STUDY OF DAMS IN THE CITIES OF PEDREIRA-SP AND AMPARO-SP

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Abstract. With the population growth, the Petrobras modernization REPLAN (Paulinia Refinery), the progressive region development and the shortage of resources from new wellsprings, there was a need to Increase the water availability of the region of Campinas - SP and with that will be implanted two dams, one in the municipality of Quarry - SP and another in the district of Two Bridges in the municipality of Amparo - SP. The construction of the dams occurred for many Reasons, one of Which is to benefit many cities through water reserves serves to about 5.5 million inhabitants are that downstream of the reservoirs. These concepts, the present work AIMS to present all the criterion and principles that are related to the construction of the dams. Through research and consultations will be all the characteristics presented, direct and indirect information,

keywords: Dam; Case study; Environmental impact; Water availability.

1 INTRODUCTION

The construction of dams has always been paramount to the growth and development of mankind, from the oldest to which it is registered, such as Egypt, the Middle East, and India. Currently, concern about water resources involving quantity and quality has been accentuated due to drastic population growth and high pollution index, so the water has become a precious commodity and the construction of dams is a way to save her in order to have adequate human consumption without scarcity and quality.

According to Junior (2016) the implementation of dams directly affects areas of major proportions, and thus end up being great potential works negative impact on the

environment (flora, relief and fauna), to the cultural environment (historical, artistic , archaeological, architectural, heritage and people celebrations), artificial (towns, urban areas, villages) and labor (and material and immaterial that are necessary for the performance of labor exercises for humans).

These types of reservoirs are artificially made obstacles able to retain water for the purpose of industrial or domestic supply, navigation, irrigation, recreation, sedimentation control, and flood and are also intended for the production of electricity.

For water supply dams it is necessary and very important follow-up, monitoring, and also its maintenance, it is one way to avoid any kind of accident that can occur and thereby ensure the proper functioning of these reservoirs.

Such containers are made with different constructive techniques and varied sizes and this is set as required for the use, in the case of farms are generally used small clumps of earth and often large structures used for hydroelectric power supply and water supply, and between various other purposes are constructed from landfills or concrete.

According to Miracle et al. (2016), the amount of water that is stored in the reservoir will depend on the needs to be met. And it should be set immediately after getting the planialtimetric survey of where they will be flooded by the dam.

The main dam construction means are concrete arch, riprap, concrete, fill and gravity. These structures have further including the houses of power, spillways, discharge structures, and control units.

In view of the major financial, environmental and human investment involving the construction of dams, will be presented in this present project all data related to the construction of dams in the city of Pedreira - SP, the river Jaguari and Amparo - SP (Two District bridges), the river Camanducaia, which have the purpose of water supply for several cities close to these cities, this project's estimated that will benefit 22 municipalities in the metropolitan region of Campinas.

The elaboration of the projects of quarry dams and Two Bridges occurred to requests from REPLAN enterprise / PETROBRAS refinery in Paulinia, São Paulo, which is 2006 was expanded and modernized with the reduction of 95% of the sulfur produced by gasoline and diesel oil, ensuring low environmental impact in the region, as cars and trucks do not emit high rates of greenhouse gases. This requested through studies the feasibility of the construction of these reservoirs to increase water availability in basins that are located upstream of REPLAN. And improve the supply of the region with the regulation of the flow.

This project provided a number of benefits for the company, including the increase in the daily flow of water supply, providing the increase of 0.519 m^3 / s to 0,667m^3 / s thus having a significant increase in 0,148m^3 / s.

With the construction of dams stands out as a major benefit, increased water availability for the population of the municipalities to be covered, which will require well in water security, since studies show that if you do not adopt such measures in 2025 about 7 cities entered for water resource vulnerability list.

Environmental and socio-cultural impacts of water projects of this size require a great preventive assessment, influencing the idea of design, formulation, and alternatives to the system, as well as in the design and detailed design. This assessment is

extremely important both for environmental and social viability as economic, highlighting the impact studies, expropriation, flooding so that future problems directly related spending can be avoided.

This assessment helps minimize problems, but not extinguished, it is inevitable that some of the forests are devastated for project implementation causing the loss of biodiversity, degradation of upstream areas caused by the flooding of the reservoir area, among other problems.

2 BACKGROUND KNOWLEDGE

The constructive types of dams

Dams are structures built by humans for thousands of years. Initially, structures were built for human consumption, and today performed for various purposes.

The benefits are multiple reservoirs as Piasentin (2018, p.13) points to the power generation, water supply for industrial and domestic use, irrigation in agricultural areas, regularization of flows that are intensified by the effects of droughts and floods , navigation, tourism and recreation, aquaculture, waste dump mining and accumulation of industrial waste.

Dams have their beginning from the history of mankind and have been instrumental in the development. Its construction was mainly due to water shortages during the dry season and the consequent need for water storage, held in empirically dams (CBDB, 2011).

These kinds of works are constructed in two ways naturally or artificially in rivers, streams or lakes, and the craft to prevent and conserve the water flow by creating a hydraulic gap or a difference in the water level. There are several types and are highly dependent on local topography, cost, soil resistance and also the local availability of material for construction, but in all water types will be retained and stored in the reservoir.

Concrete dams

The bus concrete mass or may be fused to resist the horizontal thrust of the water. The materials most commonly used in this type of dam are: conventional concrete, cyclic or CCR roller compacted concrete having a consistency and flexibility since it can be compacted by roller compaction (Massad, 2003).

According to Costa (2012) concrete dams, Figure 6 by gravity solid is not requesting a lot of equipment, is physically and structurally defined to work only in compression presenting their flat plane (peak) and curvature.

FIGURE 6 - Concrete dam

Source: Souza. 2013.

- Structural Concrete dam with buttresses

The reservoir is formed by an impermeable slab upstream supported by vertical buttresses, exerting a greater compression of the foundation on the weight of gravity dam. Therefore, the foundation where a concrete dam with buttresses will be supported should be a rock with high rigidity (SAYÃO, 2009).

