THE INFLUENCE OF HUMAN ACTIVITY OVER THE ROTOPĂNEŞTI-RĂDĂŞENI-FÂNTÂNA MARE DRAINAGE SYSTEM NETWORK

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Abstract

The drainage-desiccation developments on the Moldova river meadows in Suceava county were built for the purpose of eliminating the excess water from both the terrain's surface and from its higher levels, origination from rainfall, ground water, from the surface flow and from the surrounding higher ground. After constructing the hydro-ameliorative improvements, special attention must be given to the operation method and to its behavior over time. By operating and using the draining network, mainly shores erosion and bottom of canal clogging occurs, that may be caused by both natural and human factors. Waste disposal, vegetal waste and various packaging materials thrown into the canal, generally beside bridges, speed the process of clogging and shuttering, causing, in upriver, the decommissioning of canals, the overflow of waters accumulated during heavy rain, the flooding of nearby areas, and the malfunction of the desiccating- drainage network. Also, the shore erosion and canal clogging is largely influenced by the lands serviced by the canal category of use. The shore erosion and the canal clogging is greater upon the areas used as pastures, due to a low degree of embankment grassing, to total lack of grassing on some sections, caused by irrational grazing and by the repeated and uncontrolled animal crossing. On arable surfaces, canals generally present well grassed embankments, fact that diminishes riverbanks erosion, yet in time, for lack of maintenance works, cause water flow slowdown and stagnation, the appearance of hydrophilic vegetation and shrubs, favoring silt sedimentation and clogging.

Keywords: humidity in excess, canal clogging, geometric and hydraulic components of the drainage network.

Among the main limiting factors of the agricultural production, which occur depending on the local pedoclimatic conditions, we could mention excessive humidity, floods, low permeability and soil compaction, erosion, sliding and others.

For the proper excessive water removal after the construction of the drying-draining systems, special attention should be paid to their operation and behavior over time, also considering the new private land ownership conditions.

MATERIAL ŞI METODĂ

The excessive humidity, which occurs in the Moldova River basin and which is due to rain and/or ground water and to water system overflows, has manifested itself under various forms and at different intensities, on both horizontal and sloped land.

The natural conditions of the Baia piedmont plain support the occurrence and maintenance of excessive underground and surface humidity. The Moldova River meadow and 1.5 km-wide slip-shaped terraces, which are almost parallel with the Moldova River bed and which run north-west and south-east, with small 1-5 % slopes, with flat areas and many small depressions, facilitate water stagnation.

In the wet climate of the Moldova River basin, the heavy precipitations fallen over 1-5 consecutive days and the low evapotranspiration rate make up the main excessive humidity cause in low permeability soils (Nitu T. şi colab., 1985).

The precipitations fallen throughout the year exhibit an uneven distribution, with considerable amounts fallen in 24 hours or after long-lasting heavy rains, which cause surface overflows that carry along soil particles, thus enhancing bank erosion and hence clogging the channels (Radu O., 2009).

For the exploitation of the productive capacity of the Moldova river banks and meadow terrains, a 8761 ha area of desiccation-drainage works was built between 1978 and 1980, 3059 ha out of which contained subterranean drainage systems.

The actual drying channels network includes master collecting channels, secondary collecting channels, sector collecting channels and belt channels. The 1.5-2.0 m deep belt channels were located 20-50 m from the edge of the slopes, their role being to protect the dried-drained surface by catching the overflows from the higher neighboring areas.

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The ring canal (CC_1), from the Rotopăneşti-Rădăşeni-Fântâna Mare, Suceava county system, some 3000 m in length, collects waters from the North-East slope of a hill, on the side of Rotopăneşti, having a surface area of approx 37.50 ha, used as pasture and 23.00 ha arable and meadowland (*fig. 1*).

