Moving into the Future?

Opinion/Commentary on the

Greater Vancouver Zoo

June 2019

Prepared for the Vancouver Humane Society

www.vancouverhumanesociety.bc.ca

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Contents

1. Introduction

During the past two decades the Greater Vancouver Zoo (GVZ) has been subject to several reviews by animal welfare organizations. These reviews were followed by reports that identified issues of concern, and provided recommendations for making improvements to animal housing and care. The last report was published in 2008. Since the GVZ has periodically been in the news media and has been subject to protests and other activities by local animal welfare groups since that time, the Vancouver Humane Society (VHS) and Zoocheck decided to conduct a limited review of the facility once again.

This report will provide some general commentary, discuss a number of issues identified during three separate visits to the GVZ in 2018 and provides recommendations regarding how to address them. It should be noted that this review did not examine aspects of the zoo operation that required special access or information not readily available to the visiting public, nor does it look at other kinds of programs the zoo may be involved in. It should also be noted that prior to the visit in November 2018, a meeting was requested with the zoo owners and/or management but they declined the request. Meeting requests were also made in July 2019 but those also received no response.

Preparation of this report involved a review of previous reports, recent and past news articles, internet sources and scientific literature. A brief summary of the GVZ's history can be found in section two, while section three presents some of the observations and findings of the 2018 visits and subsequent opinions and recommendations. The final section concludes this report and presents a brief commentary about how the GVZ can move forward into the future

2. Greater Vancouver Zoo Reporting Timeline

The Greater Vancouver Zoo is located at 5048 - 264th Street in Aldergrove, British Columbia on a property of 120 acres. The zoo was initially a game farm, but this changed in 1995 when the facility was acquired by new owners. The facility name was changed to the Greater Vancouver Zoological Centre. According to the website GVZoofacts[1], many of the animals at the time came from the Stanley Park Zoo which closed in 1997 (Isbister, 2018). It was that year that the first two reports about the GVZ were published by Vancouver Humane Society and Zoocheck Inc. Table 1 below shows the identified issues and corresponding recommendations.

Table 1. Key issues and recommendations identified in 1997.

Key Issues	Recommendation
Display of abnormal behaviours due to lack of stimulation and/or opportunities to perform natural behaviours.	- Expand enclosures to provide more space for the animals. - Develop a short- and long-term enrichment program. - Provide species-specific enrichment to allow for and stimulate natural behaviours (including, provision of natural substrates and increasing enclosure complexity).
Inappropriate housing of social species.	- House animals according to their natural social needs.
Water-logging and dampness of enclosure substrates.	- Construct dry areas in enclosures that are water-logged which can be used by all animals.
Breeding practices and number of various species.	- Reduce animal collection. - Stop breeding.
Condition of enclosures and/or shelters.	- Repair or rebuild enclosures that are in poor condition. - Provide species-appropriate climate in each enclosure.

The zoo was sold in 1999 and renamed the Greater Vancouver Zoo. GVZoofacts reported that the new owners continued to expand their collection through breeding and acquisition of animals from external sources (Isbister, 2018). The GVZ also invested in infrastructure and visitor facilities.

In 2003, the VHS in collaboration with Zoocheck Inc., published a second report about the GVZ. Key issues and recommendations are listed in Table 2.

Table 2. Key issues and recommendations identified in 2003.

Key Issues	Recommendation
Display of abnormal behaviours due to lack of stimulation and/or opportunities to perform natural behaviours.	- Expand enclosures to provide more space for the animals. - Provide species-specific enrichment to allow for and stimulate natural behaviours.
Inappropriate housing of social species.	- House animals according to their natural social needs. - Do not display wolves and bears in the same enclosure.
Water-logging and dampness of enclosure substrates.	- Construct dry areas in enclosures that are water-logged which can be used by all animals.
Breeding of exotic animals.	- Stop breeding. - Focus on native species instead of exotic animals.

Many of the concerns highlighted in the 2003 report seemed to remain unaddressed. In 2004 the GVZ "lost" its accredited status with Canada's Accredited Zoos and Aquariums (at the time called the Canadian Association of Zoos and Aquariums). In that same year, after a campaign by Zoocheck Inc. and

[1] GVZoofacts was taken offline in 2019.

the VHS, the zoo moved their only elephant to a sanctuary in the United States. Also, in 2004, a baby hippopotamus was added to the GVZ collection. Inadequate housing arrangements for this hippo led to animal cruelty charges being laid by the British Columbia Society for the Prevention of Cruelty to Animals (BCSPCA) (Sonnex, 2006). Reportedly the charges were dropped when the zoo agreed to construct better hippo accommodation.

Another short report on the GVZ, incorporated in a larger report about several British Columbia zoos, was published by the VHS and Zoocheck Inc. in 2008. The issues identified were similar to those highlighted in 2003, including lack of space, lack of enrichment, inappropriate social housing, water-logging of exhibits and the lack of proper winter housing. It was noted however that a number of significant improvements had been made in the housing of several animals (e.g., elk, wild pig and some of the big cats).

While the GVZ moved forward with a number of changes, they also drew criticism for a number of high-profile animal deaths that were featured in local media. Between 2003 and 2015 the deaths included four giraffes, four zebras, two hippos and two Siberian tigers.

In 2015 the zoo changed hands again. According to the *Langley Advance Times*, the new owner had meetings with the zoo-design company Bernard Harrison and Friends to develop a 20-year plan for the zoo (Ferguson, 2015). In November 2017 information in the *Surrey Now-Leader* stated that the zoo is planning on renovating the entry buildings and parking lot (Gathercole, 2017).

According to the GVZ website the zoo currently houses 140 species (Greater Vancouver Zoo, 2019). This is a slight increase over the 126 species back in 1997. A summary of the recommendations and conclusions of previous reports can be found in Appendix A. An overview of the zoo's current animal collection can be found in Appendix B.

3. Key Issues

Onsite visits to the GVZ occurred on March 25 and November 29 -30, 2018. It was raining and approximately 15°C during the first visit and cloudy with temperatures between 5-10°C during the second and third visits. All visits occurred during regular opening hours with each being 2.5 – 5 hours in duration.

Issues identified during the three visits have been put into two categories. First, species or taxa-specific enclosure concerns (Section 3.1) that may impact animal welfare and, second, broader, systemic issues that occur, to one extent or another, on an institution-wide basis (Section 3.2).

3.1 Species specific concerns

3.1.1 Raptors

A long, low complex of cages beside the bird-show arena house one North American Kestrel, one Turkey Vulture, one Great Horned Owl, one Great Grey Owl, one Red Tailed Hawk, one Harris Hawk and one Kookaburra (a kingfisher type bird native to Australia and New Guinea) (Appendix C, Figure C.1). The zoo also has two Bald Eagles on display in a larger flight cage. Their housing is not subject to commentary.

The individual raptor enclosures are estimated at ±24m²; ±8 meters in length, ±3 meters in width and ±2.1 meters in height. Approximately ¼ of the enclosure complex is comprised of a keeper area not available to the birds. A cookie-cutter design approach has been utilized with the cages, all being the same and outfitted with similar furnishings, such as a few natural branches, tree stump(s) and a container of water, but little else. There was little or no ability for the birds to engage in flight beyond a few wing flaps.

