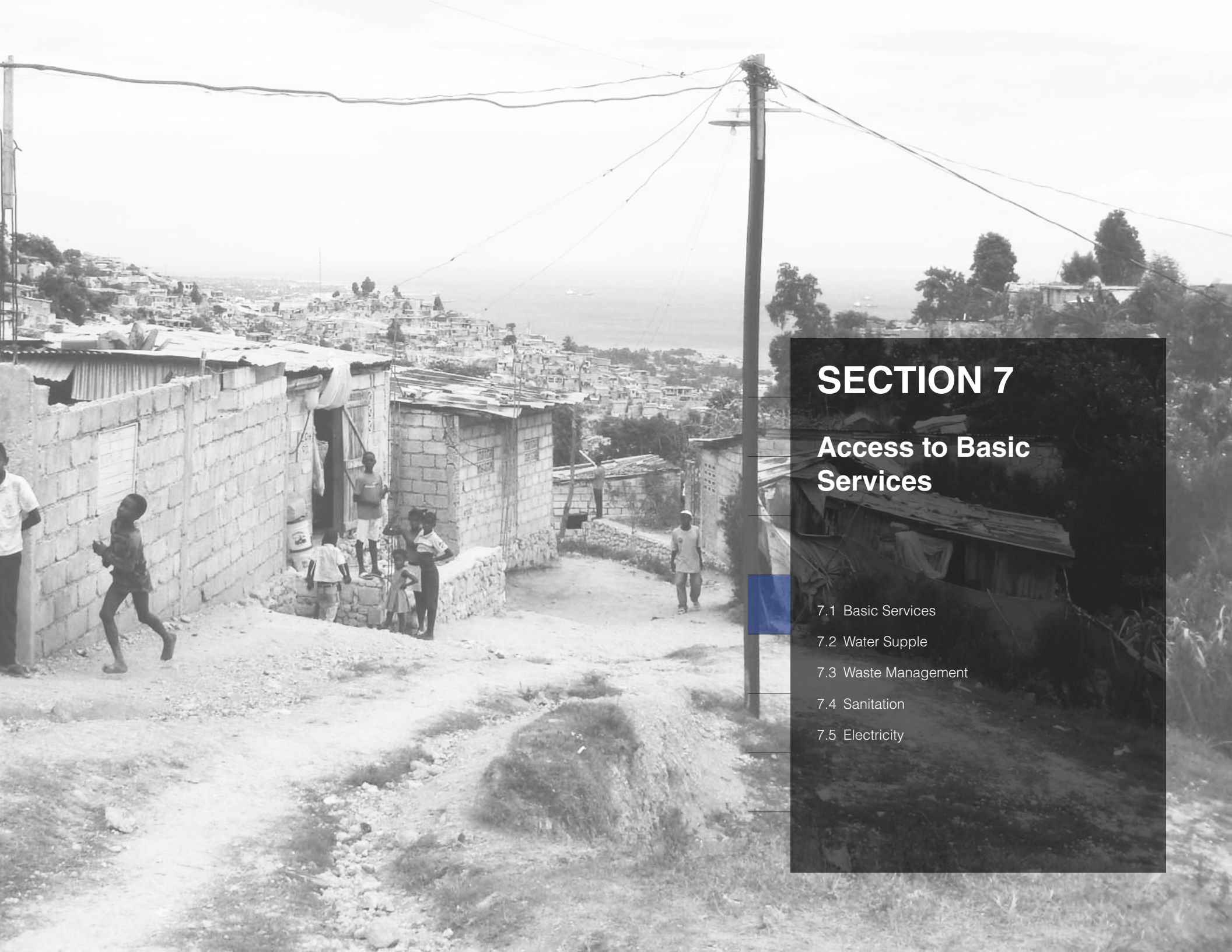
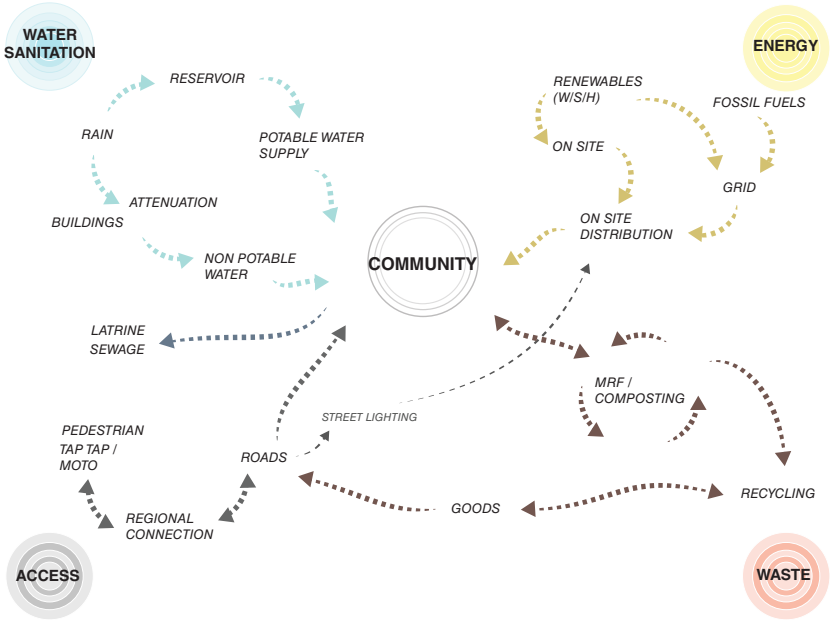


SECTION 7

Access to Basic Services

7.1
Basic Services



The interrelated characteristics of all four basic services plus accessibility

The provision of basic services to the existing and future populations of Grand Ravine is a fundamental component of the upgrading of the settlement and the realization of the Strategic Plan. Improvements in basic service provision must balance the safe development of the area, including strategies for environmental protection, risk mitigation and de-densification, accessibility and other related themes. Additionally, cost and physical/political viability as well as respect for basic human rights are prominent factors to be taken in to account in service provision strategies.

The interrelated characteristics of all four basic services, including water and sanitation, waste, energy to each other as well as to accessibility, are illustrated in the diagram above.

The overarching strategy is to increase service provision above minimum standards and to eventually reach the prescribed national standards or higher, in the neighborhood. This strategy is attainable through two phases.

a) Short to medium terms, during a period of 0 - 10 years

b) Medium to long terms, during a period of 10 - 30 years

The implementation of the current project would assure the achievement of phase one to a certain level, striving to increase its capacity and impacts for the next 10 years. However, as the 30 year plan suggests, long term strategy of increasing service provision to higher standards should be the major target for the community.

Two components define the strategies for each service,

1. Service provision systems (for example kiosks in short terms and grids or utility corridors for long terms)

2. Demand analysis

During time, alteration and modification in service provision systems and demand is inevitable and therefore this document provides guidelines and recommendations for both phases in terms of demand and systems of provision. In this respect and especially in longer terms, density projections within the neighborhood as well as socio-economic and political status of the city of Port au Prince play a prominent role.

7.2
Water Supply

Short to Medium Term Strategy

Partner organization; CONCERN, in collaboration with the relevant government department; DINEPA, is in support of extending water supply to key areas in Grand Ravine. For this reason, 6 new kiosks are to be constructed and one refurbished (7 in total) in order to be connected to a reservoir envisioned in Maranata, located on a high elevation point. The main DINEPA line on Rue Des Dalles will be feeding in to the reservoir, which will be then distributed to the 7 kiosks through gravity. The DINEPA water provided by this means will cost 1HTG per bucket (five gallons) which is half the existing price.

