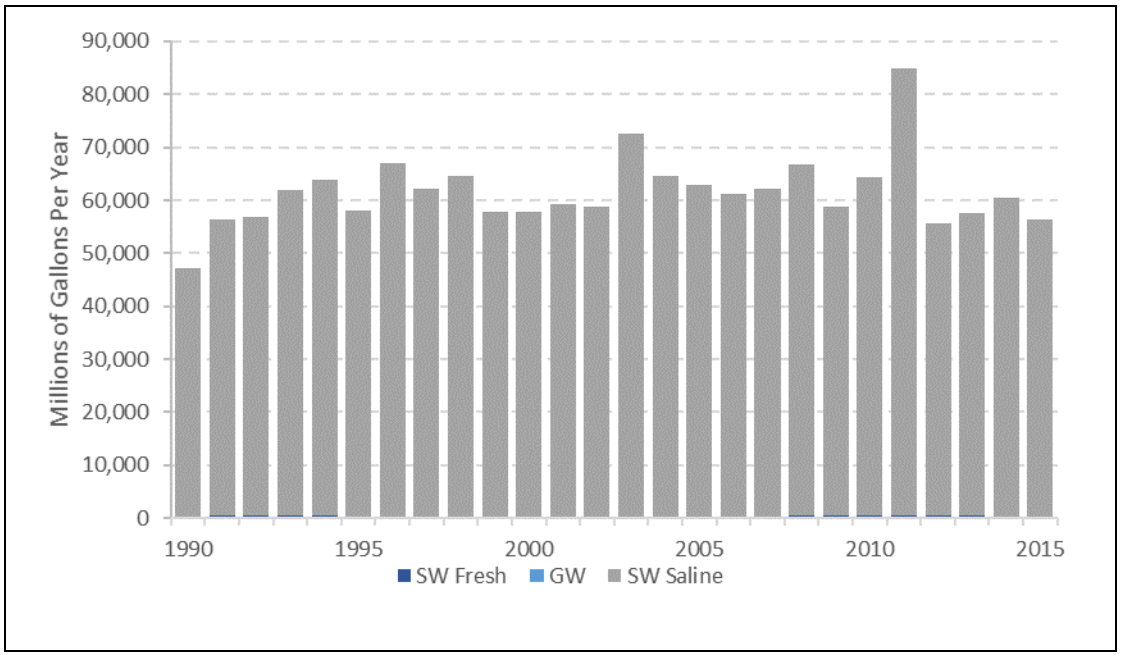


Figure A.12.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Thirty-three water purveyors which serve more than 1,000 people provide potable water to one or more of the eight HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.12.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 11% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by 1.40, 2.81, 4.21, 5.61, and 7.02 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.12.4 contains the demand estimates by HUC11. One hundred twenty-five (125) gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.12.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030104060	02030104070	02030104080	02030104090	02030104100	02030104910	02030104920	02030104930
NJ1209002	Old Bridge MUA	X					X		
NJ1216001	Perth Amboy WD						X		
NJ1219001	Sayreville WD	X					X		
NJ1225001	Middlesex WC	X					X		
NJ1304001	Atlantic Highlands WD	X	X				X		
NJ1305001	Avon by the Sea WD				X				X
NJ1306001	Belmar WD				X				X
NJ1308001	Brielle Boro WD					X			
NJ1309001	US Naval Weapons Station		X			X			
NJ1314001	Farmingdale WD					X			
NJ1315001	Freehold Boro WD		X			X			
NJ1316001	Freehold Twp WD		X			X			
NJ1319007	Parkway Water Co					X			
NJ1321001	Keansburg Water and Sewer Dept.	X					X		
NJ1322001	Keyport WD	X					X		
NJ1326001	Gordon's Corner WC		X						
NJ1327001	Manasquan WD				X	X			X
NJ1328002	Marlboro Twp MUA	X	X						
NJ1329001	Matawan WD	X							
NJ1330002	Aberdeen - Cliffwood-Cliffwood Beach	X					X		
NJ1330003	Aberdeen - High School/ Oak Shade Area	X							
NJ1339001	Shorelands WC Inc	X	X						
NJ1340001	Red Bank WD		X	X					

Table A.12.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02030104060	02030104070	02030104080	02030104090	02030104100	02030104910	02030104920	02030104930
NJ1344001	Sea Girt WD				X	X			X
NJ1345001	NJ American - Coastal North	X	X	X	X	X	X	X	X
NJ1347001	Lake Como WD				X				
NJ1348001	Spring Lake WD				X				X
NJ1349001	Boro of Spring Lake Heights WD				X				
NJ1350001	NJ American - Union Beach	X					X		
NJ1352003	Wall Twp Water Dept				X	X			
NJ1506001	BrickTwp MUA					X			
NJ1524001	Point Pleasent Borough WD					X			
NJ1525001	Point Pleasant Beach WD					X			

Table A.12.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02030104060	0.32	0.65	0.97	1.30	1.62
02030104070	0.25	0.49	0.74	0.99	1.23
02030104080	0.16	0.32	0.47	0.63	0.79
02030104090	0.39	0.78	1.17	1.56	1.95
02030104100	0.26	0.53	0.79	1.05	1.31
02030104910	0.01	0.02	0.04	0.05	0.06
02030104920	0.01	0.01	0.02	0.02	0.03
02030104930	0.01	0.01	0.02	0.02	0.03
Total	**1.40**	**2.81**	**4.21**	**5.61**	**7.02**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.12.8 and A.12.9 indicate that there is a total of 21 mgd of natural resource availability in WMA 12 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 14 mgd of available water remaining and at full allocation rates 28.5 mgd of water is remaining. Table A.12.5 shows that of the 8 HUC11s in the WMA, none have used all the available water and none would have used all the available water if full allocation diversion rates were used. Three HUC11s have a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, confined aquifer leakage is the major loss in 3 HUC11s and under full allocation diversion rates agricultural irrigation is the largest loss in 3 HUC11s. See tables A.12.5, A.12.6 and A.12.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.12.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02030104060	17.0				25%	2001	4.2	2.0	47%	2.3	1.4	34%	2.8	Potable	Potable
02030104070	24.5		Yes		25%	2007	6.1	1.8	30%	4.3	1.6	26%	4.5	Con Aq Leak	Potable
02030104080	8.7		Yes		25%	2005	2.2	0.5	23%	1.7	0.2	10%	2.0	Con Aq Leak	Non-Ag Irr
02030104090	13.5		Yes		25%	2001	3.4	0.6	17%	2.8	1.0	31%	2.3	Non-Ag Irr	Non-Ag Irr
02030104100	20.2		Yes		25%	2012	5.1	1.7	33%	3.4	3.7	74%	1.3	Potable	Potable
02030104910	0.0				25%	2013	0.0	-86.6	Net Gain	86.6	-98.0	Net Gain	98.0	Con Aq Leak	Ag Irr
02030104920	0.0				25%	2010	0.0	-21.8	Net Gain	21.8	-24.2	Net Gain	24.2	Ind-Com-Min	Ag Irr
02030104930	0.0				25%	2010	0.0	-13.6	Net Gain	13.6	-15.2	Net Gain	15.2	Ind-Com-Min	Ag Irr

Table A.12.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02030104060	1.7	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.4	2.1	0.0
02030104070	0.0	0.0	1.2	0.0	0.0	0.1	0.0	0.1	0.5	0.0	0.0	1.2	0.6	1.2	3.0	25.5
02030104080	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.2	0.3	0.6	0.0
02030104090	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.5	0.2	0.1	0.9	2.0
02030104100	1.0	0.0	1.2	0.0	0.0	0.1	0.0	0.6	0.1	0.0	0.1	2.6	0.3	0.8	3.7	27.1
02030104910	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02030104920	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02030104930	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table A.12.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02030104060	0.00	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
02030104070	0.03	0.1	0.0	0.9	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	1.0	0.2	1.2

Table A.12.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
HUC11	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02030104080	0.00	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
02030104090	0.01	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
02030104100	0.36	0.0	0.0	0.9	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.1	1.9	0.1	2.0
02030104910	0.06	0.0	86.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	86.5	86.6
02030104920	0.00	0.0	21.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.8	21.8
02030104930	0.00	0.0	13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.6	13.6

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

As indicated, diversions from surface water supplies are the main withdrawal type in WMA 12. The largest provider of surface water is the NJ American Water Company – Coastal North System as they divert from the Swimming River (safe yield = 21.5 MGD) and Glendola (safe yield = 11.1 MGD) Reservoirs. In addition, the NJ American Water Company – Coastal North System purchases surface water from the New Jersey Water Supply Authority's Manasquan Reservoir (safe yield = 30 MGD) system in WMA 12, particularly when demands are high. Peak summer demands associated with outdoor water use and the summer population increase in the beach communities periodically creates very high peak daily and weekly potable water demands. For additional information pertaining to these reservoirs, please refer to Appendix C. Refer to A.12.6 and A.12.7 for a summary of average annual demands on those two systems.

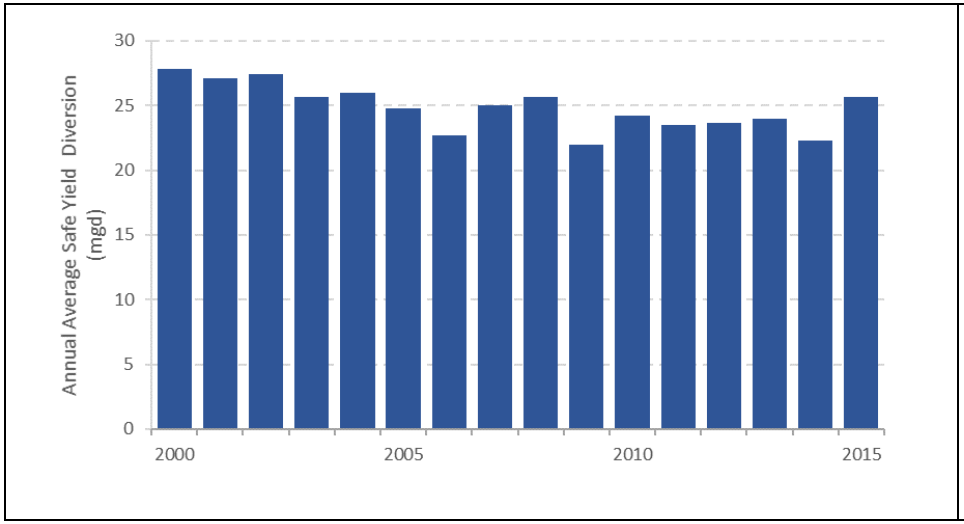


Figure A.12.6. NJ American Coastal North system annual average safe yield withdrawals

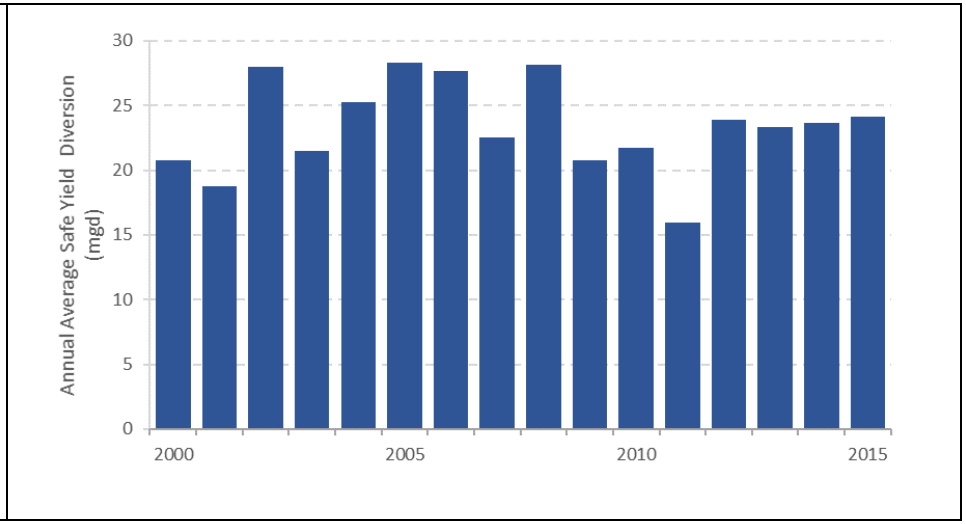


Figure A.12.7. NJWSA Manasquan system annual average safe yield withdrawals

AVAILABLE WATER FROM CONFINED AQUIFERS

WMA 12 have diversions from the Critical Area 1 region as defined in Appendix B. Refer to that section for additional information on the resource. Ground water flow in confined aquifers is driven by the regional hydrostratigraphy and water elevation gradients and therefore does not typically follow surface watershed boundaries. Impacts to confined aquifers below a surface watershed may be caused by withdrawals outside of the surface watershed.

SUMMARY AND MANAGEMENT OPTIONS

Table A.12.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
12	Monmouth	62.6	21	21.3	104.9	55	7	17	79	7.6	14	4.3	25.9	1.4	24.5

Table A.12.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
12	Monmouth	186	4	21	0	28.5	0		122	4	23.2

Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

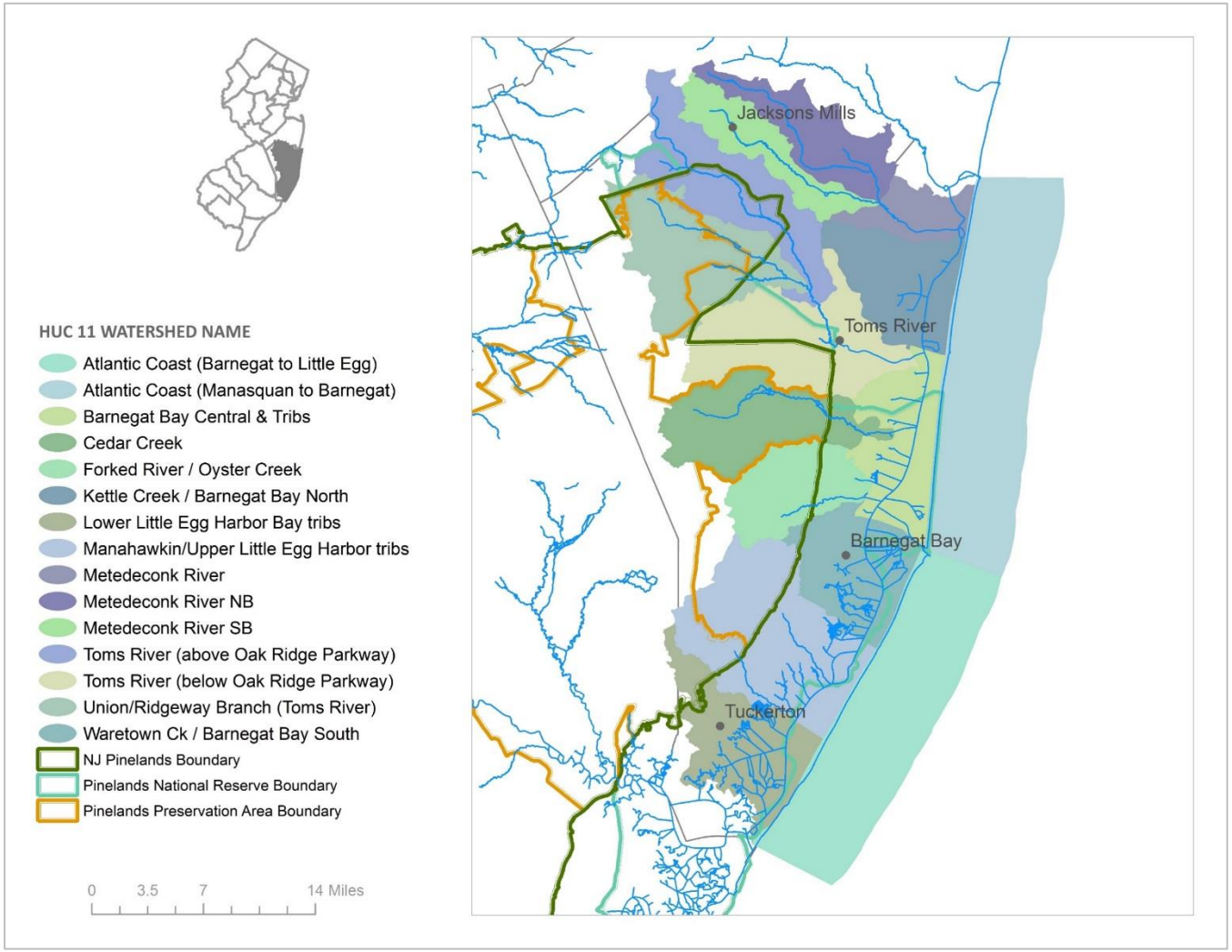
Management Options

- Reduce Consumptive Water Loss in the Raritan/Sandy Hook Bay Tributaries HUC11 through Limits on Outdoor Water Use and by Encouraging the use of Advanced Water Efficiency Technology (Policy Item #1)

- Continue to utilize available safe yield from the NJWSA's Manasquan Reservoir and/or interconnections to offset existing and potential depletive/consumptive losses associated with unconfined ground water uses.
- Allow no additional D/C uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield.
- Evaluate the use of available water from Middlesex Water Company's D&R Canal diversion as a potential ASR source for Critical Area #1.

WATERSHED MANAGEMENT AREA 13

BARNEGAT BAY



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 13 is located in New Jersey's Coastal Plain and includes 13 HUC11 watersheds that drain to the Atlantic Ocean along New Jersey's central coastal area. Two additional HUC11 watersheds (shown on the map/legend without shading) extend from the shoreline boundary of the contiguous HUC11 watersheds out into the Atlantic Ocean. WMA 13 includes the entire Barnegat Bay watershed, a 660 square mile area encompassing the majority of Ocean County, as well as small portions of Monmouth and Burlington Counties. This WMA is approximately one-half forested, with the remainder constituting a mix of residential/commercial development, a major military facility, and agriculture. Significant surface waters include the Metedeconk, Toms, and Forked Rivers and Cedar Creek.

The Toms River HUC11 watershed drains a 124 square mile area, flowing from western Ocean and Monmouth Counties southeastward to the Barnegat Bay. The larger tributaries of the Toms River HUC11 watershed include Davenports Branch, Union Branch and Wrangle Brook. The Toms River HUC11 watershed also drains a large area of the New Jersey Pinelands. Major impoundments include Success Lake and Horicon Lake. Population centers include Barnegat, Jackson, Lakehurst, Manahawkin (Stafford Twp.), Manchester, and Toms River.

Table A.13.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02040301020	Metedeconk River NB
02040301030	Metedeconk River SB
02040301040	Metedeconk River
02040301050	Kettle Creek / Barnegat Bay North
02040301060	Toms River (above Oak Ridge Parkway)
02040301070	Union/Ridgeway Branch (Toms River)
02040301080	Toms River (below Oak Ridge Parkway)
02040301090	Cedar Creek
02040301100	Barnegat Bay Central & Tribs
02040301110	Forked River / Oyster Creek
02040301120	Waretown Ck / Barnegat Bay South
02040301130	Manahawkin/Upper Little Egg Harbor tribs
02040301140	Lower Little Egg Harbor Bay tribs
02040301910	Atlantic Coast (Manasquan to Barnegat)
02040301920	Atlantic Coast (Barnegat to Little Egg)

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 13 surface water withdrawals comprise 28%, unconfined groundwater withdrawals comprise 41% and confined aquifer withdrawals comprise 31% of the total withdraw. Power generation is not a significant withdrawal source in the WMA. Potable supply is 83% of the total withdrawal, with 42% coming from unconfined groundwater sources, 37% coming from confined aquifer sources, and the remaining 21% from surface water sources. Combined commercial, industrial and mining make up 13% of the total withdrawal, with 67% coming from surface water sources, 3% from confined aquifer sources, and 30% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 4% of total water withdrawals, with 60% coming from unconfined groundwater sources, 3% from confined aquifer sources, and 37% from surface water sources. Figure A.13.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.13.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 2015 and show a flat trend from 1990 to 2015 with an abrupt increase in 2014 and 2015. Annual withdrawals by source and use sector are shown in table A.13.2.

Annual consumptive loss peaked in 2007 with an overall slightly upward trend from 1990 to 2015. Almost all consumptive loss is from potable supply uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2010. Refer to figures A.13.3 and A.13.4.

Almost all (100%) of the total sanitary sewer discharges are to saline surface water sources. Discharges average about 129 mgd over the period of record. Refer to Figure A.13.5.

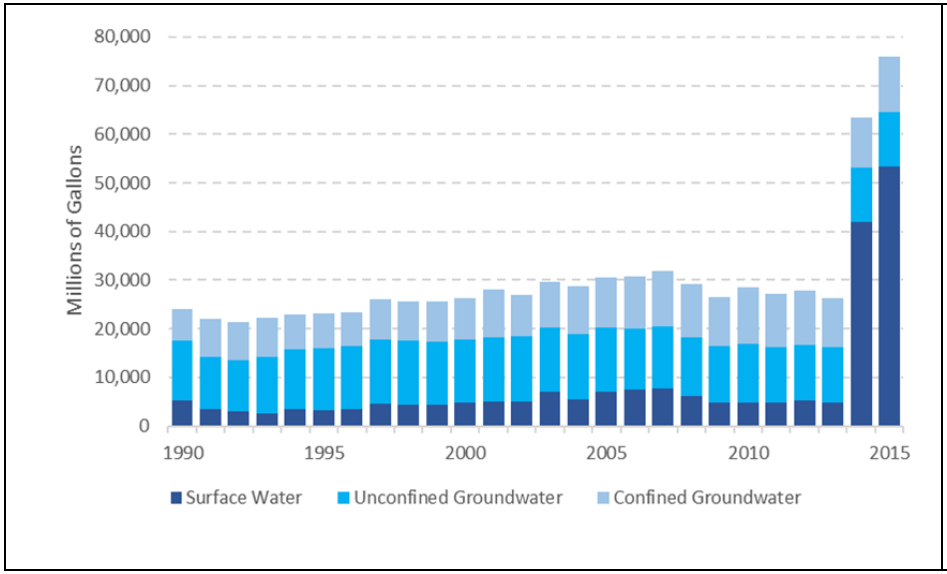


Figure A.13.1. Annual withdrawals by source.

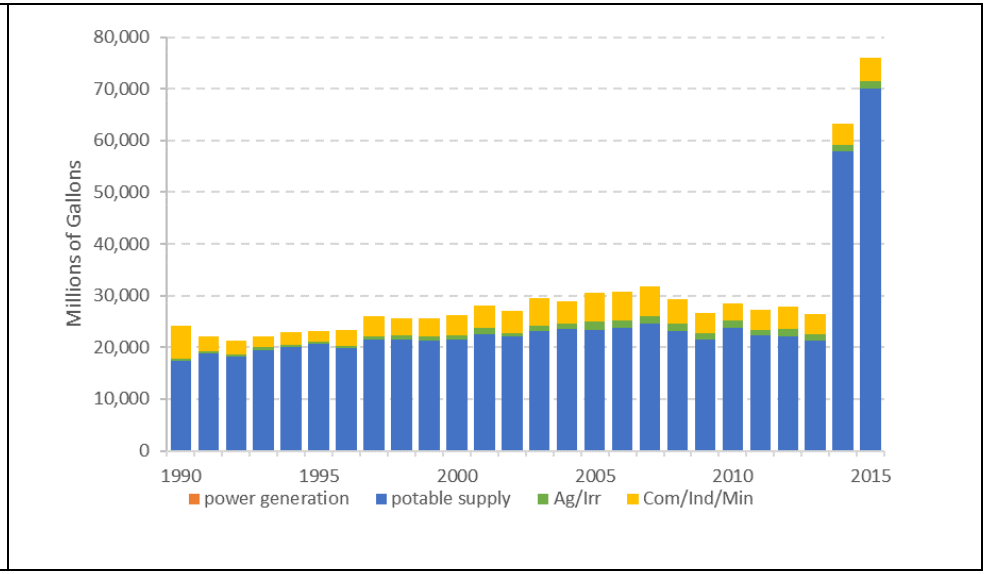


Figure A.13.2. Annual withdrawals by use sector.

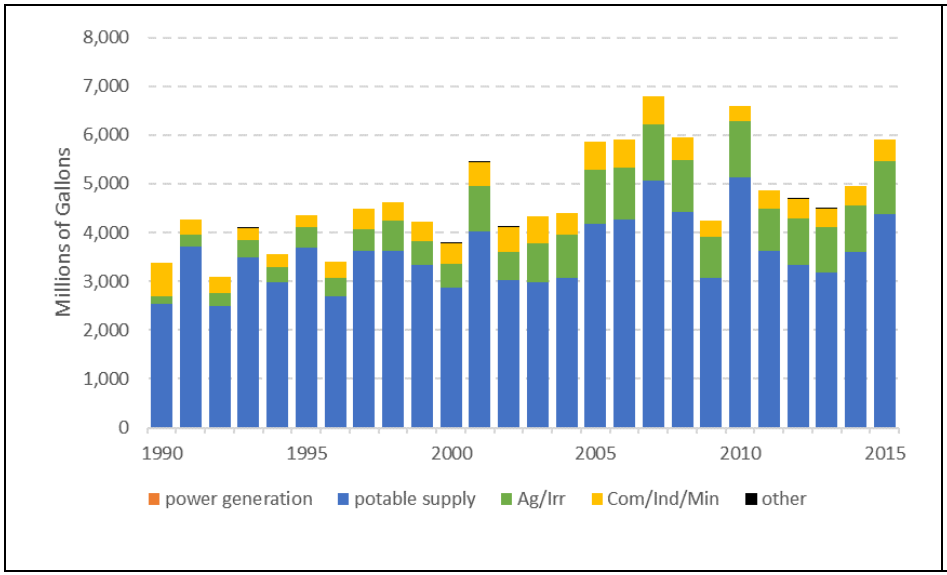


Figure A.13.3. Annual consumptive loss by use sector.

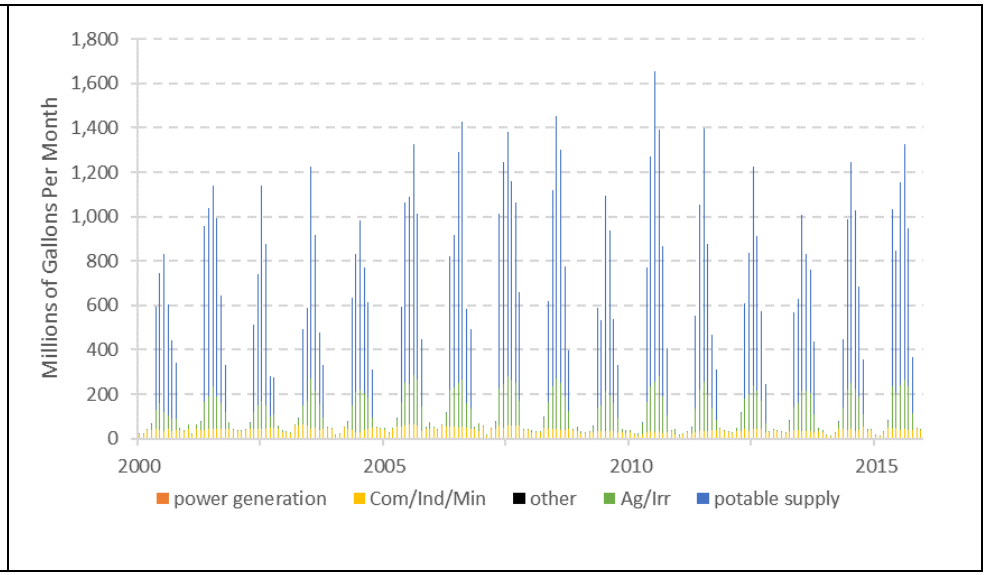


Figure A.13.4. Monthly consumptive loss by use sector.