Leading zoo associations advocate for exhibits that allow for and stimulate natural behaviours (European Association of Zoos and Aquaria, 2008; Mellor, Hunt, & Gusset, 2015). That should be a goal the GVZ pursues for all of its live collection. For the raptors, physical and psychological welfare enhancement can be facilitated by substantially reducing restrictions on natural movements and behaviours.

A core aspect of the lives of the majority of birds is flight. It is a gateway to significant facets of a bird's normal life, such as foraging or hunting, nest siting and construction, locating breeding partners, and evading predators, to name just a few. Many of the raptors at the GVZ are known to cover substantial distances in the wild. Harris's Hawks for example, are known to cover ranges up to 5.5km² (Truglio, 2003). Migrating turkey vultures have home ranges of 340km² (DeVault, Reinhart, Brisbin Jr., & Rhodes Jr., 2004) and can soar in the air for up to 6 hours (Adirondack Wildlife Refuge & Rehabilitation Center, 2018). Denying birds the opportunity to engage in their primary method of locomotion, as well as all of the behaviours that result from it, as well as their ability to make choices and to exercise some control over their daily lives may negatively impact their quality of life and welfare. The housing of flying birds should be informed by what is known about each species' natural biology, behaviour and lifestyle in its natural state.

Providing flying birds kept in captivity with flight opportunities may require devoting more space and utilizing different styles of enclosure design, but it is achievable for most birds, including raptors. It has been argued that captive birds are prone to injury when attempting to fly and therefore should be kept

in restricted spaces to discourage them from flying. Research has shown however that restricting flying behaviour in birds can lead to an array of issues, including but not limited to, deteriorating physical fitness, boredom, frustration, stress and increased risk of illness (Bateson & Feenders, 2010; Duncan & Hawkins, 2010; Conway, 2011). In summary, birds need to fly to remain healthy. In order for the GVZ to accommodate the birds the following changes are recommended:

- Each individual bird needs to have free access to sufficient space to allow them to fly and exercise. The European Association of Zoos and Aquaria (EAZA) supports the housing of birds in flight cages whether or not birds participate in flight demonstrations (Habben & Parry-Jones, 2016). It is recommended to adapt enclosure standards used by the Owl Foundation (The Owl Foundation, 2013) in combination with the minimum standards created by the EAZA Falconiformes Strigiformes Taxon and Advisory Group (Habben & Parry-Jones, 2016).

At the Owl Foundation enclosure sizes vary anywhere from 25 × 1.20 × 5.5 meters (L×W×H) for North American Kestrels to 25 × 3 × ±4.5 meters (L×W×H) for larger owls (The Owl Foundation, 2013). The ingenuity of the Owl Foundation facility design is the possibility to connect individual units, thereby creating a variety of flight distances, and adding an extra dimension of complexity to the enclosures.

While flight is a critical facet of bird life, other behavioural needs should be addressed as well. For example, the following adjustments are recommended in addition to increasing enclosure size:

- Enclosure space should be outfitted to meet species-specific needs. Great horned owls for example require tree cover and coarse surfaces, while kestrels require dust baths (Adirondack Wildlife Refuge & Rehabilitation Center, 2018).
- Perches of different thicknesses should be provided at different heights and locations throughout enclosures for exercise and foot health (Hawkins, 2010). Natural perches with intact bark provide textural complexity.
- All birds must have the opportunity, at any point in time, to remove themselves from public view.
- The construction of solid sided aviaries is recommended with mesh windows allowing birds to look out but not to grip the mesh (Habben & Parry-Jones, 2016). That may also allow visitors additional “controlled” opportunities to view the birds.
- If boundaries are built of mesh, they should be layered to prevent contact with wild birds.

3.1.2 Vivarium Species and Sulcata Tortoise housing

The vivarium building is located near the entrance of the zoo and contains a collection of reptiles, amphibians and mammals. The vivarium species are housed in various kinds of terrarium or terrarium-like exhibits and enclosures. Except for the small group of marmosets, who had access to a small outdoor paddock, none of the animals appear to have access to the outdoors or to natural sunlight.

Most of the exhibits had furnishings and objects, such as rocks, branches, leaves and other vegetation, but some of those items appeared to serve only a decorative or cosmetic function. Substrates ranged from hard surfaces to softer surfaces, such as earth, bark chips and other materials, depending on the exhibit.

Environmental conditions appeared basic and thermally simplistic with only one or two designated warm areas, usually in the space beneath a suspended heat lamp. There did not appear to be comprehensive consideration of each species' known thermal, UV and other climate needs incorporated into the design and outfitting of the exhibits. The temperature beneath each heat lamp and the temperature range within each exhibit could not be determined, but there did not appear to be opportunities throughout each exhibit for the animals to thermoregulate at will throughout each exhibit to achieve preferred body temperatures. The lack of that capacity may negatively impact their metabolism, digestion, other functions and health (Mendyk, 2018; Warwick, Frye and Murphy, 1995). It could not be determined if the vivarium animal management regime involved turning off lights or heat lamps at particular times resulting in almost immediate transition in exhibit lighting and thermal conditions at the end and beginning of each day.

The interior gallery lighting in the vivarium was subdued and, because there was no natural sunlight entering the exhibits, there was no opportunity for the animals to engage in natural thermoregulatory/basking behaviours. Several reptiles were observed positioned beneath heat lamps but, for some, there appeared to be only enough space to warm part of their bodies. Some exhibits did not appear to provide sufficient refuge sites for the animals, an important husbandry consideration, especially for those species that engage in anti-predation and refuge-seeking behaviours (Carlstead and Shepherdson, 2000).

Most reptiles in nature have access to a range of microhabitats that allow them to move from location to location to adjust their physiological functioning (Sartorius *et* al., 2002; Smith and Ballinger, 2001). Those locations can be above, at, or below ground level and involve a range of furnishings and substrates that provide varying temperatures, lighting, humidity and moisture levels.

The amount of space provided in some of the exhibits (particularly for the larger species) was modest and provided only severely restricted opportunities for animals to roam and explore. In some cases, opportunities for those activities were largely absent. Many reptiles are highly mobile, very active animals that inhabit large spaces in the wild (Warwick, Arena and Steedman, 2018), both above, on and below ground. They traverse their home ranges foraging, seeking out particular kinds of shelters and engaged in other activities. Like other kinds of animal species, reptiles require enough space to engage in species-typical movements and behaviours. A number of the vivarium reptiles (e.g., crocodilians, aquatic turtles, large lizards, such as tegu and green iguana, and large constricting snakes) were in spatially over restricted circumstances.

Most of the reptiles were inactive, but several appeared to be engaged in repetitive pacing, crawling or swimming behaviours. For example, the Fly-River Turtle was engaged in what appeared to be abnormal ITB (Interaction with Transparent Boundaries) behaviours which are repetitive behaviours that involve the animal making repeated attempts to move through the transparent glass barrier.

