Oregon Zoo
Together for Wildlife

clr
DESIGN

Oregon Zoo Campus Plan
2024





The Oregon Zoo is part of Metro.
Metro

PAGE INTENTIONALLY LEFT BLANK

CAMPUS PLAN 2024

PREPARED FOR:

Oregon Zoo
Together for Wildlife

4001 SW Canyon Rd,
Portland, OR 97221

PREPARED BY:

clr DESIGN

833 Chestnut Street, Suite 909
Philadelphia, PA 19107

PLANNING PARTICIPANTS

ADMINISTRATION
Heidi Rahn – Zoo Director
Utpal Passi – Deputy Director
Krista Swan – Director of Marketing
Hova Najarian – Director of Communications
Melanie Sorensen – Director of Education & Conservation
Lori Ford – Culture & Inclusion Manager
Charetta Long – Equity & Engagement Manager
Shervin Hess – Conservation Manager

OPERATIONS
Ivan Ratcliff – Director of Business Operations
Tim McCormack – Director of Facilities
Jennifer Burns – Safety & Health Program Manager
Mickey Webb – Director of Events
Michael Harris – Maintenance Manager
Seth Menser – Horticulture Manager
Jesse Lene – Building Controls Manager
Joel Lavespere – Public Safety Manager
Ron Herrington – Custodial Supervisor

ANIMAL CARE
Steve Lefave – Curator of Elephants
Kate Gilmore – Curator of Primates & Ambassador Animals
Kelly Gomez – Curator of Africa & Marine Life
Travis Koons – Curator of Birds, Reptiles & Native Conservation
Asaba Mukobi – Area Supervisor, Primates
Eliza Lee – Area Supervisor, Ambassador Animals
Amy Hash – Area Supervisor, Africa & Marine Life
Marcus Jason – Area Supervisor, Birds, Reptiles & Small Mammals
Jen Osburn-Eliot – Area Supervisor, North America

ANIMAL HEALTH, WELFARE, & NUTRITION
Carlos Sanchez – Director of Animal Health
Nadja Wielebnowski – Animal Welfare & Research Manager

OREGON METRO
Kristin Solomon – Senior Capital Project Manager
Staci Pfau – Senior Capital Project Manager
Joel Morton – Senior Attorney
Tom Rogers – Finance Manager
John Lindenthal – Program Director, Construction Project Management Office
Jenna Garmon – Sustainability manager
Dana Visse – Climate Analyst
Sarah Allison – Sustainability Planner

OREGON ZOO FOUNDATION
Julie Fitzgerald – Executive Director

CLR DESIGN
Gregg Leicester – Principal in Charge
Dan Miller – Project Manager, Architect
Nick Iott – Landscape Architect
Kelsey Weber – Architect
Scott Dietrich – Graphic Designer

WALKER MACY
Chelsea McCann – Principal
Emily De Lautour – Landscape Architect
Betty Lou Poston – Urban Designer
Sierra Gardiner – Landscape Designer

KPFF CONSULTING ENGINEERS
Daan Dommels – Principal
Paul Schmidtke – Civil Engineer

PAE ENGINEERS
Allan Montpellier – Principal
Tim Elley – Project Manager, Mechanical
Karina Hershberg – Regenerative Design
Robert Smith – Electrical
Steve Kelly – Technology

TJP ENGINEERING
Terri Johnson – Principal, LSS Engineer

EQUILIBRIUM ENGINEERING
Ed Quesenberry – Principal, Structural Engineer
Leif Erickson – Principal, Structural Engineer

GRI
Jason Bock – Principal
Nick Hatch – Geotechnical Engineer

DCW COST MANAGEMENT
Andrew Jonsson – Technical Lead
Bryan Baldwin – Project Manager, Cost Estimator

JP MITCHELL, LLC
Jim Mitchell – Advisor

COMMUNITY ENGAGEMENT
Terry O'Connor – Terry O'Connor Consulting
Nette Pletcher – Beez Kneez Creative

THE BOOKIN GROUP
Chris Hagerman – Principal, Senior Planner
Debbie Cleek – Principal, Senior Planner

TABLE OF CONTENTS

PAGE INTENTIONALLY LEFT BLANK

EXECUTIVE SUMMARY

PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

Together for Wildlife

For nearly 135 years, the Oregon Zoo has offered local residents and visitors from around world a chance to connect with wildlife. Along the way, it has evolved into a hub for the science of animal well-being and is an internationally recognized conservation leader. The zoo is helping to save all kinds of endangered species, from California condors to northwestern pond turtles and has generated a tremendous amount of community pride and support.

In 2008, people across the region acted on behalf of animals and sustainability with an overwhelming vote to invest in the zoo. The 2008 zoo bond measure was transformative. It provided for a dramatic overhaul to some of our most popular animal habitats, plus a state-of-the-art veterinary medical center, an education center, and much more. All told, the bond reshaped nearly 40% of the zoo campus — an impact enjoyed by millions of visitors.

Even with all that has been achieved, there are habitats in sections of the zoo that date to the late 1950s and are not able to keep pace with changing standards. There also are accessibility challenges and aging infrastructure. The zoo has a lot to be proud of, but at the same time there is more work to do — for our animals, for our guests and for our environment.

Collaborating with a professional planning team from CLR Design, the zoo set priorities through a nearly yearlong engagement process involving zoo guests, staff members, community groups, experts in animal care and conservation, and other stakeholders. The Metro Council provided additional input and guidance.

All of that work is reflected in this 2024 campus plan, which will help shape the next era of animal care, guest accessibility and resource conservation at the zoo. Focusing on areas not improved through the 2008 bond, the plan proposes updating some of the zoo's oldest animal areas, improving accessibility and amenities for guests of all ages and abilities, and ensuring the zoo does its part to both mitigate and respond to a changing climate.

The Oregon Zoo's mission is connecting our community to the wonder of wildlife to create a better future for all. This plan envisions the physical manifestation of that mission: a space for the zoo to create connections, spark interests and foster relationships that will benefit not just this region but the world — a campus that will bring us together for wildlife.

CONTEXT

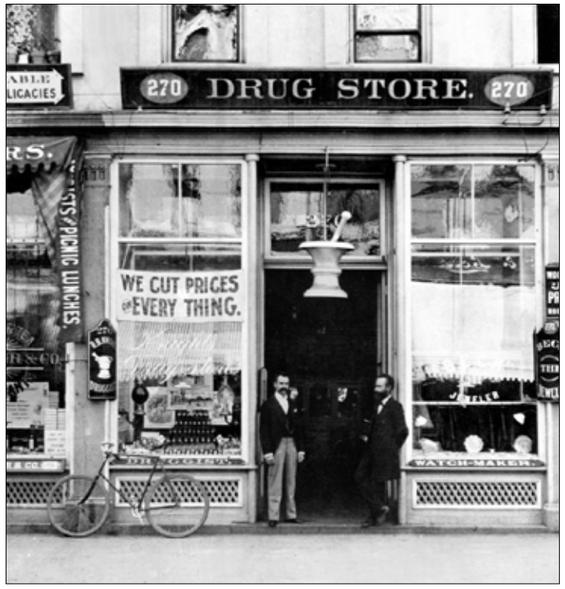
The Oregon Zoo has been at its current 64-acre location in Portland's West Hills since moving to Washington Park in 1959. The zoo is a key community resource and regional attraction, currently welcoming around 1.3 million visitors annually.

Many updates and groundbreaking animal-care advancements have been made over the years, facilitated most recently through a 2008 bond measure and subsequent capital projects. Improvements to the zoo over the past decade were guided by a previous Campus Plan completed in late 2011.

History

The zoo's history dates back to 1888 when a pharmacist named Richard Knight donated a grizzly bear and a small number of exotic animals he had acquired to the City of Portland. This led to the establishment of the Portland Zoo at a site in lower Washington Park. Over the next 70 years, the diversity and number of species housed at the zoo grew dramatically. In 1954, A successful bond measure financed the construction of the Portland Zoological Gardens, which opened at the current zoo site in 1959.

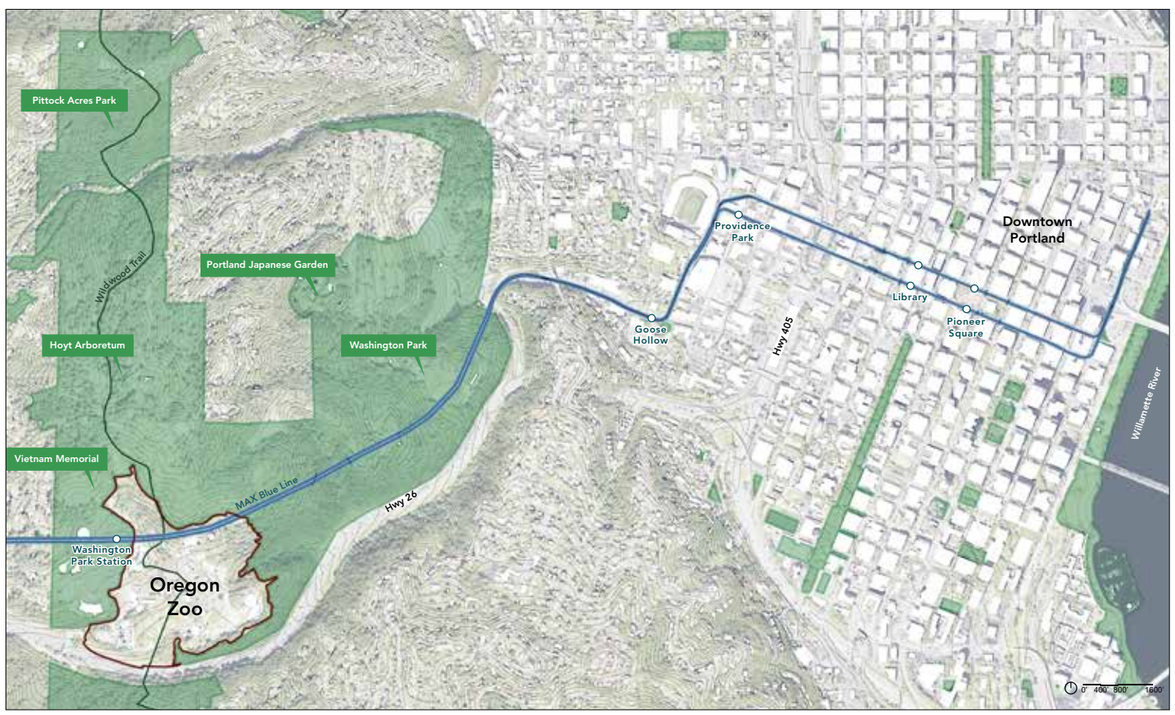
The Metropolitan Service District assumed management responsibility of the zoo in 1976 and oversaw significant renovations over the next 20 years. The zoo became the Oregon Zoo in 1998, the same year that the regional MAX light rail system was connected through the Washington Park station.



Richard Knight's Pharmacy

Ten years later, local voters approved a bond measure which, along with support from Oregon Zoo Foundation donors, funded eight major projects defined by the 2011 Campus Plan. These transformative projects reimagined roughly 40% of the zoo's usable area and include the Veterinary Medical Center, Education Center, Condors of the Columbia, Elephant Lands, Polar Passage, and Primate Forest among others.

Aerial photograph, Oregon Zoo 1967



Zoo context map

From its humble beginnings 135 years ago–through strong support from the local community, strategic planning, and responsible development–the zoo has transformed into a world-class center for wildlife education, species recovery and conservation science.

Site Characteristics

Located about two miles southwest of downtown Portland, the zoo landscape is characterized by around 80 vertical feet of north-to-south slope and surrounded by mature Pacific Northwest conifer forest. The site is easily reached via MAX light rail lines as well as by car from Highway 26 and SW Kingston Drive.

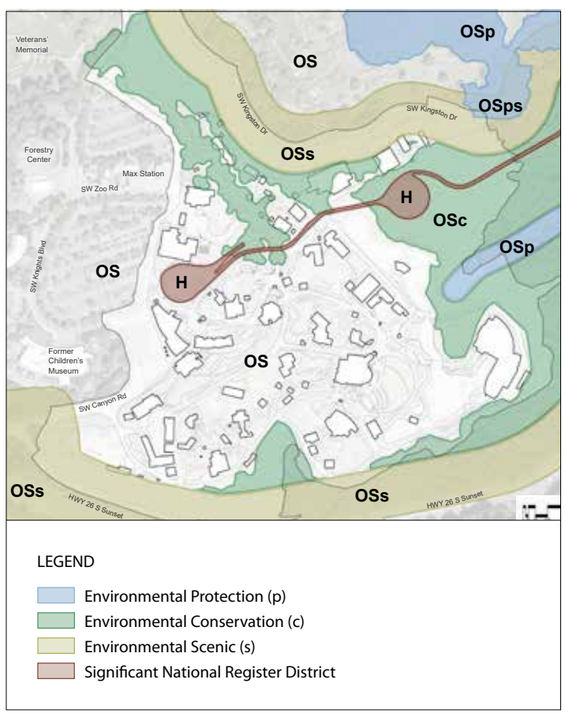
Various bike and foot trails also provide access and recreation around the zoo. The slope, forested landscape and park surroundings offer excellent views and adjacencies throughout the campus but limit the zoo's usable footprint to roughly 43 acres.

The hills surrounding the zoo, known as the Tualatin Mountains, are defined by a series of active and inactive faults leading to a generally seismically active condition. The land the zoo sits on is part of an active mapped prehistoric landslide encompassing roughly 125 acres, ranging from 20 to 100 feet deep. The zoo's ongoing monitoring program has recorded slow but steady movement near the edges of the slide and at the toe of the main slope.

Future zoo development should maintain current net loading with balanced cut-and-fills, avoid steep sloped areas, and limit water infiltration as much as possible. Foundation design and excavation will also be critical components of all future designs. Structures are likely to require a combination of mat foundations, conventional spread foundations tied together with grade beams and–for those near the toe and head of the landslide scarp–deep foundations such as micropiles or drilled shafts.

Washington Park is zoned by the City of Portland as Open Space. The Open Space zone is intended to preserve and enhance public and private open, natural, or improved park and recreational areas. Additional overlay designations fall within the Open Space zone encompassing the zoo, including environmental protection, environmental conservation and scenic resources.

Protections provided by the environmental overlay zones, which preserve the amazing natural environment surrounding the zoo also impact the improvable area within the zoo's boundaries. Development adjacent to these areas must be strategic, limited within undisturbed areas, and compliant with additional environmental regulations as defined by Title 33 of the Portland City Code.



Zoo open space zoning overlay map

Veterinary Medical Center

Planning and Strategic Framework

This Campus Plan is built on the framework of the recent Oregon Zoo Strategic Plan, drawing on knowledge gained from the 2011 Campus Plan and subsequent capital projects. Context provided by these elements helps to define the goals and drivers behind current planning efforts, which will inform progress over the next 10 to 15 years. Many of the Strategic Plan's focus areas tie directly to physical campus planning and provide important context for proposed elements in this Campus Plan.

2020 – 2023 Oregon Zoo Strategic Plan Focus Areas:

- Lead the way in animal care & welfare.
- Advance wildlife conservation.
- Deliver an inspiring guest experience (every time).
- Create diverse, equitable & inclusive environments.
- Connect with our communities.
- Provide meaningful and fulfilling staff experiences.
- Achieve financial sustainability.

The capital projects associated with the 2011 Campus Plan were transformative, advancing animal care and well-being, environmental sustainability and the zoo's ability to provide high-quality conservation education. Condors of the Columbia highlights a conservation program that has boosted the wild population of critically endangered California condors in significant ways. The Veterinary Medical Center allows zoo staff to provide industry-leading medical care to the resident animals. The Education Center provides a new home for the programs that help fulfill the zoo's commitment to conservation education and outreach.

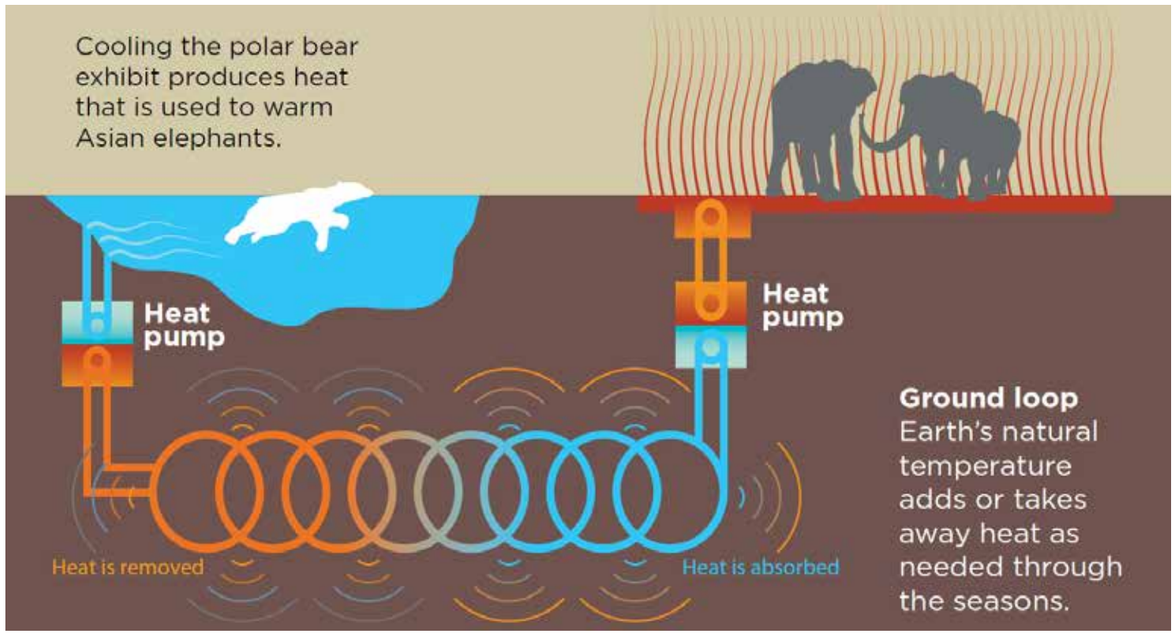
Most recently, Elephant Lands, Polar Passage, Primate Forest, and Rhino Ridge significantly expanded and improved both the indoor and outdoor housing spaces while supporting activity and choice to enhance the well-being of these complex animals.

Education Center

All of the above projects represent critical progress for the Oregon Zoo, and provide important information for planning future directions. Some key reflections informing this campus plan include:

- Enhancing animal well-being often requires a larger care footprint compared to older/existing facilities. On a constrained site, this can lead to fewer animals and less species diversity. One goal of this Campus Plan is to increase the diversity of life represented at the zoo.
- Sustainability and climate resiliency measures included in recent projects have been largely successful case studies for continued development. Rainwater and solar harvesting systems at the Education Center, Elephant Lands and VMC, as well as the geothermal heat exchanger between polar bears and elephants, are all worth studying to determine whether aspects may be incorporated into new work.
- Efforts to publicly showcase animal care have been very successful for engaging zoo guests, but special attention should also be paid to providing top-quality and naturalistic viewing opportunities.
- It can be a challenge to maintain quality guest experience during ongoing construction, especially when large areas of the zoo are closed for redevelopment. Phasing and implementation plans must be carefully developed to optimize the guest experience during such times.
- As climate change, invasive species, disease and other threats to biodiversity intensify, the broader conservation community is turning to the Oregon Zoo to advance species recovery efforts both on-grounds and in the field. The zoo supports industry-leading animal care and conservation work, but studies have shown many guests are not aware of these programs.

Primate Forest



Successful heat exchange system between polar bear (2021) and elephant (2015)

THE PLANNING PROCESS

This final report represents a consensus reached through the input of hundreds of people, numerous planning workshops, community engagement sessions, and detailed engineering analysis over the course of 2023. The process was divided into five distinct tasks.

I. WORK PLANNING

Develop a detailed schedule and strategy to deliver the Campus Plan as envisioned by the zoo.

II. PRELIMINARY PROGRAMMING

Define the goals of the Campus Plan and consider what programmatic elements are required to achieve them.

III. INVENTORY & ANALYSIS

Review and analyze the existing zoo landform, facilities, infrastructure, utilities, circulation, opportunities and constraints.

IV. CAMPUS PLAN DEVELOPMENT

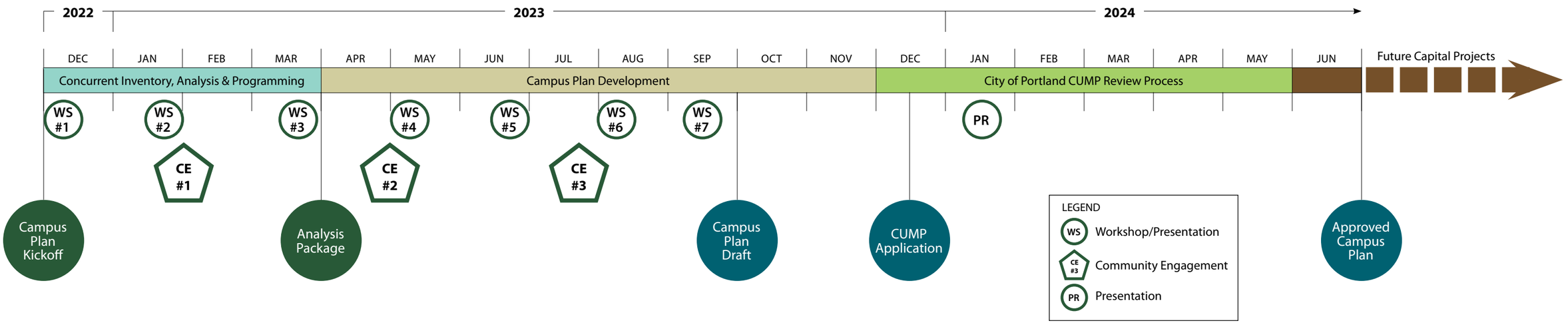
Using information gathered in the programming and analysis phases, establish priority project zones and define the direction of future improvement and development.

V. CONDITIONAL USE MASTER PLAN

Obtain preliminary approval from the City of Portland for the concepts developed in the planning phase.

Planning Phases, Components & Deliverables

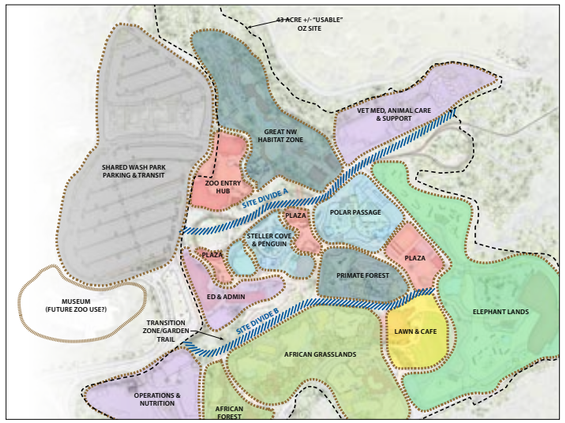
PHASE	INVENTORY & ANALYSIS	PRELIMINARY PROGRAMMING	CAMPUS PLAN DEVELOPMENT	STRATEGIC IMPLEMENTATION
KEY COMPONENTS	Building Conditions Existing Tree Circulation Land Use Land Form Sustainable Facility Performance Water and energy Animal Population Shows & Encounters Guest Services Operations	Mission / Values Planning Goals & Objectives Opportunities & Constraints Preliminary Plan Organization Diagrams Preliminary Exhibit Concepts Preliminary Circulation Guest Services Concepts	Plan Refinement Collection Plan Refinement Project Zones / Packages Phasing Scenarios Options Testing	Plan Refinement Project Packaging Implementation / Phasing Project Programs & Budgets Affirm Goals & Objectives Achieved
DELIVERABLES	Workshop Notes, Drawings, Inventory & Analysis Package	Workshop Notes & Diagrams	Workshop Notes, Illustrative Plan(s) & Preliminary Report Drafts	Workshop Notes, Schedules, Preliminary Report, Preliminary Budgets → Conditional Use Master plan; Comprehensive Campus Plan Report



Workshop Approach

Throughout the planning process, participants gathered for collaborative in-depth workshops covering key topics and including many perspectives from zoo staff as well as the team of planners and engineers. Each workshop formed the common baseline to inform next steps and build consensus on the planning direction.

Through this highly interactive approach to planning and decision-making, team members gained an understanding of what makes the zoo and its community special. Exploring and respecting the points of view, observations, recommendations, and expectations of this specific zoo community results in a tailored Campus Plan for the future that is thorough, creative, achievable and mindful of the zoo's history, culture and mission.



Example of workshop diagram – Land Use Area

Community Engagement

Many diverse stakeholder groups are affected by long-range planning efforts. In recognition of this, the internal planning team included dedicated representatives from Metro, the Oregon Zoo Foundation and all zoo departments, including administration, operations, guest services, facilities, maintenance, veterinary care, animal care, education, volunteers, communications and marketing.

Engaging with the broader community to inform planning efforts was also a high priority. Terry O'Connor Consulting, in partnership with Nette Pletcher (Beez Kneez Creative), led an extensive effort to identify stakeholder groups, learn about current zoo experiences and needs, and test design concepts at key points in the plan development process.

Stakeholder groups engaged through surveys, focus groups and open houses included:

- Broader zoo staff
- Zoo volunteers
- Zoo Apprenticeship Program participants
- Oregon Zoo Foundation board members
- Community Advocacy Council
- Zoo members
- Frequent visitors
- Multiple community groups

Front-end evaluation was designed to inform the plan's initial development. Methods included three comprehensive, online surveys asking quantitative and qualitative questions of members and frequent visitors, zoo staff, and volunteers, as well as two virtual focus groups with the Oregon Zoo Foundation board. Results provided data on these stakeholders' ease of navigating the zoo, their favorite and least favorite habitats, zoo experiences they enjoy, which areas need improvement, needs for guest amenities, and other priorities for future investment.

During the plan development phase, a second and third round of engagement activities occurred over two weeks in May and August. The purpose of these formative activities was to gain feedback from a variety of stakeholder groups on the most recent Campus Plan designs.

Questions in the first series of engagement sessions were focused specifically on the topics of flow, pathways, amenity choices and features that promote access and inclusiveness. The formative evaluation methods included two open houses with table-top activities, three focus groups and an interactive session with youth from the Zoo Apprenticeship Program who used photography to illustrate their opinions.

The third round of engagement activities were designed to include many of the same groups that participated in the second round as well as an expanded group of members and frequent visitors. These activities and discussions focused on areas in which the planning team responded to previous feedback as well as a number of specific areas of study.

Overall, through all three phases of engagement, over 2,000 opinions were collected and considered.

Community engagement sessions

CAMPUS PLAN DRIVERS

The primary purpose of the early planning effort was to carefully evaluate the context of the existing zoo site, infrastructure, previously established strategic goals and new priorities. This critical period of review and reflection led to the establishment of the Campus Plan drivers that directed and informed design efforts for the remainder of the planning process.

Animal Wellbeing

The well-being of the animals residing at the Oregon Zoo is a critical driver for all elements of the Campus Plan. In addition to AZA standards and other industry guidance for habitat design, opportunities to enhance well-being through activity and choice were explored.

Some animals thrive best in habitats customized directly for their species' needs, while others may take advantage of sharing several more-flexible habitats with other species. All animals benefit from being provided choices within their environment – sun vs. shade, heating vs. cooling, variable eating and sleeping locations, visibility vs. privacy, and many other considerations.

Choice goes hand-in-hand with flexibility, which is an important element for all public-facing habitats as well as behind-the-scenes areas. Flexible habitats allow for optimal animal care, zoo population management, and consistent guest experiences.

Staff Wellbeing

Providing a meaningful staff experience is one of the focus areas identified in the Strategic Plan. A first step toward achieving this goal is addressing the need for more quality working spaces for staff members. Cramped and aging facilities around the zoo are a primary contributor to this issue. Proposed new projects include more generous and comfortable staff areas.

In addition, the primary central working spaces for the animal care team and facilities and maintenance team are in buildings that are approaching the end of their useful lives. This Campus Plan includes strategic development dedicated to replacing these facilities with expanded and improved modern structures. High quality working spaces for staff will support better communication, more flexibility to staffing and operations, a higher level of comfort, and most importantly a better representation of the value these individuals bring to the zoo community.

Elephant Lands activity tree in Forest Hall

Existing zoo circulation diagram

Circulation and Flow

Studies of existing guest and staff circulation revealed several areas in need of improvement. The primary challenges are in the Great Northwest, Pacific Shores and Africa zones, and the focus is on providing an equitable and fully accessible experience for all guests.

To achieve this goal, pathways must be widened to accommodate more guests, graded to achieve maximum slopes, and designed to support intuitive wayfinding. These guidelines will support flow throughout the campus that is navigable by all users.

Another element of circulation and flow is to provide guests with more options for how they experience the zoo. Current paths, combined with steeply sloping topography, require guests to take long and strenuous routes to experience many of the zoo's popular attractions and animals.

This Campus Plan strives to provide additional options of varying lengths, and to reduce the physical demand by shortening overall walking distances and reducing the vertical elevation climb needed to exit from any point within the zoo. Increasing the accessibility, flexibility and choices available to guests will provide a more equitable experience for individuals of all abilities, whether they're visiting for a couple hours, a full day, or just want to visit the elephants each week!

Conservation Action & Education

Over the past 25 years, the Oregon Zoo has achieved some monumental wins for wildlife: helping prevent the extinction of the Oregon silverspot butterfly, tripling the range of the northwestern pond turtle in Washington, becoming the first institution to breed pygmy rabbits, starting a polar bear science revolution, launching a continent-wide effort to eliminate lead from the ecosystem, and helping the Yurok Tribe bring condors back to their ancestral homeland.

All of these efforts are part of bigger partnerships, but none of them would have been possible without the Oregon Zoo. As the biodiversity crisis intensifies, the zoo will leverage its facilities, expertise and partnerships to restore wildlife populations and promote human-wildlife coexistence. The zoo's diverse community is critical to the success of its conservation mission. The campus plan will draw the zoo community further into the collective conservation journey, sharing stories, offering hope and inspiring action for wildlife and the natural world.

California Condor

Guest Experience

Delivering an inspiring guest experience is another key focus area of the zoo's Strategic Plan. The improvements to circulation and flow discussed above will help in this effort, but a variety of other elements are informed by this key driver. Inspiring guests begins with amazing opportunities to view and experience thriving animals at all times of year. To this end, zoo care staff included animal visibility and climate suitability in their holistic evaluations. The collection of habitats proposed here supports a robust year-round experience with diverse animal experiences, great views, and many new ways to interact with animals and animal-care staff.

What happens in between animal-related experiences is also a critical element of this plan. The proposed layout includes many opportunities for guests to learn, rest, eat, play and decompress — all within the forest park environment of the Oregon Zoo. One important aspect of this effort is to make true hubs out of the major decision points by improving amenities and guest infrastructure at these locations. The location of these hubs was also assessed and reorganized to provide a better balance of amenities throughout the guest experience.

Operational Efficiency

Improving efficiency is critical for ensuring the campus plan supports continued sustainable operation for years to come. From day one of the planning effort, it became clear that future sustainability depends on prioritizing updates to the zoo's critical infrastructure.

Replacing facilities that have reached the end of their expected life reduces the effort and cost of increased maintenance down the road. In addition to physical structures, the organization of guest and staff flow across the campus is improved by including more generous clearances, direct service access to buildings and habitats, and clear routes of circulation.

The financial sustainability of the zoo requires a high degree of operational efficiency. In addition to the updates proposed around flow and access, improvements to guest amenity hubs are critical to enhancing this efficiency. The proposed hubs included in the campus plan are spaced evenly along the main circulation routes to provide consistent comfort for guests and revenue opportunities for the zoo. The hubs themselves include a focused collection of services including wayfinding, restrooms, dining options and retail, allowing for more centralized staffing and services.

Pollinator Garden conveys important conservation message

Elephant Lands provides unique and inspiring experiences

Campus Ecology

Campus Ecology is a term CLR uses to refer to the sustainable development and operation of a campus. Fundamentally, it is the long-term vision for showcasing the conservation, education and sustainability that guide the zoo's daily operations, policies and future projects. The zoo must holistically evaluate green design principles and ideas in terms of its unique climate, cultures, plants and animals to arrive at a unique collection of design directions.

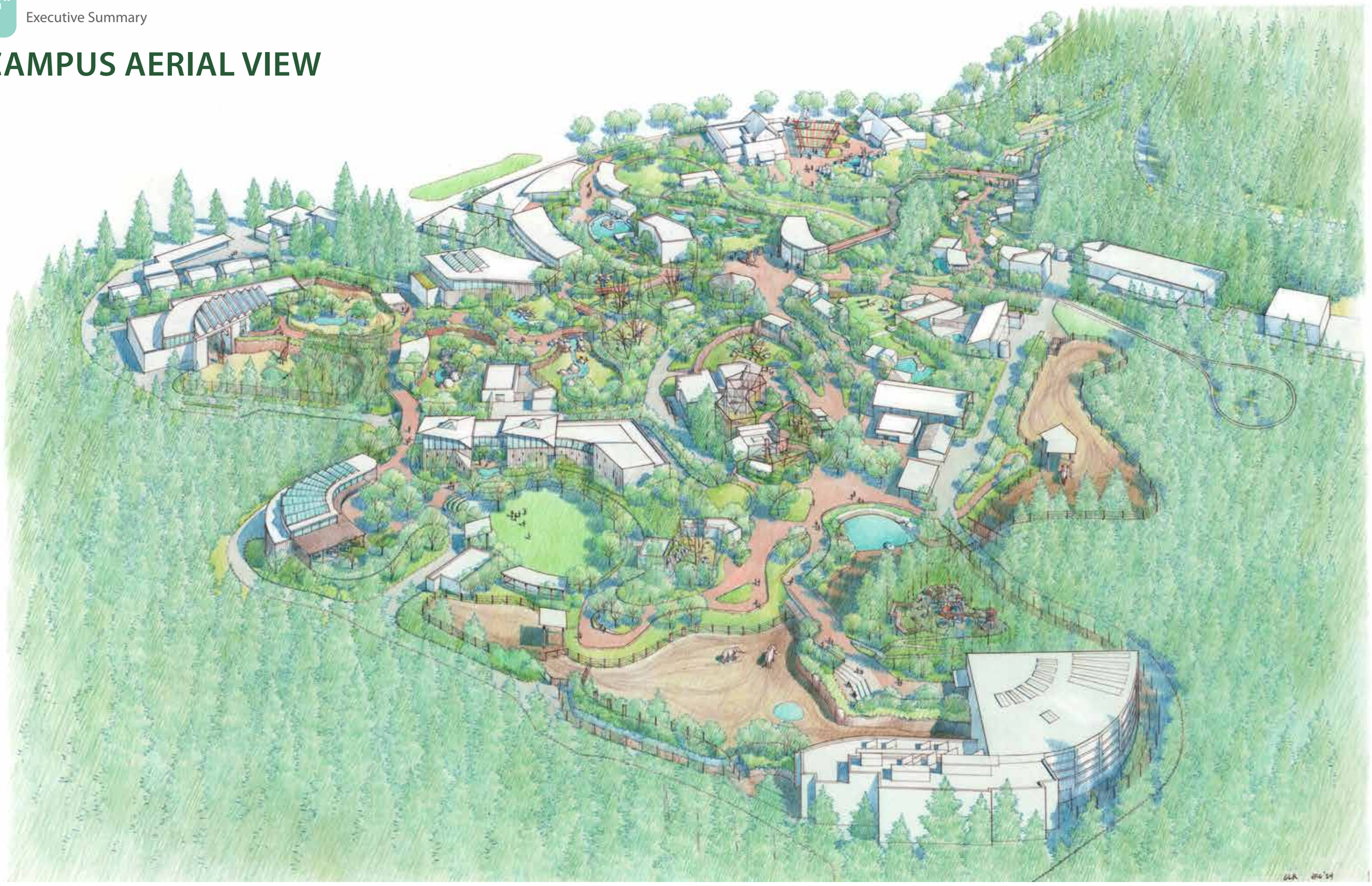
The bar for future development at the Oregon Zoo is already set high by Metro's Sustainable Buildings and Sites policy, which provides standards for design, construction, operations and maintenance of all Metro properties, supporting the goals of reducing greenhouse gas emissions, eliminating priority toxic and hazardous substance use, reducing overall waste generation, reducing potable water use, and ensuring properties positively contribute to healthy urban ecosystems and watersheds.

Beyond the established policy, the Metro team participated in campus planning workshops to help establish a set of ambitious goals supported by the engineering team and the proposed development. The primary purpose of these goals is to ensure that the Oregon Zoo campus positively contributes to human and environmental well-being, conserves natural resources, and inspires sustainability practices by guests, community organizations and businesses. This will be achieved in part by pursuing the following specific goals:

- Eliminate campus operational carbon emissions by 2040.
- Reduce water use 35% by 2040.
- Promote ecological integrity and function in design of landscaping, stormwater systems and animal habitats.
- Go beyond the Sustainable Buildings and Sites policy and contribute to climate environmental justice outcomes in the region.
- Design zoo facilities and systems to be resilient in the face of climate change and other challenges.

PAGE INTENTIONALLY LEFT BLANK

CAMPUS AERIAL VIEW



CAMPUS VISION

Existing Campus

The zoo is organized into three large zones including North America, Elephant Lands, and Africa. The non-public facing areas of the zoo are focused around the Facilities Hub in the southwest corner and the Animal Care Hub in the northeast.

ENTRY PLAZA
1. Gift Shop
2. Cascade Crest
3. Ticket Redemption
4. Train Round House

GREAT NORTHWEST
5. Mountain Goat Habitat
6. Mt. Goat & Black Bear Care Building
7. Pedestrian Bridge
8. Suspension Bridge
9. Black Bear Habitat
10. Snowy Owl Habitat
11. Covered Bridge
12. Eagle Habitat
13. Cascade Building
14. River Otter Habitat
15. Beaver Habitat
16. Waterfowl Aviary
17. Public Restrooms
18. Cougar Habitat & Building
19. Condor Habitat & Building
20. Family Farm Barn
21. Family Farm House

GATE J
22. Veterinary Medical Center
23. VMC Generator
24. Care, Connection & Conservation (C3) Building
25. Wildlife Live Building
26. Avian Reproduction Center Building

PACIFIC SHORES
27. Polar Bear Filtration Building
28. Polar Bear Care Building
29. Polar Bear Habitats
30. Boardwalk Path
31. Steller Cove Exhibit
32. Steller Cove Filtration Building
33. Penguinarium

PRIMATE FOREST
34. Chimpanzee Habitat
35. Chimpanzee Care Building
36. Chimpanzee Mesh Habitat
37. Orangutan & Gibbon Care Building & Habitat

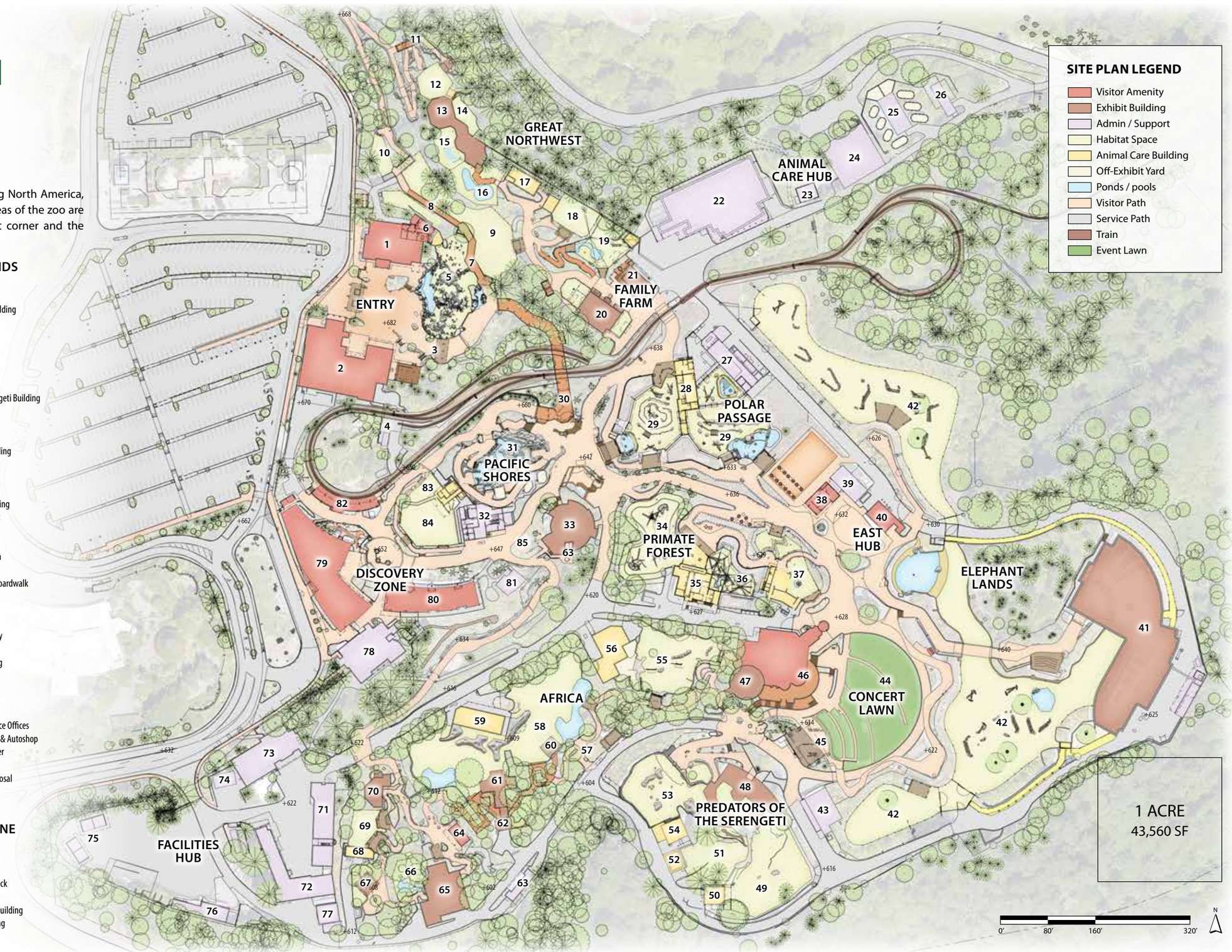
EAST HUB
38. Growlers Cafe
39. Storage Building
40. Public Restroom

ELEPHANT LANDS
41. Forest Hall
42. Elephant Habitats
43. Elephant Filtration Building
44. Lawn
45. Stage

AFRICA
46. Aviary Cafe
47. Vollum Aviary
48. Predators of the Serengeti Building
49. Cheetah Habitat
50. Cheetah Care Building
51. Painted Dog Habitat
52. Painted Dog Care Building
53. Lion Habitat
54. Lion Care Building
55. Black Rhino Habitat
56. Black Rhino Care Building
57. Tortoise & Pygmy Goat
58. Savanna Habitat
59. Hoofstock Barn
60. Giraffe Feeding Station
61. Giraffe Care Building
62. Tree Tops Building & Boardwalk
63. Butterfly Lab
64. Sankuru Trader
65. Rainforest Building
66. Africa Rainforest Aviary
67. Kongo Ranger Station
68. ASC Otter Care Building
69. ASC Otter Habitat
70. Bat Cave

GATE A
71. Facilities & Maintenance Offices
72. Horticulture, Welding, & Autoshop
73. Animal Nutrition Center
74. Greenhouse
75. Compost & Waste Disposal
76. Custodial Building
77. Hay Barn

DISCOVERY ZONE
78. Administrative Center
79. Education Center
80. Classrooms
81. Overnight Camping Deck
82. Train Station
83. Red Panda Habitat & Building
84. Tiger Habitat & Building
85. Carousel



Proposed Campus

The proposed campus plan maintains the overall organization of the zoo and focuses on strategic improvements informed by the key drivers identified by the planning team.

ENTRY PLAZA
1. Gift Shop
2. Guest Services
3. Ticket Redemption
4. Train Round House

GREAT NORTHWEST
5. Mountain Goat Habitat & Care Building
6. Pedestrian Bridge
7. Owl Habitats
8. Owl Care Building
9. Animal Habitat
10. Animal Overlook
11. Eagle Habitat
12. Covered Bridge
13. Animal Habitat
14. Black Bear Care Building
15. Black Bear Habitat
16. Public Restroom
17. Cougar Habitat & Building
18. Condor Habitat & Building
19. River Otter Habitat
20. Otter & Beaver Care Building
21. Beaver Habitat
22. Freshwater Exhibit Building
23. Filtration Building

ANIMAL CARE HUB
24. Veterinary Medical Clinic
25. Animal Care Offices
26. Flexible Holding & Support
27. Avian Holding & Support

COASTAL SHORES
28. Filtration Building
29. Polar Bear Care Building
30. Polar Bear Habitats
31. Seal Habitat
32. Sea Otter Habitat
33. Aquatic Support, Care, & Filtration Building
34. Penguin Care Building & Habitat

CENTRAL HUB
35. Guest Services
36. Carousel

PRIMATE FOREST
37. Chimpanzee Habitat
38. Chimpanzee Care Building
39. Chimpanzee Mesh Habitat
40. Orangutan And Gibbon Care Building & Habitat

EAST HUB
41. Event Shelter
42. Growlers Cafe
43. Storage Building
44. Dining Shelter
45. Public Restroom
46. Adventure Play

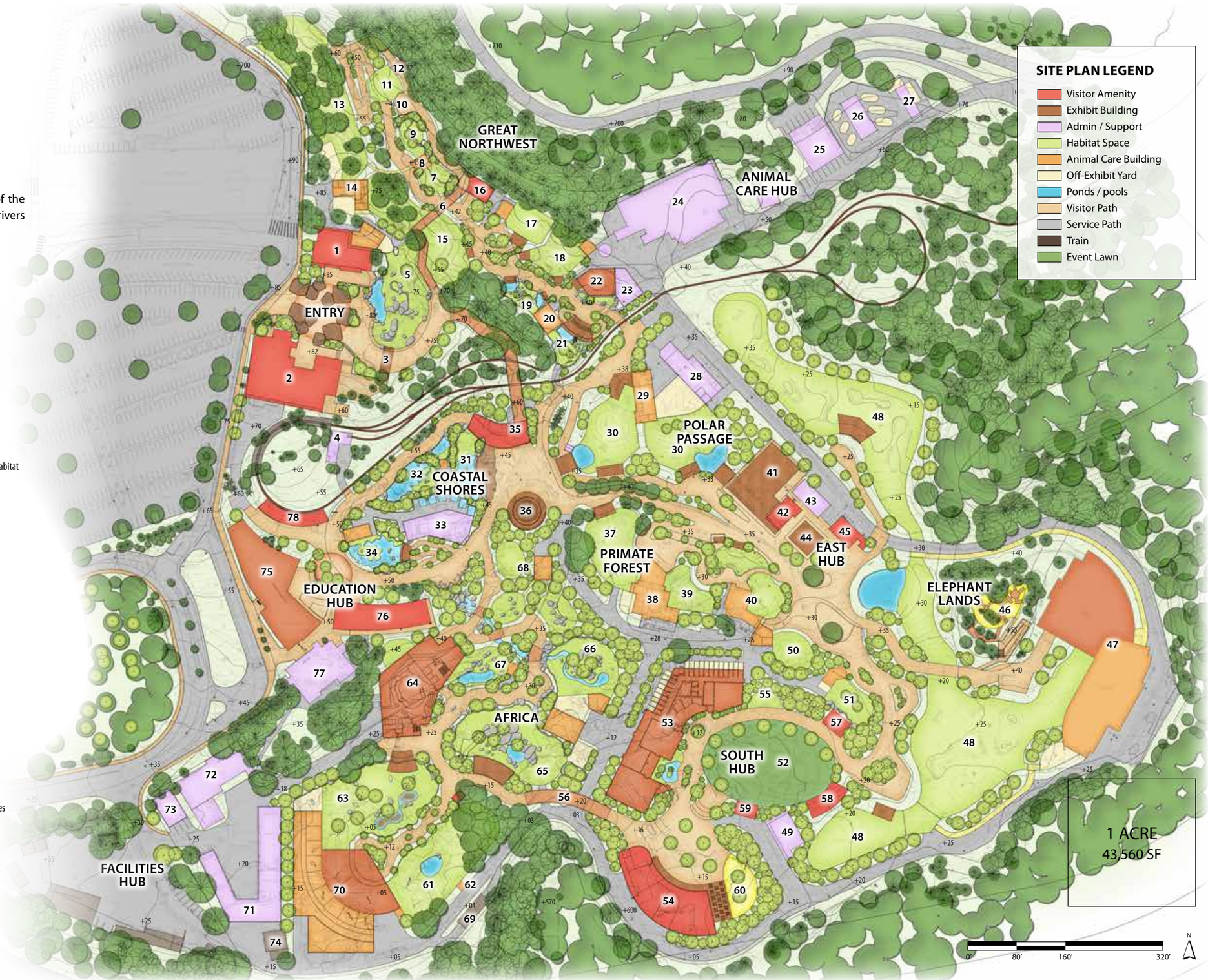
ELEPHANT LANDS
47. Forest Hall
48. Elephant Habitats
49. Filtration Building t

SOUTH HUB
50. Primate Expansion Care Building & Habitat
51. Red Panda Care Building & Habitat
52. Lawn
53. Ambassador And Herpetarium
54. Restaurant
55. Play Area
56. Bridge
57. Public Restrooms
58. Event Shelter
59. Stage
60. Play Area

AFRICA
61. Giraffe Habitat
62. Bird Care Building
63. Rhino Habitat
64. Tropical Forest Building
65. Lion Care Building & Habitat
66. Painted Dog Care Building & Habitat
67. Marsh Care Building & Habitat
68. Primate Care Building & Habitats
69. Butterfly Lab
70. Rhino/Giraffe Care & Exhibit Building

FACILITIES HUB
71. Facilities/Maintenance Shops & Offices
72. Animal Nutrition Center
73. Greenhouse
74. Hay Barn

EDUCATION HUB
75. Education Building
76. Classroom Building
77. Administration Building
78. Train Station



PHASING & IMPLEMENTATION

The implementation of a long-range campus plan is a complex and multifaceted endeavor that requires a carefully crafted approach. This campus plan encompasses a wide range of projects, objectives, and stakeholders, each with its unique challenges and dependencies. The implementation plan outlined here serves as a roadmap, summarizing milestones, timelines, and resources needed to realize the vision of the campus plan.

