

ANALYSIS OF HYDROLOGICAL CONDITIONS IN THE SYRDARYA AND AMUDARYA RIVER BASINS OVER THE NON-GROWING SEASON 2020-2021

1 Syr Darya River Basin

The actual inflow to the upstream reservoirs in the Syr Darya basin (Toktogul, Andizhan, and Charvak reservoirs) was 4.8 km³ during the non-growing season. Inflow to the Toktogul reservoir was 2.89 km³ or 101% of the forecast. Inflow to the Andizhan reservoir was 5% lower than expected, while inflow to the Charvak reservoir was 20% lower than the forecast. The total water releases from the upstream reservoirs were 11.51 km³. This is 7% less than planned by BWO SyrDarya schedule.

The total lateral inflow in the reach from the Toktogul reservoir to the Shardara reservoir, including discharges from the Karadarya and Chirchik rivers, was 8.37 km³. This is 1.7 times more than the total inflow to the upstream reservoirs but 1.4 times lower than total releases from the reservoirs.

By the end of the non-growing season, 10.04 km³ were accumulated in the upstream reservoirs, including 8.7 km³ in the Toktogul reservoir or 93% of the BWO SyrDarya's scheduled amount, 0.76 km³ (105%) in the Andizhan reservoir, and 0.56 km³ (53%) in the Charvak reservoir. The Toktogul reservoir discharged water in the amount of 6.5 km³, the Charvak reservoir was drawn down by 0.72 km³, whereas the Andizhan reservoir accumulated water in the amount of 0.38 km³. Minor water losses totaling 0.12 km³ were recorded in the reservoirs.

During the non-growing season, inflow to the Bakhri Tochik reservoir amounted to 11.71 km³, which is 1.09 km³ less than scheduled by BWO SyrDarya. Water releases from the reservoir were 11.09 km³, which is 0.17 km³ less than the schedule. The accumulation of water in the reservoir amounted to 3.46 km³. Unrecorded inflow to the reservoir was detected by the balance method in the amount of 0.87 km³. The possible cause is the underestimated inflow to the reservoir.

During the non-growing season, water withdrawal from the Naryn and the Syr Darya rivers in the reach up to the Shardara reservoir was 3.93 km³, of which: for the Kyrgyz Republic – 0.03 km³, for the Republic of Tajikistan – 0.04 km³, for the Republic of Kazakhstan (through the Dustlik canal) – 0.5 km³, and for the Republic of Uzbekistan – 3.36 km³. Water availability was uneven by state, river reach and in time (Table 1.1). The difference between the actual water supply and the water limit varied from -18% (deficit in the 1st ten-day of March) to 69% (excessive water supply in the 3rd ten-day of November) in the Toktogul-Bakhri Tochik reach and from -49% (2nd ten-day of October) to 53% (1st ten-day of November) in the Bakhri Tochik-Shardara reach (Table 1.3).

During the non-growing season 2020-2021, inflow to the Shardara reservoir was 9.73 km³ or 1.86 km³ less than scheduled by BWO SyrDarya. By the end of the season, the reservoir accumulated water to 5.07 km³ (100%). Water losses amounted to 0.32 km³. The discharge from the Shardara reservoir was 5.18 km³ (67%), including: 5.08 km³ into the river; 0.1 km³ into the Kzylykum canal. Water was discharged into Arnasay.

The actual water supply to the Aral Sea was 0.7 km³, according to KazHydromet's data, while the Kazakh Committee for Water Resources shows 1.15 km³ (48% of the expected volume).

Table 1.2 shows the reservoirs' water balance.

Table 1.1

Water availability in the Syr Darya River basin countries
in the non-growing season 2020-2021

