Analysis and recovery proposal for erosion process located in the city of Planaltina-GO

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ABSTRACT: The rapid process of growth of urban areas in the country, with disorderly occupations with little care to the physical environment, has caused serious erosion and numerous problems. In the central region of Brazil, in particular, in the Planaltina city in the state of Goiás, the situation is not very different, requiring urgent interventions aimed at the recovery of degraded areas. As striking consequence of the disorderly occupation is the erosion, which occurs without distinction on the various geomorphological domains present in the Midwest. Thus, erosions generate various economic social consequences such as loss of inhabitable or cultivable areas, pathways interruption, silting of the riverbed of watercourses, exposure of the public and private equity and risks to nearby communities, common facts also to other cities and constantly aired in the media. used urban occupations practices have been one of the main causes for the intensification of erosion processes around these areas. The removal of native vegetation, soil sealing and destination rainwater without necessary care can modify the flow regime active with the resulting upwelling of erosive processes. In this context, an erosive process large located in the city of Planaltina / GO evolves over two decades mainly due to the advancement of human occupation combined with little drainage systems consistent with the local situation, but also the lack of appropriate interventions that have contributed for converting slopes with high risk of instability and to surrounding areas. Thus, it is of paramount importance to know, among other factors, the origin and evolution of the erosive process in question, the type of local soil, environmental changes caused over time in the study area with a view to proposing interventions can be efficient recovery of the area degraded by erosion. Therefore, this article seeks to present an analysis and proposed recovery for the erosive process in question in order to use the area to be recovered for leisure, sport, education, among others.

Keywords: Analysis, Recovery, Geossynthetics, Erosion

1 INTRODUCTION

The constant problems related to erosion processes cause various concerns so that the authors of this article have been following an erosion in the municipality of Planaltina, Goiás State, since 2007. In this context, this paper aims to present an analysis of the region, such as vegetation, climate, river system and the model evolutionary erosion, togheter with the summary there is a proposal recovery for erosive process explaining the engineering works and others actions to solve the problem, taking advantage of the area to be recovered with destination to leisure, sports, education, among others.

2 CHARACTERISTICS OF MUNICIPALITY OF PLANALTINA / GO

The city of Planaltina / GO (15 Coordinates ° 27 '10 "S and 47 ° 36' 50") located in Mesoregion East Goiano in the micro-region surrounding the Federal District, with limits to the municipalities of Formosa, Goias Agua Fria , Mimoso de Goiás and Father Bernardo. The distance to the Federal Capital is close to

63 km. The city has, according to IBGE, the area of 2,543 square kilometers, estimated population in 2015 of 87,474 inhabitants and density of 32,10 hab./km². The approximate average altitude is 1035 meters.

The municipality is in the Integrated Development Region of the Federal District and Surrounding Areas (RIDE), integrated area of economic development, created by Complementary Law No. 94 of 19/02/1998. This region is formed by the Federal District and the municipalities of Abadiania, Goiás Fria, Aguas Lindas de Goias, Alexânia, headboards, West Town, Cocalzinho of Goias Corumba de Goias, Cristalina, Taiwan, Luziânia, Mimoso de Goiás, Novo Gama, Father Bernardo, Pirenópolis, Planaltina, St. Anthony's discovered, Valparaiso and Vila Boa, State of Goiás, and Unai and Buritis, in the state of Minas Gerais. It occupies an area of 55,000 square kilometers and a population approaching 3.7 million inhabitants.

3 GENERAL

3.1 *Regional climate summary*

The climate, according to Köppen climate classification comprises: tropical savannas, tropical altitudes between 1,000 and 1,200 meters with the coldest month temperature below 18 ° C and months warmer with average above 22 ° C , summer rain and dry in winter, and the tropical climate. The average annual rainfall is around 1,600 mm. In October begins the rainy season, in which the mechanical action of raindrops on the soil surface dried out by prolonged dry season can cause erosion with greater intensity on the steepest areas. In the months that follow, the storm water runoff starts to act more intensively until the month of May, when the rains are already scarce. predominant information on the site of Wikipedia, in March 2016.