In several cases (e.g., crocodilians, turtles), spectators could view from several sides, a possible stressor to the animals as it limits the ability for the animals to remove themselves from view.

According to one zoo employee, all of the GVZ reptiles are discarded individuals from the pet trade or captive reptile industry. While taking in unwanted animals is a potentially useful function for the GVZ, the animals that are accepted should be provided with spacious, high quality housing, species-appropriate environmental conditions, better-equipped living spaces and environmental enrichment,

suitable basking locations, privacy and shelter areas, as well as other key facets of husbandry, management and care. Additionally, the zoo should be providing visitors with accurate, science-based information about the needs of reptiles and amphibians, why they do not generally make good pets, the threats they face both as individuals and as populations because of the exotic pet trade and how members of the public can help.

The keeping and display of reptiles in the current vivarium may suggest to visitors that these animals are not complex and are easy to keep. Images of the enclosures can be found in Appendix C.
Potential options for moving forward include:

Repurpose the building:

- Use the existing building for another purpose, such as an educational display or small movie theatre.

Refurbish the building to provide a smaller number of higher quality exhibits:

- Reduce the number of species and individual animals in the vivarium and provide enhanced, less restricted, more complex species-appropriate conditions for a reduced, more specialized live collection.

Should the GVZ want to retain a vivarium exhibit space, it should pursue a behaviour-based husbandry model, supported by the relevant scientific evidence, to provide animals with species-appropriate conditions. At the least, it is suggested that the GVZ:

- Provide sufficient space to enable and encourage animals to perform a broad range of natural movements and behaviours. This includes space to achieve natural body postures (including, straight-line body postures), swimming, climbing, bathing, exploring, foraging, etc.
- Outfit enclosures to meet each animals' species-specific needs, including but not limited to, the expression of a broad range of their natural behaviours, their temperature, heating, lighting, humidity and moisture needs, their sleeping and sheltering habits (e.g., nocturnal, diurnal, etc.), enrichment needs, nutritional and food presentation requirements, etc.

The Sulcata tortoises were housed in a separate enclosure, next to the giraffe paddock, where they have access to a small outdoor area and a very small indoor area t a vat has a visitor viewing window on one side. Whereas the outdoor area has the advantage of some natural features (e.g., grass substrate, trees, stones), the indoor area is barren and lacks usable features or furnishings. These wide-ranging tortoises require as much space as possible and, given the footprint of the zoo, could be provided with a much larger space (in the warm weather) that allow them to roam and explore. In the interim, the zoo should explore enrichment opportunities for the tortoises.

3.1.3 Giraffes

The housing situation of the giraffes seems to be substantially the same as described in previous reports. In 2003, the enclosure was described as barren, lacking in any meaningful level of complexity or stimulation to encourage the expression of a broad range of natural behaviours. The only substantive change observed in 2018 was an overhead gazebo-type structure elevated on metal poles to a height that would allow the giraffes to walk in underneath (Figure 3.1) that was positioned adjacent to the

elevated visitor viewing walkway at the front of the outdoor enclosure (Appendix C, Figures C.5 through C.7).

If the structure was built with the goal of enhancing animal welfare, its location in front of the visitor viewing platform is puzzling, as the giraffes are forced to seek shelter in the area closest to visitors. The structure appears to be constructed to facilitate easier visitor viewing of the animals or, possibly, so a controlled public feeding program can be initiated (although that was not substantiated). If the goal is enhanced animal welfare, then additional shelters should be erected in other parts of the enclosure so the giraffes have a choice to obtain shelter without being in close proximity to visitors.

The fact that no significant changes seem to have been made to the housing situation of the giraffes during the past 16 years is baffling considering that there were four high-profile giraffe deaths during that time. Giraffes are considered sensitive animals that often do not fare well in captivity and that may have a shorter lifespans than their wild counterparts (Claus, Franz-Odendaal, Brasch, Castell, & Kaiser, 2007). Accumulating evidence indicates that the dietary and spatial requirements of giraffes can be extremely difficult to meet, suggesting that giraffes, like some other mega-fauna (e.g., elephants, polar bears) should not be kept in zoo facilities (Dagg, 2014; Hatt, et al., 2005; Hummel, et al., 2006). The current GVZ housing and husbandry practices raise the following concerns:

- Giraffes are wide-ranging animals with natural home ranges between 5km² to 654km² (Nowak, 1999; Hutchins, Kleiman, Geist, & McDade, 2003). Spatial constraints can in part be compensated with extensive enrichment programs, but there was no noticeable evidence suggesting the GVZ has any kind of comprehensive enrichment program in place for these animals.

- The natural habitat of giraffes includes arid and dry lands, like savannas and open woodlands. Average annual precipitation is 0.5 meters (Maisano, 2006; The African Savanna, 2019). In comparison, the Aldergrove region of British Columbia (where the GVZ is located) has an oceanic climate, receiving over 1.3 meters of rain annually (Government of Canada, 2019). The wet soil conditions can affect the hooves, resulting in locomotory problems (Dagg, 2014).

- Temperatures may also an issue. Giraffes are not able to maintain their body temperature as well as some other mammals and this can be problematic when they are kept in cooler climates. It has been suggested that dietary adjustments and heated facilities are the only means to support giraffes in maintaining homeostasis (Dagg, 2014).

- Giraffes are social animals, living in herds up to 100 individuals (Dagg, 2014). The structure of the herds is fluid and members come and go as they please, resulting in ever changing group compositions (Maisano, 2006; Schaul, 2011). Herd fluidity allows giraffes to choose the individuals they desire to socialize with. Most captive environments are not able to replicate these conditions due to small numbers of animals. This can result in welfare compromises, especially if individual animals are not entirely compatible.

- Diet and feeding habits are known to be instigators of many captive health issues. Giraffes are browsers, predominantly consuming leaves. Availability and financial constraints limit zoos in

meeting these dietary requirements, resulting in many zoos treating giraffes as grazers rather than browsers (Dagg, 2014). The inability to meet nutritional requirements can result in health issues. Alongside food-related ailments, many abnormal behaviours in giraffes are associated with inadequate diets (Dagg, 2014; Hummel, et al., 2006).

- A final challenge is to provide giraffes with the "natural" browsing opportunities. Giraffes use their tongues to pluck leaves from branches, to strip bark and to breakup regurgitated food. (Schaul, 2011). Additionally, research has also shown that giraffes have crepuscular feeding habits (Duggan, Burn, & Clauss, 2016), demonstrating that giraffes are most active outside of regular work hours.

The above-mentioned food and foraging habits illustrate how challenging it is to mimic life in the wild and that animal welfare compromise may be unavoidable in captivity.

Giraffes are popular among zoo visitors so many zoos keep them, but meeting their physical, psychological and social needs in captivity can be a huge challenge. The GVZ should reevaluate the keeping of these animals and may want to consider relocating them to more species-appropriate conditions elsewhere.

3.1.4 Hippopotamus

The GVZ has two hippopotamuses in their collection. The animals are housed in a reasonably sized enclosure (when compared to other zoo enclosures for hippos) with a large pool. However, the enclosure is barren, lacks enrichment and pasture and the terrestrial portion of it is small. The indoor hippo accommodation is spatially restricted and therefore not suitable for long-term housing. See Appendix C, Figures C.8 - C.10.