The foothills of buses, Figure 7, they are lighter due to its lower section in the foundation, and it has its greatest contact stresses in the upper parts and the foundation applying more effort but requires a smaller volume of concrete.

FIGURE 7-Dam with buttress in Roseland in France.

Source: Sayão. 2009.

- Arch Dam double curvature

This type of dam, Figure 8, has a shaped shell so that the concrete compression work. It is built on sites that have good quality foundations, located in closed valleys, have a thickness in the range of 10% to 15% of the dam (Massad, 2003).

FIGURE 8 - arched Dam in Australia

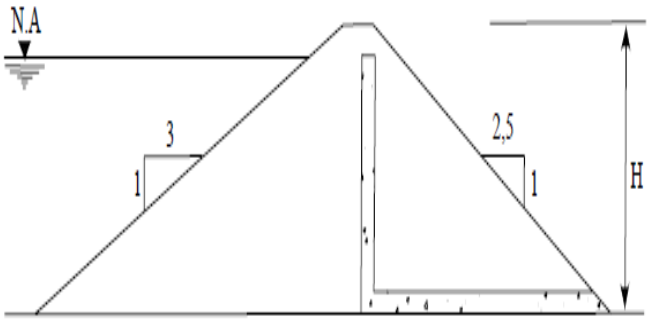
Source: Souza. 2013.

- Earth dam

The earth dam is the most common existing in Brazil, because there are very wide valleys and shallow shoulders, requiring large tracts of mountain ranges, while at the same time offers abundant soil.

Not being a rigid structure, these dams, Figure 9, let be based on foundations more changeable, conveying efforts to weak foundations compared to other dams. To Marangon (2004), the earth dam is an element built in the valleys and is intended to close them across, providing a dam to water.

FIGURE 9 - land Dam



Source: Massad. 2003.

The ground shells are composed of sections forming homogenous or mixed granular material. Although this type of dam is the oldest form of confinement when properly designed and executed, replace other dams in the interests of efficiency, suitable for any type of surface since their efforts are lightweight (Mendonça, 2012).

The dam location preferably will be in a favorable point taking advantage of the natural slope obtaining a more economically viable dam and getting some facility for construction.

- of earth and rockfill dam

These dams have basic dimensions as the width of the range, the size of the rails, the steepness of the slopes, the ridge crest of the spillway, and dimension (Oliveira, 2008).

This dam, Figure 10, has the construction of steep slopes and is widely used in Brazil. This type of foundation should be tighter than the foundation of the earth dams because in them the way of percolation is greater.

FIGURE 10 - earth rockfill dam in Lajoie in Canada

Source: Sayão. 2009.

- Dam in hydraulic landfill

Some old dams, known as hydraulic dump built using water to transport equipment for mass training. In this method, the material is discharged from the tubes placed on the outer edges to discharge (MIRANDA, 2016).

The thicker material is deposited immediately after the point of discharge while fine particles are attracted to the central part of the embankment. The result is a mass with a zoned relatively impermeable core, but the resulting discharge becomes saturated and not very compact this dam is more susceptible to large deformations during earthquakes.

- Dam of rockfill and concrete face

The dam Figure 11, consists of blocks of rock and concrete slabs on the upstream slope. Particular attention should be given to the connection between the concrete slabs because they depend on deformable means formed by rock layer which can undergo significant nesting during the first filling (Souza, 2013).

FIGURE 11 - Dam of rockfill and concrete face

Source: Piasentin. 2018.

The advantage of this construction is to be faster because they can be constructed in harsh climates, steeper slopes, smaller volumes of material and greater structural height.

It is ideal for areas with low availability of clay and sand and with long periods of rain. One of the drawbacks is that the foundation should be in the rock since the structure can not suffer many setbacks excessively.

- Rockfill dam with an asphalt core

The use of asphalt concrete began in the dam core in Portugal with the construction of the dam Valley Jay 1949, and this was applied barrier layer of dough in the form of a curtain having a thickness which varies between 0 and 0.10 20 m with a slope 1.0V: 0.8H (Neto, 2013).

Figure 12 demonstrates a construction method of this reservoir. The core in these reservoirs is replaced by clay asphalt concrete. Thus the dam has the underside of the stone fall back (steeper slopes) and the construction is more independent of weather conditions.

FIGURE 12 - rockfill dam with an asphalt core

Source: Neto. 2013.

3 Methodology

- Climatic conditions

According to Gozzo (2014), the weather is one of the relevant factors that need to be observed when a dam will be built, either for the use of irrigation, power generation or storage of large amounts of water volume. Thus it is important to carry out studies for climate identification region, and thus consider the effects caused by the weather in the reservoirs - variations in rainfall, temperature gradient, and climate change - and the impact thereof on the local climate - temperature, insolation winds, relative humidity, and greenhouse.

As Bosshard (2014) the construction of dams can lead to climate change in tropical regions called, thus the decomposition of organic matter in the reservoir changes the emission of methane gas (CH4) and one of the contributors to greenhouse gases.

According to the Köppen climate classification Geiger (1948), the Amparo municipalities - SP and Pedreira - SP have the same climatic conditions, they fall into the CWA type characterized by subtropical climate with dry winter and hot summer. The average temperature ranges from 18 ° C to 22 ° C, the prevailing mood in much of the state of São Paulo.

Where they will be deployed dams is that the river system follows the rainfall and thus have flood periods defined from November to March and the dry periods are delimited between the months of May to September, thus ensuring water security, since it is a region that historically suffers from water problems.

- the dam area Geology

The geology is defined by Pacievitch (2010) in general, as the discipline that analyzes the crust, the material that constitutes its method of formation, the changes that have suffered from its origin and texture and structure that its extension has currently.

To set the type of dam seen in item 3, according to the Geotechnical Group (2014), it is necessary to study the physical conditions, such as topography, geology, and conditions of foundations and building materials.