The primary aim of this planning exercise is to provide structure and clear direction, breaking the long-term vision into manageable phases and projects. This approach facilitates continuous progress tracking, simplifying the identification of next steps and ensuring steady progress towards the campus plan goals. Another important aspect of this implementation plan is its support for the efficient allocation and optimization of Metro and Oregon Zoo resources, including financial, human, and material, throughout the lifespan of the plan.

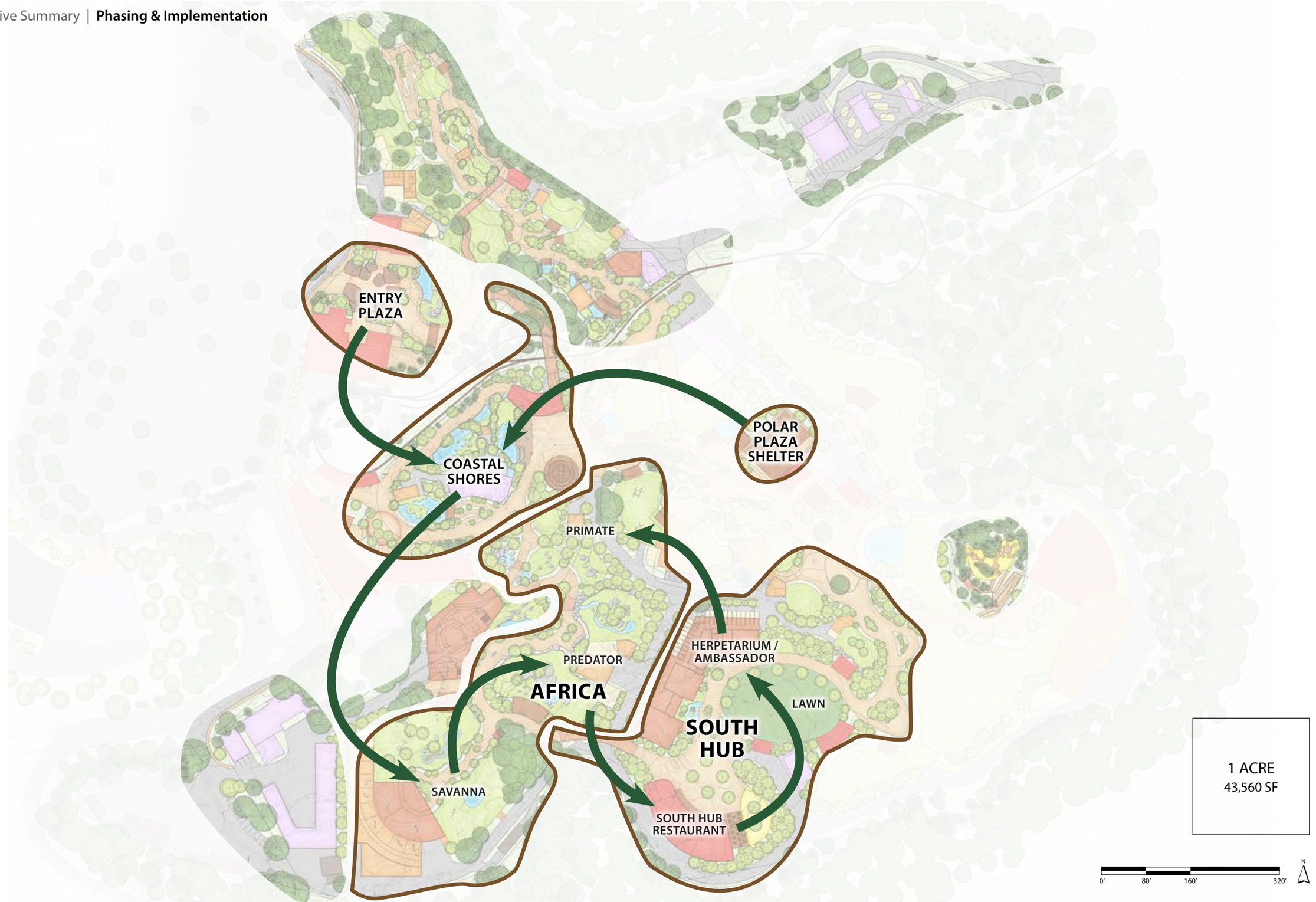
Much like the campus plan itself, the implementation plan is designed as a living document, adaptable to changes and unforeseen challenges. In a long-term project such as this, flexibility is key, as economic, environmental, and social landscapes evolve over time. The ability to adapt and modify the plan while maintaining focus on the goal is critical.

Many considerations are folded into the version of the implementation plan presented here, but some of the key discussions that lead to this plan include:

- Evaluation of project budgets and funding streams.
- Ability to maintain a great Oregon Zoo experience while updates take place.
- A focus on addressing critical needs for animals, guests, staff, and physical infrastructure.
- Balancing the overall investment between animal experiences, sustainable infrastructure, and guest services.

2024 Campus Plan Projects	Estimated Budget	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Plaza Enhancements (Entry, East Hub)	$19M														
Coastal Shores	$79M														
Africa Phase 1 (Savanna, Predator)	$109M														
South Hub (Restaurant, Herpetarium, Event Lawn)	$113M														
Africa Phase 2 (Primate)	$31M														
Projects of Opportunity or Beyond 15 years															
Destination Play	$5M														
Asia	$19M														
Gate A	$22M														
Gate J	$23M														
Great Northwest	$53M														
Tropical Forest	$63M														

** Note that estimated budgets presented above for 2024 Campus Plan Projects include escalation to the midpoint of construction, while Projects of Opportunity are presented in 2024 dollars as escalation will depend on sequence and schedule.*


ENTRY PLAZA
COASTAL SHORES
POLAR PLAZA SHELTER
PRIMATE
HERPETARIUM / AMBASSADOR
PREDATOR
AFRICA
LAWN
SOUTH HUB
SAVANNA
SOUTH HUB RESTAURANT
1 ACRE
43,560 SF
0'
80'
160'
320'
N

PAGE INTENTIONALLY LEFT BLANK

PAGE INTENTIONALLY LEFT BLANK

SUSTAINABLE ZOO

Metro and the Oregon Zoo have a unique and powerful role to advance sustainability, climate justice, and resilience in alignment with Metro's values and the commitments the agency has made to the public.

As a regional government committed to promoting sustainable communities, Metro also strives to make its own operations sustainable. With an extensive portfolio of buildings, including the Oregon Zoo and other visitor venues, parks, office buildings and solid waste facilities, and serving millions of visitors and customers each year, Metro has a significant opportunity to reduce its impacts and advance positive progress on the region's quality of life. To that end, in 2003, the Metro Council set an ambitious vision for business operations to be sustainable within one generation, by 2025. The Council adopted goals in five key categories: climate, waste, toxics, water, and habitat, and adopted a Sustainability Plan in 2010 that identifies strategies and actions to achieve these goals.

In 2010, Metro named sustainability as one of Metro's central values:

> We are leaders in demonstrating resource use and protection. We are leaders in demonstrating resource use and protection in a manner that enables people to meet current needs without compromising the needs of future generations, and while balancing the needs of the economy, environment, and society.
>
> Metro's Strategic Framework, adopted in 2021 to guide Metro's decisions and priorities, identifies racial justice, climate justice and resilience, and shared prosperity as guiding principles.

Sustainability at the Oregon Zoo

The Oregon Zoo aspires to be a model of sustainability by putting conservation of natural resources at the forefront of its daily operations and planning for future improvements. The Oregon Zoo has been leading by example for many years. Conservation is in the zoo's mission, and the zoo works on a range of issues around the world.

In alignment with these values and goals, the Oregon Zoo Campus will be designed to positively contribute to human, animal, and environmental well-being, to conserve natural resources and to lead and inspire sustainable practices by guests, community organizations, and businesses.

The campus planning process provides an opportunity to reflect on the current state of the campus, as well as to look forward to the opportunities and challenges ahead. This section focuses on sustainable and resilient design and operation including greenhouse gas emissions, water management, habitat and stormwater, and resilience planning for extreme weather events and disruptions beyond the zoo's control. In this section we look at the 2010 Metro and zoo sustainability goals, the current state of progress toward those goals, and set new goals for the coming decades.

Several campus wide strategies are highlighted in the plan including a movement away from fossil fuel use on campus, minimizing urban heat island effect, and reusing water onsite. A more detailed summary of the analyses performed during the campus planning process is included in the appendix.

Green stormwater facility at Polar Passage

METRO GOALS FOR SUSTAINABLE ZOO

Metro Sustainable Buildings & Sites Policy

Metro's Sustainable Buildings and Sites Policy sets inspiring goals for Metro properties, many of which apply to the zoo. A summary of this policy and its implications for the zoo is included in the Appendix. Some of the significant policy elements that will pertain to the zoo include:

- All new buildings over 2,000 SF and $1M in total project cost will meet the Core and Zero Carbon certifications.
- New projects will use materials with low embodied carbon content.
- All projects will meet bird-friendly design guidelines.
- No new fossil fuel infrastructure and campus will move toward electrification of buildings and fleet.
- New structures will be designed for climate resilience.

Oregon Zoo Sustainability

The Oregon Zoo will seek opportunities to go beyond the Metro Sustainable Buildings and Sites Policy to design buildings and spaces to contribute to climate environmental justice outcomes in the region and provide healthy, accessible, welcoming spaces where staff and visitors thrive.

The Oregon Zoo Campus will be designed to positively contribute to human and environmental wellbeing, to conserve natural resources and to lead and inspire sustainability practices by guests, community organizations and businesses.

CLIMATE

Eliminate greenhouse gas emissions from zoo operations by 2040 and prioritize actions that contribute to reduced regional greenhouse gas emissions.

GUIDING PRINCIPLES

- Reduce energy demand first
- Prioritize strategies that contribute to regional grid decarbonization
- Consider the climate impacts of a building through its entire lifecycle
- Minimize urban heat island effect
- Demonstrate and provide education on key climate solutions

STRATEGIES AND ACTIONS

- Electrify the zoo campus: design new buildings to be all-electric and electrify existing buildings over time as they are retrofitted
- Install electric vehicle charging infrastructure (and electrify fleet)
- Design new exhibits for energy exchange between buildings with opposing loads, when feasible
- Choose low carbon materials and natural carbon solutions in landscape and exhibit design
- Pursue active and passive renewable energy
- Conduct total cost of ownership
- analysis when choosing mechanical systems
- Implement energy management information systems across the campus (to allow for tracking and informing energy efficiency)
- Pursue strategies to reduce urban heat island effect such as cool roofs, green roofs, cool pavement, and landscape design
- Sub-meter every building/exhibit gas and electricity usage. Collect, store, and trend data electronically in a single location that is accessible to the zoo and Metro.

MEASURABLE TARGETS

- Reduce energy use per visitor to 25% below 2023 baseline by 2030
- Design buildings to achieve at least a 70% reduction in total energy use compared to an Architecture 2030 (or existing zoo) baseline building
- Generate 35% of total electricity use across the zoo campus with onsite renewable energy on an annual basis by 2040
- Maintain 100% renewable electricity
- Achieve a fossil-free, all-electric campus by 2040

WATER

Reduce municipal water use by 35% from 2023 baseline by 2040 by eliminating water waste, increasing water efficiency, and reusing water onsite.

GUIDING PRINCIPLES

- Reduce demand for water first
- Design landscaping to minimize the need for irrigation
- Reclaim and reuse water onsite to minimize the need for municipal water
- Eliminate water waste through leak detection, increased efficiency, and monitoring
- Demonstrate and educate visitors about water conservation, efficiency, and reuse systems

STRATEGIES AND ACTIONS

- Include rainwater harvesting in all new buildings
- Collect and use stormwater to supply water needs for exhibits and pools
- Eliminate dump and fill pools and upgrade exhibits with modern filtration systems
- Establish water tracking and reporting systems to better monitor water use
- Install smart irrigation in all exhibits and landscaping
- Design exhibits to reduce water use for exhibit washdown (e.g., integrate soft substrate into exhibit and holding areas)
- Install WaterSense faucets and fixtures
- Sub-meter every building/exhibit/landscape water use. Collect, store, and trend data electronically in a single location that is accessible to the zoo and Metro.

MEASURABLE TARGETS

- Achieve 2/3 of water needs for exhibits and pools from stormwater runoff collection and reuse by 2040
- Design buildings to achieve at least a 50% reduction in water use compared to a baseline building
- Reduce water use for irrigation by 50% by 2040
- Reduce water leaks by 75% from 2023 baseline by 2040

HABITAT AND STORMWATER

Promote ecological integrity and function in design of landscaping, stormwater systems, and animal habitat while respecting unique geologic constraints.

GUIDING PRINCIPLES

- Model habitat-friendly development practices that contribute to ecological integrity and provide multiple benefits
- Utilize green infrastructure whenever possible to support healthy ecosystems

STRATEGIES AND ACTIONS

- Use pervious pavement wherever feasible
- Use native and adaptive species to reduce the need for irrigation, pesticides, and maintenance
- Create local habitat for pollinators, birds, and native species across the campus and provide spaces for visitors/multiple benefits
- Incorporate green roofs where feasible to sequester carbon, filter pollutants, create habitat, absorb heat, and insulate buildings
- Install rain gardens to filter pollutants, and reduce erosion and urban heat island effect
- Conserve and restore native plant communities around undeveloped, natural campus land
- Create educational opportunities to showcase the benefits of habitat-friendly development

MEASURABLE TARGETS

- Reduce effective impervious area by 20% compared to 2023 baseline
- Create a living classroom in each quadrant of the zoo

RESILIENCE

Design zoo facilities to survive and maintain critical functions in the event of extreme weather events exacerbated by climate change, earthquake activity, supply chain disruptions, energy outages, and public health emergencies.

GUIDING PRINCIPLES

- **Anticipate** – Understand and document potential threats and disruptions
- **Absorb** – Design systems and facilities to withstand, deflect, or otherwise accommodate stresses and disruptions with minimal failure or planned, safe failure
- **Adapt** – Identify and modify existing structures and facilities that are vulnerable to anticipated stresses and disruptions
- **Recover** – Develop relationships, plans, and procedures to restore systems and facilities to full functioning after a disruptive event

STRATEGIES AND ACTIONS

The resiliency strategies and actions should be determined by conducting a comprehensive resiliency plan study. The plan should investigate strategies related to the following considerations at a minimum:

- Energy
- Water
- Stormwater
- Heat
- Windstorm
- Fire
- Smoke
- Earthquake
- Landslide
- Internet disruption
- Food

MEASURABLE TARGETS

The specific needs and targets should be determined by conducting a comprehensive resiliency plan study. The plan should investigate targets related to the following considerations at a minimum:

- **Expanded Opportunities and Aspirations:** The zoo can maintain all functions, not just critical functions, and can extend support to the local community during disruptive events.

SUMMARY OF PROGRESS FROM THE LAST 10 YEARS

The 2010 Metro Sustainability Plan laid out specific and ambitious goals for both greenhouse gas (GHG) emissions and water use reduction. These goals informed and were adopted by the 2011 Oregon Zoo Comprehensive Capital Campus Plan (CCCP). The greenhouse gas reduction goals were staged over a 40 year timeline from the 2008 baseline emissions as follows:

- 2013 – Arrest GHG Emissions
- 2020 – 25% Reduction
- 2025 – 40% Reduction
- 2050 – 80% Reduction

The 2011 Oregon Zoo CCCP identified potential strategies to reduce emissions including energy efficiency, utilizing a ground-source heat pump condenser loop, biomass boilers, solar PV, solar thermal, and green power purchase from the utility. Some of these strategies were employed in the subsequent bond projects, when determined to be appropriate and cost effective. In 2022, zoo emissions associated with natural gas and electricity totaled approximately 3600 MT CO2e – an approximately 25% reduction in GHG emissions compared to the 2009 baseline. Natural gas consumption has been reduced by ~9% from the baseline while electricity consumption increased by ~3% (note that the bond projects have added significant energy consuming program area and LSS systems to the campus). The reduction in total greenhouse gas emissions is due in part to the reduction in campus natural gas consumption but even more so by the reduced emissions associated with electricity generation in 2023 compared to 2009. The reduced emissions associated with electricity generation is a key reason in the recommendation to replace natural gas consuming equipment with electric ("Electrification") presented in this campus plan as well as the zoo's decision to purchase 100% renewable electricity. Nevertheless, electric consumption should be reduced with efficient equipment such as heat pumps, managed against peak utility demands, and offset with onsite renewable generation to the extent practical. All of which are presented in this campus plan.

The 2010 Metro Sustainability plan identified water use reduction goals staged over a 15-year timeline from the 2009 water consumption as follows:

- 2013 – 15% Reduction
- 2020 – 30% Reduction
- 2025 – 50% Reduction

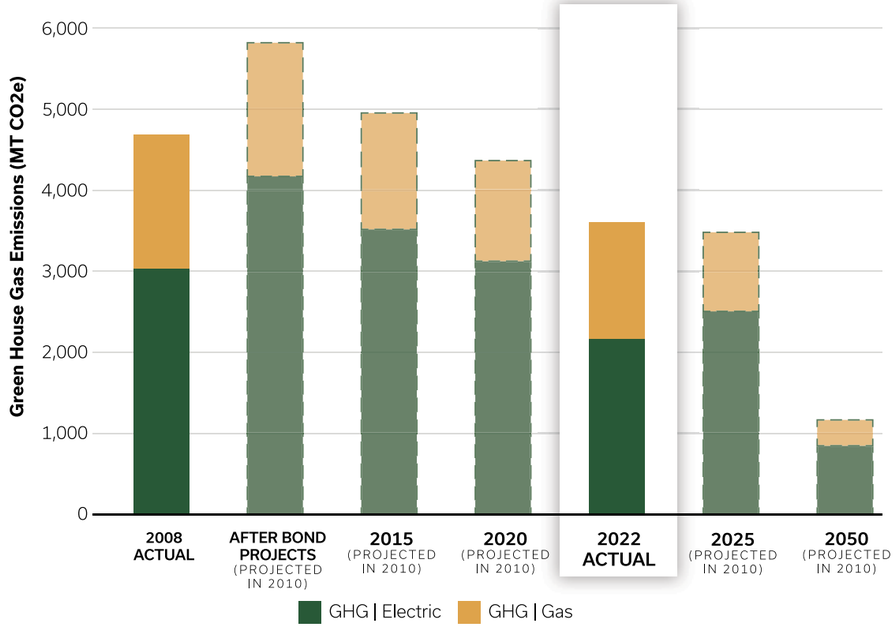
The 2011 CCCP took the water savings goals a step further and targeted a 60% reduction in water reduction by 2025. In 2022 the zoo consumed approximately 37 Million Gallons of water – a 56% reduction from the baseline consumption of 85 Million gallons. The zoo has already achieved Metro's 2025 goal for water use reduction and is very near to achieving the 60% CCCP goal with 3 more years to go. Water savings is the result of water efficient exhibit systems at elephants and polar bear, replacement of aging and leaking infrastructure, and rainwater capture and reuse systems at elephants and the Education Center. Approximately half of the current water consumption is associated with exhibit usage and reduction strategies will be most effective by targeting exhibit usage, though other non-potable demands such as restrooms and irrigation also offer significant opportunities for water savings.

UTILITY	AVERAGE ANNUAL USE		
	2008	2022	% Change
Electricity	7,393,000	7,634,000	+3%
Natural Gas	306,000 therms	277,000 therms	-9%
Water/Server	84.8 million gallons	38 million gallons	-55%

Notes: Since 2008 the zoo has significantly expanded indoor and habitat. Electrification of heating systems has nevertheless led to an overall reduction in gas consumption with only a slight increase in overall electric consumption.

Water consumption has been drastically reduced via water saving pool systems, rainwater reuse, and infrastructure improvements.

EMISSIONS REDUCTION PLAN FROM 2010 CAMPUS PLAN



The 2010 Campus Plan projected future zoo emissions up to the year 2050 beginning with the 2008 emissions baseline. It was expected that emissions would increase as new buildings and habitats were constructed with the bond. Emissions were projected to decrease over time as campus efficiency measures were implemented along with on site renewable sources and cleaner electricity from the utility. The overall 2022 actual emissions are consistent with the 2010 project.

37.5
MILLION GALLONS

56%
REDUCTION FROM 2008 EXCEEDS METRO'S GOAL

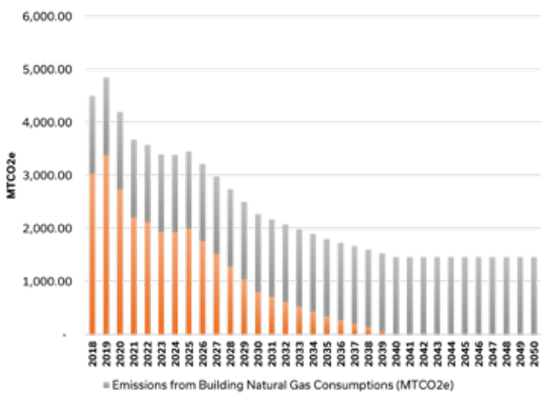
A PATH TOWARDS ELECTRIFICATION

Since one of the most impactful transitions buildings can make to reduce their operating emissions is to shift to high performance, all-electric systems, a path toward electrification is one of the key tenets of the Oregon Zoo sustainability work.

KEY FINDINGS

- Oregon has a state policy requiring the state's electric utilities to achieve zero operating emissions by 2040.
- By shifting to all-electric systems, buildings will benefit from the decarbonization of the grid. Building operating emissions will reduce in connection with grid emission reductions if all systems are electrically based.

BASELINE: YEARLY OPERATING EMISSIONS

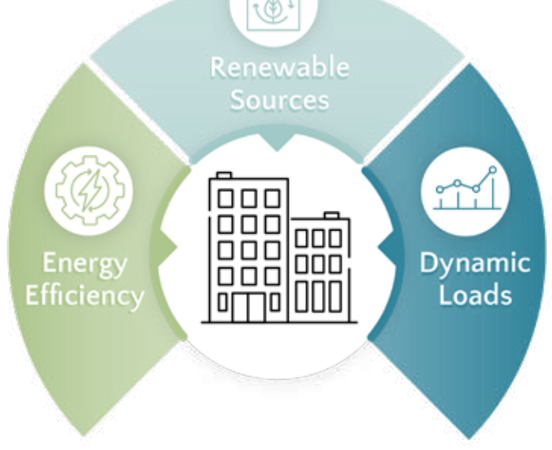


Grid-Interactive Efficient Buildings (GEBs)

Implementing grid-interactive efficient buildings and flexible loads has the potential to be one of the most impactful sustainability measures the Oregon Zoo can implement.

KEY FINDINGS

- Load flexibility and demand reduction can help reduce operating emissions and operating costs.
- There are multiple programs available through PGE to help incentivize and support participation with grid-interactive systems, including demand response schedules and onsite batteries.
- Reducing energy demand during peak times helps support a more sustainable, resilient grid.



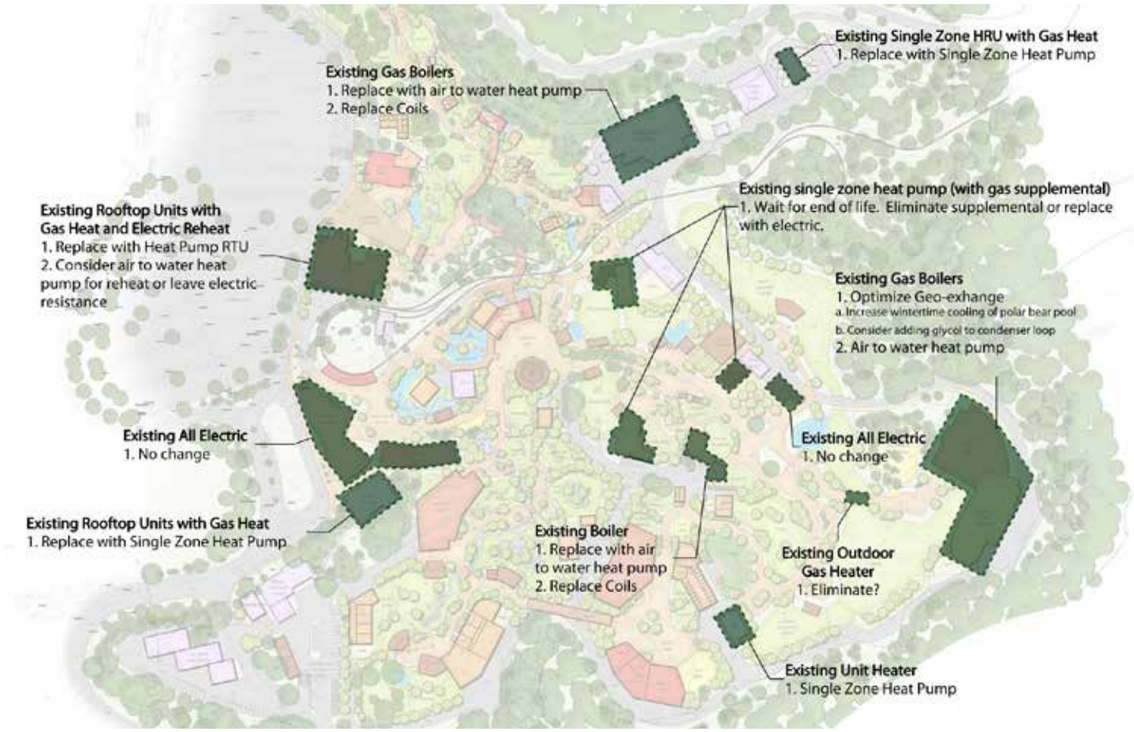
INTERACTIONS WITH THE GRID

New Construction Electrification

All new buildings will be designed to use high efficiency all-electric system for all end uses.

Existing Building Electrification

Existing buildings which are not demolished as part of the current campus plan (e.g. recent bond projects) will need to be evaluated for natural gas equipment replacement. Existing buildings can present a greater challenge to electrification than new buildings due to limitation in space, structural capacity, and especially electrical capacity. A complete campus inventory of all campus gas equipment, the timeline for equipment (or building) replacement, and the available electrical capacity at the location of the gas equipment will be required to produce a detailed electrification plan for all existing buildings.



KEY FINDINGS

Prioritization of electrification projects should be based on:

- Deferred Maintenance - Replace gas equipment at end of life
- Return on investment - Replace gas equipment that results in highest operational cost to project first cost ratio.
- Carbon Reductions - Replace gas equipment that results in the highest carbon emissions to project first cost ratio.
  - Including a dollar valuation of carbon emissions would allow items 2 and 3 to be combined in a single return on investment metric

KEY FINDINGS

Electric replacements of specific gas equipment include:

- Replace single zone units (unit heaters, gas fired roof top units) with single zone heat pumps (split systems, heat pump roof top units).
- Replace gas boilers with air to water heat pumps (may require equipment coil replacements to accommodate lower supply temperature.
- Replace domestic water heaters with air to water heat pumps.
- Replace gas kitchen equipment with electric equivalent (induction where available).

CAMPUS ENERGY SYSTEMS

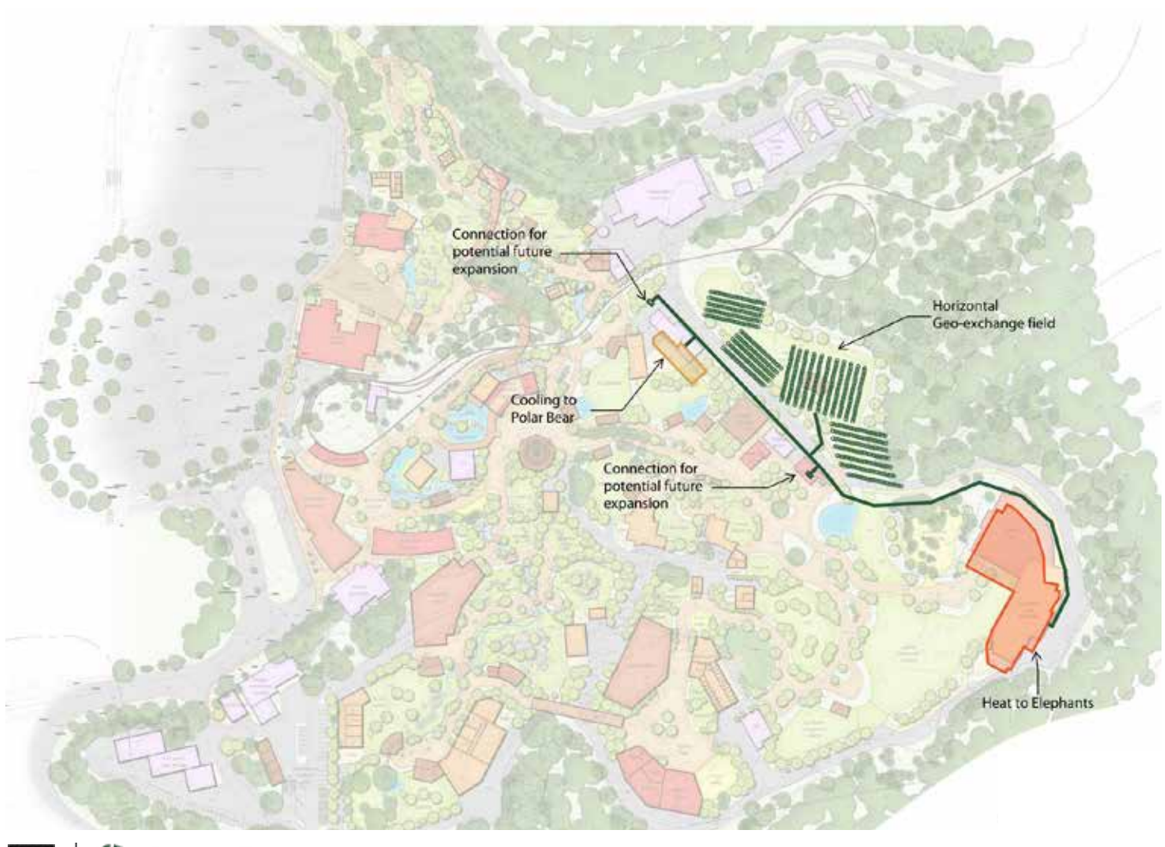
District Thermal Loop

There are unique opportunities that come forward at the campus scale. Options like district systems and shared resources across multiple areas were evaluated as part of this study.

KEY FINDINGS

- Expansion of the ground source well system throughout the entire campus is not recommended, or necessary. Air source heat pumps are anticipated to provide an efficient electric heat source for most needs of the campus.
- There might be opportunities for localized district thermal energy systems within small building clusters that have simultaneous heating and cooling loads. For example, the significant cooling loads of the penguin and sea otter could create an energy sharing opportunity with the heating needs of the Forest Pavilion.

Refer to the Appendix for additional information.



Campus Renewables

KEY FINDINGS

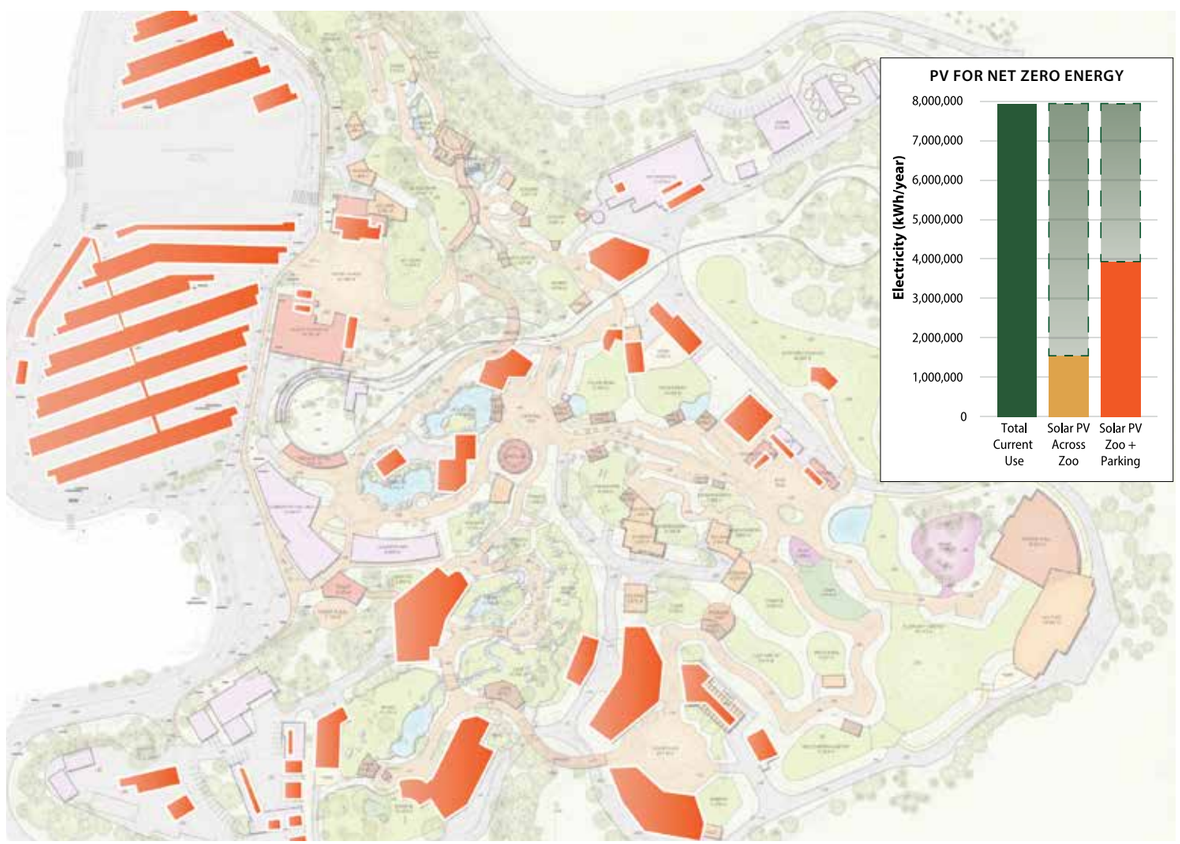
Incorporating renewables on the campus helps achieve three main goals:

- Reduced operating costs
- Reduced operating emissions
- Visitor education tool

The most cost-effective and best suited onsite renewable energy technology is photovoltaic (PV) panels. New and existing roofs with adequate solar access can benefit from the additional of PV panels.

The opportunity with the most potential is the parking lot. Incorporating PV parking canopies would greatly increase the onsite generation potential, which could provide both sustainability and energy resilience benefits. This also creates a memorable visitor entry experience with a vast PV array being the first element of their entry experience. Additionally, it provides protection from weather for visitors loading families in and out of vehicles. This solution will require collaboration between the multiple jurisdictions with ownership of these facilities, but the potential benefits make this a worthwhile conversation to continue.

Refer to the Appendix for additional information.



DESIGNING FOR ENERGY RESILIENCE

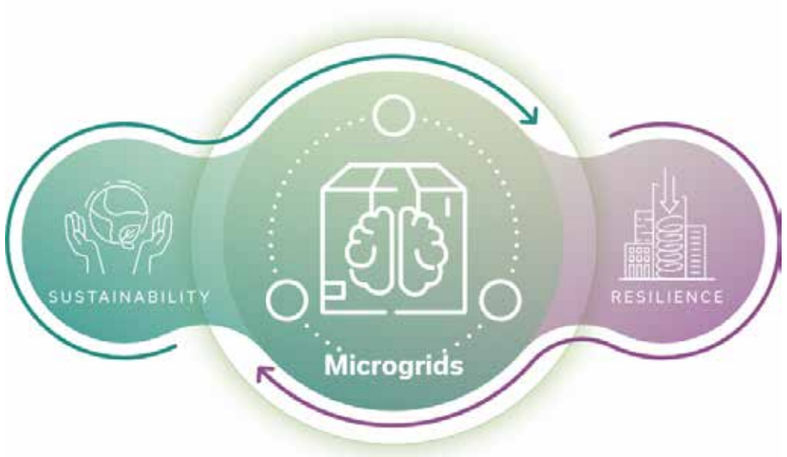
Discussions of energy resilience have become increasingly important as regions grapple with the increase in extreme weather events. The Oregon Zoo is not spared from this challenge it has experienced snow, rain and heat events in recent years beyond what was previously considered normal. Electricity and natural gas supply and distribution can also be impacted by these events which can affect their ability to deliver consistent, reliable energy.

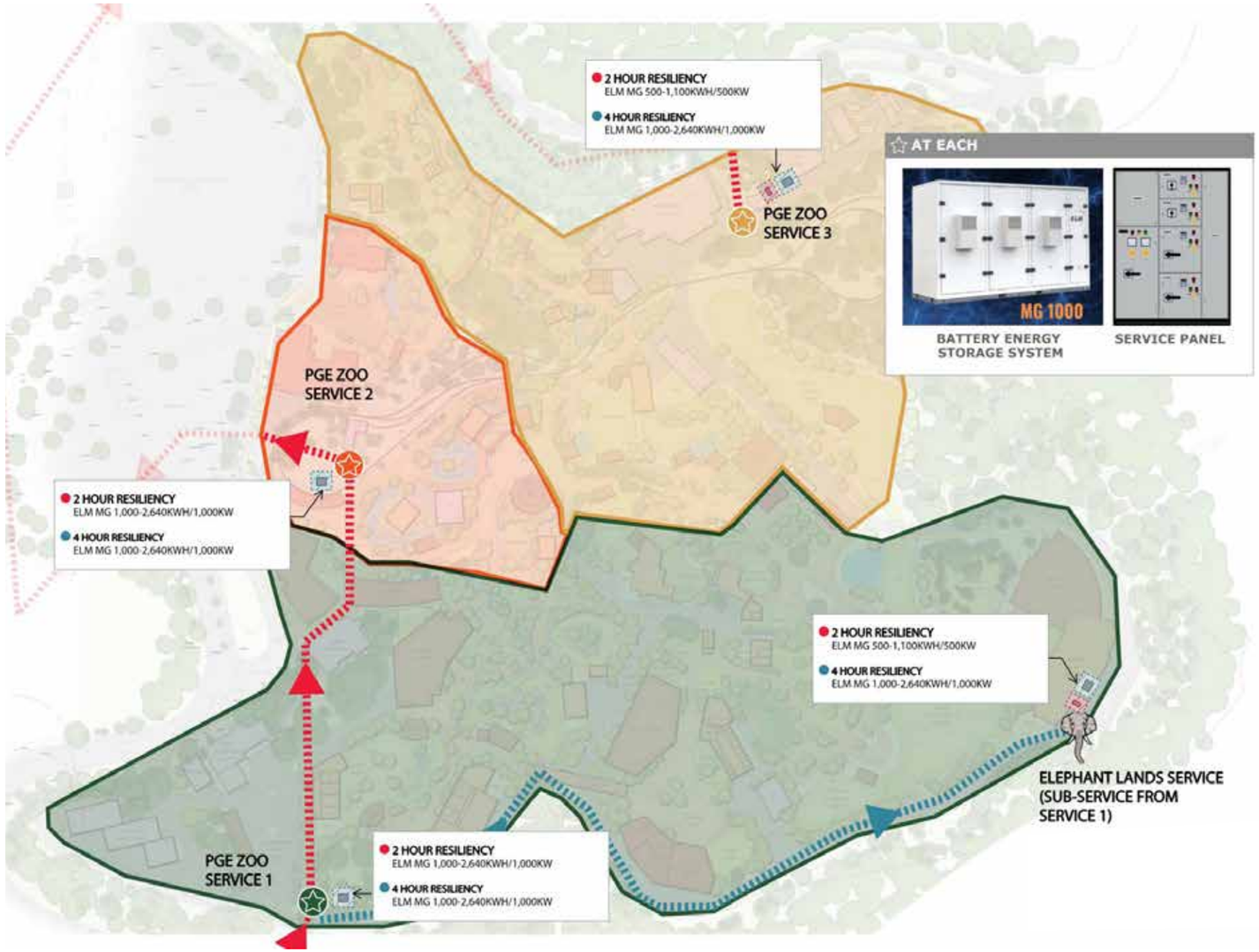
KEY FINDINGS

- A benefit of the zoo's long term goal of transitioning to an all-electric campus is that electricity is the primary source of energy that can be locally generated and stored. Electricity can be generated onsite with photovoltaic (PV) panels and stored in battery energy storage systems (BESS) to create a localized energy source that can self generate indefinitely. Fossil fuel reliant systems such as natural gas utility service and diesel generators are dependent on outside inputs to keep these systems running.
- A consideration with a PV and BESS resilience system is that the battery system size needed to support a long term outage during winter (i.e. low solar production) will likely be size and cost prohibitive. Although a long duration outage is possible, a review of the historic outage history at the Oregon Zoo found that the majority of outages are four hours or less.
- Therefore, the best solution is likely a hybrid approach with PV+BESS and diesel generators. The PV and BESS can support the more frequent short term outages minimizing the emissions and cost associated with operating the diesel generators. The generators can be reserved for only the more catastrophic events, like a major earthquake.
- Initial analysis of the historic loads found that a 1000kW/2500kWh BESS associated with each existing PGE service would be adequate to provide 4-hours of backup to each region.
- For the generators, the zoo's current use of renewable diesel helps reduce emissions and should continue to be utilized.
- In addition to energy resilience, the most important contribution of the BESS is its ability to be a grid-interactive flexible load. In this scenario, the BESS is used during normal grid operations as a grid support resource to improve grid stability and even accelerate grid decarbonization, as discussed in the Electrification section. This is perhaps one of the most important sustainable measures the zoo could implement.

By integrating onsite renewables with storage the Oregon Zoo will be able to implement a campus microgrid. This will provide both sustainable and resilience energy solutions to the site.

Refer to the Appendix for more information on grid-interactive solutions.





THE PATH TOWARDS HOLISTIC SUSTAINABILITY

WATER IS A PRECIOUS RESOURCE

The reduction in water use at the zoo since 2008 is a major success story. With a continued commitment to responsible use, including onsite reuse, the zoo can demonstrate through action that water is a precious resource. Additionally, the zoo has an opportunity with the new campus vision to rethink the role rainwater has within the campus's water story. By capturing, treating and storing the water that falls on the site annually, there is potential to reduce the imported water needs of the campus.

KEY FINDINGS

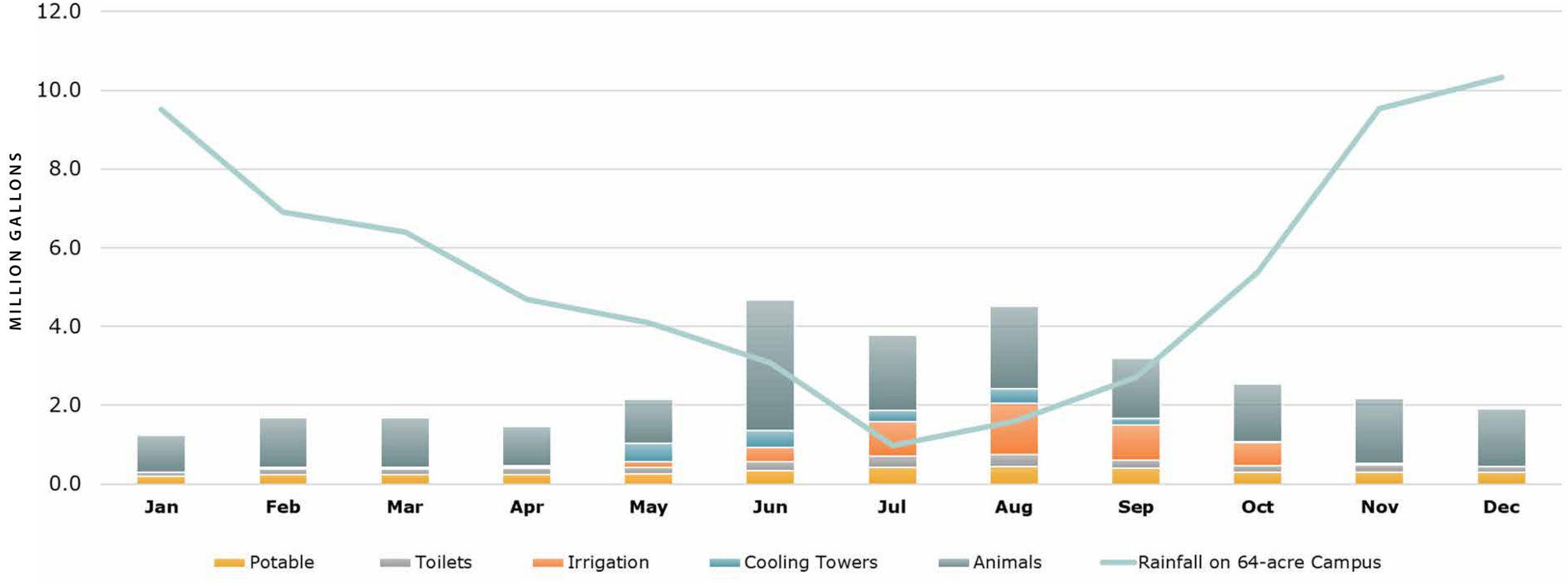
- Since exhibit usage is the largest component of the total, strategies to reduce this use category, including storm water capture and reuse offer the largest water use reduction opportunity.
- Reductions in other non-potable demand including irrigation and toilet flushing can have a significant impact.
- Potable demand is a relatively small percentage of total zoo water use (10%); therefore, an on campus treatment system to produce potable water is likely not practical due to maintenance and regulation implications. Yet considerations around water resilience will be further evaluated in the effort to develop the Comprehensive Resilience Plan.
- It is estimated that installing roughly 2.5 million gallons of rainwater storage could save 6 million gallons of water used for landscape, exhibits, and washdown areas.

Refer to the Appendix for additional information.