In order to determine the geometric and hydraulic parameters of the belt channel (CC_1), high precision geometric leveling survey measurements were conducted using the radiation and the traversing combined with radiation methods, these measurements enabled us to draft transverse and longitudinal profiles. The leveling survey data were gathered using an average precision Zeiss Ni-030 level and the surveying rod with centimeter marks, and the level differences were determined bases on two levels of the surveying instrument.

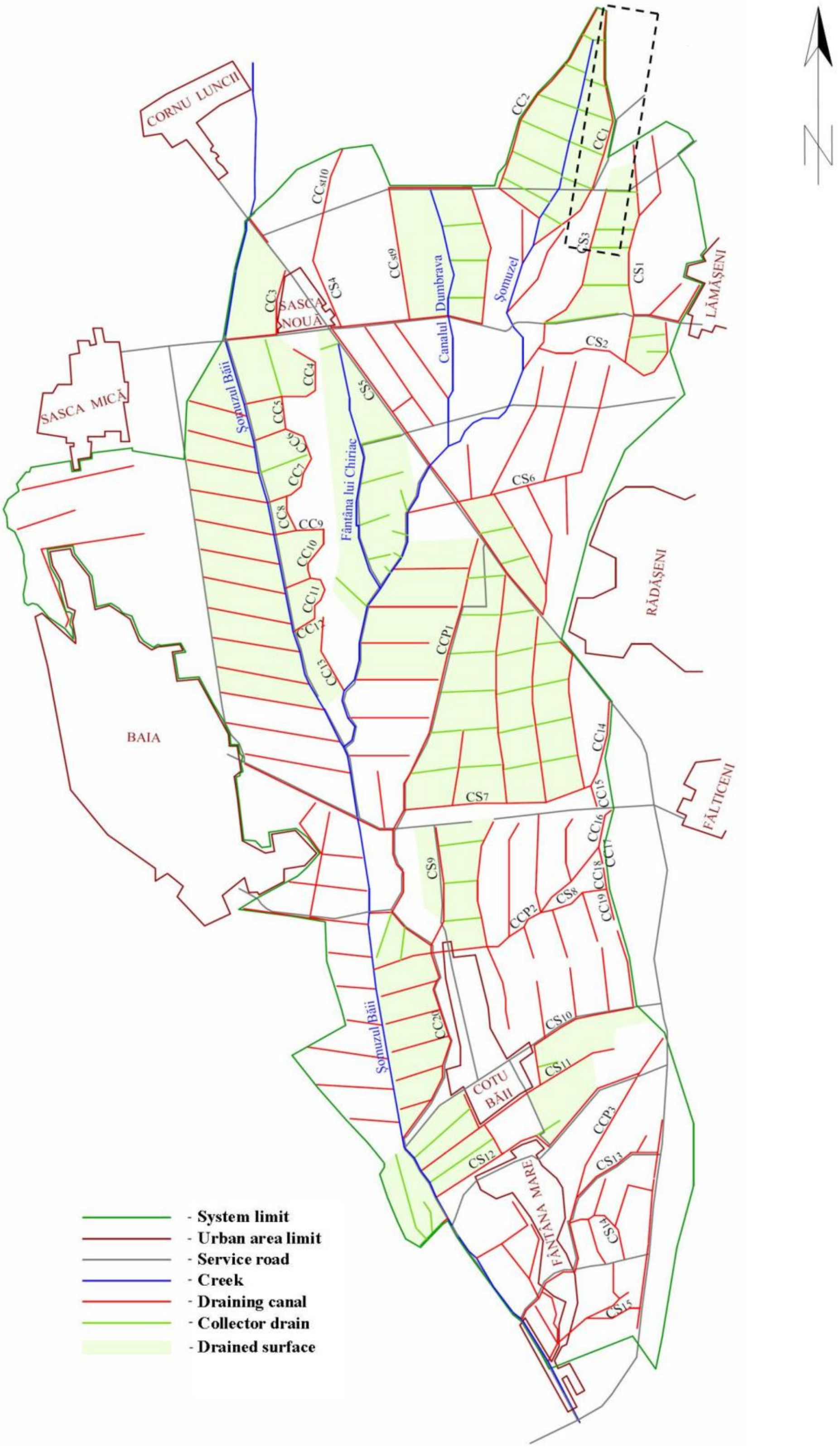


Figure 1 **Drying-drainage systems from Rotopăneşti-Rădăşeni-Fântâna Mare**

RESULTS AND DISCUSSIONS

For accommodating traffic over the desiccating-draining canals tubular plain concrete culverts were built, having a nominal diameter between 500 and 800 mm, as well as Bucov tubes culverts of greater diameter, of 1 m and 1.2 m respectively.

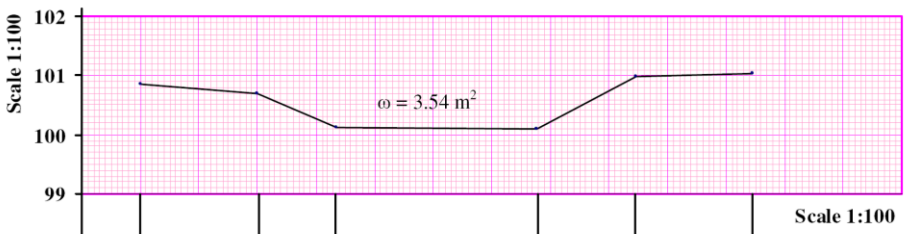
Throughout the Rotopăneşti-Rădăşeni-Fântâna Mare desiccating-draining system, most culverts are operational, yet they are more or less clogged.

The 1 m diameter culvert located 2100 m from the upstream end of the ring canal CC_1 presents a blocked section due to household residue deposits and of various nearby packaging materials, to neglected maintenance as well as to inappropriate use of the areas surrounding this section of the canal, having been used as pasture since 1992 (*fig. 2*).

Figure 2 **Clogged culvert showing vegetal and household residue within the canals**