In the field of construction, Costa (2012) says that geology applied to the construction of dams aims to promote the optimization of a project and involves ensuring a safe workplace, economic and environmental impacts of a smaller scale, can keep from the start of the study the best feasibility for the construction of the dam.

As explained Azevedo et al. (2011), the Geological Survey is divided into steps to start it is important to gather data, technical reports covering the area, aerial photographs, satellite imagery, geophysical, research demonstrating the natural materials available that can be used for construction itself, in addition to primary detailed geological mapping supported by polling (the auger drum, rotating), inspection wells and refraction seismic surveys near the installation axis and washouts. Using these features it is possible to define the types of soils and rocks, the identification of previous failures, water tables showing water levels available, among other information.

According to Gozzo (2014), the geotechnical mapping serves as a database, it is possible to organize and search for information before, during and after completion of the work. It allows queries to assist in decision making and planning, and enable the additional information at any time.

On that basis the data is separated as follows, inventory step where there is an assessment of regional conditions; feasibility stage where data are provided to assist in the selection of areas suitable for implementation of the work; checks capable of preventing environmental problems to the environment; basic design phase which are presented geological studies that meet the pre-design ideas and environmental reserves; executive project where there is information the start of the work, providing direction for the remaining construction phases; maintenance and monitoring, aims to demonstrate the changes and results from the beginning to the destruction stage; and disabling continued usage data associated with the affected area changes from the previous step (GOZZO, 2014).

According to the Journal of Engineering and Environmental Geology (2011), the need for investigations through geological studies should be anticipated, even before the bidding by ANEEL, the geological information are able to identify and understand the risks and can set the best idea for the project, avoiding future problems. The same stresses that there are construction companies aware of the importance of the Geological Survey are generally those who have experienced some unpleasant situation and suffered the ultimate financial impact. Especially, unfortunately, there is still a portion that tries to save on geological research investments and is unaware of the risks associated with lack of investigations.

The place where the dam is deployed Two Bridges and its reservoir are embossed characterized in mirrors elongated, medium to high slopes (> 15%) and local amplitudes below 100 meters. The hills have rounded tops and straight slopes, south relief saws, known as Serra dos Feixos. The shaft where the future dam will be installed

cuts the Camanducaia River, characterized by sections with rocks inserted in sandy soil providing rapids east-west direction (CANCELLARA, 2013).

According to Cancellara (2013), boring tests were performed at the sites on the edge of the right-SMDP probe 01 as shown in Figure 15, across a level of 1.60 meters residual soil followed by a change in soil rock compound by sandy-loamy silt micaceous who overcame resistance 40 blows in SPT test after 15.00 meters deep.

FIGURE 15 - Place of performance poll
SMDP-01

Source: Cancellara. 2013.

Also according to Cancellara (2013) in the left margin, it was necessary to carry out three points polls for more precise information because there is greater instability in the soil. The 02-SMDP probe, located near the river, pierced a layer of 4.00 meters landfill, followed by a 1.00-meter alluvial layer comprising silt, sandy loam, with rock elements grayish yellow in pigment. Further down, at approximately 22,00m deep, there is a change in rock with silty-sandy texture micaceous.

Continuing were performed on the left edge 03 and the SMDP-SMDP-04 polls Figure 16, which is characterized in general by having layer of 1.00 meter thick composed of colluvium bit sandy silt clay having small gravel ; layer 5.60 to 6.00 meters mature little residual soil sandy-silt clay consistency and depth resistant 03-10 strokes; a ground level shift of rock with silty-sandy texture micaceous found some rock fragments. The SMDP-03 and-04 SMDP found groundwater surveys the depth of 7.50 meters and 20.00 meters, respectively (CANCELLARA, 2013).

FIGURE 16 - Place of performance poll
SMDP-04 and observation rocks in the riverbed

Source: Cancellara. 2013.

In the report of the study pointed out that the quarry reservoir is inserted in a mountainous relief Elongated hills, and its average slope characteristics and high (> 15%) and areas with ranges greater than 300 meters. And it has shaped angular tops with ravines and slopes with rectilinear shapes. The axis is intercepted by sharp bends river Jaguari with portions of the bedrock originating tubing.

According to Cancellara (2013) surveys were carried out on the banks, both right and left, on the right edge was performed SMPE-01 and found layers of rock changes, micaceous clay and sandy silt and sandy silt clay micaceous. And by the results, it has resistance at SPT 40 strokes starting at 12.00 meters deep.

According to yet, Cancellara (2013) in the left margin analyzes were performed 4, 02-SMPE polls the SMPE-05. The SMPE-02 probe, Figure 17, was implemented on top of the rocky bed of the water body and provided with mylonite gneiss depth of 15.90 meters. Since the SMPE-03 polls the SMPE-05, Figure 18, identified rock material layers (thickness varying from 1.00 to 4.50 meters), silty clay-bit sandy soil, silt, clay and sandy micaceous the mylonite gneiss. And the resistance values presented a gradual penetration to the depth reaching 40 blows to 15 meters. In the investigation pointed rock masses that show medians and consistent changes at the top, passing the bedrock little changed in the final meters.

FIGURE 17 - Place of performance poll
SMPE-02

Source: Cancellara. 2013.

FIGURE 18 - Place of performance poll
SMPE-05

Source: Cancellara. 2013.

- physical impacts of two bridges and reservoirs Quarry

With the introduction of Quarry and Two Bridges dam, according to Article 2 of CONAMA Resolution 349 (1986) to Directly Area Affected (ADA) is the place where will be implemented the project with its settled structures, access roads that may be increased produced or changed, with its unit procedures related to his work infrastructure.

Therefore the Direct Area of Influence (ADI) is the region which will be reached directly from the impacts on the development coinciding with the (ADA) may have positive or negative interference. These consequences need to be reduced or opti-

mized by the planner. The results are caused by the presence of the building and not characterized as a result of the same action.