37.5
MILLION GALLONS

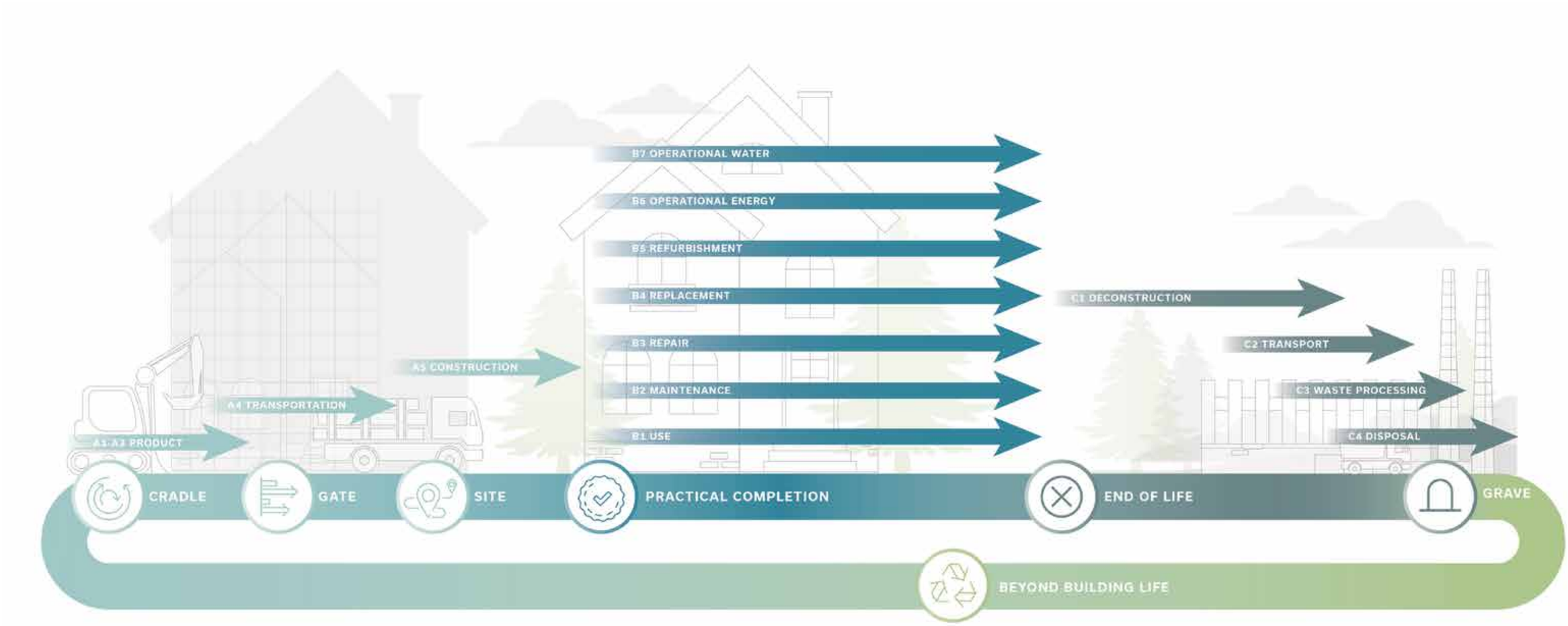
56%
REDUCTION FROM 2008 EXCEEDS METRO'S GOAL

CAMPUS WATER USE BY MONTH 2022



HOLISTIC EMISSIONS REDUCTION TARGET

Much of the emissions analysis at the zoo to date has focused on operating emissions - the emissions associated with operating the building during it's active life. In partnership with understanding the operating emissions, the zoo will expand it's view to also consider the embodied emissions of its work- that is to say, the emissions associated with building, maintaining, and deconstructing a building throughout its life. This includes the emissions associated with the materials, transportation, construction, and end-of-life disposal of the building. By taking a more in-depth look at all these factors, projects can better understand the interactions between these different factors and further reduce the overall emissions impacts of the built environment.

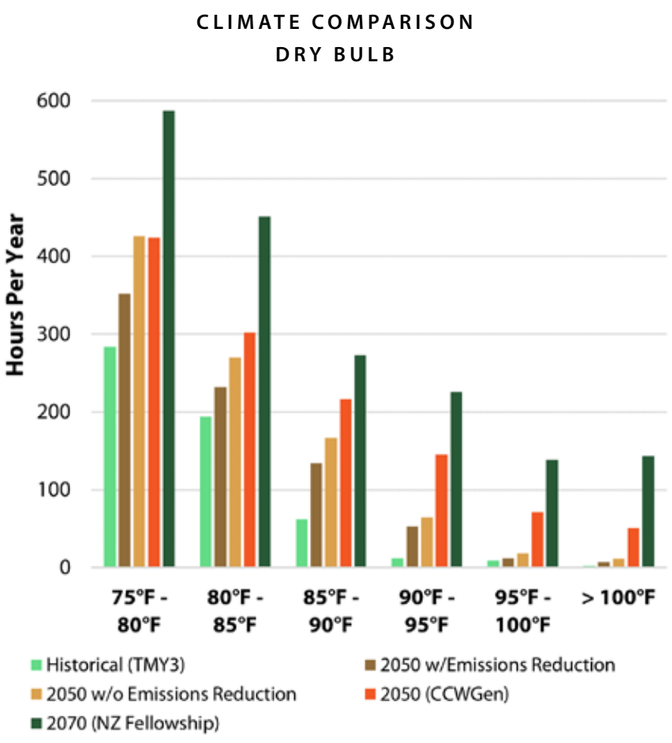


DESIGNING FOR CLIMATE RESILIENCE

Metro and the Oregon Zoo are committed to sustainable design to mitigate the zoo's contribution to greenhouse gas emissions and climate change. Nevertheless, climate change will continue to occur and future exhibit designs will need to anticipate the change. The following graph shows the number of hours the outside air temperature in Portland, Oregon exceeds 75°F over the course of a year. The light green bars are based on the historical average (1991-2005). The colored bars indicate several predictions for future outdoor temperature in Portland. Temperature predictions vary significantly depending on whether global GHG emissions are reduced, and between the different models. However, in all cases there are significantly more hours above 90° F, and in two of the models, many more hours over 100°F.

For non-critical applications in the Portland area, cooling systems design typically assumes a peak summer time outdoor temperature of 91F. Based on the predictions for future climate, a cooling outdoor design temperature of 95°F is recommended. More critical applications, including life support systems, will need to be evaluated on a case by case basis and may warrant outdoor design conditions well over 100°F.

Designing cooling systems to accommodate warmer outdoor temperatures is only one component of the recommended Comprehensive Resiliency Plan to document strategies to mitigate risks associated with climate change, a Cascadia earthquake, and other disruptive events.



Historical (TMY3): *https://energyplus.net/weather*

2050 w/emissions reduction: *https://www.weathershift.com/*

2050 w/o emissions reduction: *https://www.weathershift.com*

2050 CCWGen: *a.https://energy.soton.ac.uk/ccworldweathergen/*

2020 NZ Fellowship: *https://www.energytrust.org/wp-content/uploads/2020/06/Download-research.zip*

METERING & VERIFICATION

Energy and water sub-metering is critical to understanding and managing energy and water use on campus. In addition to installing physical meters, the meter data must be stored and accessible in a useful location for the building owners and operators to easily see and understand. At the zoo, the Education Center is an example of a metering system that is well set up and utilized. Other buildings including polar bear and primates, have the physical meters installed, though the software is not set up so that the data is easily understandable or used. A comprehensive inventory of existing meters should be performed, meter data should be labeled, stored, and trended electronically in a single location that is easily accessible to and understood by the zoo and Metro. All future projects should be set up similarly.

A LOOK FORWARD ON THE CURRENT PATH

A key tenant of the electrification movement is that through technology advances, economic benefits of renewable energy and state mandates the electric grids are in steady trending towards reductions in operating emissions. This "greening of the grid" translates to operating emissions reduction on everything that it serves, including buildings.

As the PGE grid trends towards this zero carbon state, the zoo's electricity related operating emissions will follow. Over time, this current emissions source will become zero.

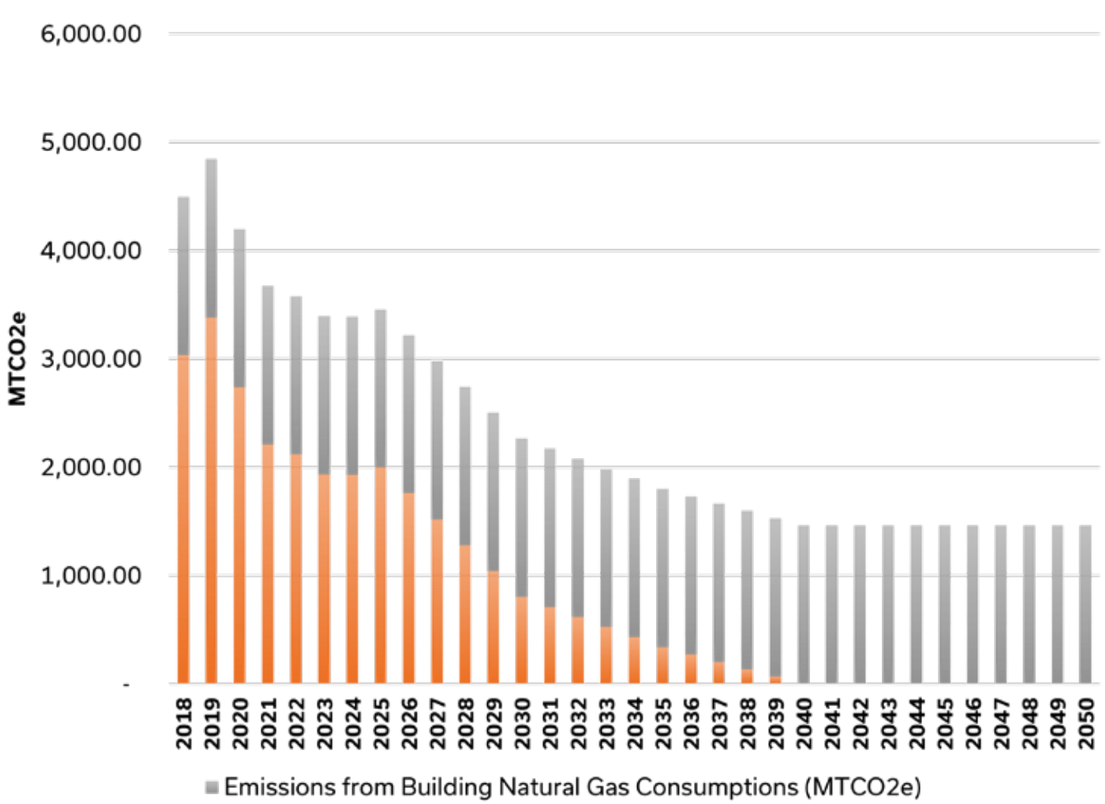
By comparison, natural gas- also known as methane gas or fossil gas- will always have emissions associated with it due to being a fossil fuel. By 2030 the natural gas on the campus will become the main source of operating emissions on campus and by 2040 it will be the only source.

Note: Alternate methane sources, such as an onsite anaerobic digester, were considered as part of this campus plan but were found to not be viable for this site. Refer to the appendix for additional details regarding the study.

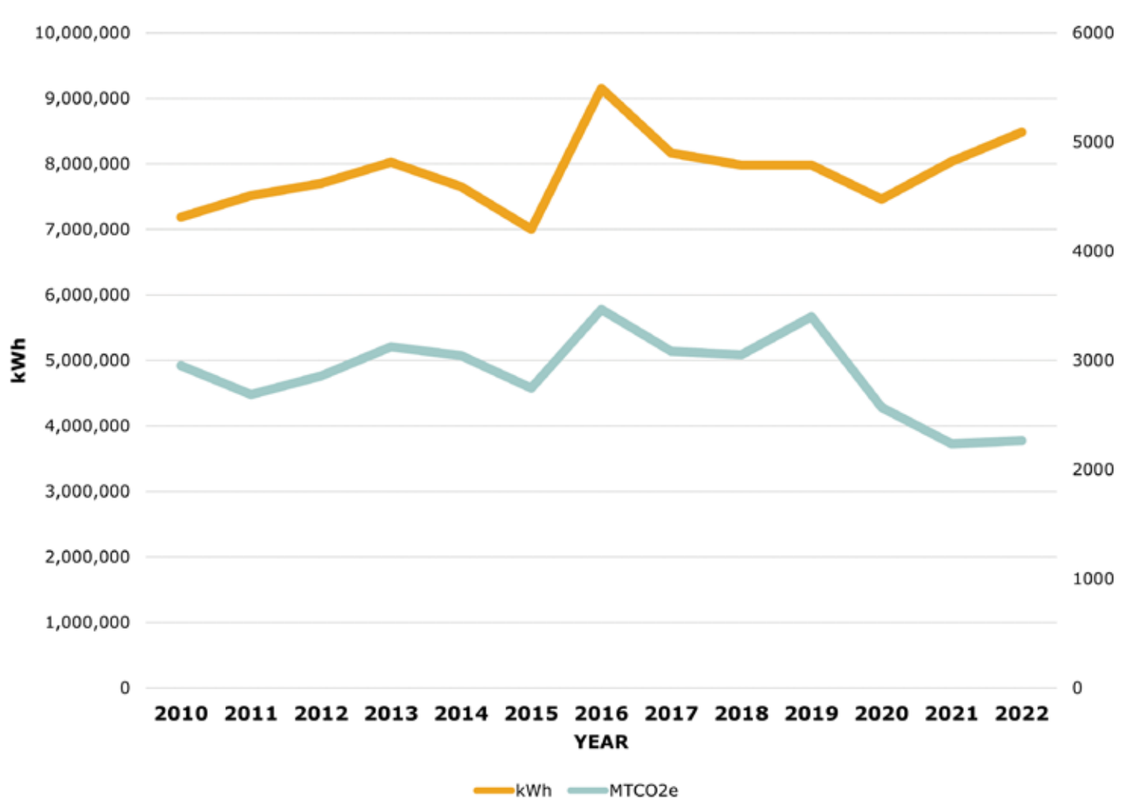
As the electric grids move towards decarbonization the relationship between energy use and operating emissions is decoupling.

This means even if zoo electricity use increases due to building and transportation electrification, overall operating emissions will continue to decrease due to the changes on the PGE grid. The zoo has already begun to witness this phenomenon with an increase in recent years in electrical usage due to new exhibits and a post-pandemic visitor return. Yet during this same period, it experience a decrease in operating emissions. This trend is anticipated to continue as PGE moves toward the state mandated HB2021 zero emissions by 2040 target.

BASELINE: YEARLY OPERATING EMISSIONS



ENERGY V EMISSIONS



PAGE INTENTIONALLY LEFT BLANK

PAGE INTENTIONALLY LEFT BLANK

PROJECT ZONE KEY MAP

1 GREAT NORTHWEST

Enhancement of the iconic Great Northwest exhibits and visitor experience with new pathways, elevated walkways, and some new animal species while preserving the native Douglas fir forest. Rotational flexible habitats will allow species like black bears, beavers, and river otters to explore different terrains, diversifying their habitat space and providing a dynamic experience for visitors.

2 COASTAL SHORES

Transform the heart of the zoo with the removal of Steller Cove, the Penguinarium, tiger and red panda exhibits to make way for a re-imagined Central Hub and new exhibits for seals, sea otters, and penguins. A new guest services building will provide direct access to the lower plaza, featuring a cafe, restrooms, and underwater views of seals, while a new carousel and open space inspired by the Pacific Northwest coastal landscape will enhance the guest experience.

3 AFRICA

Redevelopment of the existing Africa Zone with new savanna exhibits for giraffe and black rhinos, new holding buildings and year-round viewing. The Tropical Forest building will house a walk-through aviary and diverse plant collection. A Kopje walking trail will connect the African Forest and Lowland Savanna zones featuring new exhibits for lions, painted dogs, and primates.

4 SOUTH HUB

Situated midway through the guest experience, the South Hub will provide key amenities like restrooms, retail, a play area, first aid services, and a sit-down restaurant. The open plaza will serve as a transition zone between the Asia Forest Trail and African Savanna, with a focus on comfortable seating, canopy trees for shades, and a sprawling event lawn for picnics and events. Anchor attractions surrounding the hub also include the Herpetarium and Ambassador Animals.

5 ENTRY

Redevelopment of the existing zoo entry to improve accessibility, flow, and overall arrival experience. The plaza will be transformed into an inviting and intuitive space inspired by the local forest and mountain views. The design includes shade canopies, seating, and framed views of mountain goats, while also integrating existing architectural elements and native Pacific Northwest plantings.

6 EAST HUB

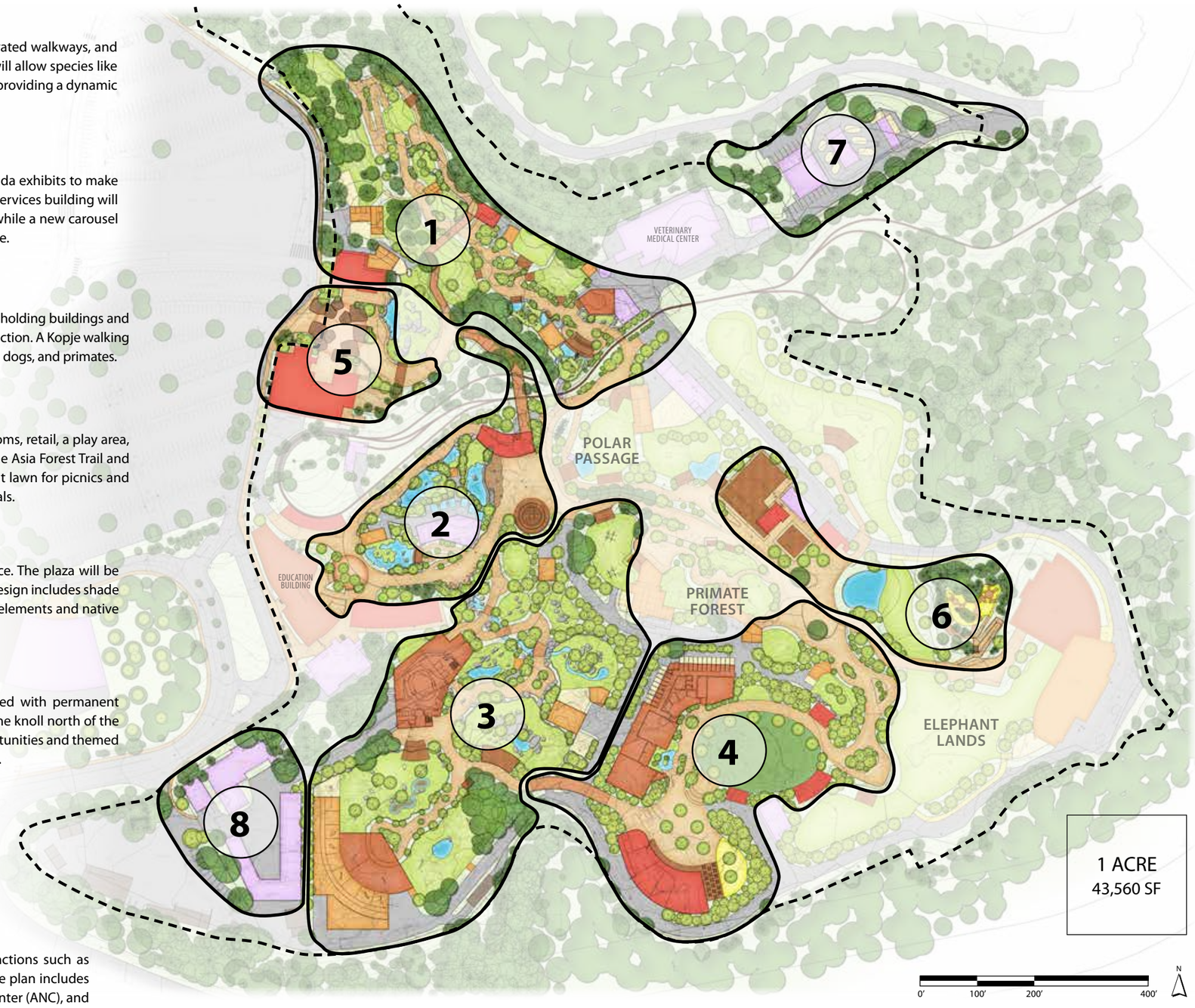
Recently completed as part of Elephant Lands and Polar Passage, the East Hub shall be enhanced with permanent architectural shelters for flexible use between daily guest picnics and after-hours private events. At the knoll north of the Elephant South Habitat, a new children's adventure playground is envisioned offering climbing opportunities and themed elements related to nearby animal species providing an engaging and unique experience for families.

7 ANIMAL CARE HUB

At the northeast corner of the zoo, Gate J is a hub for animal care functions like the Veterinary Medical Center (VMC) and serves as an entry and exit point for staff from Washington Park. Enhancements include improved vehicle access and additional staff parking. The animal care building will be replaced by a new structure featuring research labs and offices for various staff.

8 FACILITIES HUB

At the southwest corner of the zoo, Gate A serves as a hub for essential operational support functions such as horticulture, and facilities and maintenance offices, custodial staff, and welding and wood shops. The plan includes replacement of the existing older structures with new facilities, renovation of the Animal Nutrition Center (ANC), and a new greenhouse.



THE GREAT NORTHWEST

The Great Northwest is an iconic exhibit at the Oregon Zoo. Surrounded by a native Douglas Fir forest, this trail replicates the local Northwest watershed from forest canopy down to underground passageways formed by lava tubes, from waterfalls down to the bottom of the stream, all while highlighting native species in their natural habitat.

The Campus Plan proposes to preserve this immersive experience with enhanced accessibility and flow for visitors. Redevelopment within this zone will include new pathways and elevated walkways as well as the potential introduction of exciting new animal species to accompany the existing collection. The new development will limit the removal of existing mature trees as this zone falls within the City of Portland's environmental conservation overlay.

PROGRAM

Total Project Site	**3.2 AC**	**139,375 SF**
Exhibit & LSS Building		4,150 SF
Condor Care Building (ex)		440 SF
Condor Habitat (ex)		4,870 SF
Beaver & Otter Care Building		1,260 SF
Beaver Habitat		2,750 SF
Beaver View Shelter		1,440 SF
Otter Habitat		2,165 SF
Otter View Shelter 1		40 SF
Otter View Shelter 2		240 SF
Cougar Care Building (ex)		575 SF
Cougar Habitat (ex)		3,390 SF
Restroom Building (ex)		1,630 SF
Owl Care Building		570 SF
Owl Habitat		1,610 SF
Animal Habitat		1,825 SF
Eagle Habitat		2,430 SF
Black Bear Care Building		2,055 SF
Animal Yard		1,360 SF
Black Bear Yard		1,280 SF
Animal Habitat		20,010 SF
Black Bear Habitat		13,110 SF
Black Bear View Shelter		245 SF
Mountain Goat Care Building (renovated)		1,590 SF
Mountain Goat Yard (ex)		500 SF

Proposed Species


Beaver


Cougar


River Otter


Black Bear

New exhibits will also provide an opportunity to restore the understory of the native Douglas Fir Forest, continue the zoo's ongoing effort to remove non-native and invasive species, and improve the overall health of the native forest. Botanic collections may include ferns, maples, and native vegetation used by indigenous communities within the area.

As visitors round the corner of the rocky mountain goat exhibit, they will remain at the canopy-level as they trek across a new elevated bridge to the opposite side of the ravine. Then visitors will trace the edge of the ravine, eye-level with owls high up in the trees as they continue to the existing bald eagle overlook. Through the existing covered bridge, visitors will arrive at a new exhibit.

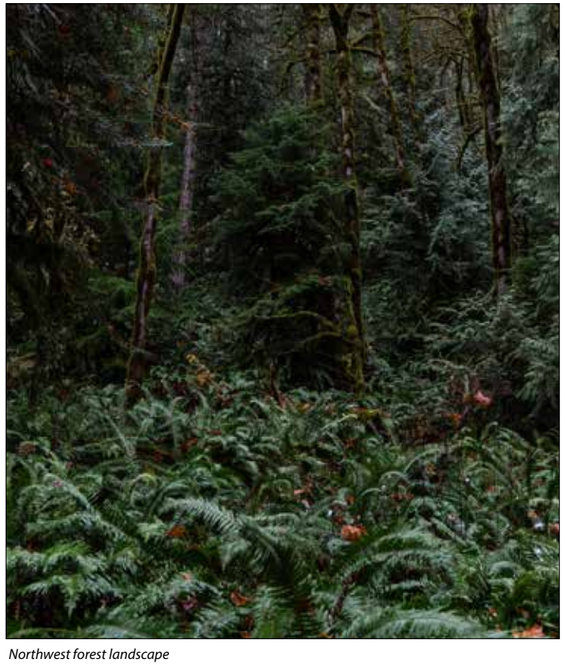
Occupying the west side of the ravine, the new exhibit will limit site disturbance by enveloping the existing natural site with its mature vegetation and complex topography. From there, visitors will make their way down to the forest floor on an at-grade path taking in close views of snowy owls, while possibly catching a glimpse of black bears up high up along the ridge.

At the base of the ravine and opposite to the existing cougar and condor exhibits, new habitats will be provided for river otters and beavers, completing one's journey down the mountain. Incorporated throughout the new pathways will be areas for visitors to pause and absorb the sights, smells and sounds of the forest as they wait in anticipation for the local animal residents to pass through.

An important feature in this zone is the implementation of rotational flexible habitats. By creating physical linkages between exhibits of different species, these animals can rotate through all the exhibits at different times, increasing their habitat space and promoting natural exploratory behaviors, as well as providing a dynamic experience for visitors. Seasonally, there may even be opportunities for one species to occupy both habitats while bears hibernate during the winter. All exhibits will be designed for the individual species with the most rigorous standards to allow for ultimate flexibility.

Section through The Great Northwest Canyon

0′ 15′ 30′ 60′



Northwest forest landscape

Tying into the zoo's campus-wide focus on water conservation, the Great Northwest will incorporate both renovated pools and new pools with life support systems (LSS). The existing 20,000-gallon pool within the Eagle exhibit is a freshwater aquarium for native PNW species and shall remain but replace the LSS equipment similar to the existing with sand filtration, temperature control, ultraviolet sterilization, and provisions for gas exchange.

The new aquatic exhibits in the Great Northwest requiring LSS are river otter, beaver, and tanks in the new Freshwater Exhibit Building. River otter and beaver have a combined volume of 40,000 to 50,000 gallons and share a life support system. Anticipating underwater viewing and the industrious behaviors of both river otters and beavers, the LSS process consists of strainers or a screen to remove coarse solids, sand filtration, ozonation, ultraviolet sterilization, and provisions for gas exchange.

Freestanding tanks will be supported by off-the-shelf packages similar to a home or commercial aquarium tank. The backwash water from the sand filters associated with all of these exhibits is an excellent candidate for reuse on the zoo's campus. For example, a simple single pass recovery system could adequately treat this water for reuse as makeup water to exhibits like Elephant Lands and Condors of the Columbia.

Great Northwest Canyon Trail

COASTAL SHORES

At the end of the existing boardwalk, visitors arrive at the center of the zoo, met with the rocky sea stacks of Steller Cove and panoramic views of the zoo beyond. Although home to some favorite animal species such as sea otters and seals, the circulation through the existing Steller Cove exhibit can be unclear, causing those unfamiliar with the zoo to miss the Education Center or Penguinarium. Further, most of the structures in this part of the zoo are reaching the end of their service life due to aging infrastructure and frequent need for maintenance and repairs. Therefore, with the demolition of Steller Cove, the Penguinarium, and the dated tiger and red panda grottos, Coastal Shores plans to redevelop the heart of the zoo with a new vision that will integrate the recently completed Polar Passage, Education Center, and Discovery Plaza with new outdoor seal, sea otter, and penguin exhibits.

Key to this redevelopment is the transformation of the Central Hub into a true plaza with guest amenities, wayfinding, and circulation. From the boardwalk level, a new Guest Services Building will be constructed to provide visitors the choice to immediately get to the lower level of the central hub by way of elevators or stairs. At the lower level, the building will house restrooms and a quick service snack option as well as feature underwater viewing of the seals. Opposite the Guest Services Building will be a new and improved hand-crafted carousel housed within an enclosed shelter. Throughout the Central Hub, there will be plenty of open space for circulation as well as built-in planters and seating.

PROGRAM

Total Project Site	**2.0 AC**	**87,870 SF**
Guest Services Building (2 floors @ 3,772)		7,545 SF
Carousel Enclosure		3,110 SF
Sea Cave		2,420 SF
Sea Otter & Seal Off-Exhibit Pools		1,540 SF
Sea Otter Habitat		3,060 SF
Seal Habitat		3,420 SF
Coastal Habitat		205 SF
Coast Habitat Support Building		800 SF
Penguin Care Building		985 SF
Penguin Habitat		3,690 SF
Penguin Underwater View Shelter		500 SF
LSS Building (2 floors @ 4,294)		8,590 SF

Reference imagery

SITE PLAN LEGEND

- Visitor Amenity
- Exhibit Building
- Admin / Support
- Habitat Space
- Animal Care Building
- Off-Exhibit Yard
- Ponds / pools
- Visitor Path
- Service Path
- Event Lawn

0' 30' 60' 120' N

Proposed Species

Sea Otter

Harbor Seal

Humboldt Penguin

From the upper level of the Guest Services Building, visitors will also have the option to begin their venture into Coastal Shores, enjoying multiple views of sea otters from varying vantage points and then panoramic views of penguins at the Discovery Plaza as they swim around their new outdoor pool.

The concept for the walkways, exhibits, and vegetation within this area is inspired by the Pacific northwest coastal landscape of forest and rugged, coastal edges supporting many of these coastal animal species. New planting areas may be broken into different plant communities: Discovery Plaza may support lower-growing and resilient coastal headland-type of plants including reed grass and frosted paintbrush, and the spaces within and immediately adjacent to the exhibits may focus more on Oregon's coastal forests.

Botanic collections bordering the new Coastal Shores exhibits could incorporate hemlock and cedar as well as understory species such as rhododendrons, azaleas, wax myrtle, and ferns. Collections of native plants important to local indigenous communities could also be highlighted in this area.

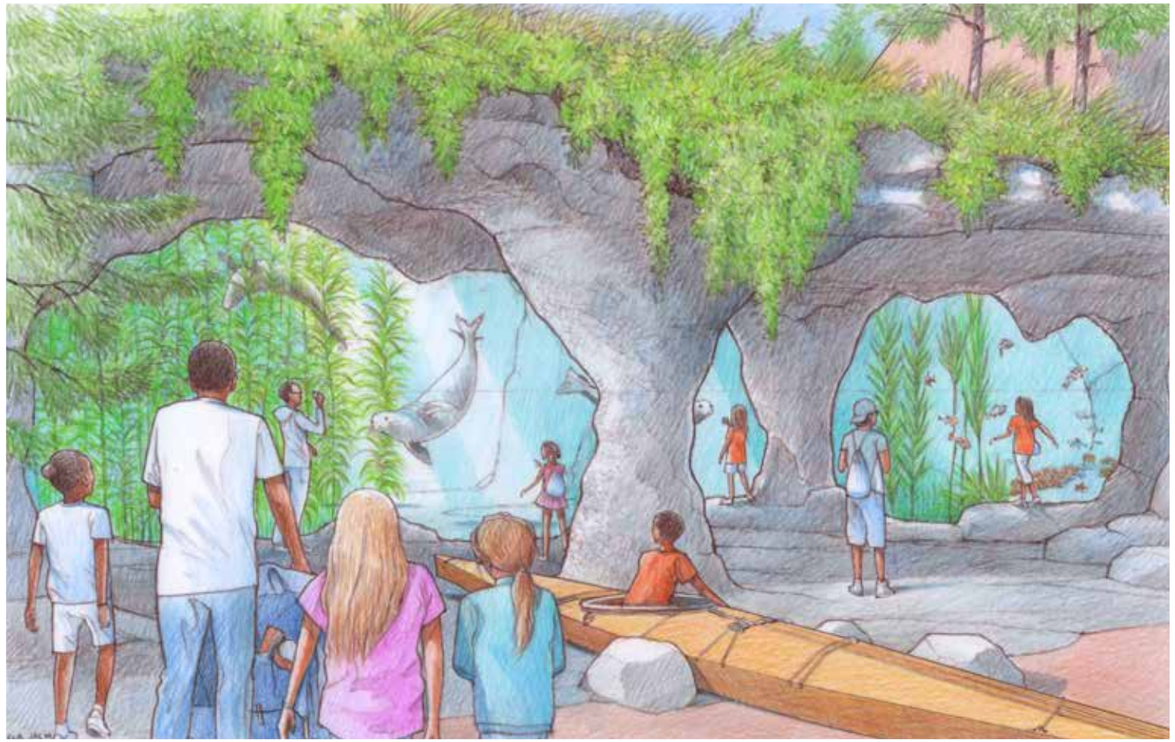
Behind the scenes, a new central service court provides direct access to all the new exhibits and a centralized location for day-to-day operations. While penguins will require a separate indoor holding building with nest boxes, sea otters and seals are able to be managed outdoors in off-exhibit pools with some open-air shelters as they are currently.

All the pools will be connected with water transfer chutes to allow for flexible rotation or create one large continuous swimming area. This flexibility allows for better integration of the zoo's role in sea otter conservation as a rotational housing facility for retired sea otter surrogate mothers after age 10 as well as young otters around age 3 who cannot be released into the wild, have been through the surrogate program, and will become future surrogate mothers.

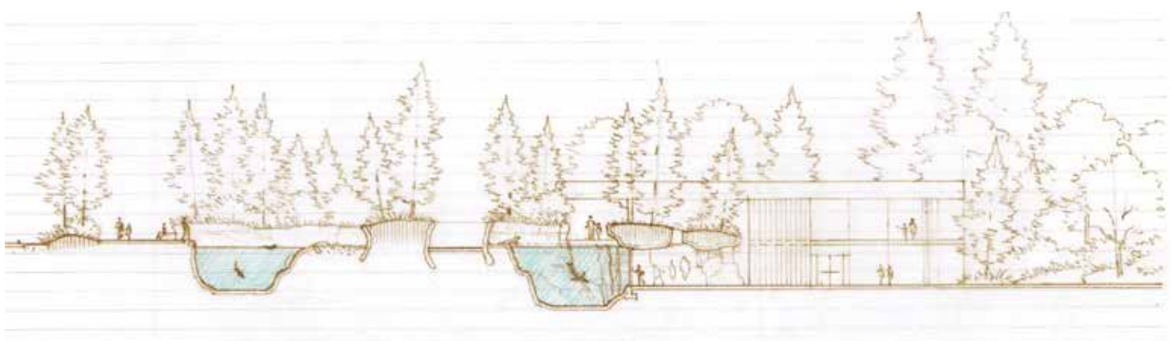
To optimize efficiency and space for zoo staff, a new two-story LSS building will be constructed to house diet prep areas, enrichment storage, diver equipment and facilities, and offices for life support staff on the first floor and all life support system (LSS) equipment for the three aquatic exhibits on the basement floor. The seal and sea otter pools will be saltwater, and penguin will be freshwater. The LSS processes for seal and sea otter incorporate sand filtrations, fractionators, temperature control, ozone, ultraviolet sterilization, provisions for gas exchange, and backwash recovery.

The penguin LSS process incorporates a combination of traditional LSS with sand filtration, ozonation, and temperature control targeting premium underwater viewing and a hybrid mechanical-natural system supplying the larger portion of the look-down-only pool. The penguin life support system also has an opportunity to use a backwash recovery system utilizing a hybrid mechanical-natural system approach. In this approach, wetland cells could be constructed. Water leaving the pool through skimmers and sumps from the exhibit will be sent to these cells to be treated, recreating the treatment processes that occur in natural wetlands, and then return to the LSS Building for refinement and polishing before reentering the animal exhibits.

This process reduces the exhibits' potable water demand through biological water treatment and reuse of exhibit pool water. To supplement water use in these exhibits, Coastal Shores will also capture and reuse rainwater.



Coastal Sea Cave underwater viewing



Section through habitat pools and Central Hub

Outdoor Penguin habitat

SOUTH HUB

The South Hub is strategically located at the midpoint of one's journey through the zoo and exemplifies the campus driver of providing a holistic guest experience beyond animal-related experiences. Located where predator exhibits currently reside, visitors will arrive in the South Hub ready to eat, take a break, and recharge for the remainder of their visit. Therefore, guest amenities are a must and include restrooms, retail, first aid, playground, and a sit-down restaurant.

Core to the South Hub is the open plaza space that unifies the surrounding amenities and destinations, while also providing a transition between the Asia Forest and Africa Savanna zones. With the thoughtful integration of pavement patterns, planters, and built-in seat walls, the plaza provides plenty of space for large crowds to flow easily through the South Hub as well as areas for groups to gather and sit.

The planting concept in this area seeks to emphasize seasonal interest as well as include large canopy trees for shade and comfort in the plaza. The species selected may reflect the indoor habitats of the Herpetarium or become a continuation of the Asian landscape with flowering trees and understory in the plaza planting beds.

Adjoining the plaza, a new event lawn will be incorporated in this area to support events and concerts within the zoo, as well as opportunities for picnicking and respite for visitors.

PROGRAM

Total Project Site	**5.0 AC**	**216,555 SF**
Pedestrian Bridge		3,560 SF
Restaurant & Patio		15,090 SF
Play Area		3,940 SF
Herpetarium & Ambassador Animal Building		21,020 SF
Ambassador Animal Yards		2,195 SF
Ambassador Animal Habitat		1,450 SF
Lawn		24,300 SF
Stage Enclosure		840 SF
Pavilion		2,000 SF
Restroom Building		1,155 SF
Red Panda Care Building		810 SF
Red Panda Yard		235 SF
Red Panda Habitat		3,620 SF
Primate Care Building		1,025 SF
Primate Habitat		3,360 SF

Anchoring the south edge of the plaza, the proposed restaurant will serve as the zoo's primary food and beverage option and will accommodate many more guests than the existing Aviary Café with a grand dining room, mezzanine level, and covered outdoor seating that offer views of the native Douglas fir forest around the zoo. The restaurant will offer multiple cuisine options in a scramble servery concept and an outdoor service window serving a la carte items outside of typical dining hours of the main restaurant.

On the lower floor, the restaurant will house a walk-in freezer and dry storage large enough to service all other food and beverage locations throughout the zoo. Its location with direct access from the main service road is ideal for deliveries and distribution.

Reference Imagery

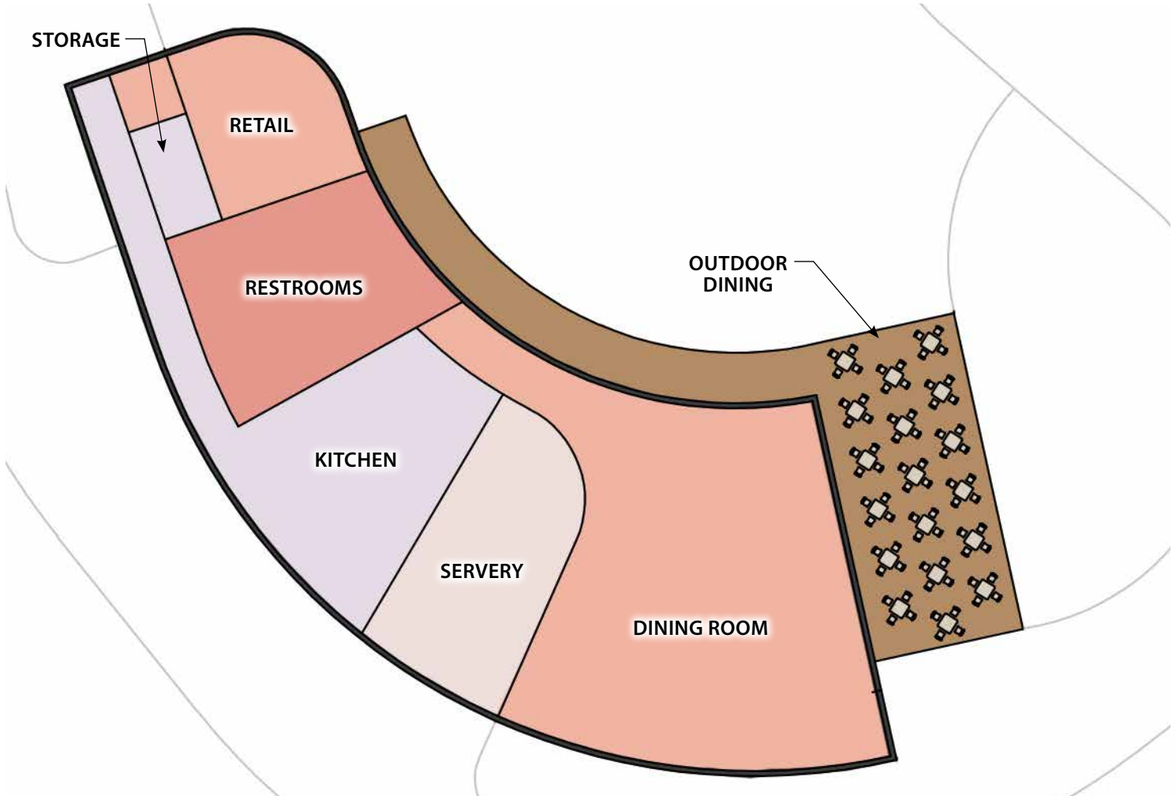
South Hub

RESTAURANT & PLAZA

The core of the South Hub focuses on a new open plaza space and primary sit-down dining option. This combination of functions provides critical space rest, decompress, and refuel before embarking on the journey through the second half of the zoo.

The restaurant facility features a sizable indoor dining option as well as covered outdoor seating adjacent to a new children's play space. This building also supports a significant restroom facility, guest services zone, and small retail area.

The natural slope of the site in this area also provides an opportunity for the lower level of the restaurant facility to incorporate much needed support functions such as receiving and storage.



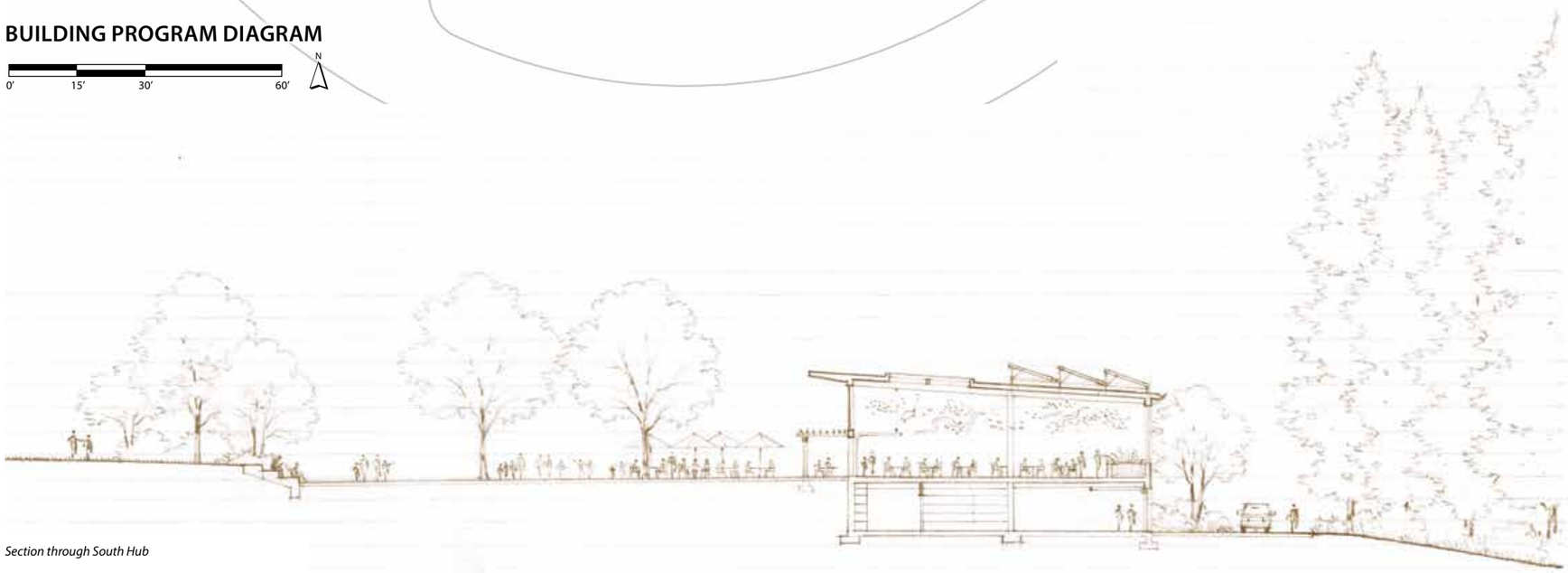
BUILDING PROGRAM DIAGRAM

0' 15' 30' 60' N

Reference Imagery

PROGRAM

Lower Level	
Offices	1,500 SF
Food & Beverage Storage	3,500 SF
Support	2,000 SF
Plaza Level	
Dining Room	4,665 SF
Outdoor Dining	3,210 SF
Servery	1,600 SF
Kitchen	1,865 SF
Restrooms	1,715 SF
Retail	995 SF
First Aid	170 SF
Storage	275 SF
Net	**21,500 SF**
Net to Gross	**1,430 SF**
Gross	**22,930 SF**



Section through South Hub

ASIA FOREST TRAIL

Opposite Elephant Lands is a new immersive walking trail through the Asian Forest with added habitats for Asian primates and red panda. At the east edge of Primate Forest, new expanded holding areas for gibbons will be constructed to increase management flexibility and provide a direct connection between the existing facility to a new outdoor high-volume mesh enclosure.

This new area will be built to reflect the natural history of the primates who reside in this part of the world, offering guests a chance to see these animals as they would in the wild. In the new outdoor exhibit, it is key that all vertical space can be utilized by these arboreal species to replicate their natural brachiating and climbing skills.

Continuing along the trail, visitors will arrive at a new mixed species exhibit for red panda and muntjac deer. Red pandas will trail through the upper canopy branches while muntjac deer forage along the forest floor. A new shared holding building with an off-exhibit yard will be placed strategically out of view from visitors. Care should be taken to incorporate noise-reducing materials within the building envelope and barrier walls surrounding the habitat as red pandas can be sensitive to sound.

In the planting and materials, the Asia Forest Trail builds upon Elephant Lands by introducing other Asian plant species, emphasizing hardy ornamental species such as flowering trees, clumping bamboo, rhododendrons, hydrangeas, and other Asian bio-region species. The dense vegetated buffer shown south of the new animal exhibits will help to create that forest backdrop as well as visual and acoustic separation before visitors arrive in the clearing of the new lawn.

Key Plan

PROGRAM

Red Panda Care Building	805 SF
Red Panda Yard	235 SF
Red Panda Habitat	3,620 SF
Primate Care Building	1,025 SF
Primate Habitat	3,360 SF

Red Panda habitat

Proposed Species

Siamang

Muntjac

© Sahar Coston-Hardy

Red Panda

HERPETARIUM & AMBASSADOR

Wrapping the northwest edge of the event lawn, the façade of the Herpetarium and Ambassador Animal building receives visitors as they round the corner from the Asia Forest Trail. This hybrid facility takes advantage of complimentary programs which benefit operationally for staff and experientially for visitors by sharing the same complex. Ambassador Animals would occupy the north wing and the Herpetarium would occupy the east wing. Together, both programs highlight species diversity as well as extend the peak visitor seasons with a fully indoor experience.

The Ambassador Animal wing provides a combination of indoor and outdoor housing for animals with a visitor presentation space for approximately 150 people that is indoors but could have the ability to open large windows or walls on fair weather days. Animal species may include birds, mammals, and reptiles from around the world.

In the naturalistic presentation space, daily demonstrations would involve a variety of animals and varying themes. Guests will be immersed in the animal experience, seeing them crawl, climb and fly as they learn about wildlife from our ambassador team and connect with nature. This designated presentation space ensures programs can operate year-round, while promoting higher visibility of animals and increased staff-visitor engagement without routinely transporting animals.

While most ambassador animal housing is behind the scenes, some rainforest mammals such as sloths, prehensile-tailed porcupines, tamanduas, and binturongs are great candidates for being visible to the public and also tie in with the program of the Herpetarium. At the intersection of the buildings, these exhibits would layer into the beginning of the indoor walk-through experience. With a focus on reptiles and amphibians, the Herpetarium would be designed to support multiple climates, including montane, temperate, tropical, and desert environments related to each species' native habitats.