Table A.13.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	265	101	11	4,507	1,109	696	611	10,889	5,921			
1991	322	171	1	2,189	522	46	906	10,059	7,876			
1992	213	226	1	2,167	565	49	681	9,700	7,755			
1993	264	257	10	1,468	679	35	867	10,589	8,047			
1994	213	237	24	1,564	809	17	1,628	11,259	7,206			
1995	199	395	5	1,199	838	20	1,811	11,564	7,202			
1996	189	346	4	1,619	1,448	24	1,726	11,072	6,997			
1997	216	516	1	2,266	1,493	28	2,230	11,020	8,202			
1998	274	563	8	2,052	1,320	30	2,028	11,331	8,101			
1999	220	501	16	2,234	1,355	55	1,980	10,984	8,358			
2000	189	511	11	2,302	1,598	57	2,303	10,819	8,466		0	
2001	226	836	40	2,786	1,568	49	1,972	10,958	9,628		4	
2002	234	408	9	2,873	1,507	28	2,017	11,408	8,599		0	
2003	435	516	33	3,819	1,430	137	2,748	11,392	9,098			
2004	376	589	60	2,838	1,393	101	2,350	11,366	9,768			
2005	720	674	60	4,115	1,368	186	2,127	11,341	9,986			
2006	663	709	49	4,028	1,389	97	2,889	10,336	10,504			
2007	682	839	38	4,167	1,484	59	2,860	10,495	11,178			
2008	553	793	45	3,109	1,490	46	2,545	9,805	10,860		0	
2009	458	598	42	2,174	1,701	70	2,211	9,318	10,053		0	
2010	595	854	55	1,784	1,320	138	2,517	9,746	11,434			
2011	302	797	46	2,413	1,172	202	2,050	9,396	10,801		0	
2012	472	833	67	2,910	1,239	139	1,812	9,508	10,819		0	
2013	325	854	42	2,611	1,162	143	1,934	9,308	9,973		0	
2014	372	912	30	3,135	842	141	38,436	9,398	10,093		0	
2015	393	1,097	67	3,407	825	170	49,583	9,297	11,074		0	

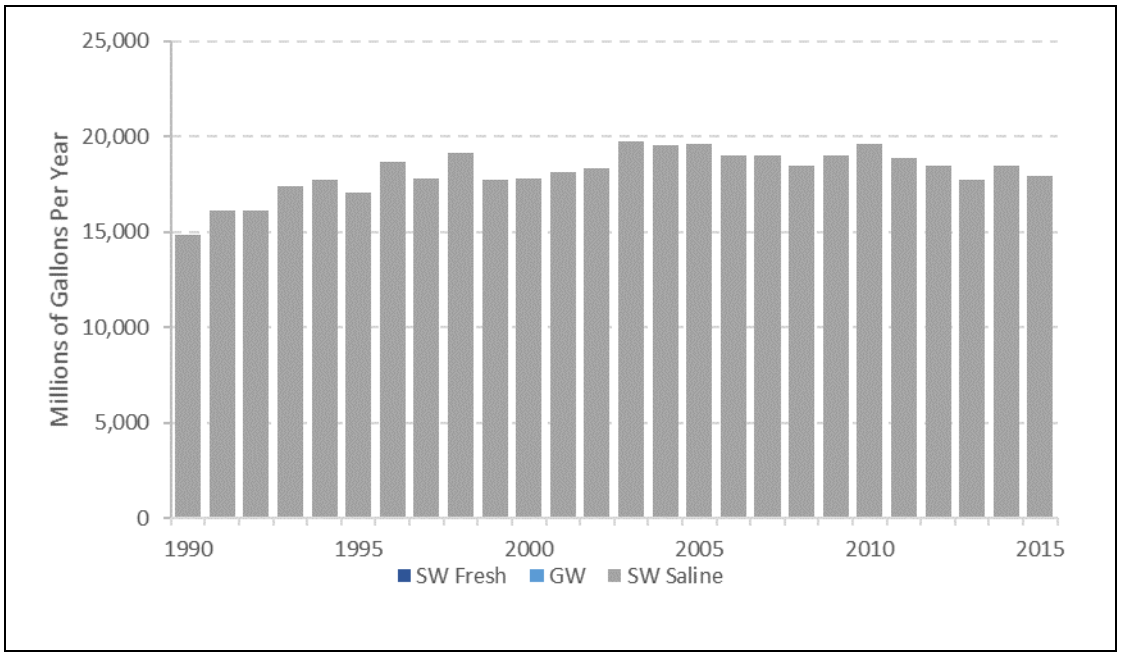


Figure A.13.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Thirty-eight water purveyors which serve more than 1,000 people provide potable water to one or more of the fifteen HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.13.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 40% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by 4.13, 8.26, 12.39, 16.53, and 20.66 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.13.4 contains the demand estimates by HUC11. One hundred twenty-five (125) gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.13.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02040301020	02040301030	02040301040	02040301050	02040301060	02040301070	02040301080	02040301090	02040301100	02040301110	02040301120	02040301130	02040301140	02040301910	02040301920
NJ1316001	Freehold Twp WD	X	X			X										
NJ1319007	Parkway Water Co	X														
NJ1327001	Manasquan WD														X	
NJ1345001	NJ American - Coastal North	X	X	X	X	X									X	
NJ1352003	Wall Twp Water Dept	X														
NJ1503001	Beach Haven WD													X		X
NJ1504001	Beachwood WD							X								
NJ1505002	Aqua NJ - Eastern Division							X	X	X						
NJ1505004	BerkleyTwp MUA							X	X	X						
NJ1506001	BrickTwp MUA	X	X	X	X											
NJ1507005	Suez Water NJ Toms River				X	X	X	X		X						
NJ1507007	NJ American - Ortley Beach				X					X					X	
NJ1510001	Island Heights WD				X			X								
NJ1511001	Jackson Twp MUA	X	X			X	X									
NJ1511010	USDOD Joint Base McGuire Dix Lakehurst						X									
NJ1512001	Lacey Twp MUA								X	X	X					
NJ1513001	Lakehurst WD						X									
NJ1514002	Lakewood Twp MUA	X	X	X	X											
NJ1515001	Lavallette WD				X										X	
NJ1516001	Little Egg Harbor Twp MUA													X		
NJ1517001	Long Beach Twp - Brandt Beach												X	X		X

Table A.13.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02040301020	02040301030	02040301040	02040301050	02040301060	02040301070	02040301080	02040301090	02040301100	02040301110	02040301120	02040301130	02040301140	02040301910	02040301920
NJ1518002	Cedar Glen Lakes WC						X									
NJ1518003	Cedar Glen West WC						X									
NJ1518004	Manchester Twp WU - Western						X	X								
NJ1518005	Manchester Twp WU					X	X	X								
NJ1520001	Ocean Twp Dept of Utilities									X	X	X				
NJ1521001	Ocean Gate WD							X		X						
NJ1522001	Pine Beach WD							X								
NJ1524001	Point Pleasent Borough WD			X												
NJ1525001	Point Pleasant Beach WD			X											X	
NJ1527001	Seaside Park WD									X					X	
NJ1528001	Ship Bottom WD												X			X
NJ1530004	Stafford Twp Water											X	X			
NJ1530005	Stafford Twp MUA Fawn Lawn												X			
NJ1531001	Surf City WD												X			X
NJ1532002	Tuckerton Water and Sewer Dept													X		
NJ1533001	Barnegat Twp Water and Sewer										X	X	X			
NJ1533002	Pinewood Estates - Brighton												X			

Table A.13.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02040301020	0.29	0.59	0.88	1.18	1.47
02040301030	0.47	0.93	1.40	1.86	2.33
02040301040	0.32	0.65	0.97	1.29	1.62
02040301050	0.63	1.27	1.90	2.54	3.17
02040301060	0.52	1.03	1.55	2.07	2.58
02040301070	0.41	0.81	1.22	1.62	2.03
02040301080	0.47	0.94	1.41	1.88	2.35
02040301090	0.13	0.27	0.40	0.54	0.67
02040301100	0.15	0.30	0.46	0.61	0.76
02040301110	0.09	0.17	0.26	0.34	0.43
02040301120	0.16	0.32	0.48	0.64	0.80
02040301130	0.30	0.59	0.89	1.18	1.48
02040301140	0.16	0.33	0.49	0.66	0.82
02040301910	0.02	0.04	0.07	0.09	0.11
02040301920	0.01	0.01	0.02	0.03	0.03
Total	**4.13**	**8.26**	**12.39**	**16.53**	**20.66**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.13.8 and A.13.9 indicate that there is a total of 54 mgd of natural resource availability in WMA 13 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 12 mgd of available water remaining and at full allocation rates 15.3 mgd of water is remaining. Table A.13.5 shows that of the 15 HUC11s in the WMA, 3 have used all the available water and 5 would have used all the available water if full allocation diversion rates were used. Two HUC11s have a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, potable supply uses are the major loss in 11 HUC11s and under full allocation diversion rates potable supply is the largest loss in 12 HUC11s. See tables A.13.5, A.13.6 and A.13.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.13.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02040301020	10.2		Yes		25%	2001	2.5	1.6	61%	1.0	1.2	49%	1.3	Potable	Potable
02040301030	9.0		Yes		25%	2004	2.2	1.7	75%	0.6	1.3	59%	0.9	Potable	Potable
02040301040	5.3		Yes		25%	2012	1.3	3.2	244%	0.0	4.5	341%	0.0	Potable	Potable
02040301050	12.1				25%	2006	3.0	4.4	145%	0.0	4.1	135%	0.0	Potable	Potable
02040301060	10.5				25%	2007	2.6	4.5	171%	0.0	4.9	188%	0.0	Non-Ag Irr	Potable
02040301070	20.3				25%	2002	5.1	2.5	49%	2.6	5.1	100%	0.0	Potable	Potable
02040301080	23.8				25%	2002	5.9	11.7	196%	0.0	9.4	158%	0.0	Potable	Potable
02040301090	26.9				25%	2007	6.7	3.2	47%	3.6	2.9	43%	3.8	Potable	Potable
02040301100	22.4				25%	2001	5.6	0.5	9%	5.1	1.0	18%	4.6	Potable	Potable
02040301110	15.7				25%	2013	3.9	2.8	72%	1.1	2.7	69%	1.2	Potable	Potable
02040301120	22.4				25%	2008	5.6	2.1	37%	3.5	1.1	20%	4.5	Potable	Potable
02040301130	25.6				25%	2006	6.4	3.3	51%	3.1	3.5	54%	2.9	Potable	Potable

Table A.13.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02040301140	10.7				25%	2006	2.7	0.9	32%	1.8	0.7	26%	2.0	Non-Ag Irr	Non-Ag Irr
02040301910	0.0				25%	2013	0.0	-38.0	Net Gain	38.0	-41.5	Net Gain	41.5	Ind-Com-Min	Ag Irr
02040301920	0.0				25%	2013	0.0	-6.3	Net Gain	6.3	-6.8	Net Gain	6.8	Ind-Com-Min	Ag Irr

Table A.13.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02040301020	1.2	0.0	0.7	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	1.9	0.1	0.3	2.2	0.0
02040301030	1.1	0.0	0.6	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	1.8	0.1	0.3	2.2	0.0
02040301040	2.4	0.0	0.1	0.1	0.0	0.0	0.0	1.4	0.0	0.0	0.0	3.5	0.0	0.0	3.5	4.9
02040301050	3.6	0.0	0.6	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	5.1	0.0	0.0	5.1	0.0
02040301060	1.0	0.0	1.3	0.5	3.4	0.2	0.0	0.7	1.0	0.0	0.0	3.3	4.4	1.4	9.1	0.0
02040301070	1.5	0.0	1.1	0.9	0.0	0.0	0.0	0.6	0.0	0.0	0.0	3.7	0.0	0.5	4.2	0.0
02040301080	12.6	0.0	1.1	2.4	0.0	0.0	0.0	0.2	0.0	0.0	0.0	14.6	0.0	0.0	14.6	0.0

Table A.13.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02040301090	1.4	0.0	1.2	0.0	6.8	0.0	0.0	0.2	0.0	0.0	0.0	2.6	6.8	0.8	10.2	0.0
02040301100	0.2	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.2	1.2	0.0
02040301110	2.3	0.0	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.6	3.4	0.0
02040301120	1.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	1.8	0.3	0.4	2.5	0.0
02040301130	1.9	0.0	1.4	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.0	1.1	6.1	0.0
02040301140	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.3	0.4	0.0	0.0	0.5	0.4	0.3	1.1	0.0
02040301910	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02040301920	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table A.13.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02040301020	0.00	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.7
02040301030	0.00	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5
02040301040	0.00	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.0	0.3

Table A.13.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
HUC11	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02040301050	0.00	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.7	0.0	0.7
02040301060	0.01	0.0	0.0	1.0	0.4	3.0	0.0	0.0	0.1	0.1	0.0	0.0	1.5	3.1	4.6
02040301070	0.02	0.0	0.0	0.8	0.9	0.0	0.0	0.0	0.1	0.0	0.0	0.0	1.7	0.0	1.7
02040301080	0.00	0.0	0.0	0.8	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	2.9
02040301090	0.00	0.0	0.0	0.9	0.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.9	6.1	7.1
02040301100	0.00	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.6
02040301110	0.00	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.6
02040301120	0.00	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.4
02040301130	0.00	0.0	0.0	1.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.8	2.8
02040301140	0.00	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.3
02040301910	0.00	0.0	38.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.0	38.0
02040301920	0.00	0.0	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	6.3

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

The one significant surface water system in WMA 13 is the Brick Township Municipal Utilities Authority Reservoir. Diversions are for the purpose of public supply and serves Brick Township & Point Pleasant Beach. In addition, portions of Point Pleasant Borough and Howell Township are served via bulk sales. The safe yield of the surface water system is calculated to be 17 MGD. See Figure A.13.6.

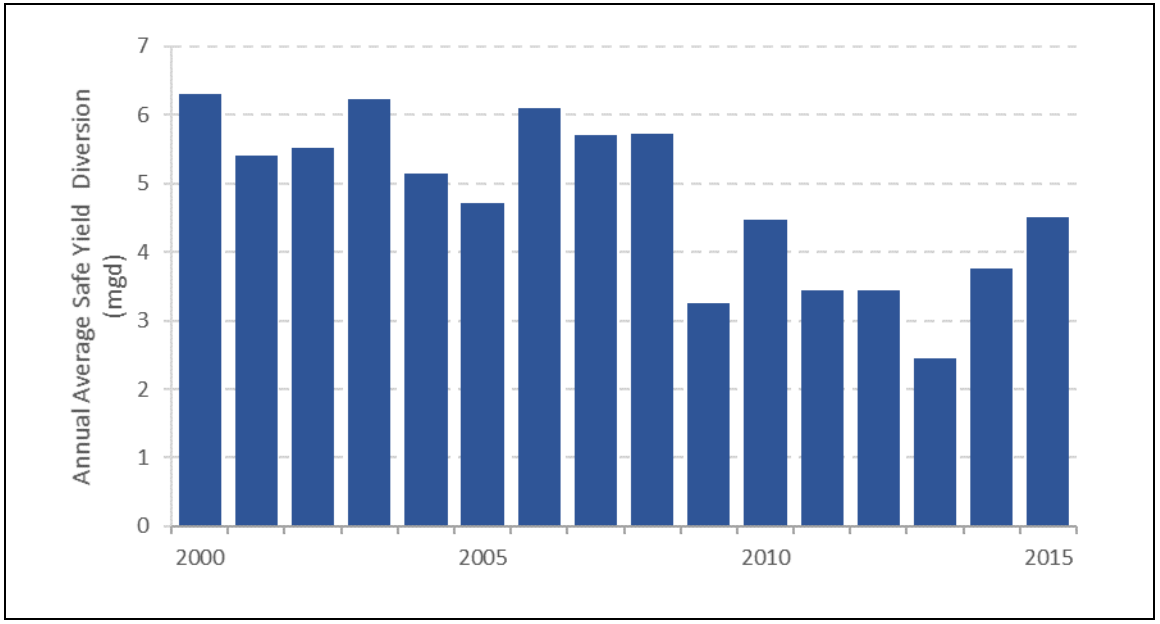


Figure A.13.6. Brick system average annual safe yield withdrawals

AVAILABLE WATER FROM CONFINED AQUIFERS

Multiple confined aquifers are present in WMA. Where these aquifer outcrop some recharge is occurring. See Appendix B Critical Area 1, Atlantic Coastal, and Critical Area 2 regions for more details. Ground water flow in confined aquifers is driven by the regional hydrostratigraphy and water elevation gradients and therefore does not typically follow surface watershed boundaries. Impacts to confined aquifers below a surface watershed may be caused by withdrawals outside of the surface watershed.

SUMMARY AND MANAGEMENT OPTIONS

Table A.13.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
13	Barnegat Bay	17	54	50.4	121.4	6	42	37	85	11	12	13.4	36.4	4.1	32.3

Table A.13.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
13	Barnegat Bay	37	74	50	0	15.3	0		44	3.4	

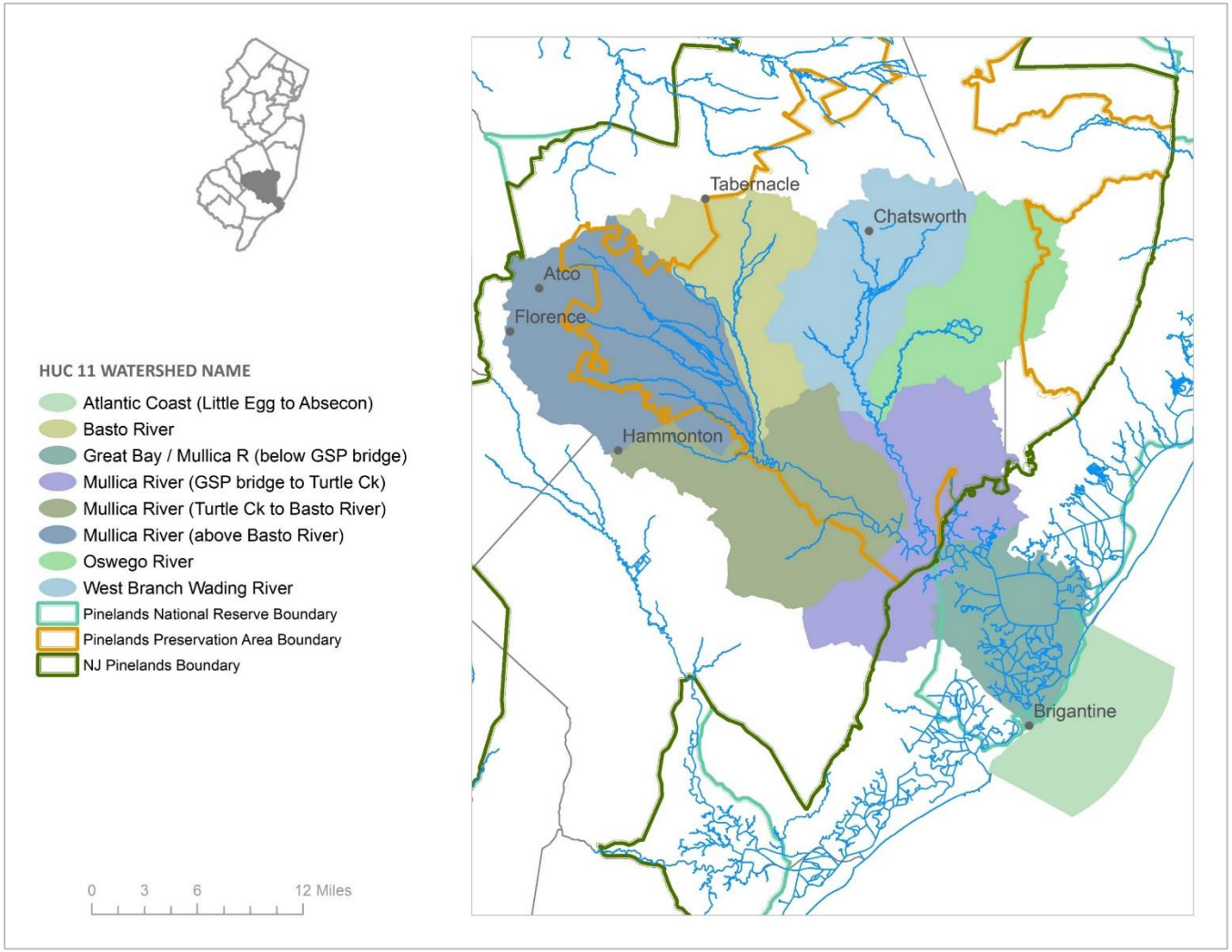
Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1), particularly critical to address consumptive water losses in the Metedeconk River, Kettle Creek / Barnegat Bay North, Toms River (above Oak Ridge Parkway), Union/Ridgeway Branch (Toms River), and Toms River (below Oak Ridge Parkway) HUC11s.
- Allow no additional D/C uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield.
- All new depletive/consumptive uses associated with unconfined ground water or unregulated (non-safe yield) surface water in the Metedeconk River, Kettle Creek / Barnegat Bay North, Toms River (above Oak Ridge Parkway), and Toms River (below Oak Ridge Parkway) HUC11 watersheds should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - If deficit continues, additional depletive/consumptive uses may have to be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Union/Ridgeway Branch (Toms River) HUC11 watersheds as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.

WATERSHED MANAGEMENT AREA 14

MULLICA



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 14 is located in the state's Coastal Plain physiographic province, encompassing approximately 641 square miles throughout portions of Atlantic, Burlington and Ocean Counties. WMA14 includes seven HUC11 watersheds, whose headwaters are located in the heart of New Jersey's Pinelands region, which ultimately flow to the Atlantic Ocean. An additional HUC11 watershed (Atlantic Coast (Little Egg to Absecon)) (shown on the map/legend without shading) extends from the shoreline boundary of the contiguous HUC11 (Great Bay/Mullica River (below GSP Bridge)) out into the Atlantic Ocean.

Primary streams within WMA 14 include the Mullica River, Wading River, Nochescatauxin Brook, Atsion Creek, the Bass River, Batsto River, Nescochaque Creek, Landing Creek, Hammonton Creek and the Oswego River. The streams are classified FW- Pinelands Waters, FW-1, FW-2 Non-trout and SE-1. Much of these waterways are incorporated in the New Jersey Wild and Scenic River System. About 80 percent of this watershed consists of government-owned (municipal/county/State/Federal) parks and forest lands, with the remainder being agricultural and mixed development.

Table A.14.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02040301150	Basto River
02040301160	Mullica River (above Basto River)
02040301170	Mullica River (Turtle Ck to Basto River)
02040301180	Oswego River
02040301190	West Branch Wading River
02040301200	Mullica River (GSP bridge to Turtle Ck)
02040301210	Great Bay / Mullica R (below GSP bridge)
02040302910	Atlantic Coast (Little Egg to Absecon)

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 14 surface water withdrawals comprise 74%, unconfined groundwater withdrawals comprise 21% and confined aquifer withdrawals comprise 5% of the total withdraw. Power generation is not significant use. Potable supply is 14% of the total withdrawal, with 83% coming from unconfined groundwater sources, 17% coming from confined aquifer sources, and the remaining <1% from surface water sources. Combined commercial, industrial and mining make up 7% of the total withdrawal, with 86% coming from surface water sources, <1% from confined aquifer sources, and 14% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 79% of total water withdrawals, with 11% coming from unconfined groundwater sources, 3% from confined aquifer sources, and 86% from surface water sources. Figure A.14.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.14.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 1995 and are lower in the 2000s where they show a relatively flat trend from 2004 to 2015. Annual withdrawals by source and use sector are shown in table A.14.2.

Annual consumptive loss peaked in 2012 with three highest years occurring since 2010. Almost all consumptive loss is from agricultural and non-agricultural irrigation uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2002. Refer to figures A.14.3 and A.14.4.

Almost all (X%) of the total sanitary sewer discharges are equally split between fresh surface water and ground water sources. Discharges average about 3 mgd over the period of record. Refer to Figure A.14.5.

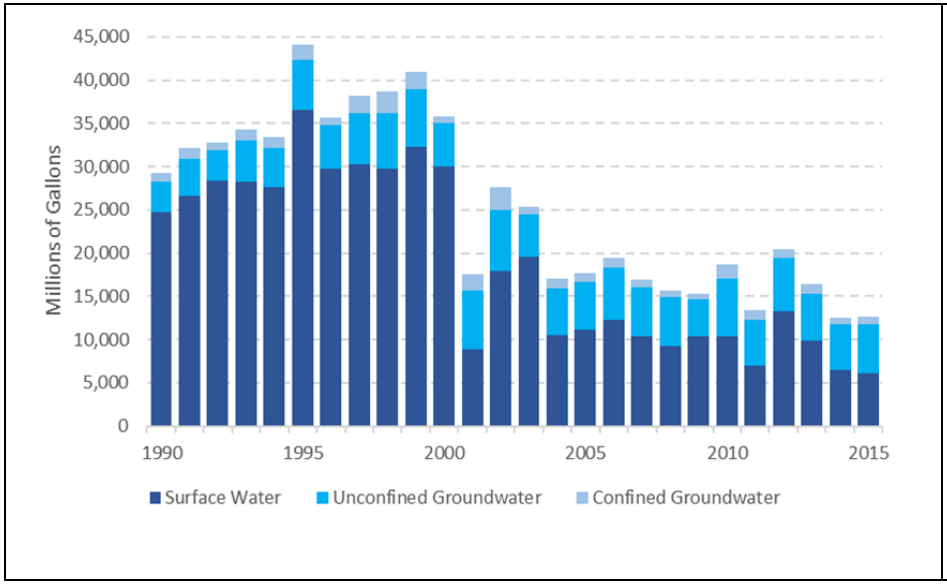


Figure A.11.1. Annual withdrawals by source.

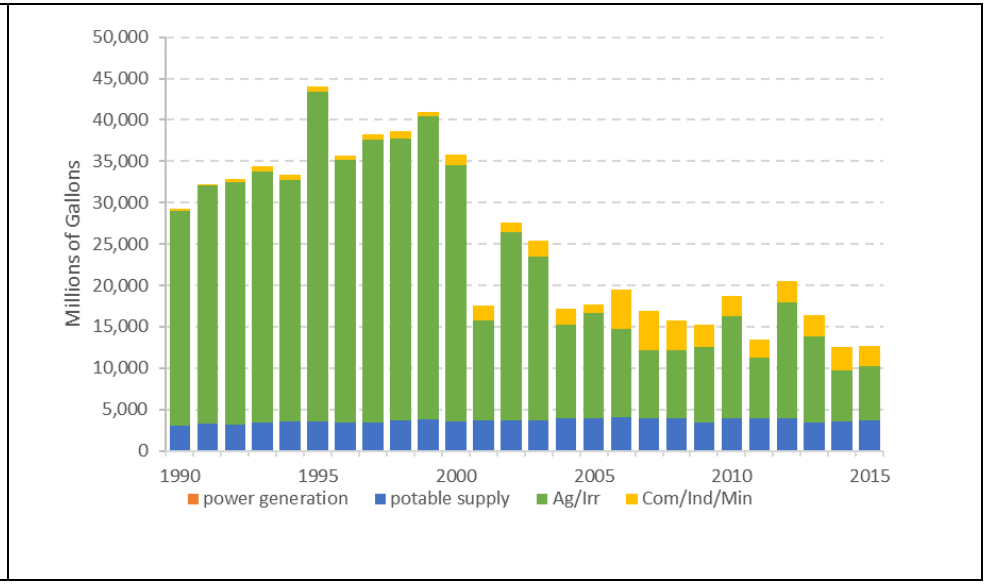


Figure A.11.2. Annual withdrawals by use sector.

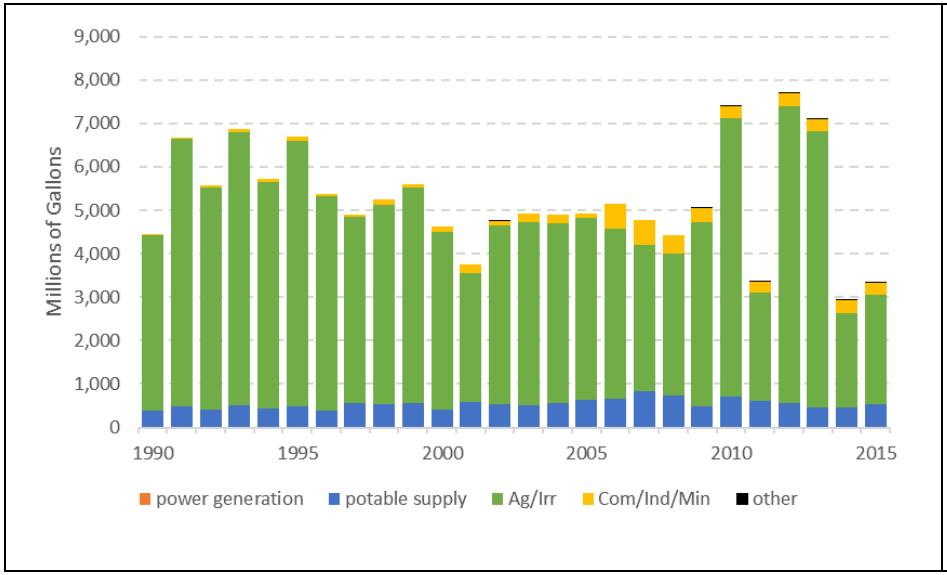


Figure A.11.3. Annual consumptive loss by use sector.