№	Water user	Water volume, km ³		Water availability, %	Deficit(-), surplus (+), km ³
		Limit/ schedule	Actual	Season	Season
1	Total water withdrawal	4.26	3.93	92	-0.33
2	Water withdrawal by country:				
	Kyrgyz Republic	0.047	0.03	59	-0.02
	Republic of Uzbekistan	3.35	3.36	100	0.01
	Republic of Tajikistan	0.37	0.04	11	-0.32
	Republic of Kazakhstan	0.50	0.50	100	0.00
3	By river reach				
3.1	Toktogul reservoir – Uchkurgan hydroscheme	1.38	1.35	98	-0.02
	of which:				
	Kyrgyz Republic	0.04	0.02	60	-0.016
	Republic of Tajikistan	0.08	0.04	48	-0.044
	Republic of Uzbekistan	1.25	1.29	103	0.037
3.2	Uchkugran hydroscheme – Bakhri Tochik hydroscheme	0.25	0.17	67	-0.081
	of which:				
	Kyrgyz Republic	0.01	0.007	70	-0.003
	Republic of Tajikistan	0.07	0.002	29	-0.068
	Republic of Uzbekistan	0.17	0.16	94	-0.010
3.3	Bakhri Tochik hydroscheme – Shardara reservoir	2.63	2.41	91	-0.22
	of which:				
	Kyrgyz Republic	0.50	0.50	100	0.00
	Republic of Tajikistan	0.21	0.00	0	-0.21
	Republic of Uzbekistan	1.92	1.91	99	-0.01
4	Inflow to the Shardara reservoir	11.59	9.73	84	-1.86
	Discharge into Arnasay	0.40	0.00	0	-0.40
5	Water supply to the Aral Sea (Karateren gauging station)	2.40	1.15*	48	-1.25

* Data from the Kazakh Committee for Water Resources

Table 1.2

Water balance of the Syr Darya River basin reservoirs
over the non-growing season 2020-2021

No.	Balance item	Water volume, km ³		Deviation (actual–plan)
		Forecast/pla n	Actual	
1	Toktogul reservoir			
1.1	Inflow to the reservoir	2.86	2.89	0.03
1.2	Water volume in the reservoir:			
	- beginning of the season (1 October 2020)	15.20	15.20	0.00
	- end of the season (1 April 2021)	9.37	8.71	-0.66
1.3	Water releases from the reservoir	8.68	9.38	0.70
1.4	Unrecorded inflow (+) or losses (-)	-0.01	-0.003	0.010
	Including % of inflow to the reservoir	0	0	0
1.5	Flow regulation: recharge (+) or diversion (-) of flow	5.82	6.49	0.67
2	Andizhan reservoir			
2.1	Inflow to the reservoir	0.82	0.78	-0.04
2.2	Water volume in the reservoir:			
	- beginning of the season (1 October 2020)	0.38	0.38	0.00
	- end of the season (1 April 2021)	0.72	0.76	0.04
2.3	Water releases from the reservoir	0.48	0.38	-0.10
2.4	Unrecorded inflow (+) or losses (-)	0.00	-0.02	-0.02
	Including % of inflow to the reservoir	0	3	3
2.5	Flow regulation: recharge (+) or diversion (-) of flow	-0.34	-0.40	-0.06
3	Charvak reservoir			
3.1	Inflow to the reservoir	1.42	1.13	-0.29
3.2	Water volume in the reservoir:			
	- beginning of the season (1 October 2020)	1.28	1.28	0.00
	- end of the season (1 April 2021)	1.05	0.56	-0.49
3.3	Water releases from the reservoir	1.64	1.75	0.11
	Unrecorded inflow (+) or losses (-)	-0.01	-0.10	-0.09
	Including % of inflow to the reservoir	1	9	8
3.5	Flow regulation: recharge (+) or diversion (-) of flow	0.22	0.62	0.40
4	Bakhri Tochik reservoir			
4.1	Inflow to the reservoir from the river	12.80	11.71	-1.09
4.2	Lateral inflow	0.300	0.314	0.01
4.3	Water volume in the reservoir:			
	- beginning of the season (1 October 2020)	1.68	1.68	0.00
	- end of the season (1 April 2021)	3.44	3.46	0.02
4.4	Water releases from the reservoir	11.37	11.11	-0.26
	of which:			
	- releases into the river	11.26	11.09	-0.17
	- water withdrawal from the reservoir	0.11	0.018	-0.09
4.5	Unrecorded inflow (+) or losses (-)	0.02	0.87	0.84
	Including % of inflow to the reservoir	0	7	7

