



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

# *ANIMAN* SPACE DESIGN: A PARROT *ANIMAN* PRECINCT

*Integrative human and animal habitats at the National Zoological Gardens of South Africa*

By

Giovanna Di Monte

Submitted in fulfillment of a part of the requirements for the degree  
Magister in Interior Architecture(Professional)  
in the Faculty of Engineering, Built Environment and Information Technology.  
University of Pretoria  
Department of Architecture  
Mentor–Professor Barbara Jekot

November 2006



I am indebted to many professionals, for encouragement, inspiration, support and/or technical assistance throughout this year and my previous years of study. Thank-you Professor Barbara Jekot, Nico Botes, Piet Vosloo, Mr. Kitshoff and the Zoo Staff. Thanks also to friends and family for their encouragement.

Most importantly, I wish to thank my loving and supportive family: Patricia Di Monte, Matteo Di Monte, Gina Di Monte, Gloria Di Monte, Giulia Di Monte, and Nunzio Di Monte. Your support was phenomenal.

Thank you all.



## ABSTRACT

This project stems out of the need to improve the quality of life for both animals and humans, and facilitate the interaction between both environments into one habitat. The design will serve as a framework for the co-habitation and interaction of humans and animals in one habitat. At the core of this dissertation lies the concept of an *animan* habitat. This term embodies the concept of an intergrated habitat for all species.

In arriving at the final design, a sequential thought process was applied. The logic behind this process will now be outlined (each corresponding section will be addressed in this document). Exploring the diversity of Architectural habitats and products has made it evident that involving Architects and Interior Architects into projects concerning animal space design can benefit wild animals and humans alike. Research into South African recreational nature spaces show the importance of the conservation of these existing spaces to different parties on local, national and international levels. The investigation of the importance of experiential nature spaces in Tshwane and the Tshwane CBDs (section 2.2.2) shows the importance and location of an establishment (the National Zoological Gardens of South Africa) with great human experiential, and animal conservation opportunities. The study of the contributions of global zoos to the world (section 2.3) confirms that any designs need to consider the principles and ethics followed by these zoos—conservation, recreation, education, experience, research, and community values. Behavioural enrichment (section 2.4) as a conservation contribution of zoos is an aspect that can be reinterpreted and incorporated into animal enclosures to enrich their environments, and further educate visitors. Studies about zoo evolutions (section 2.5) through the ages show how thoughts about captive environments are evolving. The subsequent study of exhibit design (section 2.6) makes clear the importance of considering the needs of the environment, animals, zoo occupants and visitors alike. Furthermore, research into design styles and illusions (section 2.6) prove that designs (using whichever approach) should consider the wellbeing of animals before educating or entertaining humans. Design illusions could instead be used to change mans' negative perceptions about zoos and other conserving environments. A study into design elements and principles (as studied by Ching and Miller) are currently used at the Zoo (section 2.7) to claim human and animal spaces. A variety of precedent investigations (section 3) make it clear that other institutions, zoos, reserves, bird parks, discovery centres, playgrounds, and an amphitheater, individuals (the work of Frei Otto) or companies (lightweight structure experts) offer products and techniques that could well suit *animan* space design.

The result of the above is the cohabitation and respect for humans, animal and the environment in a bidirectional habitat. This forms the core of the *animan* concept and approach for the design of the Parrot *Animan* Precinct at the National Zoological Gardens of South Africa (Zoo).

This development is a turnkey solution comprising of Site Selection and Study (section 4); Design Discourse (section 5); Technical Investigation (section 6) and Design Drawings (section 7).