The quarry dam, in turn, affects the APA (Environmental Protection Area) of Piracicaba / Juqueri-Miriam, the city of Campinas also have an affected area and the same is located on the left edge of the reservoir deployment. The APA of Piracicaba / Juqueri-Miriam, in turn, covers part of the left edge of the tank and all directly affected and influenced area (EIA, 2015).

With the implementation of quarry dam, Annex K will be flooded about 105 hectares APA corresponding part of Campinas being flooded. Thus all the Area of Direct Influence (AID), which corresponds to the left corner of the reservoir presented zoning in the management scheme, the Hydro Conservation area Jaguari, which its procedures is to ensure the preservation of sources and water, the Just as the recovery and protection of riparian vegetation, and permanent banning of pesticides and chemical fertilizers (EIA, 2015).

This application boundaries Environmental Preservation Area (APA) and Area of Direct Influence (AID), follows the same design of the study units for sub-basins and may require adjustments, it helps the planned environmental programs Pedreira dam act in proportion to the guidelines and the APA region of objectives belonging to the Basin Jaguari.

The introduction of the quarry will have a dam reservoir with an area of approximately 2.02 square kilometers to about 82 hectares overflow of the storage units of the use of PAC. In this case, the conservation area of Campinas will have about 33 hectares and the Piracicaba / Juqueri-Mirim have lost 97 hectares. It tends to be noted that this total is added to a flood area of approximately 72 hectares area corresponding to the overlapping of the two affected areas (EIA, 2015).

The Environmental Protection Area (APA) in Campinas will be affected by more than 105 hectares which represent the sum of the areas of 33 hectares reservoir and the area lost with limits applied to 72 hectares. When added to the array (FPA) of the tank, that area will have a total of 232 hectares affected.

In turn, APP Piracicaba / Juqueri Mirim 169 hectares have affected areas occupied by the quarry and reservoir 97 hectares area is lost with overlapping boundaries 72 hectares. When added to the array (FPA) of quarry dam the entire length will have a total of 370 hectares affected. In Figure 19 one can observe the affected storage units.

FIGURE 19 - Protected areas affected by quarry dam

Unidade de Conservação	Área Total (ha)	Área Alagada (ha)	Ocupação pela 'ADA (ha)	TOTAL	TOTAL Com sobreposição
APA Municipal de Campinas	22.278*	33	53	86	232
Área com Sobreposição entre as APAs	2.966	72	74	146	-
APA Piracicaba/Juqueri-Mirim (Área II)	287.000**	97	127	224	370
TOTAL		202	254	456	-

* Municipal Law No. 10,850 of June 7, 2001

** Forest Foundation

[1] [1] 100-meter protection range around the reservoir over the downstream stretch of the necessary works

Source: EIA, 2015.

However, the barrier of two bridges and a single storage unit (ADA and IDA) of the container corresponds to EPA of Piracicaba / Juqueri Mirim, which covers a greater portion of the basins of Jaguari and Camanducaia streams, which just covers the whole territory these areas.

The bus Two Bridges, in turn, constitute a reservoir of 4.86 square kilometers, Annex L, about 486 hectares APA Piracicaba / Juqueri Mirim in Amparo, when added to a distance of 100 meters from the vicinity of reservoir and downstream of the zone covering the dam and associated structures, the interference reaches approximately 908 hectares (IAS, 2015). Table 1 illustrates the storage unit affected by the dam two bridges.

TABLE 1 Protected areas affected by the dam two bridges

Conservation Unit	**Total area (there is)**	**Flooded area (there is)**	**occupation by 1ADA (ha)**	**TOTAL**
APA Piracicaba / Juqueri Mirim (Area II)	287,000 **	486	422	908

* Municipal Law No. 10,850 of June 7, 2001

** Forest Foundation

[1] protection range of 100 meters around the reservoir (391 ha) plus the downstream stretch of the necessary works (31 ha)

Source: EIA, 2015 (Adapted).

The Two Bridges and quarry reservoir will occupy areas that are material goods, residential and agricultural activities that are called small scale, mainly for self-consumption. In the case of the dam of Two Bridges, besides the presence of a small proportion of activity, there is also the presence of large areas where there is major business uses.

In this case, there is the Farm Jaborandi industrial group Ypê which carries out large-scale poultry farming jobs. There is also the Agriculture Tuiuti (Shefa), which is a dairy, which will not be fully impaired. Since the establishment Resorts, 4 Angels who works as a research laboratory and studies of animal vaccines and is a Research Center for Animals of Brazil (CPAB) will be completely flooded (EAI, 2015).

Regarding the commercial activities can point to the known "Ecological Reserve Mundão of Trails", which develops tourism activities, relying primarily on the area and structure to track and camping near the river Camanducaia, the District of Arcadas, Amparo. Although titled "Ecological Reserve" is not protected conservation unit or established by law, unless that focus on permanent preservation areas and reserves.

On the left edge of the river is located Jaguari the "Aunt Bar", downstream from the dam quarry, which is likely to suffer interference by dam construction.

There are also two small main dams that will be flooded. The river Jaguari is located the PCH White Monkey, with 2.36 MW of installed capacity owned by CPFL and should be affected by the formation of the quarry dam and river Camanducaia, SHP Feixos, with 1.15 MW installed capacity of the Company Energy Wolf Jump Ltda, which will be hindered by the Two Bridges bus.

- environmental impacts (disappropriations)

The damaged area will represent a total space that will house the following structures: dams, reservoirs, future permanent preservation area - APP, supply system, water mains, service areas, construction sites. In short, the territory will undergo a resulting direct physical intervention of the work required for the lease and operation of dams (EIR, 2015).

For this, the places that housed these areas must be expropriated in a total of 885 hectares at the dam Two Bridges and 435 hectares in the quarry dam. land negotiations with the residents due to the removal of property and the impaired area population, involving the exclusive area of the dam. The impact of changes in economic, social and cultural relations comes from the loss of property, taken from existing properties on the site and the location of economic or sociocultural activities.