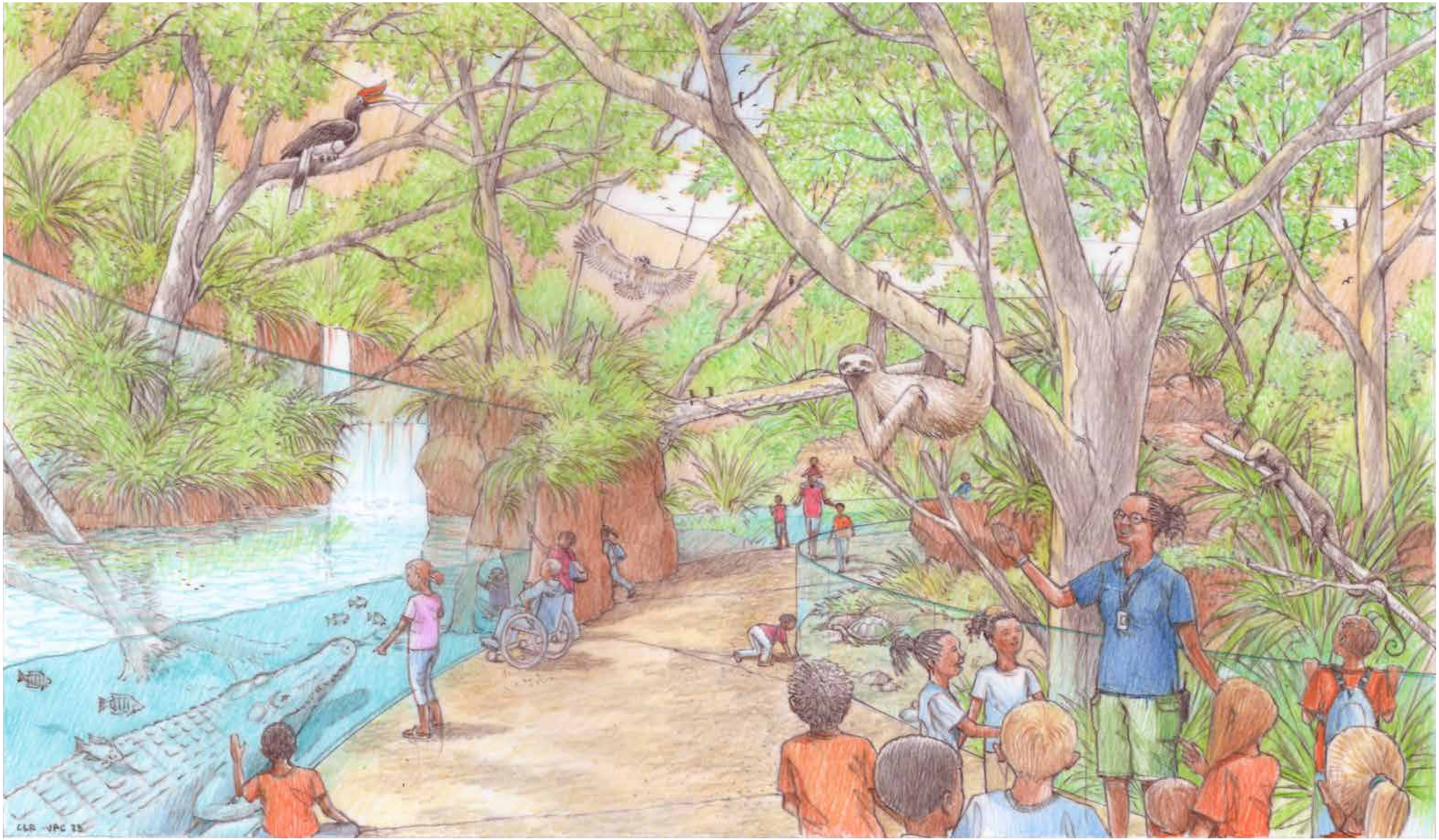
Through a mix of large open-air transects in a greenhouse type setting and smaller curated exhibits, this building would truly showcase diversity of species. Vegetation collections will introduce visitors to a variety of plants associated with each animal's region, support animal enrichment and enhance the zoo's botanic collection. The exhibits may also include aquatic features requiring life support systems (LSS) such as two to three pools in the 5,000-to-10,000-gallon volume range for crocodilian species. These pools could support fish in addition to the reptile species. The LSS would consist of sand filtration, temperature control, ultraviolet sterilization, and provisions for gas exchange.

The backwash water from the sand filters associated with the Herpetarium exhibits is an excellent candidate for reuse on site. For example, a simple single pass recovery system would adequately treat this water for reuse as makeup water to exhibits like Painted Dog, Flamingo, or Giraffe.

PROGRAM

Ambassador Animals	
Theater	2,030 SF
Rainforest Ambassador Exhibits (4 @ 280 SF)	1,120 SF
Visitor Gallery	950 SF
Animal Suites (20 @ 100 SF)	2,000 SF
Prep & Break Room	655 SF
Restroom	80 SF
Locker Room	85 SF
Shower Room	100 SF
M/E	465 SF
Herpetarium	
Rainforest Gallery	2,975 SF
Small Exhibit Gallery	780 SF
Desert Gallery	4,040 SF
Care Staff & Exhibit Support	2,220 SF
Net	**17,495 SF**
Net to Gross	**3,525 SF**
Gross	**21,020 SF**

Prehensile-tailed porcupine ambassador



Ambassador and Herpetarium interior

ENTRY

The entry plaza plays an important role for visitors as it is the first experience one has upon arriving at the Oregon Zoo. The existing plaza is currently sloped at approximately 5 percent and characterized by expansive asphalt surfacing, with little shelter from sun and rain. Circulation is challenged by the steeper slope, making it a space that is less accessible for gathering and events as well as unclear from a wayfinding perspective.

The plaza is framed on the north and south by the guest services and gift shop buildings, both of which have a distinctly Northwest Forest architectural quality. On the east side of the plaza is the existing Mountain Goat exhibit, which serves as a main attraction and immediate animal encounter for visitors.

The focus of the redesign is to create an intuitive flow in and out of the zoo as well as reduce stress for visitors. It will also direct guests towards the gift shop as they exit to encourage final opportunity for souvenirs, memberships, and donations. The redesigned plaza should generate excitement and anticipation for visitors as they arrive, and it must reinforce a positive experience as visitors depart. It should frame and accentuate the existing Mountain Goat exhibit and anchor the zoo in its context of the Pacific Northwest and Willamette Valley through plantings, materials, and design elements.

The new entry plaza concept addresses the programmatic needs of the main entry, solves accessibility challenges, and enhances visitor amenities and experiences.

The existing Guest Services and Gift Shop engage with the plaza and provide opportunities for visitors to orient themselves, sit, find grab-and-go snacks or restrooms, and shop. Design and material choices will respond to the existing architectural elements at the entry creating an integrated experience upon arriving at the Oregon Zoo. Planting throughout this area could include notable PNW native plantings such as Douglas fir, big-leaf maple, vine maples, rhododendrons, western sword fern, and other native forest groundcover.

The entry concept also considers the Washington Park Campus Plan vision to create a pedestrian-focused plaza space at the MAX station and connect to the zoo entrance.

Concept rendering for plaza design

Reference Imagery

Entry Plaza

AFRICA

From the South Hub, visitors will traverse a new pedestrian bridge spanning above the zoo's service road, allowing public and service routes to operate independently. Visitors remain at a higher elevation while being transported from the native Oregon forest to the diverse landscapes of Africa. This redevelopment of the current Africa Zone takes advantage of the natural 40-foot change in elevation to replicate various topographies while also improving circulation and wayfinding in a clear and trail-like sequence. Guests will traverse their way from the low, widespread savanna through outcroppings of kopje rocks and up to the dense canopy of the rainforest.

Architectural features that protect animals and visitors alike from inclement weather are incorporated throughout by way of covered outdoor viewing areas, indoor day rooms, and a fully indoor experience in the Tropical Forest Building. All these provide a more comfortable viewing experience as well as maximize views of animals throughout the year. For animals, new care facilities will be specially designed to the particular needs of each species and their respective group dynamics, such as bachelor herds of giraffes, prides of lions, and packs of painted dogs. Surrounding the Africa Zone, a perimeter service access road provides direct and efficient access for zoo staff to the buildings and exhibits.

PROGRAM

Total Project Site	6.2 AC	270,230 SF
Primate Care Building		1,160 SF
Primate Habitat 1		2,570 SF
Primate Habitat 2		2,610 SF
Primate Habitat 3		3,240 SF
Chimpanzee Habitat (renovated)		8,810 SF
Chimpanzee Yard		755 SF
Chimpanzee View Shelter		760 SF
Painted Dog Care Building		955 SF
Painted Dog Habitat		9,080 SF
Painted Dog & Lion Yard		1,705 SF
Lion Care Building		2,355 SF
Lion Yard		1,150 SF
Lion Habitat		15,055 SF
Lion View Shelter		1,915 SF
Tropical Forest Building		14,295 SF
Tropical Forest Outdoor Habitat		1,395 SF
Marsh Aviary Care Building		300 SF
Marsh Aviary		4,540 SF
Café		295 SF
Rhino-Giraffe Care & Exhibit Building		25,665 SF
Rhino Yard		1,350 SF
Rhino Habitat		19,350 SF
Rhino View Shelter		1,490 SF
Giraffe Habitat		18,185 SF
Ground Bird Shelters		310 SF

African savanna & kopje

Africa experience aerial view

SAVANNA

The first stop in one's journey through Africa is the Savanna. Upon arrival, there is an option for quick refreshments before trailing along the ridge above the plains. Among the sprawling landscape, the redeveloped African Savanna will focus on two popular species currently at the zoo: giraffe and black rhino.

All indoor animal areas will have natural substrate floors promoting health and creating a seamless transition to the outdoor exhibit beyond. At the dayroom as well as the outdoor covered area, visitors will be able to encounter these giants eye-to-eye by participating in staff-facilitated giraffe feedings and rhino encounters.

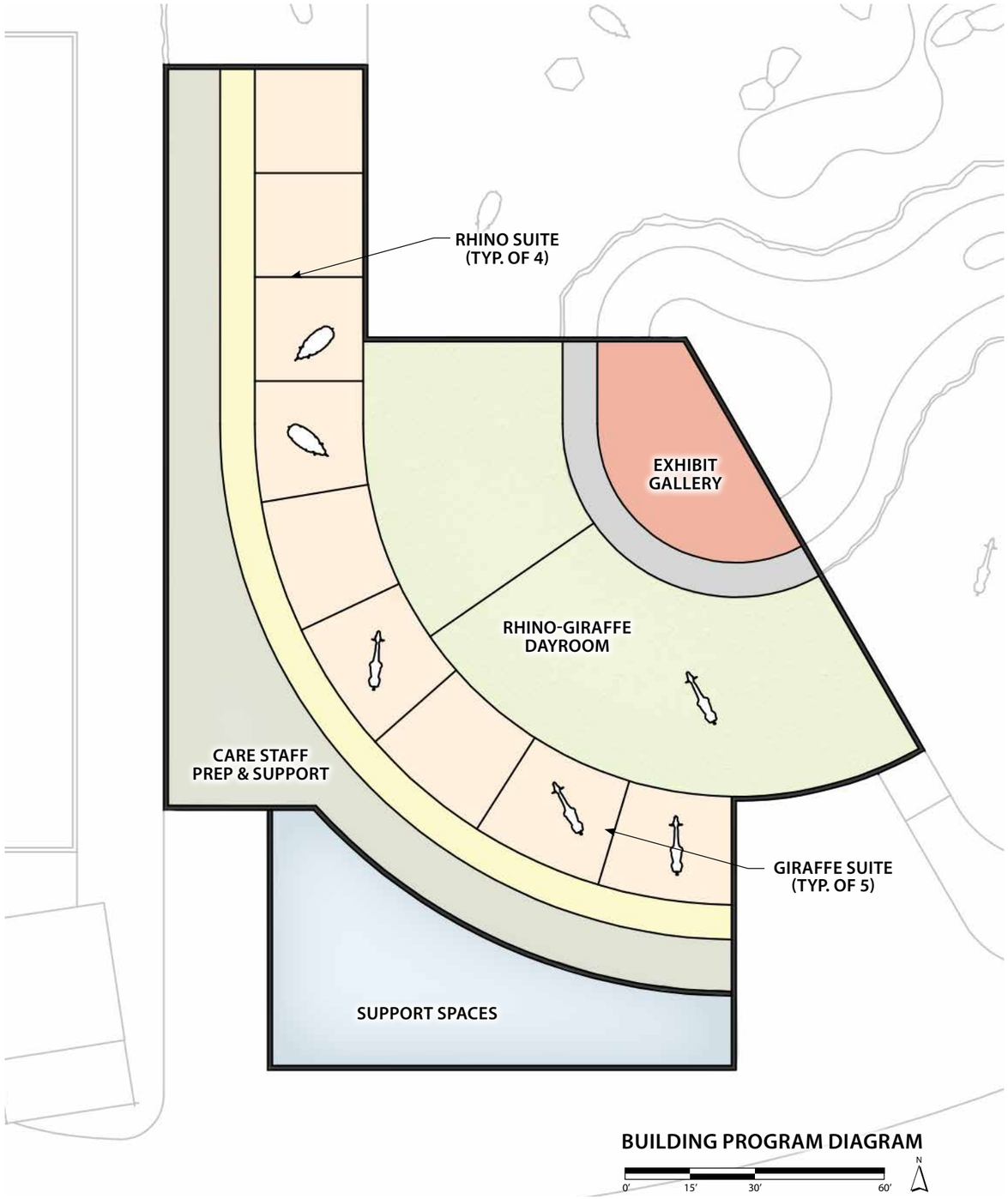
The animal habitats will be characterized by the grassy plains and widely spaced trees of the savanna. Rhinos will have a mud wallow to help cool off and protect their skin from insects and sun during the summer. Meanwhile, giraffes will share their habitat and watering hole with African ground birds, such as southern hornbills, vultures, and cranes.

The planting throughout will be inspired by native savanna species, incorporating collections of grasses and other drought tolerant plants, such as reed grass and rushes, which have similar characteristics of African-native cape rush and papyrus. Broad canopy shade trees with low understory plantings will create an immersive experience for visitors and provide respite throughout the Savanna area. It is recommended that the development consider incorporation of existing palm trees and eucalyptus trees as part of the new Savanna exhibits and visitor paths.

Service access is provided along the entire south edge of the site and the existing butterfly lab remains out of site from the visitor area.

PROGRAM

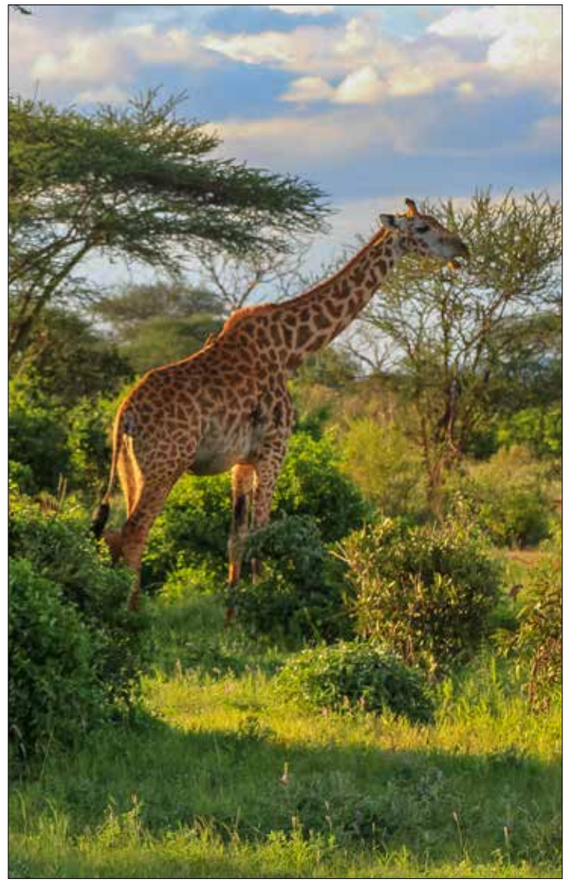
Exhibit Hall	1,695 SF
Rhino-Giraffe Dayroom	6,935 SF
Giraffe Suites (5 @ 740 SF)	3,700 SF
Rhino Suites (4 @ 600 SF)	2,400 SF
Care Staff Prep & Support	4,870 SF
Support Spaces	3,595 SF
Net	**23,190 SF**
Net to Gross	**2,470 SF**
Gross	**25,665 SF**



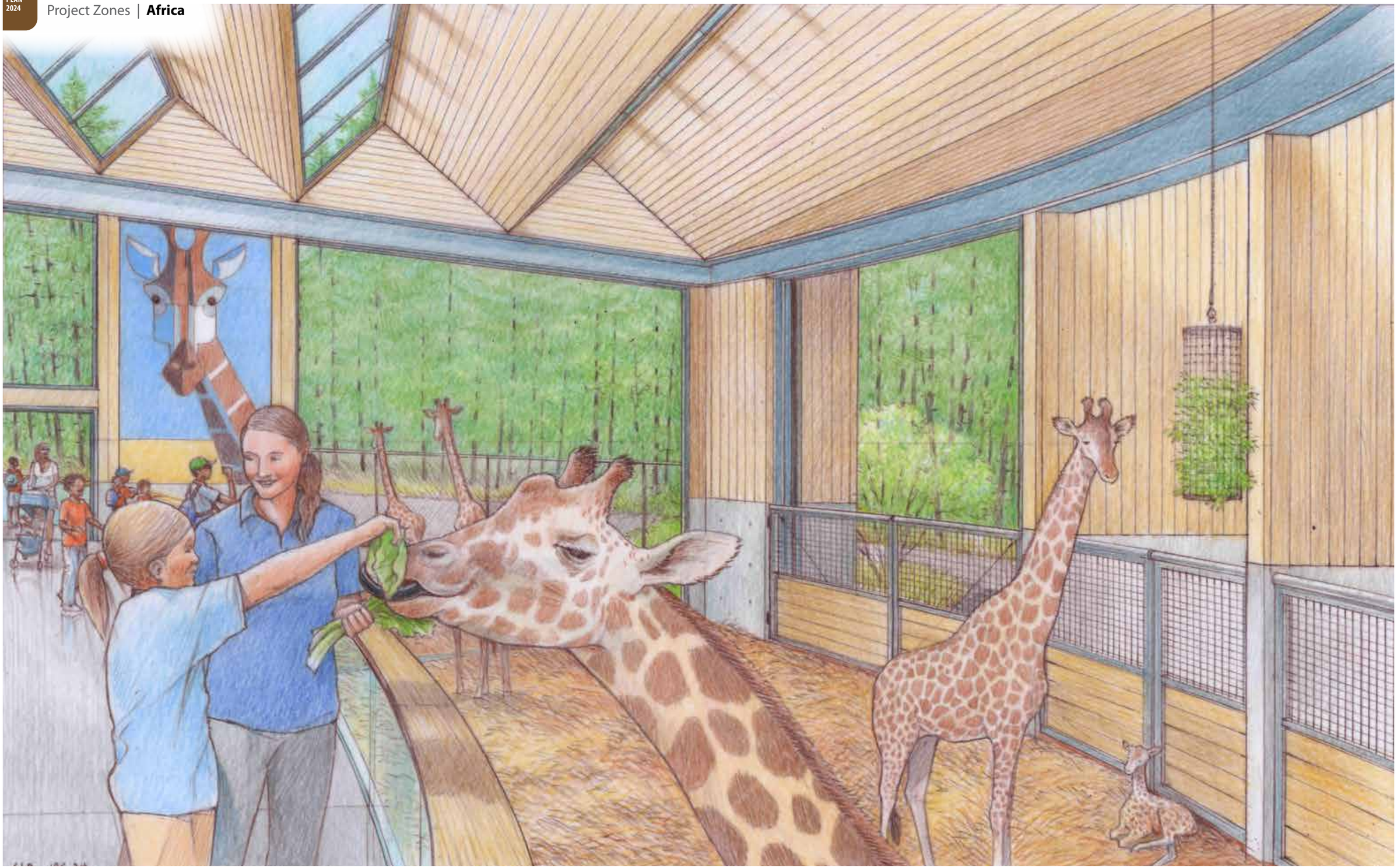
BUILDING PROGRAM DIAGRAM

Proposed Species

Black Rhino



Giraffe



Giraffe and rhino interior habitat

TROPICAL FOREST

In contrast to the flat grasslands and kopje landscape of Africa, the Tropical Forest building highlights the biodiversity of rainforests around the world with a focus on the huge variety of birds that live in our planets tropical forests. The building is embedded in the surrounding landscape and existing hillside below the Education Building while tying into the Kopje trail at two levels.

The experience begins outdoors at the bottom of the trail with the marsh aviary, home to flamingos, spoonbills, and ibis. Then, entering the building at the ground level, visitors arrive inside the aviary. Visitors are instantly transported as they are surrounded with dense, lush plantings, and colorful birds flying through the high-volume space. A waterfall will add ambient sound accompanying the bird songs and natural daylight will flood through vast glass curtain walls and skylights.

As a multi-story space, the Tropical Forest building allows visitors to experience the aviary from multiple vantage points. By taking the elevator, stairs, or entering through the northeast upper level, visitors will be able to trek around the perimeter of the aviary at the canopy level on bridges and higher-level paths.

In addition to many bird species, the indoor aviary provides an opportunity to showcase diverse non-native plant species that may not otherwise thrive in the zoo's Pacific Northwest climate. The plant collection in the Tropical Forest pavilion may include orchids, ginger, rhododendrons, bromeliads, and even edible plants such as bananas and chocolate. Large mature trees installed at 20 to 25 ft in height will provide an immediate canopy effect within the space.

Back inside the upper level, the visitor experience transitions from day to night as the building will feature nocturnal exhibits for small mammals. Flying foxes will have the flexibility to also occupy the aviary as well as the outdoor exhibit north of the building.

Between this zone and the aviary, the Tropical Forest building provides a rich indoor experience and in doing so, provides guests with a consistent and comfortable experience during the shoulder seasons. Additionally, the open flow circulation through the upper level will provide the zoo with added event space opportunities after hours.

Supporting all these exhibits is dedicated keeper space as well as bird holding in the southwest zone of the building. Mechanical rooms will house equipment designed to maintain indoor tropical temperatures in addition to life support systems (LSS) for the major water features, including the outdoor marsh. This pool will utilize a hybrid mechanical-natural filtration process. The LSS consists of drum filtration, ultraviolet sterilization, and heating supplemented with constructed wetlands.

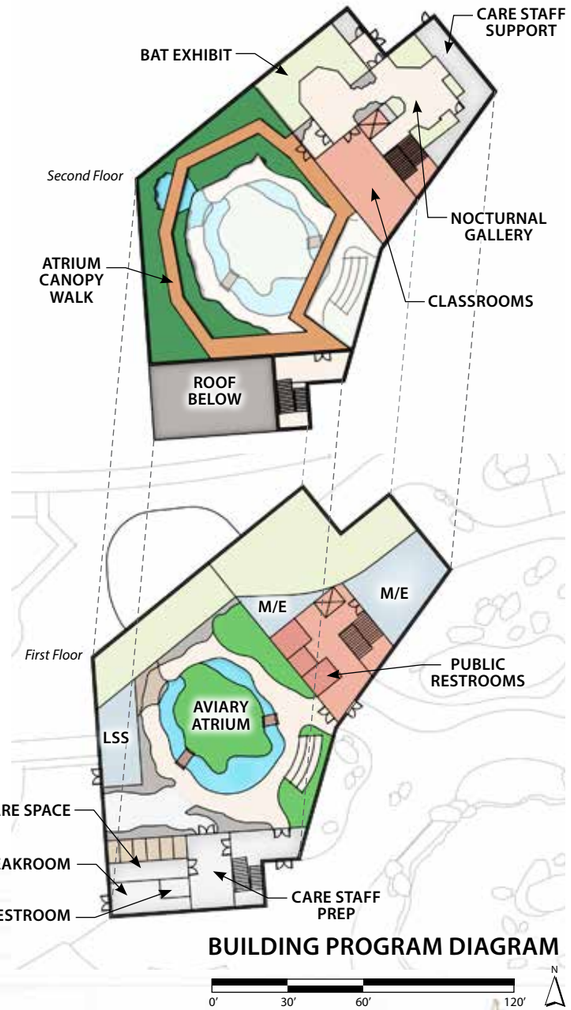
The wetland beds may be adjacent to the exhibit, or they may be integrated into the decorative stream course through the Life on the Kopje trail. Continuing the water conservation efforts, the building will capture roof runoff for flushing toilets in the visitor single-user restrooms on the ground floor.

PROGRAM

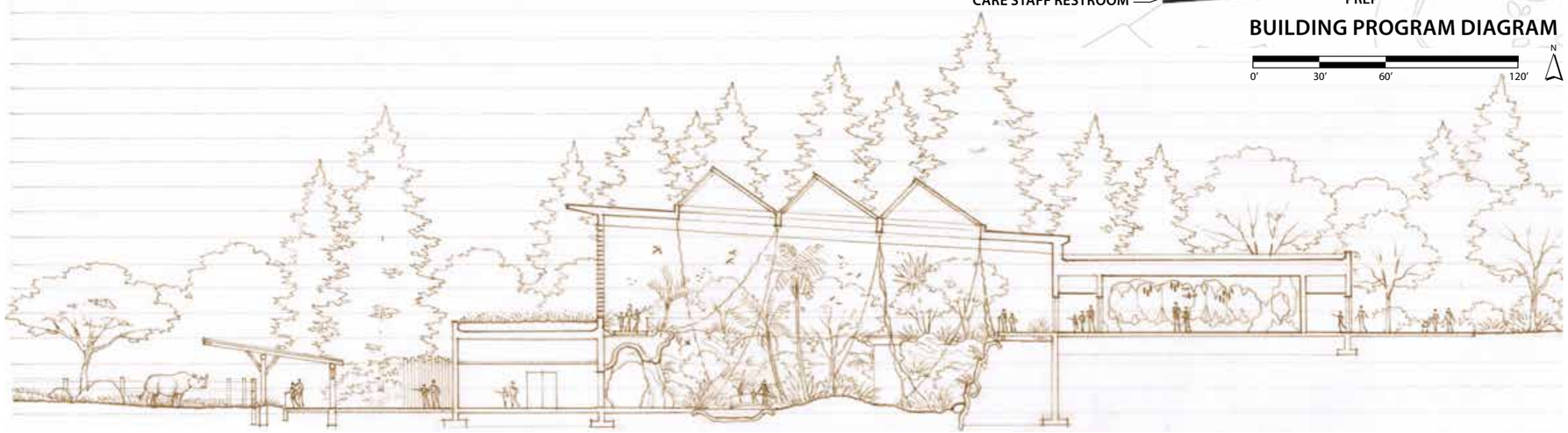
Lower Level	
Aviary Atrium	5,735 SF
Public Restrooms	360 SF
Animal Care Space	530 SF
Care Staff Prep	470 SF
Care Staff Break Room	260 SF
Care Staff Restroom	100 SF
LSS Room	570 SF
M/E	1,470 SF
Upper Level	
Atrium Canopy Walk	3,000 SF
Nocturnal Gallery	1,050 SF
Classroom	870 SF
Bat Exhibit	605 SF
Small Exhibits (4)	330 SF
Care Staff Support	680 SF
Net	**16,030 SF**
Net to Gross	**3,180 SF**
Gross	**19,205 SF**

Banana Tree

Flamingo



BUILDING PROGRAM DIAGRAM



Section through Tropical Forest building

Tropical Forest canopy

PREDATOR

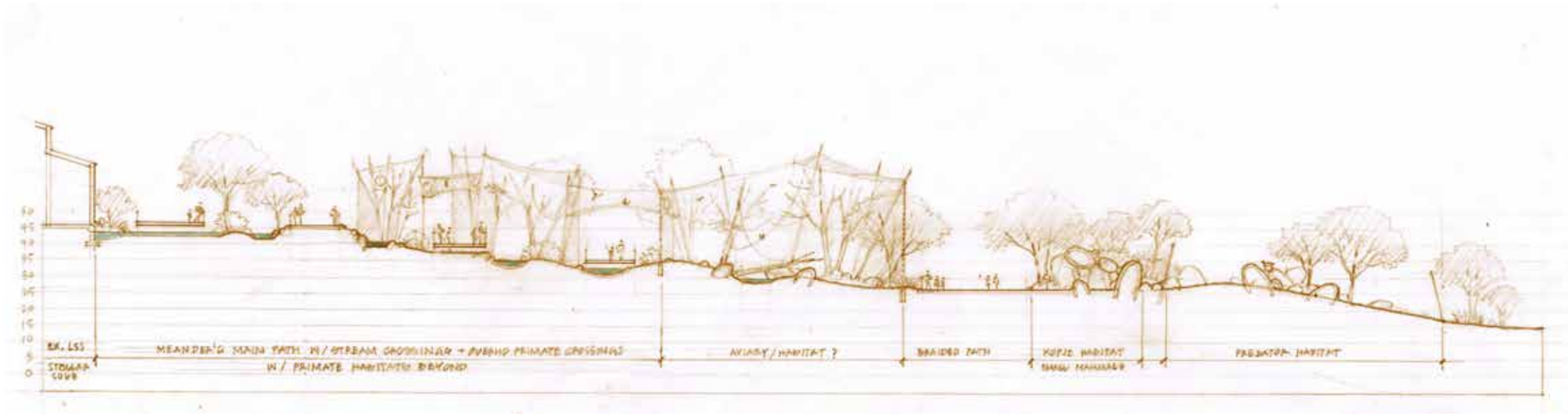
Complimentary to the herbivores of the savanna, predator species shall reside north of the new bridge into Africa. From the south end, visitors will have overlapping views of lions and painted dogs basking atop their colossal kopje rocks. These distinct geological formations provide shade as well as high vantage points for predators to scan their surroundings. As visitors wander along the west edge of the exhibits, they will encounter these formidable species at eye-level while they patrol their domain. To further tap into their hunting and investigative instincts, keepers will be able to rotate lions and painted dogs between both exhibits, leaving behind scents and tracks for the other to follow. New holding buildings and shared off-exhibit yards will help to fully implement flexible rotation and maximize animal activity.

At the back of house, service access is provided from the east service road to both buildings and exhibits. In the buildings, roof runoff shall be captured for reuse to washdown inside the animal holding areas. For cooling off in the summer, the painted dog exhibit features a running stream and the lions a small pool at the base of the rocks. The stream will utilize a simple hybrid mechanical-natural life support system (LSS). The lion pool has the option to be dump-and-fill or have a simple hybrid mechanical-natural LSS. Equipment for these life support systems shall be located and accessed within the back of house area.

Lion

Painted Dog

Key Plan



Lion kopje

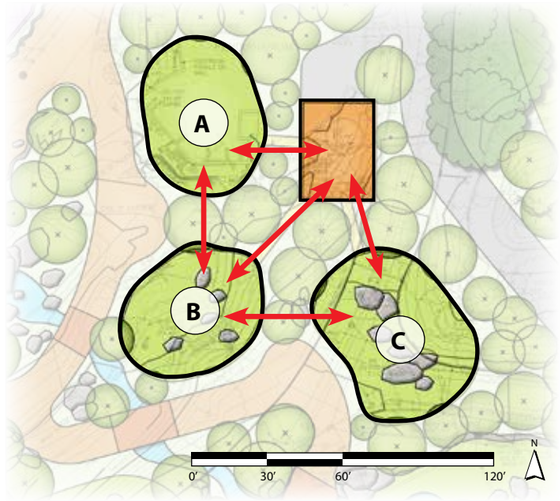
PRIMATE

At the top of the Kopje trail is a habitat sequence bridging the upland African Forest and Lowland Savanna zones. Dynamic layering of must-see Kopje outcroppings and a cascading stream course running from the top of the trail all the way down to the painted dog habitat visually draw visitors up the trail from the main path. Tertiary winding trails, narrow boardwalks and bridges integrate adventure play and exploration for children and families all while making the fifteen-foot climb up from Predator to Coastal Shores.

Nestled in the trail are three habitats for small African primates such as colobus and lemurs. The habitats will have linkages to each other to allow for flexible habitat rotation as well as provide the opportunity to be all open at once for one continuous trail habitat. The interconnected layout will greatly increase management flexibility and add choice to the various social groups of where and with whom they spend their day. Utilizing tree canopy to replicate the forest habitats these primates are from will create a more connected experience for visitors by adding ornamental deciduous trees and understory as well as demonstration gardens highlighting seasonal species such as banana trees.

The new habitats also incorporate a variety of climbing options and comfortable spaces at numerous levels, accommodating the preferences of all species that inhabit the area. Screened by vegetation is a central primate holding building providing direct linkages to each habitat.

Though not visible from the trail, this development would also include the west branch of the middle service road providing direct access for zoo staff to the new primate holding building, the Central Hub, and modified chimpanzee habitat. Modifications in the existing chimpanzee area may also provide an opportunity to include improvements such as more heat and shelter in the outdoor habitats as well as adjustments to better facilitate the housing of multiple groups of chimps.



Habitat Rotation Diagram

Red-tailed guenon

Colobus

Ring-tailed lemur

Red-ruffed lemur

Habitat design references spatial complexity of forest

EAST HUB

Fully surrounded by animal exhibits, the East Hub is a center of visitor amenities with restrooms, snack carts, lunch offerings from Growlers Café, and places to sit and gather. Notably, the restroom building is the first building in Oregon to use cross-laminated timber (CLT), a relatively new and sustainable construction material.

From here, visitors have expansive views of elephants browsing in the North Meadow or taking a plunge in the 160,000-gallon pool, all set to the backdrop of the native Douglas fir forest. Ample plaza space is provided for visitors to stop and rest, picnic at the lunch tables, or even observe a keeper talk around the elephant pool. To the west, Polar Plaza offers underwater views of polar bears and to the south, one may see primates from a distance up at the canopy level.

The flexibility of this area to be utilized by daily visitors and after-hours private events is key to the zoo's financial sustainability goal as well as providing a well-rounded visitor experience. The Campus Plan aims to complement and further support these functions with some small but impactful improvements: shade shelters and destination play.

Growler's Cafe

PROGRAM

Adventure Play Zone	5,950 SF
Polar Plaza Shelter	7,630 SF
East Hub Shelter	1,690 SF
Growlers Café (ex)	1,560 SF
Restroom Building (ex)	1,660 SF
Storage Building (ex)	1,730 SF

View of Elephant Lands from event shelter

Site for destination play

SHADE SHELTERS

Recently completed in 2021, the Polar Plaza serves primarily as an outdoor gathering area for daily guests picnicking at the zoo and secondarily as a venue for private events. Currently, shade cover and protection from the elements is provided by table umbrellas and temporary tents. The Campus Plan proposes to enhance the existing plaza with a permanent architectural shelter to extend its use throughout the year. In the Pacific Northwest style with heavy timbers, the shelter will unify the existing structures surrounding the plaza into one cohesive space. The shelter will also include movable walls so that when open it maintains framed views of polar bears and elephants, and when closed can ensure privacy for events and even further protection from inclement weather allowing for ultimate flexible use.

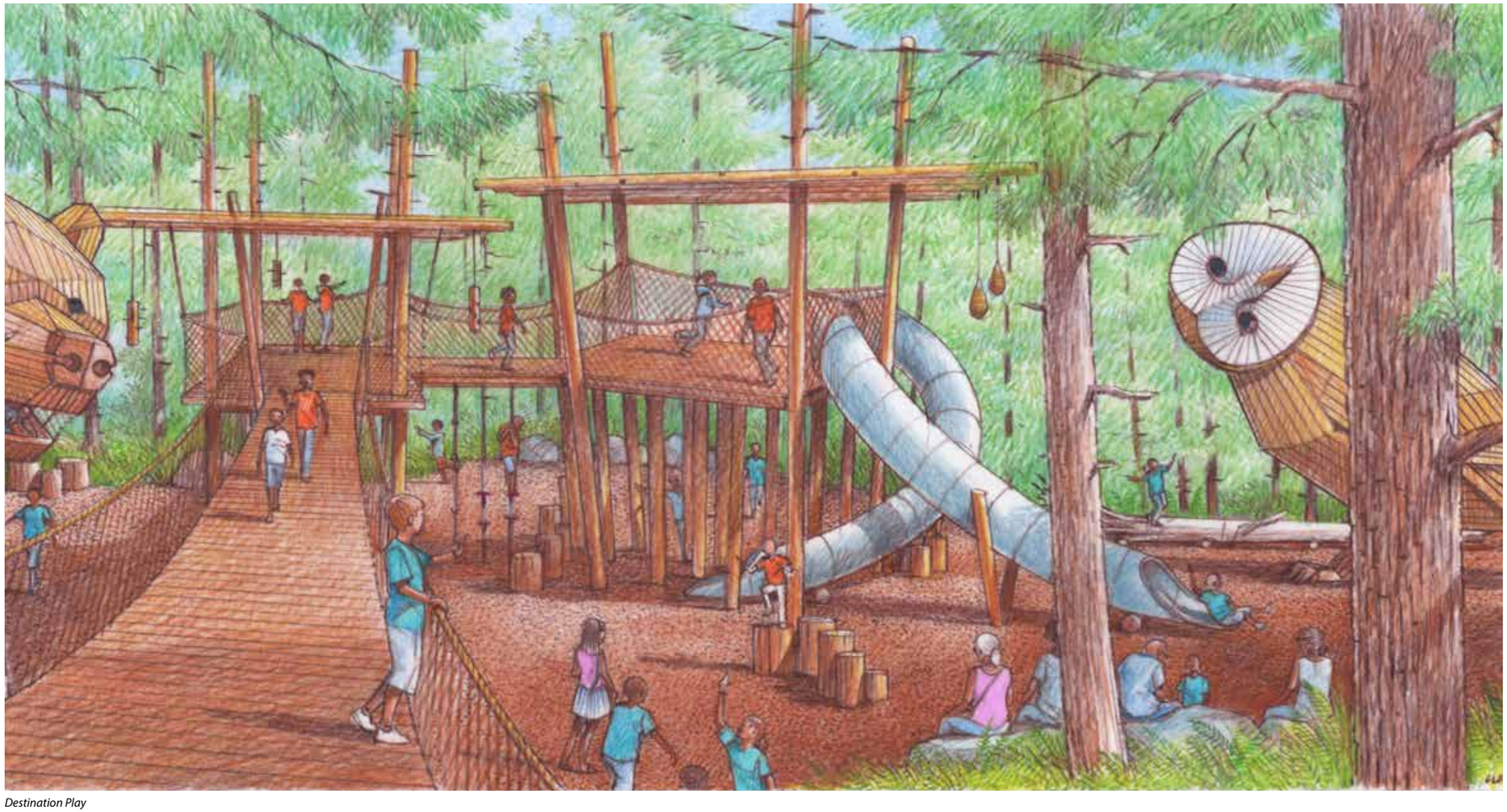
Similarly, a permanent shade shelter is proposed to be constructed in the East Hub to replace existing temporary tents and provide shaded and sheltered dining space near Growler's Café.

PLAY AREA

Elephant Lands is one of the most popular areas of the zoo and at the east end of the campus is a major destination for all visitors. Just west of Forest Hall is an existing knoll that is characterized by the Douglas fir forest seen throughout Washington Park. Over the years, this space has been used for play and picnicking opportunities, but more recently has not been open to visitors. This area is within the City of Portland's environmental conservation overlay, so development is limited and the design must be environmentally sensitive. The knoll is located at the midpoint of most zoo visits and near food services, and lends itself to creating a unique play experience where families can relax, and children can explore.

A custom children's adventure playground will provide opportunities for climbing and imagination, themed to the forest environment and include sculptural elements that reflect nearby animal species such as Asian elephants. With the playground tucked away seventeen feet above the main visitor path, the approach of switch-backing ramps and stairs traversing the edge of the knoll is part of the journey itself. Upon arrival, visitors will be able to take in panoramic views of Washington Park for an iconic photo opportunity before retreating into the forest. All elements of the play area will be inclusive and accessible, constructed of wood and powder-coated steel with custom animal and plant figurines. While preserving most of the existing native trees and planting, this area will also incorporate Asian and Oregon-native shared planting such as rhododendrons and fern species along the new pathways.

Reference Imagery



Destination Play

FACILITIES HUB

Located in the southwest corner of the zoo, Gate A does the heavy lifting of housing key operational support functions including facilities and maintenance offices, horticulture and custodial staff, welding and wood shops, animal nutrition, hay storage, staff parking, and composting. Its current location at the southwest entrance into Washington Park off Exit 72 from Highway 26 is ideal for receiving deliveries and then distributing support services throughout the rest of the campus along the main service road that follows the zoo perimeter.

The facilities and maintenance offices are currently housed in some of the oldest structures on campus and will be replaced with a two-story metal building facility in the same location. The existing Animal Nutrition Center (ANC) is a robust concrete building and will be renovated to be fully dedicated to animal nutrition with a walk-in freezer and browse cooler. Any restaurant food and beverage storage will be relocated as a part of the proposed new restaurant project at the South Hub. For the horticulture department, a new greenhouse will be incorporated in this area for growing browse as well as tropical plants.

PROGRAM

Facilities-Maintenance Shops & Offices	11,680 SF
Animal Nutrition Center (renovated)	7,445 SF
Greenhouse	1,870 SF

ANIMAL CARE HUB

The Animal Care Hub is located at the northeast corner of the zoo, housing key animal care functions such as the Veterinary Medical Center (VMC) and providing direct service access to enter and exit the zoo from Washington Park. It is critical to maintain the entry and exit flow to and from the VMC, especially for emergency situations. The approach through Gate J will be improved with a widened turning radius, and additional staff parking will be added on both the upper and lower roads.

The existing Care, Connection and Conservation (C3) Building will be replaced with a new three-story mass timber structure within the same footprint, including research lab workspaces, and meeting areas for curators, managers, and animal care support staff. The existing Wildlife Live and Avian Reproduction Center facilities will remain and may incorporate some modest renovations in the future.

PROGRAM

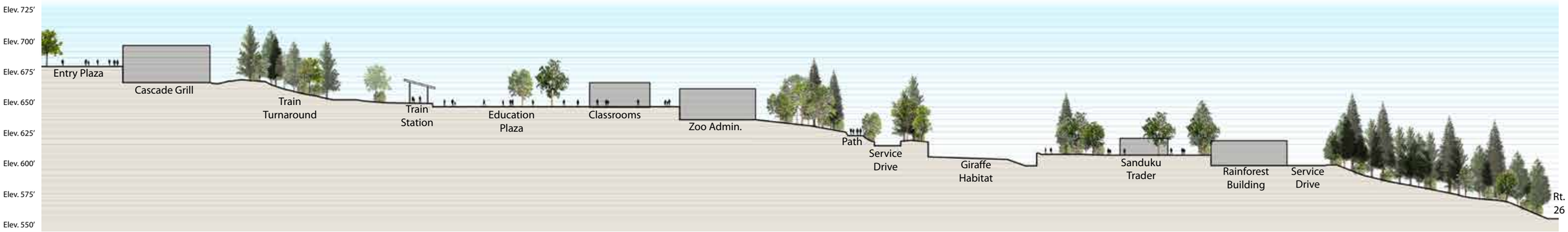
Care, Connection, & Conservation Building (3 floors @ 4,550)	13,650 SF
Wildlife Live (ex)	2,155 SF
Avian Rescue Center (ex)	1,075 SF


© Rob Helfrick

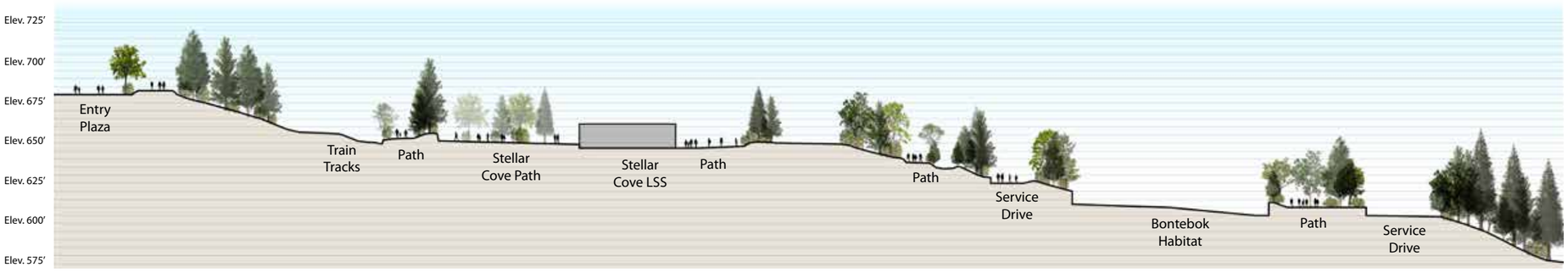
APPENDIX

PAGE INTENTIONALLY LEFT BLANK

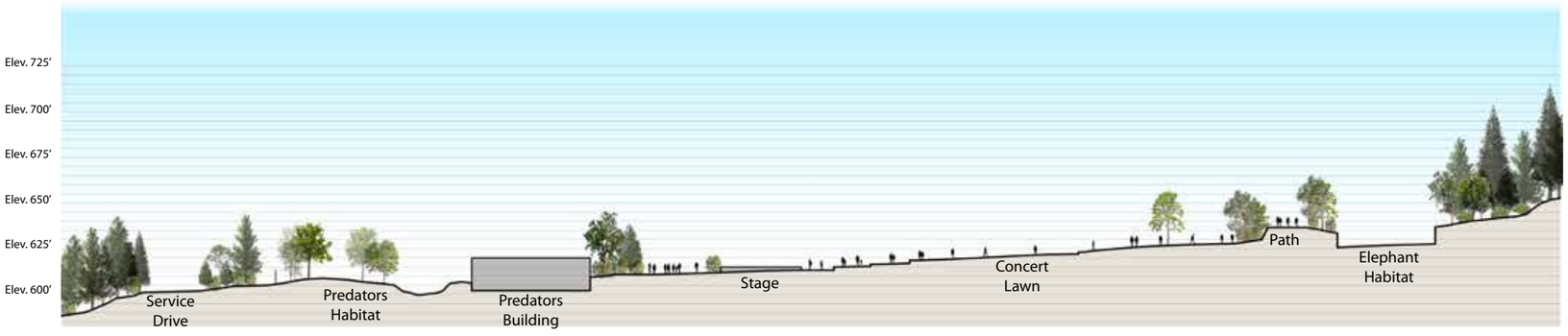
SECTIONS



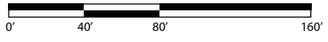
Section A



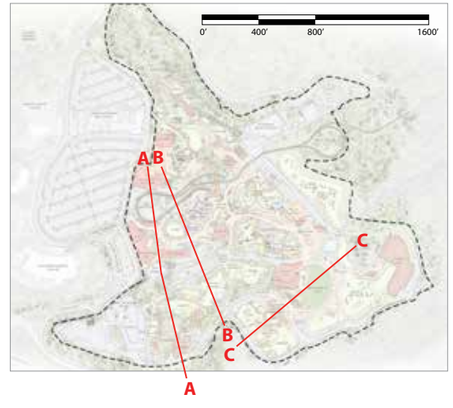
Section B

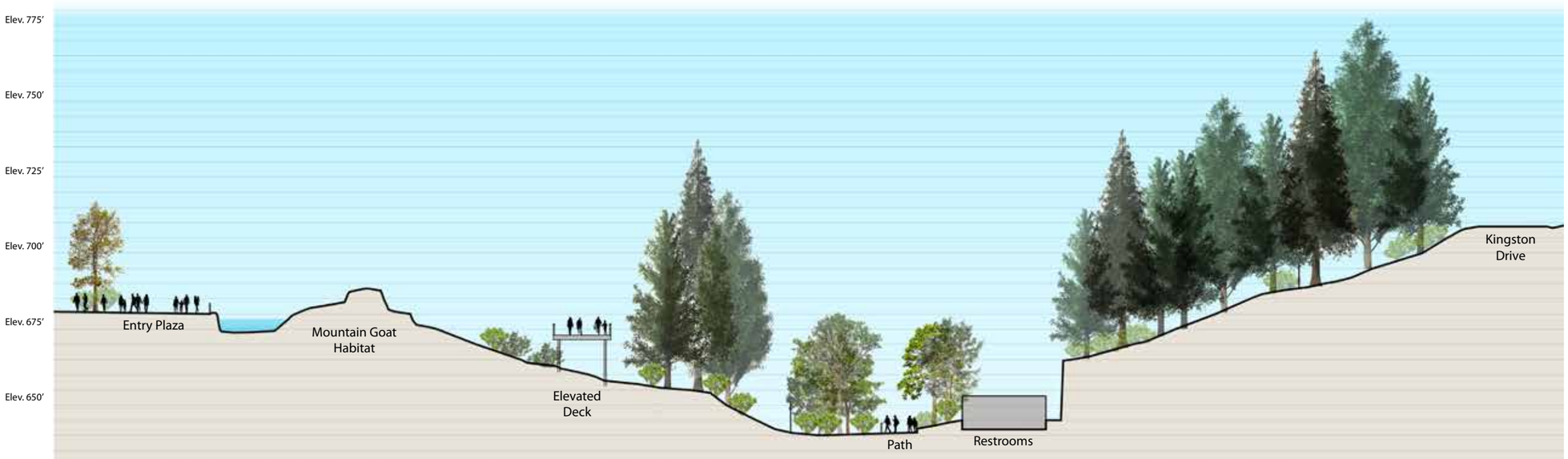


Section C

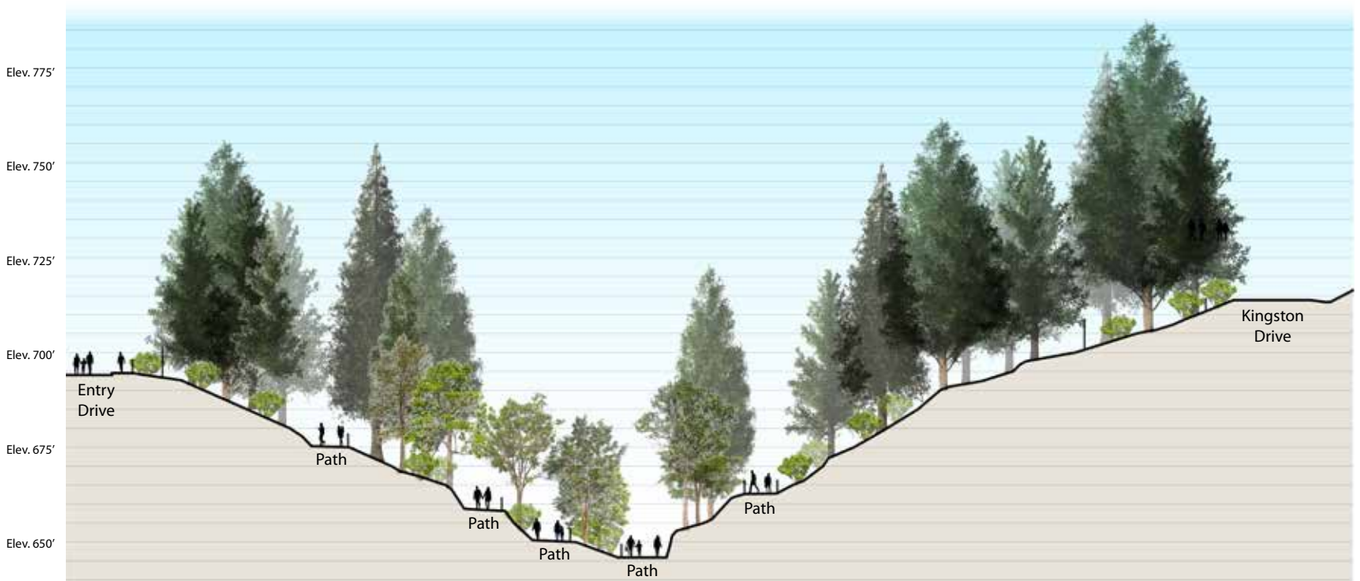


KEY PLAN





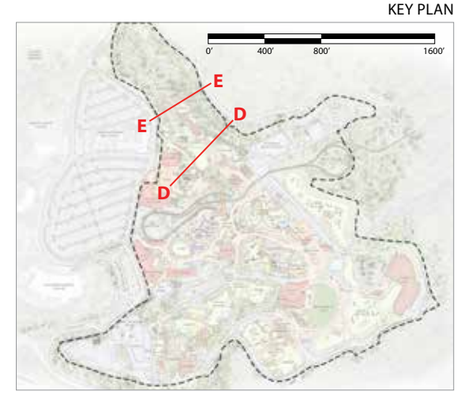
Section D

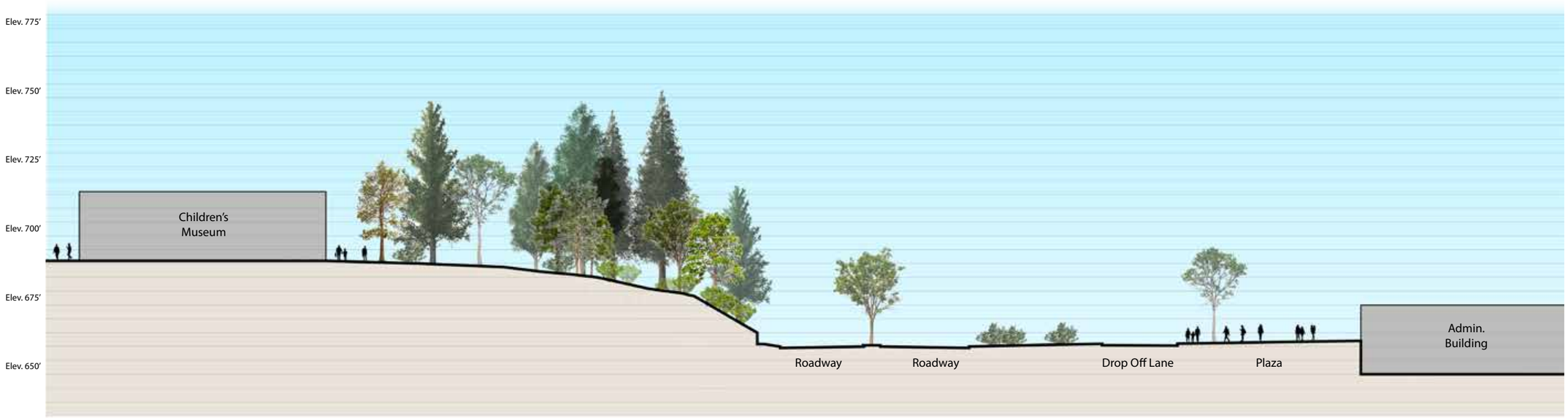


Section E

0' 20' 40' 80'

KEY PLAN

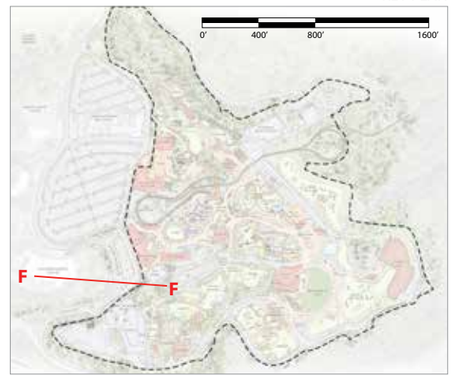




Section F

0' 20' 40' 80'

KEY PLAN



CAMPUS LAND USE DIAGRAM

OZ Campus is mainly a zoogeographic arrangement with 4 major guest service zones. 2 major features (train and middle service road) divide the campus into thirds.

