DIMENSIONING FLOWS DETERMINATION ALGORITHM FOR EQUIPMENTS AND INSTALLATIONS OF THE URBAN WASTE WATER TREATMENT PLANTS

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Abstract: *At the designing of a locality waste water treatment plant, the waste water characteristic flows of the locality constitute the main dimensioning input data of the technological objects of the plant.*

In the paper, a calculus algorithm for the analytic estimation of the water demand and waste water characteristic flows of a locality is presented.

Keywords: *waste water treatment plant, designing, waste water characteristic flows, water demand characteristic flows, calculus algorithm.*

1. INTRODUCTION

At the designing of the equipments and installations of a locality waste water treatment plant, the main data, which the designing is based on, are the processed waste water flows. That is why the problem of correct determination of waste water characteristic flows of the localities is extremely important in the designing field of the waste water treatment plants.

The waste water characteristic flows of a locality are:

- waste water average daily flow $Q_{u\ zi\ med}$ [m^3/day or m^3/s];
- waste water maximum daily flow $Q_{u\ zi\ max}$ [m^3/day or m^3/s];
- waste water maximum hourly flow $Q_{u\ orar\ max}$ [m^3/h or m^3/s];
- waste water minimum hourly flow $Q_{u\ orar\ min}$ [m^3/h or m^3/s];

For the determination of a locality waste water characteristic flows it is necessary to know its water demand characteristic flows, because it is considered that waste water characteristic flows of a locality represent 80% of its water demand characteristic flows [2,3].

The water demand characteristic flows of a locality can be determined in the two following ways:

- the practical way is to sum the water demands of all the locality consumers; in this case it is necessary to detain detailed data about the locative structure of the locality and the manner that this is endowed with water and sewage utilities, the number and nature of industrial enterprises and live stock units of the locality and their specific water demands and the fire extinction water network of the locality;

- the analytic way is to estimate the water demand of the locality following the prescriptions of the Romanian national normative and standards [2,3,4,5,6,7] which settle the water supply quantities for populated centres, industrial enterprises and live stock units and indicate the calculus methodology of the locality water demand characteristic flows.

In this paper a specialised calculus algorithm for estimating the locality water demand and waste water characteristic flows is presented.

2. CALCULUS ALGORITHM OF A LOCALITY WATER DEMAND AND WASTE WATER CHARACTERISTIC FLOWS

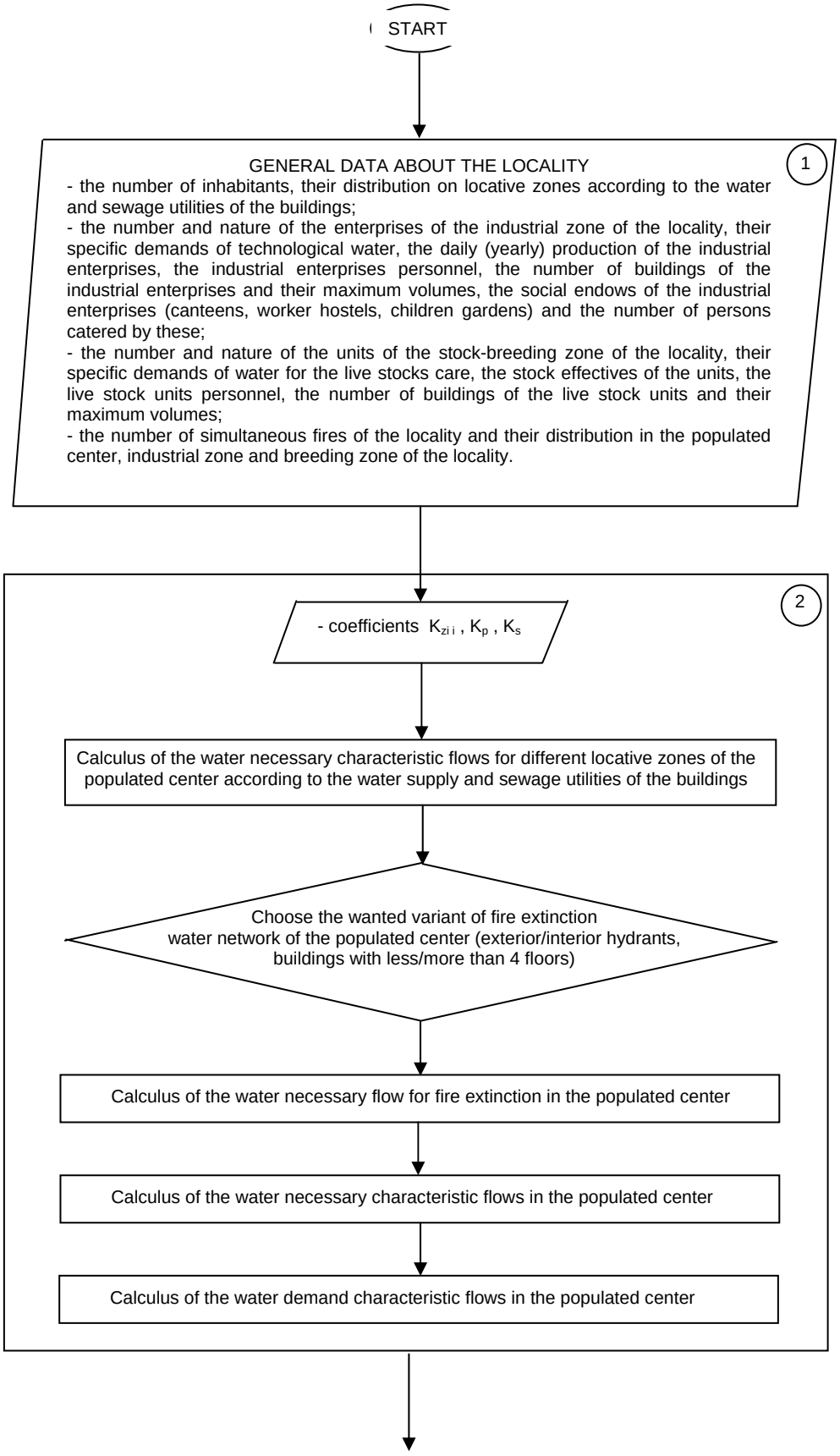
The calculus algorithm of a locality water demand and waste water characteristic flows is structured on the following main modules (the logical schema of the algorithm is presented in the paper):