However, since these kiosks are mainly located in the North Western part of Grand Ravine, it is recommended to follow the same approach in the South Eastern part of the neighborhood, where other dense areas are in need of water supply. Therefore this document recommends five additional water kiosks in these areas. This implies the construction of four new kiosks and the refurbishment of an existing structure that is currently not functioning. (See the following map) One of these kiosks may be connected to the first reservoir but the other four will be connected to the second reservoir preferably also located in Maranata, with the similar system of water distribution to the kiosks through the force of gravity. An alternative to the construction of a second reservoir in Maranata is to build it on higher grounds in Bellevue 1, as shown in the adjacent map.

These Kiosks will be managed by community members. Currently the water supply in Grand Ravine is managed by a group of community members as an informal business and it only requires a process of formalization. Therefore, through a series of social engineering sessions and trainings with DINEPA, the existing group can be organized in to the “Community Water Committee”. This committee will manage the kiosks spread around the neighborhood and run the business model. The revenues will be partly spent on public matters and partly on staff income. Such social engineering schemes are critical to the ongoing success of the water project in Grand Ravine.

The number of households served by each kiosk is identified on the map. These numbers are based on densification and de-densification strategies envisioned for the next 10 years. Therefore, as the 10 year land use plan suggests, the southern parts of the neighborhood are not provided by water kiosks, promoting the future de-densification of high risk zones and areas identified for environmental protection. These areas will remain off-grid. (For more information on land use please see chapter: A Vision for Smart Growth, Section Land Use)

Further supplementary strategies such as individual household rain water collection as well as increasing affordable public water supply from the roofs of institutions with the capacity to capture more rainwater than needed, such as schools, churches and community buildings, can be promoted as water businesses. New schemes and programming should include incentives, authority and mandates, accountability relationships.

Additional strategies consist of introducing new reservoirs for rain water harvesting, up high on the hills in Southern part of the site, located such that gravity can be used for transporting water, as to provide reserve non potable water supply. Moreover, this strategy supports the hydrological risk reduction schemes, by reducing the water volume and velocity, downhill and at the same time the water would be a suitable supply for agricultural activities in the Southern neighborhoods. However, any large rain water harvesting projects should be developed in consultation with DINEPA.

Water Demand Analysis

The following provides water demand analysis based on the number of households which have access to each water point. The number of households per each water point is based on the projections of the 10 years density plan. (See chapter; A Vision for Smart Growth, section Density) This is due to the fact that the water supply system of kiosks is envisioned for the short to medium terms up to 10 years.

Rather than each sub-neighborhood, the demand analysis is made for each water point, especially because in 10 years the inner movement of people is going to make the sub neighborhood boundaries less important. Therefore, the 24 hour storage requirements of each water point, number of spigots, maximum queuing time in addition to the capacity and size of both reservoirs are provided in the following charts. The aim is to reach the minimum standard of 60 liters per person per day in medium terms, as previously mentioned in the diagnostic. This amount is composed of 20 L of potable and 40 L of non-potable water. (See Diagnostic Chapter 4, Section 05, Water).

However, in short term, the current system of kiosks and water flow rate, limit the possibility of providing the inhabitants with this amount of water. The flow rate of 0.25 L/s is a standard from the DINEPA guidelines on kiosk design (DINEPA website, working paper 1.2.3.). DINEPA recommends a service provision of 20 buckets per hour, which takes into account inefficiencies from the transaction (purchasing, changing buckets, queuing, etc). Using the two DINEPA standards, 20 buckets per hour and 250 people per spigot, one can calculate the estimated minimum service provision or supply. Though, the one variable is number of hours of operation. Assuming 14 hours of operation (6am to 8pm) the estimated supply is 22.4 liters per person per day.

It is useful to think about water consumption from both a supply and a demand perspective. Therefore, even though the target set in this document is the provision of minimum of 60 L/person/day in 10 years or medium terms, with the current system of supply, DINEPA sets a provision target to meet a minimum demand expectation of around 20L/ person/ day which is recommended as the short term supply.

Employing the standard kiosk design from DINEPA 1.2.3 results in a normalization of spigots and tanks. Each kiosk has 4 spigots and a tank with 7.7 m^3 storage capacity.

-diameter: 2.4 m -height: 1.9 m -freeboard: 0.2m
-usable height: 1.7 m -kiosk tank: 7.69 m^3
-4 spigots per tank (DINEPA 1.2.3)

In this case several standard kiosks would be located at each water point, introducing 12 water stations (See table below). In this case around 575.469 m^3 of water needs to be reserved in both reservoirs.

Reservoir 1: 413.137 m^3
Reservoir 2: 162.331 m^3

Nevertheless, with an alternative kiosk design, the demand can be supplied in only 12 kiosks. Specialy designed kiosks can be installed at each of the water points, which can be tailored to the demand needs at each water point. The DINEPA standard kiosk includes 4 spigots and a tank. Since the water points will require a large number of spigots, a single larger kiosk would be more cost effective than multiple kiosks. The alternative scenerio with designed kiosks, would have a corresponding tank sized in proportion to those demands (or multiple 10m3 tanks). This alternative allows for smaller reservoirs since each kiosk has higher tank capacity. (See Table below)

Total: 540 m^3 (remaining for reservoirs)
Reservoir 1: 390 m^3
Reservoir 2: 150 m^3

Storage requirements for the system are based on supplying the daily demand if the system has to be taken off line for one 24 hour period. The storage is split between primary reservoirs and tanks built into the kiosks at the water points.

The two previous tables present a regular orderly collection system which operates continuously during the day. However, in order to reflect the reality of collection one should consider peak hours and demand. People collect water at specific times during the day, namely, early morning and early evening. Households collect 80% of their water needs during this 6 hour time e.g. 6am to 9am and 3pm to 6pm. Thus, during each peak hour, with 120 L/HH, 19200 buckets is expected to be collected at all 12 kiosks, requiring 320 spigots in total to handle this amount. These estimations are to provide an understanding of the large demand and the necessary equipment and structure to accommodate such numbers if the minimum 60L/person/ day was to be met.