# TABLE OF CONTENTS

LIST OF MAPS, FIGURES AND TABLES	XII
LIST OF APPENDIX	XII
1. INTRODUCTION AND BACKGROUND	01
Foreword	
1.1. DISSERTATION IDEA DEVELOPMENT	02
1.2. PROBLEM STATEMENT AND BACKGROUND	02
1.2.1. Importance and Relevance	02
1.2.2. Delimitations	02
1.2.3. Assumptions	02
1.3. RESEARCH METHODOLOGY AND THESIS OUTLINE	03
2. CONTEXT STUDY	05
2.1. ARCHITECTURAL DIVERSITY	06
2.1.1. Architectural Habitat.	06
2.1.2. Interior Architectural Habitats	06
2.2. OUTDOOR AND RECREATIONAL ENRICHMENT FOR MAN. A HABITAT FOR ALL LIFE FORMS	07
2.2.1. Importance of outdoor spaces in South Africa	07
2.2.2. SA Zoo as an important establishment in Tshwane	10
2.2.3. Contribution to Tshwane Inncity Regeneration Strategy	12
2.2.3.1. <i>Location of zoos worldwide</i>	12
2.3. ZOOS CONTRIBUTIONS TO SOCIETY, ANIMALS AND THE ENVIRONMENT	13
2.3.1. Zoo Philosophy	13
2.3.2. Conservation	13
2.3.3. Recreation	13
2.3.4. Education	14
2.3.5. Zoos offer visitor experience	15
2.3.6. Research	15
2.3.7. Community Values	15



<b>2.4. DESIGN FOR BEHAVIOURAL ENRICHMENT</b>	<b>16</b>
2.4.1. Why Behavioural Enrichment	16
<b>2.5. ZOO EVOLUTION</b>	<b>18</b>
2.5.1 The concept of travelling menageries.	18
2.5.2 Animal enclosure using architectural styles.	18
2.5.3 Mixed species exhibits and barless zoo concept.	18
2.5.4 Human educational and interactive experiences.	18
2.5.5 Human and Animal Existence at zoos.	18
2.5.6 Zoos of tomorrow.	20
<b>2.6. EXHIBIT DESIGN</b>	<b>20</b>
2.6.1. What exhibits must be for animals	20
2.6.2. What exhibits must be for humans	21
2.6.3. Design Styles	21
2.6.3.1. <i>Exhibit Dilemmas and Illusions</i>	21
2.6.3.2. <i>Design Illusions</i>	22
(a) <i>Zoo as a theater.</i>	22
(a) <i>Boundaries.</i>	22
<b>2.7. DESIGN ELEMENTS AND PRINCIPLES FOR SPACE DEFINITION (AS USED IN THE SA ZOO)</b>	<b>23</b>
2.7.1. Primary Elements	23
2.7.1.1. <i>Point</i>	23
2.7.1.2. <i>Line</i>	23
2.7.1.3. <i>Plane</i>	23
2.7.1.4. <i>Volume</i>	23
2.7.2. Form	24
2.7.2.1. <i>Surface configuration of form</i>	24
(a) <i>Primary Shapes</i>	24
(b) <i>Primary Solids</i>	24
2.7.2.2. <i>Visual tactile properties of form</i>	25
2.7.2.3. <i>Transformation of form</i>	25
2.7.3. Plans as Forms in Spaces	26
2.7.3.1. <i>Light and views</i>	26
(a) <i>Light</i>	26
(a) <i>Views</i>	26