Grazing throughout the section of the canal and throughout the times when the soil is saturated with water, repeated animal crossing through unequipped areas have caused an effect of shore erosion and canal clogging which lead to canal's geometric and hydraulic components alteration.

The transversal profiles made every 25 m along the CC_1 ring canal on a 100 m length upstream of the blocked culvert show a narrowing of the canal. The transversal section made 100 m upstream of the blocked culvert (*fig. 3*), highlights shore erosion and canal clogging, which led to light channel enlargement from 5.10 m (Radu O., 2012), to 6.46 m, also to the enlargement of the canal's bottom width from 0.60 m to 3.43 m and to the reduction in depth from 1.80 m to 0.86 m, and to a section narrowing from 5.13 m^2 la 3.54 m^2.

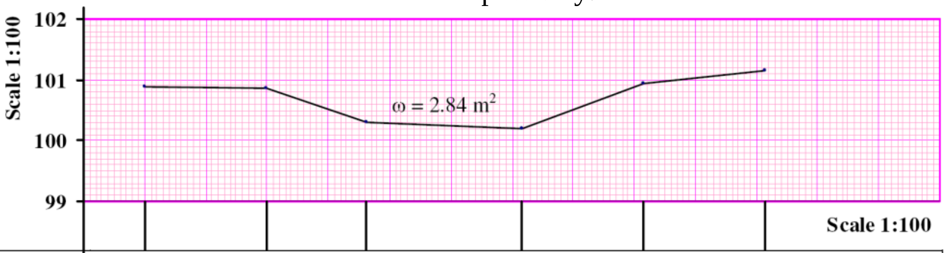


Point number		1		2		3		4		5		6
Land elevation (m)		100.853		100.693		100.121		100.108		100.967		101.041
Level differences (m)			-0.160		-0.572		-0.013		+0.859		+0.074	
Distances (m)	partial		2.00		1.35		3.43		1.68		2.00	
	total	0		2.00		3.35		6.78		8.46		10.46
Slope (%)			8.00		42.37		0.38		51.13		3.70	

Figure 3 **Transversal section through CC_1 canal 100 m upstream from the blocked culvert**

Due to vegetal and household residue deposits as well as to silt depositing near the culvert, at the time when the latter was still operational, the flowing section measured beside the culvert in the upstream is lesser than that recorded at 100 m and it measures 2.84 m^2 (*fig. 4*).