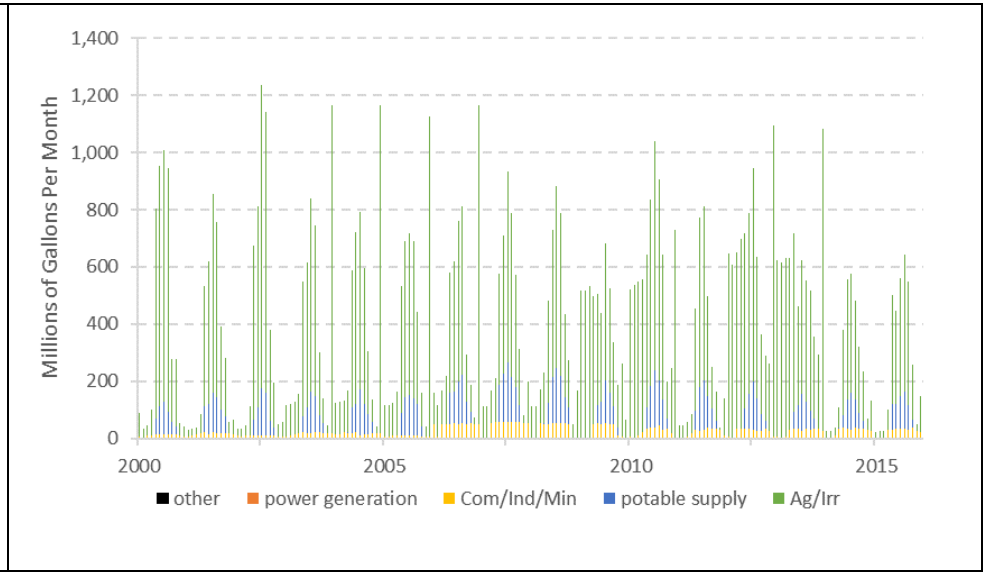


Figure A.11.4. Monthly consumptive loss by use sector.

Table A.14.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	24,647	866	474	136	126	19		2,508	475			
1991	26,469	1,737	542	109	57	19		2,537	736			
1992	28,046	990	239	275	90	33		2,488	684			
1993	28,001	1,796	560	271	236	16		2,786	671			
1994	27,207	1,280	644	383	307	7		2,938	612			
1995	36,170	2,572	1,114	401	276	4		2,975	552			
1996	29,479	1,971	345	333	152	2		2,893	466			
1997	29,909	2,828	1,517	355	165	8		2,934	482			
1998	28,937	3,196	1,933	786	172	8		3,049	579			
1999	31,929	3,473	1,294	375	179	3		3,002	757			
2000	29,126	1,651	262	893	422	2		2,912	563		29	
2001	7,570	3,268	1,253	1,328	560			2,960	642		29	
2002	17,309	3,608	1,886	633	560	2		2,877	729		0	
2003	18,074	1,432	278	1,458	464	5		3,080	572			
2004	9,089	1,772	555	1,389	405	9		3,251	633			
2005	10,480	1,907	392	628	384	4		3,231	663			
2006	7,760	2,361	556	4,518	256	4		3,382	655		9	
2007	5,689	2,414	125	4,683	21	3		3,247	689		0	
2008	5,795	2,335	120	3,405	191	4		3,202	661		3	
2009	7,641	1,373	71	2,723	64	3		2,797	574		27	
2010	8,050	3,393	992	2,289	125	4		3,234	646		8	
2011	4,906	2,029	397	2,097	78	3		3,220	653		2	
2012	10,952	2,657	439	2,369	191	5		3,231	632		0	
2013	7,604	2,293	562	2,325	165	1		2,870	550		0	
2014	4,065	1,865	193	2,439	343	1		3,060	525		0	
2015	3,955	2,146	466	2,184	277	1		3,204	402		0	

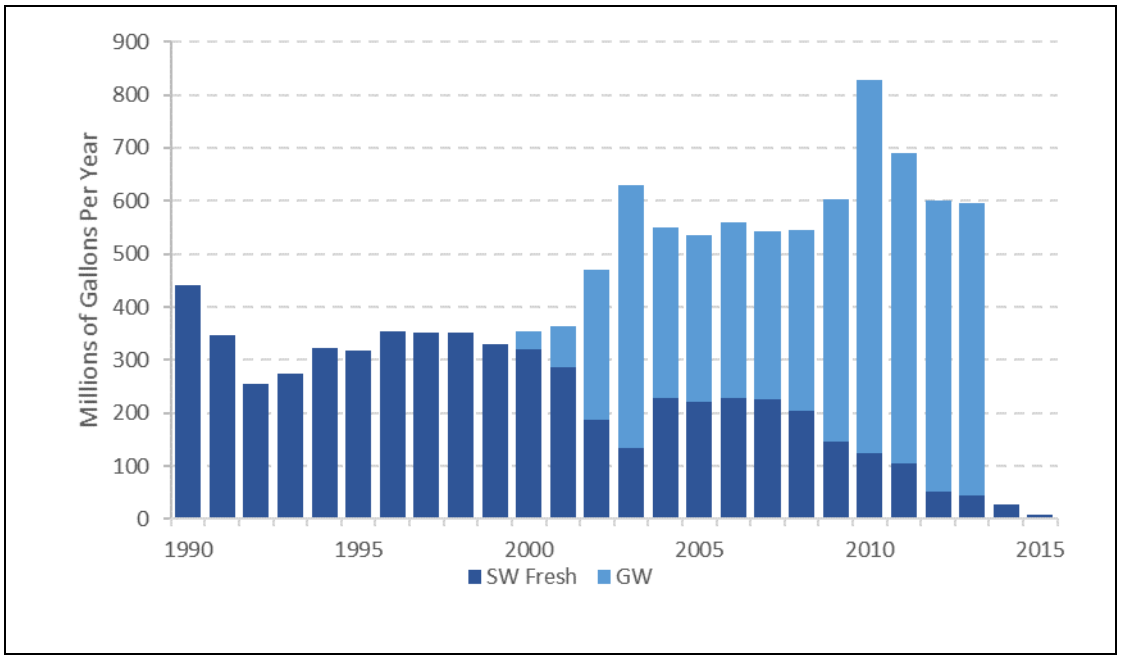


Figure A.14.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Eleven water purveyors which serve more than 1,000 people provide potable water to one or more of the eight HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.14.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 22% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by 0.55, 1.19, 1.78, 2.26, and 2.65 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.14.4 contains the demand estimates by HUC11. One hundred twenty-five (125) gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.14.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02040301150	02040301160	02040301170	02040301200	02040301210	02040302910
NJ0103001	Brigantine WD					X	X
NJ0107001	Egg Harbor City WD			X			
NJ0113001	Hammonton WD		X	X			
NJ0119002	NJ American - Atlantic			X	X	X	
NJ0313001	Evesham MUA		X				
NJ0320001	Medford Twp MUA	X	X				
NJ0405001	Berlin WD		X				
NJ0435003	Waterford Twp WD		X				
NJ0436001	Ancora Psychiatric Hospital /NJAWC		X				
NJ0436007	Winslow Twp DMU		X				
NJ1516001	Little Egg Harbor Twp MUA				X	X	

Table A.14.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02040301150	0.00	0.01	0.01	0.01	0.01
02040301160	0.11	0.30	0.48	0.58	0.62
02040301170	0.08	0.18	0.26	0.32	0.38
02040301180	0.12	0.23	0.35	0.46	0.58
02040301190	0.00	0.00	0.00	0.01	0.01
02040301200	0.09	0.16	0.23	0.31	0.37
02040301210	0.15	0.30	0.44	0.57	0.68
02040302910	0.00	0.00	0.00	0.01	0.00
Total	**0.55**	**1.19**	**1.78**	**2.26**	**2.65**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.14.8 and A.14.9 indicate that there is a total of 39 mgd of natural resource availability in WMA 14 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 9 mgd of available water remaining and at full allocation rates 0 mgd of water is remaining. Table A.14.5 shows that of the 8 HUC11s in the WMA, 1 has used all the available water and 5 would have used all the available water if full allocation diversion rates were used. Under current conditions, agricultural irrigation uses are the major loss in 5 HUC11s and under full allocation diversion rates potable supply is the largest loss in 4 HUC11s. See tables A.14.5, A.14.6 and A.14.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.14.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02040301150	17.7				25%	2010	4.4	4.2	94%	0.3	14.4	324%	0.0	Ag Irr	Ag Irr
02040301160	28.9				25%	2010	7.2	10.1	140%	0.0	17.6	243%	0.0	Ag Irr	Ag Irr
02040301170	30.8				25%	2008	7.7	7.5	98%	0.1	9.1	118%	0.0	Ag Irr	Ag Irr
02040301180	16.7				25%	2000	4.2	2.6	61%	1.6	8.0	192%	0.0	Ag Irr	Potable
02040301190	21.4				25%	2007	5.3	0.9	17%	4.5	1.0	18%	4.4	Ag Irr	Ag Irr
02040301200	26.8				25%	2007	6.7	4.6	68%	2.1	4.4	66%	2.3	Potable	Potable
02040301210	15.6			Yes	25%	2001	3.9	0.1	4%	3.8	0.6	16%	3.3	Potable	Potable
02040302910	0.0				25%	2000	0.0	0.0	0%	0.0	0.0	0%	0.0	Potable	Potable

Table A.14.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02040301150	0.0	0.0	0.7	0.0	0.0	3.0	2.1	0.0	0.0	0.0	0.0	3.4	2.1	0.2	5.7	0.0
02040301160	1.8	0.0	2.4	0.2	0.1	7.5	1.2	0.1	0.1	0.0	0.0	10.8	1.4	0.9	13.1	0.0
02040301170	1.4	0.0	1.0	0.0	0.0	6.8	0.0	0.1	0.0	0.0	0.0	8.4	0.1	1.6	10.0	0.0
02040301180	0.0	0.0	0.4	0.0	1.4	15.9	23.6	0.0	0.0	0.0	0.0	14.7	25.0	0.2	39.9	0.0
02040301190	0.0	0.0	0.2	0.0	0.0	2.3	0.5	0.0	0.0	0.0	0.0	2.3	0.5	0.4	3.2	0.0
02040301200	3.2	0.0	0.6	0.4	0.0	0.5	0.0	0.4	0.0	0.0	0.0	4.6	0.0	0.9	5.5	0.0
02040301210	0.0	0.0	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.9	0.0
02040302910	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table A.14.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
HUC11	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02040301150	0.00	0.0	0.0	0.6	0.0	0.0	0.7	0.3	0.0	0.0	0.0	0.0	1.2	0.3	1.5
02040301160	0.00	0.0	0.0	1.8	0.1	0.1	0.8	0.2	0.0	0.0	0.0	0.0	2.7	0.2	2.9
02040301170	0.51	0.5	0.0	0.7	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	2.0	0.5	2.5
02040301180	0.00	0.0	0.0	0.3	0.0	1.2	12.2	23.6	0.0	0.0	0.0	0.0	12.5	24.8	37.3
02040301190	0.00	0.0	0.0	0.2	0.0	0.0	1.7	0.4	0.0	0.0	0.0	0.0	1.9	0.4	2.3
02040301200	0.00	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.9
02040301210	0.00	0.0	0.0	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.8
02040302910	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

There are no major reservoirs located in WMA 14. Some smaller reservoir systems may be present and while critical to the residents that rely of them, they are not covered in this statewide plan.

AVAILABLE WATER FROM CONFINED AQUIFERS

Multiple confined aquifers are present in the WMA. Recharge is occurring from up-dip areas where the aquifer outcrops and from the vertical movement of water from aquifers above and below. See Appendix B Atlantic Coastal and Critical Area 2 regions for more details. Ground-water flow in confined aquifers is driven by the regional hydrostratigraphy and water elevation gradients and therefore does not typically follow surface watershed boundaries. Impacts to confined aquifers below a surface watershed may be caused by withdrawals outside of the surface watershed.

SUMMARY AND MANAGEMENT OPTIONS

Table A.14.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
14	Mullica		39	10.4	49.4		30	7	37		9	3.4	12.4	0.5	11.9

Table A.14.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
14	Mullica	46	53	10		-15.6	0			0.4	

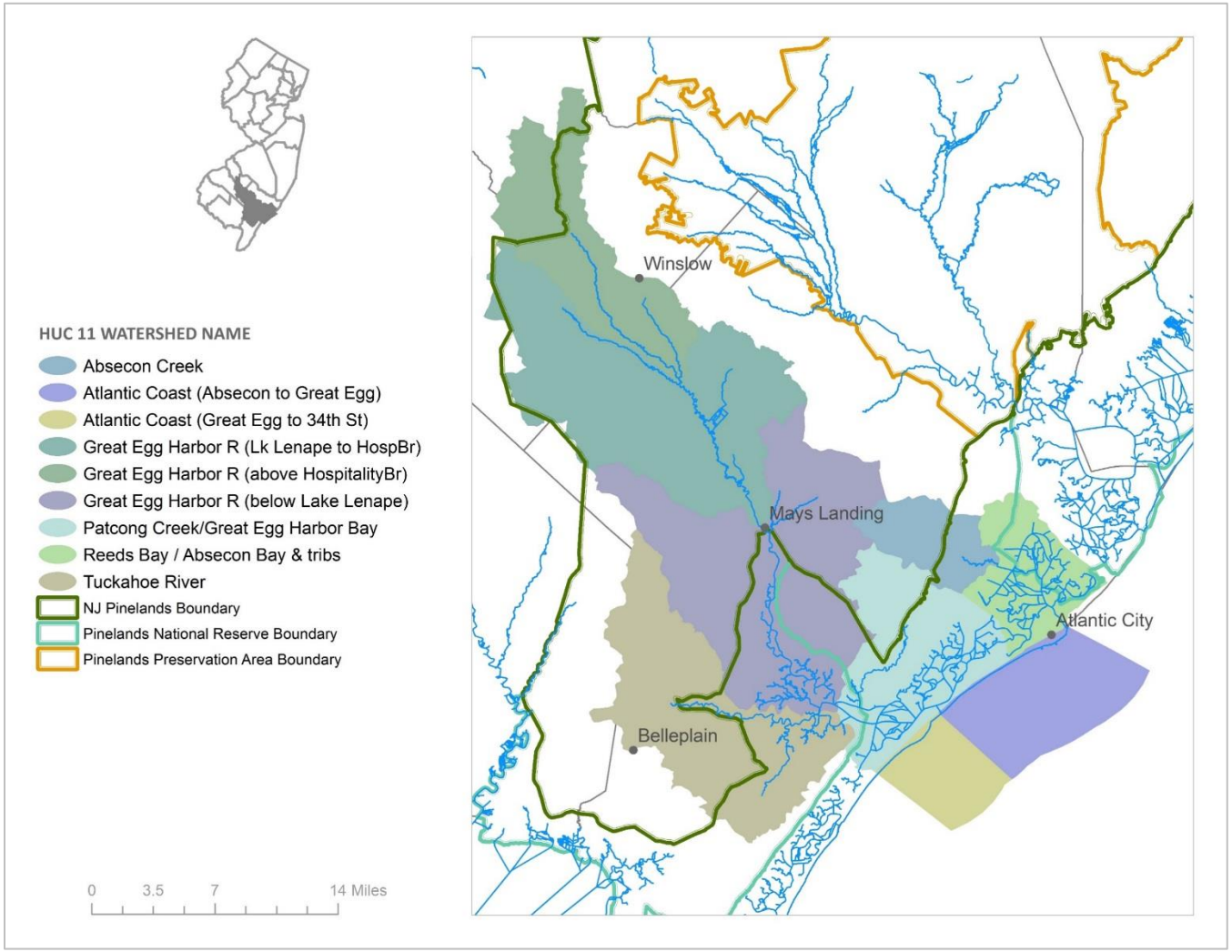
Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for facilities located in the Batsto, Mullica River (above Batsto River and Turtle Creek to Batsto River) and West Branch Wading River HUC11s.
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Mullica River (Turtle Ck to Basto River) HUC11 watershed should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor water use in the Basto River, Mullica River (above Basto River), Mullica River (Turtle Ck to Basto River), Oswego River and West Branch Wading River HUC11 watershed as they approache the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
    - If deficit occurs, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of an existing depletive/consumptive use, increased storage, or increased recharge.

WATERSHED MANAGEMENT AREA 15

GREAT EGG HARBOR



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 15 is located in New Jersey's Coastal Plain Province, extending southeastward from Gloucester and Camden Counties to the Atlantic Ocean. WMA 15 encompasses approximately 613.5 square miles, and includes seven HUC11 watersheds that flow generally southeastward toward the Atlantic Ocean: Great Egg Harbor River (Above Hospitality Branch, Lake Lenape to Hospitality Branch, and Below Lake Lenape), Tuckahoe River, Patcong Creek/Great Egg Harbor Bay, Absecon Creek, and Reeds Bay/Absecon Bays & tributaries. Two additional HUC11 watersheds (shown on the map/legend without shading) extend from the shoreline boundary of the contiguous HUC11s out into the Atlantic Ocean.

The watershed's dominant land use is forested, with the remainder a mix of agriculture and residential/commercial development. Population centers include Berlin, Winslow, Monroe, Egg Harbor and Hamilton Townships, Pleasantville and Atlantic City. The major tributaries are Hospitality Branch, Watering Race, Babcock Creek, Deep Run, South River and Stephens Creek. There are many lakes and ponds in this area, with the largest being Lake Lenape, an impoundment that spills to the tidal portion of the Great Egg Harbor River at Mays Landing (Hamilton Township).

Table A.15.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02040302010	Reeds Bay / Absecon Bay & tribs
02040302020	Absecon Creek
02040302030	Great Egg Harbor R (above HospitalityBr)
02040302040	Great Egg Harbor R (Lk Lenape to HospBr)
02040302050	Great Egg Harbor R (below Lake Lenape)
02040302060	Patcong Creek/Great Egg Harbor Bay
02040302070	Tuckahoe River
02040302920	Atlantic Coast (Absecon to Great Egg)
02040302930	Atlantic Coast (Great Egg to 34th St)

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 15 surface water withdrawals comprise 20%, unconfined groundwater withdrawals comprise 55% and confined aquifer withdrawals comprise 25% of the total withdraw. Power generation is not significant use. Potable supply is 69% of the total withdrawal, with 63% coming from unconfined groundwater sources, 32% coming from confined aquifer sources, and the remaining 5% from surface water sources. Combined commercial, industrial and mining make up 20% of the total withdrawal, with 80% coming from surface water sources, 10% from confined aquifer sources, and 10% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 11% of total water withdrawals, with 89% coming from unconfined groundwater sources, <1% from confined aquifer sources, and 11% from surface water sources. Figure A.15.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.15.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 2007 and decreasing trend from 2009 to 2015. Annual withdrawals by source and use sector are shown in table A.15.2.

Annual consumptive loss peaked in 2007 with an overall decreasing trend from 2007 to 2015. Consumptive loss is equally split between potable and agricultural and non-ag irrigation uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2007. Refer to figures A.15.3 and A.15.4.

Almost all (95%) of the total sanitary sewer discharges are to saline surface water sources. The remaining 5% of the discharges are to groundwater and fresh surface water. Discharges average about 77 mgd over the period of record. Refer to Figure A.15.5.

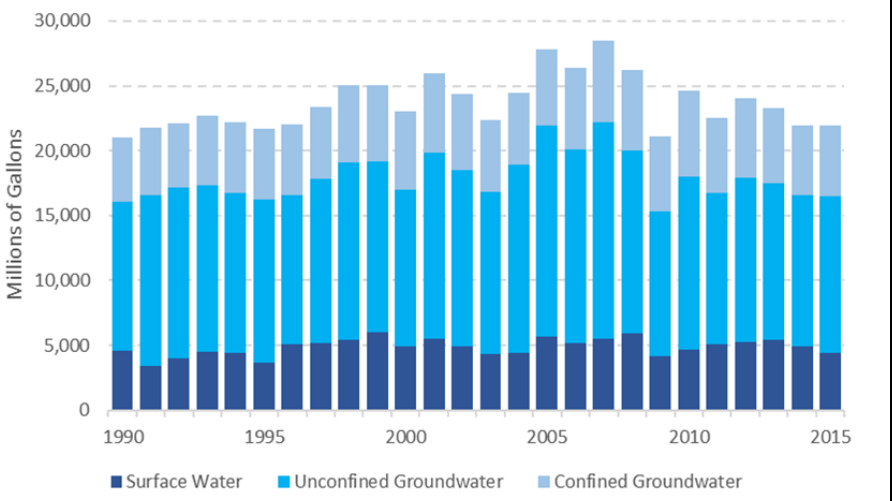


Figure A.15.1. Annual withdrawals by source.

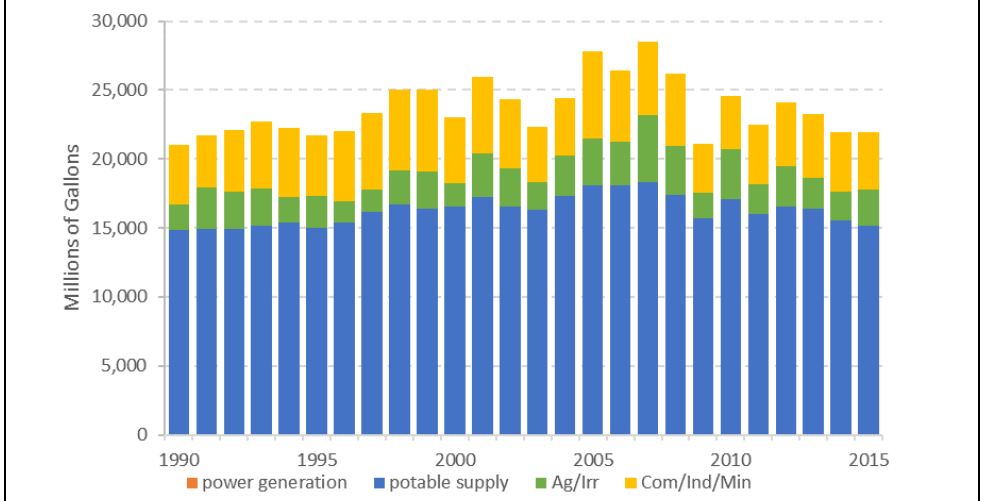


Figure A.15.2. Annual withdrawals by use sector.

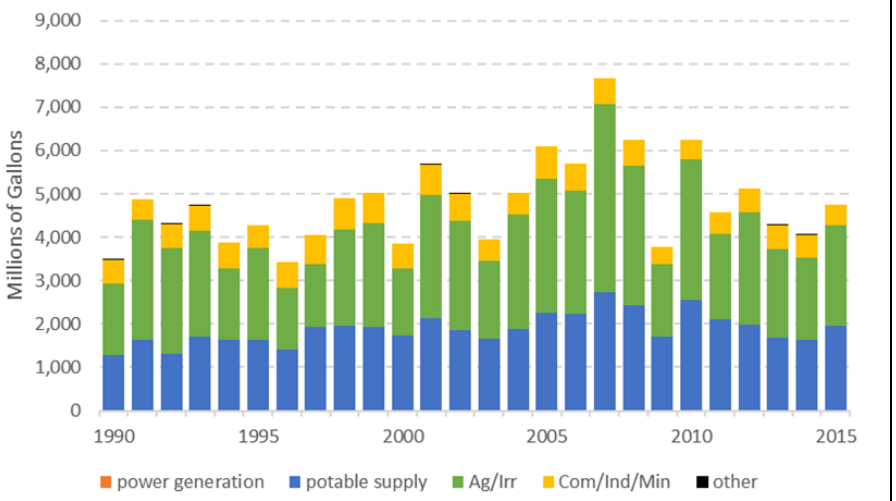


Figure A.15.3. Annual consumptive loss by use sector.

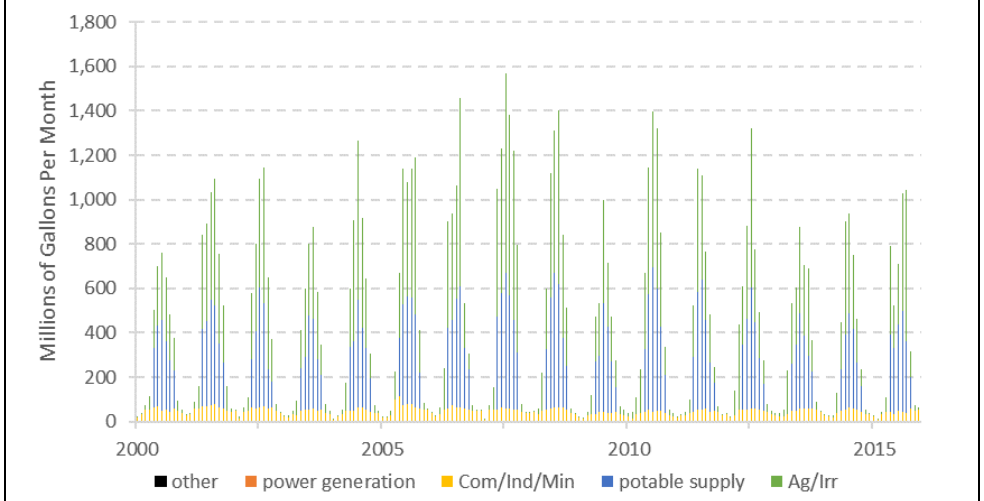


Figure A.15.4. Monthly consumptive loss by use sector.

