

CHAPTER 6

6.0 SOLID WASTE

6.1 Overview

The proposed project will be a tourism based development and as such will result in an increased population growth and the hiring of a temporary and full time labor force all of which will result in the generation of solid waste on the caye. At full occupancy there could be approximately 481 persons on the caye, and although full occupancy is difficult to achieve, it is recommended that the solid waste management for the project meet and exceed the maximum occupancy rate of the project. In view of this factor, the proposed project will implement a proper solid waste management plan aimed at identifying the source and offering disposal alternatives.

In light of the proposed development, a comprehensive solid waste management plan will be required to be put in place. An important component in the management plan is the separation of garbage into different categories for its required disposal. This differential system should facilitate the management of the waste. The three broad categories that will be used are as follows:

1. Construction and Field Waste (Waste category I)
2. Domestic Waste (Waste category II)
3. Commercial Waste (Waste category III)

6.2 Projected Waste Profile and Generation

As previously mentioned the proposed project will be a tourism venture with population growth impacts as well as increased labor force. With this in mind, it will be hard to predict how much waste will be produced by each visitor, staff or guests of the resort. It is anticipated that at full development about 950 persons will be on the project. Although its difficult to predict, its suffice to say that upper scale tourists resorts consume far more processed goods, cleaning products and disposable goods (Conservation International, 1999) than the local population or staff who will be producing nearer to the Belizean average.

That average is stipulated in the Belize Solid Waste Management Project (Stantec 1999) whereby they concluded that the average San Pedrano was producing about 4.8 lbs of solid waste per day as seen in table 6.1. This was well above the amounts being produced in inland locations where they range less than the national average of 3.0 lbs/capita/day.

It is anticipated that the average False Caye guest will be producing at least as much waste as the average San Pedrano. The profile of the average householder as a guest/vacationer with higher income levels tend to fit these profiles especially in the case of the higher end hotel units and villas that are available for rent or sale on the property. Likewise, the staff and office workers would be producing a little less than the national average due to their work schedule.

According to the BSWMP (Stantec 1999), there is no data on the volume of the municipal versus domestic waste, as there is no separation at source for Belize at the different municipalities. Municipal waste includes waste generated by the commercial and business sector located within or near municipalities. Municipal waste also includes very little industrial waste in Belize Municipalities.

Table 6.1: Estimated Solid Waste Generation for Belize Municipalities

City/Town	Population	Tons per annum	Tons per day	lbs/capita/day
Orange Walk	13,483	6,365	17.4	2.8
Belize City	50,050	29,770	81.6	3.4
San Pedro	4,499	3,900	10.7	4.8
San Ignacio/Santa Elena	13,260	7,104	19.5	2.9
Benque Viejo	5,088	2,080	5.7	2.5
Belmopan	8,130	3,510	9.6	2.6
Stann Creek	7,888	4,680	12.8	3.3
Dangriga	8,814	3,120	8.5	2.1
Punta Gorda	4,329	1,560	4.3	2.2
TOTAL	115,541	62,089	170.1	26.6
MEAN		6,899	18.9	3.0

Source: Stantec 2001, & CS0 2000

On the assumption that the extrapolated figures will hold true for False Caye, then one arrives at the following figures for solid waste production at the development recalling the following dwelling/accommodation capacities:

- Typical Hotel Unit = 74 rooms (>148 person capacity)
- Added Hotel Unit = 32 rooms (> 128 person capacity)
- Villa Type A = 19 Units (114 person capacity)
- Villa Type B = 19 Units (152 person capacity)
- Villa Type C = 15 Units (120 person capacity)
- Cabanas = 14 Units (56 person capacity)
- Special Lot = 6 (48 persons capacity)
- Special Estate = 1 (8 person capacity)
- Workers = 10% occupancy (76 workers)
- Transient Visitors = 100 visitors to the site, including from neighboring Placencia Village and mainland Belize.

The occupancies are further divided into unit keys that refer to the lock out system that the development will use. Table 6.2 shows that at full occupancy the proposed False Caye development can expect in the order of 950 guests/visitors/workers.