Hippos are native to the African continent. Not surprisingly, there are fundamental differences between their wild habitat and lifestyle versus the life experienced by the hippos at the GVZ. They include:

- In the wild, hippos are social animals during the day but will forage on their own at night (Eltringham, 1999). As many as 100 individuals can raft together in a single pool (Klingel, 1991; Mason, 2013). Hippos show a preference to interact with kin and familiar individuals (Blowers, Waterman, Kuhar, & Bettinger, 2010). Best practice husbandry guidelines recommend that wild circumstances should be replicated as much as possible. It is therefore recommended to keep hippos in mixed groups with one male and five or more females (Forthman, 1998; Tennant, et al., 2017).

- Hippos are semi-aquatic, designing suitable enclosures for aquatic-terrestrial animals is among the most difficult tasks for zoos to accomplish (Zubkowicz, 2009). Hippos prefer slow moving water in which they can swim freely (Estes, 2012). No flowing water was evident and it could not be determined if the pond was subject to any kind of filtration regime.

- The GVZ hippo enclosure pond water was cloudy. Modern hippo zoo facilities sometimes offer underwater viewing opportunities to visitors. These kinds of exhibits require clean, transparent water and seem to elicit more active behaviour in captive hippos. Another advantage of clean

water is the possibility to establish fish colonies. In the wild a symbiotic relationship exists between fish and hippos. The fish will contribute to the hygiene of the hippos by cleaning different body parts. (Zubkowicz, 2009)

- Feeding habits are tied in with the activity budget of the hippos. During the day, hippos rest. At night hippos are active foraging. Hippos can cover up to 10 km per night and feeding sessions can take up to 6 hours (Herbison & Frame, 2019). To mimic this behaviour in a captive environment is very challenging, especially since the height of activity is outside regular business hours. To enable hippos to perform natural behaviours, strategies must be implemented for the animals to be able to forage and roam at night. Overnight caretakers or automated feeding systems should be used to encourage night-time foraging activities.

- Hippos are found in tropical regions of Africa. They need to keep their core body temperature stable and regulate their temperature behaviourally by basking in the sun to warm up or entering the water to cool down, depending on their need (Eltringham, 1999). Similar to the giraffes, the Vancouver-area climate may be problematic for hippos. It was not determined if the pool water was heated or if the barn itself was mechanically heated.

The hippo enclosure at the GVZ requires upgrading to enhance the welfare of the animals, both indoors and outdoors. However, even if significant changes were made, such as construction of a larger, enriched indoor facility, the climate of the region will still be problematic. Therefore, the GVZ should explore options for relocating the hippos to more appropriate accommodation in a warmer climate.

3.1.6 Red Fox

A single animal was observed during all three visits. The enclosure is generally a square, grassed area situated between the enclosures of different ungulate species on two sides and the wolf enclosure across a visitor pathway on the other side. The enclosure interior is mostly flat but slopes slightly down to the fenceline at each side (Appendix C, Figure C.11). The fox has limited privacy opportunities in the display area, since the visitor viewing station is moderately elevated and the fencing does not act as a visual barrier. The absence of privacy could be a stressor.

Canada's natural areas are home to red foxes that are known to have home ranges anywhere from 4-8km² (Canadian Wildlife Federation, 2019). While local weather conditions are of little concern, it is still important to provide the opportunity for the animal to obtain shelter from the elements, a wooden dog-house-type shelter had been provided, or to allow animals to erect/construct their own shelter. Red foxes will spend more time in dens during the colder months (Canadian Wildlife Federation, 2019). It could not be determined if the fox had excavated one or more dens in the enclosures.

The addition of visual baffles that allow the fox to obtain privacy without retreating into the box or a den would be advantageous.

Red foxes are usually monogamous and tend to spend a majority of the year in pairs, for reproductive and parental care reasons (Fox, 2007). Foxes have solitary tendencies when foraging (Kistler, Hegglin, Würbel, & König, 2009). It can be concluded that red foxes are semi-social and therefore should be able to engage in natural social behaviours when living in captivity. Depriving animals of natural social

interactions with members of their own species compromises their welfare. Attempts must be made to find a companion for the red fox or the fox should be rehomed to a facility that can meet its social requirements.

In the meantime, the current enclosure should be enlarged or the fox moved to a more sizeable enclosure elsewhere on the zoo property. Permanent and temporary furnishings should be used to interrupt sightlines. Kistler *et al*. (2010) showed that foxes prefer enclosures with structures and that foxes use these elements to orientate themselves.

The red fox enclosure at the GVZ lacks complexity and the opportunity for the animal to engage in a full range of natural movements (e.g., running at speed) and behaviours. Red foxes are known to be highly intelligent, agile and playful (Canadian Wildlife Federation, 2019). They are habitat generalists, able to survive in a wide range of climates. They have an excellent sense of smell, hearing and sight (Augustyn, et al., 2019; Canadian Wildlife Federation, 2019). It must also be noted that foxes tend to have crepuscular or nocturnal habits (Fox, 2007). Husbandry management must adapt to the natural time budget of the foxes and ensure that the foxes have foraging opportunities during their natural activity peak. In addition, temporary enrichment must be used to encourage the animals to explore and play. In summary, the following adjustments are recommended.

- The enclosure should be enlarged to allow for engagement in a broader array of natural movements and behaviours or the fox moved to a larger enclosure on the zoo property.
- Horizontal and vertical furnishings and other enrichment should be dispersed throughout the enclosure.
- A more natural social context must be created. If this is not possible consideration should be given to relocating the fox to another facility where it can have companionship.
- As an interim measure, temporary enrichment (e.g., simple furnishings, objects, food, odor and other sensory enrichment) should be used in order to stimulate exploration, play and foraging behaviour. Kistler et al., (2009) showed that foxes will be more active and show more natural foraging behaviour when food is presented at unpredictable times and in unpredictable areas of the enclosure.
- If they are not already present, underground dens should be created to allow the fox to seek shelter and visual baffles added to allow the fox to remove itself from public view.

3.1.7 Squirrel Monkeys and Coatimundi

The squirrel monkeys are located near the entrance of the zoo in an older enclosure consisting of a small indoor area and a fenced outdoor space (Appendix C, Figures C.12 and C.13). A second similar enclosure housing a white-nosed coatimundi is attached to the squirrel monkey cage. A visitor pathway bisects the two enclosures and allows people to look through glass windows into the interior accommodation of each. Both indoor facilities were small and basic. Permanent enrichment objects were present in the outdoor enclosures but little was observed in the indoor areas. During the first visit the coatimundi was observed engaged in repetitive pacing in one area of its indoor accommodation. It's possible this exhibit was originally situated where it is to fill a gap in the layout but, today, the animals would be better served by being in a much larger, more complex space elsewhere in the GVZ.

3.2 Zoo-wide systemic concerns

There are four reoccurring, largely systemic, concerns that should be addressed.