The obstruction in the culvert's section also caused the longitudinal slope of the canal to change, as fig. 5 is showing. By analyzing fig. 5 one notes different values in the canal longitudinal slope in different sections and the creation of counter-slopes from between 0.02% to 0.76% respectively.



Point number		1		2		3		4		5		6
Land elevation (m)		100.891		100.860		100.313		100.183		100.943		101.153
Level differences (m)			-0.031		-0.547		-0.130		+0.760		+0.210	
Distances (m)	partial		2.00		1.63		2.55		1.97		2.00	
	total	0		2.00		3.63		6.18		8.15		10.15
Slope (%)			1.55		33.56		5.10		38.58		10.5	

Figure 4 **Transversal section through the CC_1 canal, upstream, beside the blocked culvert**

Point number		1		2		3		4		5
Bank elevation (m)		100.772		100.720		100.837		100.903		100.939
Elevation of chanel bottom (m)		100.053		100.007		100.012		100.000		100.191
Level differences (m)			-0.046		+0.005		-0.012		+0.191	
						+0.138				
Distances (m)	partial		25.0		25.0		25.0		25.0	
	total	0		25.0		50.0		75.0		100.0
Slope of chanel bottom (%)			0.18		0.02		0.05		0.76	
						0.14				

Figure 5 **Longitudinal section on the CC_1 canal, upstream of the culvert**

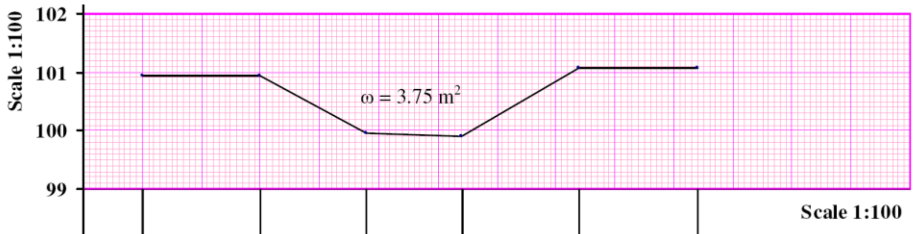
Throughout the 100 m studied section of the canal, a 0.14% counter-slope is always present, which causes, during periods of heavy rain, as well as at the snow melt, the water to flow towards the upstream end of the CC_1 canal, overflowing at approx 250 m upstream of the blocked culvert, where a pond was thus formed (*fig. 6*).

Figure 6 **Water overflowing the canal and the subsequently formed pond**

Within the transversal profile made beside the culver and downstream (*fig.7*), the section flow of 3.75 m^2 is larger by approx 1 m^2 than the value recorded at the section upstream of the culvert. The narrowing in section flow at this point is due to vegetal and household depositing beside the culvert.

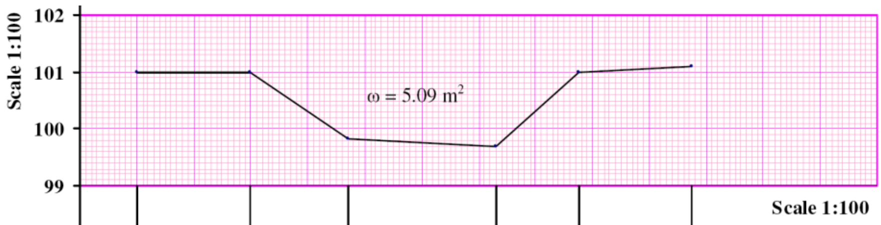
The bottom of the canal elevation is lesser downstream by some 35 cm than that of the upstream bottom elevation, the downstream section of the canal not being altogether clogged.