Table 6.2: Projected Domestic Waste Production for False Caye

Type	Facility	No of Producers in Category	Lbs per Capita per day (ppcd)	Projected Solid Waste Production per Day (lbs)	Projected Solid Waste Production per week (lbs)
1	Typical Hotel Unit	148	4.8	710.40	2,841.60
2	Type B Hotel Unit	128	4.8	614.40	2,457.60
3	Villa Type A	114	4.8	547.20	2,188.80
4	Villa Type B	152	4.8	729.60	2,918.40
5	Villa Type C-1	48	4.8	230.40	921.60
6	Villa Type C-2	72	4.8	345.60	1,382.40
7	Special Lot	48	4.8	230.40	921.60
8	Over Water Cabanas	56	4.8	268.80	1,075.20
9	Special Estate	8	4.8	38.40	153.60
10	Employees	76	3.0	228.00	1,596.00
11	Transient Visitors	100	3.0	300.00	2,100.00
Total Solid Waste Generation		950	4.5	4,243.20	18,556.80

Table 6.2 shows that at full occupancy (see chapter 4), the resort can expect to produce in the order of 4,243.20 lbs (4.2 Cubic Yards) of domestic waste per day or 18,556.80 lbs (18.6 cubic yards) per week. Although full occupancy may never be achieved given the nature of the development, the systems adopted for the site must have enough capacity to accommodate the waste at full capacity continuously or otherwise it will be viewed as potentially inadequate. The system adopted for managing this waste must be efficient and environmentally dependable. It should also be noted that in terms of waste management, volumes are a more useful quantity to consider than weight. This is especially true for False Caye where its solid waste will be transported out by marine vessels (eg. Boats docked at the facility) where space will be at a premium and cost prohibitive. This suggests that somewhere along the line it will be in the resort's interest to purchase a good quality compactor. The resort can take many measures to reduce its waste output and save cost.

6.3 Construction and Field Waste - Waste Category I

(i) **Construction Waste** – At the proposed project all the waste produced will come from the construction phase. The resort intends to construct 40 hotel units with various lock out systems and 40 villas of different lock out sizes, spas, restaurants and ancillary and auxiliary facilities. The building materials will be homogenous as much as possible thereby limiting the type of field waste produced and also the volumes.

In normal construction sites, especially resorts and condo complexes, it is commonly assumed that between 5-10% of the building materials used onsite is eventually discarded as construction waste. In addition, the project during construction will consist of the usual scraps and discards which could include material wrappings and packaging materials, especially during the furnishing phase. An average of 5-10m³ of compact waste materials will be produced on average for each building including the hotel units and the villas in addition to the bars, restaurants and other ancillaries. All inorganic construction waste produced at the site such as plasterboard, mortar, tiles will be retired to the lower areas on the rear of the property as landfill. Wood pieces will be recycled as will other materials that can find additional application around the site. Organic materials such as wood that cannot be recycled further will be collected and burned in open air fires or given to the communities as firewood.

(ii) **Field Waste** - The little field waste produced will be from clearing of certain trees to erect structures but as noted in Chapter 4 it is the intention of the developer to retain as much of the native vegetation as possible. Notwithstanding this the sheer size of the caye and number of buildings to be erected the proposed project plans to incorporate a small footprint on the caye. Calculations of the footprint of the villas and hotel and other buildings alone suggest that they will take up approx. 2 acres. The plants from these areas will have to be removed not to mention additional clearing for site enhancement (e.g. small gardens), ventilation and to allow natural lighting where possible. In addition, as mentioned previously, the developer plans to maintain the integrity of the development within their own right as much as possible without jeopardizing the sensitivity of the caye.

6.4 Domestic Waste – Waste Category II

Domestic waste will be the primary waste that will be produced on site during the operation of the proposed project. It is anticipated that between 75 – 85 % of all the waste produced will fall into this category. The resort will ensure that the domestic waste produced is sorted into appropriate classifications prior to disposal. To achieve this, waste must be stored in separate containers depending on whether they are biodegradable, non-biodegradable or toxic and properly labeled so that all conscientious individuals feel comfortable and encouraged in using them. The amount of this type of waste produced on the caye is expected to be small given the size of the development and the fact that the guests and staff will be limited. The various offices and miscellaneous areas will supplement this amount considerably by their daily production of waste paper etc.

6.4.1 Domestic Waste disposal

Domestic waste disposal is an important issue especially considering the sensitive environment in which the project will be located. Due to the prevailing conditions and all the possible factors, the solid waste disposal is limited to two options: Option A, on site disposal, and Option B, disposal at the Placencia dumpsite. In any event, the solid waste will be classified into biodegradable and non biodegradable categories for easier disposal.

Table 6.3 summarizes the solid waste disposal options for the proposed False Caye project. The first option considered was Option A, which is the option to dispose of the solid waste at a secure

location within the project site. The solid waste would be separated into biodegradable and non biodegradable. This option has two other sub-options where burning and land filling/reclamation is considered. The other option is Option B, which consists of the separation of the solid waste also, along with the collection and transportation of such waste to the Placencia Dumpsite, after approval by the relevant authorities.