3.2.1 Environmental and behavioural enrichment

Many zoos face challenges in providing their animals with sufficient space. While the availability of living space tends not be a main concern for the many of the animals at the GVZ, more could be done to enrich animal spaces to encourage expression of natural movements and behaviours. This is especially the case with some of the older exhibits.

It was not possible to determine how extensive, comprehensive or formalized enrichment programs at the GVZ were. However, substantive evidence, in the form of furnishings, objects, food and sensory enrichment, indicative of a comprehensive enrichment programming, was not observed. See Appendix D.

Complexity of enclosures is, for the most part, provided by the natural landscape (e.g., woodlots, hillocks, water features) although it should be noted that many of the ungulate enclosures in the first third of the zoo are mosty flat, fenced off portions of the property with little diversity in the terrain. Conversely, it is also worth noting that several of the newer enclosures (e.g., cougar – during the March visit this exhibit housed Eurasian lynx, black bear, American badger) are better designed and contain a relatively diverse range of species-appropriate features (Appendix D). This is a very positive development for the zoo.

Though the use of natural terrain and features must be encouraged, it may not be sufficient to fulfill all the needs of all of the animals all the time. Most animals spend the majority of their time in the wild foraging or hunting. This part of their activity budget should be encouraged as much as possible through the provision of food enrichment that results in animals “working” for their food. Additionally, other types of enrichment, such as additional features, furnishings, objects, sensory and temporal enrichment can be used to provide animals with opportunities to engage in natural behaviours.

3.2.2 Housing of social animals

All previous reports included recommendations to decrease the overall number of animals in the zoo. It must be noted that any attempt to decrease animal populations, should not be done at the expense of animal welfare.

At the time of the visits many animals, who are considered to be herd, pack or group species (e.g., giraffe, hippo, eland, musk ox) were housed in what appeared to be arbitrary or unnatural social settings, occasionally with only one or two individuals of their species. Though it can be complicated to create stable groups of some species in captivity, social context is still an important facet of welfare, so facilitating natural social environments, wherever possible, should be given priority consideration. See Appendix D.

3.2.3 Indoor enclosures

Although lower mainland British Columbia is often (but not always) spared from extreme weather events, indoor enclosures must still be provided for animals that are not entirely comfortable in cool, wet conditions. Many of the indoor shelter facilities did not appear appropriate for long-term housing, particularly for some of the larger exotics, such as the giraffes and hippos, or active exotic species, such as the primates. All exotic species to be retained in the collection should be provided with more expansive, purpose-built, climate-controlled facilities that can accommodate their physical and behavioural needs for prolonged periods of time (e.g., during winter months). See Appendix D.

3.2.4 Excess ground water and water-logging

In all previous reports excess ground water and water-logging were identified as problematic. Substantial areas of standing water and mud were observed during the March visit and, to a lesser extent, during the November visits. It appeared that landscaping had taken place in several of the enclosures, presumably to deal with the ground water, resulting in elevated dry areas of substrate. This is a positive development that needs to be applied to other enclosures throughout the zoo. For the welfare of the animals, especially the species that are not used to cool, wet climates, it is important to provide dry areas that can accommodate all animals in the enclosure at the same time The provision of multiple dry areas throughout enclosures may also prevent inter-individual conflicts between animals competing for the same preferred spaces. See Appendix D.

3.2.5 Other enclosures

There are other enclosures that require attention. The table below shows the enclosures and the related concern. See Appendix D.

Table 3. Enclosure concerns

Key Issues	Concern
Cheetah*	Fence chewing, abnormal behaviour, lack of enrichment
Wolves	Social structure, enclosure complexity, lack of enrichment.
Zebras and other exotic ungulates	Social structure, enclosure complexity, lack of enrichment, wetness of enclosures**

*One of the cheetahs was chewing on the fence for minutes at a time (see Appendix IV)

**Special concerns for animals that are not used to wet conditions (e.g. desert-dwelling animals)

4. Conclusion

This report follows previous reports written in 1997, 2003 and 2008. The GVZ seems to have made a number of significant, very positive, changes since the 1997 report was published with many of those changes almost certainly having a positive welfare impact on the animals. However, some longstanding issues remain problematic and should be addressed.

Many zoos have less physical space than the GVZ. Though larger natural spaces alone may not be sufficient to guarantee a high level of animal welfare, they bring with them a certain degree of inherent complexity and often provide enhanced opportunities for animals to engage in natural movements and behaviours, such as running at speed and foraging. The size of the GVZ facility is an advantage that many zoos do not have and could be exploited better by reducing the live collection size and offering the remaining animals more space and increased resources.

A seemingly positive GVZ trend is the repair, restoration and/or replacement of enclosure fencing and the construction of new enclosures (e.g., American badger, cougar, black bear) that appear better designed for particular species and to mitigate potential issues such as excess ground water (water-logging). The cougar enclosure (previously home to the Eurasian lynx) is one example, being reasonably large, complex and superior to some of the other GVZ exhibits.

It also seems, although this has not been verified, that the GVZ is moving toward the display of only native British Columbian and cold weather species. If so, this is a positive development that capitalizes on the existing climate and terrain.

In the meantime, the GVZ should proactively take steps to address the various localized and systemic issues identified in this report and in previous reports. They include, but are not limited to, lack of space for certain species, lack of appropriate environmental conditions, lack of environmental and behavioural enrichment, lack of shelter and privacy areas, lack of proper social contexts, excess ground water and water logging of enclosure substrates.

Our recommendations to the GVZ are:

1. Disperse those animals that are not appropriate for living in the lower mainland British Columbia climate to more appropriate accommodation elsewhere;
2. Disperse those animals that the zoo does not have the resources to accommodate in a way that satisfies their physical, psychological and social needs to more appropriate accommodation elsewhere;
3. Expedite the removal of the remaining older, sub-optimal cages and enclosures;
4. Expand the smaller enclosures (e,g, red fox, Spur-thighed tortoise) that are spatially over-restrictive or deficient in other ways, or move the affected animals to larger facilities elsewhere on the zoo property;
5. Adopt a behaviour-based husbandry regime for all animals at the GVZ;
6. Develop and deliver a comprehensive zoo-wide environmental/behavioural enrichment program as a critical component of daily animal husbandry, care and management;
7. Incorporate animal welfare as a foundational tenet of the GVZ.

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Appendix A. Zoo recommendations 1997 – 2008

1997 – Zoocheck Inc.

GENERAL

- Reduce animal collection.
- Expand existing cages/enclosures.
- Create educationally productive thematic mixed species exhibits.
- Identify paddocks/enclosures that get waterlogged and construct raised dry rest areas.
- Environmental/behavioural enrichment plan with short- and long-term goals.
- Improve shelters.
- Repair/replace damaged/bent fencing.
- Cover/remove wire protrusions and sharp points.
- Develop educational master plan:
    - Incorporate + increase exhibit signage
    - Participatory non-animal displays
    - Interpretive sessions for visitors
    - Implement other recognized low-cost educational strategies
    - Consider establishing a citizen's volunteer education committee to develop and implement plan.