100 m downstream of the clogged culvert the section flow of 5.09 m^2, decreasing downstream (*fig. 8*).



Point number	1	2	3	4	5	6
Land elevation (m)	100.951	100.946	99.950	99.915	101.061	101.070
Level differences (m)		-0.005	-0.996	-0.035	+1.146	+0.009
Distances (m) partial		2.00	1.80	1.60	2.00	2.00
Distances (m) total	0	2.00	3.80	5.40	7.40	9.40
Slope (%)		0.25	55.33	2.19	57.3	0.45

Figure 7 **Transversal section through the CC_1 canal, downstream, nearby the clogged culvert**



Point number	1	2	3	4	5	6
Land elevation (m)	100.984	100.979	99.830	99.702	100.989	101.099
Level differences (m)		-0.005	-1.149	-0.128	+1.287	+0.110
Distances (m) partial		2.00	1.70	2.60	1.45	2.00
Distances (m) total	0	2.00	3.70	6.30	7.75	9.75
Slope (%)		0.25	67.59	4.92	88.76	5.50

Figure 8 **Transversal section through the CC_1 canal, downstream, 100 m from the clogged culvert**

Analyzing the longitudinal profile made on the 100 m section, upstream of the culvert (*fig. 9*), we notice that here as well a counter-slope has been formed, due to neglecting of mowing the grass, to the appearance of hydrophilic vegetation and of shrubs that hinder the water flow and favors silt sedimentation (*fig. 10*).

Point number	1	2	3	4	5
Bank elevation (m)	100.946	100.993	100.842	100.882	100.979
Elevation of chanel bottom (m)	99.915	99.757	99.701	99.673	99.702
Level differences (m)		-0.158	-0.056	-0.028	+0.029
Level differences (m), 1–5			-0.213		
Distances (m) partial		25.0	25.0	25.0	25.0
Distances (m) total	0	25.0	50.0	75.0	100.0
Slope of chanel bottom (%)		0.63	0.22	0.11	0.12
Slope of chanel bottom (%), 1–5			0.21		

Figure 9 **Longitudinal section on the CC_1 canal, upstream of the culvert**

Figure 10 **Hydrophilic vegetation and of shrubs on the canal**

On the overall 100 m control section there's always a 0.21% longitudinal slope in place, fact that maintains the water flow and evacuation in the Şomuzel main collecting canal.

Downstream of the blocked culvert, where the area serviced by this section of the canal is used as arable land and meadowland, the shore erosion and canal clogging is less pronounced, the canal's section flow being greater than the value recorded on the upstream section, which services pasture areas. If the mean section flow of the canal on the transversal sections made every 25 m upstream is 3.34 m^2 then on the 100 m downstream section it is greater by 1.15 m^2 measuring 4.49 m^2.

CONCLUSIONS

The shore erosion and the canal clogging on desiccated-drained areas is pronounced on surfaces used as pastures, due to the lesser degree of grassing on the embankments, yet inexistent on some sections, due to irrational grazing and the repeated and uncontrolled animal crossing.

On arable areas of terrain the canals have well grassed embankments, fact that diminished the banks' erosion, yet over time, through lack of maintenance, cause the water flow to slow down and even stagnate, hydrophilic vegetation and shrubs to grow, favoring silt sedimentation and the occurrence of clogging.

Canal clogging and the appearance of hydrophilic vegetation cause the longitudinal slope to alter, presenting different values along canals, oftentimes creating counter-slopes which cause the water to stagnate and the depositing of silt, heightening the average canal clogging rate and accelerating their decommissioning.

The depositing of household residue, of vegetal residue, and of various packaging materials into the canals, generally nearby culverts accelerates the process of clogging and blocking.

The blocking of the culverts' section flow contributes to speeding up the process of canal upstream clogging, to their decommissioning and to collected waters overflow during periods of heavy rainfall, to the flooding of nearby areas, having repercussions upon the normal functioning of the desiccating- draining network.

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