Table 6.3 False Caye Solid Waste Disposal Options

OPTION A Disposal	OPTION A-2 Disposal	OPTION B Disposal
Option A-1 is the composting of the organic waste and land filling of the inorganic waste on low lying area within the project site.	Option A-2 is the composting of the organic waste within the property and burning of the inorganic waste on site	Option B is the composting of the organic waste within the property, and carting the non biodegradable (inorganic) waste to the Placencia dumpsite.
Composting in soils that are high in salinity could pose a problem to the bacteria. The compost would have to be utilized within the island.	Composting in soils that are high in salinity could pose a problem to the bacteria. The compost would have to be utilized within the site.	Composting in soils that are high in salinity could pose a problem to the bacteria. Compost bins will be installed to counteract this process. Compost will be utilized within the property.
A disposal site on the property for the inorganic would contaminate the site with pests and diseases as well as the need for adequate low land. Water contamination can also occur given the nature of the fragility of the area.	Just as with Option A, the burning of the solid waste would not only contaminate the soil and water but also the air. This especially true if plastics are being burnt. Toxins and dioxins can be released and this practice should be discouraged.	The carting of the non biodegradable (inorganic) waste could easily be handled by the service boat that will commute on a regular basis to and from the mainland to the project site. Space would be at a premium and it's not hygienically safe to transport this waste with other products.
From an ecological stand point this proposed option would reduced transiting means thereby less indirect impacts (e.g. fuel, noise, dust etc.), Less volume transported to the existing Placencia dump site, but with loss of aesthetic value to the existing project site.	Proposed option would procure more direct impacts such as water, soil and air. There would be less volume of waste to be transported to the Placencia dumpsite but not without a loss of the project site's aesthetic value.	Use of the Placencia dumpsite centralizes the impact to an already existing disturbed site. The present Placencia Site will be transformed to a future transfer station, with the Mile 24 site as a Central Regional Landfill, providing the opportunity for final disposal at a safe site.

6.4.2 Selection of the preferred option

The advantages and disadvantages for each option were discussed and analyzed. Taking into consideration the fragility and ecological sensitive nature of the area, Option B was chosen. The analysis identified that it would be environmentally and ecologically beneficial to carry out solid waste separation on site and carting out the non biodegradable waste to the Placencia dump site (See figure 6.1), which is an already disturbed and impacted site.

All the non biodegradable waste will be carted to the Placencia Dumpsite. Waste will be stored on site until a sizeable load can be taken. False Caye will make every effort to consolidate its load in order to reduce boat traffic in the area. The project will implement the composting of its organic waste. The organic waste generated by the project will basically consist of food scraps, grass and hedge trimmings and clippings. False Caye will install composting bins to process the organic waste thereby producing a rich source of nutrient for the existing landscape.

6.5 Commercial Waste (Waste category III)

Commercial waste is classified as waste products produced from the operation of the project at full development. Such waste include to some degree hazardous waste which is normally termed for such category. But due to the different volumes, degrees and schedules that encompass hazardous waste, the EIA preparers prefer to utilize commercial waste without taking the term 'hazardous' out of context.

With this in mind, operational wastes such as machinery and electronic equipment old parts, tires, used batteries, used oil, and aerosol and paint cans to name a few. Disposal options will be implemented to manage these wastes prior to disposal. Waste such as batteries and used oil will be stored in a containment wall and shipped to a designated disposal contractor. Recycling activities will be investigated for this type of waste.

Commercial waste is outright dangerous to human health and should only be handled with specialized equipment and carefully disposed of far away from any inhabited area.

6.6 Solid Waste Management Plan for False Caye

The solid waste management plan for the proposed project will encompass the storing, collection and disposal of the waste that is generated on site. This plan intends to develop and implement waste minimization strategies aimed at reducing the overall solid waste volume as well as to educate the staff and guests on the importance.

With this in mind, the proposed project plans to address all the relevant issues regarding solid waste management and implement these into their daily routine. A more comprehensive and detailed plan will be produced once the proposed project is in operation. It is the intention of the project to keep their environment free of solid waste as much as possible.