Table A.15.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	191	1,636	1	3,441	383	528	916	9,544	4,400			
1991	526	2,544	1	2,848	387	532		10,248	4,654			
1992	277	2,423	0	3,393	607	535	294	10,160	4,450			
1993	212	2,492	1	3,822	525	509	428	9,816	4,879			
1994	223	1,592	7	4,010	462	523	147	10,273	4,993			
1995	178	2,152	6	3,436	431	489	5	10,011	4,994			
1996	175	1,394	2	3,959	563	543	913	9,549	4,894			
1997	186	1,433	2	4,409	531	634	557	10,699	4,918			
1998	262	2,202	1	4,764	489	635	393	10,946	5,370			
1999	318	2,337	0	4,811	585	582	855	10,249	5,321			
2000	255	1,442	4	3,783	350	625	845	10,324	5,378			
2001	453	2,705	2	4,500	473	559	544	11,191	5,507		16	
2002	339	2,447	16	3,998	448	552	577	10,719	5,250		9	
2003	396	1,611	8	3,163	345	500	730	10,591	4,990		22	
2004	396	2,541	8	3,344	318	537	698	11,578	4,993		18	
2005	432	3,005	11	4,478	1,296	552	755	11,933	5,355		17	
2006	337	2,840	13	4,128	473	555	728	11,579	5,757		15	
2007	315	4,506	14	4,293	710	355	863	11,478	5,961		25	
2008	360	3,195	16	4,461	430	328	1,083	10,442	5,833		35	
2009	246	1,614	2	2,775	563	238	1,108	8,970	5,596		25	
2010	423	3,177	10	3,144	464	281	1,095	9,665	6,307		24	
2011	179	1,979	14	3,461	441	413	1,430	9,230	5,340		18	
2012	233	2,637	12	3,871	426	338	1,120	9,602	5,832		7	
2013	211	2,052	21	3,825	494	260	1,405	9,536	5,437		5	
2014	150	1,964	14	3,498	500	327	1,271	9,212	5,028		5	
2015	194	2,359	15	3,422	551	187	812	9,130	5,241		6	

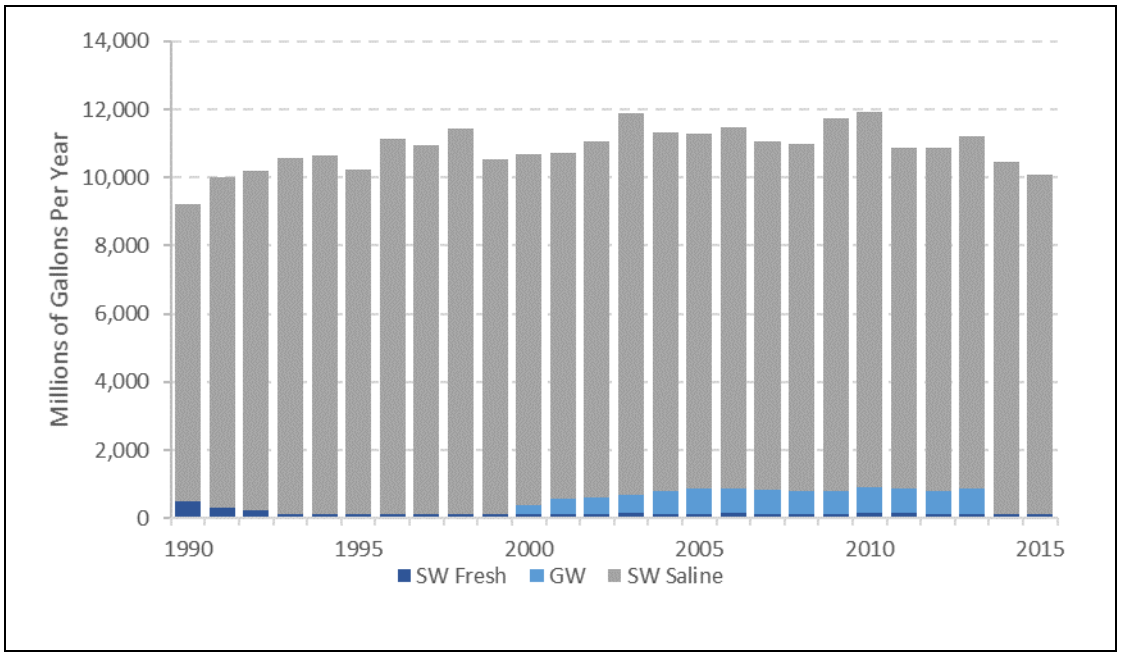


Figure A.15.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Sixteen water purveyors which serve more than 1,000 people provide potable water to one or more of the nine HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.15.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 33% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by 1.18, 2.68, 4.00, 4.88, and 5.37 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.15.4 contains the demand estimates by HUC11. One hundred twenty-five (125) gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.15.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02040302010	02040302020	02040302030	02040302040	02040302050	02040302060	02040302070	02040302920	02040302930
NJ0102001	Atlantic City MUA	X					X		X	
NJ0103001	Brigantine WD	X								
NJ0104003	Buena Borough MUA				X					
NJ0112001	Hamilton Twp MUA		X		X	X	X			
NJ0113001	Hammonton WD			X	X					
NJ0116001	Margate City WA						X		X	
NJ0119002	NJ American - Atlantic	X	X			X	X			
NJ0122001	Ventnor City Water & Sewer Utility	X					X		X	
NJ0405001	Berlin WD			X						
NJ0415002	Aqua NJ - Blackwood			X						
NJ0428002	Pine Hill Borough MUA			X						
NJ0436007	Winslow Twp DMU			X						
NJ0508001	NJ American - Ocean City						X	X		X
NJ0516001	Woodbine MUA							X		
NJ0811002	Monroe Twp MUA			X	X					
NJ0818004	Washington Twp MUA			X						

Table A.15.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02040302010	0.16	0.31	0.42	0.49	0.53
02040302020	0.09	0.19	0.27	0.35	0.41
02040302030	0.17	0.56	0.95	1.11	1.18
02040302040	0.23	0.59	0.94	1.14	1.26
02040302050	0.20	0.41	0.59	0.76	0.88
02040302060	0.32	0.66	0.90	1.12	1.26
02040302070	-0.02	-0.04	-0.08	-0.11	-0.15
02040302920	0.01	0.02	0.03	0.04	0.04
02040302930	0.00	-0.01	-0.01	-0.02	-0.03
Total	**1.18**	**2.68**	**4.00**	**4.88**	**5.37**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.15.8 and A.15.9 indicate that there is a total of 36 mgd of natural resource availability in WMA 15 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 0 mgd of available water remaining and at full allocation rates 0 mgd of water is remaining. Table A.14.5 shows that of the 9 HUC11s in the WMA, 5 have used all the available water and 5 would have used all the available water if full allocation diversion rates were used. One HUC11 has a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, potable supply uses are the major loss in 5 HUC11s and under full allocation diversion rates potable supply is the largest loss in 7 HUC11s. See tables A.15.5, A.15.6 and A.15.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.15.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02040302010	9.4			Yes	25%	2005	2.3	0.9	38%	1.4	0.8	34%	1.5	Non-Ag Irr	Potable
02040302020	5.7				25%	2010	1.4	15.3	1076%	0.0	21.8	1537%	0.0	Potable	Potable
02040302030	18.0				25%	2007	4.5	9.1	202%	0.0	10.3	228%	0.0	Potable	Potable
02040302040	45.5			Yes	25%	2007	11.4	18.1	159%	0.0	15.6	137%	0.0	Ag Irr	Ag Irr
02040302050	31.5				25%	2005	7.9	5.4	69%	2.5	7.1	90%	0.8	Potable	Potable
02040302060	14.2				25%	2008	3.6	7.8	218%	0.0	7.0	196%	0.0	Potable	Potable
02040302070	21.1				25%	2001	5.3	3.7	69%	1.6	3.1	59%	2.1	Con Aq Leak	Potable
02040302920	0.0				25%	2005	0.0	-26.1	Net Gain	26.1	-25.4	Net Gain	25.4	Ag Irr	Ag Irr
02040302930	0.0				25%	2000	0.0	0.0	0%	0.0	0.0	0%	0.0	Potable	Potable

Table A.15.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02040302010	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.7	0.3	0.0	0.0	0.9	0.3	0.0	1.3	0.0
02040302020	11.3	4.9	0.5	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.7	4.9	0.1	16.6	0.0
02040302030	7.4	0.0	1.4	0.0	0.0	4.5	0.4	0.0	0.0	0.0	0.0	12.0	0.4	0.0	12.4	0.0
02040302040	1.1	0.0	2.2	0.3	5.0	18.6	0.0	0.3	0.0	0.0	0.0	20.1	5.0	1.4	26.5	0.0
02040302050	1.6	0.0	1.5	0.3	0.0	1.5	0.2	0.7	1.0	0.0	0.0	5.1	1.2	0.9	7.2	0.0
02040302060	7.9	0.0	1.4	0.0	0.0	0.1	0.1	0.7	0.1	0.1	0.0	9.2	0.2	0.1	9.6	0.0
02040302070	0.5	0.0	1.4	5.9	4.7	0.1	0.8	0.1	0.0	0.0	0.0	7.0	5.5	1.6	14.1	0.0
02040302920	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02040302930	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table A.15.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02040302010	0.00	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.0	0.4
02040302020	0.00	0.0	0.0	0.4	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	1.3
02040302030	1.69	0.0	0.0	1.1	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	3.3	0.1	3.3
02040302040	0.00	0.3	0.0	1.6	0.2	4.4	1.9	0.0	0.0	0.0	0.0	0.0	3.7	4.7	8.4
02040302050	0.04	0.0	0.0	1.1	0.3	0.0	0.2	0.0	0.1	0.1	0.0	0.0	1.7	0.1	1.8
02040302060	0.01	0.0	0.0	1.0	0.6	0.0	0.0	0.0	0.1	0.0	0.1	0.0	1.8	0.0	1.8
02040302070	0.00	0.0	0.0	1.0	5.2	4.1	0.0	0.1	0.0	0.0	0.0	0.0	6.2	4.2	10.4
02040302920	0.00	0.0	25.4	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	25.4	26.1
02040302930	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

There are no major reservoirs located in WMA 15. Some smaller reservoir systems may be present and while critical to the residents that rely of them, they are not covered in this statewide plan.

AVAILABLE WATER FROM CONFINED AQUIFERS

Multiple confined aquifers are present in the WMA. Recharge is occurring from up-dip areas where the aquifer outcrops and from the vertical movement of water from aquifers above and below. See Appendix B Atlantic Coastal and Critical Area 2 regions for more details. Ground water flow in confined aquifers is driven by the regional hydrostratigraphy and water elevation gradients and therefore does not typically follow surface watershed boundaries. Impacts to confined aquifers below a surface watershed may be caused by withdrawals outside of the surface watershed.

SUMMARY AND MANAGEMENT OPTIONS

Table A.15.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
15	Great Egg Harbor		36	27.2	63.2		59	22	81		-23	5.2	-17.8	1.2	-19

Table A.15.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
15	Great Egg Harbor	34	59	27		-29.4	0		25	2.1	

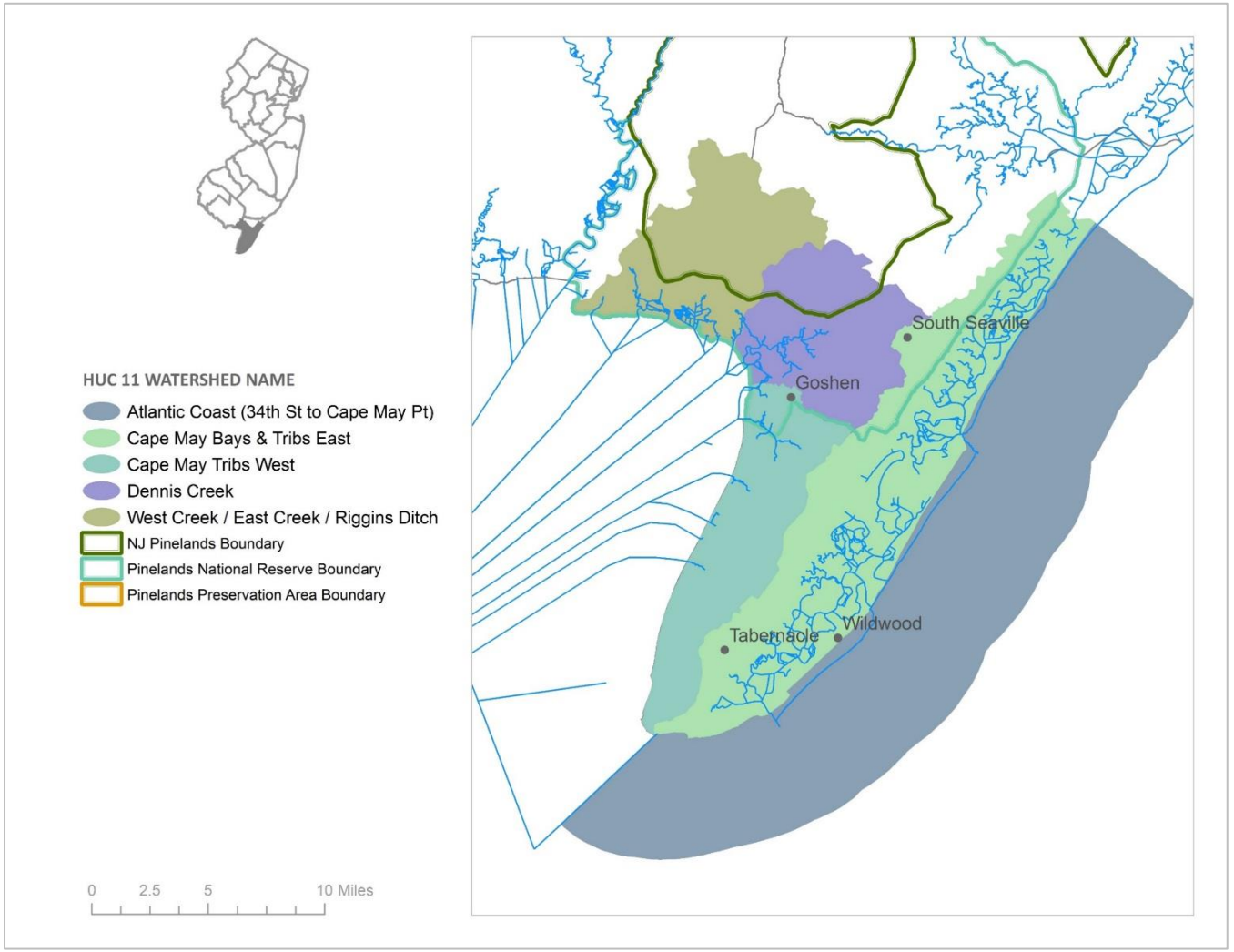
Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for facilities located in the Great Egg Harbor River (Lake Lenape to Hospitality Branch and Above Hospitality Branch) and Tuckahoe River HUC11 watersheds.
- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Absecon Creek, Great Egg Harbor R (above HospitalityBr), Great Egg Harbor R (Lk Lenape to HospBr), and Patcong Creek/Great Egg Harbor Bay HUC11 watersheds should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Great Egg Harbor River (below Lake Lenape), Patcong Creek/Great Egg Harbor Bay and Tuckahoe River HUC11 watersheds as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.

WATERSHED MANAGEMENT AREA 16

CAPE MAY



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 16, which is 391.7 square miles, is located in the extreme southern end of New Jersey's Coastal Plain Province, and is surrounded by the Atlantic Ocean and Delaware Bay. The region consists of a low lying and gently rolling plain that is 54 feet above sea level at its highest point and is largely covered by wet (hydric) soils and wetlands. Large expanses of swamp land (Great Cedar, Timber and Beaver Swamps) occupy the north-central part of the WMA. Most, if not all, streams here terminate by flowing into freshwater swamps in their lower reaches that, in turn, discharge into tidal saltwater bodies and marshes near the shore. WMA 16 includes four HUC11 watersheds (Cape May Tribs West, Cape May Bays & Tribs East, Dennis Creek, and West Creek/East Creek/Riggins Ditch) that drain to either the Atlantic Ocean or Delaware Bay. A fifth HUC11 watershed, the Atlantic Coast (34th Street to Cape May Point) (shown on the map/legend without shading) extends from the shoreline boundary of the contiguous HUC11 (Cape May Bays & Tribs East) out into the Atlantic Ocean.

The county's permanent year-round population is approximately 97,000, with 41 percent of the population residing on the barrier islands that comprise the eastern perimeter of the peninsula. The summertime population rises significantly and is estimated at 750,000 with 65 percent residing on the barrier islands.

The principal water resource issue within WMA 16 is drinking water supply. The area is largely dependent upon groundwater resources that are highly vulnerable to saltwater intrusion from the west, south and east, particularly in the southern portion of the peninsula.

Table A.16.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02040206210	West Creek / East Creek / Riggins Ditch
02040206220	Dennis Creek
02040206230	Cape May Tribs West
02040302080	Cape May Bays & Tribs East
02040302940	Atlantic Coast (34th St to Cape May Pt)

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 16 surface water withdrawals comprise 4%, unconfined groundwater withdrawals comprise 37% and confined aquifer withdrawals comprise 59% of the total withdraw. Power generation is not significant use. Potable supply is 89% of the total withdrawal, with 33% coming from unconfined groundwater sources, 66% coming from confined aquifer sources, and the remaining <1% from surface water sources. Combined commercial, industrial and mining make up 4% of the total withdrawal, with 45% coming from surface water sources, 4% from confined aquifer sources, and 51% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 8% of total water withdrawals, with 72% coming from unconfined groundwater sources, 4% from confined aquifer sources, and 24% from surface water sources. Figure A.16.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.16.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 2008 and show slight increase from 1990 to 2015. Annual withdrawals by source and use sector are shown in table A.13.2.

Annual consumptive loss peaked in 2010 with an overall slightly upward trend from 1990 to 2015. Consumptive loss is split between potable supply and power generation uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2011. Refer to figures A.13.3 and A.13.4.

Sixty-five percent of the total sanitary sewer discharges are to saline surface water sources. The remaining 35% of the discharges are to fresh surface water. Discharges average about 44 mgd over the period of record. Refer to Figure A.16.5.

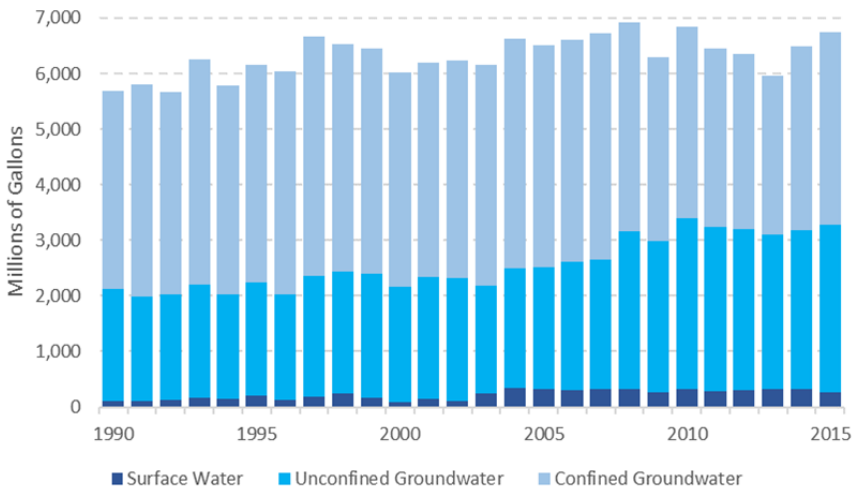


Figure A.16.1. Annual withdrawals by source.

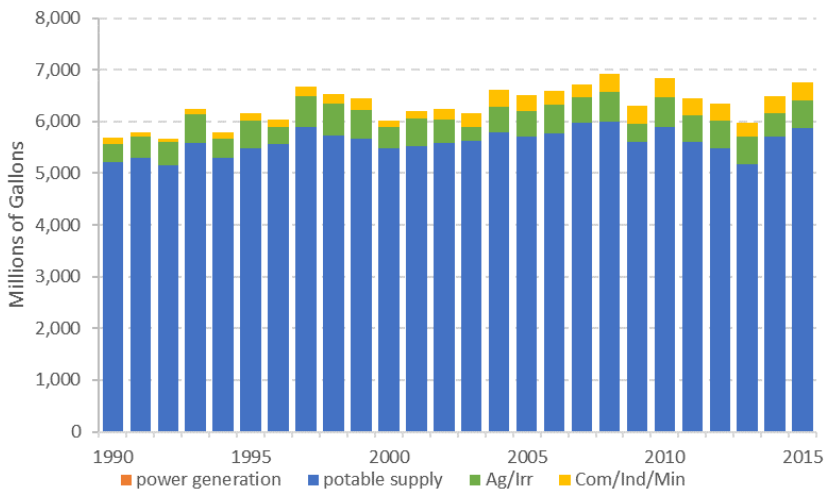


Figure A.16.2. Annual withdrawals by use sector.

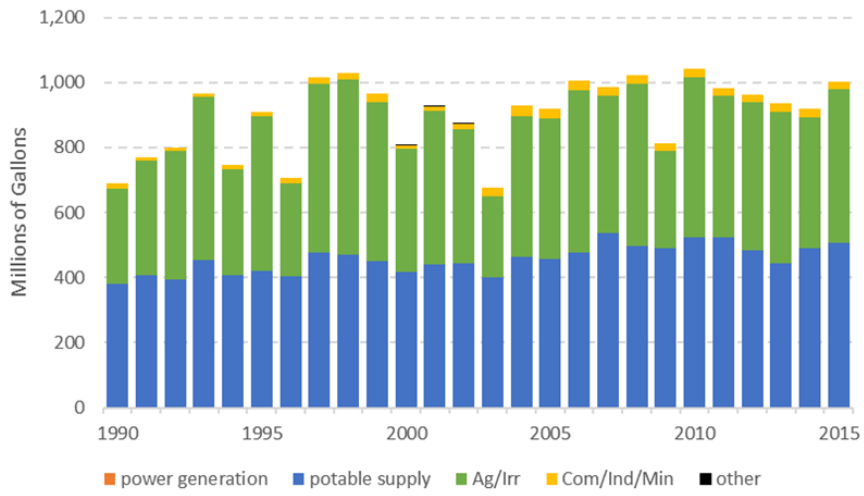


Figure A.16.3. Annual consumptive loss by use sector.

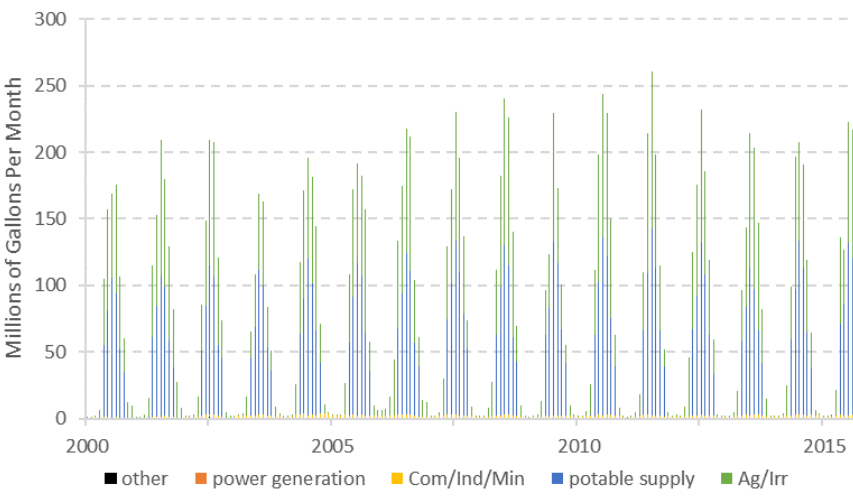


Figure A.16.4. Monthly consumptive loss by use sector.

Table A.16.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	72	265		45	80			1,672	3,548			
1991	77	325		22	72			1,486	3,813			
1992	117	329		18	58			1,514	3,636			
1993	171	393		0	108			1,533	4,044			
1994	113	260		41	74			1,547	3,756			
1995	175	361		36	103			1,566	3,925			
1996	87	240		37	114			1,556	4,013			
1997	156	420	10	36	155			1,593	4,302			
1998	203	393	8	40	154			1,647	4,085			
1999	121	414	18	40	201			1,622	4,044			
2000	90	319	13		118			1,640	3,837			
2001	101	393	29	48	103			1,694	3,830		2	
2002	54	379	21	63	146		1	1,668	3,909			
2003	72	169	40	164	103		2	1,681	3,936		0	
2004	110	348	30	224	115		4	1,697	4,089		0	
2005	132	329	27	183	132		3	1,746	3,959		0	
2006	125	403	32	173	98		16	1,800	3,945		7	
2007	139	318	33	165	91		13	1,906	4,036		16	
2008	134	416	31	167	141	40	14	2,283	3,693		1	
2009	101	223	23	163	177		10	2,301	3,281		18	
2010	146	403	17	162	181	32	18	2,488	3,391		0	
2011	112	370	22	158	126	43	16	2,449	3,149		0	
2012	116	385	22	174	115	42	15	2,388	3,086		0	
2013	124	389	20	196	63		10	2,331	2,836		0	
2014	93	348	21	209	86	37	12	2,428	3,258		0	
2015	100	421	22	158	138	37	17	2,452	3,406		0	

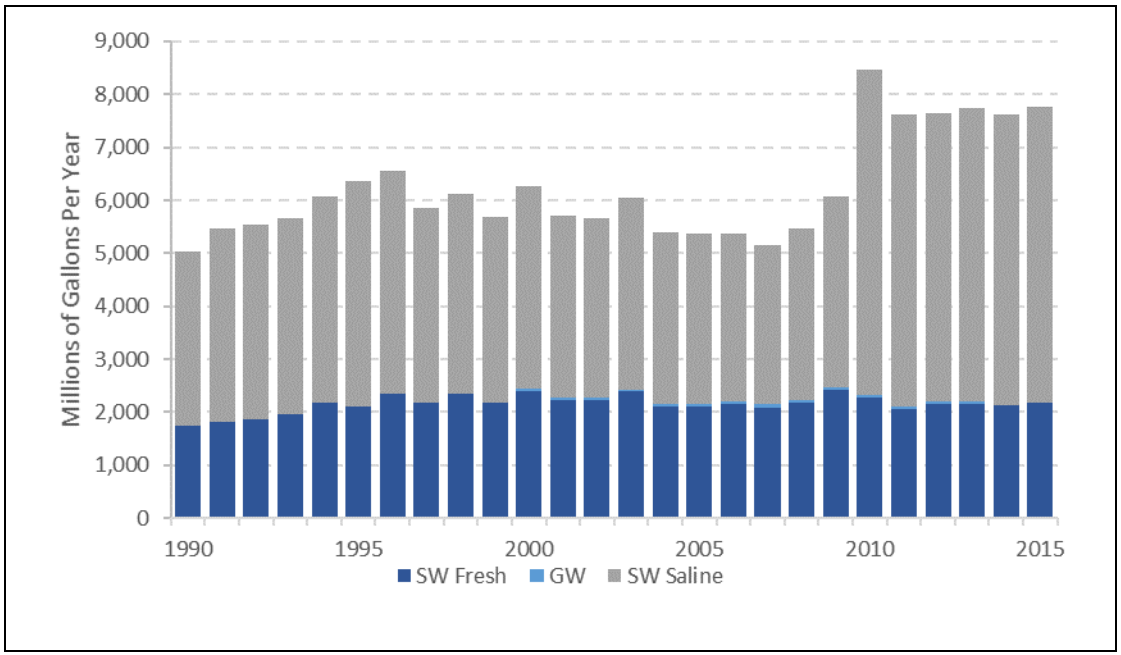


Figure A.16.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Ten water purveyors which serve more than 1,000 people provide potable water to one or more of the five HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.16.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 20% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by -0.25, -0.51, -0.78, -1.13, and -1.47 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.16.4 contains the demand estimates by HUC11. One hundred twenty-five (125) gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.16.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02040206210	02040206220	02040206230	02040302080	02040302940
NJ0501001	Avalon Water and Sewage Utility				X	X
NJ0502001	City of Cape May Water & Sewer D				X	X
NJ0505002	Lower Twp MUA			X	X	X
NJ0506010	NJ American - Cape May Courthouse		X	X	X	
NJ0508001	NJ American - Ocean City				X	X
NJ0509001	Sea Isle City WD				X	X
NJ0512001	West Cape May WD			X	X	
NJ0514001	Wildwood City WD			X	X	X
NJ0516001	Woodbine MUA	X	X			
NJ0609001	NJ State Prison Bayside	X				

Table A.16.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02040206210	0.00	0.00	0.00	0.00	0.00
02040206220	-0.02	-0.04	-0.07	-0.09	-0.11
02040206230	-0.05	-0.10	-0.16	-0.25	-0.33
02040302080	-0.14	-0.31	-0.46	-0.66	-0.85
02040302940	-0.03	-0.06	-0.09	-0.13	-0.16
Total	**-0.25**	**-0.51**	**-0.78**	**-1.13**	**-1.47**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.16.8 and A.16.9 indicate that there is a total of 7 mgd of natural resource availability in WMA 16 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 6 mgd of available water remaining and at full allocation rates 0 mgd of water is remaining. Table A.16.5 shows that of the 5 HUC11s in the WMA, 1 has used all the available water and 3 would have used all the available water if full allocation diversion rates were used. Two HUC11 have a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, potable supply uses are the major loss in 2 HUC11s and under full allocation diversion rates non-agricultural irrigation is the largest loss in 3 HUC11s. See tables A.16.5, A.16.6 and A.16.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.16.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02040206210	5.5			Yes	25%	2000	1.4	1.4	100%	0.0	1.4	105%	0.0	Ag Irr	Ag Irr
02040206220	4.5			Yes	25%	2008	1.1	0.7	60%	0.5	2.4	211%	0.0	Ag Irr	Ag Irr
02040206230	3.9			Yes	25%	2010	1.0	-0.1	Net Gain	1.0	1.9	188%	0.0	Potable	Ag Irr
02040302080	13.0			Yes	25%	2000	3.2	-7.2	Net Gain	10.4	-1.9	Net Gain	5.1	Non-Ag Irr	Non-Ag Irr
02040302940	0.0				25%	2011	0.0	0.8	0%	0.0	0.4	0%	0.0	Potable	Potable

Table A.16.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02040206210	0.0	0.0	0.3	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.5	1.7	0.0
02040206220	0.3	0.0	0.5	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.1	1.2	0.0
02040206230	2.5	0.0	1.7	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	3.9	0.0
02040302080	0.1	0.0	2.6	0.4	0.0	0.0	0.0	0.7	0.1	0.0	0.0	3.3	0.1	0.1	3.5	0.0
02040302940	0.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.9	0.0

Table A.16.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02040206210	0.00	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
02040206220	0.08	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5
02040206230	0.00	1.5	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	2.7	4.0
02040302080	0.03	3.9	4.4	1.9	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	2.4	8.3	10.6
02040302940	0.00	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

There are no major reservoirs located in WMA 2. Some smaller reservoir systems may be present and while critical to the residents that rely of them, they are not covered in this statewide plan.