2.7.3.2. Organization of space	27
2.7.4. Circulation through space	28
2.7.4.1. Entrance	28
2.7.4.2. Path-space relationships	29
2.7.5. Proportion and scale	29
2.7.6. Principles	29
2.7.7. Temperature	29
2.7.8. Sound – Acoustic Planning	30
2.7.9. Smells	30
2.7.10. Activities changing spaces	30
2.7.11. Signage	30
<b>3. PRECEDENTS INVESTIGATIONS</b>	<b>31</b>
<b>3.1. PRECEDENTS A – WORLD ZOO FEATURES</b>	<b>32</b>
3.1.1. Human used spaces	32
3.1.2. Advance animal space concept	32
<b>3.2. PRECEDENTS B – SA PLACES WITH ANIMAL AND HUMAN SPACES</b>	<b>33</b>
<b>3.3. PRECEDENTS C – LIGHTWEIGHT STRUCTURES</b>	<b>42</b>
3.3.1. Frei Otto	42
3.3.2. Marquees	42
3.3.3. Canobrella	43
3.3.4. Cable mesh structures - Carl Stahl	43
<b>3.4. PRECEDENTS D – EDUCATIONAL DISCOVERY CENTRES</b>	<b>44</b>
3.4.1. Bondi Beach Marine Discovery Centre	44
3.4.2. University of Pretoria Discovery Centre	44
<b>3.5. PRECEDENTS E – PLAYGROUNDS</b>	<b>45</b>
3.5.1. <i>Learning curves. A feast for the senses.</i> Unknown author. <i>Landscape Design</i> , 1996/04 vol 1996/249 p22-28)	46
3.5.2. <i>"A Different way to play"</i> – L.W. Murray <i>Landscape Architecture</i> , 2004 Aug vol 94/8 p130-133	46
3.5.3. <i>"For Children only"</i> C. Cooper Marcus. <i>Landscape architecture</i> . 2001/12 vol 91/12 p66-71&85	46
3.5.4. <i>"Spray and splash water park"</i> unknown author. <i>Parks and grounds</i> . 1996/06 vol 96/90 p 52-53	46
<b>3.6. PRECEDENTS F – AMPHITHEATERS - Steel pines.</b> V.Mays. <i>Architecture</i> 200/08. vol 91/8. pg 62-67.	<b>47</b>



<b>4. SITE SELECTION AND STUDY-THE EXISTING PARROT ENCLOSURE</b>	<b>47</b>
<b>4.1. INTRODUCTION</b>	<b>48</b>
4.1.1. General	48
4.1.2. Bird enclosures	48
4.2.2.1. <i>How different animals and their behaviour are catered for in the existing parrot enclosures</i>	<i>51</i>
(a) <i>Flying</i>	<i>51</i>
(b) <i>Feeding</i>	<i>51</i>
(c) <i>Nesting or breeding</i>	<i>51</i>
(d) <i>Resting</i>	<i>51</i>
(e) <i>Cleansng</i>	<i>51</i>
(f) <i>Protection</i>	<i>51</i>
4.2.2.2. <i>Services</i>	<i>52</i>
4.2.2.3. <i>Bird Enrichment Programmes</i>	<i>52</i>
4.2.3. Humans Spaces	52
4.2.3.1. <i>Service areas for management.</i>	<i>52</i>
(a) <i>Circulation</i>	<i>52</i>
(b) <i>Eating</i>	<i>52</i>
(c) <i>Resting</i>	<i>52</i>
(d) <i>Ablution</i>	<i>52</i>
(e) <i>Protection</i>	<i>52</i>
(f) <i>Learning</i>	<i>52</i>
(g) <i>Viewing</i>	<i>53</i>
(h) <i>Work – recording or monitoring</i>	<i>53</i>
(i) <i>Work – cleaning or preparation</i>	<i>53</i>
(j) <i>Work – storage</i>	<i>53</i>
4.2.3.2. <i>Visitor areas.</i>	<i>54</i>
(a) <i>Circulation</i>	<i>54</i>
(b) <i>Eating</i>	<i>54</i>
(c) <i>Resting</i>	<i>54</i>
(d) <i>Ablution</i>	<i>54</i>
(e) <i>Protection</i>	<i>54</i>
(f) <i>Education</i>	<i>54</i>
(g) <i>Viewing</i>	<i>54</i>
(h) <i>Playing</i>	<i>55</i>
<i>Other services</i>	<i>55</i>