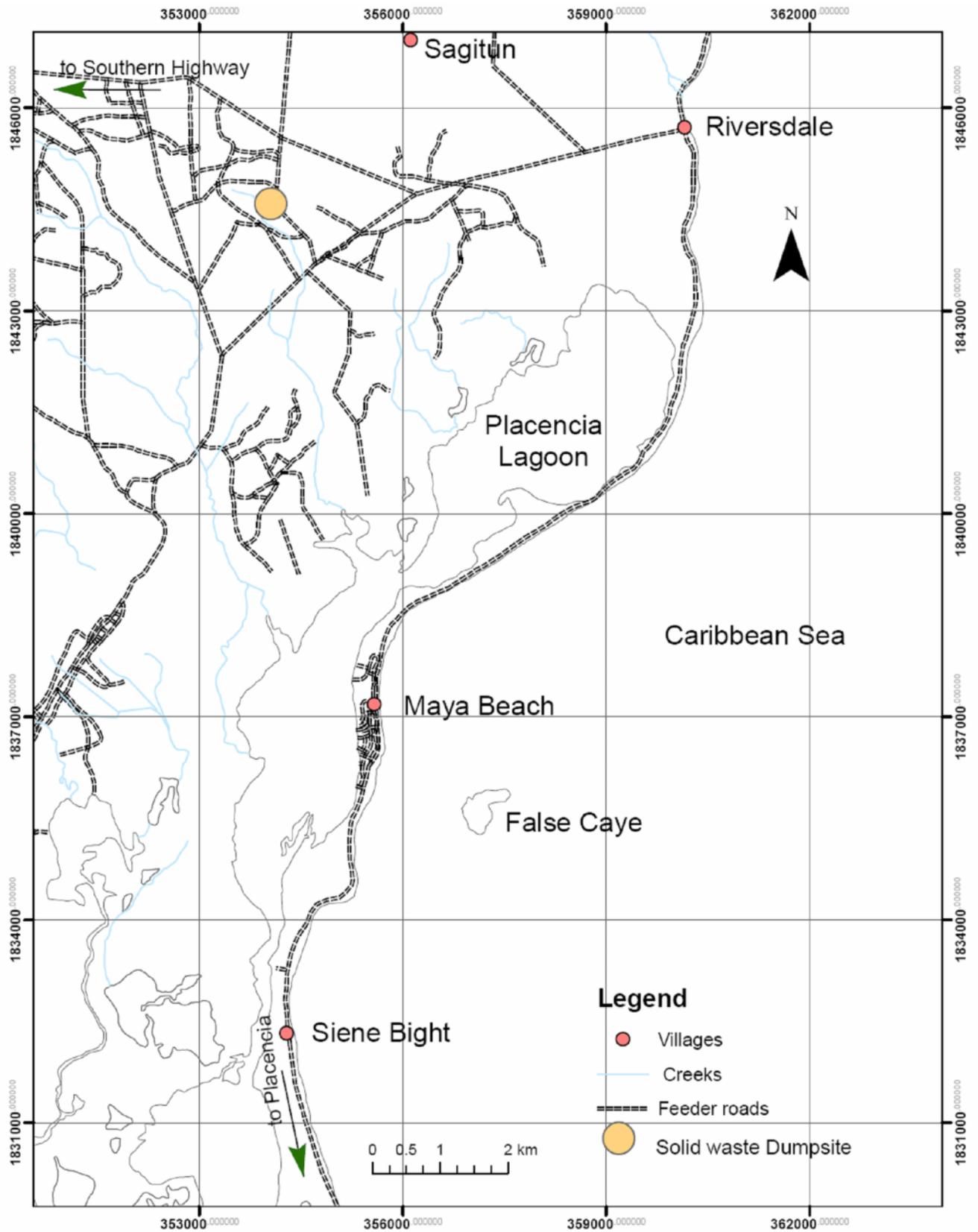


Fig. 6.1 Placencia Dump Site in Relation to the Project Site

6.6.1 Waste Minimization Strategies

Transportation of waste materials from the site by whatever means will be an expensive proposition given the fact that the waste disposal site is located about 15 miles from the project site. The project proponent will understandably be loath to bear this cost and will therefore pursue other less expensive options as long as they are compatible with maintaining sound environmental values.