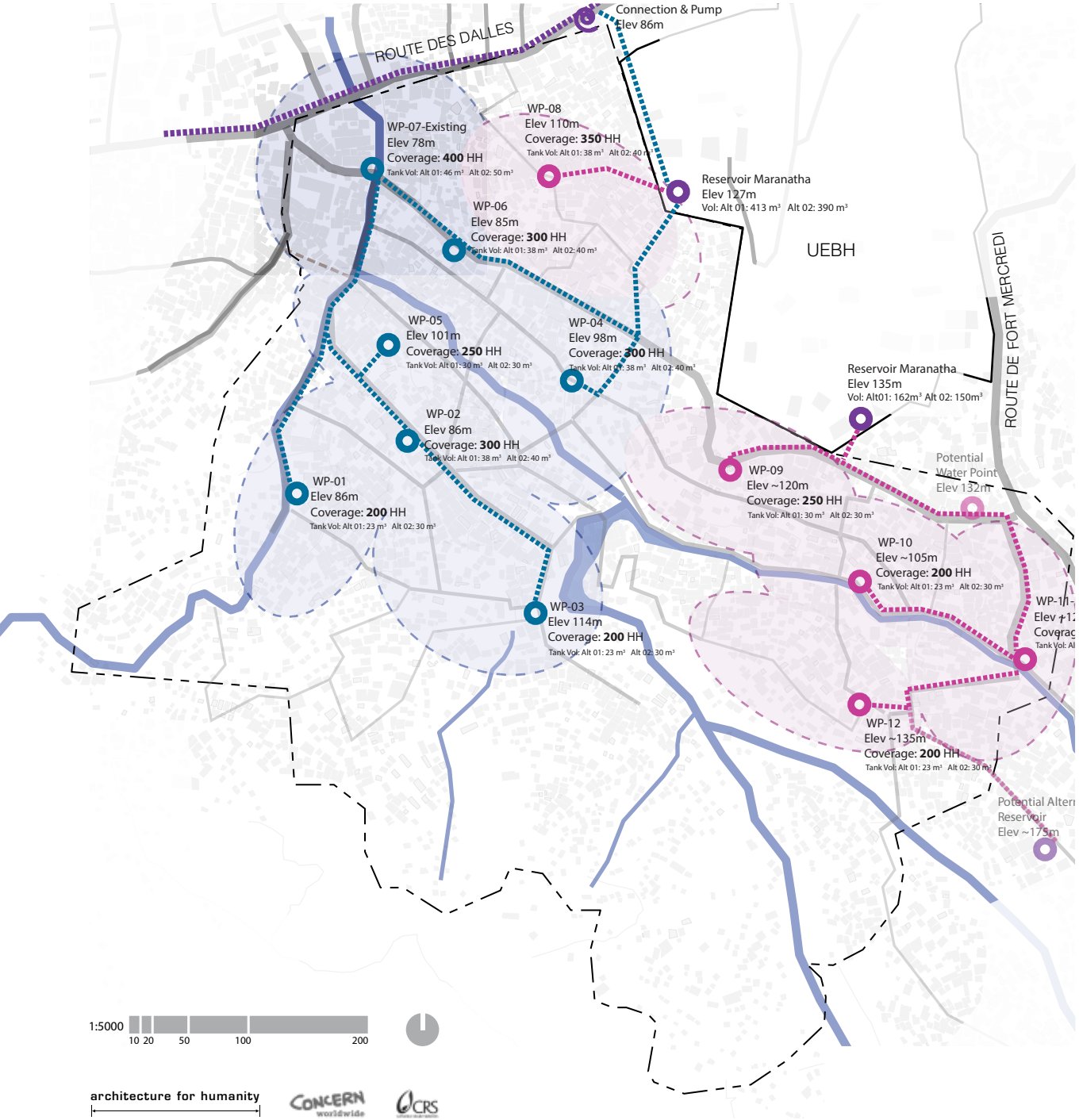
Water provision and munimum number of spigots in each water point based on DINEPA requirements

-Flow rate: 0.25 L/s (Dinepa 1.2.3) - Buckets per hour: 20(Dinepa 1.2.3)
- Number of people per spigot: 250 people max (Dinepa 1.2.3)

WP	Coverage (HH)	Persons	Min number of spigots	Buckets provided per day	L per person per day
1	200	1000	4	1120	22.4
2	300	1500	6	1680	22.4
3	200	1000	4	1120	22.4
4	300	1500	6	1680	22.4
5	250	1250	5	1400	22.4
6	300	1500	6	1680	22.4
7	400	2000	8	2240	22.4
8	350	1750	7	1960	22.4
9	250	1250	5	1400	22.4
10	200	1000	4	1120	22.4
11	250	1250	5	1400	22.4
12	200	1000	4	1120	22.4
Totals:	3200	16000	64	17920	

Water demand analysis at each water point to meet 60 L per person per day requirement, both alternative kiosks are presented

WP	Coverage (HH)	# ppl	Buckets per day	Kilo-liters per day (KLD)	# spigots required	Max # ppl queueing / hr (30 min wait)	# ppl per spigot	Alt 01 # Std Kiosks	Alt 01 Std Kiosk tank (m^3)	Alt 02 # designed Kiosks	Alt 02 Designed Kiosks tank (m^3)
1	200	1000	3000	60	11	88	91	3	23.1	1	30
2	300	1500	4500	90	17	136	89	5	38.5	1	40
3	200	1000	3000	60	11	88	91	3	23.1	1	30
4	300	1500	4500	90	17	136	89	5	38.5	1	40
5	250	1250	3750	75	14	112	90	4	30.8	1	30
6	300	1500	4500	90	17	136	89	5	38.5	1	40
7	400	2000	6000	120	22	176	91	6	46.1	1	50
8	350	1750	5250	105	19	152	93	5	38.5	1	40
9	250	1250	3750	75	14	112	90	4	30.8	1	30
10	200	1000	3000	60	11	88	91	3	23.1	1	30
11	250	1250	3750	75	14	112	90	4	30.8	1	30
12	200	1000	3000	60	11	88	91	3	23.1	1	30
Total	3200	16000	48000	960	178	1424		50	384.5	12	420



Map: Water Points; Short to Medium Term

Legend

- Project Boundary
- Existing Ravine
- Main DINEPA connection from Route des Dalles
- Connection from reservoir to water points
- Connection from reservoir to water points
- Connection point to the main line and pump station
- Proposed Reservoirs
- Potential alternative reservoir
- Water points proposed by CONCERN
- Additional water points proposed by AFH
- Potential additional water point
- Area of coverage by CONCERN proposed water points
- Area of coverage by AFH proposed water points

WP	Water Point
Elev	Elevation
HH	Households
Vol	Volume

architecture for humanity CONCERN worldwide CRS

Long Term Strategy

The demand analysis for short to medium term reveals that a household water provision is a method more appropriate than a kiosks system, especially in longer terms, aiming to provide the inhabitants with higher amount of water supply. Even at the minimum standard of 60 Liters per person per day, the large volume of kiosks' water tanks, high numbers of spigots required and of course the physical limitations of carrying the jerry cans, etc. all reveal the benefits of introducing a water grid. Phasing the strategies would allow the systems to adapt to the circumstances as required and apply the appropriate alternative according to the implications of time. The following phases are suggested in this document

1.Short terms (current project): Kiosk system with minimum or lower amount of water supply, managed by the community committee

2. Medium terms (10 years):

a) The application of designed kiosks as mentioned above.

b) Decentralized grid system, house to house provision with inner community reservoirs, managed by the community committee

3. Long terms (30 years): Centralized grid system, house to house provision connected to the city water supply network

Aligning the governmental aims, utility capacity and strategic planning is central to maximizing appropriate coverage and public health outcomes. Therefore, the long term approach in providing the community with standard amount of water supply, is introducing a water network connected to the city grid which is informed by other strategies in the master plan such as densification in proposed areas, environmental protection and access plan. In long terms, the aim is to increase the amount of water supply to a higher standard of 120Liters per person per day. A centralized water network is more cost benefit in this case.