4.2.4. The Landscape	55
4.2.5. The Sammy Marks Fountain	55
4.2.6. Summary of visitors and management accommodation and facilities	55
<b>5. DESIGN DEVELOPMENT</b>	<b>57</b>
<b>5.1. AIMS AND GOALS</b>	<b>58</b>
<b>5.2. AN ANIMAN PRECINCT</b>	<b>60</b>
5.2.1. Birds Spaces	60
<i>5.2.1.1. Protected Parrot Habitat.</i>	
(a) Flying	60
(b) Feeding	60
(c) Nesting or Breeding	60
(d) Resting	60
(e) Cleansing	61
(f) Protection	61
<i>5.2.1.2. Open-air Habitats</i>	61
5.2.1.2.1 Services	61
5.2.1.2.2 Enrichments	61
(a) Flying	61
(b) Feeding	61
(c) Nesting or breeding	62
(d) Resting	62
(e) Cleansing	62
(f) Protection	62
5.2.2. Human Spaces	62
<i>5.2.2.1. Management Service spaces</i>	62
<i>5.2.2.2. Visitor spaces</i>	60
(a) Experi-path educational space	62
(b) Discovery Haven	63
(c) Picnic Zone	63
(d) Informal sloping ground	63





<i>(e) Formal Seating</i>	63
<i>(f) Undercover Seating</i>	63
<i>(g) Relaxing Watch Spots</i>	63
<i>(h) Service Areas</i>	63
<b>6. TECHNICAL INVESTIGATION TREATISE</b>	<b>65</b>
<b>6.1. AN ANIMAN PRECINCT</b>	<b>66</b>
6.1.1. Animal Inhabited Spaces	67
6.1.1.1. <i>A Protected Parr of Habitat</i>	67
<i>(a) The Structure</i>	67
<i>Shape.</i>	67
<i>Materials</i>	67
<i>(b) The Services</i>	67
<i>(c) Birds required spaces</i>	67
<i>Flying</i>	67
<i>Feeding</i>	67
<i>Nesting or breeding</i>	68
<i>Resting</i>	68
<i>Cleansing</i>	68
<i>Protection</i>	68
6.1.2. Management occupied Spaces	69
6.1.2.1. <i>Service Passage</i>	69
<i>(a) Service Passage Preparation and Monitoring Zone</i>	70
<i>Multiuse Unit.</i>	70
<i>Preparation Surface</i>	70
<i>Mesh Storage Cabinet</i>	71
<i>Sickle-bush perch branches and feeding tray storage</i>	71
<i>Monitoring Strip</i>	71
<i>Monitoring Zone</i>	71
<i>Cleansing Zone</i>	71
6.1.2.2. <i>Breeding and conservation office</i>	71
6.1.2.3. <i>Training and meeting office</i>	71
6.1.2.4. <i>Main Parrot Food Preparation Zone</i>	72
6.1.2.5. <i>Main Parrot Feeding Schedule Zone</i>	72



6.1.3. Visitor occupied Spaces	72
6.1.3.1. <i>Experi-path</i>	72
(a) <i>Floor</i>	72
(b) <i>The Learn Zone</i>	73
(c) <i>The Relax Zone</i>	74
(d) <i>The Walk and Watch Zone</i>	74
(e) <i>Services</i>	74
(f) <i>Shade Structure</i>	74
6.1.3.2. <i>Discovery Haven</i>	75
(a) <i>Structure</i>	76
(b) <i>Interactive Discovery Walls</i>	76
(c) <i>Literature Archive</i>	76
(d) <i>Display Projections</i>	76
(e) <i>Interactive Touchscreens</i>	76
(f) <i>Office</i>	76
(g) <i>Services</i>	77
6.1.3.3. <i>Services</i>	77
6.1.4. Summary of Accommodation	77
6.1.5. Legal Aspects	78
6.1.6. Economic Issues	79
6.1.7. Adaptability and Flexibility	79
6.1.8. Ventilation and Light	79
6.1.9. Accommodation Schedule	80



7. DESIGN DRAWINGS	83
8. CONCLUSION	137
9. APPENDIX	139
10. LIST OF REFERENCES	147



## LIST OF FIGURES

### MAPS

- Map 1. Some South African existential nature spaces with animals.  
Map 2. Some Tshwane existential nature spaces with animals.  
Map 3. Educational institutions in Tshwane CBD and some of its eastern suburbs.  
Map 4. Existing SA Zoo facilities and enclosures (a,b,c) needing improvement.