Considering this, the staff of the project will implement waste minimization strategies that will include reduction, recycling and reusing of the generated waste. This practice should minimize the general solid waste significantly thereby reducing the operational cost. The following summarizes these strategies:

- (i) **Reduction** – The staff of the project will work with guests, transient visitors and contractors to reduce their waste. Such a reduction can take many forms but is especially evident in such ways as reducing the amounts of shopping bags and packaging material, purchasing in bulk or wholesale rather than retail and others such as calculating construction materials more accurately to take account of waste etc.
- (ii) **Reuse** - Once materials are used they should be reused if possible. There are many opportunities for reusing products such as substituting Styrofoam plates and cups with regular washable plates to putting used clothes up for sale as second hand items etc.
- (iii) **Recycle** – Many of the items that the guests and staff of the development use will be recyclable. Items such as glass can be crushed and reused in concrete. By the same token substituting glass bottles for plastic ones can help to reduce waste volumes (although they may incur higher transportation cost). Composting kitchen waste is another example where useful products can be obtained for gardening, soil conditioning etc from waste which would otherwise be discarded. In Belize there are established business operations that will take paper, cardboard, aluminum and metal waste for recycling into useful products e.g. toilet paper. Used tires can be recycled and used for road barriers or as flower pots.

With these methods in mind, the proposed project will explore every option to implement these strategies.

6.6.2 Waste Classification Volumes

Belize has little data on volumes and types of materials being disposed onto open air landfills, incineration, burial etc. The Belize Solid Waste Management Project (Stantec, 2000) and the Central Statistical Office, 2000, estimate that most domestic waste is organic (60%), while the remaining consists of metals, plastics; glass, other waste (5%) and paper comprises 20%. The production of waste for False Caye is expected to be similar, except for the inclusion of construction material to be produced during the construction period.

As gotten from the Waste Minimization Strategies, much of the generated waste produced by the project during operation will consist of domestic waste. Applying the composition percentages

on the projected solid waste production, the management of the resort plans to better manage and utilize the required resources.

In retrospect also, this composition can give an account of the possible organic volume that is expected from this type of waste. This will enable the staff to better manage the organic waste and program its use in terms of fertilizer usage. Moreover, this percentage can estimate the number of required compost bins that will be utilized to carryout such activity. The following table describes the types of waste within the domestic waste profile and its anticipated volumes.

Table 6.4 Project Domestic Waste Profile

Composition	Percentages	Solid Waste Generated (lbs)	Volume Composition (lbs)	Waste Minimization Strategy
Organics	60		1,343.2	Composting
Plastic	5		111.9	Recy/Incin
Paper	20	2238.6	447.7	Comp/Incin
Glass	5		111.9	Recycling
Metal	5		111.9	Landfill/Recy
Other Waste	5		111.9	Landfill/ Incin
	100%		2,238.6	

As can be seen from table 6.4, about 60 % of the solid waste produced during operation can be recycled by composting. Moreover, waste such as cardboard, paper, grass trimmings, hedge trimmings and wood chippings can be added as well. The end result of the composting process is a rich fertilizer that can be added to the landscape.

Considering the volume of waste to be composted, the project will utilize a composting system with a processing capacity of 40 – 200 pounds per day of biomass per system. This system is ideal considering the current national occupancy rate of Belize. With this in mind the project will install 3-4 of these systems around the project site. Additional tubs will be installed as needs be to facilitate the occupation increase.

6.6.3 Solid Waste Collection

The solid waste generated on site will be divided into two sections as described in Section 6.4.2. Garbage receptacles will be placed at strategic locations for the collection and storage of garbage. This will be especially important in considering the marinas and its related activities. Non combustible wastes such as glass, iron, aluminum, some plastics and others will be further separated and recycled as much as possible.

The non biodegradable waste will be transported to the Placencia Dumpsite first by boat then by road. Presently provisions are being made for the construction of a service pier on the Placencia strip that will also be used to transport construction materials. For the time being, waste will be

stored at a secure location on the mainland and then transported to the dumpsite for final disposal.

The collection schedule may vary from time to time depending on the volume and available human resources, nevertheless the endeavor will still remain a weekly operation. The precise collection days will be finalized after discussion with management and staff, and will be determined on the demand needs.

6.6.4 Public Awareness Program

The solid waste management program will also incorporate a public awareness program aimed at educating and sensitizing the staff, transient visitors, guests, contractors and others about the importance of managing garbage. The main focus will be to ensure that proper ethics are conducted when it comes to throwing away the garbage. The staff will post signs and notices to enhance the program. Overall, it is anticipated that the program will be a continuous effort that will yield fruitful results.

6.7 Reporting Requirements

All pertinent and relevant information will be made available to all pertinent authorities such as the SWMA, Ministry of Health, and the Department of the Environment. False Caye Development will ensure that contractual obligations, if any, are fulfilled at all times, and any guidelines and the monitoring of these guidelines and practices will be done internally, wherever possible. Any gross violations requiring notification to the enforcement authorities will be done as soon as possible, if necessary.