AVAILABLE WATER FROM CONFINED AQUIFERS

Multiple confined aquifers are present in the WMA. Recharge is occurring from up-dip areas where the aquifer outcrops and from the vertical movement of water from aquifers above and below. Salt water intrusion is of particular concern in this region. See Appendix B Cape May region for more details. Ground water flow in confined aquifers is driven by the regional hydrostratigraphy and water elevation gradients and therefore does not typically follow surface watershed boundaries. Impacts to confined aquifers below a surface watershed may be caused by withdrawals outside of the surface watershed.

SUMMARY AND MANAGEMENT OPTIONS

Table A.16.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
16	Cape May		7	13.6	20.6		1	12	13		6	1.6	7.6	-0.2	7.8

Table A.16.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
16	Cape May	2	10	14		-3.1	0		6	0.4	

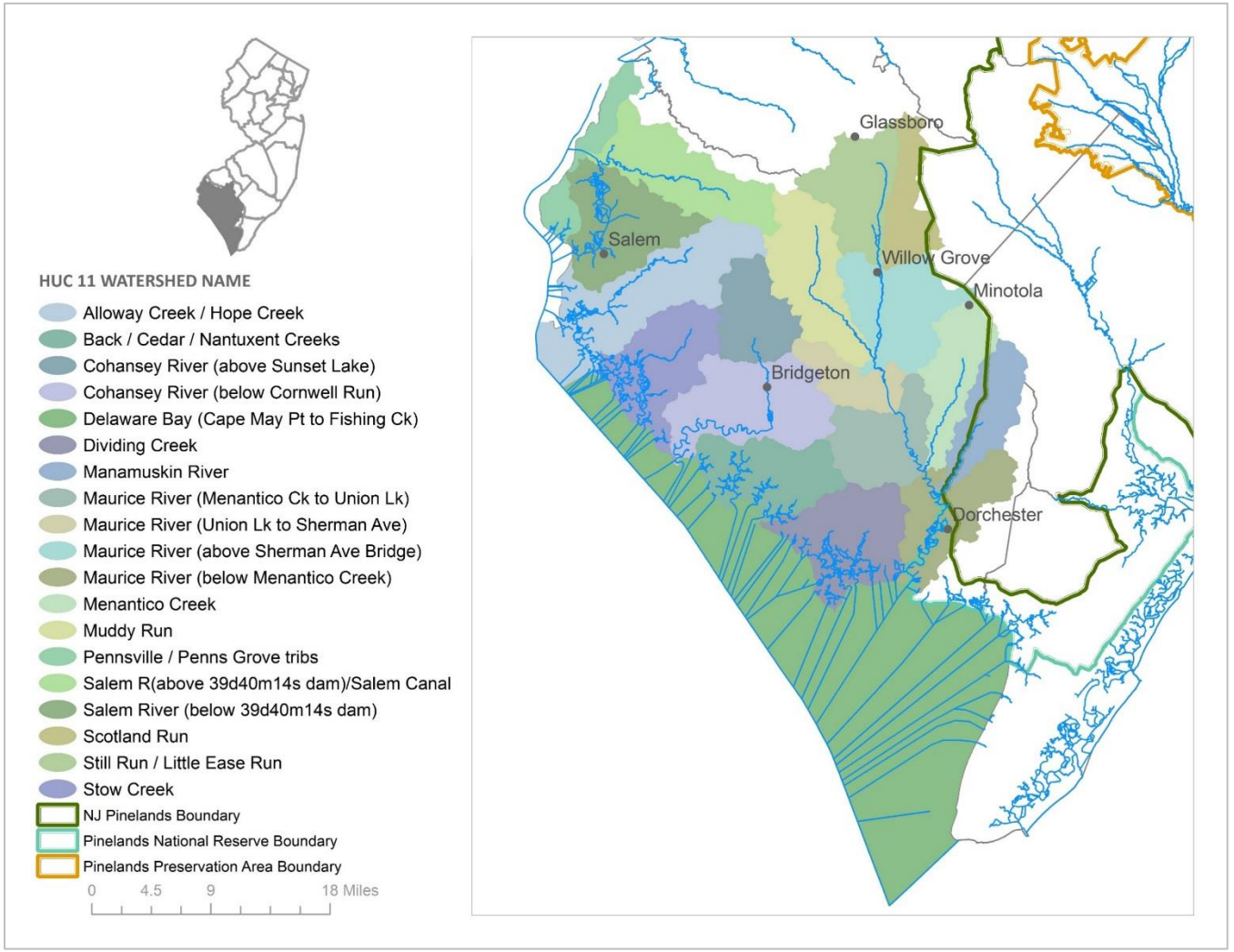
Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- The Department will continue to coordinate with Cape May County officials to facilitate selected short- and long-term water supply options aimed at ensuring a sustainable water supply.
- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for facilities located in the West Creek/East Creek/Riggins Ditch and Dennis Creek HUC11 watersheds.
- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the West Creek / East Creek / Riggins Ditch HUC11 watershed should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Dennis Creek and Cape May Tribs West HUC11 watersheds as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.

WATERSHED MANAGEMENT AREA 17

MAURICE, SALEM AND COHANSEY



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 17, the State's largest, is located in the Coastal Plain Province in the extreme southwestern corner of New Jersey, adjacent to both the Delaware River and Delaware Bay, and encompasses approximately 1,224 square miles. WMA 17 includes portions of Atlantic, Cumberland, Gloucester and Salem Counties. The Cohansey, Maurice and Salem Rivers are the main surface water components in WMA 17. Nineteen (19) HUC11 watersheds comprise WMA 17. One of these HUC11 watersheds (Delaware Bay (Cape May Point to Fishing Creek)) (shown on the map/legend without shading) extends from the shoreline boundary of several contiguous HUC11s out into Delaware Bay.

The Cohansey River is nearly 30 miles long, draining 105 square miles of eastern Salem County to the Delaware Bay. It is an area of very low physiographic relief, which results in numerous small, meandering tributaries. Sunset Lake and Mary Elmer Lake are among the 20 significant impoundments in this portion of the WMA. Although much of the land surface remains forested, the main land use in is agriculture.

The Maurice River has a drainage area of 386 square miles and meanders south for 50 miles through Cumberland County to the Delaware Bay. Primary tributaries to this river are Scotland Run, Manantico Creek, Muskee Creek, Muddy Run and the Manumuskin River. There are also about 20 major lakes in this area, the largest of which is Union Lake. The principal land use here is also agriculture.

The Salem River drains an area of 114 square miles and flows 32 miles from Upper Pittsgrove Township westward to Deepwater, then south to the Delaware River. Much of the lower portions of the river are tidal. The major tributaries of the Salem River include the Mannington Creek, Game Creek, Majors Run and Fenwick Creek. Land use in this drainage basis is about 40% cropland, with the remainder comprised of woodland/pasture, tidal/freshwater marsh, and urban.

Table A.17.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02040204910	Delaware Bay (Cape May Pt to Fishing Ck)
02040206020	Pennsville / Penns Grove tribs
02040206030	Salem R(above 39d40m14s dam)/Salem Canal
02040206040	Salem River (below 39d40m14s dam)
02040206060	Alloway Creek / Hope Creek
02040206070	Stow Creek
02040206080	Cohansey River (above Sunset Lake)
02040206090	Cohansey River (below Cornwell Run)

Table A.17.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02040206100	Back / Cedar / Nantuxent Creeks
02040206110	Dividing Creek
02040206120	Still Run / Little Ease Run
02040206130	Scotland Run
02040206140	Maurice River (above Sherman Ave Bridge)
02040206150	Muddy Run
02040206160	Maurice River (Union Lk to Sherman Ave)
02040206170	Maurice River (Menantico Ck to Union Lk)
02040206180	Menantico Creek
02040206190	Manamuskin River
02040206200	Maurice River (below Menantico Creek)

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 17 surface water withdrawals comprise 49%, unconfined groundwater withdrawals comprise 45% and confined aquifer withdrawals comprise 6% of the total withdraw. Power generation is not significant use. Potable supply is 27% of the total withdrawal, with 85% coming from unconfined groundwater sources, 13% coming from confined aquifer sources, and the remaining 2% from surface water sources. Combined commercial, industrial and mining make up 54% of the total withdrawal, with 83% coming from surface water sources, 3% from confined aquifer sources, and 14% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 18% of total water withdrawals, with 77% coming from unconfined groundwater sources, 2% from confined aquifer sources, and 21% from surface water sources. Figure A.17.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.17.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 1995 and show a variable trend from 1990 to 2015. 2000s withdrawals are generally lower than the 1990s withdrawals. Annual withdrawals by source and use sector are shown in table A.17.2.

Annual consumptive loss peaked in 2010 with an overall slightly upward trend from 1990 to 2015. Almost all consumptive loss is from power generation uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2007. Refer to figures A.17.3 and A.17.4.

Forty-five percent of the total sanitary sewer discharges are to fresh surface water sources, 34% percent go to saline surface water and the remaining 21% of the discharges are ground water. Discharges average about 36 mgd over the period of record. Refer to Figure A.17.5.

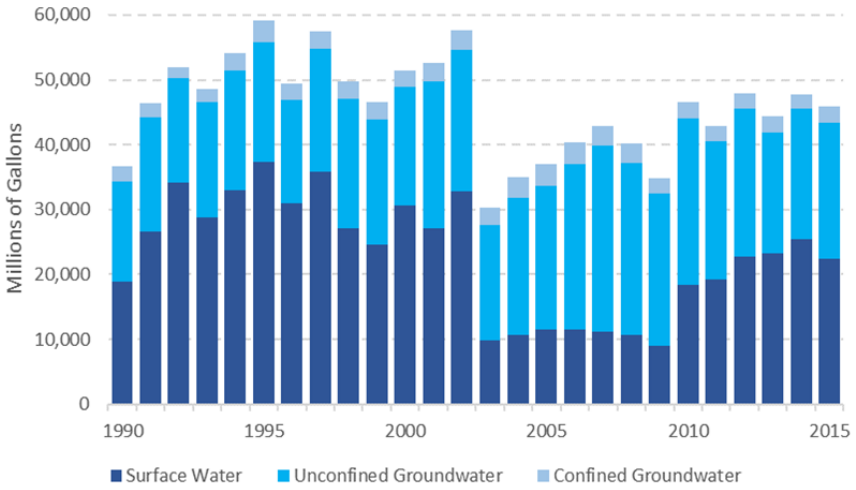


Figure A.17.1. Annual withdrawals by source.

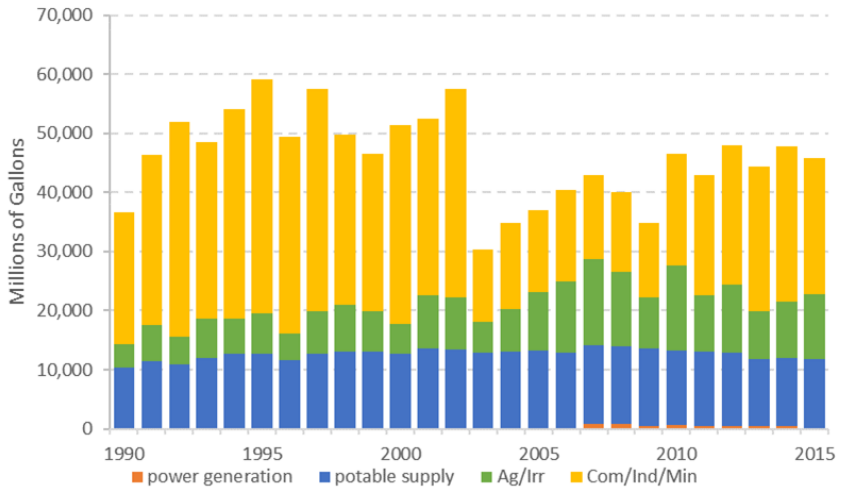


Figure A.17.2. Annual withdrawals by use sector.

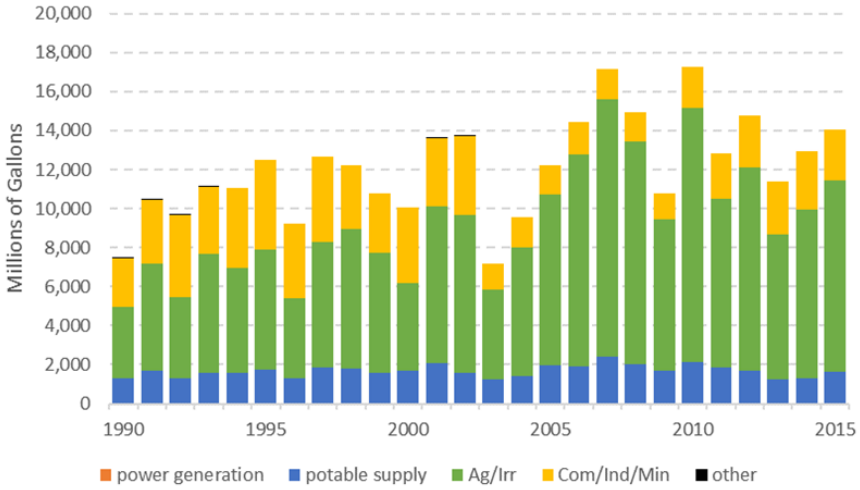


Figure A.17.3. Annual consumptive loss by use sector.

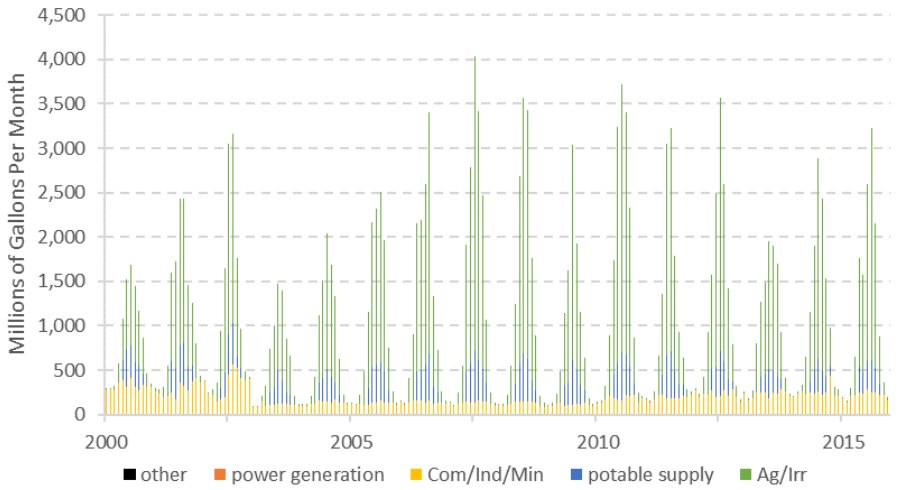


Figure A.17.4. Monthly consumptive loss by use sector.

Table A.17.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	687	3,311	10	17,793	3,391	1,108	479	8,592	1,307			
1991	1,660	4,433	15	24,485	3,286	1,046	469	9,961	1,013			
1992	1,170	3,461	11	32,446	2,874	1,010	567	9,729	659			
1993	2,402	4,328	20	25,874	2,961	1,087	549	10,406	946			
1994	1,241	4,723	19	31,222	3,080	1,162	494	10,725	1,450			
1995	1,602	5,243	40	35,314	2,444	1,814	492	10,702	1,458			
1996	870	3,701	14	29,645	2,557	1,153	412	9,671	1,476			
1997	1,463	5,577	72	33,909	2,692	1,035	390	10,828	1,564			
1998	1,624	6,306	21	25,198	2,589	994	260	11,133	1,705			
1999	1,434	5,345	71	22,830	2,778	1,092	376	11,132	1,482			
2000	886	4,060	71	29,703	3,081	858	23	11,201	1,501			
2001	1,391	7,474	107	25,501	3,480	969	257	11,712	1,554			83
2002	2,249	6,644	71	30,399	3,698	1,173	81	11,486	1,659			116
2003	1,084	3,855	223	8,460	2,950	913	213	11,027	1,535			92
2004	1,363	5,743	190	9,063	4,566	989	227	10,877	1,890			0
2005	1,966	7,480	277	9,274	3,590	1,066	244	11,176	1,851			51
2006	2,621	9,080	360	8,694	5,762	948	210	10,615	1,992			108
2007	2,956	11,467	215	7,947	5,435	780	201	11,174	2,003		685	53
2008	2,751	9,726	214	7,759	5,099	652	183	10,954	2,050		739	
2009	1,769	6,650	167	7,147	5,028	370	75	11,258	1,757		543	
2010	2,524	11,698	234	15,748	2,742	374	66	10,718	1,881		596	
2011	2,245	7,203	202	16,940	2,881	464	110	10,620	1,765		525	
2012	2,349	8,853	356	20,234	2,918	412	173	10,449	1,643		530	
2013	1,449	6,532	225	21,728	2,357	347	89	9,236	1,855		545	
2014	1,922	7,448	185	23,416	2,577	171	54	9,557	1,886		528	
2015	2,114	8,567	220	20,222	2,824	137	35	9,627	2,152			

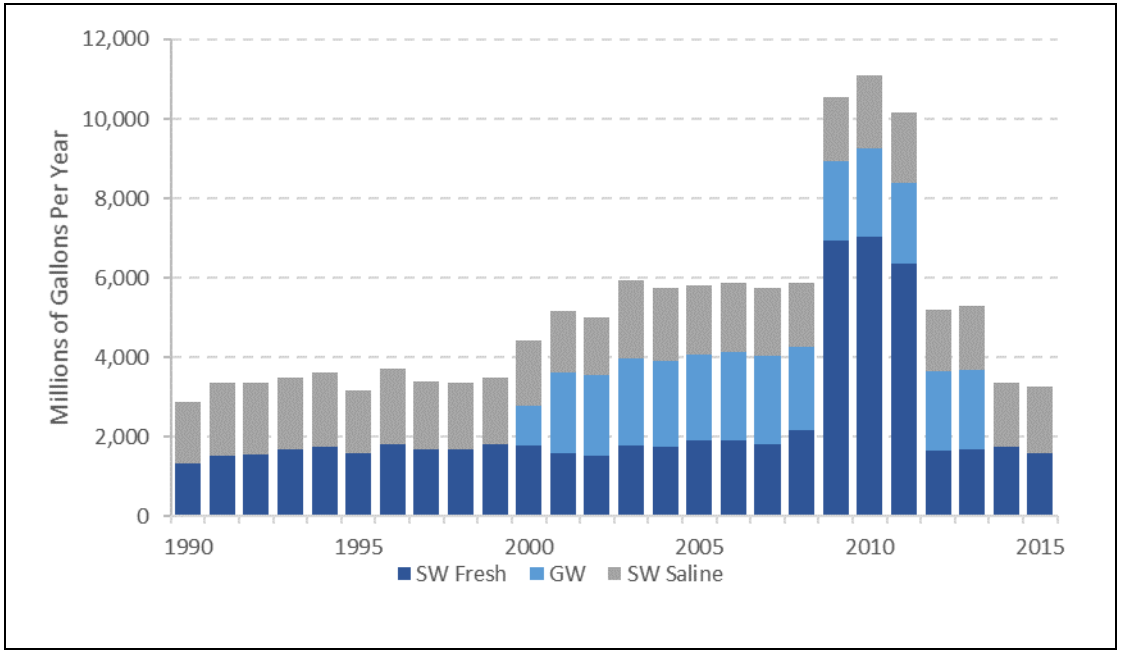


Figure A.17.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Nineteen water purveyors which serve more than 1,000 people provide potable water to one or more of the Nineteen HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.17.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 37% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by 0.75, 1.63, 2.44, 2.91, and 3.22 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.17.4 contains the demand estimates by HUC11. One hundred twenty-five (125) gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.17.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02040206020	02040206030	02040206040	02040206060	02040206080	02040206090	02040206120	02040206130	02040206140	02040206150	02040206160	02040206170	02040206180	02040206200
NJ0104003	Buena Borough MUA									X				X	
NJ0601001	Bridgeton City WD						X								
NJ0605004	Fairton Federal Correctional Institution						X								
NJ0610001	Millville WD									X		X	X	X	X
NJ0613004	Upper Deerfield Twp WD					X	X				X	X			
NJ0614003	Vineland Water & Sewer Utility								X	X		X	X	X	
NJ0614005	United Moblie Homes of Vineland													X	
NJ0801001	Clayton Borough WD							X	X						
NJ0806001	Glassboro Borough WD							X							
NJ0809002	NJ American - Logan	X													
NJ0811002	Monroe Twp MUA							X	X						
NJ0813001	Newfield WD									X					
NJ0818004	Washington Twp MUA							X	X						
NJ1702001	Elmer Borough WD										X				
NJ1707001	NJ American - Penns Grove	X	X												
NJ1708001	Pennsville Twp WD	X	X	X											
NJ1710001	Harding Wood Mobile Home Park							X							
NJ1712001	Salem WD			X	X										
NJ1715001	Woodstown WD		X												

Table A.17.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02040204910	0.00	0.00	0.00	0.00	0.00
02040206020	0.01	0.02	0.00	-0.01	-0.05
02040206030	0.01	0.01	0.01	-0.03	-0.05
02040206040	0.01	0.01	0.00	-0.02	-0.06
02040206060	0.01	0.01	0.00	0.00	-0.01
02040206070	0.01	0.01	0.02	0.03	0.03
02040206080	0.03	0.04	0.05	0.08	0.09
02040206090	0.12	0.23	0.32	0.41	0.49
02040206100	0.02	0.04	0.06	0.06	0.08
02040206110	0.01	0.01	0.03	0.03	0.04
02040206120	0.11	0.38	0.64	0.75	0.79
02040206130	0.05	0.17	0.28	0.33	0.35
02040206140	0.10	0.20	0.29	0.36	0.42
02040206150	0.01	0.02	0.03	0.01	0.00
02040206160	0.04	0.07	0.11	0.14	0.17
02040206170	0.06	0.13	0.19	0.24	0.29
02040206180	0.09	0.18	0.26	0.34	0.41
02040206190	0.04	0.08	0.11	0.14	0.17
02040206200	0.01	0.03	0.04	0.05	0.07
Total	**0.75**	**1.63**	**2.44**	**2.91**	**3.22**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.17.8 and A.17.9 indicate that there is a total of 47 mgd of natural resource availability in WMA 17 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 0 mgd of available water remaining and at full allocation rates 0 mgd of water is remaining. Table A.17.5 shows that of the 19 HUC11s in the WMA, 15 have used all the available water and 16 would have used all the available water if full allocation diversion rates were used. Under current conditions, agricultural irrigation uses are the major loss in 12 HUC11s and under full allocation diversion rates potable supply is the largest loss in 14 HUC11s. See tables A.17.5, A.17.6 and A.17.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.17.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02040204910	0.0				25%	2000	0.0	0.0	0%	0.0	0.0	0%	0.0	Potable	Ag Irr
02040206020	1.7				25%	2012	0.4	-1.5	Net Gain	1.9	-0.3	Net Gain	0.8	Con Aq Leak	Ag Irr
02040206030	7.5				25%	2002	1.9	6.4	342%	0.0	7.3	390%	0.0	Ag Irr	Ag Irr
02040206040	9.8			Yes	25%	2007	2.5	2.9	120%	0.0	5.3	216%	0.0	Ag Irr	Ag Irr
02040206060	18.7			Yes	25%	2007	4.7	2.3	50%	2.4	4.9	105%	0.0	Ag Irr	Ag Irr
02040206070	15.7				25%	2010	3.9	2.3	57%	1.7	4.6	117%	0.0	Ag Irr	Ag Irr
02040206080	7.1				25%	2010	1.8	22.1	1248%	0.0	26.8	1512%	0.0	Ag Irr	Ag Irr
02040206090	16.1				25%	2010	4.0	8.5	212%	0.0	17.0	422%	0.0	Ag Irr	Ag Irr
02040206100	6.8				25%	2012	1.7	5.1	296%	0.0	10.5	612%	0.0	Ag Irr	Ag Irr
02040206110	6.3			Yes	25%	2002	1.6	14.5	925%	0.0	0.7	47%	0.8	Ind-Com-Min	Potable
02040206120	9.2				25%	2007	2.3	4.5	193%	0.0	6.1	266%	0.0	Ag Irr	Ag Irr
02040206130	7.3				25%	2012	1.8	3.2	172%	0.0	4.3	234%	0.0	Potable	Potable

Table A.17.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02040206140	27.1				25%	2001	6.8	9.4	138%	0.0	16.0	236%	0.0	Potable	Potable
02040206150	10.7				25%	2007	2.7	15.0	558%	0.0	20.0	746%	0.0	Ag Irr	Ag Irr
02040206160	5.0				25%	2010	1.2	4.4	352%	0.0	5.6	450%	0.0	Ag Irr	Ag Irr
02040206170	6.7				25%	2009	1.7	3.2	190%	0.0	3.9	231%	0.0	Potable	Potable
02040206180	15.1				25%	2008	3.8	11.2	297%	0.0	15.6	413%	0.0	Ag Irr	Ag Irr
02040206190	7.4				25%	2006	1.8	2.5	134%	0.0	3.9	209%	0.0	Ag Irr	Ag Irr
02040206200	11.2				25%	2001	2.8	2.3	84%	0.4	0.5	19%	2.3	Ind-Com-Min	Potable

Table A.17.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02040204910	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02040206020	0.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	2.2	0.0	1.0	3.2	0.0
02040206030	0.5	0.0	0.5	0.0	8.5	0.3	5.6	0.0	0.1	0.0	0.0	1.1	14.1	0.9	16.2	0.0
02040206040	0.1	0.0	0.3	0.0	0.0	0.4	2.3	0.0	0.0	0.0	0.0	0.7	2.3	0.9	3.9	0.0
02040206060	0.0	0.9	0.7	0.0	0.0	1.3	0.1	0.0	0.1	0.0	0.0	1.8	1.1	0.1	3.1	0.0
02040206070	0.0	0.0	0.4	0.0	0.0	1.9	0.7	0.0	0.0	0.0	0.0	2.1	0.7	0.0	2.8	0.0

Table A.17.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02040206080	0.7	0.0	0.8	3.0	0.0	27.7	2.1	0.1	0.0	0.0	0.0	29.0	2.1	0.0	31.1	0.0
02040206090	3.5	0.0	0.9	0.3	0.0	9.2	0.9	0.0	0.0	0.0	0.0	12.5	0.9	0.0	13.4	0.0
02040206100	0.0	0.0	0.5	0.0	0.0	5.9	0.1	0.0	0.0	0.0	0.0	5.8	0.1	0.1	6.1	0.0
02040206110	0.0	0.0	0.4	2.4	119.7	0.0	0.0	0.0	0.0	0.0	0.0	2.6	119.7	0.0	122.2	0.0
02040206120	1.4	0.1	0.9	0.0	0.0	2.8	0.6	0.1	0.0	0.0	0.0	4.6	0.7	0.2	5.5	0.0
02040206130	3.1	0.0	0.8	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	3.8	0.0
02040206140	13.5	0.0	0.9	2.8	0.0	3.5	0.0	0.0	0.0	0.0	0.0	18.5	0.0	0.0	18.5	0.0
02040206150	0.2	0.0	0.9	0.1	0.0	16.3	0.9	0.2	0.1	0.0	0.0	15.9	0.9	0.7	17.5	0.0
02040206160	0.5	0.0	0.4	0.1	0.0	3.6	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.9	5.1	0.0
02040206170	5.6	0.0	0.4	0.2	0.0	0.8	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0	6.4	0.0
02040206180	2.5	0.0	0.5	0.7	0.0	9.9	0.3	0.1	0.0	0.0	0.0	12.5	0.3	0.5	13.3	0.0
02040206190	0.2	0.0	0.3	0.1	0.0	2.7	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.1	3.1	0.0
02040206200	0.0	0.0	0.4	0.4	9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.7	9.9	1.1	11.7	0.0

Table A.17.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02040204910	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
02040206020	0.00	1.0	1.0	0.1	1.2	0.0	0.0	0.0	0.0	0.0	1.4	0.0	2.7	2.0	4.7
02040206030	0.00	0.3	0.0	0.4	0.9	7.7	0.1	0.6	0.0	0.0	0.0	0.0	1.3	8.5	9.8
02040206040	0.00	0.0	0.4	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.3	0.7	0.9
02040206060	0.00	0.0	0.0	0.5	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.8
02040206070	0.00	0.0	0.0	0.3	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.5	0.1	0.6
02040206080	0.00	2.7	0.0	0.6	2.7	0.0	2.8	0.2	0.0	0.0	0.0	0.0	6.0	3.0	9.0
02040206090	0.00	2.9	0.0	0.6	0.3	0.0	0.9	0.1	0.0	0.0	0.0	0.0	1.8	3.0	4.9
02040206100	0.00	0.0	0.0	0.4	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0
02040206110	0.00	0.0	0.0	0.3	2.1	105.3	0.0	0.0	0.0	0.0	0.0	0.0	2.4	105.3	107.7
02040206120	0.04	0.0	0.0	0.6	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	1.0	0.1	1.0
02040206130	0.01	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.7
02040206140	5.63	0.0	0.0	0.6	2.5	0.0	0.3	0.0	0.0	0.0	0.0	0.0	9.1	0.0	9.1
02040206150	0.09	0.0	0.0	0.7	0.0	0.0	1.6	0.1	0.0	0.0	0.0	0.0	2.5	0.1	2.6
02040206160	0.00	0.0	0.0	0.3	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.7
02040206170	0.00	0.0	2.6	0.3	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.6	2.6	3.2
02040206180	0.00	0.0	0.0	0.4	0.7	0.0	1.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	2.1
02040206190	0.00	0.0	0.0	0.2	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.6
02040206200	0.00	0.0	0.0	0.3	0.3	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.6	8.7	9.4

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

There are no major reservoirs located in WMA 17. Some smaller reservoir systems may be present and while critical to the residents that rely of them, they are not covered in this statewide plan.