Based on the Framework and Access plan a network of utility corridors are designed as conduits for water supply. These utility corridors contain water pipes, sewage systems and perhaps electrical wiring. Based on the projections on 30 year access plan, the neighborhood is divided to a number of urban blocks -roughly 15- each fed by a hierarchical set of utility corridors. By this means each household would have an individual connection to the network. Water pipes' sizes range from 200mm for the main connections to 50mm for the narrower inner neighborhood connections.

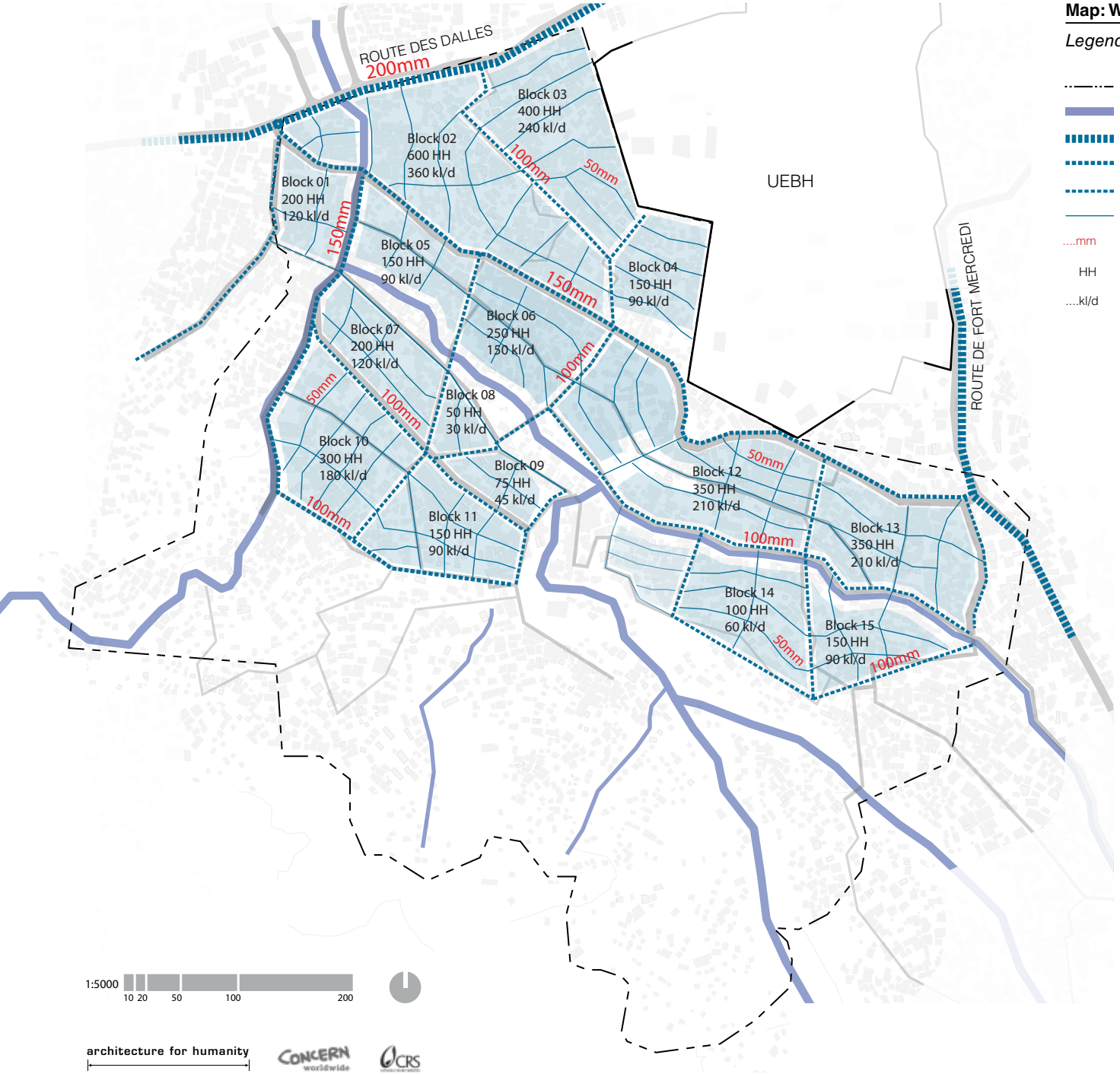
According to the projected density and number of households in 30 years, water demand is calculated in each urban block is calculated in the chart below and illustrated in the adjacent map. The amount of supply determines the specifications of the utility corridors and pipe sizes. It is worth noting that the diagrammatic map displays the concept of the strategy and requires more in depth adjustments, based on time and implementation implications, to further reflect the realities. Potential reservoirs and pumping stations are not shown.

30 years projected demand liters (L) per person: 120L/person/day
Waste water back into system: 90%
Total daily water demand: 2.1 MLD (Million liters per day)
Number of people per household: 5

Long Term demand assumptions in each urban block

Block	Cover-age (HH)	#ppl	L/day	Local Storage m^3	Total waste water (L)	Waste water (L/HH)
1	200	1000	120000	120	108000	540
2	600	3000	360000	360	324000	540
3	400	2000	240000	240	216000	540
4	150	750	90000	90	81000	540
5	150	750	90000	90	81000	540
6	250	1250	150000	150	135000	540
7	200	1000	120000	120	108000	540
8	50	250	30000	30	27000	540
9	75	375	45000	45	40500	540
10	300	1500	180000	180	162000	540
11	150	750	90000	90	81000	540
12	350	1750	210000	210	189000	540
13	350	1750	210000	210	189000	540
14	100	500	60000	60	54000	540
15	150	750	90000	90	81000	540
Total	3475	17375	2085000	2085	1876500	

In areas identified as new housing development or sites and services, in order to represent a show-case for the future of the neighborhood, a utility grid, corresponding to the proposed larger long term neighborhood network, is recommended to be implemented in the current project. By this means the short term interventions resemble long term strategies, facilitating future interventions and modifications, ready to grow and scale up to the entire neighborhood.



Map: Water Supply Grid; Long Term Strategy (30 Years)

Legend

- Project Boundary
- Existing Ravine
- Main DINEPA connection from Route des Dalles
- Primary inner community connection lines
- Secondary connection lines
- Tertiary connection lines
- ....mm Pipe size ranges
- HH Households
- ....kl/d Water demand in each of the 15 urban blocks, Kilo Liter per Day

architecture for humanity CONCERN worldwide CRS

7.3
Waste Management

Short to Medium Term Strategy

Considering the existing methods of waste disposal in Grand Ravine, as households mainly dump their waste in ravines or burn it, causing serious health problems, as mentioned in the Diagnostic (Chapter 04, Section 5.3. Waste), setting up a waste collection service in the neighborhood is essential. In fact according to the CAP survey carried out by partner organization CONCERN, 95% of households consider such service, necessary.