3.2 *Region vegetation summary*

The cerrado biome covers the entire area of the municipality, the Federal District, as well as the states of Goiás, Tocantins, Mato Grosso do Sul, part of Mato Grosso, West of Bahia and West of Minas Gerais. In this biome the occurrence of various types of vegetation are recorded as: cerradão; typical cerrado; cerrado savanna or drain field; dirty field - have similar floristic composition of typical cerrado and cerrado drain; clean camp; riparian vegetation; paths; and rock fields.

3.3 *Summary of river system*

The water system of the city is characterized by waterways that have characteristics typical plateau area of drainage which are frequent gaps and enclosed valleys.

3.4 *Model of evolutionary erosions to the region*

There are several models that attempt to translate the evolutionary processes of erosion for many different locations. In the Midwest, several studies have been developed for the Region of the Federal District. Thus the proximity of the region, the following are some models that attempt to translate the type of occurrence.

Costa (1981) studied about erosions in the city of Gama (DF) and classified two main types of occurrence, laminar erosion and gullies. The analysis of evolution of erosions, classified the development of erosion in four phases:

I - in the first stage is the formation of surface erosion and grooves;

II - in the second phase there is deepening in "V" section until the decomposed rock;

III - the third stage is the development in decomposed rock with excavations in the horizontal direction providing the formation of a section in the form of "U"; and

IV - the fourth stage to the base level of bedrock, based on enlargement and the emergence of new erosions on the flanks.

Mortari (1994) proposed a "Model Embedded" for development of erosions in the Federal District as a result of geological and geotechnical and structural conditions of the region, especially the orientation of the layers of saprolite diving and metasediments of the local geological domain. By "Embedded Model" at the beginning of the erosion gullies usually have the form "V" and evolve in depth, width and length depending on the water conditions and geotechnical characteristics of the soil.

The process evolves to reach the bedrock, which in the region of the Federal District consists mostly of

slate and *metarritimitos* that due to active tectonics, present their strata rather inclined, with the layers dip in the order of 40 to 60.

The water flow to achieve this contact, tends to "fit" and following flow about its orientation and tending to deepen, following the dive itself the less resistant layers.

As the groove is deepened, it becomes more evident and the material becomes more resilient, tending to stabilize the bottom of the erosion wear with base then be considered a normal geological erosion process. This type of behavior makes it difficult to meander background channel, preventing erosion with the side extension of the base (trapezoidal shape) to an equilibrium profile with the subsequent development of vegetation. In the Federal District and Surrounding Region, as the city of Planaltina, typically erosions occur in the form of "V" and the depth is limited to the existence of saprolite.

4 CHARACTERISTICS OF EROSION STUDIED

Erosive process consisting at first of two branches with an approximate length of 180 meters each. Then the two branches, erosion consists of a main body with the next extension of 2,160 meters and slopes ranging up to over 30 meters. It is inserted in the region Mansions Sector West Sector, Courts 01, 02, 05, 6:11.

Erosion is characterized by being a large gully, caused mainly by the outflow of two existing drainages in its headwaters, and this forms a water erosion. This drainpipe is constituted of a 1,200 mm pipe, a branch, and two 1500 mm pipes, in another branch. The pellet then generated erosion has caused the constant silting of a stream called Lambari Stream, existing at the end of the main erosion process. Approximately at point 1080 meters there is a lateral erosion on the left, with an approximate length of 54 m and an average width of 14 meters. Close to 1680 meters there is a lateral erosion on the right side with an approximate length of 320 meters and an average width of 5 meters. Figure 1 shows the overview of the erosion process.

For better understanding, divide into four (4) main parts, as shown in Figure 2.

4.1 *Description each excerpts erosion*

4.1.1 *First excerpt*

It extends from the start of erosion by the approximate point 200 meters and consists of two branches with approximately 180 meters each. Presence of vegetation formed by species of medium to small (mamonas, hoses, etc.) and creeping species such as Brachiaria. Additionally, we have:

a) branch 01 - Presence drainage tube with 1200 mm; soil transported with small stone blocks. The bases of slopes consist of hard rocks and medium-sized rocks fractured.

b) 02 branch - Presence drain with two tubes each 1500 mm; stratified rock hard and small stone blocks.