AVAILABLE WATER FROM CONFINED AQUIFERS

Multiple confined aquifers are present in the WMA. Recharge is occurring from up-dip areas where the aquifer outcrops and from the vertical movement of water from aquifers above and below. See Appendix B Delaware Bay region for more details. Ground-water flow in confined aquifers is driven by the regional hydrostratigraphy and water elevation gradients and therefore does not typically follow surface watershed boundaries. Impacts to confined aquifers below a surface watershed may be caused by withdrawals outside of the surface watershed.

SUMMARY AND MANAGEMENT OPTIONS

Table A.17.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
17	Maurice, Salem and Cohansey		47	28.2	75.2		122	11	133		-75	17.2	-57.8	0.7	-58.5

Table A.17.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
17	Maurice, Salem and Cohansey	179	206	28		-109.4	0		4	1.5	

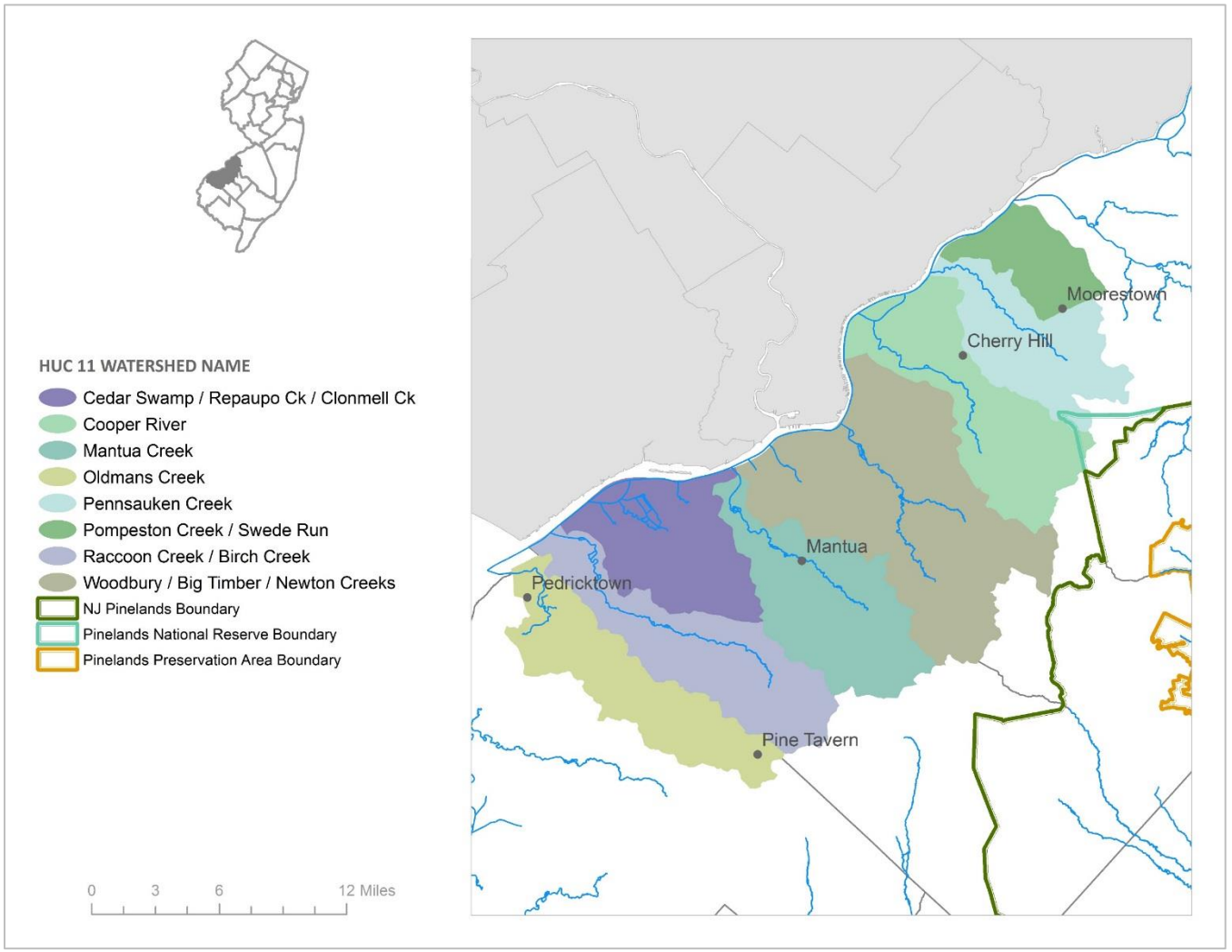
Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for all agricultural facilities located in WMA 17.
- Complete Cumberland County Water Supply feasibility study and implement findings/recommendations.
- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Salem R(above 39d40m14s dam)/Salem Canal, Salem River (below 39d40m14s dam), Cohansey River (above Sunset Lake), Cohansey River (below Cornwell Run), Back / Cedar / Nantuxent Creeks, Dividing Creek, Still Run / Little Ease Run, Scotland Run, Maurice River (above Sherman Ave Bridge), Muddy Run, Maurice River (Union Lk to Sherman Ave), Maurice River (Menantico Ck to Union Lk), Menantico Creek, and Manamuskin River HUC11 watersheds should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Alloway Creek / Hope Creek and Stow Creek HUC11 watersheds as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
- For proposed new or expanded water allocations (non-residential water users >100,000 GPD), where more than 50% of the water will be used for consumptive, non-potable purposes, discourage the use of potable water sources.
- Investigate utilizing the NJ American Water Tri-County project as a source of water for new or expanded uses (not including agriculture) in WMA 17.

WATERSHED MANAGEMENT AREA 18

LOWER DELAWARE



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 18 is located in the Coastal Plain Province of New Jersey, bordering the Delaware River, encompasses approximately 377 square miles, and includes 68 municipalities located in portions of Gloucester, Camden and Burlington Counties. WMA 18 includes eight (8) HUC11 watersheds as depicted in the map above. Major streams within WMA 18 include the Cooper River, the Big Timber, Mantua, Newton, Oldmans, Pennsauken, Pompeston, Raccoon, Repaupo and Woodbury Creeks, and Baldwin Run, Swede Run and Maple Swamp.

Table A.18.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02040202090	Pompeston Creek / Swede Run
02040202100	Pennsauken Creek
02040202110	Cooper River
02040202120	Woodbury / Big Timber / Newton Creeks
02040202130	Mantua Creek
02040202140	Cedar Swamp / Repaupo Ck / Clonmell Ck
02040202150	Raccoon Creek / Birch Creek
02040202160	Oldmans Creek

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 18 surface water withdrawals comprise 42%, unconfined groundwater withdrawals comprise 12% and confined aquifer withdrawals comprise 46% of the total withdraw. Power generation is not significant use. Potable supply is 64% of the total withdrawal, with 17% coming from unconfined groundwater sources, 64% coming from confined aquifer sources, and the remaining 19% from surface water sources. Combined commercial, industrial and mining make up 32% of the total withdrawal, with 85% coming from surface water sources, 14% from confined aquifer sources, and 1% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 4% of total water withdrawals, with 12% coming from unconfined groundwater sources, 11% from confined aquifer sources, and 77% from surface water sources. Figure A.18.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.18.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 1991 and show a downward trend from 1990 to 2015. Annual withdrawals by source and use sector are shown in table A.18.2.

Annual consumptive loss peaked in 1998 with a variable but downward trend from 1998 to 2015. The majority of consumptive loss is from potable supply uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2012. Refer to figures A.18.3 and A.18.4.

Almost all (100%) of the total sanitary sewer discharges are to fresh surface water sources. The remaining <1% of the discharges are to groundwater. Discharges average about 204 mgd over the period of record. Refer to Figure A.18.5.

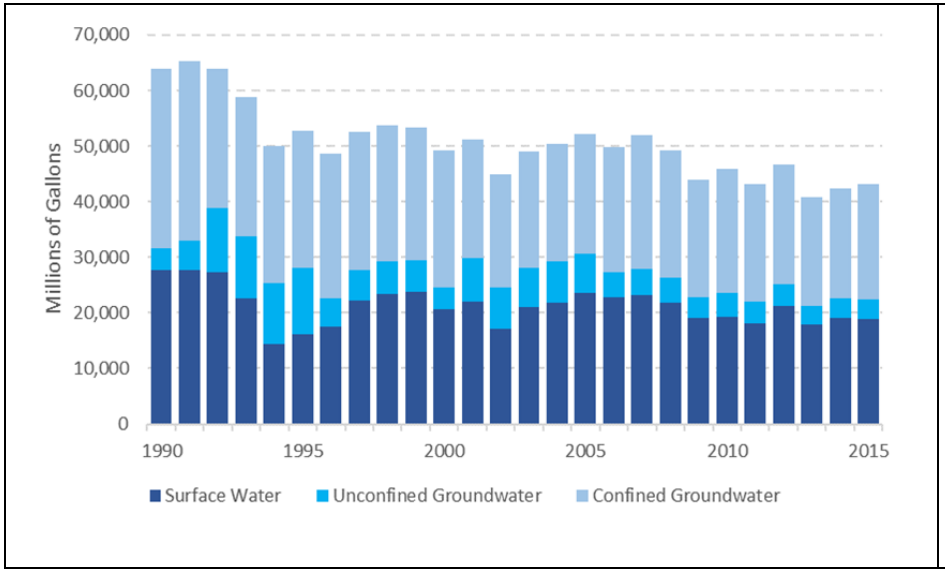


Figure A.18.1. Annual withdrawals by source.

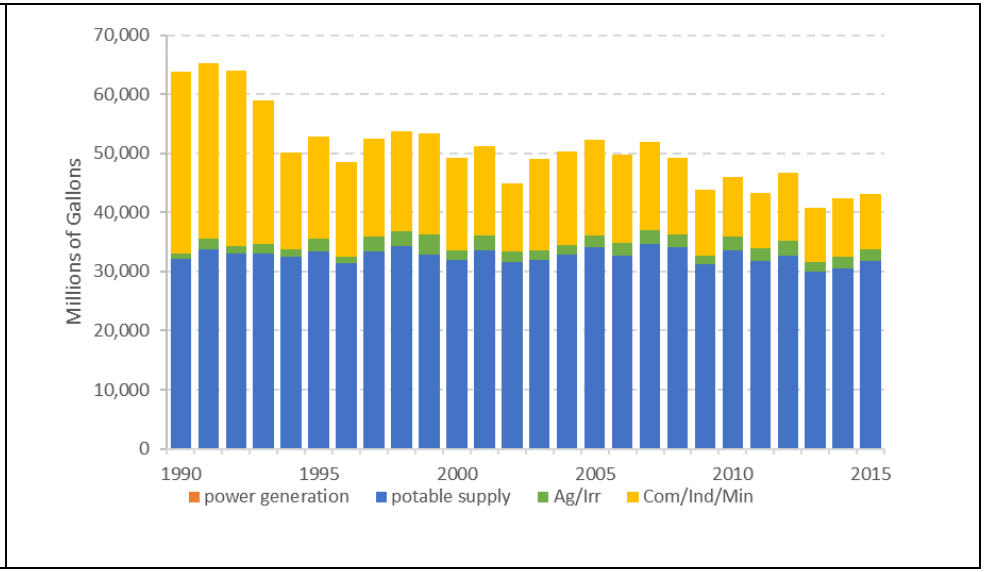


Figure A.18.2. Annual withdrawals by use sector.

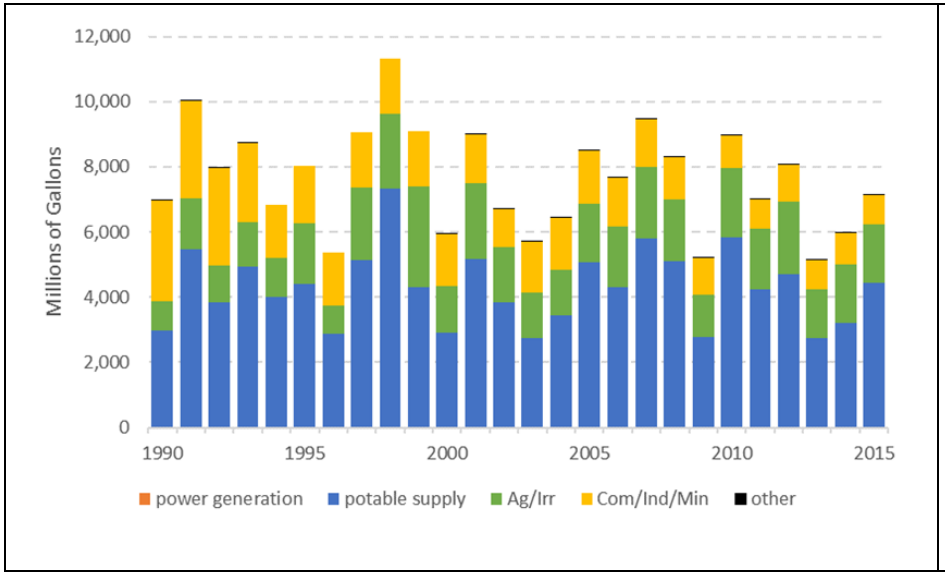


Figure A.18.3. Annual consumptive loss by use sector.

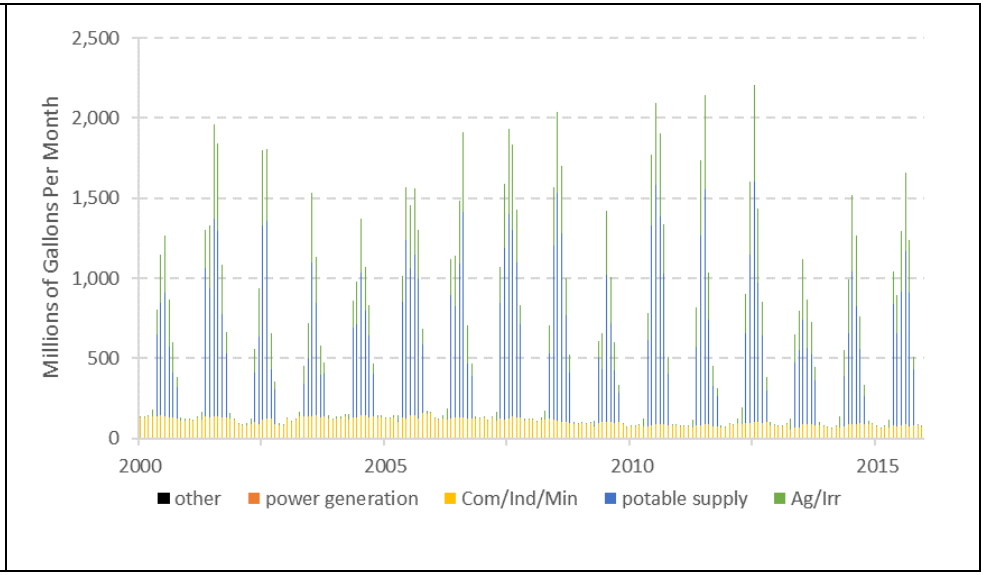


Figure A.18.4. Monthly consumptive loss by use sector.

Table A.18.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	876	68	70	26,746	14	4,064		3,882	28,173			
1991	1,522	93	110	26,178	304	3,248		4,932	28,854			
1992	997	92	160	26,414	231	3,087		11,107	21,925			
1993	1,291	84	151	21,361	128	2,739	0	10,997	22,114			
1994	1,043	150	123	13,289	233	2,733	0	10,738	21,780			
1995	1,668	248	153	14,559	220	2,457	0	11,409	22,037			
1996	734	118	115	13,342	170	2,637	3,470	4,708	23,272			
1997	2,142	172	160	13,258	217	3,168	6,907	5,106	21,357			
1998	1,940	394	235	13,901	219	2,657	7,465	5,346	21,495			
1999	2,765	441	229	14,148	140	2,678	6,930	5,019	20,936			
2000	1,302	168	139	13,032	153	2,523	6,238	3,718	21,939			1
2001	2,060	258	257	12,702	197	2,166	7,322	7,230	19,041			0
2002	1,432	289	173	9,125	212	2,094	6,566	6,897	18,093			0
2003	1,073	191	271	12,929	178	2,350	6,991	6,741	18,257			0
2004	1,198	177	165	13,469	167	2,316	7,202	7,023	18,646			0
2005	1,511	240	249	14,124	137	1,921	7,930	6,615	19,484			0
2006	1,625	237	211	13,123	115	1,801	8,101	4,030	20,549			0
2007	1,830	325	312	12,258	234	2,328	9,124	4,132	21,343			0
2008	1,542	319	266	11,067	212	1,761	9,201	4,057	20,841			1
2009	1,035	217	190	9,631	181	1,334	8,396	3,422	19,456			0
2010	1,745	318	312	8,196	170	1,674	9,402	3,765	20,418			0
2011	1,481	292	275	7,816	180	1,401	8,828	3,473	19,503			0
2012	1,736	340	391	9,925	189	1,362	9,676	3,247	19,801			0
2013	1,166	259	227	7,776	167	1,345	8,996	2,917	17,993			0
2014	1,458	244	282	8,217	149	1,553	9,410	3,154	17,910			0
2015	1,383	261	327	7,735	166	1,491	9,840	3,068	18,910			0

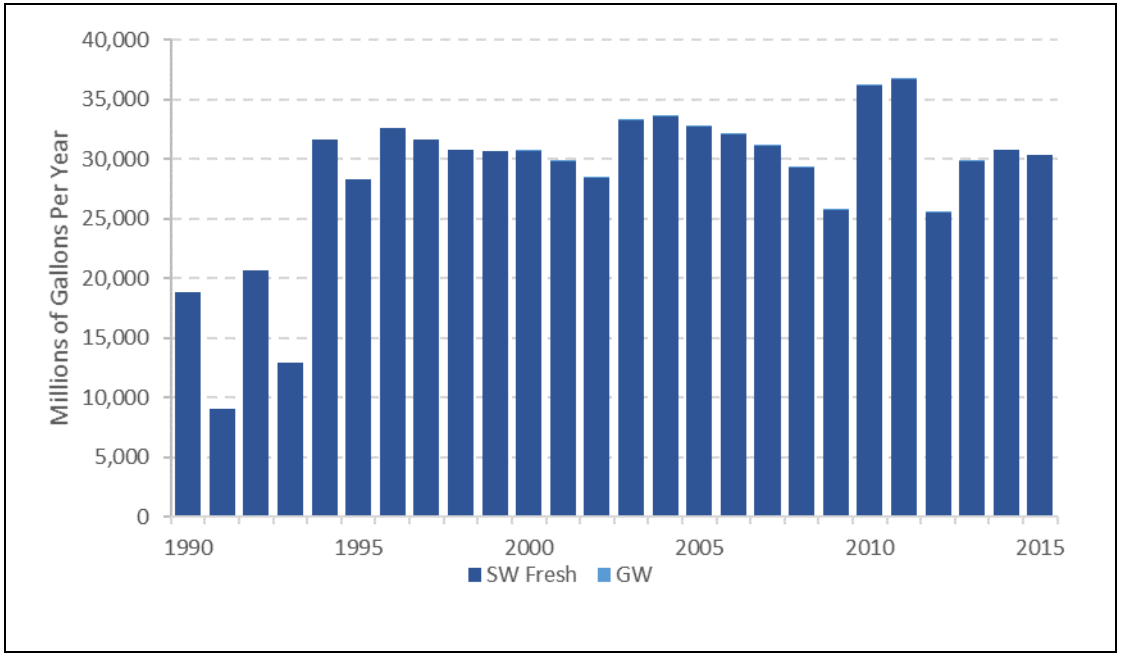


Figure A.18.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Thirty-seven water purveyors which serve more than 1,000 people provide potable water to one or more of the eight HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.18.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 12% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by 1.16, 3.90, 6.63, 7.79, and 8.20 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.18.4 contains the demand estimates by HUC11. One hundred twenty-five (125) gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.18.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02040202090	02040202100	02040202110	02040202120	02040202130	02040202140	02040202150	02040202160
NJ0313001	Evesham MUA		X	X					
NJ0319001	Maple Shade WD		X						
NJ0322001	Moorestown WD	X	X						
NJ0324001	Mount Laurel Twp MUA		X						
NJ0327001	NJ American - Western Division	X	X	X	X				
NJ0404001	Bellmawr WD				X				
NJ0405001	Berlin WD				X				
NJ0407001	Brooklawn WD				X				
NJ0408001	Camden City WD			X	X				
NJ0411001	Clementon WD				X				
NJ0412001	Collingswood WD			X	X				
NJ0414001	Gloucester City WD				X				
NJ0415002	Aqua NJ - Blackwood				X				
NJ0416001	Haddon Twp WD			X	X				
NJ0424001	Merchantville-Pennsauken WC		X	X					
NJ0428002	Pine Hill Borough MUA				X				
NJ0436007	Winslow Twp DMU				X				
NJ0802001	Deptford Twp MUA				X	X			
NJ0803001	East Greenwich Twp WD					X	X		
NJ0806001	Glassboro Borough WD					X		X	
NJ0807001	Greenwich Twp WD					X	2		
NJ0808001	NJ American - Harrison					X	X	X	
NJ0809002	NJ American - Logan							X	X
NJ0810004	Mantua Twp MUA					X	X		
NJ0811002	Monroe Twp MUA				X	X			

Table A.18.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02040202090	02040202100	02040202110	02040202120	02040202130	02040202140	02040202150	02040202160
NJ0812001	National Park WD				X				
NJ0814001	Paulsboro WD				X	X	X		
NJ0815001	Pitman WD					X			
NJ0817001	Swedesboro WD							X	
NJ0818004	Washington Twp MUA				X	X			
NJ0819001	Wenonah WD					X			
NJ0820001	West Deptford Twp WD				X	X			
NJ0821001	Westville WD				X				
NJ0822001	Woodbury City WD				X				
NJ0823001	Woodbury Heights WU				X	X			
NJ0824001	Aqua NJ - Woolwich						X	X	X
NJ1707001	NJ American - Penns Grove								X

Table A.18.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02040202090	0.03	0.08	0.14	0.17	0.18
02040202100	0.06	0.21	0.36	0.42	0.44
02040202110	0.04	0.12	0.20	0.24	0.25
02040202120	0.34	1.13	1.91	2.25	2.37
02040202130	0.26	0.88	1.50	1.76	1.85
02040202140	0.09	0.31	0.53	0.62	0.65
02040202150	0.25	0.83	1.41	1.65	1.74
02040202160	0.10	0.34	0.59	0.68	0.72
Total	**1.16**	**3.90**	**6.63**	**7.79**	**8.20**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.18.8 and A.18.9 indicate that there is a total of 24 mgd of natural resource availability in WMA 18 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 5 mgd of available water remaining and at full allocation rates 52.3 mgd of water is remaining. Table A.18.5 shows that of the 8 HUC11s in the WMA, 3 have used all the available water and 5 would have used all the available water if full allocation diversion rates were used. Two HUC11s have a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, confined aquifer leakage is the major loss in 4 HUC11s and under full allocation diversion rates agricultural irrigation is the largest loss in 5 HUC11s. See tables A.18.5, A.X.6 and A.18.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.18.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02040202090	2.5				25%	2007	0.6	-0.2	Net Gain	0.9	0.3	52%	0.3	Con Aq Leak	Ag Irr
02040202100	5.4				25%	2003	1.4	2.0	144%	0.0	-4.7	Net Gain	6.1	Con Aq Leak	Non-Ag Irr
02040202110	9.3				25%	2005	2.3	14.0	604%	0.0	3.9	166%	0.0	Potable	Potable
02040202120	28.0				25%	2009	7.0	-11.1	Net Gain	18.1	-53.8	Net Gain	60.7	Con Aq Leak	Non-Ag Irr
02040202130	14.7				25%	2010	3.7	3.8	103%	0.0	4.5	122%	0.0	Con Aq Leak	Ag Irr
02040202140	13.3				25%	2002	3.3	2.6	78%	0.7	5.3	161%	0.0	Ag Irr	Ag Irr
02040202150	11.5				25%	2001	2.9	2.6	89%	0.3	7.0	244%	0.0	Ag Irr	Ag Irr
02040202160	9.4				25%	2010	2.4	5.3	227%	0.0	8.7	371%	0.0	Ag Irr	Ag Irr

Table A.18.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02040202090	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	1.2	1.3	29.7
02040202100	3.6	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	4.1	7.5	0.0
02040202110	11.2	0.0	0.2	0.0	0.6	0.0	0.0	0.2	0.0	0.0	0.0	10.4	0.7	3.7	14.8	0.3
02040202120	2.3	0.0	0.6	0.0	0.0	0.0	0.0	0.1	0.6	0.0	0.0	2.8	0.6	4.0	7.4	19.1
02040202130	1.2	0.0	0.6	0.1	0.2	0.3	0.5	0.0	0.1	0.0	0.0	2.0	0.9	1.9	4.8	0.0
02040202140	1.2	0.0	0.2	0.3	0.6	1.6	1.8	0.0	0.0	0.0	0.0	3.0	2.3	1.3	6.6	6.4
02040202150	0.9	0.0	0.7	0.0	0.0	0.7	0.9	0.0	0.0	0.0	0.0	2.1	0.9	1.4	4.3	0.0
02040202160	0.0	0.0	0.5	0.0	0.0	2.0	3.3	0.0	0.0	0.0	0.0	2.2	3.3	0.9	6.5	2.0

Table A.18.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02040202090	0.00	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.5	1.5
02040202100	0.00	5.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	5.4	5.6
02040202110	0.00	0.0	0.0	0.2	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.8
02040202120	0.00	16.7	0.0	0.5	1.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	1.7	16.7	18.4
02040202130	0.00	0.0	0.0	0.4	0.2	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.7	0.3	1.0

Table A.18.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02040202140	0.00	0.5	0.0	0.1	2.6	0.5	0.2	0.2	0.0	0.0	0.0	0.0	2.9	1.1	4.0
02040202150	0.00	1.0	0.0	0.5	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.6	1.1	1.7
02040202160	0.00	0.2	0.0	0.4	0.0	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.6	0.5	1.1

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

There are no major reservoirs located in WMA 18. Some smaller reservoir systems may be present and while critical to the residents that rely of them, they are not covered in this statewide plan. WMA 18 is within the multi-state Delaware River watershed. New York City has three reservoirs in the upper Delaware watershed in New York State. Operations of these major surface water supply reservoirs have a hydrologic and regulatory impact on the flows in the river as well as diversion from the Delaware and Raritan Canal. The Flexible Flow Management Program signed by the 1954 Supreme Court Decree Parties of New Jersey, New York City, New York State, Pennsylvania and Delaware and Delaware River Basin Commission regulations govern some water supply operations in the WMA.