A collection service managed by a community-led enterprise is introduced by CONCERN, as the main strategy for solid waste management in Grand Ravine. As mentioned in the Diagnostic Section 5.3. Waste, according to the CAP survey, around 60% of the respondents indicated that they are willing to pay less than 50 HTG a month for the trash collection service. Therefore, this system can become a business model, managed by a "Community Waste Management Organization" called ACHKO, with collectors and other staff being members of the community. CONCERN has developed a detailed waste management model by comparing three different scenarios and identifying the viability of business to become self-sufficient. The final proposal is a door to door collection model, where the collectors then sort and separate the waste to organic and non-organic materials at a Waste Center and finally valuate the recyclable materials. Plastic waste (non-biodegradable) can be sold to recycling companies such as Tropical Recycling, ECSSA recycling, and metal residues to companies such as GS industries. Finally, biodegradable waste is turned into compost, which can be sold on the market for suburban and rural agriculture in bags of 30 kg. (Source: CONCERN, Étude de marché sur les filières de déchets solides dans la zone de Grand Ravine, Jan 2014)

The current document likewise, suggests that a waste separation and recycling scheme should be emphasized in this model. However, it recommends at least three kiosks, dispersed around the neighborhood, in which the sorting and separation of the trash takes place (See the following map). This will decrease the transportation time between houses and the kiosks, considering the topographical characteristics of the neighborhood and conditions of the pathways. It also reduces the amount of trash that needs to be collected and sorted in each kiosk comparing to introducing one center. Additionally, this scheme is flexible in a way that it has the opportunity to be converted to a different scenario, where households bring their own waste to the kiosks as a voluntary contribution, in case a shift in scenarios is required during time.

Furthermore, in the CAP survey 30% of the respondents declared that they don't know whether they are willing to pay for a waste collection service or not. Thus, the model should allow for some flexibility and not entirely rely on full household contribution. The following paragraphs provide a rough estimation of the economic viability of the waste management scheme if the household contribution is not in place.

The income generated from selling recyclable and compostable waste can be used to operate and maintain the collection plan, perhaps without user financial contribution. The amount of trash generated by each neighborhood varies according to the population density. Additionally the densification strategies for the next 10 to 30 years affect the waste production patterns across the neighborhood as well as the overall amount of waste generated in Grand Ravine, considering the population growth (See chapter A Smart for Vision for Growth, Section Land Use and Density).

Hence, the collected waste will be separated by the staff at the kiosks, to organic, recyclable and non-recyclable materials and only the latter needs to be collected by the SMCRS trucks and thus will be taken to the dumpster locations at the two main gateways of the neighborhood. (See the following map)

As mentioned in the Diagnostic, currently with around 20,000 inhabitants in Grand Ravine and at least an average 0.5 kg of waste generated per person per day, more than 10 tons of waste is produced daily in Grand Ravine. (See Diagnostic, Chapter04, Section5.3 Waste)

73% organic: 7.47 T

10% cardboard, paper, tissue: 1.02 T

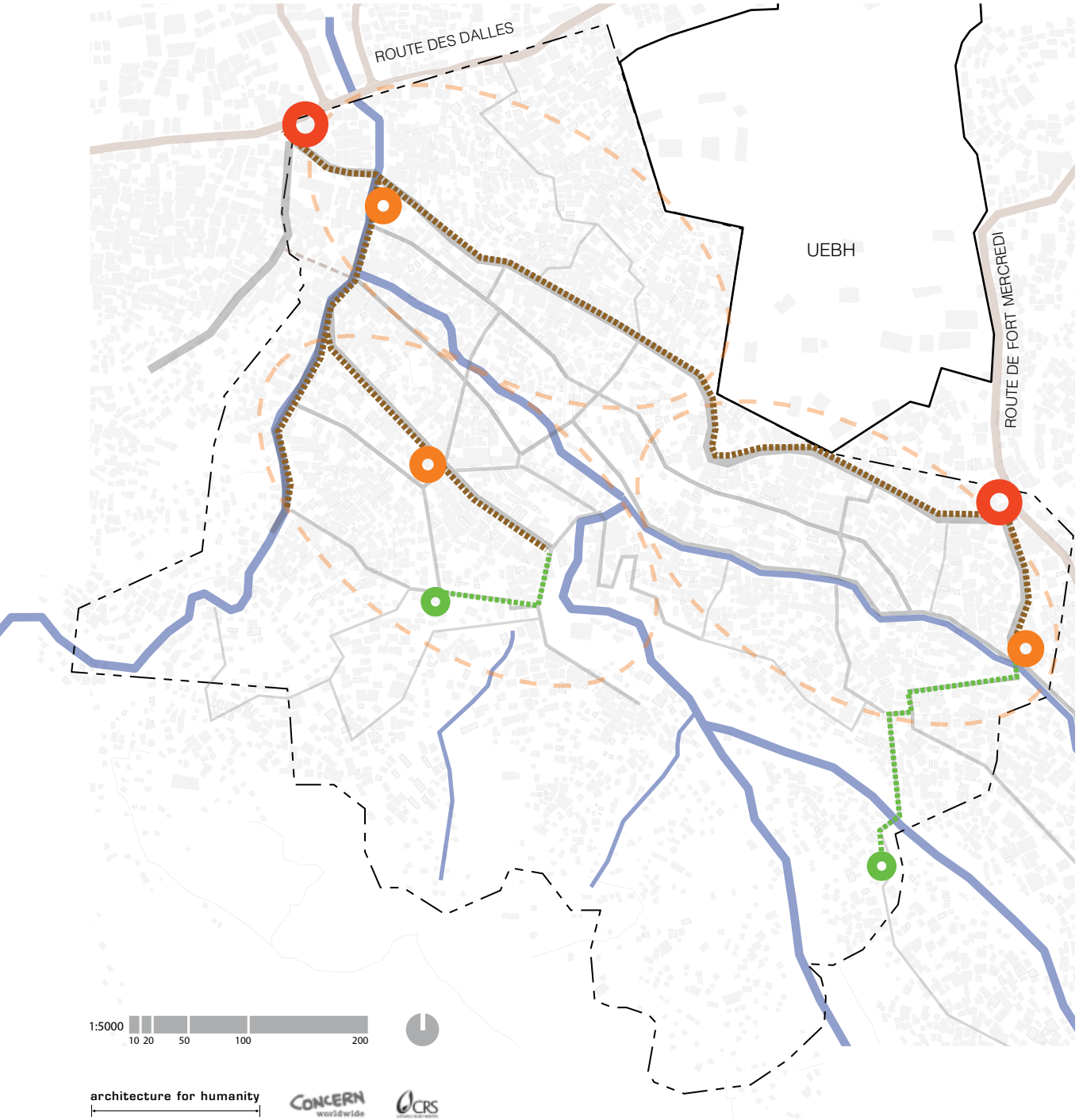
6% plastic: 0.61 T

3% metal: 0.30 T

8% other: 0.8 T

Therefore only 0.8 tons of waste needs to be collected by SMCRS trucks from the dumpster locations, while most of the other types of waste could be recycled or composted.

As mentioned in the report by CONCERN recyclable materials could be sold to the relevant recycling



Map: Waste Management; Short to Medium Term

Legend

- Project Boundary
- Existing Ravine
- Truck Collection Route
- Cart Transportation Route
- Proposed SMCRS Dumpster Locations
- Proposed Recycling/Waste Kiosk
- Proposed Potential Composting Sites
- Areas covered by each waste collection team from the kiosks

architecture for humanity CONCERN worldwide CRS

companies. Considering only the plastic waste as an example, the revenue would be close to sufficient to manage the small business. However, other recyclable materials such as paper and metal in addition to an abundant amount of organic waste suitable for composting will add to the following estimations.