### FIGURES

- Figure 1. *A defined walkway.*  
Figure 2. Lightweight sun protection device.  
Figure 3. A defined patio.  
Figure 4. A pavilion at Glenstantia Primary School, Pretoria.  
Figure 5. The Federal Garden Kassel, Germany 1955.  
Figure 6. Tshwane CBD.  
Figure 7. CBD Zoos.  
Figure 8. Interactive signage, Chimpanzee Enclosure pathway, SA Zoo.  
Figure 9. Visitors swim with sharks, uShaka Marine World, Durban.  
Figure 10. Diving visitors, uShaka Marine World, Durban.  
Figure 11. A Rhino Enclosure, SA Zoo.  
Figure 12. Enrichment props at a Chimpanzee enclosure, SA Zoo.  
Figure 13. A play element at a Baboon enclosure, SA Zoo.  
Figure 14. *Yarmouth Beach 1891.* Fisher, *et al.* 1966:69.  
Figure 15. *Versailles Zoo.* Fisher, *et al.* 1966:49.  
Figure 16. *Bear cages in Berlin Zoological Gardens.*  
Figure 17. *Old Carnivore House, Pretoria Zoo, 1930* (photographed by author 2006).  
Figure 18. Elephant Nightquarters, Pretoria Zoo (photographed by author 2006).  
Figure 19. *Hagenbeck revolution, Hamburg Zoo, 1907.*  
Figure 20. *uShaka Marine World* (sketch by author 2006).  
Figure 21. *Bester birds and Animal Zoo Park* (photographed by author 2006).  
Figure 22. Monte Casino Bird Park (photographed by author 2006).  
Figure 23. Chimpanzee Enclosure and adjacent human space, Johannesburg Zoo.  
Figure 24. Chimpanzee Enclosure, SA Zoo.  
Figure 25. Gibbon Enclosure, SA Zoo.  
Figure 26. A path to the Reptile Enclosures, SA Zoo.  
Figure 27. Primate enclosure, SA Zoo.  
Figure 28. Space near the Vulture Enclosure, SA Zoo.  
Figure 29. The Shark Tank, SA Zoo Aquarium.  
Figure 30. A viewing structure at the Lion Enclosure, SA Zoo.  
Figure 31. Perching space at the Leopard Enclosure, SA Zoo.  
Figure 32. A viewing path at the Baboon Enclosure, SA Zoo.  
Figure 33. A covered walkway at a private enclosure, SA Zoo.  
Figure 34. A private enclosure, SA Zoo.  
Figure 35. A pathway at the Leopard Enclosure, SA Zoo.  
Figure 36. A parrot breeding enclosure, SA Zoo.  
Figure 37. A viewing space above the Hippopotamus Enclosure, SA Zoo.  
Figure 38. A space for relaxing and eating, SA Zoo.  
Figure 39. The Gorilla Enclosure, SA Zoo.  
Figure 40. Viewing structures of the Bear Enclosure, SA Zoo.  
Figure 41. A pathway to the Elephant Enclosure, SA Zoo.  
Figure 42. The Tiger Enclosure, SA Zoo.  
Figure 43. The Main Entrance to the SA Zoo.  
Figure 44. A bird of prey enclosure, SA Zoo.  
Figure 45. A walk-in bird aviary, SA Zoo.  
Figure 46. The Aquarium signage, SA Zoo.  
Figure 47. Open-air Macaw Enclosure.  
Figure 48. Open-air Lemur Island.  
Figure 49. Enclosed and free roaming animals.  
Figure 50. Protected bird breeding enclosures.  
Figure 51. A variety of animal breeding spaces.  
Figure 52. A Small Cockatoo Breeding Enclosure.  
Figure 53. A mixed species walkthrough Bird Aviary.  
Figure 54. A large mammal mixed species enclosure.  
Figure 55. A mixed species protected enclosure.  
Figure 56. An open-air Crane Enclosure.  
Figure 57. A moat boundary at a Bear Enclosure.  
Figure 58. An open-air mixed species enclosure.  
Figure 59. A large open-air enclosure protected at the park limits.  
Figure 60. The Snake Enclosures are of heavy solid architecture.  
Figure 61. Some protected animal enclosures densely vegetated.  
Figure 62. A protected bird enclosure.  
Figure 63. A protective barrier Cranes in breeding.  
Figure 64. A wooden visual barrier for animal hiding.  
Figure 65. Wooden poles form a visual barrier wall for the Kelp Gulls.