Analysis Notes:

OZ Campus Usable/Developed Site 43 acres +/-. Property Line to 64 acres.

Site is dominated by 3 major habitat land use areas - Great Northwest, Elephant Lands, and Africa.

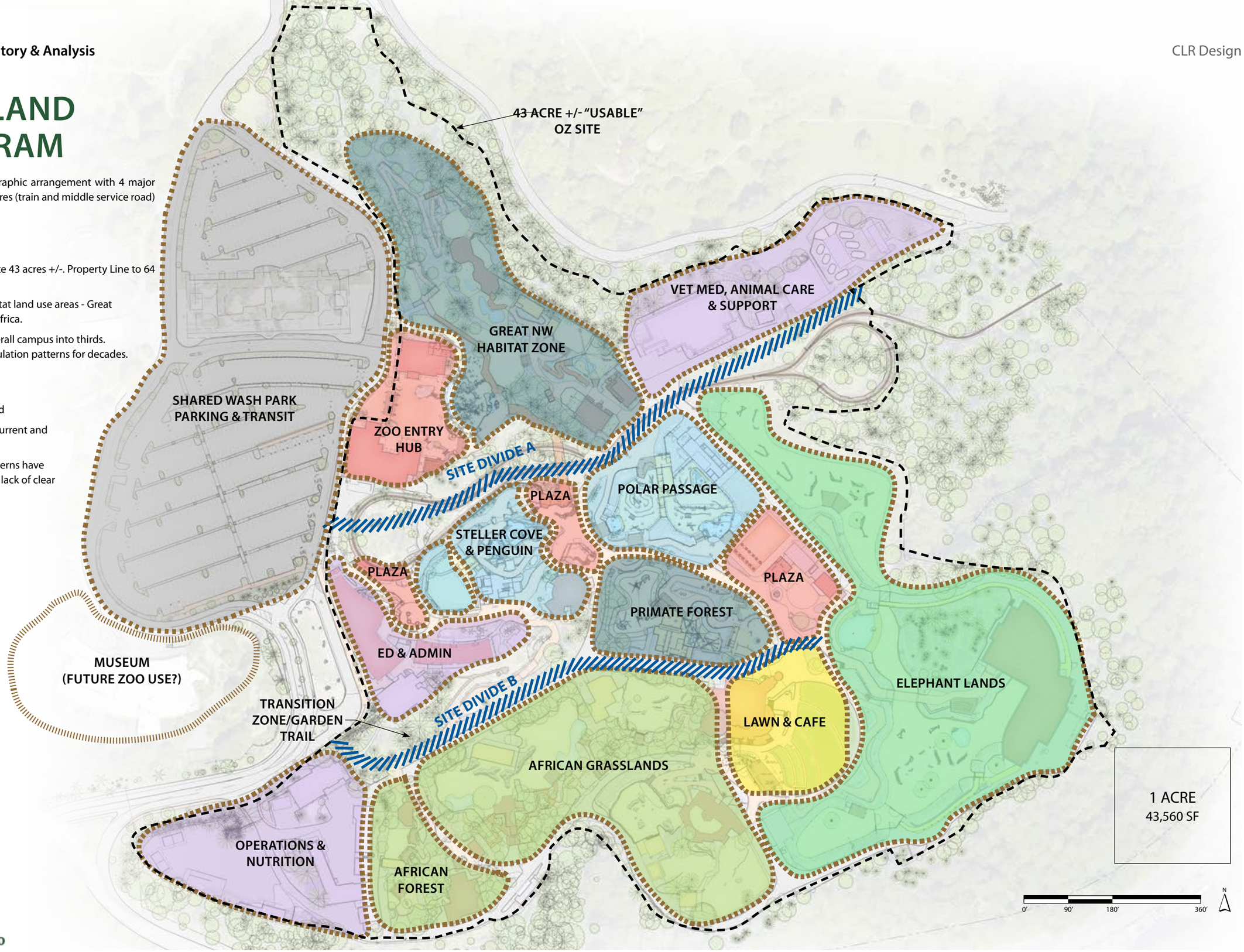
Two major features divide the overall campus into thirds. Has driven development and circulation patterns for decades. Should these be drivers??

Site Divide A - Train Loop

Site Divide B - Middle Service Road

Inadequate parking capacity for current and future attendance?

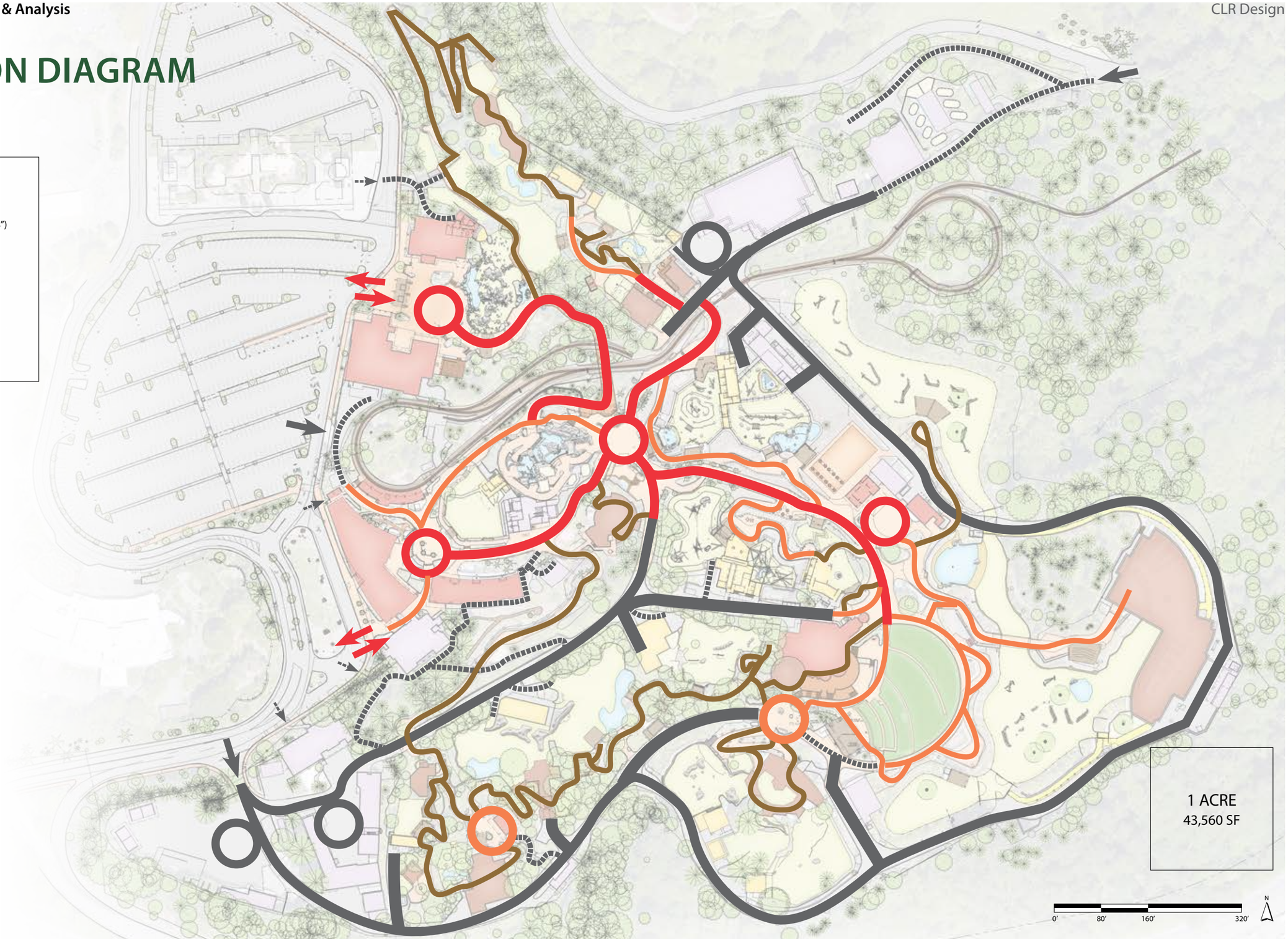
Land Form and development patterns have created disjointed guest flow and lack of clear path hierarchy



CIRCULATION DIAGRAM

SITE PLAN LEGEND

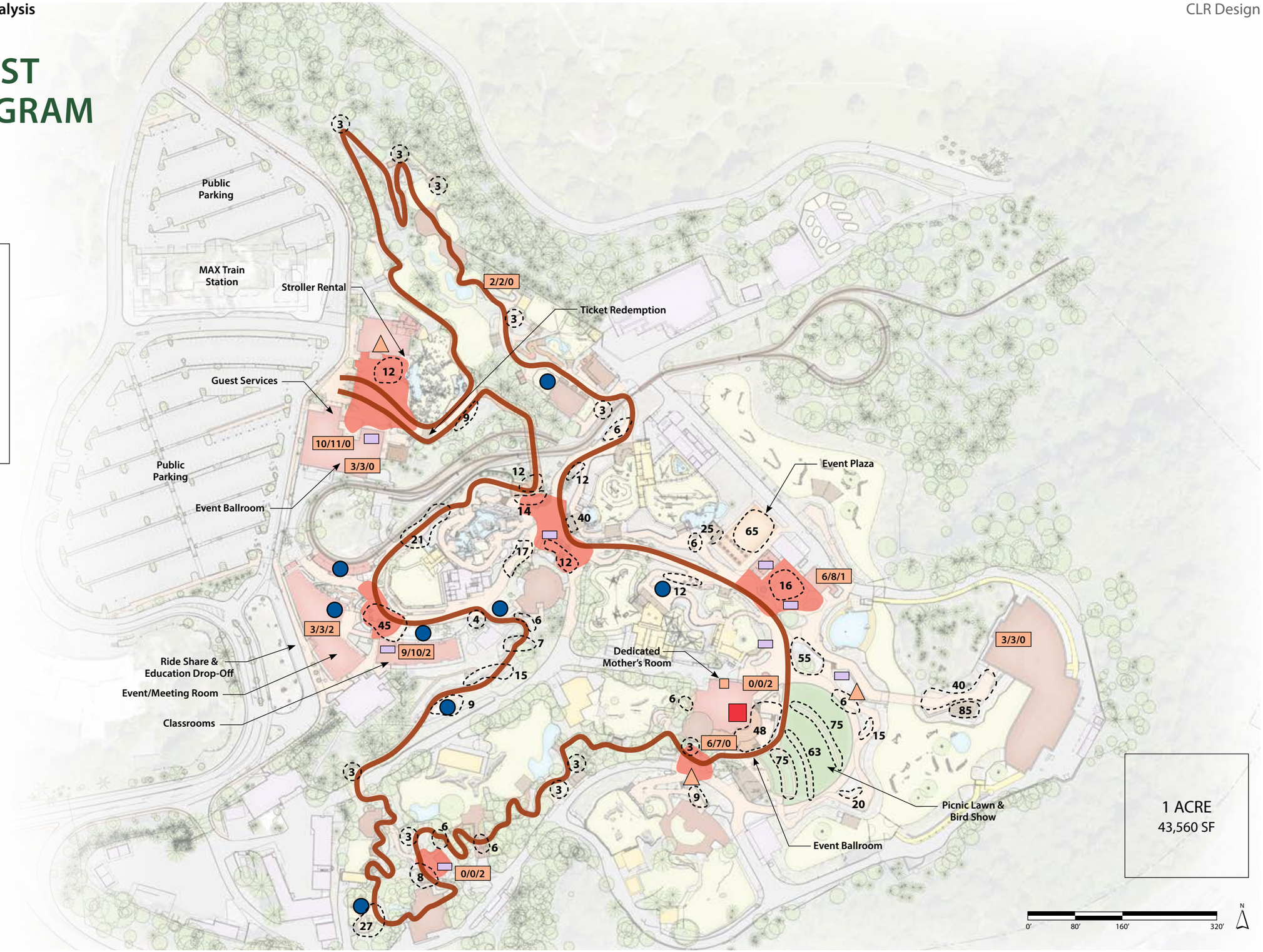
- Public Route - Large (>18')
- Public Route - Medium (10'-18")
- Public Route - Small (<10')
- Public Entry/Exit
- Service Road (>20')
- Service Route (<20')
- Service Vehicle Gate
- Service Person Gate



EXISTING GUEST SERVICES DIAGRAM

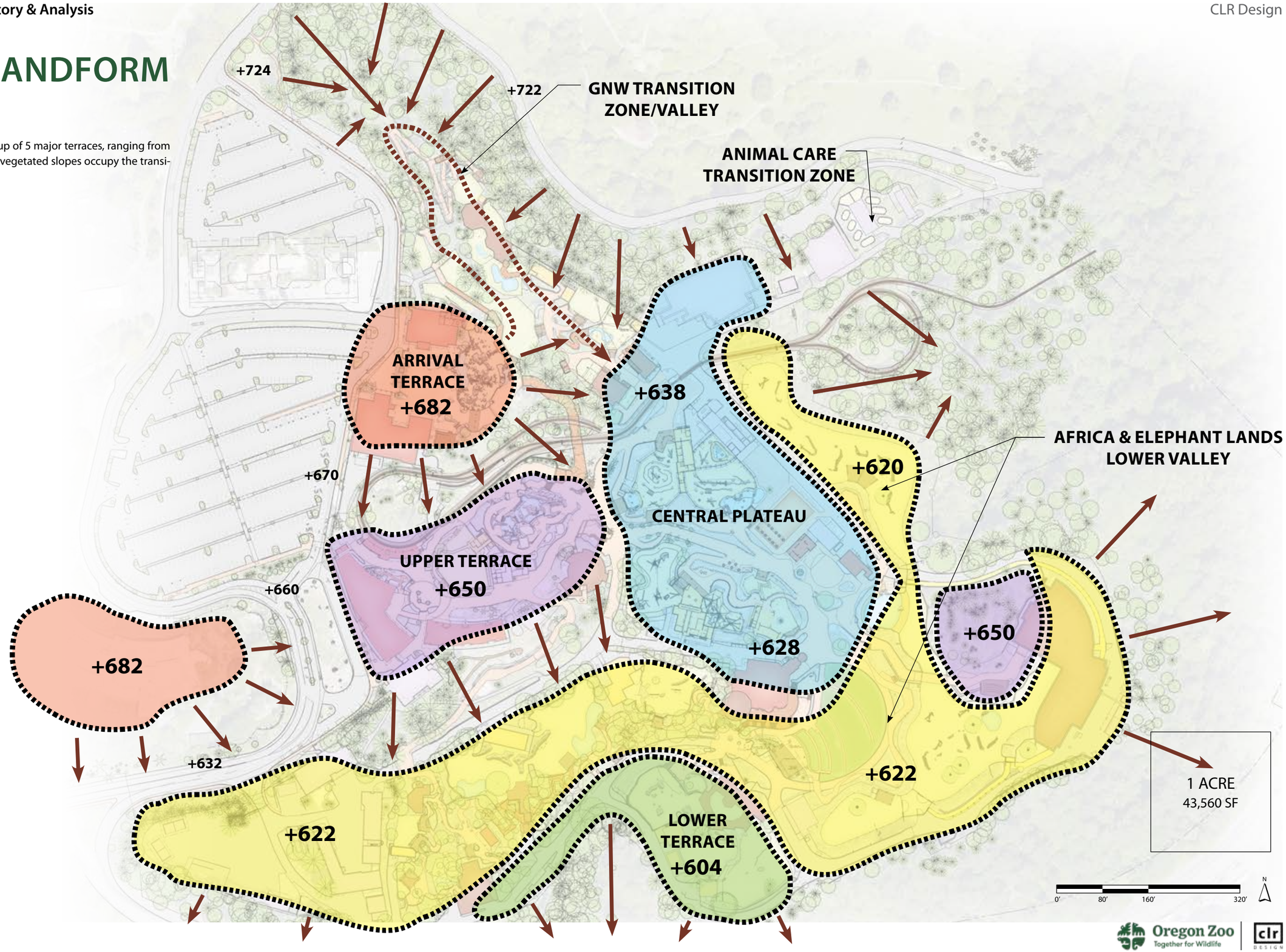
SITE PLAN LEGEND

- Children's Play Area or Ride
- x/x/x — Public Restroom (men/women/fam)
- Primary Food Establishment
- Secondary Food or Snack
- Gift and/or Other Retail
- Plaza/Hub Area
- 12 — Seating Area (capacity)
- Main Circulation Path



CAMPUS LANDFORM DIAGRAM

The Oregon Zoo Campus is made up of 5 major terraces, ranging from elevation 600' up to 680'++. Steep vegetated slopes occupy the transitional zones



TYPICAL GUEST VISIT ROUTES

SEE EVERYTHING LOOP *2.55 MILES*

1. **Entry**
2. Great Northwest
3. Family Farm
4. Polar Passage
5. Primate Forest
6. Elephant Plaza
7. Elephant North Meadow
8. Forest Hall
9. Concert Lawn / Aviary Cafe
10. African Predator
11. Rhino
12. Treetops
13. Rainforest
14. Otter
15. Bats
16. Penguin / Central Plaza
17. Steller Cove
18. Tiger / Red Panda
19. Education Building / Plaza
20. Train
21. **Exit**

POPULAR HIGHLIGHTS *1.64 MILES*

1. **Entry**
2. Great Northwest
3. Family Farm
4. Polar Passage
5. Primate Forest
6. Elephant Plaza
7. Forest Hall
8. African Predator
9. Penguin
10. Steller Cove
11. **Exit**

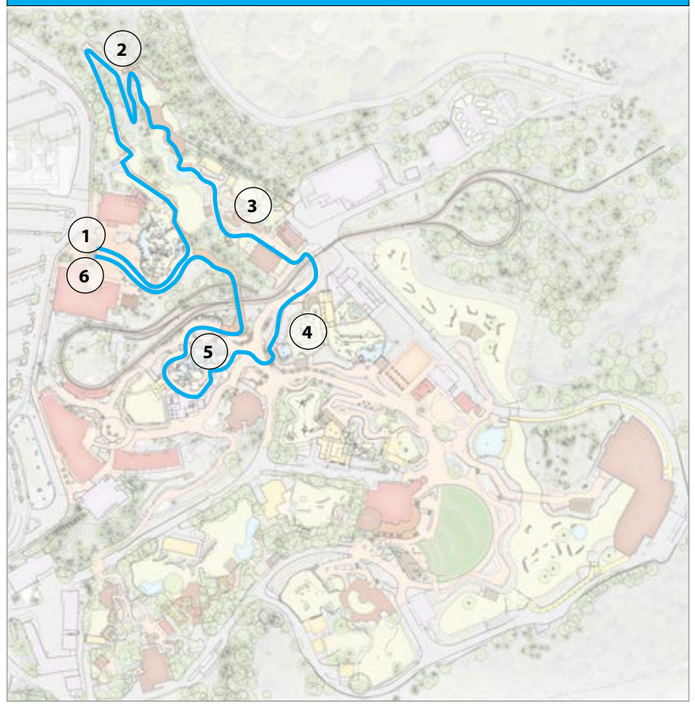
2010 BOND PROJECT TOUR *1.27 miles*

1. **Entry**
2. Steller Cove
3. Primate Forest
4. Concert Lawn/Aviary Cafe
5. Forest Hall
6. Elephant Plaza
7. Polar Passage
8. Education Building / Plaza
9. Train
10. **Exit**

AFRICA LOOP *1.45 Miles*

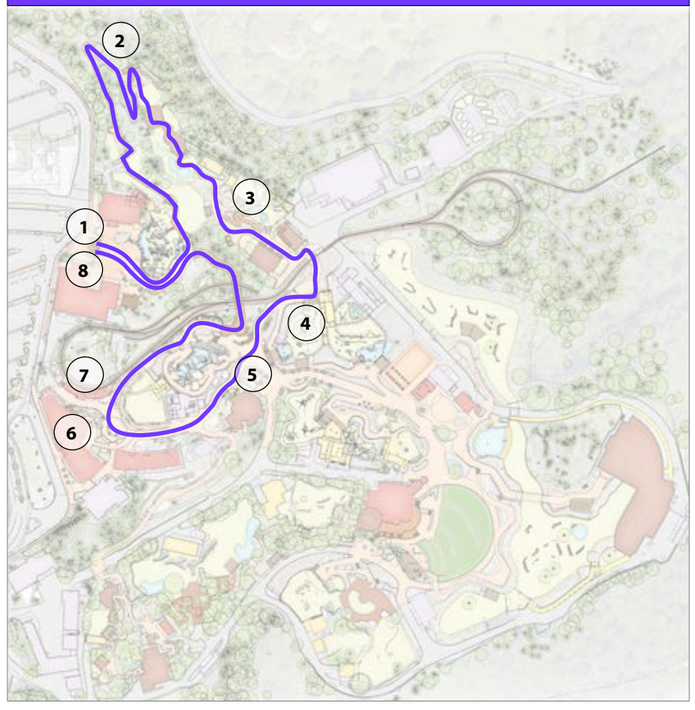
1. **Entry**
2. Steller Cove
3. Primate Forest
4. Concert Lawn / Aviary Cafe
5. African Predator
6. Rhino
7. Treetops
8. Rainforest
9. Otter
10. Bats
11. Tiger / Red Panda
12. Education Building / Plaza
13. **Exit**

NORTH AMERICA LOOP *0.75 Miles*



1. **Entry**
2. Great Northwest
3. Family Farm
4. Polar Passage
5. Steller Cove
6. **Exit**

RIDES & PLAY LOOP *0.75 Miles*



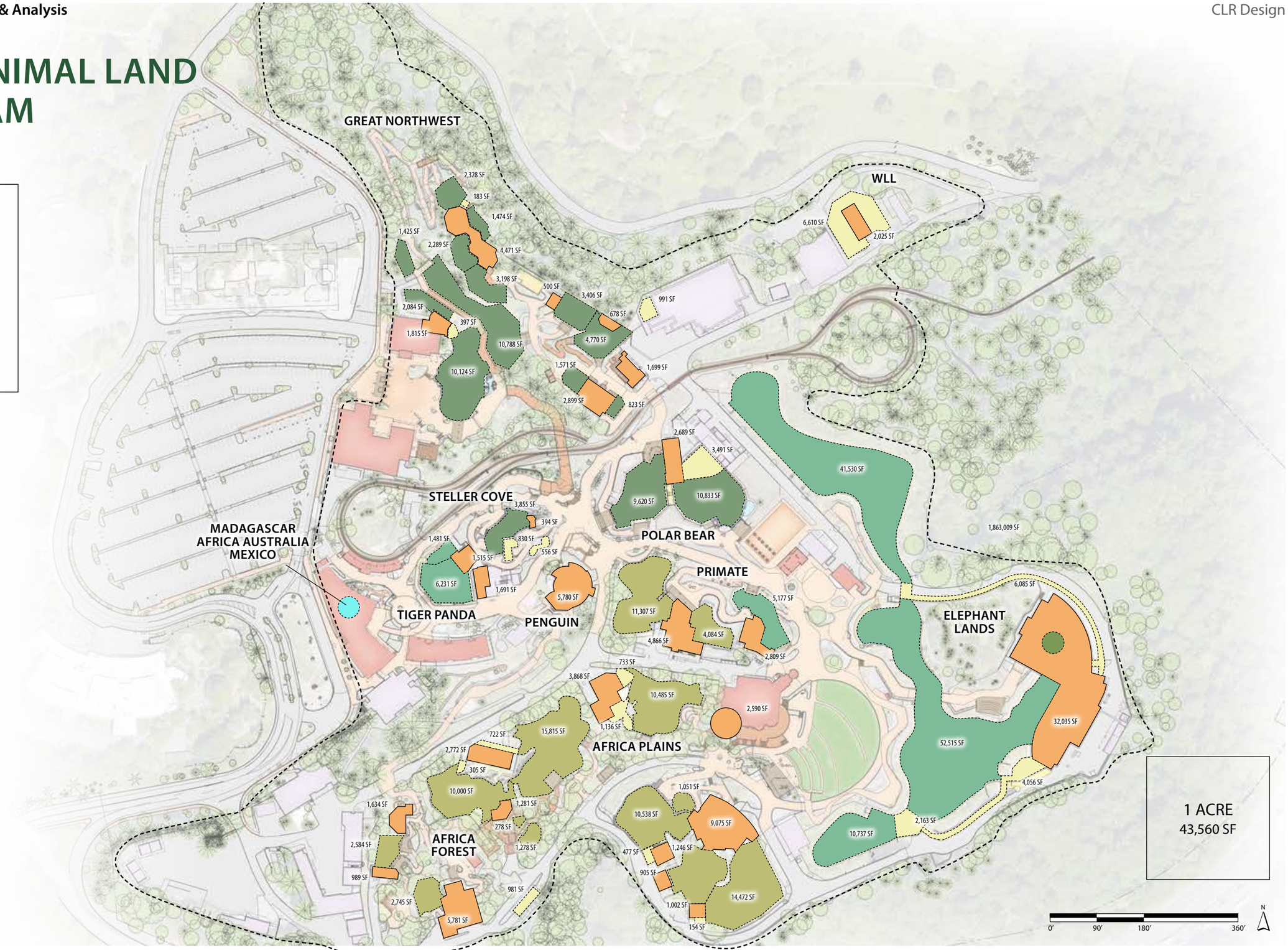
1. **Entry**
2. Great Northwest
3. Family Farm
4. Polar Passage
5. Carousel
6. Education Building / Plaza
7. Train
8. **Exit**

EXISTING ANIMAL LAND USE DIAGRAM

SITE PLAN LEGEND

- Exterior Habitat - North America
- Exterior Habitat - Asia
- Exterior Habitat - Africa
- Animal Holding / Exhibit Building
- Off - Exhibit Yards
- Site Boundary

TOTAL ANIMAL LAND USE - Animal Buildings, Habitats, Yards, Transfers = 405,000 SF/ 9.20 Acres



EXISTING FACILITY ASSESSMENT DIAGRAM

SITE PLAN LEGEND

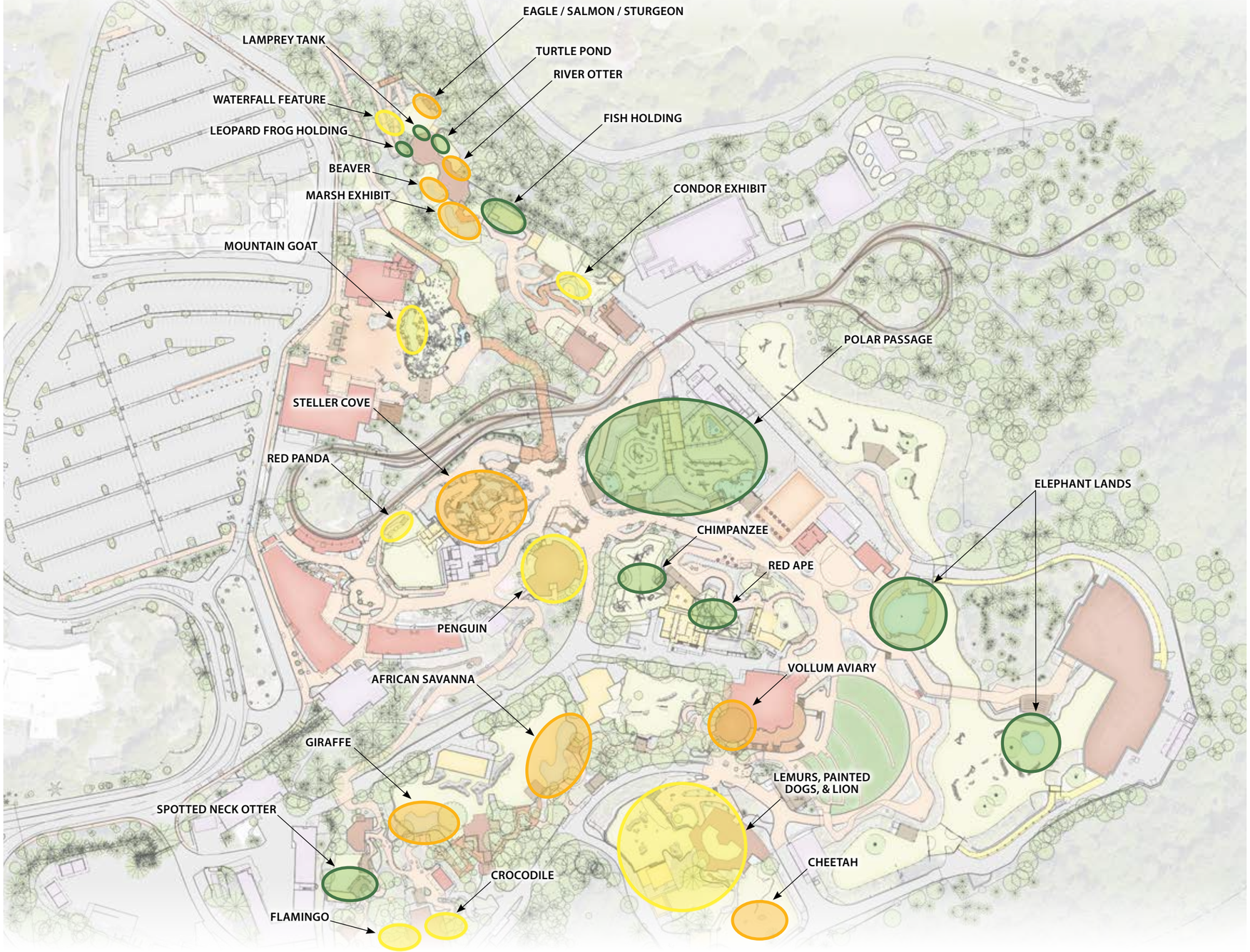
Physical Condition	Program & Education
+	+
+	-
-	+
-	-

HOOP HOUSE / ANIMAL CRATES
CASCADE PUMP HOUSE & RESTROOMS
BEAR/GOAT HLDG
GENERATORS
COVERED BIKE RACK
TRAIN ROUND HOUSE
ANIMAL NUTRITION CENTER
HOOFSTOCK BARN
PYGMY GOAT / TORTOISE
GIRAFFE HLDG
GIRAFFE FEEDING STATION
F&M OFFICES
TREE TOPS
GREENHOUSES
HORT / WELDING SHOP
CUSTODIAL
KONGO RANGER STATION
HAY BARN
BUTTERFLY LAB

1 ACRE
43,560 SF

0' 90' 180' 360'
N

MATRIX OF EXISTING LIFE SUPPORT SYSTEMS



	Performance	Remaining Service Life	Efficiency	Maintenance	Total
Front Entry					
Mountain Goat	1	0	1	2	4
Great Northwest					
Eagle / Salmon / Sturgeon	2	0	0	0	
Lamprey Tank	2	0	0	2	4
Turtle Pond (renovated at time of visit)	2	2	1	2	7
River Otter	0	0	0	1	1
Beaver with Avian Collection	0	0	0	0	0
Aviary (referred as Marsh Exhibit)	0	0	0	1	1
Salmon Interactive (ref: Waterfall Feature)	2	0	0	1	3
Leopard Frog Holding	2	1	0	2	5
Salmon Quarantine (referred as Fish Holding)	2	1	0	2	5
Condor Exhibit	2	0	0	2	4
Stellar Cove					
Blowhole	1	0	0	1	2
Kelp	1	0	0	0	1
Tidepool Touch	0	0	0	0	0
Sea Otter	1	0	0	0	1
Sea Lion	1	0	0	0	1
Quarantine Pool	1	0	0	0	1
Red Panda					
Red Panda	1	1	1	1	4
Penguin					
Penguin	1	1	0	1	3
Vollum Aviary					
Vollum Aviary	2	0	0	0	2
Polar Passage					
Polar Passage	2	2	1	2	7
Primate Forest					
Red Ape	1	1	1	2	5
Chimpanzee	1	1	1	2	5
Elephant Lands	2	2	1	2	7
Predators of the Serengeti					
Lemurs	2	0	0	1	3
Painted Dog	2	0	0	1	3
Lion	2	0	0	1	3
Cheetah	1	0	0	1	2
Africa					
Spotted Neck Otter	2	2	1	1	6
Flamingo	2	0	0	1	3
Crocodile with Fish	2	0	1	1	4
Giraffe	1	0	0	1	2
African Savanna	0	0	0	1	1

LSS Inventory

	Volume (gal)	Viewing Arrangement	Existing LSS Description	Cleaning	Staff Maintenance Perception of LSS	Staff Perception of Exhibit Water	Guest Perception of Exhibit Water	Year Built
Front Entry								
Mountain Goat	25,000	Look Down	Two 36" Sand filters, ultraviolet sterilizer (UV), Two pool pumps	Dump and Fill twice a year. B/W to waste twice a month	Low maintenance system. UV system could be upgraded to newer technology	First impression of zoo. Needs to be maintained	Good clarity	1998
Great Northwest								
Eagle / Salmon / Sturgeon	10,500	Underwater	Three 36" Sand filters, Two Baldor motor/Fybroc pumps, UV, Chiller	B/W every 3 days to waste. System is scrubbed by divers 1x week which a B/W is performed after.	Low maintenance system. Chiller is new, but a single point of failure. Takes two people to due a proper B/W. UV system could be upgraded to newer technology	Positive	No complaints	1982
Lamprey Tank	450	Underwater	Small home aquarium type system at tank	Siphon 1x week for a ~20% water change	Low maintenance system	Positive	No complaints	2020
Turtle Pond (being renovated at the time of our visit)	750	Underwater / Look Down	One 18" sand filter, one pool Pump, heater, and UV	Dump and filled monthly. Siphon 1x week for a ~20% water change	Recently renovated LSS. No concerns	Positive	New renovation, but no current issues	1982
River Otter	20,000	Underwater	Three 36" Sand filters, UV sterilizer, pool pump for filtration, 10hp pump for waterfall feature	Dump and fill every 3-4 months, difficult to remove leaves and settled debris. B/W 1-2x week to waste.	LSS maintenance is low. UV system could be upgraded to newer technology. Strainers cleaned daily due to excessive debris entering pool.	Poor. Lots of natural dirt runoff into pools during rainy season. Filtration can't keep up. Pool is consistently cloudy/murky. After D/F is only positive clarity, which last ~4-5 days before cloudiness returns.	Overall medium perception. Several good comments mixed with critical reviews of settled debris.	1982
Beaver with Avian Collection	22,000	Underwater	Four 36" sand filters, Chopper pump for beaver debris, 10hp filter pump.	Dump and fill monthly. Lower pool gets dumped more often due to debris clogging intake to pumps. B/W Daily to waste	Low maintenance system when birds are not in the pool. When birds are in the pool backwash frequency is daily. Backwashing requires simultaneous addition of potable water as backwash source pool in the exhibit is too small to supply a full filter backwash. Strainers cleaned daily due to excessive debris entering pool.	Mediocre. Pool has consistent green tint to it. Clarity is decent but can be cloudy.	Clarity issues when birds are present. Guests are excited to see that volume of moving water.	1982
Aviary (referred as Marsh Exhibit)	10,000	Look Down	None, recirculation to create a stream effect, recirculation pump is a submersible in the pool	Dump and fill Monthly or weather dependent. Pool will become muddy during heavy rains which prompts D/F	Low maintenance system	Extremely poor. Pond is dirt brown. After D/F you get about a day of decent clarity. Lots of natural dirt runoff into pool during rainy season.	Comments consist of clarity and possible smell.	1982
Salmon Interactive (ref: as Waterfall Feature)	500	Look Down	One 24" sand filter, One pump	System only runs in spring/summer. Dump and fill 1-2x per year. BW 1x per week	Low maintenance system	Positive	No comments	1982
Leopard Frog Holding	Two 300 gal tubs	No guest viewing / Off Exhibit	Submersible pump pulling from salmon exhibit and returned to salmon exhibit.	System BW to waste 2x per day for ~10% water change. System only runs for ~3 months out of year.	Low maintenance system	N/A	N/A	1982
Salmon Quarantine (ref: as Fish Holding)	500	No guest viewing / Off Exhibit	Dedicated local system	Siphon/BW 1x per week if animals are present in system.	Low maintenance system	Positive	N/A	1982
Condor Exhibit	1,500	Look Down	One pool pump on vault for recirculation	Dump and fill twice a month or weather dependent. Dependency determines on algae growth due to sunlight. D/F are done weekly during sunny weather.	Low maintenance system	Positive	Positive comment on water clarity	2004 or 2014
	Volume (gal)	Viewing Arrangement	Existing LSS Description	Cleaning	Staff Maintenance Perception of LSS	Staff Perception of Exhibit Water	Guest Perception of Exhibit Water	Year Built
Stellar Cove								
Blowhole	5,000	Look Down	One 10hp pump for recirculation. No filtration	System only runs in spring/summer. Dump and fill 1-2x per year	Low maintenance system. Filtration was removed by prior LSS team. System could use filtration.	Mediocre. Pool is consistently cloudy with no filtration on the system.	Positive comments. Good interactions	1999
Kelp	14,400	Underwater	One 36" sand filter, fractionator, trickle filter, Ozone.	B/W 1x week. Post heavy scrub dives system will need 2-3 B/W in a day. Vacuum dives every other week to waste.	Filtration is undersized. Original equipment is at end of service life, system integrates some new process components and some replacement items that have more service life. Higher maintenance than other simpler systems, but not excessive relative to the complexity of the system. Salt mixing for fish systems and marine mammal systems is inefficient and improvements here would save labor. Kelp backwash water is not recovered.	Positive	Positive feedback on days a scrub hasn't taken place. Foggy after cleaning	1999
Tidepool Touch	2,300	Look Down	Two 24" sand filters, Two pool pumps, fractionator, trickle filter, ozone.	System has been shutdown for 3 years. No data.	System has been shutdown for 3 years. No data.	N/A	No comment history	1999
Sea Otter	90,000	Underwater	Four horizontal Neptune Benson Sand filters, Two 15hp pumps, three fractionators, one 7hp frac pump, trickle filter, ozone contact chamber	B/W every 3 days to recovery. B/W to waste once to waste every 2 months. Vacuumed 1x per week to waste.	Original equipment is at end of service life, system integrates some new process components and some replacement items that have more service life. Higher maintenance than other simpler systems, but not excessive relative to the complexity of the system. Salt mixing for fish systems and marine mammal systems is inefficient and improvements here would save labor. Small diameter horizontal filters struggle with marine mammal loading. Kelp backwash water is not recovered. Recovery of marine mammal BW water could be greatly improved upon.	Positive	Extremely positive feedback	1999
Sea Lion	220,000	Underwater	Two horizontal Neptune Benson Sand filters, Two 30hp pumps, Four fractionators, trickle filter, Ozone contact chamber.	B/W twice per week to recovery. B/W to waste once to waste every 2 months. Vacuumed 1x per week to waste.	Original equipment is at end of service life, system integrates some new process components and some replacement items that have more service life. Higher maintenance than other simpler systems, but not excessive relative to the complexity of the system. Salt mixing for fish systems and marine mammal systems is inefficient and improvements here would save labor. Small diameter horizontal filters struggle with marine mammal loading. Kelp backwash water is not recovered. Recovery of marine mammal BW water could be greatly improved upon.	Positive	Extremely positive feedback	1999
Quarantine Pool	5,600	Nonpublic, Look Down	Two 36" Sand filters, one pool pump, fractionator, trickle filter, ozone.	B/W to waste 1x per month when animals are not present (which is routine). If animals present, BW 1x per week to waste.	Original equipment is at end of service life, system integrates some new process components and some replacement items that have more service life. Higher maintenance than other simpler systems, but not excessive relative to the complexity of the system. Salt mixing for fish systems and marine mammal systems is inefficient and improvements here would save labor. Small diameter horizontal filters struggle with marine mammal loading. Kelp backwash water is not recovered. Recovery of marine mammal BW water could be greatly improved upon.	Positive	N/A	1999

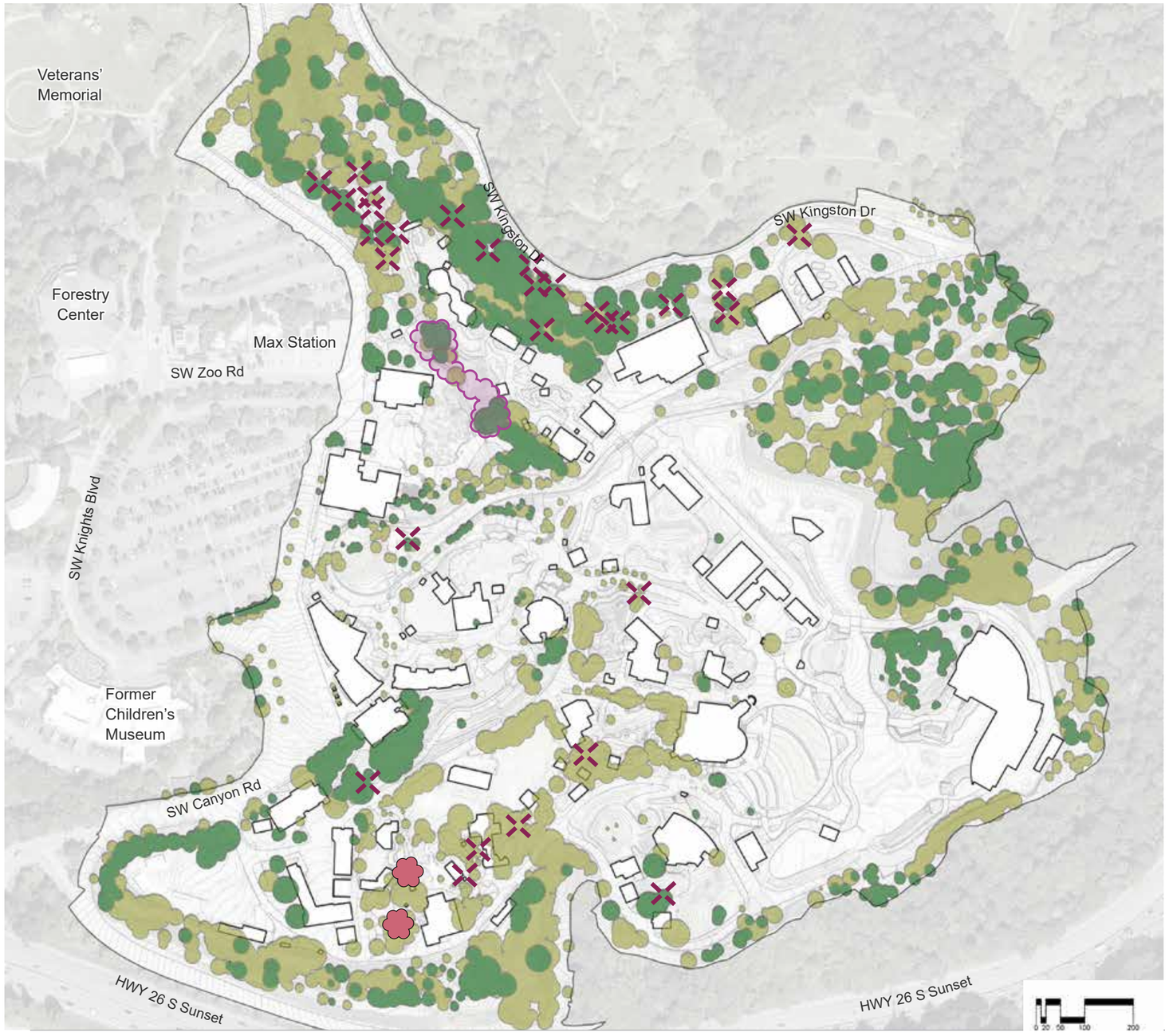
Red Panda								
Red Panda	850	Look Down	One 18" Sand filter, heater, and UV, pool pump	System only runs in spring/summer. Dump and fill 1x per month.	Low maintenance system	Positive	N/A	
Penguin								
Penguin	25,000	Underwater	Two horizontal Neptune Benson Sand filters, temperature control, ozone, and recovery	Dump and fill once every 2 months. B/W to recovery every 2-3 days.	BW recovery system could be greatly improved. B/W filters are vastly undersized which operators need to stir regularly. Wave machine needs redesigned to provide less mechanical noise. Main filtration system works as intended.	Mediocre to positive. New Ozone skid is on order to help improve this. Current ozone production will fluctuate on clarity effectiveness.	Overall positive comments on clarity. Guests are unhappy with the smell in this area.	1952 with 2012 refresh
Vollum Aviary								
Vollum Aviary	700	Look Down	One 18" Sand filter, pool pump, UV	Dump and Fill 1x week. B/W to waste Daily. Sometimes 2x a day.	Filtration system is inadequately sized to keep up with load	Positive	Not a large enough system to generate comments	1988
Polar Passage								
Polar Passage	115,000	Underwater & Look Down	Sand filters, ozone, temperature control, deaeration	Vacuum 1x per week. Vacuum goes to recovery until basin is full and then switched to waste. Waste only runs for 1-3mins.	Low maintenance system provided ACS is working	Positive	Extremely positive feedback	2020
Primate Forest								
Red Ape	850	Look Down (currently drained for safety of baby orangutan)	One 36" Sand filter, pool pump and UV	Dump and fill twice a month or weather dependent. Dependency determines on algae growth due to sunlight. D/F are done weekly during sunny weather.	Low maintenance system	Positive	N/A	2010
Chimpanzee	1,000	Look Down	One 36" Sand filters, pool pump, chlorine injector and UV	Dump and fill twice a month or weather dependent. Dependency determines on algae growth due to sunlight. D/F are done weekly during sunny weather.	Low maintenance system	Positive	N/A	2020
Elephant Lands	165,000	Look Down	Rotating drum screen, three sand filers, and ozone	Dump and Fill 1x per year. May be moving that to 1x every two years. B/W every 2-3 days to waste.	Low maintenance system when controls are online	Mediocre to positive. Ozone system trends to be finicky. Pool will fluctuate from green tint to clear blue	Extremely positive feedback	2015
	Volume (gal)	Viewing Arrangement	Existing LSS Description	Cleaning	Staff Maintenance Perception of LSS	Staff Perception of Exhibit Water	Guest Perception of Exhibit Water	Year Built
Predators of the Serengeti								
Lemurs	960	Look Down	One 18" Sand filters, pool pump and UV	Dump and Fill 1x week. B/W to waste after refill.	Low maintenance system	Positive	Not a large enough system to generate comments. Clarity is good	2009
Painted Dog	1,000	Look Down	One 36" Sand filter, self prime pump, UV	Dump and fill 2-3x a month. B/W to waste 2-3x month	Low maintenance system. Drain for B/W cant keep up with flow-rate and floods mechanical room.	Positive	Not a large enough system to generate comments. Clarity is good	2009
Lion	4,000	Look Down	One 36" Sand filter, self prime pump, UV	Dump and fill 2-3x a month. B/W to waste 2-3x month	Low maintenance system. Drain for B/W cant keep up with flow-rate and floods mechanical room. Plumbing has a crack on suction side between pool and pump providing consistent air bubbles through system.	Positive	Not a large enough system to generate comments. Clarity is good	2009
Cheetah	1,900	Look Down	One 18" Sand filters, pool pump and UV	Dump and fill 2-3x a month. Weather dependent. In heavy rains mud runs off into pool and pool will get cleaned 1x or more a week. B/W once every 2 weeks to waste.	Low maintenance system. Drain for B/W can't keep up with flow-rate and floods mechanical room.	Poor to positive. Pool looks great in spring/summer months. During rainy season pool will turn dirt brown due to natural dirt runoff into pool. Pool is usually shutdown and drained during rainy season for this reason.	Not a large enough system to generate comments. Clarity is good	1990
Africa								
Spotted Neck Otter	4,000	Look Down	One 36" Sand filter, self prime pump, UV	Dump and Fill 2-3x month	Recently renovated LSS. No concerns.	Positive	Positive feedback	1991
Flamingo	7,500	Look Down	One 36" Sand filter, self prime pump, UV	Dump and Fill 1x week. System B/W daily to waste	Filtration system is inadequately sized to keep up with load. Filter needs stirring 2-3x a month.	Positive	Positive feedback. Some comments around floating debris that may be corrected with new skimmers	1991
Crocodile with Fish	10,000	Underwater / Look Down	Two sand filters (industrial and tall), heater, two pool pumps	B/W 1x per week. Due to evaporation loss system is topped off 3-6" every day.	Low maintenance system	Positive. Water is routinely clear. Exhibit could use more attention due to algae growth on pool walls which obscures pool clarity.	Positive feedback. Good clarity	1991
Giraffe	20,000	Look Down	No LSS equipment	Dump and fill 8-10x per year. Weather dependent, Dependency determines on algae growth due to sunlight. D/F are done weekly during sunny weather.	N/A	Poor. Lots of natural runoff into pool making it dirty/cloudy. Pool will turn green in summer months. Pool is stagnant due to no LSS.	Extremely positive feedback	1991
African Savanna	20,000	Look Down	Submersible pump. No filtration.	Dump and fill 12-20x per year. Weather dependent, Dependency determines on algae growth due to sunlight. D/F are done weekly during sunny weather.	N/A	Poor. Lots of natural runoff into pool making it dirty/cloudy. Pool will turn green in summer months.	Mixed perception	1991

CANOPY ASSESSMENT

The site is characterized and framed by a mature canopy of deciduous and coniferous trees throughout the campus, most notably at the edges where they seamlessly connect to Washington Park's Douglas fir and Maple forest. A Tree Assessment and Management Plan was executed March through August 2022 and inventoried 110 trees, only accounting for those with current maintenance concerns or in areas where future construction is planned. Trees adjacent to buildings, infrastructure, and pedestrian walkways were inspected and evaluated for size, health condition, and value to help zoo managers to better understand and prioritize their efforts. 32 trees were designated for removal due to their condition of dead or poor health, which can lead to risk of fallen trees damaging infrastructure and buildings, or injury. The zoo has already taken many efforts in 2022 to remove dead or dying trees, especially in the Cascades/Great Northwest area where the planting is most naturalized. Some removed trees were kept as nurse logs in this area.