AVAILABLE WATER FROM CONFINED AQUIFERS

Multiple confined aquifers are present in the WMA. Recharge is occurring from up-dip areas where the aquifer outcrops and from the vertical movement of water from aquifers above and below. See Appendix B Critical Area 2 region for more details. Ground water flow in confined aquifers is driven by the regional hydrostratigraphy and water elevation gradients and therefore does not typically follow surface watershed boundaries. Impacts to confined aquifers below a surface watershed may be caused by withdrawals outside of the surface watershed.

SUMMARY AND MANAGEMENT OPTIONS

Table A.18.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
18	Lower Delaware		24	113.3	137.3		19	74	93		5	39.3	44.3	1.2	43.1

Table A.18.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
18	Lower Delaware	133	22	113		52.3	0			3	35

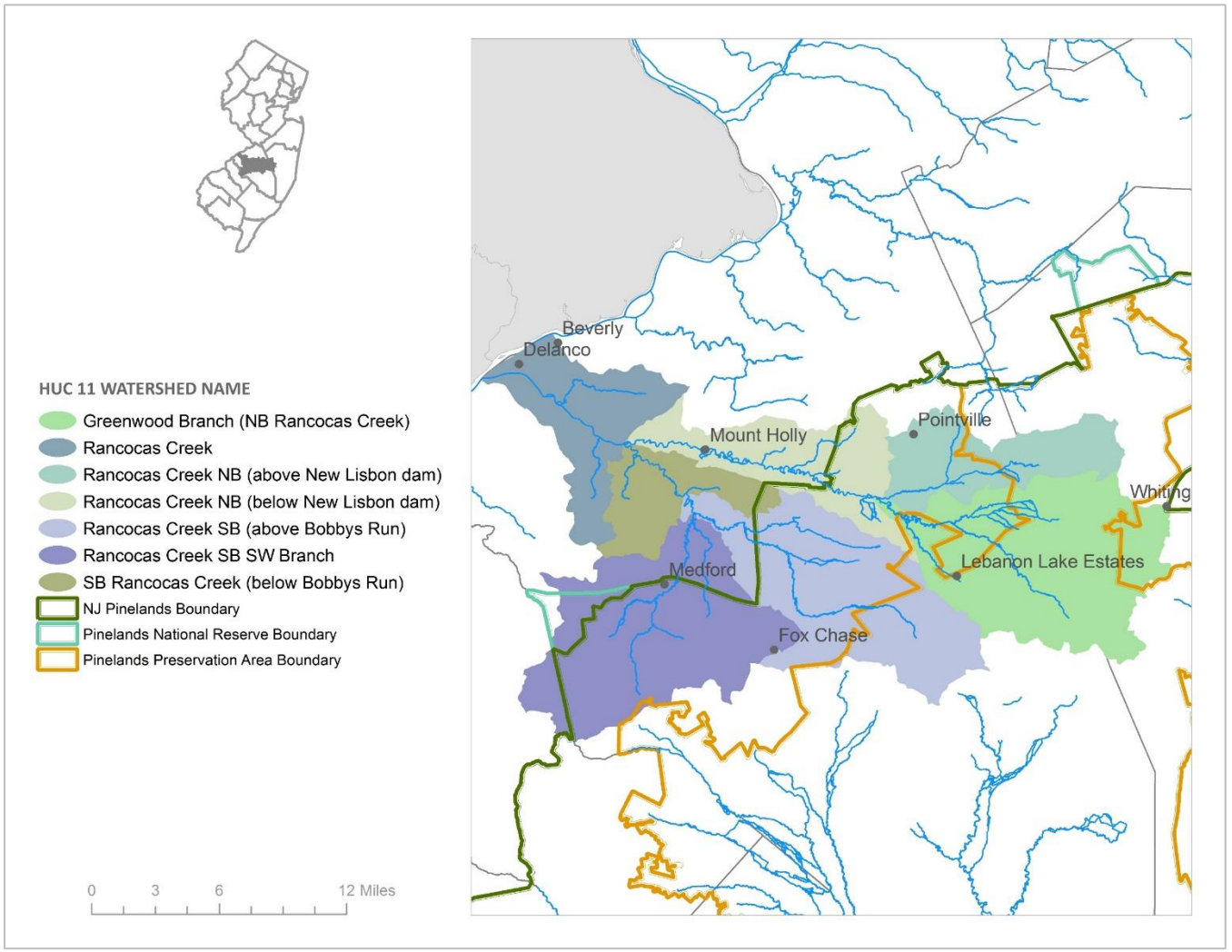
Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for all agricultural facilities located in WMA 18, particularly the Cedar Swamp/Repaupo Creek/Clonmell Creek, Raccoon Creek/Birch Creek and Oldmans Creek HUC11s.
- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Pennsauken Creek, Cooper River, Mantua Creek and Oldmans Creek HUC11s should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Cedar Swamp / Repaupo Ck / Clonmell Ck and Raccoon Creek / Birch CreekHUC11 watersheds as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
- For proposed new or expanded water allocations (non-residential water users >100,000 GPD), where more than 50% of the water will be used for consumptive, non-potable purposes, discourage the use of potable water sources.
- Investigate utilizing the NJ American Water Tri-County project as a source of water for new or expanded uses (not including agriculture) in WMA 18.

WATERSHED MANAGEMENT AREA 19

RANCOCAS



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 19 is located in the Coastal Plain Province of New Jersey. The North and South Branches and main stem of the Rancocas Creek, which discharges to the Delaware River, are the significant surface water bodies here. WMA 19 includes seven (7) HUC11 watersheds stretching across 33 municipalities and portions of Burlington, Camden, and Ocean Counties. The WMA encompasses approximately 350 square miles, with a significant portion located within the Pinelands.

The North Branch Rancocas Creek is 31 miles long and is fed by the Greenwood Branch, McDonalds Branch and Mount Misery Brook. The major tributaries to the South Branch Rancocas Creek include the Southwest Branch Rancocas Creek; Stop the Jade Run, Haynes Creek and Friendship Creek.

The main stem flows about 8 miles and drains an area of approximately 49 square miles before emptying into the Delaware River at Delanco and Riverside. Tidal influence occurs for about 15 stream miles extending the entire length of the mainstream to the dam at Mount Holly on the North Branch, Vincentown on the South Branch and Kirby's Mill on the Southwest Branch.

Table A.19.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02040202020	Rancocas Creek NB (above New Lisbon dam)
02040202030	Greenwood Branch (NB Rancocas Creek)
02040202040	Rancocas Creek NB (below New Lisbon dam)
02040202050	Rancocas Creek SB (above Bobbys Run)
02040202060	Rancocas Creek SB SW Branch
02040202070	SB Rancocas Creek (below Bobbys Run)
02040202080	Rancocas Creek

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 19 surface water withdrawals comprise 53%, unconfined groundwater withdrawals comprise 12% and confined aquifer withdrawals comprise 35% of the total withdraw. Power generation is not significant use. Potable supply is 45% of the total withdrawal, with 24% coming from unconfined groundwater sources, 70% coming from confined aquifer sources, and the remaining 6% from surface water sources. Combined commercial, industrial and mining make up 13% of the total withdrawal, with 87% coming from surface water sources, 11% from confined aquifer sources, and 1% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 42% of total water withdrawals, with 2% coming from unconfined groundwater sources, 5% from confined aquifer sources, and 42% from surface water sources. Figure A.19.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.19.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 1994 and show a downward trend from 1997 to 2015. Annual withdrawals by source and use sector are shown in table A.19.2.

Annual consumptive loss peaked in 2010 with an overall slightly downward trend from 2010 to 2015. Consumptive loss is primarily from power generation and potable supply uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2010. Refer to figures A.19.3 and A.19.4.

Almost all (99%) of the total sanitary sewer discharges are to fresh surface water sources. The remaining 1% of the discharges are to groundwater. Discharges average about 51 mgd over the period of record. Refer to Figure A.19.5.

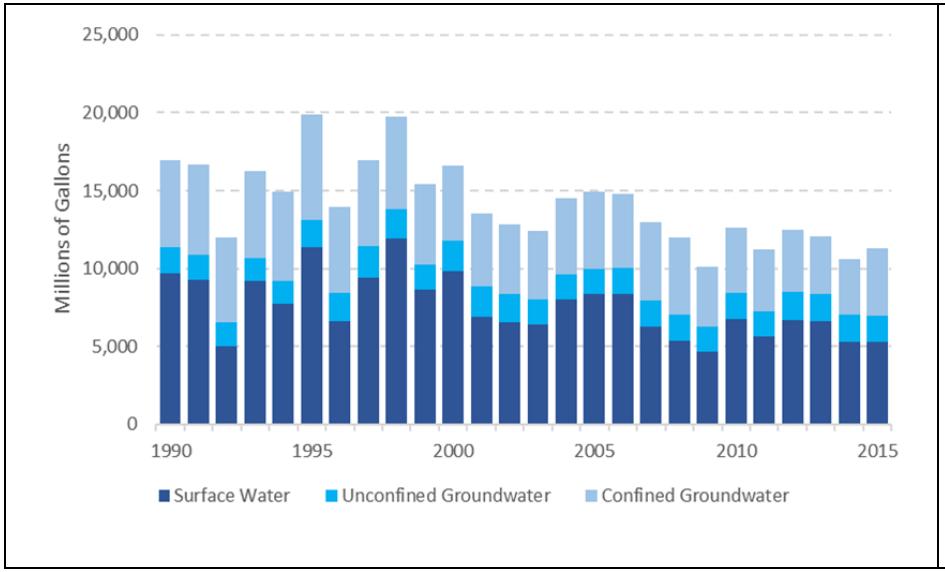


Figure A.19.1. Annual withdrawals by source.

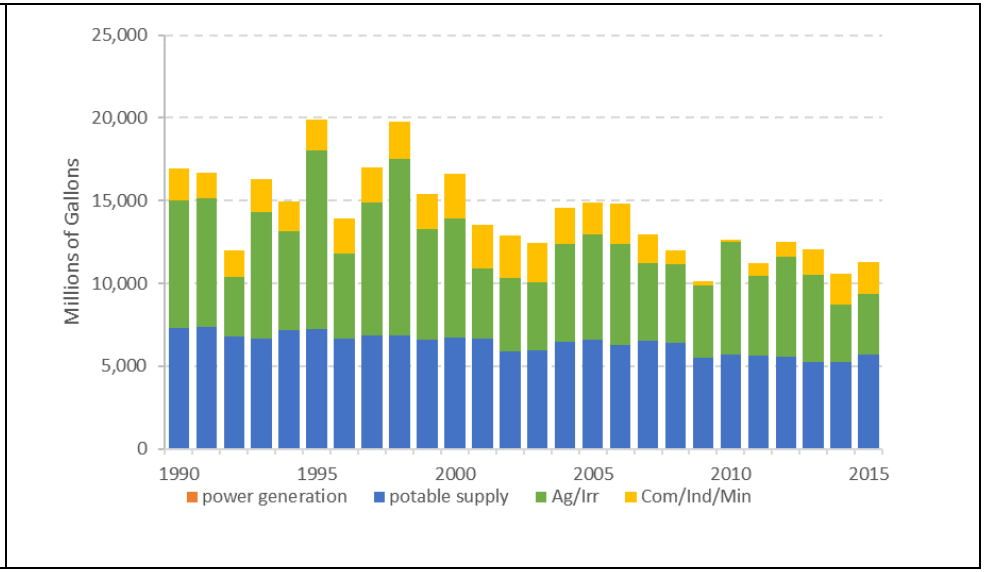


Figure A.19.2. Annual withdrawals by use sector.

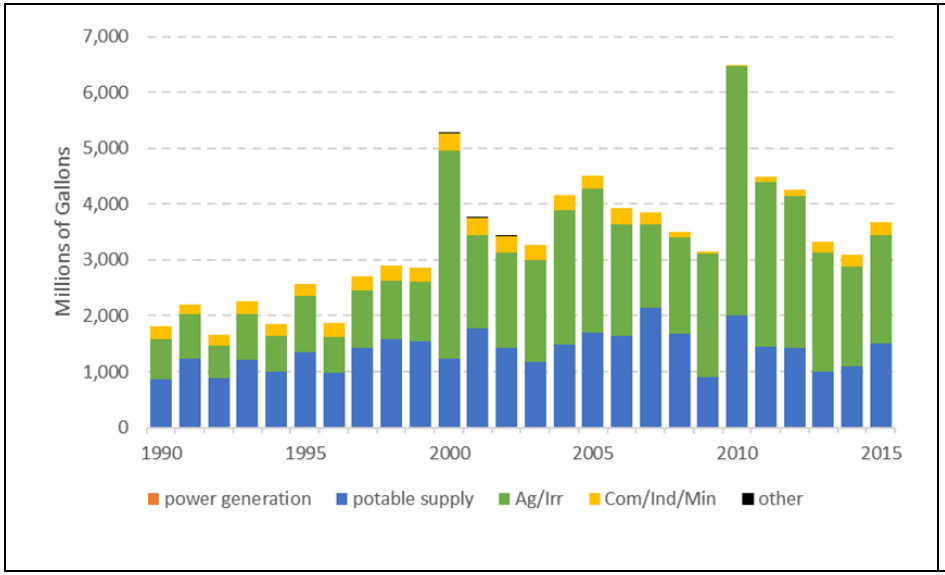


Figure A.19.3. Annual consumptive loss by use sector.

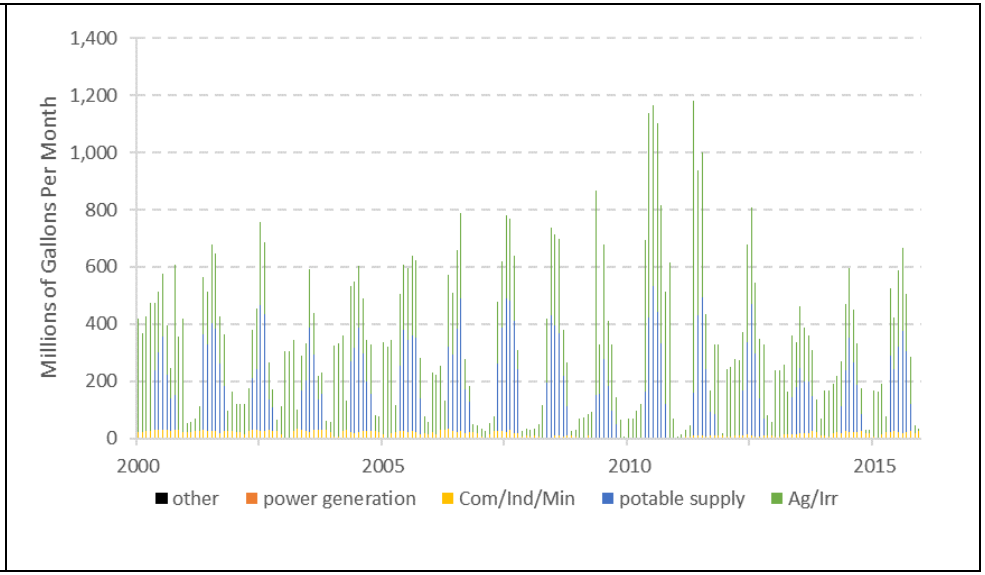


Figure A.19.4. Monthly consumptive loss by use sector.

Table A.19.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	7,423	33	242	1,661		294	572	1,671	5,041			
1991	7,532	37	196	1,286		271	473	1,554	5,321			
1992	3,318	20	281	1,365		283	346	1,474	4,932			
1993	7,352	31	295	1,653		287	216	1,426	5,015			
1994	5,807	24	191	1,456		337	478	1,442	5,222			
1995	9,520	252	977	1,521	27	332	300	1,460	5,504			
1996	4,627	296	224	1,719	85	339	232	1,455	4,960			
1997	7,418	343	271	1,697	86	309	324	1,534	4,996			
1998	9,735	354	530	1,965	57	263	201	1,514	5,160			
1999	6,426	74	173	1,892	33	206	302	1,505	4,808			
2000	7,038	53	109	2,379	19	319	442	1,822	4,457			
2001	4,012	69	167	2,320	15	266	558	1,907	4,206			
2002	3,862	275	270	2,376	15	156	299	1,502	4,111			
2003	3,945	28	100	2,160	13	201	323	1,545	4,095			
2004	5,760	39	120	1,945	7	232	332	1,551	4,553			
2005	6,163	46	162	1,708	4	254	468	1,547	4,553			
2006	5,807	99	224	2,143	20	252	405	1,546	4,299			
2007	4,383	100	223	1,495	30	242	354	1,552	4,599			
2008	4,339	105	319	605	14	180	442	1,552	4,407			
2009	4,103	39	223	172	26	41	363	1,545	3,618			
2010	6,389	80	335	73	62	7	304	1,548	3,821			
2011	4,543	84	213	721	34	13	354	1,534	3,731			
2012	5,467	194	378	856	38	9	374	1,541	3,658			
2013	4,785	189	339	1,493	28	11	333	1,555	3,331			
2014	3,107	106	214	1,870	35	9	339	1,548	3,375			
2015	3,181	95	384	1,878	36	20	248	1,544	3,893		0	

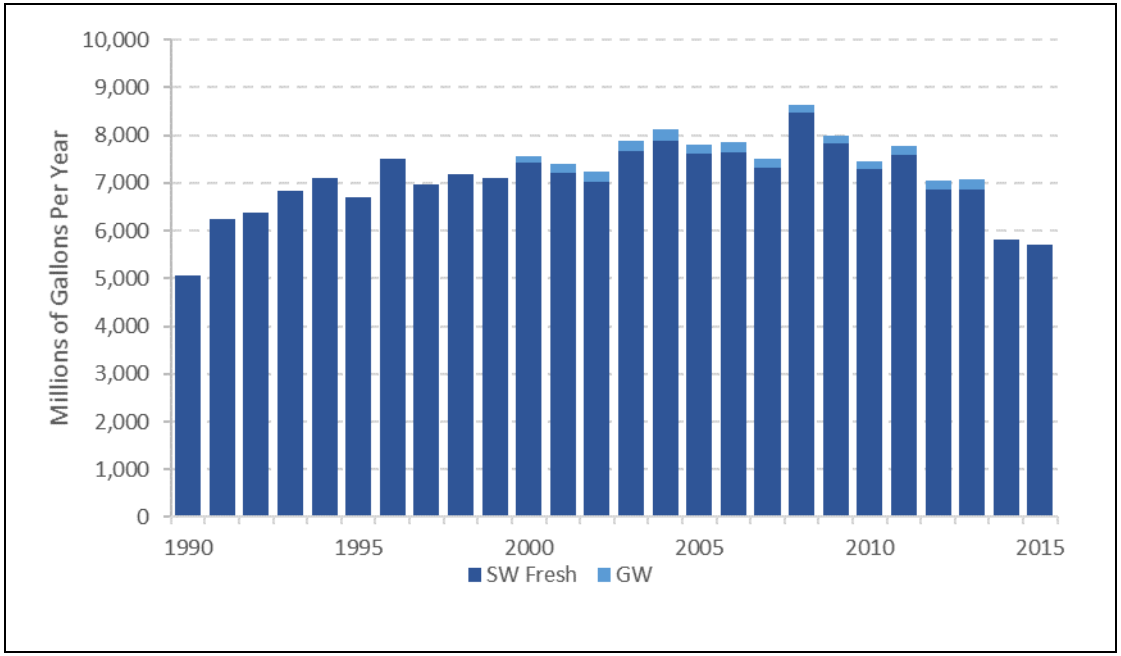


Figure A.19.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Eighteen water purveyors which serve more than 1,000 people provide potable water to one or more of the seven HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.18.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 18% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by 0.68, 1.97, 3.26, 3.94, and 4.31 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.18.4 contains the demand estimates by HUC11. One hundred twenty-five (125) gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.19.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02040202020	02040202030	02040202040	02040202050	02040202060	02040202070	02040202080
NJ0306001	Burlington Twp WD							X
NJ0313001	Evesham MUA					X	X	
NJ0320001	Medford Twp MUA					X	X	
NJ0322001	Moorestown WD							X
NJ0323001	NJ American - Mt Holly			X	X		X	X
NJ0324001	Mount Laurel Twp MUA					X	X	X
NJ0325001	JMDS-Dix Main Sys.	X		X				
NJ0326006	Joint Base MDS McGuire Area	X						
NJ0327001	NJ American - Western Division					X		X
NJ0328001	Pemberton Boro WD			X				
NJ0329003	Pemberton Twp Water - Lake Valley			X	X			
NJ0329004	Pemberton Twp - Dept Main	X	X					
NJ0333001	Pinelands WC				X			
NJ0338001	Willingboro MUA							X
NJ0339001	New Lisbon Developmental Center				X			
NJ0405001	Berlin WD					X		
NJ1518002	Cedar Glen Lakes WC		X					
NJ1518004	Manchester Twp WU - Western		X					

Table A.19.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02040202020	0.10	0.23	0.37	0.46	0.54
02040202030	0.16	0.35	0.54	0.70	0.85
02040202040	0.06	0.20	0.33	0.39	0.42
02040202050	0.02	0.06	0.11	0.12	0.13
02040202060	0.10	0.33	0.56	0.66	0.69
02040202070	0.09	0.30	0.51	0.60	0.63
02040202080	0.15	0.50	0.85	1.00	1.05
Total	**0.68**	**1.97**	**3.26**	**3.94**	**4.31**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.19.8 and A.19.9 indicate that there is a total of 19 mgd of natural resource availability in WMA 18 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 8 mgd of available water remaining and at full allocation rates 13.8 mgd of water is remaining. Table A.19.5 shows that of the 7 HUC11s in the WMA, 3 have used all the available water and 2 would have used all the available water if full allocation diversion rates were used. Two HUC11 has a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, confined aquifer leakage is the major loss in 3 HUC11s and under full allocation diversion rates agricultural irrigation is the largest loss in 4 HUC11s. See tables A.19.5, A.19.6 and A.19.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.19.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02040202020	10.6				25%	2001	2.7	2.7	103%	0.0	4.0	151%	0.0	Potable	Potable
02040202030	17.6				25%	2004	4.4	2.2	50%	2.2	1.1	25%	3.3	Ag Irr	Potable
02040202040	10.4				25%	2010	2.6	-2.3	Net Gain	4.9	-2.8	Net Gain	5.4	Ag Irr	Ag Irr
02040202050	14.4			Yes	25%	2010	3.6	12.1	334%	0.0	9.0	249%	0.0	Ag Irr	Ag Irr
02040202060	13.9				25%	2001	3.5	2.1	61%	1.4	-0.6	Net Gain	4.1	Con Aq Leak	Ag Irr
02040202070	3.0				25%	2001	0.7	0.7	94%	0.0	0.5	63%	0.3	Con Aq Leak	Ag Irr
02040202080	4.2				25%	2010	1.1	-6.8	Net Gain	7.8	-6.3	Net Gain	7.4	Con Aq Leak	Non-Ag Irr

Table A.19.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02040202020	0.0	1.5	0.4	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.4	2.5	0.3	3.2	0.0
02040202030	0.1	0.0	0.8	0.0	5.9	0.0	3.8	0.0	0.0	0.0	0.0	0.9	9.8	0.0	10.7	0.0
02040202040	0.0	0.0	0.5	0.0	0.0	0.4	1.2	0.0	0.0	0.0	0.0	0.8	1.2	0.9	2.9	0.0
02040202050	0.2	0.0	0.8	0.0	0.0	0.7	13.4	0.0	0.0	0.0	0.0	1.5	13.4	0.4	15.3	0.0
02040202060	1.3	0.1	1.6	0.0	0.0	1.1	1.2	0.0	0.5	0.0	0.0	3.7	1.7	2.1	7.5	0.0
02040202070	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.1	0.6	0.9	0.0
02040202080	0.0	0.0	0.1	0.1	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.5	0.3	1.3	2.1	0.0

Table A.19.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02040202020	0.00	0.0	0.0	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.1	0.5
02040202030	0.00	0.0	0.0	0.6	0.0	5.2	0.2	2.4	0.0	0.0	0.0	0.0	0.8	7.6	8.4
02040202040	0.00	4.5	0.0	0.4	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.6	4.6	5.2
02040202050	0.08	0.3	0.0	0.6	0.0	0.0	0.3	2.0	0.0	0.0	0.0	0.0	1.0	2.3	3.2
02040202060	0.43	3.2	0.0	1.2	0.0	0.0	0.1	0.4	0.0	0.0	0.0	0.0	1.8	3.6	5.4

Table A.19.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02040202070	0.00	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2
02040202080	0.00	8.6	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	8.6	8.9

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

There are no major reservoirs located in WMA 19. Some smaller reservoir systems may be present and while critical to the residents that rely of them, they are not covered in this statewide plan.

AVAILABLE WATER FROM CONFINED AQUIFERS

Multiple confined aquifers are present in the WMA. Recharge is occurring from up-dip areas where the aquifer outcrops and from the vertical movement of water from aquifers above and below. See Appendix B Critical Area 2 region for more details. Ground water flow in confined aquifers is driven by the regional hydrostratigraphy and water elevation gradients and therefore does not typically follow surface watershed boundaries. Impacts to confined aquifers below a surface watershed may be caused by withdrawals outside of the surface watershed.