1. General data about the locality.
2. Calculus of the populated centre water demand characteristic flows.
3. Calculus of the industrial zone water demand characteristic flows.
4. Calculus of the stock-breeding zone water demand characteristic flows.
5. Calculus of the locality water demand characteristic flows.
6. Calculus of the locality waste water characteristic flows.

In the module “General data about the locality” there are introduced in the algorithm the following data about the locality: the number of inhabitants, their distribution on locative zones according to the water and sewage utilities of the buildings, the number and nature of the enterprises from the industrial zone of the locality, their specific demands of technological water [1], the daily (yearly) production of the industrial enterprises, the industrial enterprises personnel, the number of buildings of the industrial enterprises and their maximum volumes, the social endows of industrial enterprises (canteens, worker hostels, children gardens) and the number of persons catered by these, the number and nature of the units from the stock-breeding zone of the locality, their specific demands of water for live stock care, the stock effectives of the units, the live stock units personnel, the number of buildings of the live stock units and their maximum volumes, the number of simultaneous fires in the locality and their distribution in the populated centre, industrial zone and stock-breeding zone of the locality.

In the module “Calculus of the populated centre water demand characteristic flows” can be chosen the wanted variant of locality by its climate (modifying the value of the coefficient $K_{zi\,i}$ of variation of the daily flows) or by its water supply and sewage installation structures (modifying the values of the coefficient K_p of water looses in adduction and distribution network and of the coefficient K_s of the technological demands of the water supply and sewage system)[4] and the wanted variant of fire extinction water network (exterior / interior hydrants, buildings with less / more than 4 floors) and result the values for the water demand characteristic flows of the populated centre in the chosen variant.