The tree assessment also identified a grove of trees of high value that should be protected. These 18 noted trees include species of Fir, Cedar, and Maple. The Oregon Zoo Horticulture Manager also identified valuable tree specimen during a site walk in January 2023. Palm trees and notable Eucalyptus trees as shown in the rainforest area should be retained or transplanted if area is planned for redevelopment.

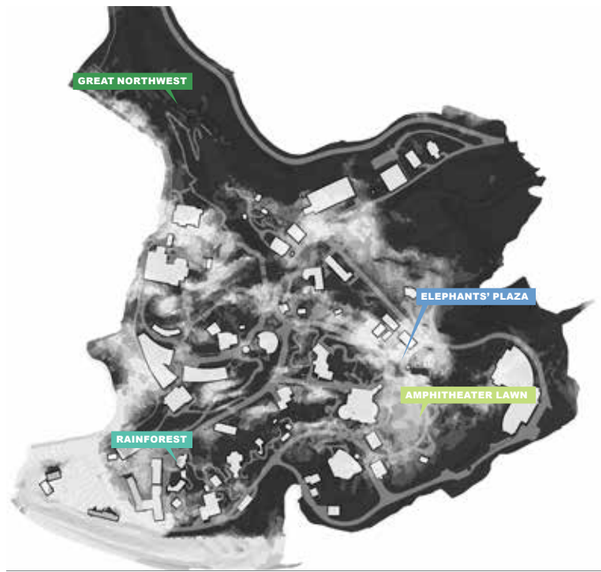
The character of the Great Northwest tree canopy is highly valued by the zoo and visitors alike. There is opportunity to take precedent from other zoos such as the Redwood Sky Walk at Sequoia Park Zoo and utilize the site's naturally steep topography and existing mature trees, to create a canopy walk experience for guests. Working within the environmental conservation overlay will require an environmental review through land use, which will require a longer timeframe, increase costs, and a higher level of assessment. Mitigating for impacts may be done to offset new improvements, and may benefit this part of campus by removing invasives and restoring the health of the native forest landscape to the north of the Great Northwest exhibit area.



MICROCLIMATE

Lidar data was collected to create a sun/shade analysis during the Summer/Winter Solstices and Autumn/Spring Equinoxes. The data evaluates shade created by existing buildings, trees, and topography and computes the average sunlight hours, creating a comprehensive gradient map. The darkest color represents areas with little to no sunlight, that provide shade during the hot summer months and may also provide cover for the rainy winter months. These darker zones may be less desirable for guests in cold and wet conditions during cooler seasons, as they will gain little to no warmth from the sun. The lightest color has the most sun exposure of 6 or more hours. Sunlight is most prominent between the farmstead through to Elephant's Plaza and amphitheater lawn. The zoo has noted challenges in these areas to keep visitors and staff cool during the summer and attempts to mitigate the heat with water misters and umbrellas to provide shade. Both sun and shade should be considered during bond project planning to provide adequate opportunities for guests to find protection and warmth in cooler seasons and cooling shade in warmer seasons.

There are strong southerly winds from autumn through spring and adjusts to strong northwest winds during the summer. Winter can average up to 20 days of rain per month, which should be in consideration when reevaluating the campus framework, so a visitor does not have to venture far in search for cover.



Microclimate: Dec-Feb

15-20 rainy days per month

Strong Southerly Winds

High 47 °F
Low 36 °F

Sunlight Hours

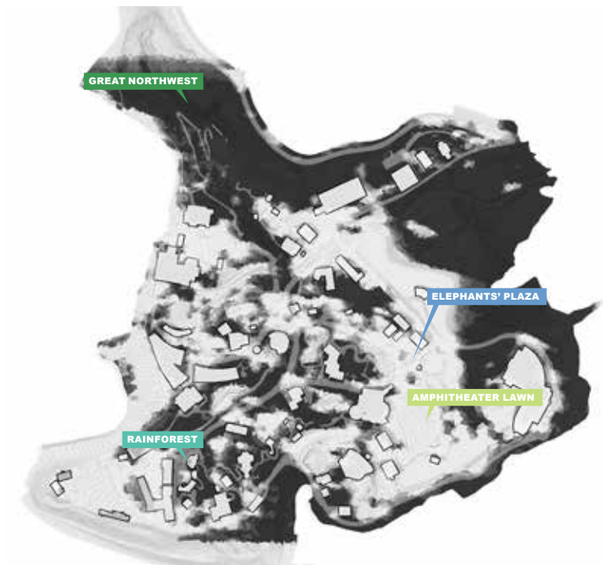
0 HOURS
- In areas with no sun exposure during the winter months, there should be opportunities for warm shelter nearby.
- Notable zones include Northwest, Rainforest, Africa, and Pollinators

1.5 HOURS
- Many areas along the pathways receive little sunlight, only during high noon.

3 HOURS
- The typically sunny spots on the site reduce to midday sun during the winter.

4.5 HOURS
- The amphitheater lawn and other often sunny areas receive sunlight during midday.
- Likely a desired area for warmth during these months.

6+ HOURS
- Sunniest spots throughout the year include the plaza by polar passage and the entrance plaza. There may be opportunities for solar panels in these zones if future shelters are to be installed.



Microclimate: Jun-Aug

3-8 rainy days per month

Strong Northwesterly Winds

High 81 °F
Low 58 °F

Sunlight Hours

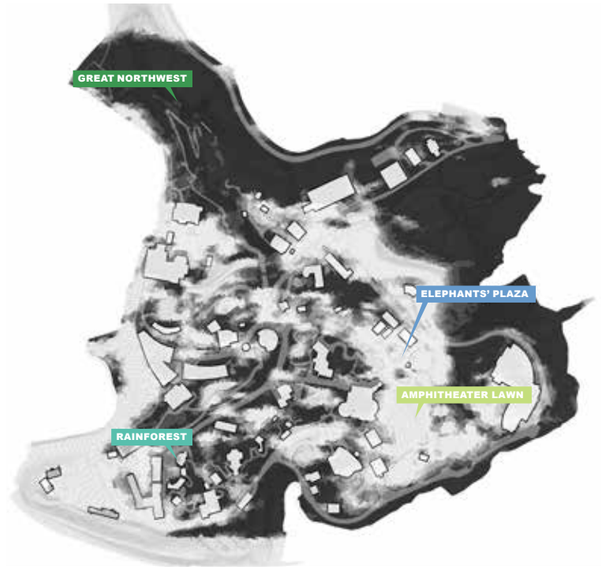
0 HOURS
- The most shaded areas throughout the seasons are the Northwest and Rainforest areas. Africa also has many rock formations and tunnels allowing for little natural sunlight.

1.5 HOURS
- The dark mesh netting affects sunlight penetrating the condor, eagles, and duck exhibits year round.

3 HOURS
- There are few spaces with medium sun exposure during the day.

4.5 HOURS
- Edges around the most exposed areas, notably the amphitheater lawn and elephant plaza, indicating very limited areas for shade until reaching a new zone.

6+ HOURS
- There is lots of exposure between the farmstead through Elephants to the amphitheater lawn area. There may be a need for covered spaces to allow visitors to cool from the heat.



Microclimate: Mar-May

8-16 rainy days per month

Strong Southerly Winds

High 64 °F
Low 46 °F

Sunlight Hours

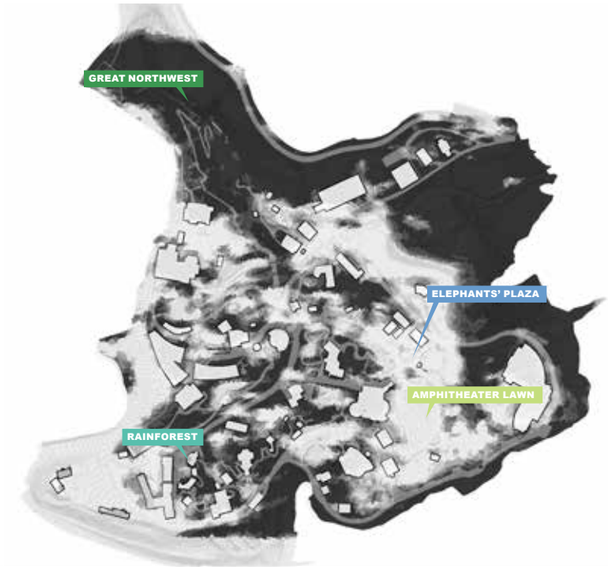
0 HOURS
- The most protection from rain, but may be less comfortable in temperature.
- Includes Northwest and Africa zones.

1.5 HOURS
- Most of the pathways in Africa, Rainforest, and Northwest receive little sunlight, except during high noon.

3 HOURS

4.5 HOURS
- In areas with no sun exposure during the spring months, there should be opportunity for warm shelter nearby.

6+ HOURS
- Although the amphitheater lawn space receives 6+ hours of sunlight, the frequent rain makes the lawn surface less desirable for use.



Microclimate: Sep-Nov

8-16 rainy days per month

Strong Southerly Winds

High 64 °F
Low 46 °F

Sunlight Hours

0 HOURS
- Africa gets further shaded during the autumn season.

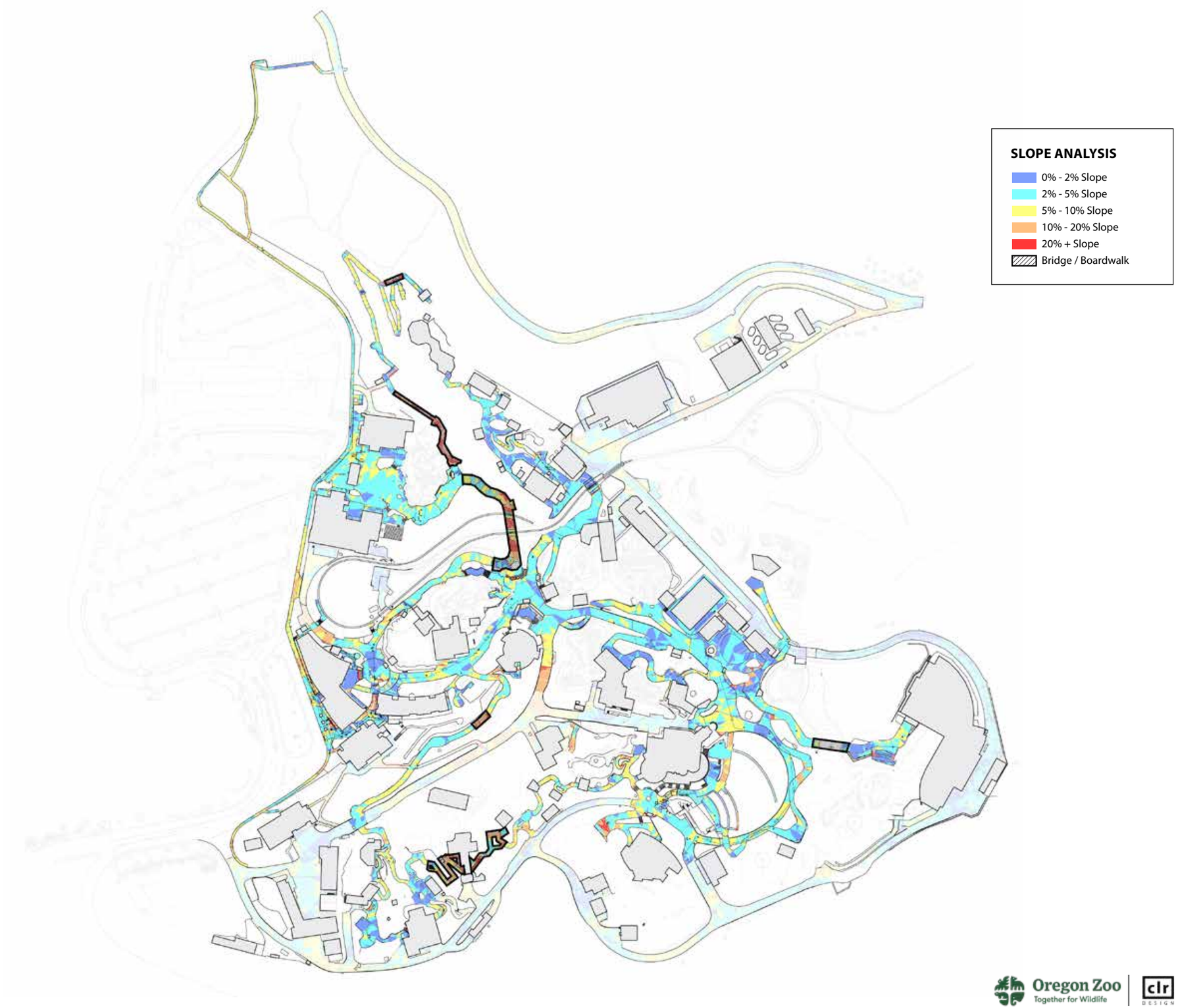
1.5 HOURS
- Pathways in the Northwest and Africa receive some light during high noon.

3 HOURS
- There are few spaces with medium sun exposure during the day.

4.5 HOURS
- There are more opportunities for subtle shade by the sunnier spots during later times of the day.

6+ HOURS
- Elephants plaza, amphitheater lawn, and parts of lions have continued exposure during the fall months

SLOPE ANALYSIS



IRRIGATION

The current irrigation system, consisting of sprays and rotors, uses potable water in order to meet the water demand of the various adaptive tropical plants on site. The data was derived from the survey and extrapolated to determine the irrigated zones.

There have been challenges where new construction cuts off irrigation lines, causing trees to die.

Irrigation Limitations

Areas Accessible to Public

- Class A allowed but must use drip in areas with food or drinking water

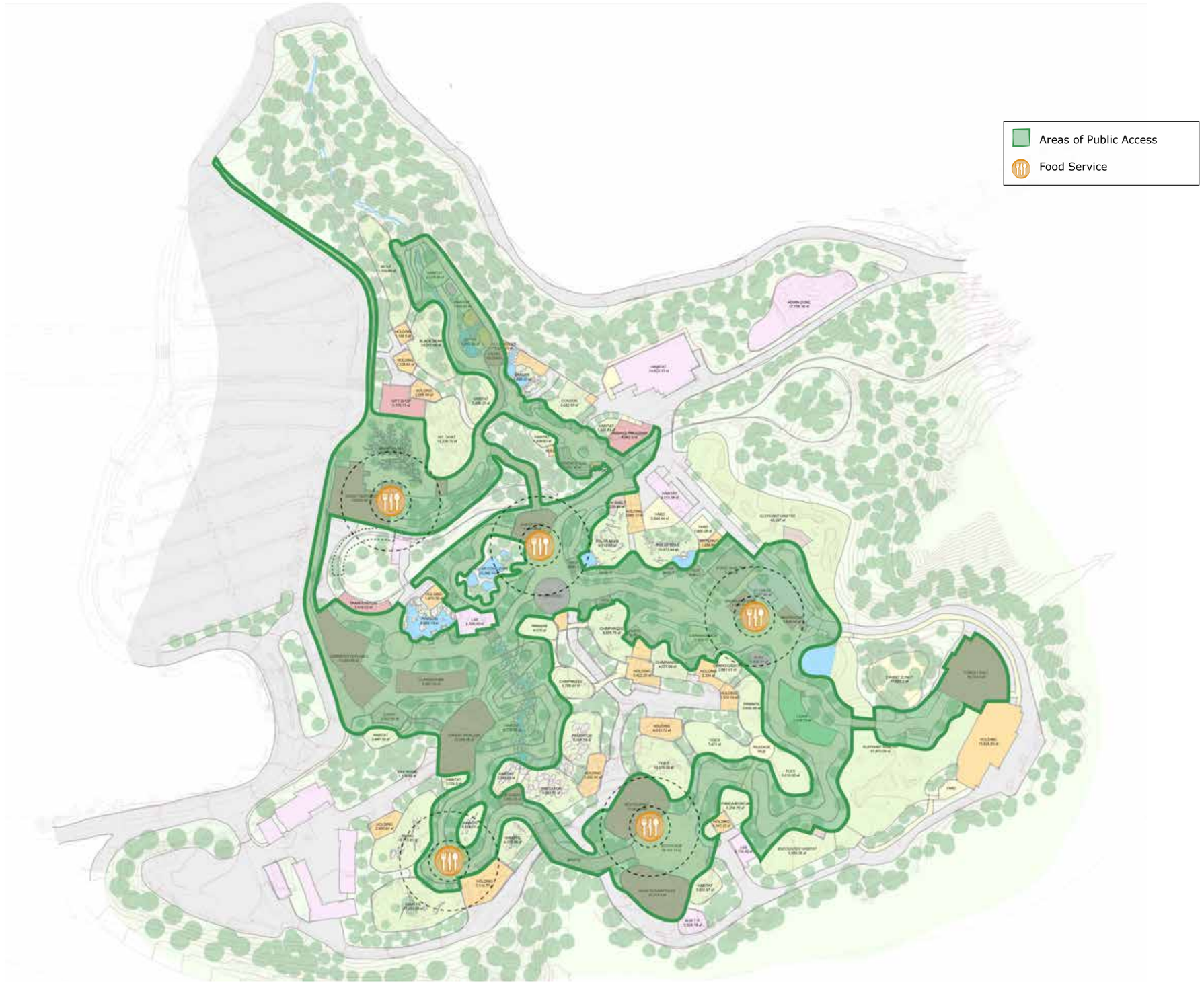
Areas not Accessible to Public

Class B

- Keep 10' from areas with food or drinking water if using spray or drip

Class C

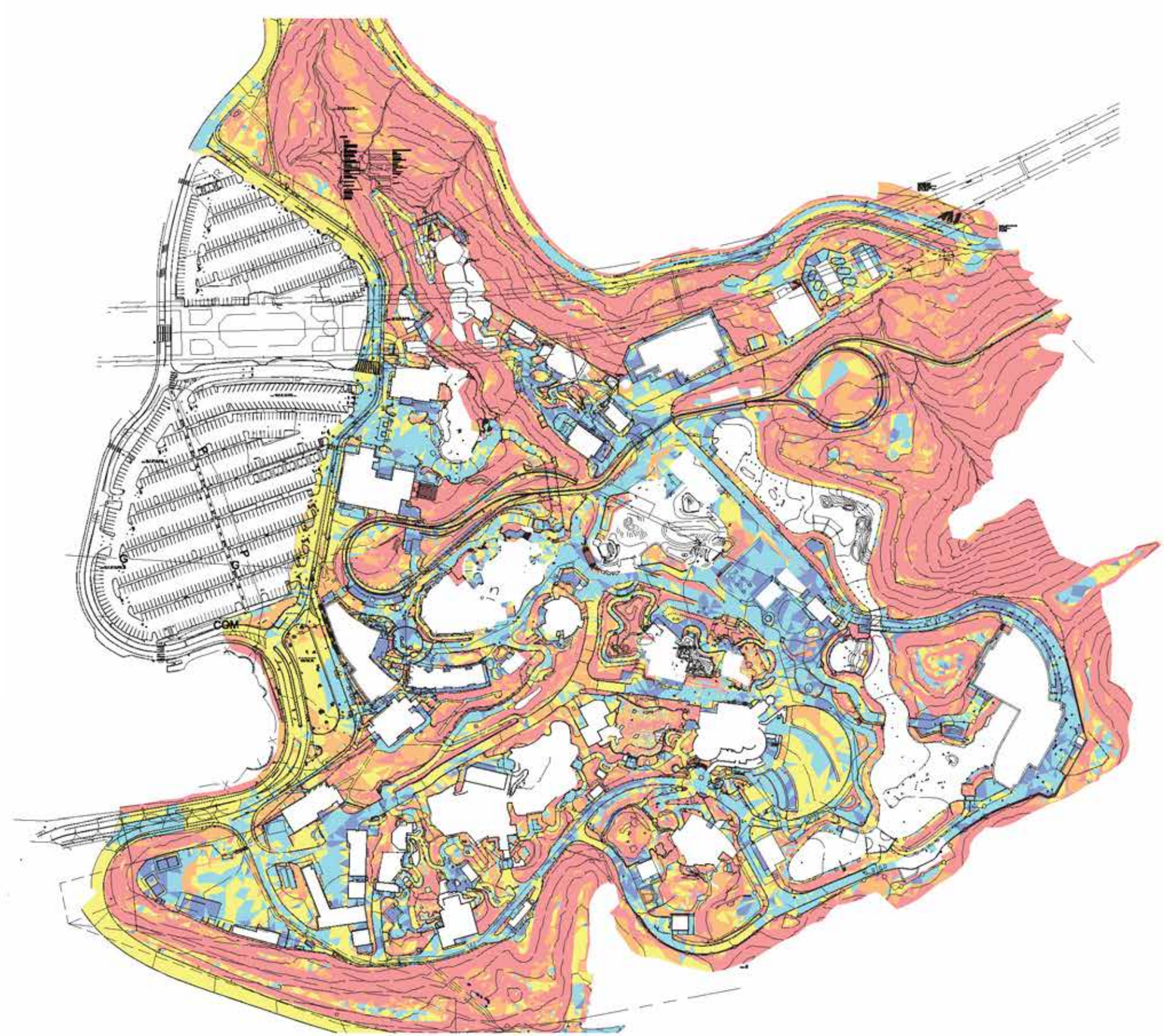
- Keep 70' from areas with food or drinking water if using spray irrigation
- Keep 10' from areas with food or drinking water if using drip irrigation



SLOPE EXHIBIT

The site generally slopes from north to south at an average of 5%.

Existing areas that are flat vs those that are steepened need to be evaluated during the campus plan to identify any issues with proposed building locations.

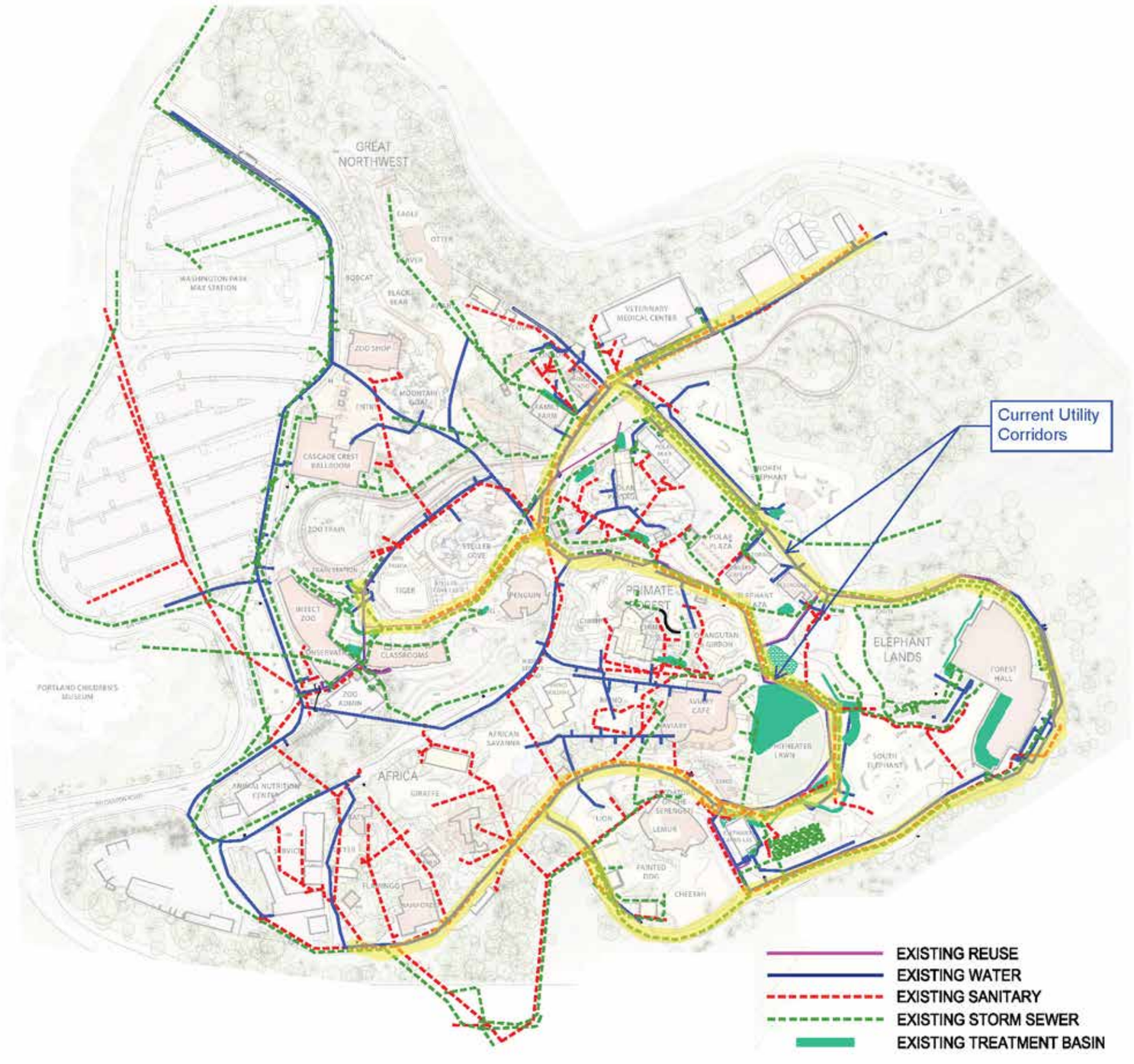


SLOPE TABLE			
#	MIN. SLOPE	MAX. SLOPE	COLOR
1	0.00%	2.00%	
2	2.00%	5.00%	
3	5.00%	10.00%	
4	10.00%	20.00%	
5	20.00%	> 20.00%	

EXISTING UTILITY EXHIBIT

The site has 3 main utility corridors running through the site.

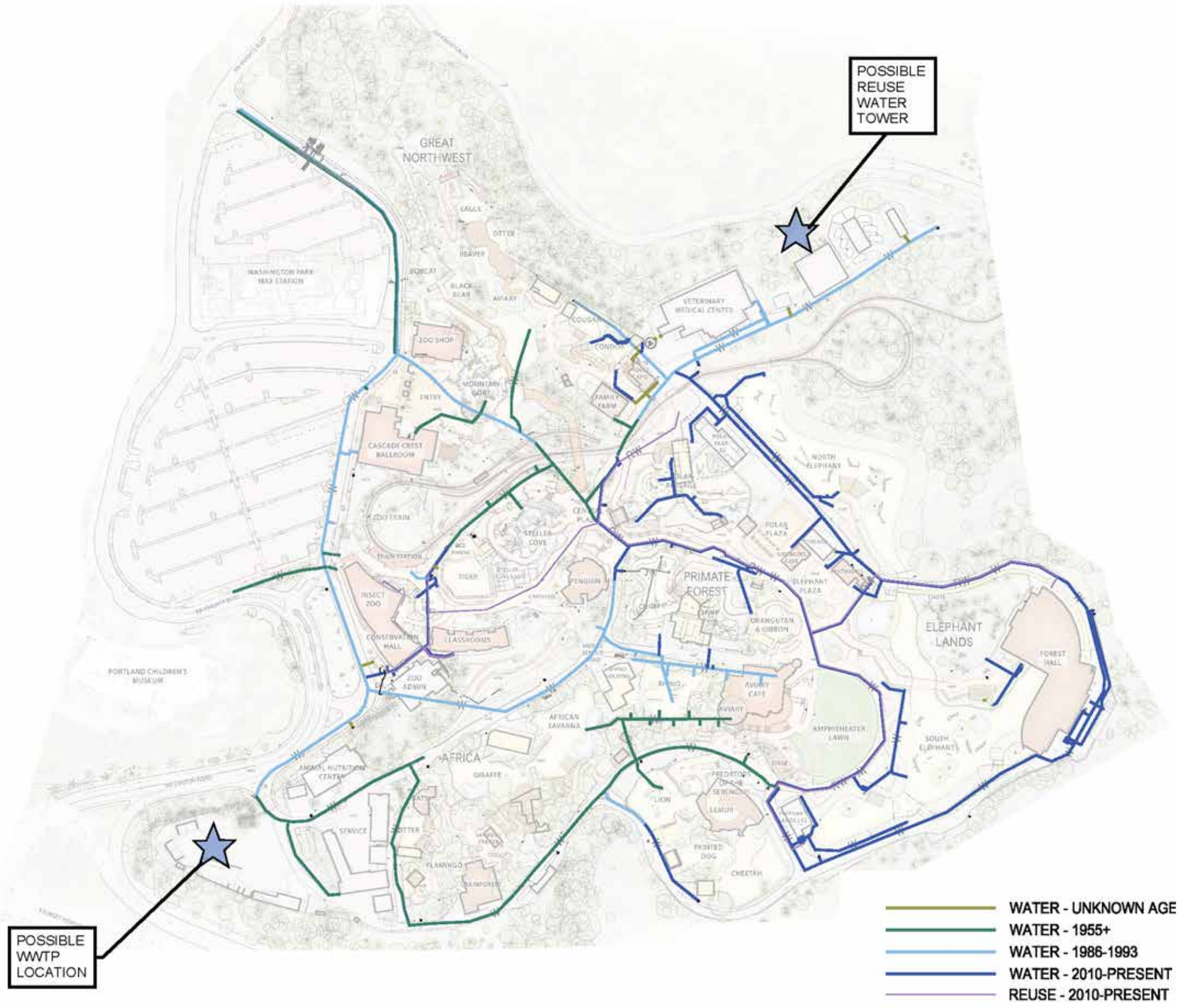
These corridors should be maintained if possible when looking at the proposed campus plan. Many of the utilities within these corridors have been recently constructed.



EXISTING WATER SYSTEMS EXHIBIT

Water lines north of stellar cove, within the Great Northwest, Africa, and predators are past the recommended life cycle.

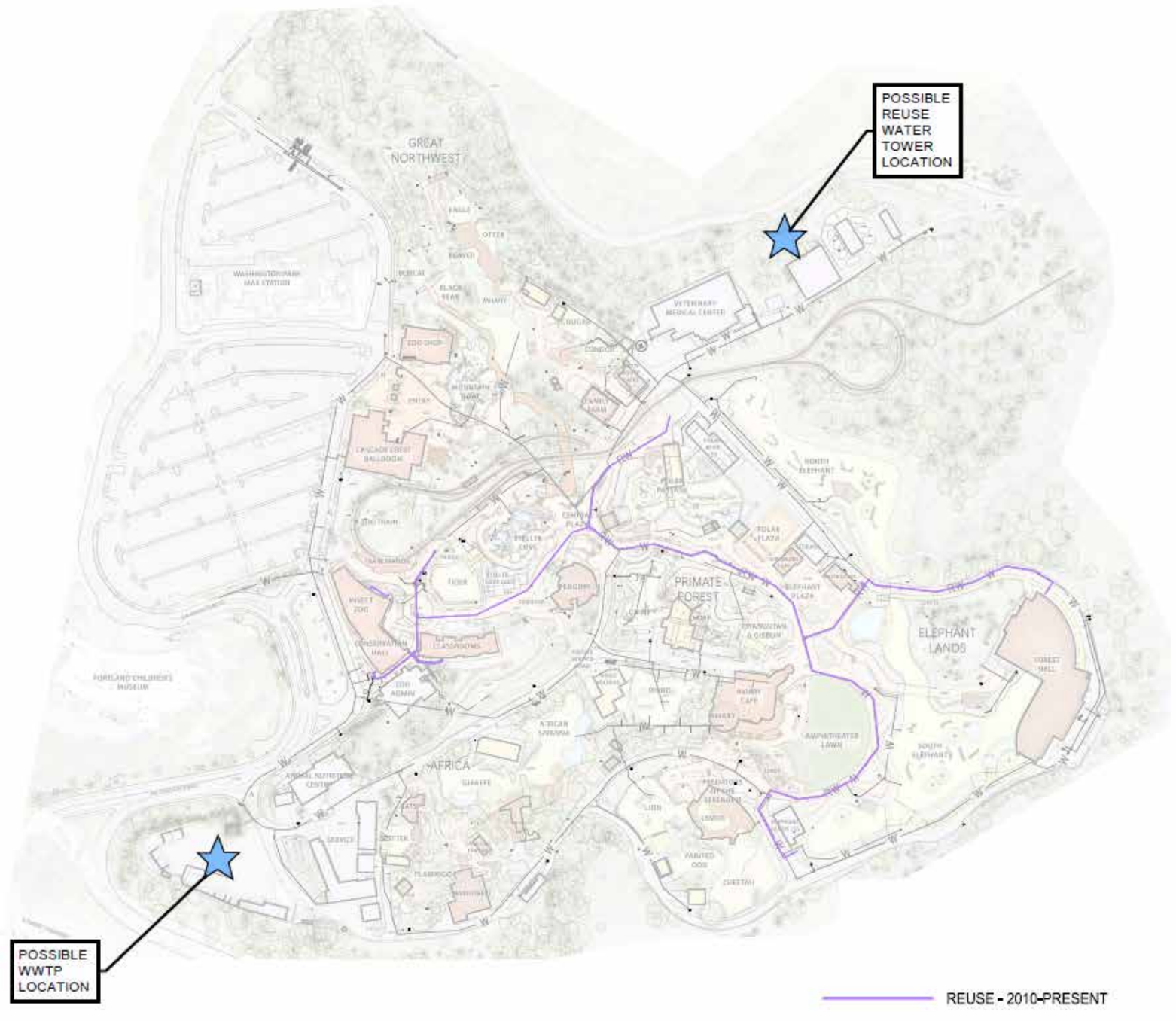
It is recommended that all lines constructed prior to 1955 be replaced with this campus plan. Lines constructed during the 1986 - 1993 should be evaluated. If near or within proposed construction, the lines should be replaced at the time of construction.



EXISTING WATER REUSE EXHIBIT

Per the 2010 Campus Plan, a non potable water line was constructed in ares where there were proposed improvements. This line, referred to as the "purple pipe" is shown in the figure to the right.

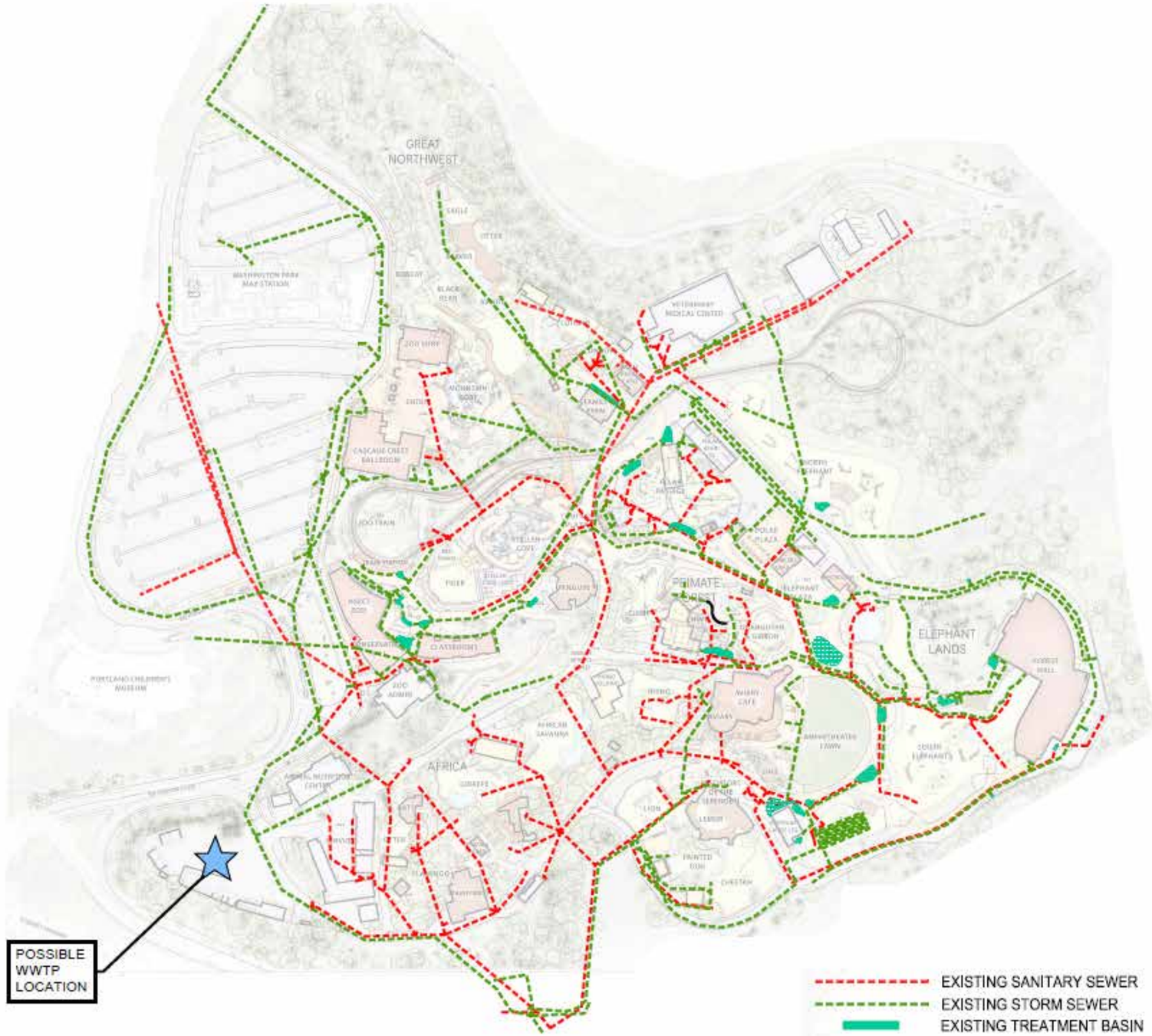
The intention was to collect sanitary sewer effluent, treat it at a waste water facility, pump up to a storage area, and use the purple pipe for distribution of the non potable water.



EXISTING STORM & SANITARY SEWER SYSTEM EXHIBIT

Per the 2010 Campus Plan, waste water and storm water was to be separated where possible. The figure to the right shows separate storm and sanitary sewer lines.

The intent of this Campus Plan is to continue to provide Sanitary and Storm sewer separation with all proposed improvements.



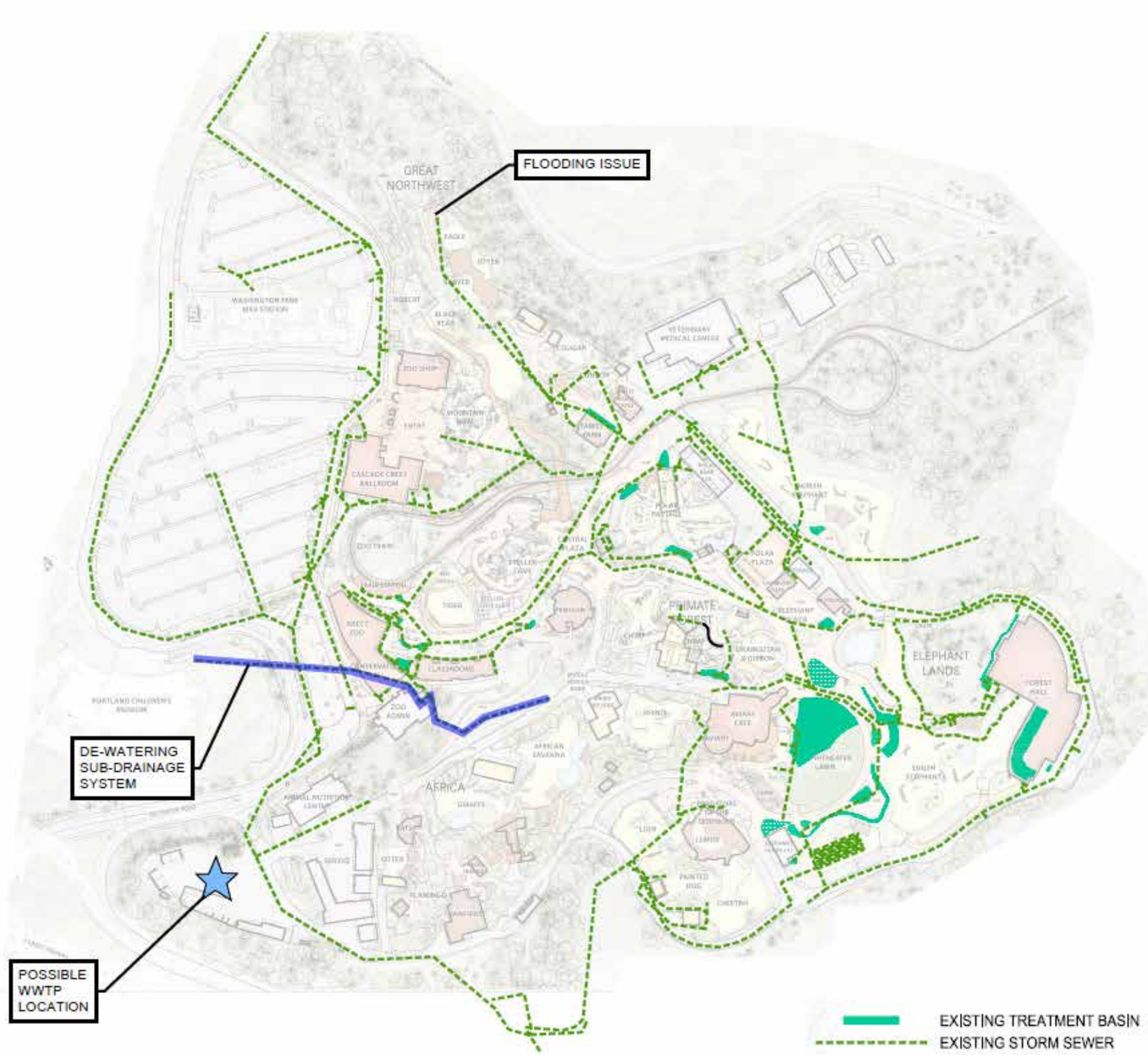
EXISTING STORM SYSTEM EXHIBIT

Most of the storm system shown in the figure on the right has been constructed recently.