SPECIES SPECIFIC (species listed are still present in 2018)

- Porcupine:
    - Vertically and horizontally positioned branch work of varying sizes (1/2" to 3") for climbing and chewing.
    - Elevated wooden platforms throughout enclosure.
    - Fresh browsing material
    - Earth boxes covering 25% of substrate
    - Provision of sleeping boxes

- Squirrel Monkey:
    - Improve outside enclosure with enrichment items:
        - Vary branches in size
        - Provide branches with leaves and bark intact
        - Provide bungee cords, rope ladders
        - Provide deep straw bed area for scatter feeding to encourage forage behaviours
    - Upgrade inside quarters:
        - Provide raised sleeping box, bedding material, privacy (visual barriers), lighting
        - Provide appropriate heating

- Red-tailed Hawk/Great Horned Owl:
    - Provide natural perches (different heights, sizes), privacy, visual barriers
    - Improve use of vertical space

- Mode Red-tailed hawk to different location (not near snack bar)
- Provide for space for Great Horned Owl (a pair requires minimum of 48ft horizontal distance and 900 square feet floor space)
- Provide visual barriers at varied heights

- Vivarium:
  - Provide more usable space.
  - Ability to remove themselves out of the view of the public
  - Remove the “swamp” exhibit

- Black Bear:
  - Provide with variety of objects to chose from to manipulate and play
  - Provide climbing frames, use of vertical space
  - Provide nesting material (straw, wood-wool, branches, leaves)
  - Provide visual barriers
  - Enclosure should have two paddocks in order to separate animals if necessary

- Wolf:
  - Provide dry resting areas
  - Provide privacy, visual barriers
  - Provide more space
  - Stop breeding
  - Provide dry denning/digging areas
  - Provide raised viewing points (use of vertical space)

- Large Cats:
  - Use of vertical space
  - Add environmental complexity with large rocks, logs with intact bark, high wooden platforms, climbing structures, add culverts and buried concrete sewer pipes for hiding and add periodic water spraying
  - Enrichment options: whole carcass feeding, hiding food treats, adding scents, durable play objects, working-for-food games
  - Provide visual barriers from enclosure neighbours, visitors and enclosures co-occupants

- Ungulates:
  - Provide dry areas
  - Less animals per enclosure.

1997 – Samantha Lindley

GENERAL

- Ensure that all animals have access to fresh, potable water

SPECIES SPECIFIC (species listed are still present in 2018)

- Porcupine:
  - Give the animal the choice to move between indoor and outdoor enclosure

- Birds:
  - Provide food and water in a manner that is appropriate to species (not on floor)
  - Provide substrate other than concrete
  - Provide suitable indoor enclosures with appropriate doors for the birds to move between indoor and outdoor environment
  - Provide room to fly
  - Provide privacy, perches should be available from a high vantage point

- Petting Zoo:
  - Supervision should be provided at all times
  - Do not allow visitors to feed the animals
  - Provide natural substrates
  - Rotate animals between paddocks to not be confronted with people all the time

- Hippos:
  - Pool should be deep enough to fully submerge
  - Shelter inadequate and run down
  - Shelter must provide regulated heat
  - Provide an indoor pool

- Wolves:
  - Utilize the woods to provide cover/privacy
  - Increase stand-off barrier length between public and animals
  - Stop breeding wolves and reduce the pack size
  - Have the pack together or locate them out of sight – keeping animals in adjacent pens will encourage fence running

- Black bears:
  - Provide covering
  - Increase enclosure size

- Giraffe:
  - Ensure the giraffe is housed according to social needs (herd animal)
  - Provide browsing throughout the day, provided species-appropriate

- Big Cats:
  - Provide more cover/privacy
  - Utilize vertical space
  - Increase distance standoff barriers
  - Don’t house cats in adjacent pens

- Provide pools in the shade, deep enough to lie in

- Ungulates:
  - Feed appropriate diets
  - Don't provide food on the ground or if you do don't let it spoil (pest control)

2003 – Zoocheck Canada Inc. and the Vancouver Humane Society

GENERAL

- Provide space to encourage natural behaviours
- Provide enrichment / stimulate behaviours
- Prevent water-logging of enclosures by providing elevated dry areas that all animals can use
- Only house different species together if it is suitable
- Stop breeding animals
- Focus on native species instead of exotic species
- Move animals that aren't taken care for properly to other facilities/sanctuaries

SPECIES SPECIFIC (species listed are still present in 2018)

- Black Bear and Wolves:
  - Do not let species cohabit the same enclosure

- Big Cats:
  - Provide species appropriate enrichment

- Giraffes:
  - Provide enclosure features to allow for natural behaviour
  - Provide enrichment
  - Increase enclosure size
  - Provide natural feeding opportunities (high browse)

- Reptiles and amphibians:
  - Provide more space for all animals

- Squirrel and Spider Monkeys:
  - Provide more species appropriate enclosure features
  - Provide enrichment / implement enrichment program

2008 – Zoocheck Canada Inc. and the Vancouver Humane Society

GENERAL

- Prevent water-logging of enclosures by providing elevated dry areas that all animals can use
- Provide species-appropriate substrate that will allow for natural behavior/movement
- Increase complexity of enclosures
- Implement enrichment programs
- Provide appropriate social stimulation/housing
- Provide appropriate winter housing

SPECIES SPECIFIC (species listed are still present in 2018)

- Vivarium species
    - Enclosures range from small to excessive small.

Appendix B. Animal inventory 2018

(I) Animals from sign in zoo, but not observed.

(II) Animals from website, but not observed.

≥ Observed minimum of x, but potentially more animals in enclosure.

Table B1. Amphibia (amphibians)

Common English Name	**Scientific Name**	**Quantity**	**Origin**
Blue-legged Mantella	*Mantella expectata*	≥ 1	Madagascar
Oregon Spotted frog (II)	*Rana pretiosa*	Not present/on display	North America
White's Tree Frog	*Litoria caerulea*	≥ 1	Australia / New Guinea

Table B2. Aves (birds)

Common English Name	**Scientific Name**	**Quantity**	**Continent of Origin**
American Flamingo (III)	*Phoenicopterus ruber*	≥ 17	South/Central America
Bald Eagle	*Haliaeetus leucocephalus*	2	North America
Black Swan (I)	*Cygnus atratus*	Not present/on display	Australia
Domestic Chicken	*Gallus gallus domestic*	≥ 4	N/A
Egyption Goose	*Alopochen aegyptiaca*	≥ 1	Africa
Emu	*Dromaius novaehollandiae*	1	Australia
Great Gray Owl^^	*Strix nebulosa*	1	North America/Asia/Europe
Great Horned Owl	*Bubo virginianus*	1	North/South America
Harris Hawk	*Parabuteo unicinctus*	1^	North/South America
Helmeted Guineafowl	*Numida meleagris*	≥ 5	Africa
Kookaburra	*Dacelo spp*	1	Australia/New Guinea
Marabou Stork (I+II)	*Leptoptilos crumeniferus*	Not present/on display	Africa
Muscovy Duck	*Cairina moschata muscovy*	≥ 3	South America
Nene Goose	*Branta scandvicensis*	≥ 1	Hawaii
North American Kestrel	*Falco sparverius*	1	North America
Ostrich	*Struthio camelus*	2	Africa
Parrots (I)	Psittaciformes	Not present/on display	Tropical/Subtropical Regions
Peafowl	*Pavo cristatus*	≥ 2	Asia
Red-tailed Hawk	*Buteo jamaicensis*	1	North America
Snow Goose	*Anser caerulescens*	≥ 3	North America
Tolouse Goose	*Anser anser domesticus*	≥ 2	France