The impact of the removal of residents of the region is already underway. Both factors inevitably change the social and economic dynamics, procedures pre-established by the neighborly relations survival, and interfere with the variation of the functional and economic relations with opportunities for craft production cooperatives, business and traditional cultural relations (EIA, 2015).

During the planning phase, with even inaccurate information certainly will be an increase in seizures related to trading around the compensation amounts. These uncertainties concern with regard to expropriations in this context can be generated questions on benefits do not match what is expected, that is deemed necessary for housing and restoration activities elsewhere.

In population surveys in areas to be occupied by the dam quarry and two bridges a total of 82 families were identified, of these 27 families are located in the area to be flooded quarry and 55 families in the dam Amparo (EIA, 2015). Table 2 shows the families living in the area that will be compromised by construction.

TABLE 2 - Families living in the area directly affected (ADA)

families	**two Bridges**	**quarry**	**Total**
families Interviewed	44	25	69
Family No Information (*)	11	2	13
Total Families	55	27	82

(*) On 13 households was not possible to collect the information. The dam Quarry 1 family was not found and one chose not to respond to the questionnaire; Dam in Two Bridges, 3 families were found and 8 did not respond.
Source: EAI, 2015 (Adapted).

The compensation for expropriation can be performed in two ways: through payment in cash or government bonds (in urban environments or in the case of land reform).

According to Abagge (2007), the expropriation process is divided into two phases: the declaratory and enforceable. The second can be subdivided into administrative (when there is an agreement between the Government and the owner of the property to be expropriated), and judicial (when the parties do not come into agreement and if a lawsuit is necessary to ensure the expropriation).

Castilho (2014) says there are several reasons why the Government can order private property, as follows:

a) Expropriation by social interest: destined to social causes, for the construction of affordable housing, sanitation works, watershed protection;

b) expropriation for land reform applied in the form of sanction against the person who is in possession of unproductive land, which is not performing a social function;

c) Expropriation for urban reform: needed for public transport projects (bus, train or subway), construction of new neighborhoods, streets conservation or preservation of historic and cultural heritage;

d) damaging property Expropriation: applies in the case of land used for planting psychotropic substances (illicit drugs). In these cases, it is noted that there is not any compensation.

According to Kauche (2013) calculate the amount of compensation to expropriation should take into account several aspects, including the property value, profits, interest, court costs, and indexation. Such precautions are necessary because the previous owner of the property can not suffer financial losses resulting from the expropriation. It is up to the Government reimburse it in an amount that corresponds to the actual value of the property.

In the same survey, it was estimated that 14 rural settlements are harmed by the dam of two bridges 27 and quarry locations affected by the reservoir 41 by adding properties. However, it is important to note that this number may be underreported. In this regard, it should be mentioned that the DAEE hired Paulista Company of Works and Services - DMFS, to carry out the real estate cadastre of the areas included in the region to be damaged, this investigation began in April 2015 (EIA, 2015).

The impacts in rural areas with productive activity, considering the loss of areas dedicated to agriculture and forestry, will be enormous because these areas are in the direction of the dam spillway.

The quarry dams and bridges two reservoirs should form with total area respectively of 202 and 486 ha² ha², the areas to be flooded effectively correspond to 181 hectares and 463 hectares and other areas are occupied by the river.

Also one must consider the areas to be occupied by the construction of dams and related structures such as the spillway, the evacuation channel and the ladder to the

fish, which will measure approximately 40 hectares in quarry dam and 31 hectares in Amparo.

The expropriation compensation will consider trading, expropriation for public purposes and compensation with regard to housing, productive improvements and activities, the contractor's responsibility, in this case, the Ministry of Water and Electricity - DAEE, Department of Sanitation and Water Resources of the State of São Paulo (EIA, 2015).

This program is the contractor's responsibility, and it will be in charge for the expropriation project, record directly involved population, negotiation and expropriation processes, and agreements aimed at supporting the people affected to minimize the impact on the lifestyle people directly affected.

As the technical visit, the sites of dams held some interviews with owners who will be affected by the projects. The first place visited was the quarry county, according to the resident Pires has the same position against the dam, it will evict an estimated area of approximately 22 hectares and including the main house of the property.

Following Alexander (28), it was already in the process of change in the day of the visit (07/14/2018) because the location of the farm is among the areas that will be expropriated and flooded and for this reason is against the construction of the same.

Finally, still in Pedreira, Carlos Henrique (58) stated that it is against the building, and it claims that there is a bus upstream of the future installation and could be reused. It Pirajá owner of the site, which is the family's possession since 1958, and also reports that its website will be affected in an area of APP (Permanent Preservation Area).

Already in Amparo was interviewed Jovelino (61), which is against the construction since it has always resided in the place and has no information about the expropriation and if the area is completely flooded.

Marcia Dias (46), he said the family is at the farm to six (6) generations and is against the dam construction because it will not bring benefits to the residents of the municipality to be upstream of the bus and will have part of the affected area.

- Quarry environmental impacts of dams and bridges Two

According to Article 1 of Resolution No. 001/86 of the National Environmental Council - CONAMA (1986), environmental impact is defined as any type of alteration of the chemical, physical and biological in the environment caused by human action , affecting indirectly or directly to the basics with regard to life, such as health, safety and well being, economic and social activities, the biota including flora and fauna, sanitary and aesthetic conditions and the characteristic of environmental resources.

So the environmental alteration is associated with the construction of a project that from a design analysis can generate positive and negative impacts and can make use of mitigation or compensatory measures, plans, and programs for environmental management in order to decrease the environmental change.

The Environmental Company of the State of São Paulo - CETESB uses the Federal Law No. 6.938 / 81 reporting on the Brazilian political environment, which regulates

the Federal Decree No. 99.274, the State Law No. 13,542 / 2009 and among other norms and laws in order to assist on the basis of the technical opinion issued by Preliminary Environmental License.