Figures 3 to 7 show the area of the beginning of the erosion process, drains and views of the branches.

4.1.2 *Second excerpt*

It extends 20 meters after the junction of the two branches, around 200 meters from the start of erosion, and goes up to about 680m. soft friable rock presence and predominance of oxisol, yellow soil and in cambissolo, blocks of rock - based hard rock at the base of the slopes. Such rock layer to a height of 2 meters. Presence of embankments in fractured rocks. Figures 8 and 9 show the erosion process in the second section views.

4.1.3 *Third excerpt*

This section extends approximately from the distance of 680 meters from the beginning erosion and continues until the approximate distance of 980 meters.

There is a predominance of embankments in oxisol, yellow soil and in cambisols, and water upwelling in the valley of erosion with the consequent saturation of the bases of slopes. Figure 10 shows a view of the erosion process in the third section.

4.1.4 *Fourth excerpt*

This section extends approximately 980m away from the beginning of the erosion, and goes to the distance of 2.339,11m. There is a predominance change soil with latosols switching, and water upwelling in the valley of erosion with the consequent saturation of the bases of slopes. Figures 11 and 12 show views of the erosive process in the fourth section.

5 RISKS IN THE SURROUNDING OF EROSION

In addition to erosion as a whole constitute as a risk area, there are specific points that deserve special attention, such as shown in Figures 13 and 14.

6 DESIGN / PROJECT DESCRIPTION

The project design basically part with the recovery of degraded the correct discipline area of rainwater and the preparation of infrastructure for future installation of a linear park consisting of several elements structured as reforestation, lighting, amphitheater, sports courts, trails for skate among others, to benefit the greatest possible number of people. In general, linear parks are urban interventions to recover for citizens awareness of the natural site in which they live, gradually expanding the green areas, leisure, recreation, etc. In order to establish a set of actions, under the coordination of the Executive, and the participation of owners, residents, users and investors in general, to promote structural urban transformations and progressive enhancement and improvement of environmental quality in the municipality incorporated into Areas System Green city. The proposed infrastructure for the area to be recovered is described below.

7 POPULATION TO BE GRANTED

The population to be benefited comprises the whole of the city of Planaltina, specifically the Mansions of the West Sector Sector district and its adjoining areas estimated at more than 10,000 people, according to estimates of the City of Planaltina.

8 PROPOSED PROJECT

The following is the summary of the intended project.

8.1 *Stormwater*

In general the project consists of the capture of surface and driving the same waters, in a disciplined manner, to the stream Lambari, located at the end of erosion. Along the stretch of erosion, other releases can be observed: one BSTC network 1200-570 meters; one BSTC network 800-740 meters and other network BSTC 800-1090 meters from the source.

A contribution in the form of erosion, stabilized, comprising 15% of the total flow is observed at 1680 meters from the source.

In order to regulate the flow, it was proposed the extension of releases BDTC and BSTC until convergence thereof. Starting this convergence, (200 m from the beginning), in order to make aproveitavel area for collective purposes is suggested driving water through gallery.

In order to reduce the speed of the system and optimize the topography, they are suggested some energy dissipation.

From 680 meters, the drainage structure passes gallery for gabion, this going until the desague in stream Lambari.

The project foresees the receipt of future releases of Building neighboring areas to erosion.

8.2 *Landfills and contentions*

After careful review of the types present along the eroded soils were set appropriate geotechnical

solutions each profile.

containment solutions take into account the reduced use of imported soil. For this practice should make a tradeoff between the volumes of cut and fill.

The unstable embankments must be retaludados with gradient compatible with the type of soil and revegetated, thus preventing the initiation of new surface erosion.

As the erosion reached the horizon "C" soil, silted surface vegetation layer, there is the need to import most fertile soil ("topsoil") for the surface treatment of slopes.

For the embankment without the possibility of retaludamento to a secure tilt suggest the inclusion of geosynthetic reinforcement, so that the reinforced structures are incorporated into the area, without visual intrusion.

In areas for collective use and sports practices teraplenagem should be in platores. Draining of the crests and toes of embankments should be forwarded through channels to sluice gates.