Turkey Vulture	*Cathartes aura*	1	North/South America
Whooper Swan	*Cygnus cygnus cygnus*	≥ 2	Northern Europe/Asia

Table B3. Mammalia (mammals)

Common English Name	**Scientific Name**	**Quantity**	**Origin**
Addax	*Addax nasomaculatus*	≥ 3	Africa
African Lion	*Panthera leo*	≥ 3	Africa
Alpine Ibex (I)	*Capra ibex*	Not present/on display	European Alps
American Badger	*Taxidea taxus*	≥ 2	North America
American Bison	*Bison bison*	≥ 3	North America
American Elk	*Cervus canadensis*	≥ 5	North America
Ankole Cattle*	*Hybrid Bos (primigenius) taurus*	≥ 1	North America
Aoudad	*Ammotragus lervia*	Not present/Not visible	North Africa
Arctic Fox (I)	*Vulpes lagopu*	Not present/on display	Arctic Regions
Arctic Wolf	*Canis Lupus*	2	Arctic North America
Bactrian Camel	*Camelus bactrianus*	1	Central Asia
Black Spanish Burro	*Equus asinus domestic*	1	Spain
Capybara	*Hydrochoerus hydrochaeris*	4	South America
Cheetah	*Acinonyx jubatus*	≥ 1	Africa
Chinchilla	*Chinchilla chinchilla*	≥ 3	South America
Coati	*Nasua Nasua*	1	South America
Collared Peccary	*Pecari tajacu*	4	North/South America
Common Marmoset	*Callithrix jacchus*	≥ 1	South America
Coyote (I)	*Canis latrans*	Not present/on display	North America
Dromedary	*Camelus dromedarius*	1	North Africa
Dwarf Zebu (I+II)	*bos taurus indicus dwarf*	Not present/Not visible	India
Eland	*Taurotragus oryx*	2	East/South Africa
Grizzly Bear	*Ursus arctos ssp.*	≥ 1	North America
Hippopotamus	*Hippopotamus amphibius*	2	Africa
Indian Crested Porcupine	*Hystrix indica*	1	Central/East Asia
Miniature Horse	*Equus ferus caballus*	1	N/A
Muskox	*Ovibos moschatus*	≥ 1	Arctic Regions
Nilgai (I+II)	*Boselaphus tragocamelus*	Not present/Not visible	India
North American Black Bear	*Ursus americanus*	≥ 2	North America

North American Cougar	*Puma concolor couguar*	≥ 1	North America
North American Moose	*Alces americanus*	≥ 2	North America
Northern (Eurasian) Lynx	*Lynx lynx*	≥ 1	North America
Onager (I+II)	*Equus hemionus*	Not present/on display	Asia
Patagonian Mara	*Dolichotis patagonum*	2+3	South America
Père David's deer	*Elaphurus davidianus*	≥ 2	China
Plains Zebra	*Equus quagga*	2	Africa
Red Fox	*Vulpes vulpes*	1	North America
Red Kangaroo	*Macropus rufus*	≥ 1	Australia
Red-Necked Wallaby	*Macropus rufogriseus*	≥ 1	Australia
Red Panda	*Ailurus fulgens*	≥ 1	China
Red River Hog	*Potamochoerus porcus*	≥ 3	Africa
Reindeer	*Rangifer tarandus*	6	Arctic Regions
Ringed-Tailed Lemur	*Lemur catta*	≥ 2	Madagascar
Rocky Mountain Goat	*Oreamnos americanus*	1	North America
Roosevelt Elk	*Cervus canadensis roosevelti*	Not present/on display	North America
Rothschild's Giraffe	*Giraffa camelopardalis rothschildi*	2	Africa
Ruffed Lemur	*Lemur varius*	≥ 1	Madagascar
Scimitar-Horned Oryx	*Oryx dammah*	4	North Africa
Siberian Tiger	*Panthera tigris altaica*	≥ 1	Asia
Sika Deer	*Cervus nippon*	≥ 7	East Asia
Squirrel Monkey	*Saimiri sciureus*	≥ 3	Central/South America
White-Fronted Marmoset	*Callithrix geoffroyi*	≥ 2	South America
White-Tailed Deer	*Odocoileus virginianus*	≥ 4	North/South America
Wild Boar (I)	*Sus scrofa*	Not present/on display	Europe
Yellow Baboon	*Papio cynocephalu*	≥ 2	Africa

Table B4. Reptilia (reptiles)

Common English Name	**Scientific Name**	**Quantity**	**Origin**
African Cold Skink	*Eumeces schneideri*	1	Central/West Asia/North Africa
African Plated Lizard	*Gerrhosaurus validus*	1	Southern Africa
American Alligator (II)	*Alligator mississippiensis*	Not present/on display	North America
Armadillo Girdled Lizard	*Ouroborus cataphractus*	1	West/South Africa
Ball Python	*Python regius*	≥ 1	Africa

Boa Constrictor	*Boa constrictor*	≥ 1	North/Central/South America
Burmese Python	*Python bivittatus*	2	South(East) Asia
Carpet Python	*Morelia spilotes*	1	Australi /New Guinea
Coastal Carpet Python	*Morelia spilota mcdowelli*	1	Australia
Colombian Rainbow Boa	*Epicrates maurus*	1	South America
Colombian Tegu	*Tupinambis teguixin*	≥ 1	South America
Fly River Turtle	*Carettochelys insculpta*	1	Australia/New Guinea
Green Iguana	*Iguana iguana*	1	Mexico/Central/South America
Green Tree Python	*Morelia viridis*	1	Indonesia/Australia
Leopard Gecko	*Eublepharis macularius*	≥ 1	Central Asia
Mexican Cantil	*Agkistrodon bilineatus*	1	Mexico/Central America
Nile Monitor	*Varanus niloticus*	1	Africa
Red-Footed Tortoise	*Chelonoidis carbonarius*	2	South America
Round-Nose Plated Lizard	*Gerrhosaurus major*	1	Africa
Siberian Tortoise^	*Agrionemys horsfieldii*	1	Central Asia
Spectacled Caiman	*Caiman crocodilus*	2	Central/South America
Spiny Softshell Turtle	*Apalone spinifera*	1	North America
Spur-Thighed Tortoise	*Testudo graeca*	2	Eurasia/Northern Africa
Sulcata Tortoise	*Centrochelys sulcata*	≥ 1	Africa
Tokay Gecko	*Gekko gecko*	≥ 1	Asia

Table B5. Arachnids (invertebrates)

Common English Name	**Scientific Name**	**Quantity**	**Origin**
Madagascar hissing cockroach	*Gromphadorhina portentosa*	≥ 30	Madagascar
Scorpion	?	1	?
Tarantula	?	?	?