In the module “Calculus of the industrial zone water demand characteristic flows” must be introduced the distribution of the industrial enterprises personnel on groups by the work places conditions for different kinds of technological processes [5] and the number of daily shifts of the industrial enterprises and can be chosen the wanted variant of industrial zone by its climate (modifying the value of the coefficient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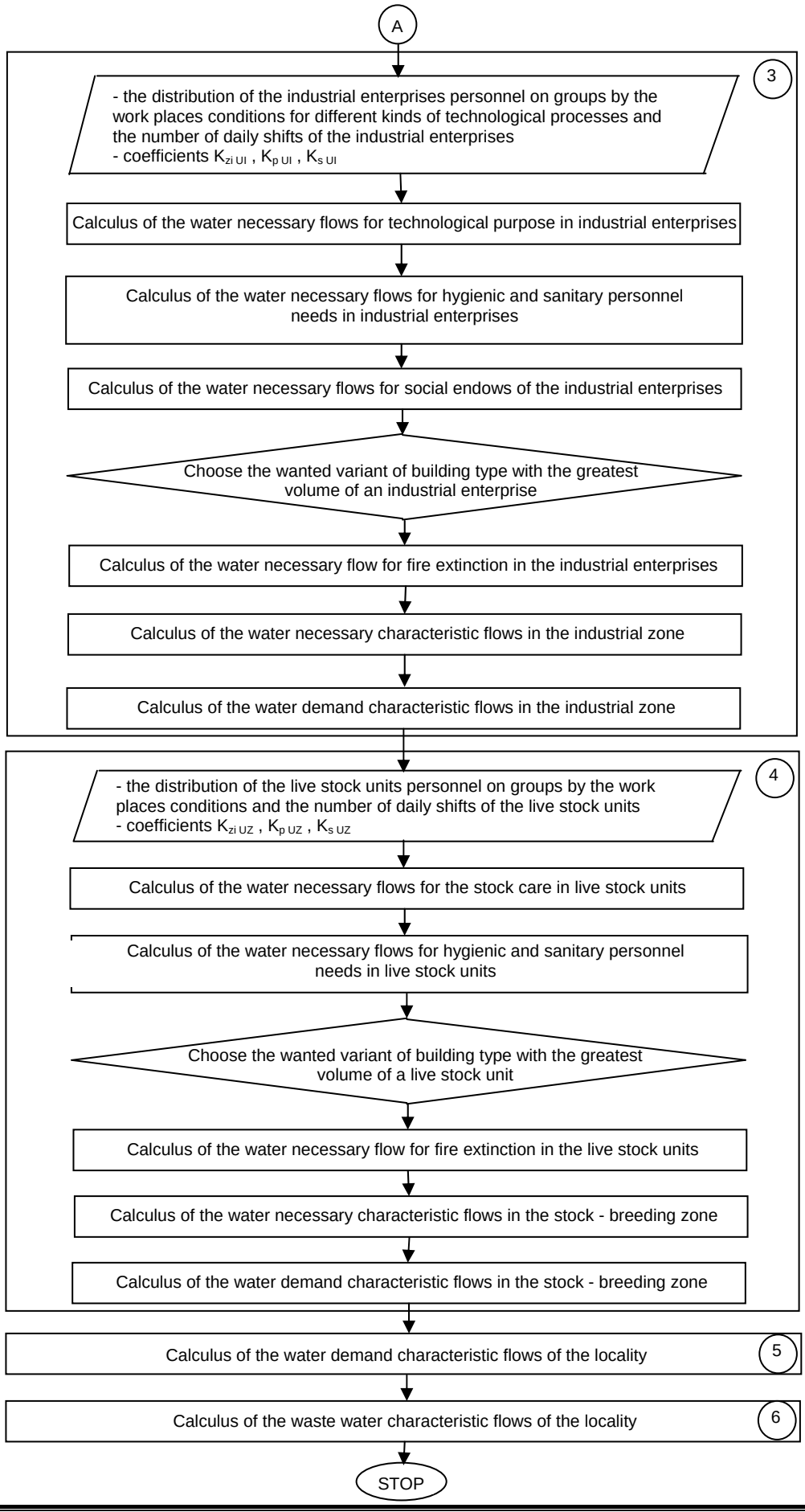
GENERAL DATA ABOUT THE LOCALITY
- the number of inhabitants, their distribution on locative zones according to the water and sewage utilities of the buildings;
- the number and nature of the enterprises of the industrial zone of the locality, their specific demands of technological water, the daily (yearly) production of the industrial enterprises, the industrial enterprises personnel, the number of buildings of the industrial enterprises and their maximum volumes, the social endows of the industrial enterprises (canteens, worker hostels, children gardens) and the number of persons catered by these;
- the number and nature of the units of the stock-breeding zone of the locality, their specific demands of water for the live stocks care, the stock effectives of the units, the live stock units personnel, the number of buildings of the live stock units and their maximum volumes;
- the number of simultaneous fires of the locality and their distribution in the populated center, industrial zone and breeding zone of the locality.
1
2
- coefficients $K_{zi\,i}$, K_p , K_s
Calculus of the water necessary characteristic flows for different locative zones of the populated center according to the water supply and sewage utilities of the buildings
Choose the wanted variant of fire extinction water network of the populated center (exterior/interior hydrants, buildings with less/more than 4 floors)
Calculus of the water necessary flow for fire extinction in the populated center
Calculus of the water necessary characteristic flows in the populated center
Calculus of the water demand characteristic flows in the populated center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3
- the distribution of the industrial enterprises personnel on groups by the work places conditions for different kinds of technological processes and the number of daily shifts of the industrial enterprises
- coefficients $K_{zi\,UI}$, $K_{p\,UI}$, $K_{s\,UI}$
Calculus of the water necessary flows for technological purpose in industrial enterprises
Calculus of the water necessary flows for hygienic and sanitary personnel needs in industrial enterprises
Calculus of the water necessary flows for social endows of the industrial enterprises
Choose the wanted variant of building type with the greatest volume of an industrial enterprise
Calculus of the water necessary flow for fire extinction in the industrial enterprises
Calculus of the water necessary characteristic flows in the industrial zone
Calculus of the water demand characteristic flows in the industrial zone
4
- the distribution of the live stock units personnel on groups by the work places conditions and the number of daily shifts of the live stock units
- coefficients $K_{zi\,UZ}$, $K_{p\,UZ}$, $K_{s\,UZ}$
Calculus of the water necessary flows for the stock care in live stock units
Calculus of the water necessary flows for hygienic and sanitary personnel needs in live stock units
Choose the wanted variant of building type with the greatest volume of a live stock unit
Calculus of the water necessary flow for fire extinction in the live stock units
Calculus of the water necessary characteristic flows in the stock - breeding zone
Calculus of the water demand characteristic flows in the stock - breeding zone
Calculus of the water demand characteristic flows of the locality
5
Calculus of the waste water characteristic flows of the locality
6
STOP