ECSSA (Environmental Cleaning Solutions S.A.) a recycling center in Haiti pays specific amount of money in exchange for recyclable materials mainly plastic items. With an average of 6.5 HTG per kg of plastic items if the recyclables are collected by the recycling center team from a central location in the neighborhood, around 4000 HTG or $100 of revenue per day ($3000 a month) could be made only by selling plastic materials to this company. The daily minimum wage in Haiti is 200 HTG or $5, meaning the model can afford several staff members. Supplementary revenues from selling compostable materials may be added to this number, further ensuring the financial sustainability of this model. Three kiosks are proposed across the neighborhood, each employing a few staff members that are responsible for the collection and separation of the waste in the kiosks. This does not account for any transportation costs or overheads.

Rough Estimations of the Size of the Kiosks

With the collection being regulated to once a week, 70 tons of waste needs to be separated in the three kiosks.

Approximate garbage density = 0.5 T / Cubic meters (source: www.reade.com, advanced materials)

The volume of the waste in one week = 140 m3 of solid waste in total or around 45m3 in each kiosk

The kiosk should be at least around 50 m2 to 100 m2 with the height of at least 3m. (Depending on the sorting required, may need up to double this clear height).

The above calculations are merely to provide a conceptual understanding of the proposed waste management scheme. For more specific analysis, further studies, local surveys and market assessments are suggested. It is also worth noting that uncollected waste should be considered when calculating income generation and at the same time a multiplier should be added for total waste production when considering potential collection demand. Additionally, with population growth and further development in the neighborhood, an increase in waste production is expected.

As a final point, expanding this model to the public sphere is highly recommended. Each kiosk is responsible for the cleaning and maintenance of the public spaces and streets of their allocated area. The main activities of the assigned personnel are sweeping the main streets and pathways as well as cleaning public spaces, playgrounds, etc.

SMCRS truck collects the trash from the main dumpster locations


People already recycle plastics in Port au Prince

Medium to Long Term strategy

The proposed waste management scheme can evolve through time where in medium to long terms, the recycling process occurs at the household level and the collectors would pick up the already separated waste from the households. This is only achievable through awareness raising and training campaigns initiated by the Community Waste Management Organization or ACHKO and also the City of Port au Prince.

Furthermore, raising awareness and creating a new behavioral pattern is critical to obtaining a clean and better maintained public space.


A clean public space as well as domestic waste collection, is the objective of the waste management system in Grand Ravine

7.4
Sanitation

Short to Medium Term Strategy

CONCERN proposes a customer driven scheme providing a range of choices of sanitation solutions for the inhabitants to receive a subsidy on their chosen option. In this scheme the inhabitants are treated as clients rather than beneficiaries, increasing the sense of ownership of the project. The presented options consist of five different typologies of sanitation solutions as follows,

a. Private open pit latrines: This is the most economically viable option. However, since according to DINEPA standards it cannot be dislodged, it is less promoted. Due to the risks of underground water contamination as well as the difficulties in maintenance this option is not recommended by this document.

b. Private lined pit latrines: This option is highly promoted by CONCERN, as the priority model.

c. Private pour flush toilet: It requires 3L of water per flush and connects to a pit or septic tank. Especially in social clusters, it is recommended to group the septic tanks of up to 4 families together and provide different chambers in one tank. This document highly recommends this option, since it considers the shortage of water while providing a better quality of sanitation and a practical maintenance solution.

d. Multi-family bathroom unit: It includes a pit latrine, urinal and a shower connecting to a septic tank. This option can be modified to different combinations. This model can be upgraded to a wet toilet by reusing the water from the shower to flush the toilet. Additionally, these units can be grouped together and share a septic tank and construction materials, corresponding to the idea of social clusters. Therefore, during the application process, a collective request of households would make this option more affordable.

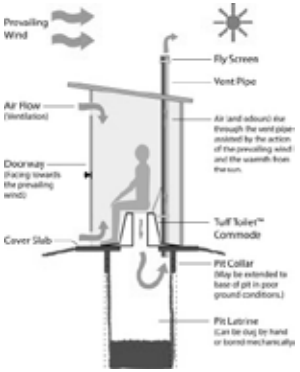
e. Ecosan: (This is a complicated option especially in terms of maintenance and it is recommended where the water table is high)

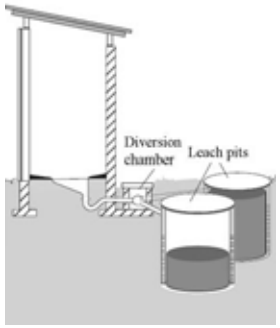
- Flushing toilets suggested by new housing designs, is also included in this model as an option, to provide equal choices to the clients. However, unaffordability of the original product and water shortage are the main barriers for this option.

Septic tanks are proposed in three of the above sanitation solutions. It is recommended to construct one septic tank per each social cluster rather than for individual households. However, adequate space for septic and leach is required. Calculation of space for septic and leach for 4 families would be 15-20m2 (including setback) which would be difficult to incorporate in current densities. However, such space should be considered in any new housing development project in Grand Ravine.

The initial target in CONCERN's program would provide 234 households with a toilet. However, the short to medium-term strategy is to reach the DINEPA standard of one appropriate toilet per four families (that is 1024 toilets with the existing population) and in long terms to have one toilet per each.

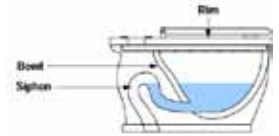
The business model for sanitation as introduced by CONCERN is goin to be maintained by a Community Micro-entrepreneur of Bayacous. Bayacous are members of the community, mobilized and trained by DINEPA, specialized in the maintenance and dislodging of the latrines. This service can be provided upon households' request.





Lined Pit Latrine

Example of an Ecosan Toilet



Pour Flush Toilet connected to pits

Source: CONCERN, Grand Ravine Sanitation Typologies Table

Medium to Long Term Strategy

The medium to long term strategy as mentioned in the previous section, is introducing a sewage network either connected to few in-situ treatment areas or connected to the city grid with centralized treatment plants. In other words, the urban blocks as previously described in the water supply section, are served by a sewage network connected to different in-situ treatment areas, if city wide sewage network is not in place. By this means each household would have an individual connection to the network. This grid consists of utility corridors and follows the global strategies designed for the neighborhood.

The sewage pipes sizes for Grand Ravine range from 250mm for the main collector pipes to 100mm for the inner street collectors (See the following map).

The in-situ treatment areas consist of baffles in the utility corridors where the sewage from each urban block is treated in an Anaerobic Baffle Reactor (ABR) system connected to a filter bed where the nutritious over-flow is filtered through the ground covered by plantations, layers of gravel and rocks.

Even though individual pits and multi-family septic tanks are proposed as short term interventions in this document, the evolutional strategy is to move towards a centralized system of service provision. Centralized service provision systems and treatment plants are more cost effective considering long term paybacks throughout the entire life cycle of the project, including maintenance and sustainable impacts. However, since in this context, such networks may not be in place even in medium terms, a more decentralized network is proposed as in-situ treatment areas, representing a more affordable and sustainable option comparing to individual septic tanks or pits. This is assuming that adequate access to water supply will be enhanced applying similar evolutionary strategies as mentioned above.

These in-situ treatment areas can be applied as medium term solutions, only if connection to the centralized city network is not in place. Such decentralized system requires significant cost incentives especially for management and maintenance. It is recommended for a specialist organization to manage interventions of this kind, otherwise potential for failure is great.