8.3 *Sanitation*

All waste from internal intalações park will eventually receive proper treatment, before launching the network.

8.4 *Floors and flooring*

The areas of parking lots should be interlocked block. The paths and walks are coated in concrete. The water from unpaved areas should be targeted for retention basins to be postriormente loops in the network.

8.5 *Reforestation and treatment landscape*

The species to be planted are native primarily medium-sized trees of the savannah and municipality characteristics, as well as palm trees and shrubs that may be alive or type climbing fences.

It is recommended, in environmental education activities to be undertaken by the Executive, according to cincunvizinhos residents so that they plant trees on their properties, allowing the common use. In this case, it is recommended to give preference to fruit species.

As for landscaping, this is the structuring element of designed spaces, defining their limits, their routes and improving environmental quality.

8.6 *Linear park proposed*

The future installation of the Proposed Park, in addition to being mounted infrastructure, also aims to motivate educational programs targeting the good care of household waste, cleaning of public spaces, the permanent reorganization of watercourses and the supervision of these spaces.

9 IMPLEMENTATION OF WORKS

The implementation of the proposed works should be given as the project and following the technical specifications for infrastructure works (collection of surface and driving the same waters, in a disciplined manner, to the stream Lambari, located at the end of erosion, is including also platores and retaining embankments) to be described in the Executive Project, with a planned period of eight (8) months for its completion.

One should take advantage of the dry season to better progress of ground handling services and drainage. As for the works of Revegetation, surface treatment of embankments and landscaping should take the start of the rainy season.

The regularization of the main channel will be performed using conventional method. The existence of side roads facilitate the logistics of the work, since they may be used as a service road.

All excavated material will be used in landfills (volumes compensation). It should be preferred initially for the use of stone materials as foundation of landfill structures. For revegetation of the area should be appropriate imported topsoil.

The section to be protected with gabion blanket should be performed as designed, respecting the technical specifications.

The passages in low bearing capacity soil should be removed to areas where these soils do not engage the bearing function..

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FIGURES

Figure 1. Location of the erosion process in the municipality.

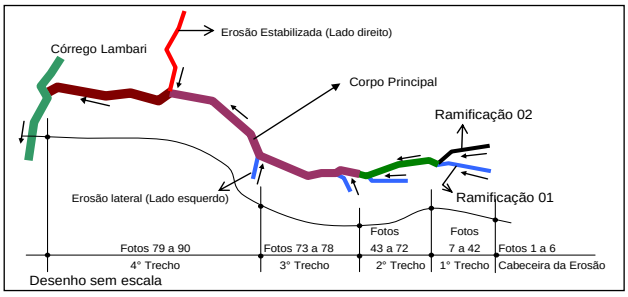

Figure 2. Sketching erosion.

Figure 3. Area of the beginning of the erosion process.

Figure 4. Desagüe the branch 1.

Figure 5. View of the branch 1.

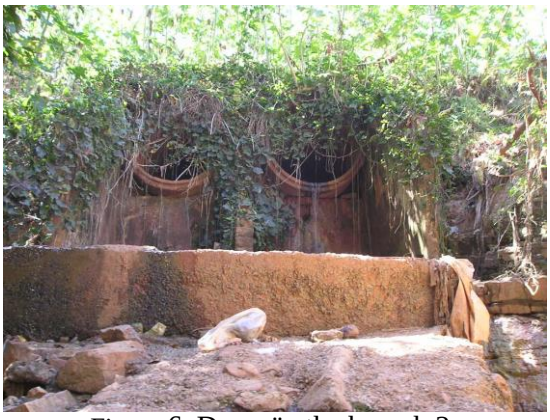

Figure 6. Desagüe the branch 2.

Figure 7. View of the branch 2.

Figure 8. Erosion in the second sentence.

Figure 9. Erosion in the second sentence.

Figure 10. Erosion in the third sentence.

Figure 11. Erosion process in the fourth section (Photo 2007. The residence view has been consumed by erosion).

Figure 12. Stream silted at the end of the erosive process.

Figure 13. Residences near to erosion.

Figure 14. Living close to erosion.