No.	Balance item	Water volume, km ³		Deviation (actual–plan)
		Forecast/pla n	Actual	
4.6	Flow regulation: recharge (+) or diversion (-) of flow	-1.73	-0.62	1.11
5	Shardara reservoir			
5.1	Inflow to the reservoir from the river	11.59	9.73	-1.86
5.2	Lateral inflow	0.0	0.0	0.00
5.3	Water volume in the reservoir:			
	- beginning of the season (1 October 2020)	0.83	0.83	0.00
	- end of the season (1 April 2021)	5.09	5.07	-0.02
5.4	Water releases from the reservoir	7.68	5.18	-2.50
	of which:			
	- discharge into Arnasay	0.40	0.00	-0.402
	- water releases into the river	7.19	5.08	-2.12
	- water withdrawal from the reservoir	0.08	0.10	0.02
5.5	Unrecorded inflow (+) or losses (-)	0.35	-0.32	-0.67
	Including % of inflow to the reservoir	3	3	0
5.6	Flow regulation: recharge (+) or diversion (-) of flow	-3.91	-4.66	-0.74
	Total flow regulation by reservoirs: inflow (+) or diversion (-)	0.05	1.43	1.38
	Total unrecorded inflow (-) or losses (+)	0.35	0.42	0.07

Table 1.3

Deviation of actual water supply from limit in the Syr Darya River basin over the non-growing season 2020-2021

Indicator	Unit	October			November			December			January			February			March			Season	
		I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III		
Toktogul-Bakhri Tochik reach																					
Total water withdrawal, of which:	Limit	m ³ /s	189	183	163	82	40	20	6	12	32	69	76	76	89	78	105	193	212	225	1623
	Actual	m ³ /s	159	161	150	87	55	34	8	15	34	66	74	76	84	77	93	158	195	207	1520
	Deviat.	%	-16	-12	-8	6	37	69	38	18	8	-4	-2	-1	-6	-1	-11	-18	-8	-8	-6
Kyrgyz Republic	Limit	m ³ /s	8.5	7.1	6.8	2.5	1.8	1.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	4.0	4.7	7.1	47
	Actual	m ³ /s	5.2	5.3	5.7	4.0	2.6	1.1	0.55	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.5	0.8	1.8	28
	Deviat.	%	-39	-26	-16	63	47	-33	-45	-50	-50	-50	-50	-50	-50	-50	-50	-88	-82	-75	-41
Tajikistan	Limit	m ³ /s	23.0	20.0	20.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	8.0	10.0	22.0	25.0	28.0	153
	Actual	m ³ /s	4.0	3.6	3.9	4.1	4.4	1.3	0.0	0.4	1.9	1.1	0.1	0.3	1.0	2.5	4.4	3.7	5.5	4.9	41
	Deviat.	%	-83	-82	-80	-66									-84	-69	-56	-83	-78	-83	-73
Uzbekistan	Limit	m ³ /s	158	156	137	68	38	19	5	11	31	68	75	75	82	69	94	167	182	190	1423
	Actual	m ³ /s	150	152	140	79	48	32	7	14	32	65	74	75	83	74	88	154	188	200	1451
	Deviat.	%	-5	-3	3	16	25	71	55	20	3	-5	-2	-1	1	8	-6	-8	3	6	2
Bakhri Tochik-Shardara reach																					
Total water withdrawal, of which:	Limit	m ³ /s	210	204	201	137	127	121	116	129	136	122	114	120	147	176	183	263	261	250	2635
	Actual	m ³ /s	134	104	124	209	141	126	139	140	130	105	112	150	171	180	182	230	211	181	2410
	Deviat.	%	-36	-49	-38	53	12	5	19	8	-5	-14	-2	25	16	2	0	-12	-19	-28	-9
Kazakhstan	Limit	m ³ /s	0	0	0	0	0	0	8.0	18.0	25.0	27.0	40.0	52.0	75.0	95.0	85.0	65.0	53.0	39.0	498
	Actual	m ³ /s	0	0	0	2.7	3.0	3.0	3.0	3.0	3.0	8.8	33.1	68.4	95.3	103	105	88.9	49.2	20.7	499
	Deviat.	%							-63	-83	-88	-67	-17	31	27	8	24	37	-7	-47	0
Tajikistan	Limit	m ³ /s	36.0	30.0	27.0	16.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	22.0	32.0	32.0	35.0	212
	Actual	m ³ /s	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	0.0	0.0	0
	Deviat.	%	-100	-100	-100	-100	-100									-100	-100	-100	-100	-100	-100
Uzbekistan	Limit	m ³ /s	174	174	174	121	121	121	108	111	111	95	74	68	72	73	76	166	176	176	1924
	Actual	m ³ /s	134	104	124	206	138	123	136	137	127	96	78	82	76	78	77	141	162	161	1911
	Deviat.	%	-23	-40	-29	71	15	2	25	23	14	1	6	21	5	6	2	-15	-8	-9	-1