To acquire the Preliminary Environmental License of quarry dams and Two Bridges, the Department of Water and Power (DAEE) located in the center of São Paulo, which owns the CNPJ 46,853,800 / 0001-56, was responsible for the request of the license described based on the segments:

a) does not authorize its implementation, only approves its location and design of the project;

b) Before deploying the project should request the environmental operating license, subject to penalty;

c) The Preliminary Environmental License is valid for five (5) years;

d) The Preliminary Environmental License does not prevent the construction consortium to apply for permits, licenses, and certificates of any kind by the Municipal body, State or even Federal;

e) The Preliminary Environmental License was signed by Ana Cristina Pasini da Costa, Director of the Environmental Impact Assessment, on August 25, 2016.

The Environmental Impact Report (EIR) is one of several documents required by agencies for the environmental licensing process and also prior environmental licensing LP. Studies in the quarry dams and Two Bridges located on the river Jaguari and Camanducaia respectively, followed standards set out in Reference term n ° 410/13 / IE, issued on August 28, 2013, by CETESB provided for in Competition notice number 004 / DAEE / 2013 / DLC.

Dams under study, both the EIR as the EIA (Environmental Impact Assessment) and executive design engineering were carried out by the consortium formed by companies Themag Engineering and Management and Hydro Studio Engineering, with the contractor the Department of Water and Power (DAEE).

There are currently many global discussions about the water supply, particularly in regions with population density, ie high rate of population occupation. In Brazil, the discussion is accentuated in the great metropolis of the country, São Paulo, with this daily, seek up new alternatives for water increase in capital and especially towns, as the population growth has occurred in a disorderly manner in these regions.

The dam quarry and Two Bridges, located in the river Jaguari and Camanducaia River makes up the UGRHI 5 Unit (Water Resources Management). The UGRHI 5 known as PCJ Basin is formed by the basin of the rivers Jundiaí, Piracicaba, and Capivari that present the biggest drought in the state of São Paulo.

The PCJ Basins (river Piracicaba, Capivari and Jundiaí) have an area of approximately 15,304 km². Within the State of São Paulo has an extension of 14,138 square kilometers, ie, it occupies 92.4% of the total territorial state. The other 1,166 km² is part of the State of Minas Gerais and represent 7.6% of the territory. Regarding hydrographic terms, there are seven main sub-basins, the Piracicaba river sub-basin and its tributaries and the rivers Jaguari, Corumbataí, Atibaia, and Camanducaia and also the areas that comprise the drainage of Jundiaí and Capivari.

With that dams are intended to ensure water security in the region, mainly municipalities around and downstream of dams, summarizing a water demand safer population, especially in times of drought, ensuring water for about 2.5 million people.

The dam of Two Bridges and Quarry has the intention to store water in the flood period, and in the dry period to use this water, thus not damaging the surrounding population with water deficit.

In recent years the region near these rivers is increasing its population rate significantly, so has increased pressure on water demand, finally states have adopted measures to be no lack of water at the time and in the future for the population and aimed at development of the region, thereby improving the quality of life of the population.

The quarry reservoir is located near Highway John Beira, known as SP-095 and the town road Basil Vieira de Godoi, already the Two Bridges is close to the highway John Beira, also known as SP-095 and the highway Aziz Lian, also known as SP-107.

The quarry dam is 3 km from the urban center of the city of Pereira and will be installed in the river Jaguar, located in the municipalities of Pedreira and Campinas, such reservoir will have an area of 2.02 square kilometers and can store about 32 billion liters of Water. Already the dam of Two Bridges is 8 km from the city of Amparo, and will be introduced in the river Camanducaia and will run until Ribeirão Pantaleon such reservoir will have an area of 4.86 square kilometers and can store about 53 billion liters of water.

Both dams are in regions with rapid economic development and population, and that was by agribusiness enterprises and large national and multinational companies in the region, so it has been the need to increase the water demand in the region.

Thus the goals proposed by the Municipal, State and Federal Agencies have to minimize or even solve the water problem in the region, following national water security targets established by the National Water Agency (ANA) in 2013, which has the intention to ensure water quality, 24 hours a day, for the entire population, while ensuring biodiversity, hydrology, and the ecosystem of the region.

In recent times, especially in the last decade, the expansion was proposed in the Piracicaba River, as in drought times the water volume in the basin was considered critical, with an index below 1,500 m^3 /person/year, and besides, the most basins nearby also showed supply problems for the local population.

To solve the problem with the flow of Camanducaia and Jaguari rivers, dams to be constructed should be a reservoir with a useful storage capacity of approximately 85 billion liters of water, as already mentioned this total 32 billion liters of water are of Quarry and other dams 53 billion gallons of water dam are two bridges.

In the context of the state of São Paulo, the largest share of the municipalities has a population of 100,000 inhabitants, in addition, has 77% regional population. According to the Master Plan for Water Resources Utilization macro metropolis Paulista 2013, it is estimated that in the year 2035 these regions will have more than 6 million people.

In addition, the metropolitan region of Campinas (MRC), the region of Piracicaba, Jundiaí, Sorocaba and among other regions have large industrial complexes of various segments that are leased in the area of the PCJ basins, moreover, it occupies a large

and extensive rail network, bus stations and airports draining all matter created in this region, including the Paulinia Refinery Petrobras (REPLAN).

The production of flowers, sugar, and alcohol, developed the agribusiness in the region of Piracicaba, it was really necessary to sanitation, the increased water demand, especially in the creation and placement of new sources and water supply structures, more for this region is close to a major industrial park in Brazil.

The formation of shells takes place from the bus rivers, dams thus forming up, which in turn supplies water to the treatment plant, supplying the reservoir and clear treated water, forming a cycle.

- **existing vegetation in the areas of dams**

The region will be deployed dams, is inserted in the areas of the Atlantic, and is identified by having several priority studies for its conservation and preservation, for displaying an abundance of biodiversity and it is deeply threatened, remaining about 10% existing original coverage in that area.