- Figure 66. Vegetation used as visual barriers for animals to hide behind.
- Figure 67. Slender mesh connections for protected breeding enclosures.
- Figure 68. Steel supports forming the skeleton of enclosures.
- Figure 69. Steel frames and mesh protect the enclosures.
- Figure 70. Play components in the open-air Macaw Enclosure.
- Figure 71. An enriched environment with a deep soil level for animals to burrow into.
- Figure 72. Play components enrich a Black-Faced Spider Monkey Enclosure.
- Figure 73. Birds can grip onto enclosure mesh.
- Figure 74. Primates grip onto enclosure mesh.
- Figure 75. Bats grip onto enclosure mesh.
- Figure 76. The Bat-caved Fox Enclosure.
- Figure 77. Textiles provide shade in the protected breeding enclosures.
- Figure 78. Wooden branches and textiles provide shade for the birds.
- Figure 79. Human access in a breeding enclosure are visible to visitors.
- Figure 80. Human access doors are visible to visitors.
- Figure 81. Wooden walkways are supported by solid construction.
- Figure 82. A covered walkway at the Snake Enclosure.
- Figure 83. Natural materials are used for covered pathways.
- Figure 84. Adventurous pathways wind and rise.
- Figure 85. Pathway barriers blend into the surroundings.
- Figure 86. Uncovered unexperiential visitor walkways.
- Figure 87. An elevated pathway to a viewing structure.
- Figure 88. Natural and subtle pathway materials.
- Figure 89. Pathway barriers are of natural materials.
- Figure 89. Pathway barriers are of natural materials.
- Figure 90. An enclosed walkway encloses human scent and hides visitors for protection.
- Figure 91. An open-air amphitheater provides sun and rain protection.
- Figure 92. Wood topped concrete seats at the Amphitheater.
- Figure 93. Benches are placed at different places.
- Figure 94. Plastic furniture is placed under trees for resting.
- Figure 95. Furniture is limited to viewing structures with partitions and seats.
- Figure 96. Play structures do not allow animal views
- Figure 97. Play, party and relaxing spaces are very close to animal enclosures
- Figure 98. Low enclosure walls allow children to interact with farm animals.
- Figure 99. Uninteresting signage is small and unaccommodating to the visually impaired.
- Figure 100. There are a few unadvanced interactive signages.
- Figure 101. Uninteresting unaccommodating signage.
- Figure 102. An exotic landscape sets an interesting atmosphere.
- Figure 103. Lush vegetation creates a mysterious pathway.
- Figure 104. Variety in the landscape.
- Figure 105. A conference facility overlooks the Lion Enclosures.
- Figure 106. Birds and bird accessories are sold at the entrance.
- Figure 107. Sandton.
- Figure 108. A stainless steel cable and ferrule connection.
- Figure 109. A balustrade of X-tend mesh, Germany.
- Figure 110. Burger's Zoo, Arnhem.
- Figure 111. The centre offers a theatrical and adventurous experience avoiding the typical discovery centre display of information or pictures.
- Figure 112. A quiet literature information and reading zone.
- Figure 113. Sub-zones with experiments and information on display tables.
- Figure 114. A typical display table with interactive experiments.
- Figure 115. A computer information zone.
- Figure 116. Meldreth Manor School Adventure Playground, Cambridge, United Kingdom.
- Figure 117. The Head Start Adventure Playground, Massachusetts, USA.
- Figure 118. The Princess of Whales Memorial Playground, London, United Kingdom.
- Figure 119. Plan of Regency Park Amphitheater (Mays, V. 2002: 66)
- Figure 120. Lawn at the Regency Park Amphitheater. (Mays, V. 2002:67)
- Figure 121. Plan of an existing Parrot Enclosure area.
- Figure 122. Plan of an existing protected parrot enclosure.
- Figure 123. A breeding box at an existing parrot breeding enclosure.
- Figure 124. The enclosures' irrigation system. Water supply pipes run above to the middle of each enclosure.
- Figure 125. An existing parrot enclosure.
- Figure 126. The existing Service Passage.
- Figure 127. Access to breeding boxes from the existing Service Passage.
- Figure 128. Drainage gratings in the Service Passage.