2 Amu Darya River basin

The actual water content in the Amu Darya River at the nominal Atamyrat gauging station (upstream of intake to Garagumdarya) was 10.2 km³, which is 11% less than scheduled by BWO AmuDarya.

Inflow to the Nurek reservoir was 3.7 km³ (97% of the forecast), while water releases from the reservoir were 7.3 km³ (96% of that scheduled by BWO AmuDarya). The river received additional 3.65 km³ through discharge from the Nurek reservoir. The reservoir was drawn down to 6.28 km³ by the end of season. Water balance discrepancy that indicates to water losses and/or overestimated inflow to the reservoir was 0.52 km³.

In the reservoirs of Tuyamuyun hydroscheme (TMHS), the water accumulation plan for the non-growing season has not been fulfilled – by the 1st of April the actual water volume was lower than the scheduled one by 0.47 km³ and totaled 2.65 km³. Failure to fulfill the accumulation plan is explained by lower inflow to the in-stream reservoir than was expected – flow at the Bir-Ara section was estimated at 6.69 km³ (82% of the forecast). Water releases from TMHS also were lower than scheduled by BWO AmuDarya – 7.34 km³ (96%). Water disbalance at the Bir-Ata – Tuyamuyun g/s reach (calculated by the balance method) amounted to 1.23 km³ or 18% of river flow at Bir-Ata g/s. This can be attributed to water losses in reservoirs of Tuyamuyun hydroscheme and/or overestimated inflow to the hydroscheme.

The established limit of water withdrawal in the basin was 84% used; water withdrawal amounted to 13.17 km³, including 10.55 km³ downstream of Atamyrat gauging station (starting from the intake to Garagumdarya). Water availability by country changed from 80% to 89 % (Table 2.1). The available water supply was 81% in the upper reaches (up to Garagumdarya intake), 94% in the middle reaches (from nominal Atamyrat g/s to TMHS), and 66 % (68% - Turkmenistan, 66% - Uzbekistan) in the lower reaches. Water deficit was estimated at 523 million m³ (18% of the established limit) in the Republic of Tajikistan, 1.3 km³ (20%) in the Republic of Uzbekistan, and 737 million m³ (11%) in Turkmenistan.

Table 2.4 shows deviations of actual water supply from the established water limit. These deviations varied from -26% (deficit in the 2nd ten-day of March) to 28% (excessive supply in the 1st ten-day of December) in the Nurek-Tuyamuyun reach and from -71% (1st ten-day of February) до 485% (3rd ten-day of January) in the Tuyamuyun-Samanbay reach.

Water losses in the Atamyrat nominal -Bir-Ata reach were insignificant - 0.52 km³ (4% of river flow at the nominal Atamyrat g/s). Water losses in the Tuyamuyun-Samanbay reach amounted to 1.47 km³ (38% of river flow at Tuyamuyun g/s). The total open-channel losses in middle and lower reaches amounted to 1.99 km³ or 14% of regulated river flow.

The established limit of environmental water releases into canals in the Amu Darya lower reaches was 73% used; the water supply was 0.57 km³. According to the Uzbek Hydromet's data, 1.05 km³ were delivered to Aral Sea region and the Aral Sea or 50% of planned water delivery.

Tables 2.2 and 2.3 show the river's main course balance and the reservoirs' water balance, respectively.