$K_{zi\ UI}$ of variation of the daily flows) or by its water supply and sewage installation structures (modifying the values of the coefficient $K_{p\ UI}$ of water looses in adduction and distribution network and of the coefficient $K_{s\ UI}$ of the technological demands of the water supply and sewage system)[6] and also the variant of building type with the greatest volume of an industrial enterprise, randomize chosen, for fire extinction flow determination and result the industrial zone water demand characteristic flows.

In the module "Calculus of the stock-breeding zone water demand characteristic flows" must be introduced the distribution of live stock units personnel on groups by the work places conditions [5] and the number of daily shifts of the live stock units and can be chosen the wanted variant of stock-breeding zone by its climate (modifying the value of the coefficient $K_{zi\ UZ}$ of the daily flows variation) or by its water supply and sewage installation structures (modifying the value of the coefficient $K_{p\ UZ}$ of water looses in adduction and distribution network and of the coefficient $K_{s\ UZ}$ of the technological demands of the water supply and sewage system)[7] and also the variant of building type with the greatest volume of a live stock unit, randomize chosen, for fire extinction flow determination and result the stock-breeding zone water demand characteristic flows.

In the module "Calculus of the locality water demand characteristic flows" there are determined the locality water demand characteristic flows by summing the correspondent water demand characteristic flows from the populated centre, the industrial zone and the stock-breeding zone.

In the module "Calculus of the locality waste water characteristic flows" there are determined the locality waste water characteristic flows from the locality water demand characteristic flows.

Based on the presented calculus algorithm it was made an interactive program which aloud to determine rapidly and comfortably the values of water demand, respectively of waste water characteristic flows. The program was conceived in a matricidal structure and can be easily adapted to every locality, with all kinds of water supply and sewage utilities in the populated centre zones, with a desired number of industrial enterprises which can be chosen from a multitude of types (in order of their technological processes) and with a desired number of live stock units which can be chosen from all kinds of stock-breeding units.

3. CONCLUSIONS

The estimation of a locality waste water characteristic flows is extremely important for the designing phase of the waste water treatment plant which the locality will be endowed with, because the dimensioning of all the equipments and installations of the waste water treatment plant is based on the values of the waste water characteristic flows.

In this paper a specialised calculus algorithm for analytical estimation of the locality water demand characteristic flows, respectively waste water characteristic flows, based on the Romanian national normative and standards prescriptions, is presented.

Based on the presented calculus algorithm it was made an interactive program which aloud to determine rapidly and comfortably the values of water demand, respectively of waste water characteristic flows. The program was conceived in a matricidal structure and can be easily adapted to every locality, with all kinds of water supply and sewage utilities in the populated centre zones, with a desired number of industrial enterprises which can be chosen from a multitude of types (in order of their

technological processes) and with a desired number of live stock units which can be chosen from all kinds of stock-breeding units.

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