The Atlantic Forest is formed by various formations of vegetation, and in this region find themselves vegetables ranging from lowland forests to the altomontanas forests, and evergreen forests to deciduous forests (those whose leaves fall in a given season). This small vegetation not only protect the flora, but it also enables the maintenance of plant and animal ecosystem a whole.

The region is the quarry bus is mainly occupied by semideciduous forest1 and man-made environment2Which is in the early stages of secondary succession procedure, namely, the local vegetation is present in the result of the renewal of old pasture or even eucalyptus crops.

The degradation observed in the vicinity of the dam Quarry is marked by the absence of vegetation elements which can be classified in categories in the most developed for the advanced medium renewal process. However are 15 native species, about 8.1%, which are framed in the threatened species which may be mentioned peruiferum Myroxylon (Peru Balsam), Cariniana legalizes (Jequitibá-pink) and Zeyheria tuberculosis (ESI Shaggy).

In AID / ADA quarry reservoir are observed predominant anthropogenic environments on site with extensive areas of sugarcane planting pastures, but to observe the IDA / dam ADA was noted native formations with different forest issues nearby, and this highlights the presence of fragments in an advanced stage of renovation, and are found in the lower region of the terrain height characteristics between 20 to 30 meters, few clearings.

It was found the massive presence of Acrocomia aculeata (Macaúba), better known as macaúba, being found as isolated forms and within a few fragments at different stages of the dam renewal of two bridges in the city of Amparo.

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[1] Forest which is conditioned double seasonality of weather, with a tropical (seasons with heavy rainfall) and other subtropical (with dry periods).

[2] Are the actions performed by the human being in the environment.

The species with the highest extinction rate is Euterpe edulis (palmitoyl-Juçara), considerably weak compared to all other species. The species of the families Myracrodruon urundeuva (Aroeira-black), peruiferum Myroxylon Zeyheira and tuberculosis as well as being classified as fragile, they are the most vulnerable as the timber interest. And also in the group that suffers constantly endangered species Cedrela fissilis (Cedar), Guarea guidonia (Carrapeta True or Jataúba) peltophorum dubium (canafístula Sobrasil) and Machaerium villosum (Rosewood-Paulista).

According to Paulínia Refinery - Replan (2012) was a field survey to identify the flora of vulnerabilities in the region, and its methodology applied to aim to distinguish the plant type, and its regeneration step, as well as the fact in APP (permanent preservation area). Followed by three (3) primary steps: Cartography, literature review and field visit.

Data collection was conducted through aerial topographic studies and bibliographic materials, then specialized groups performed work in pre-stipulated recognition field, using the following materials: GPS, spreadsheets and site maps, voice recorder and camera (REPLAN, 2012).

- **fauna present in the area of dams**

The specific proposal of the Fauna study was to collect data about the mammals of genres, fish fauna, avifauna and herpetofauna evaluated in the affected areas directly by the dams.

According to Puma (2016) associated with terrestrial animals, Atlantic Forest is characterized by having a high range. According to studies, there are about 950 species of birds, mammals 260, 300 450 and more reptiles amphibians. And on this, about 140 birds (15%), 70 animals (30%), 95 reptiles (30%) and 230 amphibians (50%) species are mainly found in the region, or part of the Atlantic biome.

According to Miranda (2014) in the study area, there is the occurrence of greater tolerance, that is, there are species that are associated with the typical ecosystem of open areas or demonstrate some level of relationship of dependence of these forest environments.

As Picoli et al. (2014) very important to emphasize that great extent on the part of Pedreira, Amparo and Campinas have the presence of areas with natural environments that have been turned into disturbed areas, areas with a better quality of conservation to protect the most diverse communities of species of animals.

According Leonel et al. (2009), even with the high rate of hunting and urbanization, are no confirmed evidence of large predators in this region, such as: the brown ounces (Puma concolor), the maned wolf (Chrysocyon brachyurus), the ocelot (Leopardus pardalis) and the otter (Lontra longicaudis).

According to the Environmental Impact Report (2016), the Quarry and Two Bridges dam, the quarry reservoir has eight (8) species that are wild native, and of these only one listed as endangered, and one is as close to extinction they being the puma and the otter.

In the barrage of Two Bridges, are fourteen (14) native species recorded, of which three (3) are vulnerable according to the national list, and the other species listed in

the state list of the São Paulo government as threatened, and 3 (three) are considered near threatened, they being the puma, ocelot, otter, capuchin and sauá.

According to Fluckiger (2016), the inclusion of exotic species and domestic animals is a major problem for the native wildlife, and may directly or indirectly affect the site. These animals can be predators to wild mammals in this region. Food domestic animals are small and medium-sized mammals, and they rats, opossums, armadillos, and cavies.

Moreover, it also has the other side of the chain, the larger species, domestic animals such as consuming food. Finally, according to surveys show that animals like cats and dogs are important parts to disperse diseases like leishmaniasis and parvovirus.

About Ichthyofauna more specifically in the river Jaguari where will be built the Quarry Dam, more than 30 species of fish have been identified, among them Lambari red tail, Piau Piau / Ferreirinhas, Piava / Taguara, Tambiú, Lambeth yellowtail, Lambarizinho / Piaba and so on.

To the study of the local fish fauna several species have fishing potential, however, for IDA and ADA are uncommon as interviews with the locals. In the region where the dam will be constructed corresponding species of fish 11 to 44% of the quantity related to the location (EIR, 2013).

The mammals that are the mammalian set present in a thus region was held studies near the dam with its traces of their daily activities left by their tracks, their dens to rest of foods, we used photographic trap attached to the surroundings of dams.

Since the birds have by definition is a group of birds located in a given environment, where they conducted a study on, in which 808 species of birds have been recorded, this represents about 44% of all Brazilian birds.