Planning Guideline

In order to correspond to the long term strategies and follow the evolutionary trajectory, a set of planning guidelines are to be followed and enforced in short term interventions in the community,

1. Phasing the project enables the short term sanitation solutions to eventually connect to the network.

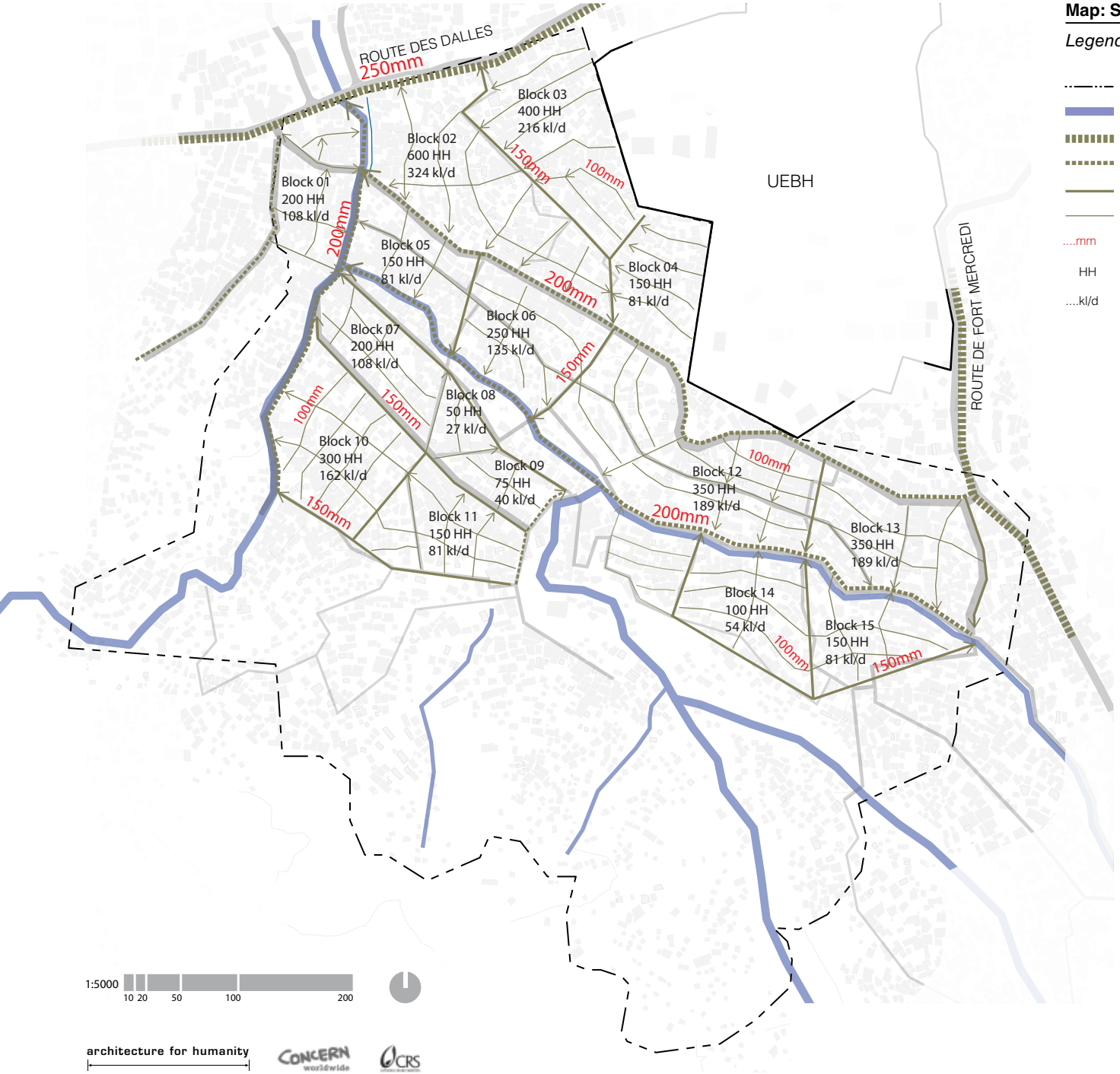
2. The latrines built in the current project, should be strategically located along the utility corridors to have the possibility to connect to the grid in the future. Therefore a careful supervision of construction quality and technique in addition to on-site inspection of latrines' location, enforcing their correspondence to the master plan is highly recommended.

3. Since the sanitation components of the project begins prior to housing implementation, the planning suggestions of this document should be taken in to account during the process of beneficiery selesction for sanitation solutions. In other words, the households currently living in high risk zones or areas identified for de-densification and from the red tagged houses, who will subsequently benefit from a housing option with a toilet, are not recommended to be prioritized as beneficiaries (or clients) of sanitation typologies. The households living in the areas identified for densification and retrofit are recommended to be the priority beneficiaries of sanitation options.

4. On the other hand, households who apply and complete their latrine units could be prioritized in selection for retrofit or expansion of their house.

5. Households collectively applying for sanitation option are prioritized beneficiaries.

6. In areas identified as new housing development or sites and services, a grid consisting of utility corridors, can be already implemented as a short term intervention. They need to correspond to the proposed larger long term neighborhood network. The sewage grid in these small to mid-sized areas can be connected to the decentralized treatment baffles as explained above.



Map: Sewage Grid; Long Term Strategy (30 Years)

Legend

- Project Boundary
- Existing Ravine
- Main sewage line on Route des Dalles
- Primary inner community sewage collection lines
- Secondary sewage collection lines
- Tertiary sewage collection
- ....mm Sewage pipe size ranges
- HH Households
- ....kl/d Waste water production in each of the 15 urban blocks, Kilo Liter per Day

architecture for humanity CONCERN worldwide CRS

7.5 Electricity

Short to Medium Term Strategy

The energy and specifically electricity shortage in Grand Ravine is a matter requiring long-term strategies and actions. Generally, it is recommended for the community to move towards more environmentally friendly sources of energy that their affordability and accessibility may be ensured by the proposed overall strategies of this planning document. However, identifying specific details and strategies about all sources of energy in Grand Ravine is out of the scope of this document. Thereby, since it is expected for electricity to become the main source of energy in this neighborhood, the following proposed strategies are mainly concentrated on electricity.

Short term strategies, for improving access to electricity for the inhabitants of Grand Ravine, mainly focus on street lighting. Exterior street lighting provides general illumination for safety and wayfinding purposes for both pedestrians and motorists. Lighting is used to illuminate buildings, landscapes and public spaces, roads and pathways and other outdoor areas. The overall perception of safety (environmental and social) is greatly affected by lighting. Illumination levels and glare / shade control are critical in improving visibility for the inhabitants and decreasing opportunities for crimes. A practical and standard street lighting design considers, lighting sources and illumination patterns, type of fixtures and other attachable elements.

In order to attain an appropriate light level, the light fixtures should be suitable for the context and dimension of space and more specifically, the width of the road or pathway, to be able to control glare and unwanted shades over the space. With light fixtures mounted at a high level, it is difficult to control glare and achieve proper illumination levels in narrow pathways. Therefore, this plan recommends two types of light fixtures to be installed in Grand Ravine,

L1: Standard roadway solar lights; often mounted to a mast arm and suspended over the roadway at a height of around 7.5 meters with illumination coverage of around 15 to 17 meters in radius (33 meters in diameter).