- Figure 129. Wheepholes in the walls of the existing Service Passage.  
Figure 130. A secondary circulation pathway.  
Figure 131. Benches adjacent to the visitors' circulation path.  
Figure 132. Existing signage blocks views.  
Figure 133. Sammy Marks Fountain  
Figure 134. New Parrot Animal Precinct.  
Figure 135. A new Protected Habitat's concept of spaces.  
Figure 136. Bird feeders' conceptual form and orientation.  
Figure 137. A structure feeding zone to cover the birds.  
Figure 138. A typical breeding zone in a new protected parrot habitat.  
Figure 139. Concept for all perch elements.  
Figure 140. Concept for variety of resting spaces in the new enclosures.  
Figure 141. Concept for an Open-air Habitat.  
Figure 142. Concept of spaces in the Animal Parrot Precinct.  
Figure 143. Concept for a preparation and monitoring area.  
Figure 144. Open-air Habitat concept.  
Figure 145. Picnic Zone concept  
Figure 146. Sloped lawn concept.  
Figure 147. *Sloped lawn concept.*  
Figure 148. Plan of the Brow-necked Habitat.  
Figure 149. Protected Habitat Bird Movements  
Figure 150. Shading structure and Feeding Tray.  
Figure 151. Experi-path and Protected Parrot Habitat.  
Figure 152. Plan of the Preparation and Monitoring Zone, Service Passage.  
Figure 153. Service Passage.  
Figure 154. Structured Wall System.  
Figure 155. Preparation and Monitoring Zone  
Figure 156. Perspective of the Preparation and Monitoring  
Figure 157. Plan of administrative spaces  
Figure 158. Plan of Experi-path  
Figure 159. Experi-path. Zones are defined with materials, texture and form.  
Figure 160. Perspective sketch of the Experi-path.  
Figure 161. Experi-path Shade Structure Detail.  
Figure 162. Plan of the Discovery Haven  
Figure 163. Structured Wall Systems.  
Figure 164. Hidden Viewpoints, Discovery Haven.  
Figure 165. Discovery Haven Partitions.  
Figure 166. Lighting, Discovery Haven.  
Figure 167. Discovery Haven, Perspective drawing

## LIST OF APPENDIX FIGURES

- Figure 168. Tshwane green spaces 1.  
Figure 169. Tshwane green spaces 2.  
Figure 170. Tshwane green spaces 3.  
Figure 171. Tshwane green spaces 4.  
Figure 172. Tshwane green spaces 5.  
Figure 173. Tshwane green spaces 6.  
Figure 174. Tshwane green spaces 7.

## LIST OF TABLES

- Table 1. World Zoo Facilities (a dash denotes none; an empty cell denotes information is not known.)  
Table 2. Summary of visitors and management accommodation and facilities.  
Table 3. New Management and Visitor Accommodation  
Table 4. Protected Habitat Accommodation Schedule  
Table 5. Management Accommodation Schedule.  
Table 6. Visitor Accommodation Schedule.