According to Araujo et al. (2009 cited CANCELLARA, 2013) regarding the herpetofaunal about 236 amphibian species are in the region of knowledge, this refers to 25% of species. And according to the survey conducted by Haddad Jr and Marquis (1993 cited CANCELLARA, 2013), Sierra Japi could be recorded about 28 amphibian species, grouped into 6 families.

- **The estimate of the work overpricing**

According to the survey of the Plan of TCU Annual Inspection (Fiscobras) indicates that every ten (10) companies with the public contract, seven (7) have serious irregularities such as delays, poorly designed basic projects, modification additives, delivery works below quality, it is characterized as a work of overpricing.

According to the engineer and lawyer Kings (2016 apud Oliveira, 2018), reports that the main ways of public resource deviation occur in the following ways:

a) the price of greater resources than it actually used or supplied;

b) the request for amendment of the work or service budget, causing losses to the public sector and benefiting the contractor;

c) the price of a top venture at odds with reality, and terms of security, quality, and useful life;

d) delays without a valid justification, contractual changes that generate a preview of features to the contracted, causing additional costs for public company;

e) using the so-called game schedule, the contractor proposes higher installments for the services to be performed, and decreases in the past installments, so that, if adding is the total price of the work, but there is a risk of companies contracted abandon the work before completing it.

According to Law 13,303 of June 30, 2016, known as the State Law, enterprises are chosen annually based on specific characteristics such as risk analysis, project size and cost, it is calculated systematically on to indicate what are the construction sites and which team should prioritize, noting irregularities, future budgets are cut and the funds are blocked.

According to the TCU (2018 apud Dantas, 2018) was found around 1275 (one thousand two hundred seventy-five) companies between 1725 (thousand seven hundred and twenty-five) who had to overprice in his works and may even reach 25% (twenty-five) than budgeted at the beginning.

The electronic newspaper Mail (2018) mentions that the dam works "will begin in May and will be performed by construction companies OAS Engineering and Construction SA and Cetenco Engineering SA" which won competing with 18 other proposals for quarry dam and 17 proposals for dam Two bridges in the bidding process industry INTERNATIONAL COMPETITION No. 001 / DAEE / 2017 / DLC, which can be consulted on DAEE site, offering the lowest value, 230,900,000 of quarry dam and 196 090 000 of the Amparo dam totaling 427 million that will be financed by an international loan of $ 204 million together with the Andean Development Corporation (CAF), known as the Development Bank of Latin America.

The OAS Engineering is the subject of various investigations by Operation Lava jet, which indicates that the company benefited from an irregular form of public money, and had his contract with ended Petrobras, in the process, had their imprisoned executives and giving a default in their suppliers of 117.8 million.

The Cetenco Engenharia SA has already been condemned by the Court of São Paulo for a corruption scheme in sets with other builders by misuse of public money from a subway construction.

Taking into consideration the situation worse, with examples of other projects that had their overpriced works, it is estimated that the value of works amounting to 427 million plus 25%, you reach a total of 533.75 million. This value may vary due to public scrutiny and public interest in the project by spending.

4 CONCLUSIONS

Dams are constructive elements that are capable of storing large amounts of water and thus make possible the supply, irrigation, retention of waste and be a source of electric power generation, and in line with these uses, buses Quarry and Two bridges are viable means to provide and supply water availability for the population downstream of the developments.

Through the research conducted was obtained as much information to better understand all the concepts related to the dams, the main settings, the purpose of each usage pattern and types of construction methods in general.

And before all the reviews and analysis of the references of reports and opinions of the studies can then contain and understand the whole viability of the work, its procedures and execution stages that confirm the feasibility of the construction of dams in the municipalities of Pedreira / Campinas Amparo.

By analyzing all the necessary procedures for the implementation of these dams, it was found that the project will benefit several cities in the region with the supply of water, which is recurrent shortages in drought times, and also will bring, all matters involving environmental impacts in the area, and the physical impacts that are associated with the expropriation of the owners of homes and loss of heritage sites to be flooded.

With work and the technical site visit can understand the size and grandeur of the buses that aims to help society as a whole, and also comprehend and understand the frustration of residents who are expropriating their homes because their lands were some generations of family heritage and for the construction of dams, but cannot observe reality broadly and understand that this project will benefit millions of people.

Since it is extremely important to build these dams even if it works with considerable environmental impacts in the affected area and physical impact on people's lifestyle directly injured with expropriations, but that in the future will benefit because there are no setbacks with the lack of d ' water, it will be one of the viable alternatives to the water crisis that is regular and that affects most municipalities that are downstream of future works, and as this will minimize the dependence of water coming from the Cantareira System to supply the region.

One can also understand all the concepts that address the principles relating to the processes and forms to bid a work of public authorities and thus understand how it is done and all the procedures that are associated companies that are contracted for services. However, it is known that some of the construction companies that participate and win the event are associated with overpricing situations in public buildings.

The competent bodies that are responsible for these construction techniques, such as entities and the very community involved, the Committees of the PCJ Basin, could examine the possibility or even at the time it was carried out the preparation of the implementation of engineering project at that location ponder the idea of building a dam for multiple uses of water resources belonging to catchment area and thereby check whether there is a likelihood of enabling the bus to hydroelectric and in this case provide the development of that site. Or even use it as a dam for tourism and it fits this constructive type of multiple uses.

Thus also consider what is relevant and essential to contain and mention in the design of studies and environmental impact reports and alternative environmental recompensação to the area that will be directly affected and demonstrate some options that may be taken by virtue of that event.

There is also an issue that is outstanding and plausible the opportunity that dams will provide during the period of their execution, which is linked with the availability

of places for individuals who are interested in working in the reservoirs and thus help in the inclusion of part of the population in the construction of these reservoirs.

And it is concluded that during the entire work process of drafting, research, information and new principles acquired with this thesis, we can improve and expand the knowledge before it was precisely surface and that at this moment there was necessary to assimilate the trial on dams that was interpreted wrongly and that from the new perspectives in accordance with the studies presented brought with them the importance that contributed to the end result of the monograph.

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