SUMMARY AND MANAGEMENT OPTIONS

Table A.19.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
19	Rancocas		19	20.2	39.2		11	15	26		8	5.2	13.2	0.7	12.5

Table A.19.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
19	Rancocas	31	5	20		13.8	0			2.6	

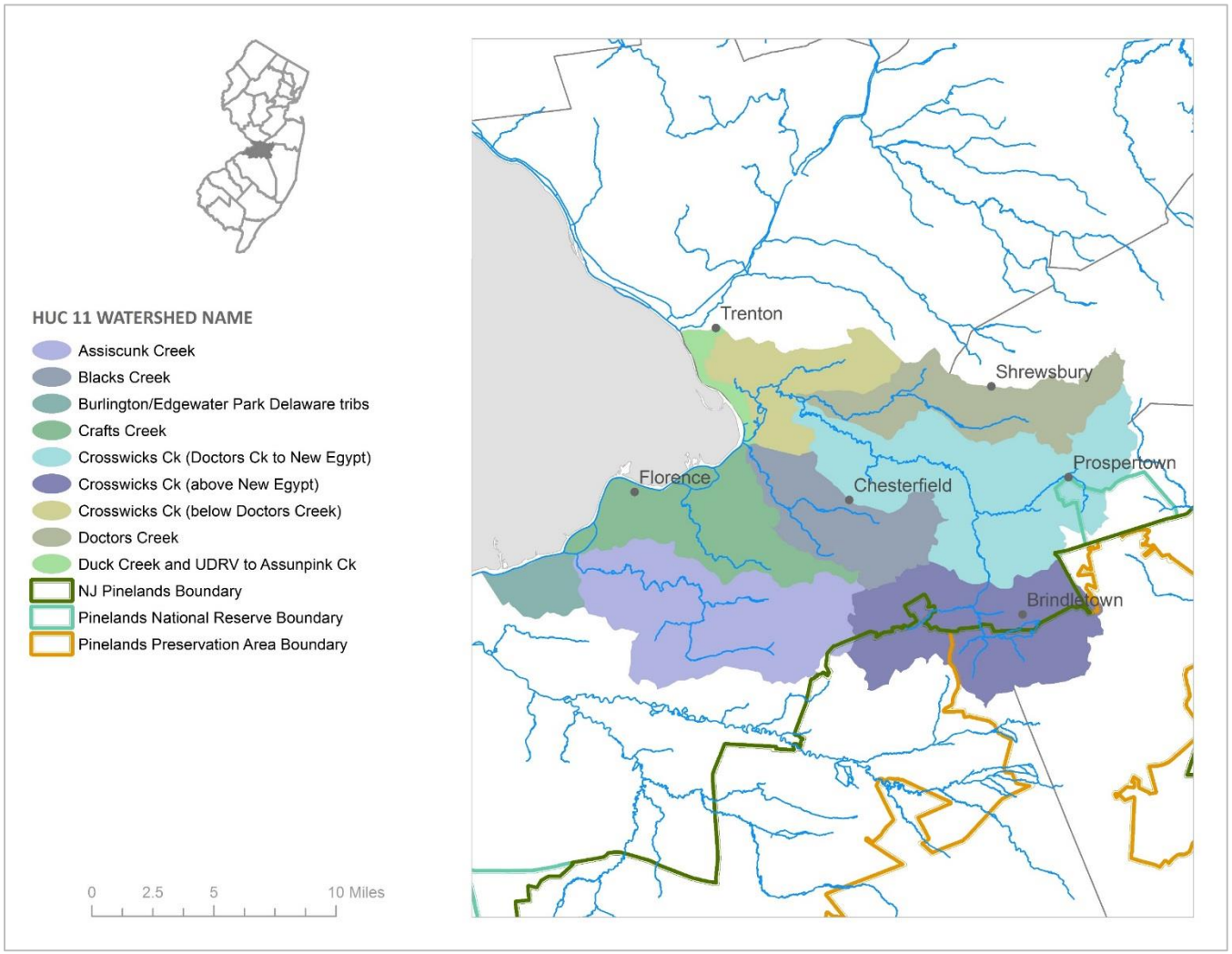
Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for all agricultural facilities located in WMA 19, particularly the South Branch Rancocas Creek (above Bobby's Run and below Bobby's Run) HUC11 watersheds.
- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Rancocas Creek NB (above New Lisbon dam) and Rancocas Creek SB (above Bobbys Run) HUC11 watersheds should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- For proposed new or expanded water allocations (non-residential water users ≥100,000 GPD), where more than 50% of the water will be used for consumptive, non-potable purposes, discourage the use of potable water sources.
- Investigate utilizing the NJ American Water Tri-County project as a source of water for new or expanded uses (not including agriculture) in WMA 19.

WATERSHED MANAGEMENT AREA 20

ASSISCUNK, CROSSWICKS AND DOCTORS



DESCRIPTION OF PLANNING AREA

Watershed Management Area (WMA) 20 is located in the Coastal Plain Province of New Jersey, borders the Delaware River, and encompasses approximately 249 square miles. WMA 20 includes 26 municipalities, which are located in portions of Burlington, Mercer, Monmouth and Ocean Counties. Major streams within WMA 20 include the Assiscunk, Blacks, Crafts, Crosswicks, Doctors, Duck and Mill Creeks. The largest HUC11 watershed in WMA 20 is Crosswicks Creek. Allentown Lake, Oxford Lake, Prospertown Lake and Imlaystown Lake are the largest surface water impoundments in the Crosswicks Creek Watershed.

Table A.20.1. HUC11 Codes and Names in the Watershed Management Area.

HUC11 ID	HUC11 Name
02040201030	Duck Creek and UDRV to Assunpink Ck
02040201040	Crosswicks Ck (above New Egypt)
02040201050	Crosswicks Ck (Doctors Ck to New Egypt)
02040201060	Doctors Creek
02040201070	Crosswicks Ck (below Doctors Creek)
02040201080	Blacks Creek
02040201090	Crafts Creek
02040201100	Assiscunk Creek
02040201110	Burlington/Edgewater Park Delaware tribs

SUMMARY OF WATER WITHDRAWALS, CONSUMPTIVE LOSS AND DISCHARGE

In WMA 20 surface water withdrawals comprise 96%, unconfined groundwater withdrawals comprise 1% and confined aquifer withdrawals comprise 3% of the total withdraw. Power generation is 95% of total withdrawal, with 100% coming from surface water. Potable supply is 3% of the total withdrawal, with 43% coming from unconfined groundwater sources, 48% coming from confined aquifer sources, and the remaining 8% from surface water sources. Combined commercial, industrial and mining make up 1% of the total withdrawal, with 6% coming from surface water sources, 90% from confined aquifer sources, and 4% from unconfined groundwater sources. Agricultural and non-agricultural irrigation make up the remaining 1% of total water withdrawals, with 8% coming from unconfined groundwater sources, 10% from confined aquifer sources, and 82% from surface water sources. Figure A.20.1 shows annual withdrawals by source from 1990 to 2015 and Figure A.20.2 shows annual withdrawals by use sector from 1990 to 2015. Withdrawals peaked in 1997 and show a downward trend from 2005 to 2015. Annual withdrawals by source and use sector are shown in table A.20.2.

Annual consumptive loss peaked in 1998 with a variable pattern. Consumptive loss is split between agricultural and non-ag irrigation and from potable supply uses. For the 2000 through 2015 period monthly consumptive use peaked in July of 2010. Refer to figures A.20.3 and A.20.4.

Almost all (99%) of the total sanitary sewer discharges are to fresh surface water sources. The remaining 1% of the discharges are to groundwater. Discharges average about 81 mgd over the period of record. Refer to Figure A.20.5.

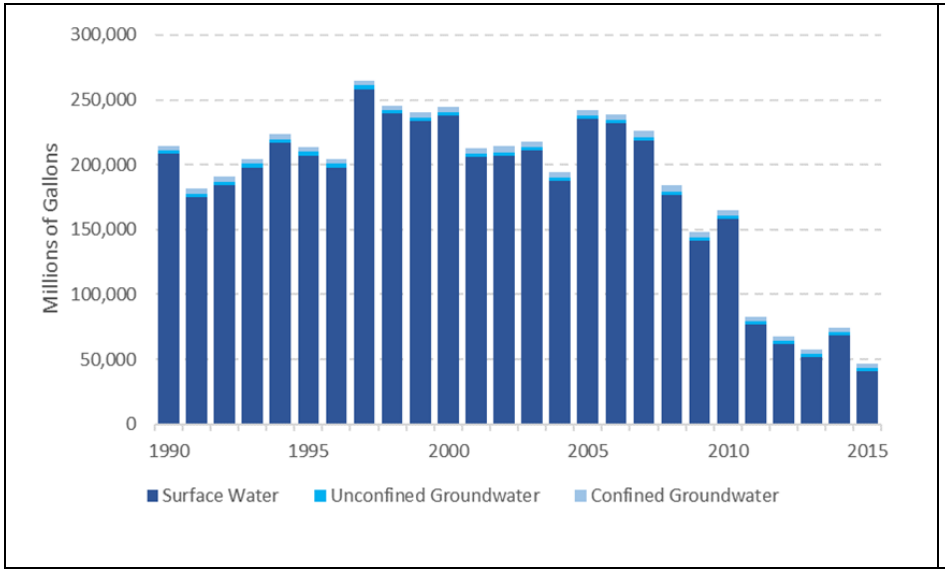


Figure A.20.1. Annual withdrawals by source.

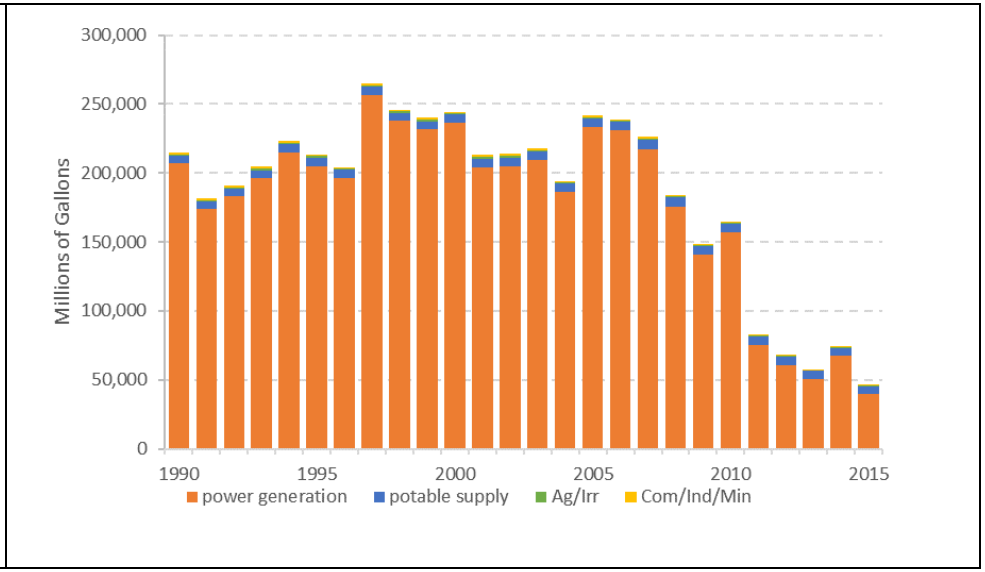


Figure A.20.2. Annual withdrawals by use sector.

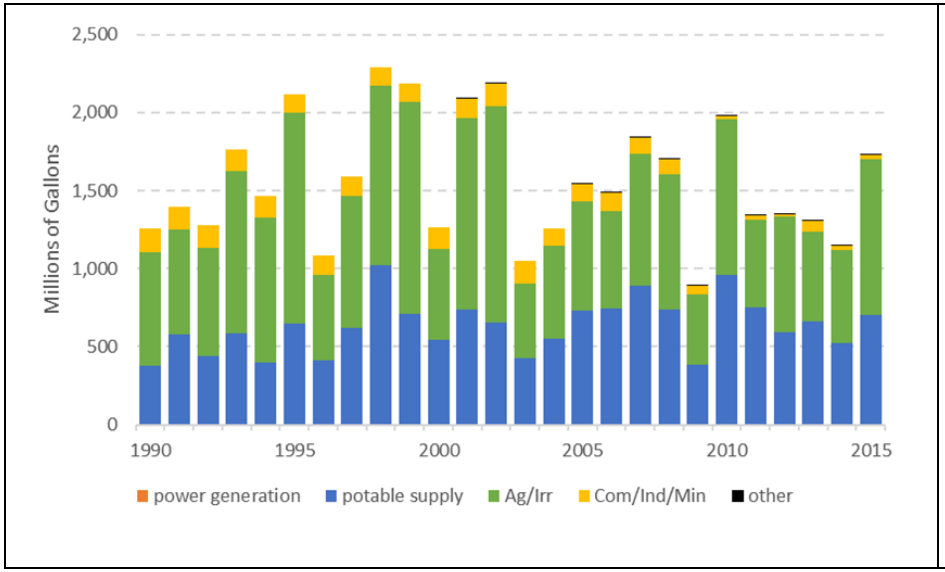


Figure A.20.3. Annual consumptive loss by use sector.

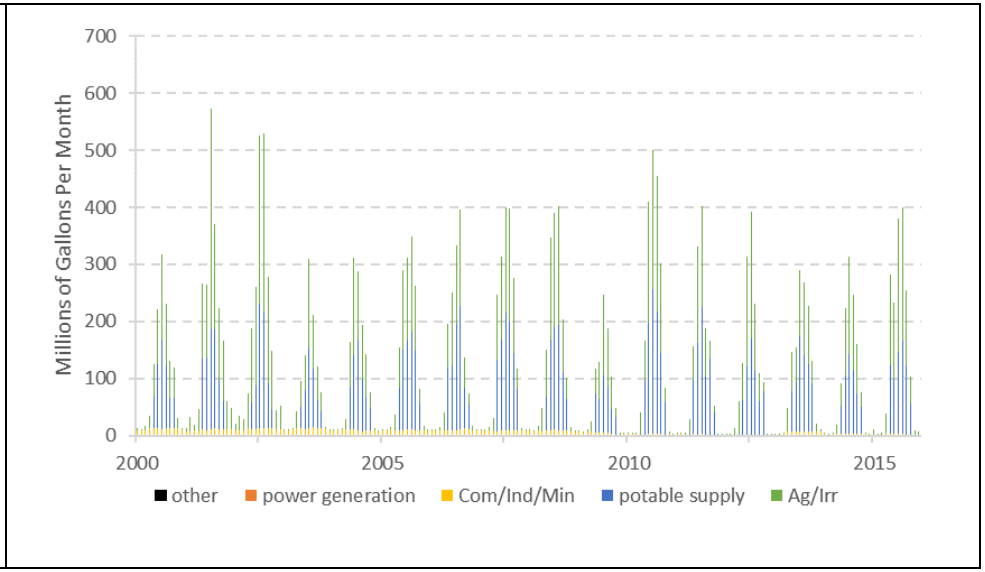


Figure A.20.4. Monthly consumptive loss by use sector.

Table A.20.2 Summary of Annual Withdrawals by Source and Use Sector

	Ag/Irrigation			Com/Ind/Min			Potable Supply			Power Generation		
	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined	Surface Water	Unconfined	Confined
1990	729	122	42		6	1,533	672	2,173	2,262	207,103		
1991	712	63	53			1,485	602	2,138	2,906	173,795		
1992	721	77	44		68	1,392	504	2,675	2,429	182,838		
1993	1,004	130	44		64	1,362	512	2,702	2,680	196,188		
1994	905	105	72		52	1,280	494	2,863	2,279	215,212		
1995	1,229	223	84	27		1,133	531	3,046	2,251	204,935		
1996	688	55	49		51	1,225	549	2,698	2,374	196,509		
1997	995	97	45		85	1,186	507	2,767	2,532	256,482		
1998	1,316	123	68		58	1,130	602	2,459	2,274	237,709		
1999	1,545	119	65		204	1,165	577	2,665	2,209	231,446		
2000	556	45	50		28	1,391	581	2,679	2,733	236,481		
2001	1,438	69	73		15	1,207	598	2,686	3,206	203,702		
2002	1,396	49	97	3	4	1,393	553	2,653	3,061	204,948		
2003	697	27	36	133	253	1,199	554	2,709	2,839	209,580		
2004	564	42	52	153	92	1,049	564	2,655	2,738	186,268		
2005	627	42	116	140	3	1,164	547	2,663	2,961	233,679		
2006	548	51	93	135	2	1,189	546	2,601	2,892	230,965		
2007	719	56	174	125	3	1,048	511	2,574	3,535	217,488		
2008	712	68	191	136	3	1,020	432	2,434	3,633	175,569		
2009	361	41	116	124	2	544	420	2,276	3,538	140,839		
2010	761	134	230	120	2	265	437	2,483	3,624	156,614		
2011	485	27	128	128	1	238	417	2,574	3,131	75,421		
2012	606	40	175	110	1	179	414	2,390	2,891	60,762		
2013	419	44	180	105	27	677	422	2,493	2,898	50,571		
2014	472	49	146	106	1	295	425	2,247	2,866	67,424		
2015	787	116	224	103	2	258	401	2,254	2,859	39,586		

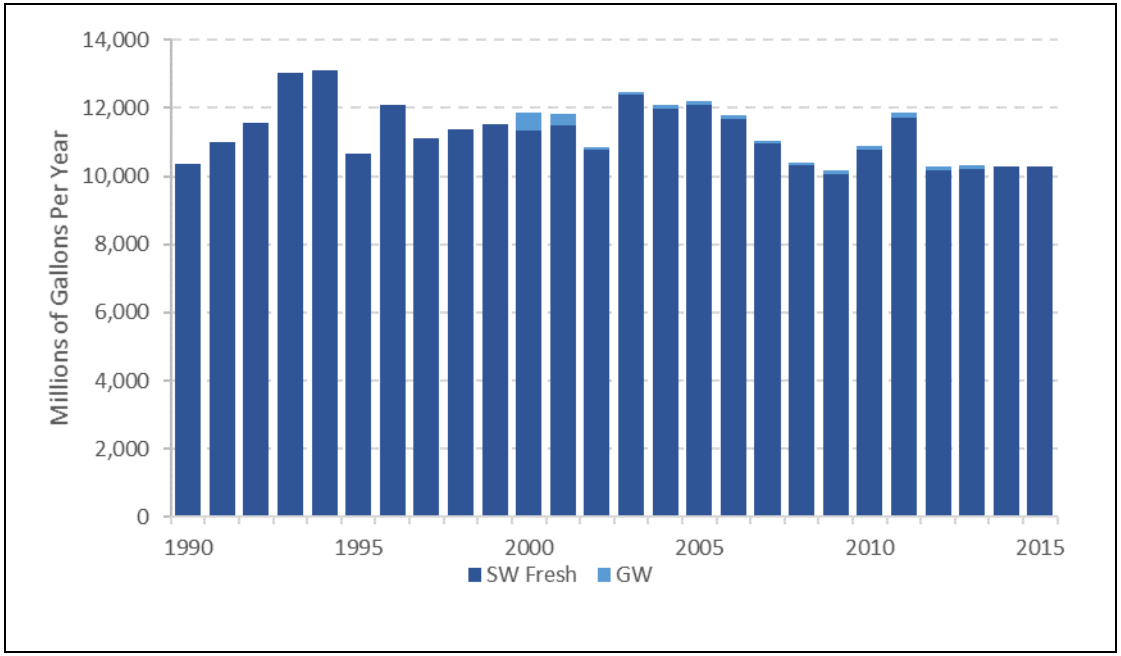


Figure A.20.5. Annual discharges by source.

PUBLIC COMMUNITY WATER SYSTEMS AND PROJECTED WATER DEMAND

Fifteen water purveyors which serve more than 1,000 people provide potable water to one or more of the nine HUC11s in this WMA. The systems and the HUC11s where they provide some or all the potable supply is shown in Table A.20.3. In some areas, private domestic wells are the primary source of potable water. It is estimated that 11% of the total potable supply in the WMA is from private domestic wells.

Potable water demand is expected to increase by 0.54, 1.48, 2.43, 2.97, and 3.30 mgd by 2020, 20125, 2030, 2035 and 2040, respectively. Table A.20.4 contains the demand estimates by HUC11. One hundred twenty-five (125) gpcd is assumed and the three MPO projection datasets were used to estimate population growth. Refer to Appendix D for additional information on the water purveyors.

Table A.20.3. Public Community Water Systems serving greater than 1,000 people and the HUC11(s) they serve.

PWID	NAME	02040201030	02040201040	02040201050	02040201060	02040201070	02040201080	02040201090	02040201100	02040201110
NJ0303001	Bordentown WD	X		X		X	X	X		
NJ0305001	Burlington City WD							X	X	X
NJ0306001	Burlington Twp WD							X	X	X
NJ0307002	Albert C Wagner Youth Correctional Facility			X		X				
NJ0315001	Florence Twp WD							X	X	
NJ0318002	NJ American - Homestead							X	X	
NJ0323001	NJ American - Mt Holly						X	X	X	
NJ0325001	JMDS-Dix Main Sys.		X						X	
NJ0326006	Joint Base MDS McGuire Area		X							
NJ0327001	NJ American - Western Division									X
NJ0338001	Willingboro MUA									X
NJ1103001	Aqua NJ - Hamilton Square			X	X	X	X			
NJ1111001	Trenton Water Works	X		X	X	X				
NJ1302001	Allentown WD				X					
NJ1523003	NJ American - New Egypt		X	X						

Table A.20.4. HUC11 Projected Increase in Water Demand from 2015

HUC11	Demand 2020 (mgd)	Demand 2025 (mgd)	Demand 2030 (mgd)	Demand 2035 (mgd)	Demand 2040 (mgd)
02040201030	0.01	0.04	0.06	0.07	0.08
02040201040	0.16	0.39	0.61	0.77	0.90
02040201050	0.11	0.26	0.40	0.51	0.61
02040201060	0.01	0.03	0.06	0.07	0.07
02040201070	0.03	0.10	0.17	0.20	0.21
02040201080	0.03	0.11	0.19	0.22	0.23
02040201090	0.08	0.27	0.45	0.53	0.56
02040201100	0.08	0.23	0.38	0.45	0.49
02040201110	0.02	0.07	0.12	0.14	0.14
Total	**0.54**	**1.48**	**2.43**	**2.97**	**3.30**

AVAILABLE WATER FOR DEPLETIVE AND CONSUMPTIVE USES FROM THE UNCONFINED GROUNDWATER AND UNREGULATED SURFACE WATER

Tables A.20.8 and A.20.9 indicate that there is a total of 10 mgd of natural resource availability in WMA 20 using NJ's Low Flow Margin method. Under current peak 2000 to 2015 rates there is 18 mgd of available water remaining and at full allocation rates 8.3 mgd of water is remaining. Table A.20.5 shows that of the 9 HUC11s in the WMA, 2 have used all the available water and 5 would have used all the available water if full allocation diversion rates were used. Four HUC11s have a net gain of water due partially to a surface water sanitary sewer discharge. Under current conditions, agricultural irrigation uses are the major loss in 4 HUC11s and under full allocation diversion rates agricultural irrigation uses are the major loss in 4 HUC11s. See tables A.20.5, A.20.6 and A.20.7 for details by HUC11 of remaining available water and a summary of withdrawals and returns. More information on the Low Flow Margin method is available in the references at the end of this appendix.

Table A.20.5. Summary of HUC11 area, Low Flow Margin and Remaining Available Water.

HUC11	LFM (mgd)	NJ Highlands	Major SW Potable Supply 1	Potentially 7Q10 Limited 2	L.F.M. Percentage	Peak Year With.	Available Water (mgd)	Current Net Dep-Con (mgd)	Current % Available Used	Current Remaining Available Water (mgd)	Full Alloca. Net Dep-Con (mgd)	F.A. % Avail. Used	Full Alloca. Remaining Avail. Water (mgd)	Largest Dep-Con	
														Current	Full Allocation
02040201030	0.2				25%	2007	0.1	-9.7	Net Gain	9.7	-9.6	Net Gain	9.7	Ind-Com-Min	Ag Irr
02040201040	9.7				25%	2002	2.4	1.5	64%	0.9	1.1	47%	1.3	Con Aq Leak	Potable
02040201050	11.9				25%	2005	3.0	2.1	72%	0.8	6.4	217%	0.0	Ag Irr	Ag Irr
02040201060	5.1			Yes	25%	2002	1.3	1.9	151%	0.0	3.3	257%	0.0	Ag Irr	Ag Irr
02040201070	2.4				25%	2013	0.6	-4.2	Net Gain	4.8	-5.0	Net Gain	5.6	Con Aq Leak	Ag Irr
02040201080	3.8				25%	2001	0.9	-0.1	Net Gain	1.0	2.5	267%	0.0	Ag Irr	Ag Irr
02040201090	2.1			Yes	25%	2007	0.5	0.4	79%	0.1	1.1	223%	0.0	Con Aq Leak	Potable
02040201100	3.6			Yes	25%	2002	0.9	1.4	156%	0.0	2.4	271%	0.0	Ag Irr	Ag Irr
02040201110	0.8				25%	2000	0.2	-1.9	Net Gain	2.1	-0.7	Net Gain	0.9	Potable	Com/Ind/Min

Table A.20.6. Summary of HUC11 Withdrawals in millions of gallons per day (mgd)

HUC11	Public Supply		Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined				RSW Withdrawals
	UnGW	Non-RSW SW	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	SFD Adj UnGW	SW	Leakage	Total	
02040201030	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	665.1
02040201040	0.0	0.0	0.6	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.5	0.8	0.8	2.2	0.0
02040201050	0.0	0.0	0.9	0.0	0.0	0.1	1.6	0.0	0.0	0.0	0.0	0.9	1.6	1.0	3.5	0.0
02040201060	0.0	0.0	0.3	0.0	0.0	0.2	1.6	0.0	0.0	0.0	0.0	0.5	1.6	0.4	2.5	0.0
02040201070	2.6	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.4	2.8	0.0
02040201080	0.0	0.0	0.3	0.0	0.0	0.1	1.0	0.0	0.0	0.0	0.0	0.4	1.0	0.2	1.6	0.0
02040201090	1.3	0.0	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1.5	0.1	0.5	2.1	1.4
02040201100	0.0	0.0	0.5	0.0	0.0	0.4	0.5	0.0	0.1	0.0	0.0	0.7	0.7	0.5	2.0	0.0
02040201110	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.1	2.3	0.3

Table A.20.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02040201030	0.00	9.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.7	9.7
02040201040	0.01	0.1	0.0	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.4	0.2	0.6
02040201050	0.07	0.5	0.0	0.6	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.8	0.7	1.4
02040201060	0.00	0.2	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.3	0.3	0.6

Table A.20.7. Summary of HUC11 Discharges in millions of gallons per day (mgd)

HUC11	Public Supply			Domestic	Ind-Com-Min		Ag Irrigation		Non-Ag Irrigation		Power Generation		Combined		
	UnGW	SW Fresh	SW Saline	UnGW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	UnGW	SW	Total
02040201070	0.00	6.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	6.9	7.0
02040201080	0.08	1.2	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	1.3	1.6
02040201090	0.00	1.2	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.2	1.7
02040201100	0.00	0.1	0.0	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.4	0.1	0.5
02040201110	0.00	1.8	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	1.8	4.2

AVAILABLE WATER FROM MAJOR SURFACE WATER SUPPLY RESERVOIR SYSTEMS

There are no major reservoirs located in WMA 20. Some smaller reservoir systems may be present and while critical to the residents that rely of them, they are not covered in this statewide plan.

AVAILABLE WATER FROM CONFINED AQUIFERS

Multiple confined aquifers are present in the WMA. Recharge is occurring from up-dip areas where the aquifer outcrops and from the vertical movement of water from aquifers above and below. See Appendix B Critical Area 2 region for more details. Ground water flow in confined aquifers is driven by the regional hydrostratigraphy and water elevation gradients and therefore does not typically follow surface watershed boundaries. Impacts to confined aquifers below a surface watershed may be caused by withdrawals outside of the surface watershed.

SUMMARY AND MANAGEMENT OPTIONS

Table A.20.8 Natural Resource Availability, net demand and remaining availability, and 2020 estimates of potable use.

WMA#	WMA Name	Natural Resource Availability (mgd)				Net Demand (mgd)				Remaining Availability (mgd)				Estimated increase in potable use 2015 to 2020 (mgd)	Estimated remaining water availability in 2020 (mgd)
		Reservoirs	SW Intakes/ Unconf GW	Conf GW (sub to revision)	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined	Reservoirs	SW Intakes/ Unconf GW	Conf GW	Combined		
20	Assiscunk, Crosswicks and Doctors		10	22.2	32.2		-8	15	7		18	7.2	25.2	0.5	24.7

Table A.20.9 Full allocation rates, remaining water, and options for additional water supply

WMA#	WMA Name	Water Availability Allocation (mgd)			Full Allocation Remaining Available Water (mgd)				Options for Additional Water Supply (mgd)		
		SW	Unconf GW	Conf GW	Reservoirs	SW intakes/unconf GW	Conf GW	Combined	Ocean/ bay sewer discharges	Potable conservation savings	Unbuilt water supply projects
20	Assiscunk, Crosswicks and Doctors	925	7	22		8.3	0			0.4	

Note that the sanitary saline discharges are included as a separate column in the table above and are excluded from remaining available water totals. Saline discharges are included in HUC11 LFM tables in the same WMA.

Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for all agricultural facilities located in WMA 20, particularly the Crosswicks Creek (Doctors Creek to New Egypt, Doctors Creek, Assiscunk Creek and Blacks Creek HUC11s.
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Doctors Creek and Assiscunk Creek HUC11 watersheds should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Crosswicks Ck (Doctors Ck to New Egypt), Crosswicks Ck (below Doctors Creek), Blacks Creek and Crafts Creek HUC11s as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
    - If deficit occurs, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- For proposed new or expanded water allocations (non-residential water users ≥100,000 GPD), where more than 50% of the water will be used for consumptive, non-potable purposes, discourage the use of potable water sources.
- Investigate utilizing the NJ American Water Tri-County project as a source of water for new or expanded uses (not including agriculture) in WMA 20.