Appendix C. Section 3.1

The raptor enclosures are basic, provide minimal or no flight space, do not offer privacy or shelter and have limited perching possibilities.

Space is one of the main concerns for the species housed in the vivarium building. The enclosure depicted in Figure C.2 below is shared by two caimans. Several heat lamps are positioned above a relatively small haul-out area but it appears they could only be used comfortably by one animal at a time.

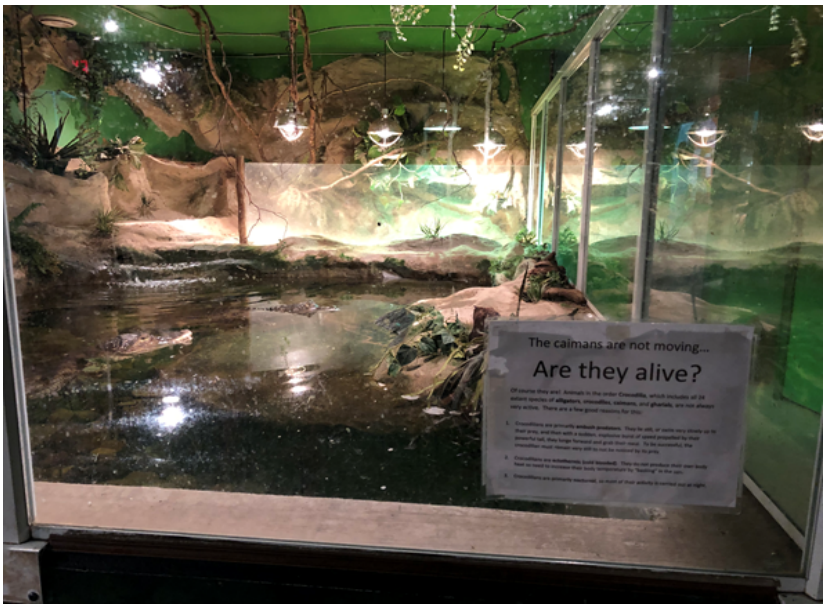

Figure C.3 Spiny Soft Shell Turtle engaged in abnormal ITB (Interaction with Transparent Boundaries) behaviours (repeated attempts to get through glass barriers).

Figure C.4 Green iguana enclosure. Green iguanas are highly mobile lizards inhabiting both terrestrial and arboreal environments. This exhibit is spatially restricted and lacking in complexity. The molded gunite rock and painted mural have no biological relevance to the animal.

Figure C. 5. The giraffe paddock is muddy due to frequent use and water saturated ground. The giraffes have to move through this area in order to reach their indoor facility. The shelter structure is situated adjacent to the elevated visitor walkway.

Figure C.6 shows the majority of the outside enclosure. Giraffes are relatively wide-ranging animals that require large spaces in captivity to achieve normal movement and exercise. No attempt has been made to increase enclosure complexity by adding features or furnishings to facilitate exploration, foraging, play and other behaviours.

Figure C.7 The interior of the giraffe accommodation is small and lacks complexity.

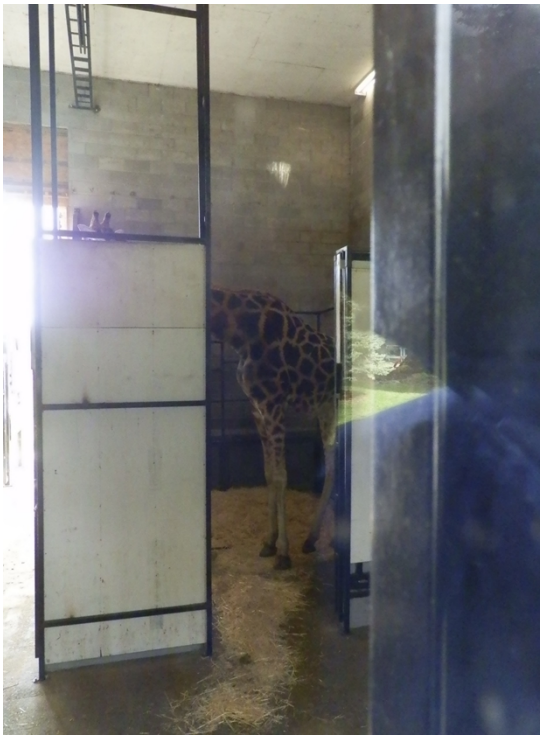

Figure C.8 - The hippo enclosure has a large pond but is otherwise barren with no pasture.

Figure C.9. The indoor hippo accommodation is barren, consists of entirely hard surfaces and appears to be built for the convenience of the caretakers. There is one small pool that both animals are required to share.

One fox was observed in the enclosure, shown in Figure C.11. There is no indoor area available except for the doghouse-style shelter. Fixtures in this enclosure are uninspiring. A larger space would be desirable, along with a companion and an enrichment program to encourage the fox to display natural behaviours.

Figure C.12. The squirrel monkeys and coatimundi have access to small indoor and outdoor areas. Both should be provided with more space and stimulation.

Appendix D. Section 3.2

Enclosure complexity and provision of enrichment, including features, furnishings, objects, food, sensory and temporal enrichment, appears to be lacking at the GVZ. Figure D.1 is a standard ungulate enclosure at the zoo.

Food enrichment can increase the time spent on foraging and feeding. Standard feeding practice appears to be providing hay to ungulates at feeding stations as shown in Figure D.2. Providing separate feeding locations, using feeding racks and puzzle feeders, and other food enrichment strategies will increase feeding time.

Examples of GVZ enclosures that are complex, provide shelter and are relatively spacious include this cougar enclosure in Figure D.3. The construction and design of these enclosures should function as a model for the renovation and construction of other enclosures.

Figure D.4. The black bear enclosure provides natural climbing and bathing opportunities.

Figure D.4 Black bear enclosure.

D.5. The porcupine enclosure is constructed with several visible barriers. Water saturation and drainage has also been addressed in this enclosure.

Figure D.5 North-American porcupine enclosure.

Many social animals are housed in unnatural social conditions. Figure D.6 Musk oxen live in groups of 8 to 24 animals. Only one musk ox was observed during the GVZ visit.

Figure D.6 Housing of social animals.

The building in Figure D.7 shows the indoor facility for 3 lions, 1 Siberian tiger, 1 porcupine, ±2 baboons (exact number unknown) and 1 lynx. Though it was not possible to view the interior, the size of the building appears insufficient to house these different animals comfortably indoors. It is important that shelters provide for the needs of each species.

Figure D.7 Indoor enclosure shared by multiple species.

The indoor enclosure in Figure D.8 houses red river hogs. The enclosure is designed with ease of maintenance in mind. Though these pigs will presumably spend most time outdoors, indoor enclosures must provide space and enable animals to perform natural behaviours.

Figure D.8 Indoor enclosure, red river hogs.

Figure D.9., D.10, D.11: The Aldergrove area receives on average more than 1 meter of precipitation each year, creating an issue of excess standing water and water logging.