Table 2.1

Water availability in the Amu Darya River basin countries
in the non-growing season 2020-2021

N	Water user	Water volume, km ³		Water availability, %	Deficit (-), surplus (+), km ³
		Limit/schedule	Actual	Season	Season
1	Total water withdrawal	15.73	13.17	84	-2.559
2	Water withdrawal by state:				
	<i>Kyrgyz Republic</i>	-	-	-	-
	<i>Republic of Tajikistan</i>	2.88	2.36	82	-0.52
	<i>Turkmenistan</i>	6.50	5.76	89	-0.74
	<i>Republic of Uzbekistan</i>	6.35	5.05	80	-1.30
3	Downstream of the Atamyrat reach	12.48	10.55	85	-1.93
	of which:				
	<i>Turkmenistan</i>	6.50	5.76	89	-0.74
	<i>Republic of Uzbekistan</i>	5.98	4.79	80	-1.19
4	By river reach				
	Upper reaches	3.25	2.62	81	-0.63
	of which:				
	<i>Kyrgyz Republic</i>	-	-	-	-
	<i>Republic of Tajikistan</i>	2.88	2.36	82	-0.52
	<i>Republic of Uzbekistan, Surkhandarya</i>	0.37	0.26	71	-0.11
	Middle reaches	8.35	7.81	94	-0.54
	of which:				
	<i>Turkmenistan</i>	5.10	4.82	94	-0.28
	<i>Republic of Uzbekistan</i>	3.25	2.99	92	-0.25
	Lower reaches	4.14	2.74	66	-1.39
	of which:				
	<i>Turkmenistan</i>	1.40	0.95	68	-0.45
	<i>Republic of Uzbekistan</i>	2.73	1.79	66	-0.94
5	Sanitary and environmental releases into canals within lower reaches	0.80	0.57	71	-0.23
	including:				
	<i>Turkmenistan</i>	0.15	0.12	83	-0.03
	<i>Republic of Uzbekistan</i>	0.65	0.44	68	-0.21
6	Supply to the Aral Sea region and the Aral Sea	2.1	1.05	50	-1.05

Table 2.2

The Amu Darya River's main course water balance over the non-growing season 2020-2021

Balance item	Water volume, km ³		Deviation (actual-plan)
	Forecast/plan	Actual	
1. Water content in the Amu Darya River - non-regulated flow at Atamyrat g/s nominal*	11.42	10.18	-1.242
2. Flow regulation by the Nurek reservoir: recharge (+) or diversion (-) of flow	3.83	3.65	-0.18
3. Water withdrawal in the middle reaches (-)	-8.35	-7.81	0.54
4. Return CDF (+) in middle reaches	1.23	1.19	-0.04
5. Water losses (-) or unrecorded inflow to the main course (+)	0.06	-0.52	-0.58
<i>% of flow at the nominal Atamyrat GS</i>	0	4	3
6. Flow at the Bir-Ata GS	8.20	6.69	-1.50
7. Water releases from TMHS (including water diversion from the reservoir)	7.18	5.27	-1.91
8. Water withdrawal in lower reaches, including from TMHS (-)	-4.14	-2.74	1.39
9. Return CDF (+) in lower reaches	0.00	0.00	0.00
10. Emergency and environmental water releases into canals (-)	-0.80	-0.57	0.23
11. Runoff losses (-) or unrecorded inflow to the main course (+)	-1.34	-1.47	-0.13
<i>% of flow in the Tuyamuyun GS reach</i>	27	38	12
12. Supply to the Aral Sea region and the Aral Sea (Samanbay GS)	0.91	0.49	-0.42
TOTAL losses:	-1.28	-1.99	-0.71
<i>% of regulated flow</i>	8	14	6

* Minus water withdrawal in upper reaches (Tajikistan and Surkhandarya province)

Table 2.3

Water balance of the reservoirs in the Amu Darya River basin over the non-growing season
2020-2021