Items to note is that the Great Northwest has experienced flooding due to clogging of the inlet that takes in the runoff from the hillside. This runoff overflows and causes flooding through the pathways of the zoo.

Another item to note is the de-watering sub-drainage system that must be maintained or adjusted to fit the proposed campus plan.

The figure to the right identifies a possible location where a Waste Water Treatment Plant (WWTP) may be located if sanitary sewer effluent recycling is still deemed an effective way to minimize water use and continues to line up with the zoo's goals and sustainability vision.

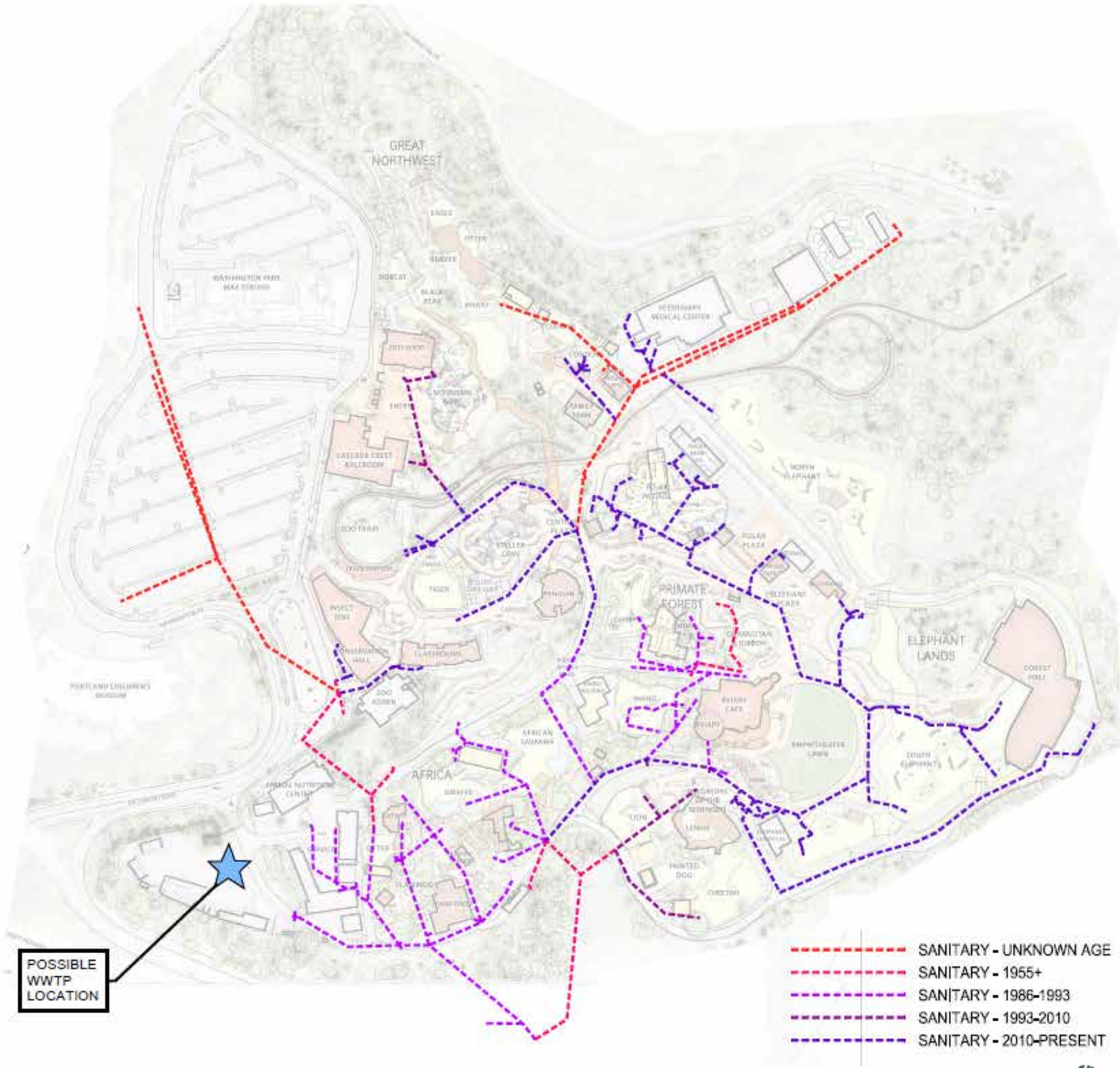


EXISTING SANITARY SEWER SYSTEM EXHIBIT

Sanitary sewer lines within the Great Northwest, Africa, Primate Forest, and predators are near or past the recommended life cycle.

It is recommended that all lines constructed prior to 1955 be replaced with this campus plan. Lines constructed during the 1986 - 1993 should be evaluated. If near or within proposed construction, the lines should be replaced at the time of construction.

The figure to the right identifies a possible location where a Waste Water Treatment Plant (WWTP) may be located if sanitary sewer effluent recycling is still deemed an effective way to minimize water use and continues to line up with the zoo's goals and sustainability vision.

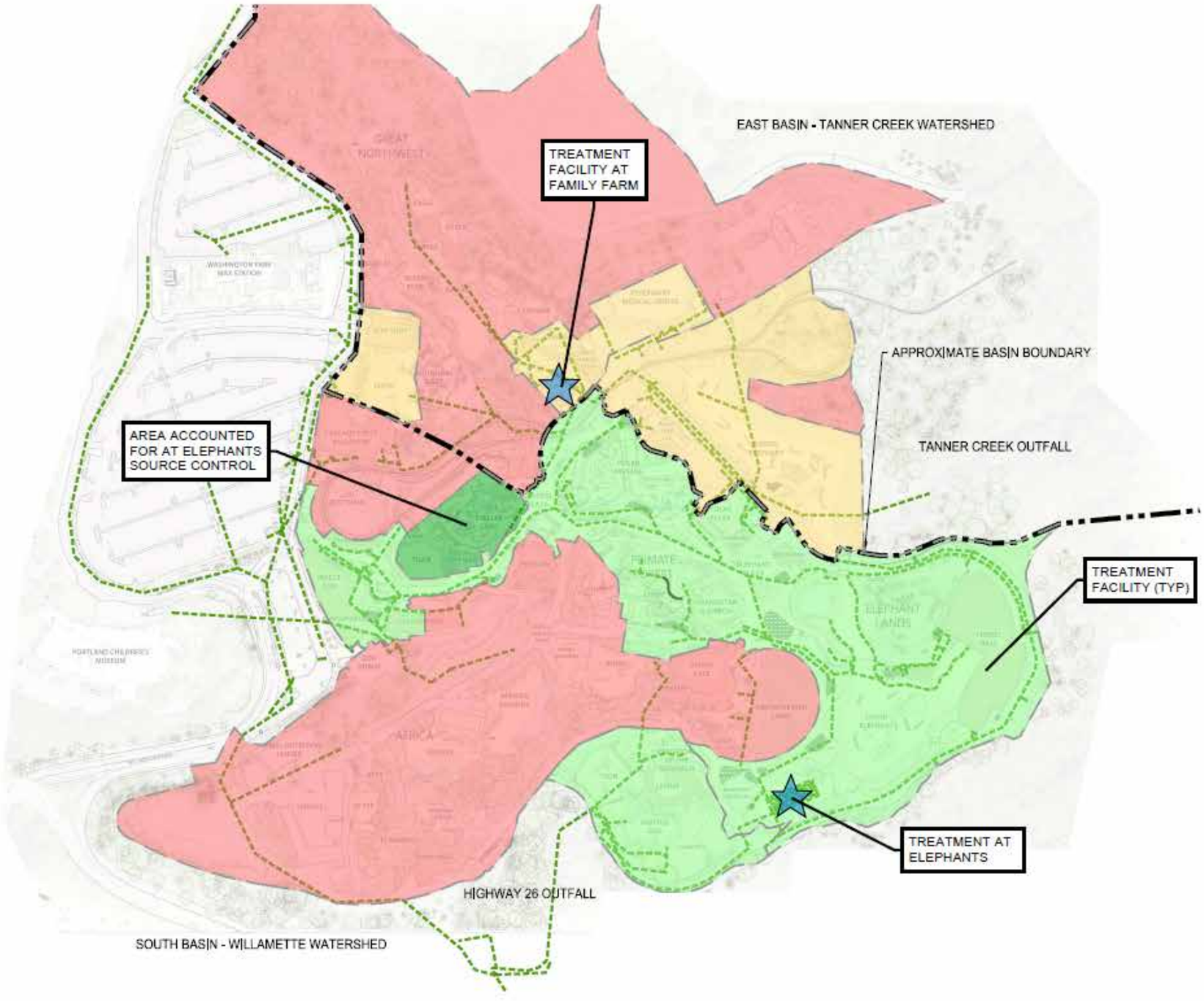


EXISTING STORM BASIN WATERSHED EXHIBIT

The existing site drainage is split into two separate basins, Tanner Creek and Willamette Watershed. The topographical delineation is identified with a thick black line in the figure to the right.

As improvements have been completed onsite from the previous campus plan, stormwater regulations and requirements have been met and are managed by several facilities throughout the zoo.

It is important to note that at elephants, there is a large detention system regulating the flow out into the Willamette Watershed. Also, there is a large detention system by the north portion of Elephants which regulates the flow out into the Tanner Creek watershed.



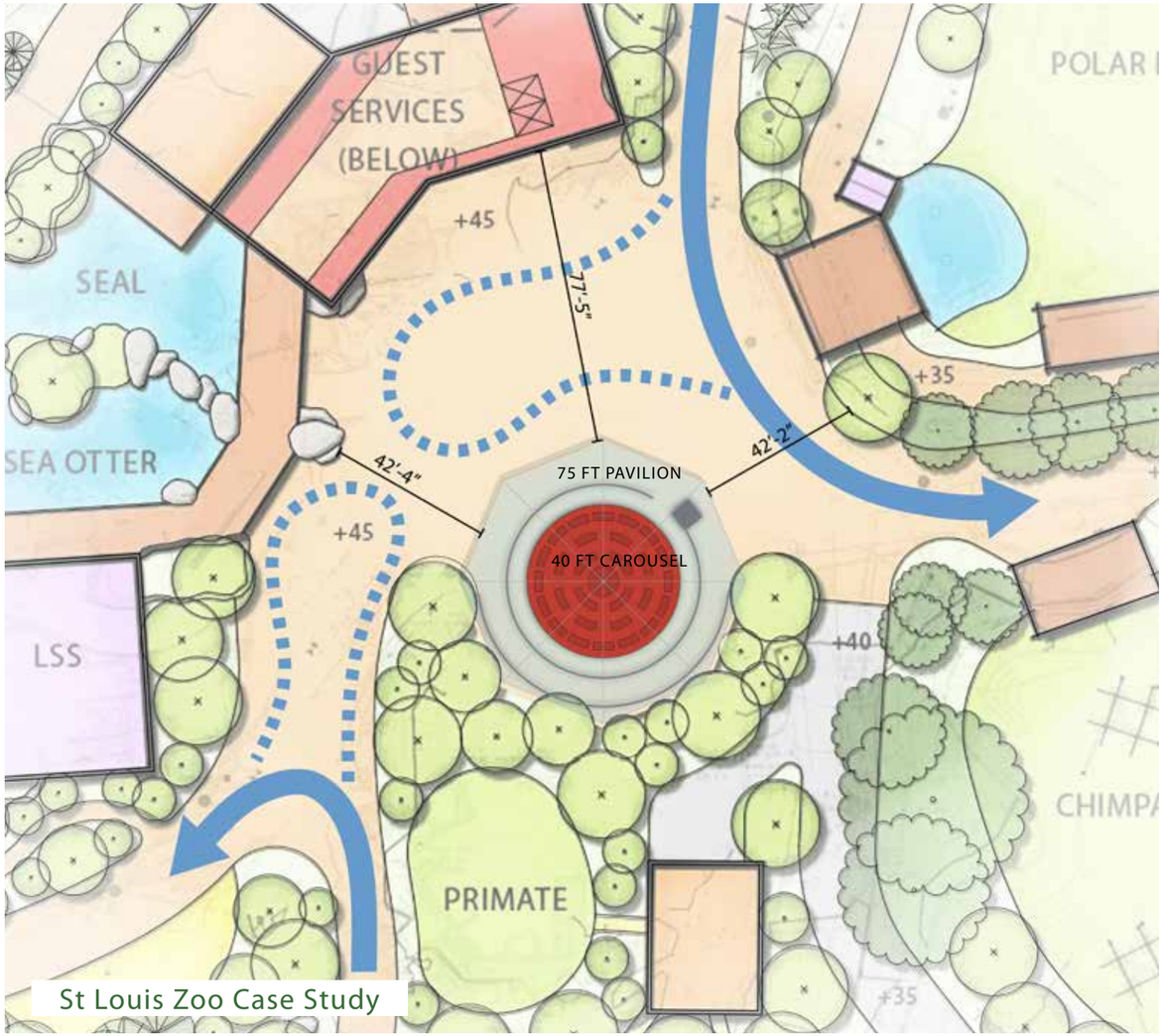
WORKSHOP 5:
ENTRY OPTION B

WORKSHOP 5:
ENTRY OPTION B

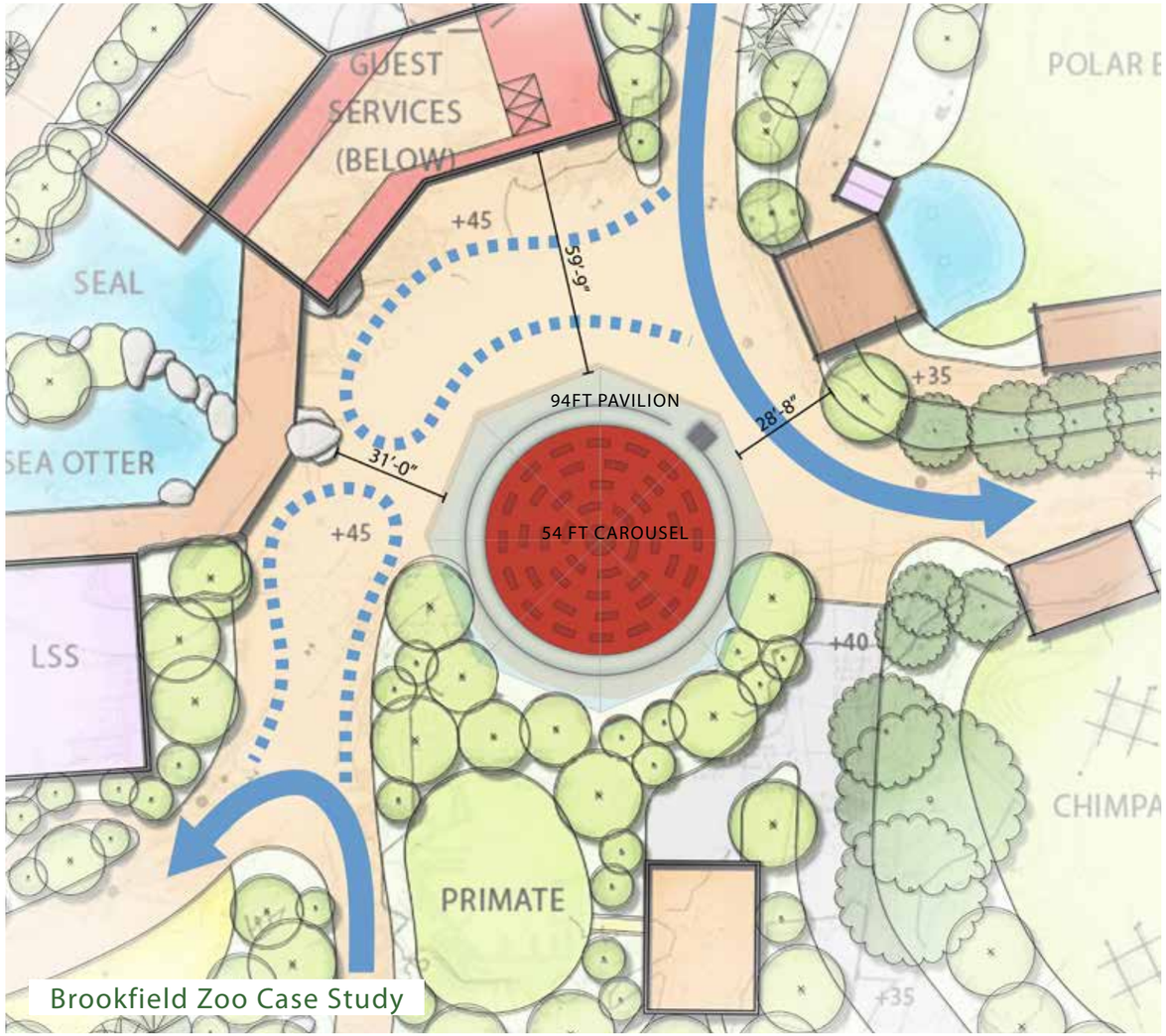
The second concept prioritizes entry circulation by using geometric forms to create a streetscape-like plaza with a directional form that leads visitors from the entry to the zoo. This plaza will be defined with a pattern of linear pavers and an angled canopy constructed with a wood and steel structure and an artistic installation of layered perforated metal 2D bird silhouettes connected with cable wire. This playful shade structure covers most of the plaza space and orients visitors through the plaza and to the zoo.

The plaza is regraded to have slopes less than 2 percent, increasing accessibility and better supporting events and gathering. The edges of the plaza are bordered by raised concrete planting beds that frame new concrete entrances to the guest services building and gift shop, similar to concept A. A 3-level custom wood amphitheater with concrete stairs is incorporated near the mountain goats exhibit, providing a new resting spot for visitors. New asphalt is incorporated near the mountain goats and provides a seamless transition to the existing asphalt path leading into the zoo. The paving at the west side of the Mountain Goat enclosure will be raised 1 to 2 feet and so the wall and rail will be reconstructed with similar materials to the existing using rock formations and cable wiring guardrails, similar to Option A.

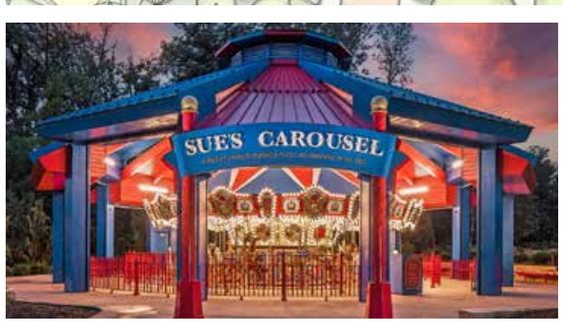
WORKSHOP 5: CAROUSEL STUDY

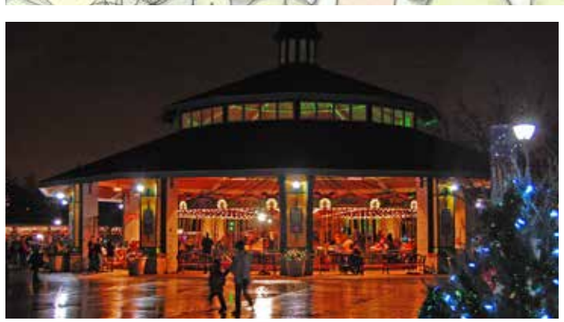


St Louis Zoo Case Study



Brookfield Zoo Case Study

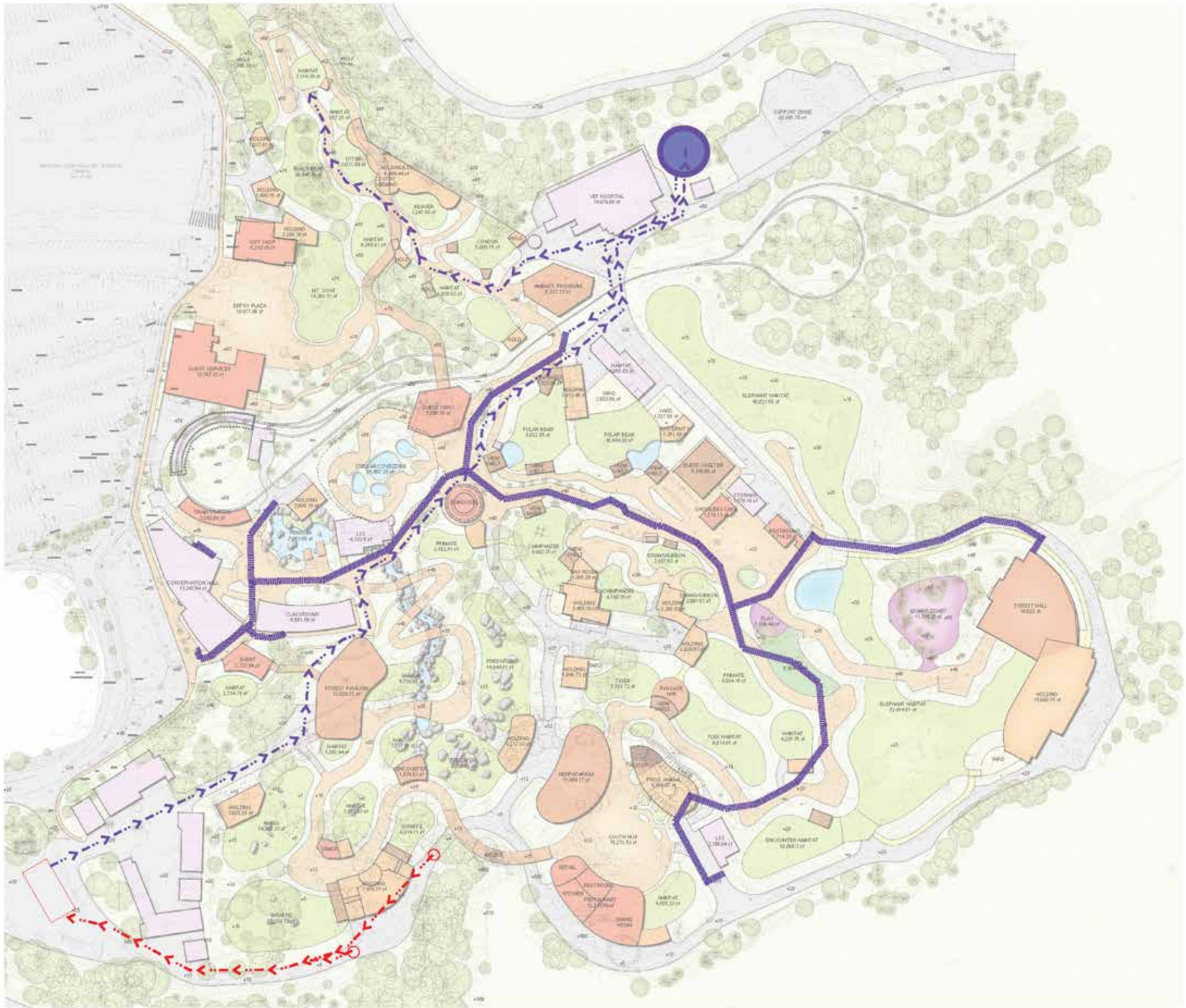




PROPOSED SANITARY SEWER REUSE SYSTEM EXHIBIT

The figure to the right shows a possible route for the waste water collection, treatment, and distribution on the latest proposed campus plan.

Collection would occur on the southern end of the site where the sewer already flows, then be pumped up to the waste water treatment facility where it would be treated and pumped up to a storage tank on the northern end of the site. Either using gravity or pump, the non potable water would be distributed using the existing and newly constructed purple pipe to provide the large water users.



PROPOSED EXHIBIT RECOVERY SYSTEM EXHIBIT

The figure to the right shows a opportunities for water reuse and recovery within the existing systems today. Currently saltwater recovery is occurring at Stellar Cove. Current LSS systems provide fresh water recovery at Polar Bear.

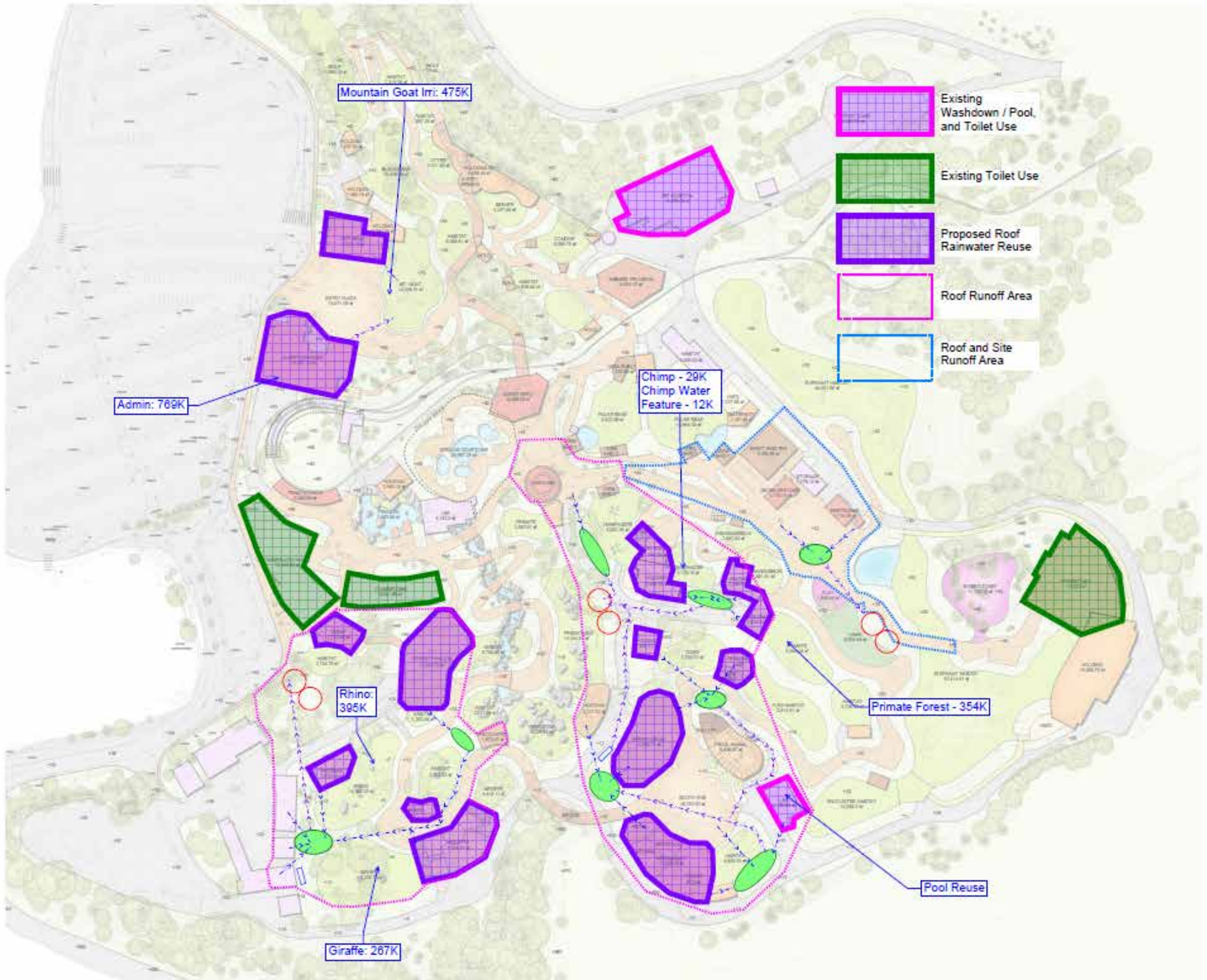
Salt water recovery is proposed at the new penguins exhibit.

Fresh water recover is proposed at the new beaver and otter exhibit in the Great Northwest.

Fresh water recovery is also recommended for the Savannah water feature.

PROPOSED STORM WATER REUSE SYSTEM EXHIBIT

The figure to the right shows the possible configuration of a regional storm water harvesting system. Site runoff would be collected in regional basins. The runoff would then be directed toward green infrastructure such as filtration basins or Water Quality Catch Basins, which would provide the initial cleaning. The cleaned storm water would be stored in underground facilities where it would either be used for landscaping or sent to exhibits with LSS systems for final cleaning and polishing prior to use within exhibits.

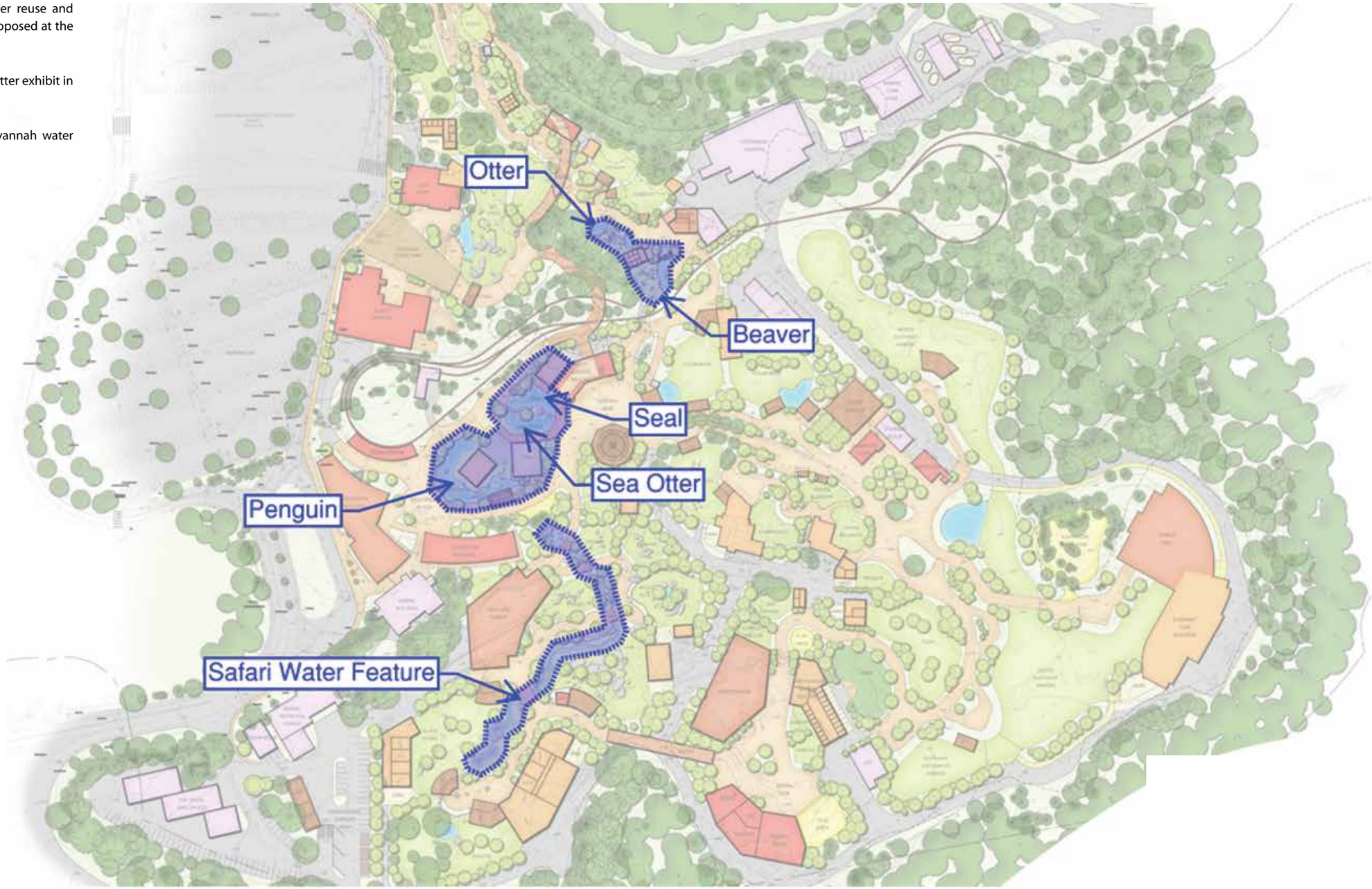


PROPOSED SANITARY SEWER REUSE SYSTEM EXHIBIT

The figure to the right shows a opportunities for water reuse and recovery for the latest site plan. Salt water recovery is proposed at the new Seal, Sea Otter, and Penguins exhibit.

Fresh water recover is proposed at the new Beaver and Otter exhibit in the Great Northwest.

Fresh water recovery is also recommended for the Savannah water feature.



PROPOSED ROOF RUNOFF REUSE EXHIBIT

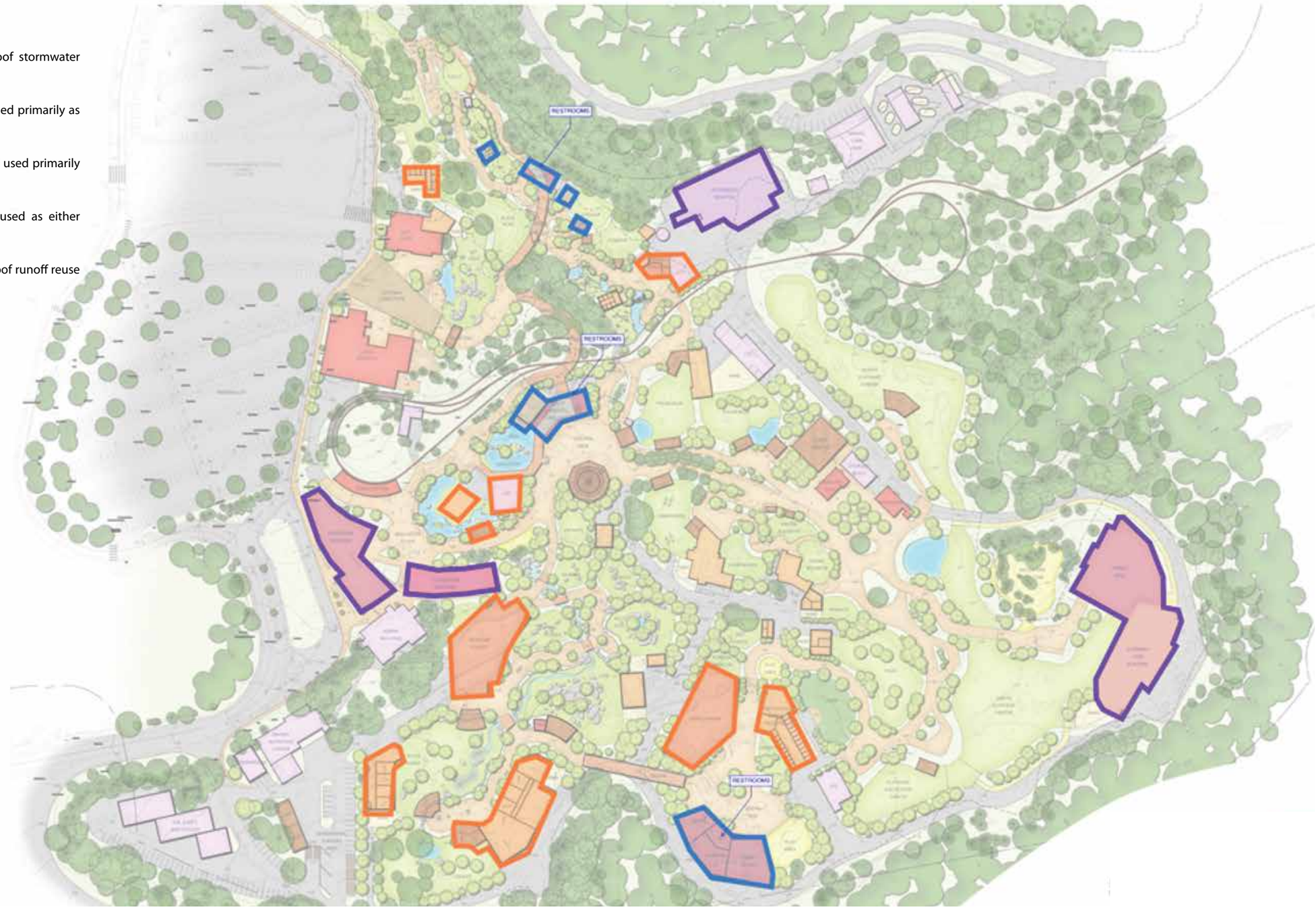
The figure to the right shows a opportunities for roof stormwater harvesting.

Blue indicates roof runoff that can be collected and used primarily as restrooms.

Orange indicates roof runoff that can be collected and used primarily as washdown for the exhibits.

Purple indicates roof runoff that is currently being used as either restrooms and/or washdowns.

Buildings not highlighted are either existing without roof runoff reuse or not deemed usable for roof runoff at this time.



PROPOSED REGIONAL SITE STORM WATER REUSE SYSTEM EXHIBIT

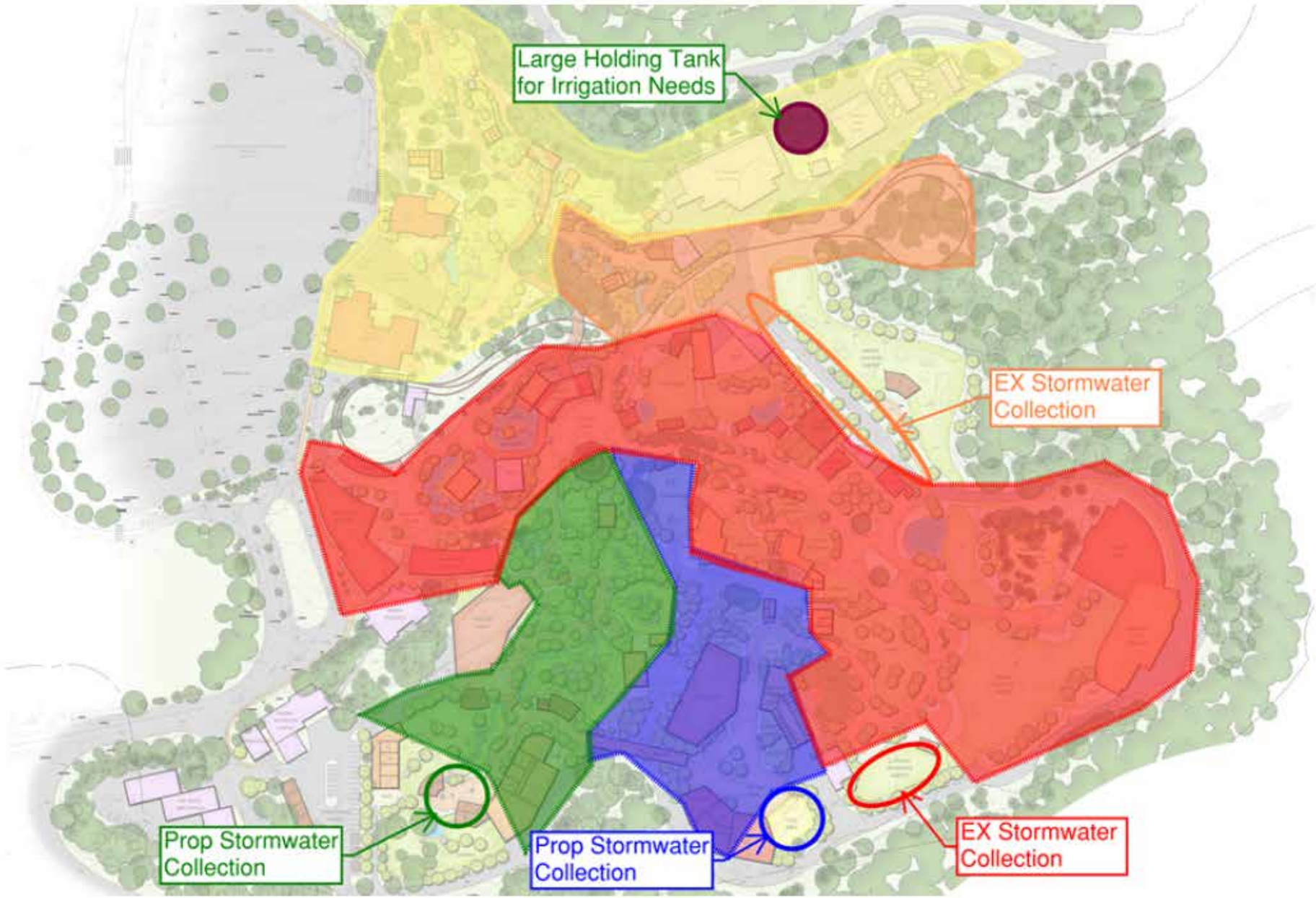
The figure to the right shows the possible configuration of a regional storm water harvesting system on the latest proposed site plan.

Site runoff would be collected in regional basins identified in yellow, orange, red, green or blue.

The runoff would then be directed toward green infrastructure such as filtration basins or Water Quality Catch Basins, which would provide the initial cleaning.

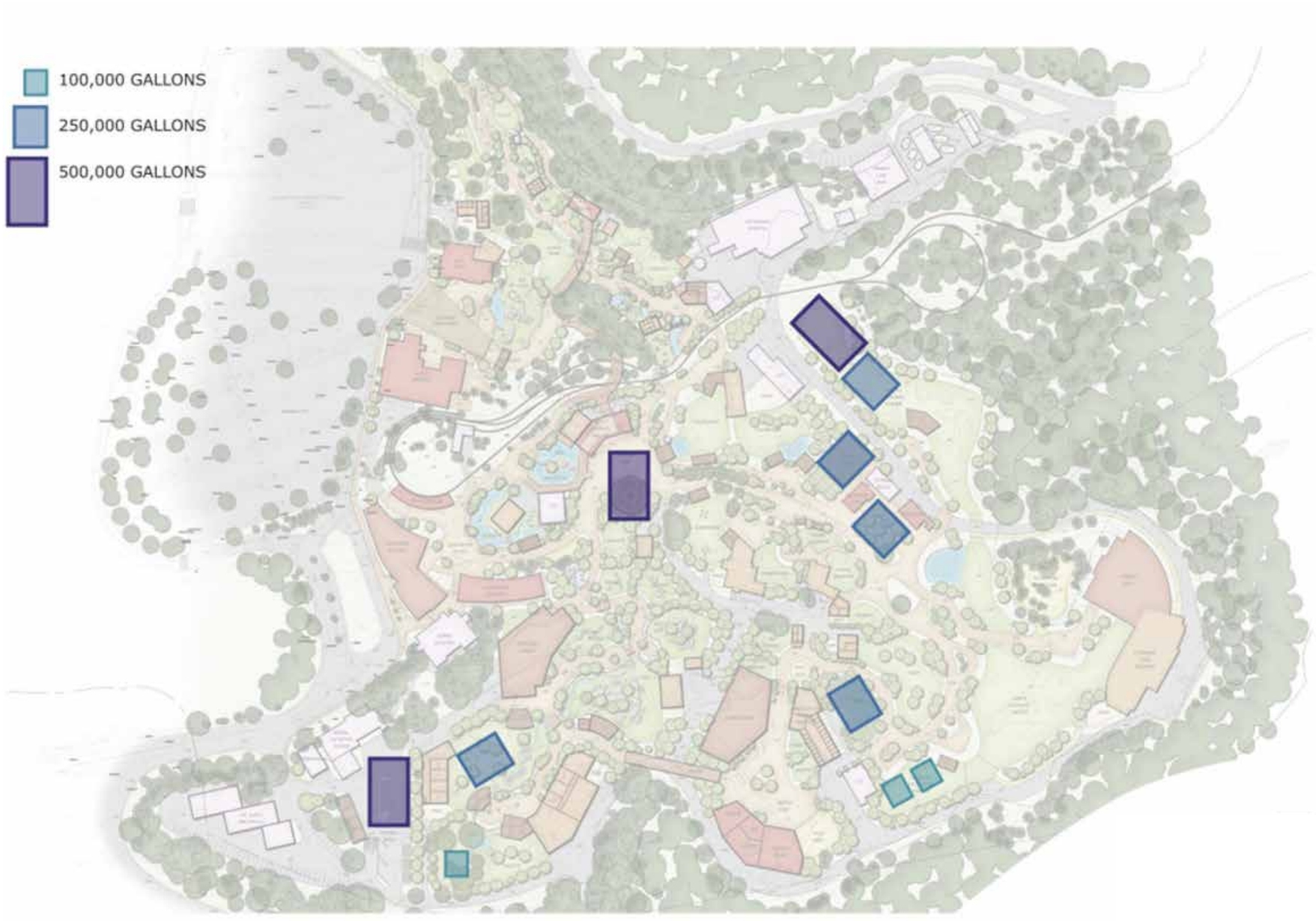
The cleaned storm water would be stored in underground facilities identified in the figure to the right.

The cleaned runoff would be used for landscaping or sent to exhibits with LSS systems for final cleaning and polishing prior to use within exhibits.



PROPOSED SITE STORM WATER STORAGE EXHIBIT

The figure to the right shows a possible layout for the proposed underground storage system. A system that hold roughly 2.5 million gallons could provide 6 million gallons of water to exhibits and landscaping throughout the year.



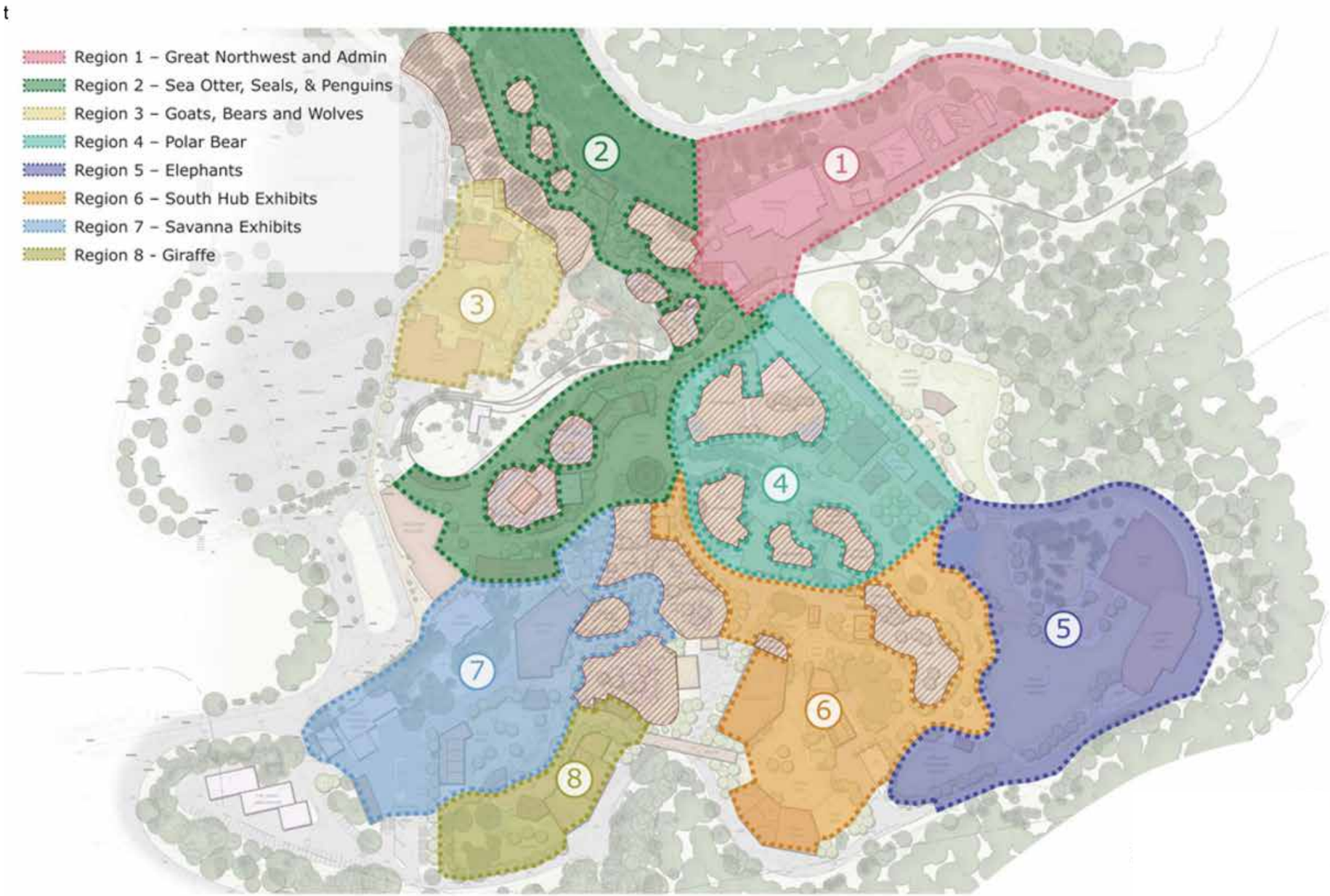
PROPOSED REGIONAL SITE STORM WATER EXHIBIT

The figure to the right shows a possible basin layout for harvesting site storm water runoff.