L2: Pedestrian-scale solar lights; usually mounted to around 4 meters or even less for narrow pathways, with an illumination radius of around 8 to 10 meters (20 meters in diameter).

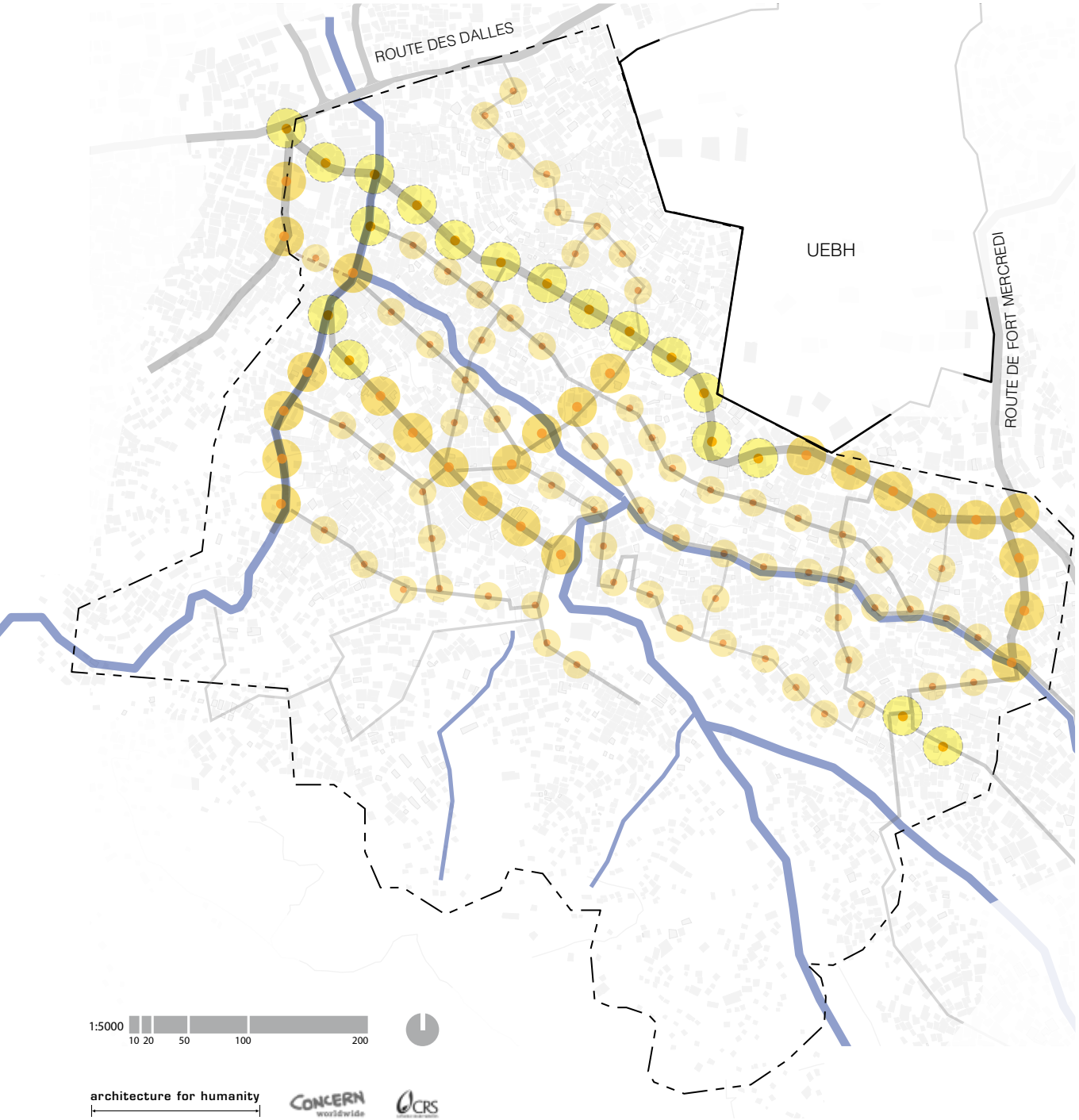
Currently, there are around 18 solar street lights in Grand Ravine mostly in an acceptable condition. However, they are not systematically distributed around the neighborhood. Therefore by relocating these fixtures according to the lighting plan, they can be reused and better distributed to improve the illumination level of the neighborhood.

In addition to the existing fixtures, in order to provide lighting only on the main access routes as proposed in the 10 year access plan, 25 fixtures of type one and 70 fixtures of type two are required. These numbers are rough estimations baed on the radius of coverage and represent the least required quantity of fixtures to illuminate up to 80% of the streets' surface. The following map illustrates the location of the fixtures.

Uneven lighting can cause dark zones or cast shadows on spaces and objects. It is recommended for fixtures to be located on the curbs of sidewalks with a uniform distance. This distance should be about 16.5 meters (the coverage radius) in fixtures of type one and around 10 meters for type two fixtures. Where sidewalks include a green space with street trees, the fixtures should be located in between the trees in a way that the tree canopy does not block the illumination coverage. Other components such as wayfinding elements, informing placards, etc. could be attached to the fixtures.

A limited number of these solar street lights can include a component or a station to charge mobile phones or other small electric devices of the inhabitants. These stations, distributed around the neighborhood, are decentralized and localized sources of electricity and as practice has proven, it is common for the people from the community to take ownership and manage each station. Therefore, it is recommended to create and train a community committee prior to installations and formulate a business model in which committee members, maintain the fixture and manage the amount of electricity usage and make sure the stations are not over used and the lights still function during the night. The funds accumulated from selling the electricity, may be used as fees for the committee members and the maintenance costs of all street lights.

Similar to other basic services, it is not recommended to install street lighting in the Southern parts of Grand Ravine which are identified for de-densification and environmental protection. Through this strategy further development in high risk zones and protected areas is discouraged and de-densification is promoted.



Map: Street Lighting; Short Term

Legend

- Project Boundary
- Existing Ravine
- Existing fixtures, Relocated
- Typology one fixtures (33 Diameter)
- Typology two fixtures (20 Diameter)

Existing: 18 fixtures (relocation required)

Type One: 25 fixtures

Type Two: 70 fixtures

architecture for humanity

CONCERN worldwide

CRS

Example of type one solar street lights. Higher fixtures with larger illumination area, suitable for wider roads and streets.

Example of type two solar street lights. Shorter fixtures with smaller illumination area, suitable for pedestrian walk ways and narrow pathways.

Medium to Long Term Strategy

The long term objective is to provide all the households with electricity, specifically in areas identified for densification. Utility corridors as mentioned in the previous basic services represent the routes for electricity provision. As all EDH connections in the city are overheads rather than a sub soil conduit, the same model is proposed here. The following map illustrates the conceptual electricity grid and hierarchies to be considered in the long term. The overheads should follow updated EDH requirements and guidelines depending on the time of implementation.

Map: Electricity Overheads Network; Long Term Strategy

(30 Years)

Legend

- Project Boundary
- Existing Ravines
- Regional Access Routes
- Primary Access Routes
- Secondary Access Ways
- Tertiary Access Ways