Balance item	Water volume, km ³		Deviation (actual-plan)
	Forecast/plan	Actual	
1 Nurek reservoir			
2.1 Inflow to the reservoir	3.78	3.69	-0.10
2.2 Water volume in the reservoir:			
beginning of the season (1 October 2020)	10.57	10.55	-0.02
end of the season (1 April 2021)	6.22	6.28	0.07
2.3 Water releases from the reservoir	7.61	7.34	-0.27
2.4 Lateral inflow (+) or water losses (-)	-0.53	-0.61	-0.09
<i>% of the inflow to the reservoir</i>	14	17	3
2.5 Flow regulation: recharge (+) or diversion (-) of flow	3.83	3.65	-0.18
2 Reservoirs of TMHS			
2.1 River flow at Bir-Ata GS	8.20	6.69	-1.50
2.2 Water volume in the reservoirs:			
beginning of the season (1 October 2020)	2.46	2.46	0.00
end of the season (1 April 2021)	3.12	2.65	-0.47
2.3 Water release from the hydroscheme	7.18	5.27	-1.91
of which:			
– release into the river	5.00	3.84	-1.16
– water diversion	2.18	1.43	-0.75
2.4 Unrecorded inflow (+) or water losses (-)	-0.35	-1.23	-0.88
<i>including %of inflow to the reservoir</i>	4	18	14
2.5 Flow regulation: recharge (+) or diversion (-) of flow	-1.02	-2.85	-1.83
TOTAL losses in reservoirs (-), unrecorded inflow (+)	-0.88	-1.84	-0.96

Table 2.4

Deviation of actual water supply from limit in the Amu Darya River basin over the non-growing season 2020-2021

Indicator	Unit	October			November			December			January			February			March			Season	
		I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III		
Nurek-Tuyamuyun reach																					
Total water withdrawal, of which:	Limit	m ³ /s	961	924	861	721	671	537	459	500	502	565	607	617	638	757	842	991	1045	1084	11595
	Actual	m ³ /s	837	782	730	672	625	531	586	522	526	496	567	620	675	708	680	768	775	836	10430
	Deviat.	%	-13	-15	-15	-7	-7	-1	28	4	5	-12	-7	1	6	-6	-19	-23	-26	-23	-10
Tajikistan	Limit	m ³ /s	253	231	212	206	206	190	145	129	125	122	128	132	143	160	193	229	241	256	2880
	Actual	m ³ /s	180	152	135	145	164	166	163	155	140	152	150	145	137	149	156	133	131	149	2357
	Deviat.	%	-29	-34	-36	-29	-21	-12	13	20	13	25	17	9	-5	-7	-19	-42	-46	-42	-18
Turkmenistan	Limit	m ³ /s	395	384	360	295	260	230	219	211	205	210	230	246	275	359	406	483	527	552	5100
	Actual	m ³ /s	383	367	352	308	269	233	224	218	213	213	231	264	305	339	333	410	406	447	4837
	Deviat.	%	-3	-4	-2	4	4	1	2	3	4	2	0	7	11	-6	-18	-15	-23	-19	-5
Uzbekistan	Limit	m ³ /s	314	309	289	220	205	117	95	160	172	233	249	239	220	238	243	280	277	276	3615
	Actual	m ³ /s	274	262	243	219	192	131	199	150	173	130	187	212	234	221	191	226	238	240	3258
	Deviat.	%	-13	-15	-16	0	-6	12	109	-7	0	-44	-25	-11	6	-7	-21	-19	-14	-13	-10
Tuyamuyun-Samanbay reach																					
Total water withdrawal, of which:	Limit	m ³ /s	388	363	328	33	0	0	0	5	10	10	10	10	413	565	693	746	659	598	4135
	Actual	m ³ /s	328	283	209	65	24	9	9	9	27	29	26	58	119	451	517	428	337	289	2741
	Deviat.	%	-16	-22	-36	101				84	166	190	163	485	-71	-20	-25	-43	-49	-52	-34
Turkmenistan	Limit	m ³ /s	158	158	158	33	0	0	0	5	10	10	10	10	93	155	195	206	209	211	1400
	Actual	m ³ /s	138	123	97	29	11	5	5	5	5	5	5	5	31	155	163	122	105	100	948
	Deviat.	%	-13	-22	-39	-10				0	-50	-50	-50	-50	-67	0	-16	-41	-50	-52	-32
Uzbekistan	Limit	m ³ /s	230	205	170	0	0	0	0	0	0	0	0	0	320	410	498	540	450	387	2735
	Actual	m ³ /s	190	159	112	36	13	4	4	4	22	24	21	53	89	297	354	305	232	189	1793
	Deviat.	%	-17	-22	-34										-72	-28	-29	-43	-48	-51	-34