Storm water from carnivorous and omnivorous exhibits is collected and sent to the sanitary sewer system.

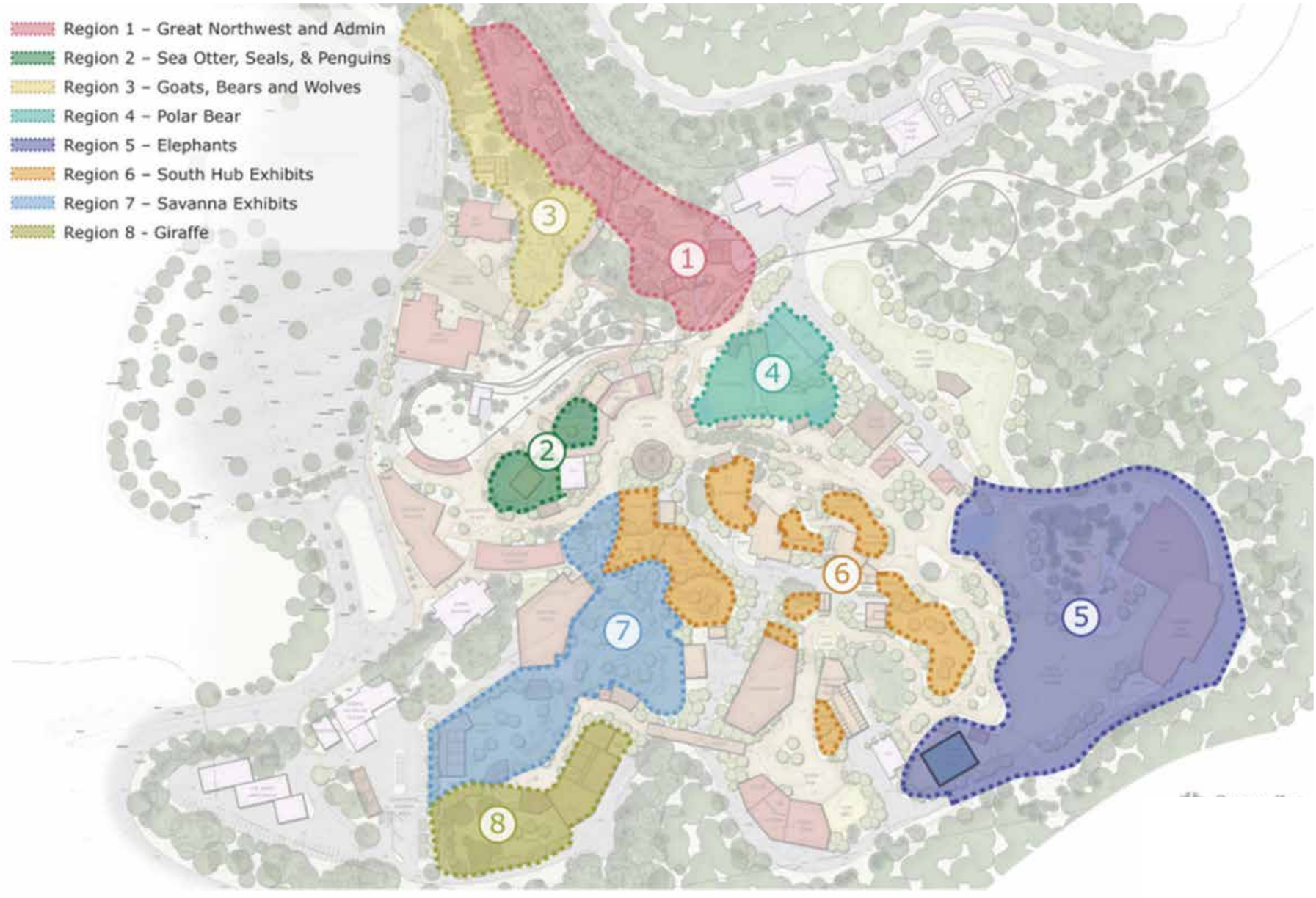
Buildings identified to reuse storm water roof runoff are not included in the basin calculations.

t



PROPOSED REGIONAL SITE STORM WATER EXHIBIT

The figure to the right shows how the regional basin storm water collection could be divided up between exhibits for optimal use throughout the year.



VISION FOR THE FUTURE

Summary

In the coming years, the zoo will be part of a larger effort to increase sustainability within Metro facilities. These newly adopted policies will influence both new construction and existing buildings at the zoo.

Sustainable Buildings and Sites

The Metro Sustainable Buildings and Sites policies applies to new and existing buildings, as well as exterior sites. A key provision that will likely impact the zoo is that new projects larger than 2,000 SF and $1 million in project budget will need to achieve two key rating systems:

FOR BUILDINGS:

- Living Building CORE Green Building Certification
- International Living Future Institute Zero Carbon

FOR SITES:

- LEED Sites Gold Certification

METRO SUSTAINABLE BUILDINGS AND SITES POLICY	KEY CONSIDERATIONS FOR ZOO PROJECTS
All new buildings over 2,000 SF and $1M in total project cost shall be built to the ILFI CORE Standard at a minimum.	Most new zoo projects will be large enough to need to comply with this requirement.
New projects to "exclude the use of fossil fuels and dedicated fossil fuel infrastructure and fossil gas combustion."	All new construction at the zoo will need to be all-electric.
State of Oregon 1.5% for Green Technologies requirement	This requirement is not new and is well aligned with the overall zoo goals for sustainability. It will continue to be factored into project budgets and planning.
Select existing building will be required to apply to the LEED for Existing Buildings at a Silver level or higher	It is possible some zoo buildings will need to comply with this requirement.
Existing buildings that are already certified will be encouraged to incrementally achieve higher ratings than their current status	This requirement could apply to some existing LEED certified buildings, such as the Education Center and elephant's Forest Hall.
All buildings larger than 10,000 SF need an Energy Efficiency Action Plan with identified EEMs	Based on the 2016 Assessment Building Inventory list, this requirement may apply to existing zoo buildings, including the following: • Admin Center, Living Collection Admin Bldg, Vet Med Center, Forest Hall, Aviary Cafe, Cascade Crest, Hay Barn, Facilities and Maintenance Office.

A PATH TOWARDS ELECTRIFICATION

Electrification will require that all new buildings use electricity in lieu of gas for all end uses, and that existing gas loads are eliminated or converted to electric. Strategies for the electrification for new and existing buildings are as follows:

New buildings on campus can be designed to be all electric from the start. In addition to relying only on electrical energy, building designs will seek to reduce energy consumption and peak loads. For all new buildings and exhibits the designers should ask the following questions and consider pursuing the indicated strategies:

Is there a year-round heating or cooling load?

If Yes: Consider connecting to other buildings for energy sharing.

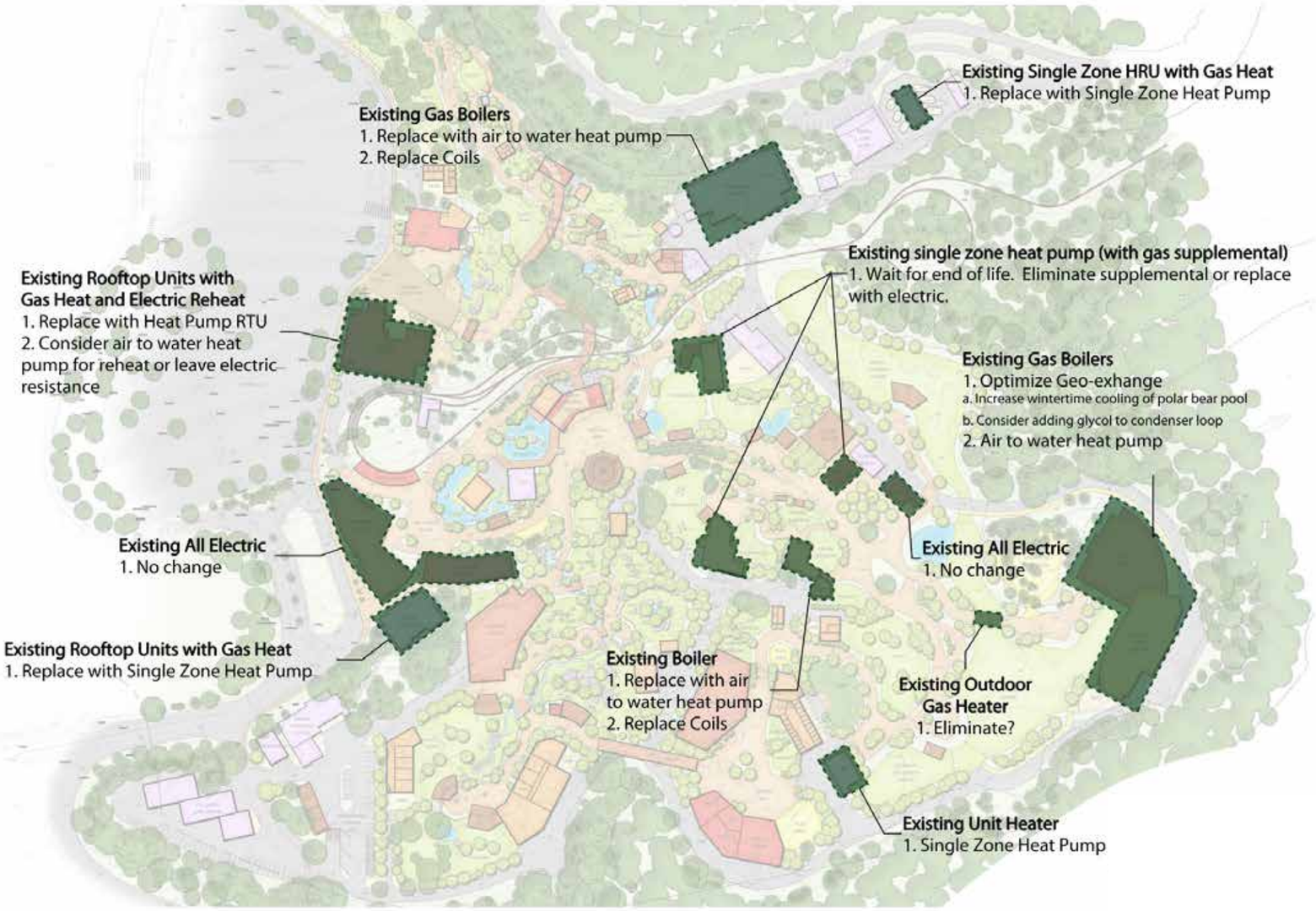
Is there a high air change demand and high heating and/or cooling load? (e.g. elephants, polar bear, and primate)

If yes: use air to air heat recovery to reduce loads and use heat pump heating and cooling to meet the remaining loads.

Is there low air change demand, low loads, and potential for expanded temperature range?

If yes: consider passive design strategies including high performance envelope, and simple mechanical systems-potentially no mechanical cooling and only electric resistance heating (if heating load is very low and cooling isn't required).

Buildings and exhibits which are scheduled for demolition in the near term (before 2040) can potentially be eliminated from consideration for electrification of existing equipment, unless the equipment replacement is required before the end of building life, or the gas consumption is high relative to the difficulty of retrofitting an electric system (i.e. most bang for the buck in terms of carbon reduction). Existing buildings which are not demolished as part of the current campus plan (e.g. recent bond projects) will need to be evaluated for natural gas equipment replacement. Existing buildings can present a greater challenge to electrification than new buildings due to limitation in space, structural capacity, and especially electrical capacity. **A complete campus inventory of all campus gas equipment, the timeline for equipment (or building) replacement, and the available electrical capacity at the location of the gas equipment will be required to produce a detailed electrification plan for all existing buildings.**



Prioritization of electrification projects should be based on:

- Deferred Maintenance - Replace gas equipment at end of life
- Return on investment - Replace gas equipment that results in highest operational cost to project first cost ratio.
- Carbon Reductions - Replace gas equipment that results in the highest carbon emissions to project first cost ratio.
  - Including a dollar valuation of carbon emissions would allow items 2 and 3 to be combined in a single return on investment metric

Electric replacements of specific gas equipment include:

- Replace single zone units (unit heaters, gas fired roof top units) with single zone heat pumps (split systems, heat pump roof top units).
- Replace gas boilers with air to water heat pumps (may require equipment coil replacements to accommodate lower supply temperature.
- Replace domestic water heaters with air to water heat pumps.
- Replace gas kitchen equipment with electric equivalent (induction where available).

A PATH TOWARDS ELECTRIFICATION

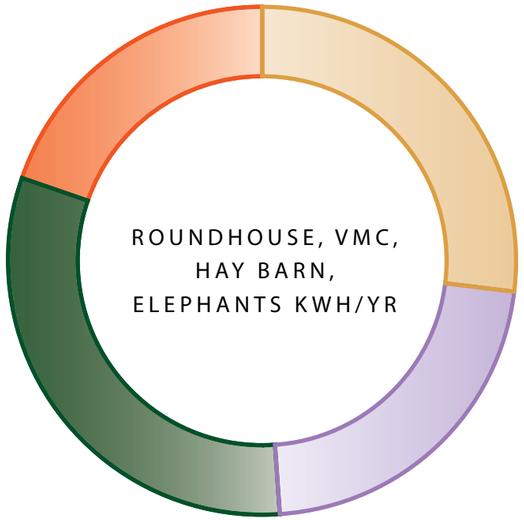
An initial review of the existing campus electrical loads and anticipated increases due to electrification determined that on a whole the campus has enough spare service capacity to support the new loads due to the from natural gas. This indicates that in addition to all new construction being all-electric, there is likely a path forward for the zoo to begin conversion of existing buildings over to all-electric without a need for significant infrastructure upgrades in the near term.

There are possible caveats that will need to be explored in more detail in future investigative and design efforts:

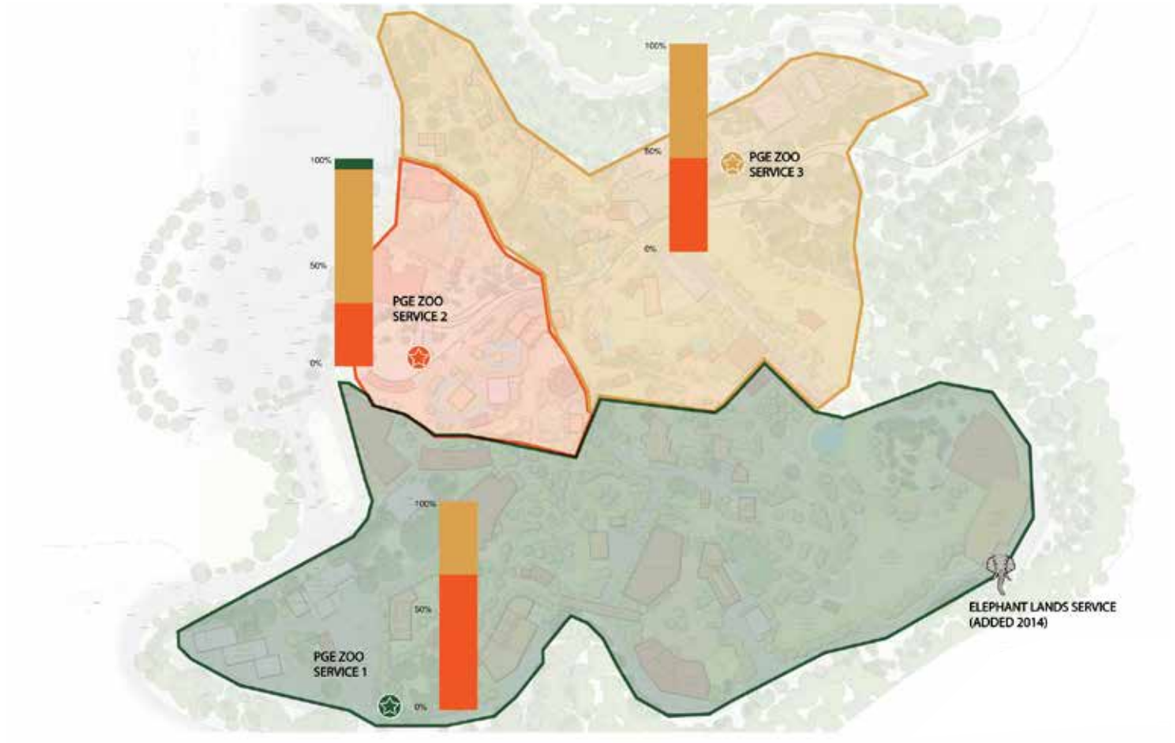
- While the total available capacity between the three electrical services appears adequate for electrification of existing load, the capacity at any given location may not be. Electrical distribution may need to be upgraded or one utility service or another may need to be extended to certain locations in order to match provide available capacity at the specific equipment locations.

- This calculation does not factor in the electrical load of new exhibits and buildings. Nor does it factor in the demolition of existing buildings. Increases to total building area on campus could increase the total demand, though demolition of existing energy intensive users (Steller Cove, for example) may offset that increase.

ENERGY USE BY ZONE



Roundhouse | 2,069,000 kWh/yr **VMC** | 1,678,000 kWh/yr **Hay Barn** | 2,395,000 kWh/yr **Elephants** | 1,492,000 kWh/yr



Current Usage **Proposed Gas Offsets** **Residual Capacity**

This image shows the existing peak electrical consumption of each service (red), the additional load due to electrification of existing gas loads (yellow) and the remaining available capacity on each service (green).

It is important to note that the additional load has been considered as an even distribution across the campus. If one zone experiences a concentrated increase, there is potential for capacity issues in that area.

Based on the early estimates, it is anticipated a fourth PGE service will need to be added to the zoo Campus to support the new developments and full electrification of both existing and new facilities.

SERVICE	
PGE Service	Service Percent Loaded[1]
PGE Service 1	67%
PGE Service 2	29%
PGE Service 3	45%

1. Value compares peak current to equipment ratings

MECHANICAL

District Energy Systems

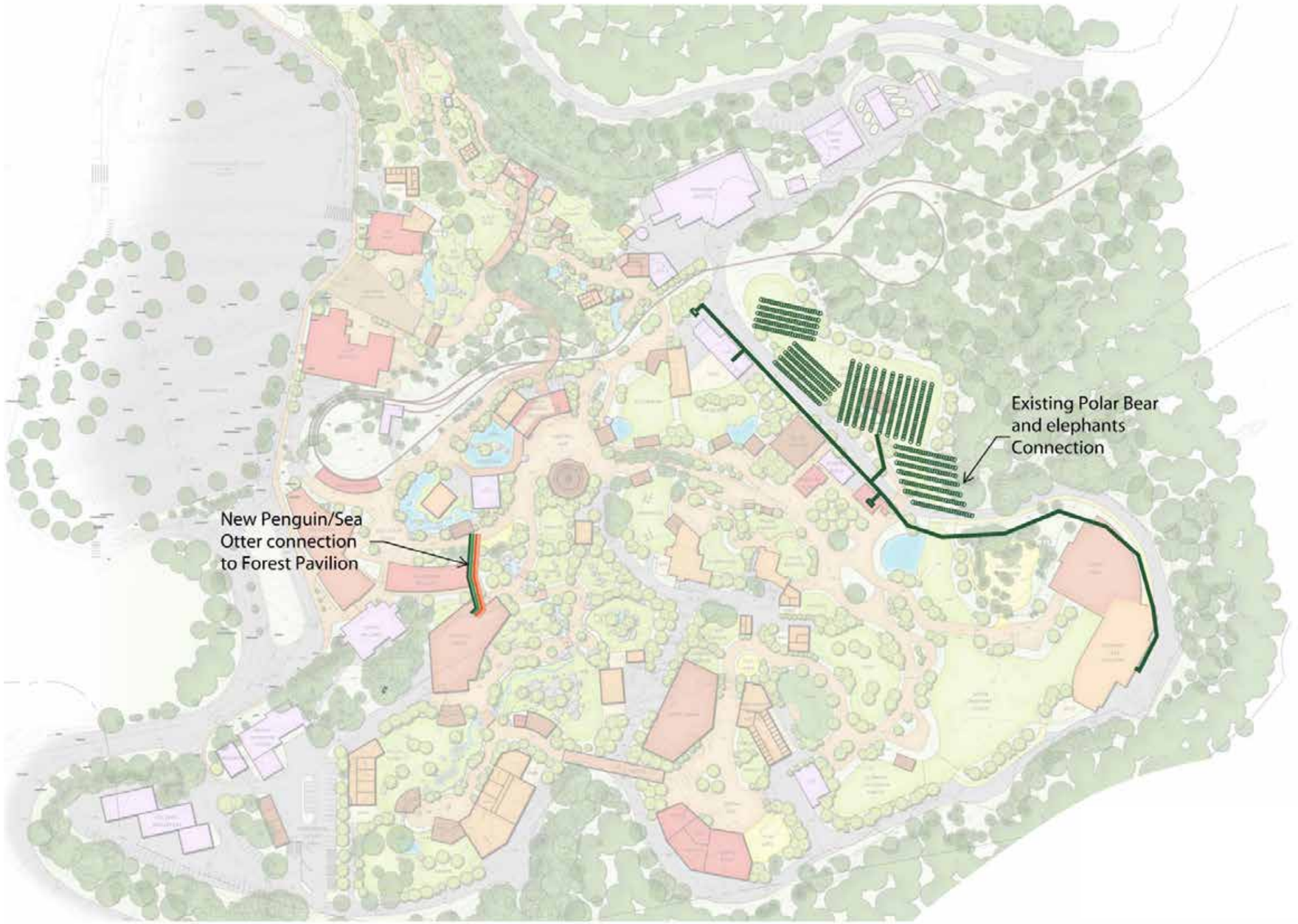
Due to the cost and construction complexity of ground source wells (vertical bore, horizontal slinky or open loop vertical extraction and injection wells) as well as the improving technology of air source heat pumps, further developing a campus ground source heat pump loop is not recommended.

However, where there are significant simultaneous heating and cooling loads, there is an opportunity for connection between buildings. This smaller "district" infrastructure could be captured within exhibit projects as opportunities are identified.

The penguin and sea otter exhibits may have a significant cooling load for pool cooling. These exhibits could be connected to the nearby Forest Pavilion which is likely to be heating dominated. Heating water could even be extended to giraffes, pending construction phasing and loads analysis. The benefit of energy sharing will depend on the pool temperature set point(s) throughout the year.

LEGEND

- 6-inch pre-insulated direct buried chilled water supply & return
- 6-inch pre-insulated direct buried heating water supply & return



CAMPUS RENEWABLES

With an incorporation of onsite renewables around the campus, the Oregon Zoo will be able to fulfill three crucial goals – reduced operating costs, reduced emissions, and visitor education on sustainable practices and energy resilience.

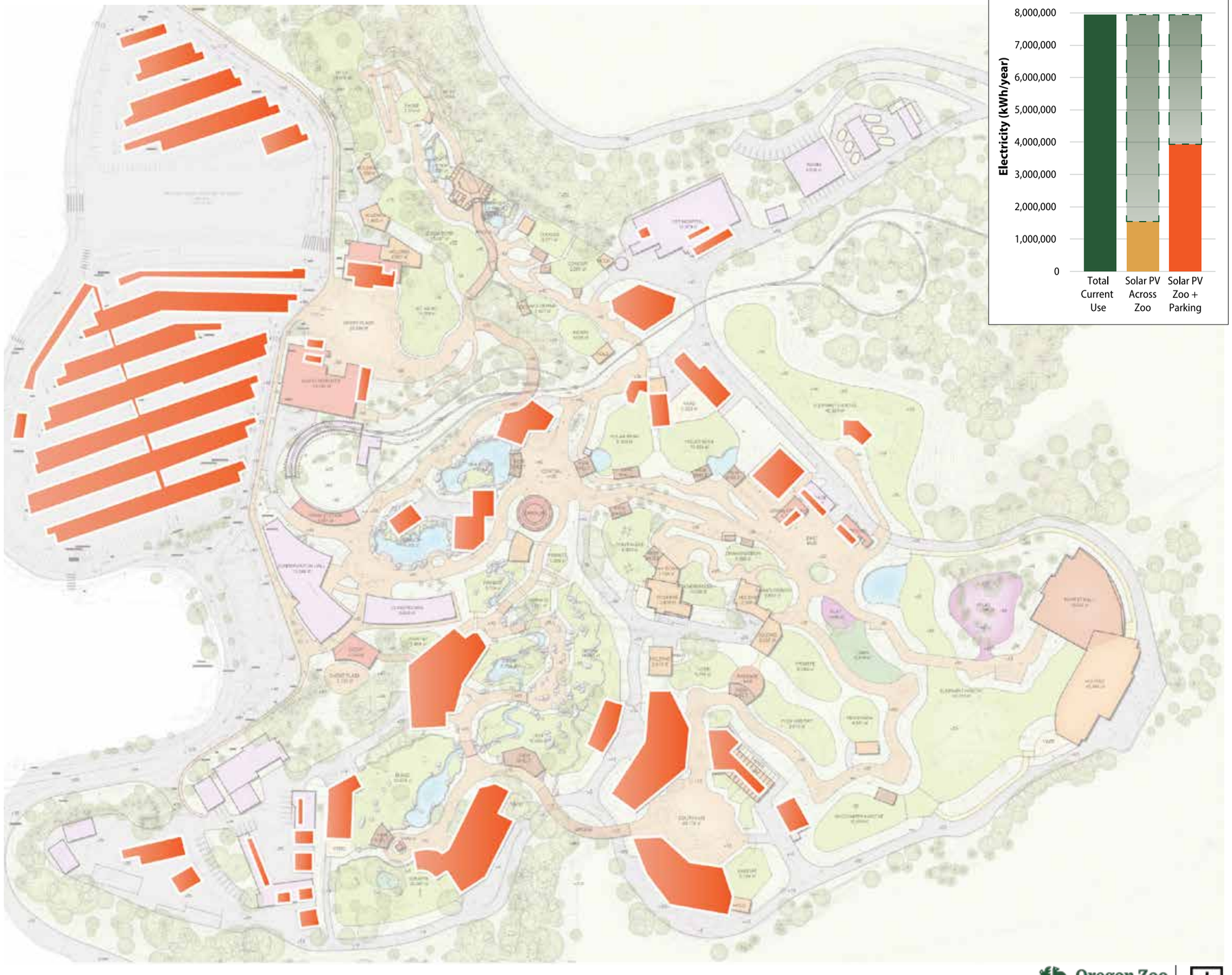
The best suited and most cost effective technology option for onsite generation is photovoltaic (PV) panels. Placement of panels will depend on a variety of factors including available roof area and shading from nearby trees. New and existing buildings with large roofs and adequate sun access are strong candidates for rooftop PV arrays.

The most optimal location on the campus for PV is the main and upper parking lots. These areas are large, open and already have a slight tilt to the south - an optimal angle for PV panel placement. The potential production from carport PV canopies far eclipses the potential for roof top PV on the zoo buildings.

There are added benefits of the parking lot option related to the visitor experience. The more practical one is the added protection from sun and rain given to families loading in and out of vehicles. From an experiential standpoint, seeing a large renewable energy installation as the first view of the Oregon Zoo sets a tone to the values, goals and mission of the zoo as an institution that is working to help restore and regenerate the natural environment.

The key challenge with a parking lot installation is the multi-jurisdictional ownership of this portion of the zoo. Installation of the system would require approval by entities other than the zoo and a contractual agreement around use of the produced energy would need to be established.

Given the multiple benefits to the zoo – lower energy costs, reduced operating emissions and visitor education opportunities – inclusion of onsite renewable energy whenever possible is a key element of the future Oregon Zoo.



UNDERSTAND & REDUCE MUNICIPAL WATER CONSUMPTION

The reduction in water use at the zoo since 2008 is a major success story. There are several sources of data for the current water consumption at the zoo. Data was provided for seven utility meters, three of which indicate consumption for 2022 (4 of which show zero consumption). The total usage of the utility meters in 2022 is 34.9 million gallons. Data was also provided for 68 zoo owned meters on campus, one of which is labeled "Main" and indicates a total 2022 usage of 37.6 million gallons. The reason for the difference between the utility meters and zoo main meter is not known; however, the total usage is likely in the range of 35-38 million gallons per year.

The other 67 zoo meters are generally labeled and appear to total about 31 million gallons. Some of the sub meters "double" count water usage – e.g. at the building level and again at a specific usage. Where known, the double counting was removed; however, there may be other uncorrected double counting in the 31 million gallon total (potentially in the cascades area).

It is not known how much of the ~6 million gallon difference between the sub-meter total and main meter can be explained by uses which are not sub-metered vs. leakage in the zoo's distribution piping. A complete and well calibrated sub-metering network would be required to ensure that all uses are sub metered (and not double counted) in order to accurately estimate the leakage.

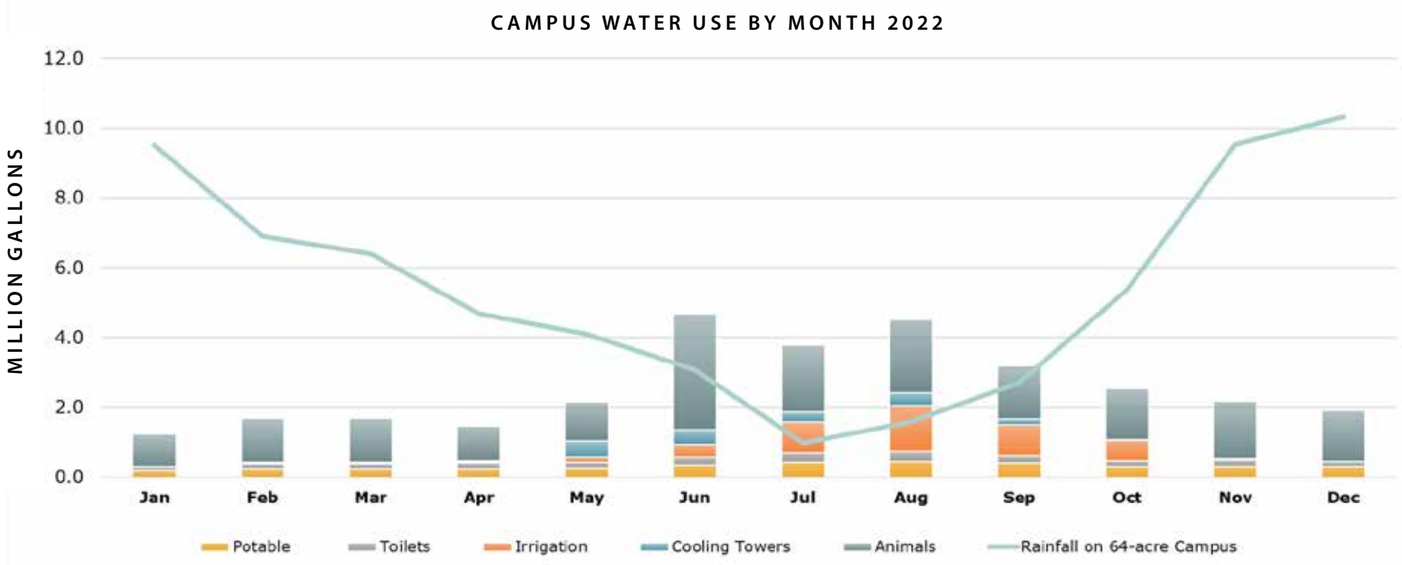
The design team categorized water usage from the sub-meter data to the extent practical, though the exact breakdown of end uses cannot be determined due to unknown piping distribution networks downstream of each meter (and meters which serve multiple end uses). The team estimates about half of campus water is used for exhibits (including wash-down) and the other half is divided between potable, irrigation, and other non-potable demands. About 17% of the usage (6 million gallons) is "unidentified" – either leakage or unmetered use.

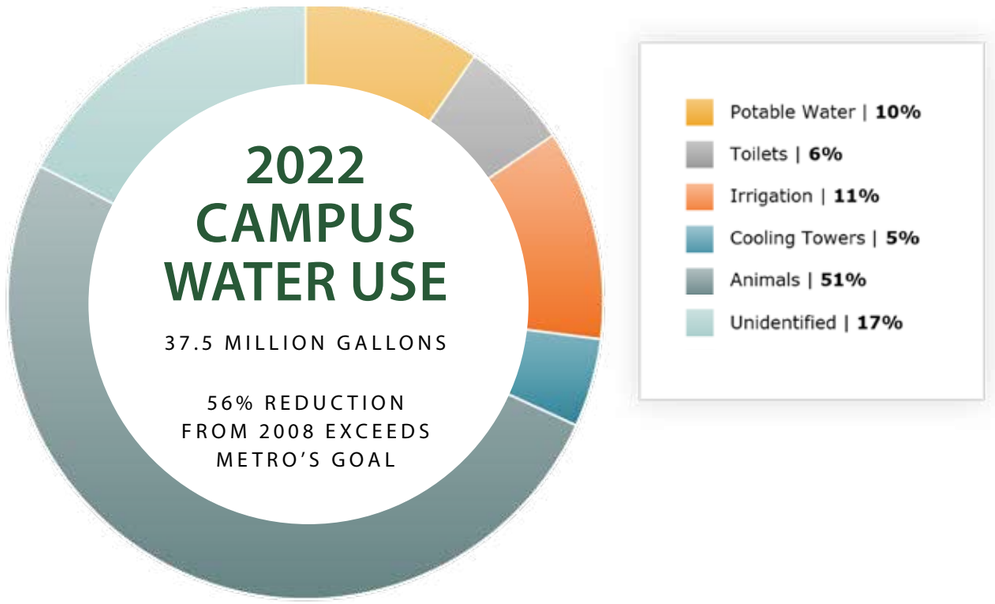
Because exhibit usage is the largest component of the total, strategies to reduce exhibit water use, including storm water capture and reuse (as described on the following page) offer the largest water use reduction opportunity. Reductions in other non-potable demand including irrigation and toilet flushing can have a significant impact. Potable demand is a relatively small percentage of total zoo water use (10%); therefore, an on campus treatment system to produce potable water is likely not practical due to maintenance and regulation implications (unless identified as a recommended resiliency strategy in a Comprehensive Resiliency Plan).

There are several large uses that are not completely understood (e.g. Steller Cove "irrigation" meter - presumably pool, wash down, and cooling tower use) or that may be the source leakage (e.g. Cascades) that should be verified in order to develop reduction strategies.

ZOO SIGNIFICANT DEMANDS TO VERIFY

Sub-Meter	Annual Usage
Cascade Turtle Stream	32,166
Cascade hose bibs	4,329,725
Cascades main supply	6,181,902
Children's Museum	73,421
IRR Upper Lot Check Valve	2,019,740
Steller Cove #1 Chiller Irrigation	1,430,936
Steller Cove #2 Chiller Irrigation	78,762
Steller Cove Chiller	48,593
Steller Cove hose bibbs	1,220,736
Swamp Africa III	1,389,398
Swamp Building Domestic	1,998,795
Swamp Monkey	312,607

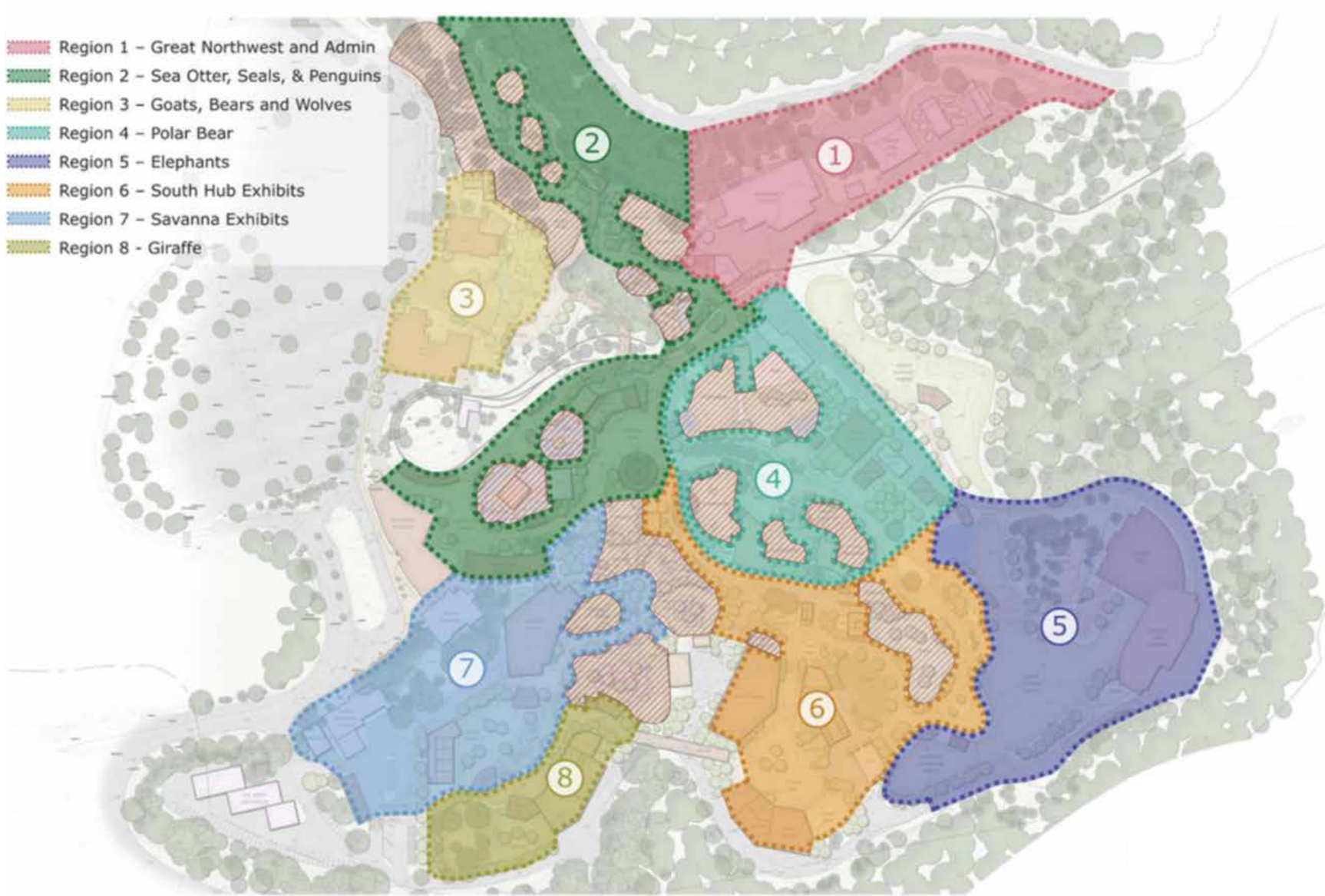




STORM WATER (NON-POTABLE) SUPPLY

It is estimated that installing roughly 2.5 million gallons of rainwater storage could save 6 million gallons of water used for landscape, exhibits, and washdown areas. The general implementation of site runoff harvesting is as follows: capture site stormwater runoff, initial cleaning through green infrastructure such as vegetative filter basis or Water Quality Catch Basins, store in large underground concrete storage vaults, and if continuing to an exhibit, final cleaning through the existing LSS systems. The three main services are located as follows:

- **South Hub Restaurant**
  - 100,000-gallon storage tank
- **Asia**
  - 250,000-gallon storage tank
- **Herpetarium**
  - Roof Runoff capture for toilets and washdown
- **Predator**
  - Roof Runoff capture for washdown
- **Primate**
  - Roof Runoff capture for washdown
- **Tropical Forest**
  - Roof Runoff capture for toilets and washdown
- **Savanna**
  - 250,000-gallon tank
  - Savanna River water pump and recycling?
- **Entry Plaza**
  - 200,000-gallon tank
- **Great Northwest**
  - Natural stream that flows from the north will be captured and piped to underground storage tanks after being cleaned. The excess will be diverted to the Tanner Creek basin.
  - 250,000-gallon tank
- **Coastal Shores**
  - 500,000-gallon tank
  - LSS system for water refinement and polishing.
- **Gate A – F/M**
  - 500,000-gallon tank
- **Gate J – Animal Care**
  - 500,000-gallon tank
- **Polar Plaza**
  - 2 – 250,000-gallon tanks
- **Destination Play**
  - 100,000-gallon tank

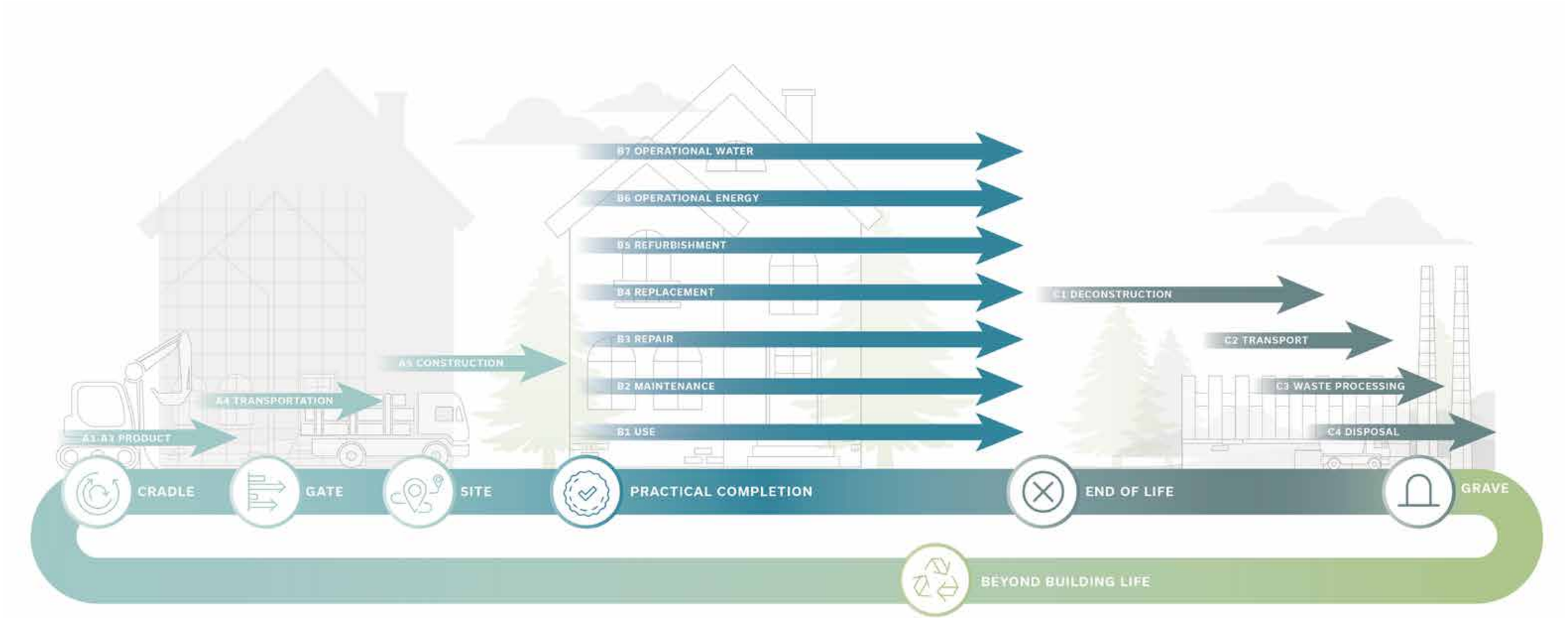


WHOLE BUILDING LIFE CYCLE ASSESSMENT (LCA)

As implied by the name, a whole building life cycle assessment (LCA) works to take a more holistic looks at the emissions impact of a building. Historically, there has been a strong focus on only the operating emissions - the emissions associated with operating the building during it's active life. This had come at the expense of ignoring the embodied emissions before, during, and after the building's operating life. This includes the emissions associated with the materials, transportation, construction, and end-of-life disposal of the building. By taking a more in-depth look at all these factors, projects can better understand the interactions between these different factors and further reduce the overall emissions impacts of the built environment.

In the case of the zoo, this equation is further complicated by the specific needs of the more unique animal habitat spaces. Sustainably sourced wood structures can provide reduced embodied emissions as compared to concrete or steel, but might not be the correct material choose due to the specific needs of the habitat. The Oregon Zoo will need to take a creative approach with all future development to appropriately balance the opportunities for whole building LCA emissions reductions and the needs of the buildings. With the new Metro requirement to achieve the ILFI Zero Carbon certification, quantifying and reducing the embodied emissions will be a key element of achieving this certification.

A more detailed look at whole building LCAs will be a key element in all zoo projects moving forward.



ELECTRICAL

To support the ongoing operations at the Oregon Zoo, the following modifications to the zoo's existing switchboards should be considered as a portion of this equipment is dated:

- The service at the elephants should not require any maintenance as it was recently installed in 2014
- Maintain existing 1200amp 480V switchgear at Haybarn
- Replace existing 3000amp 480V switchgear at Train Roundhouse
- Replace existing 1200amp 480V switchgear at Vet Medicine Center

Refer to the electrical site plan diagrams for existing normal and emergency campus distribution in the appendix.

The campus will require a new PGE service to support future campus plan exhibit areas once existing campus buildings currently utilizing gas are converted to all electric facilities. This service is estimated at 3000A, 480V to serve redeveloped and future exhibits.

The new service location will need to be coordinated with PGE and with zoo program to determine a suitable location for it.

Assume the following feeders from this new service, though these quantities and sizes will need to be confirmed as program for each building proposed in the campus planning diagrams is detailed:

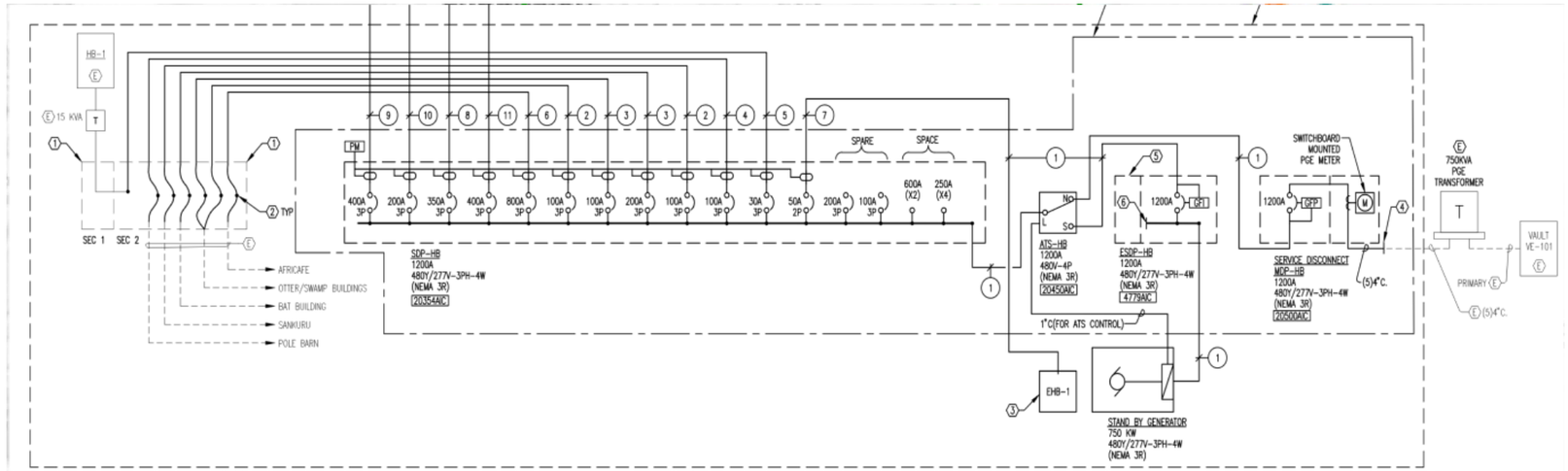
NEW SERVICE 1: 26 FEEDERS TOTAL

- (10) 200A 480V
- (6) 400A 480V
- (10) 100A 480V

For proposed larger buildings (i.e. Tropical/Forest, Herpetarium, South Hub Retail/Dining), the feeder will terminate within a panelboard within the structure.

For areas containing multiple small buildings (i.e. Rhino, Chimp/Primate, Condor/Cougar/Eagle), the feeders may terminate at a panel located adjacent to one structure and branch out to serve other adjacent small buildings from the same panel.

HAYBARN ELECTRICAL ONE-LINE DIAGRAM



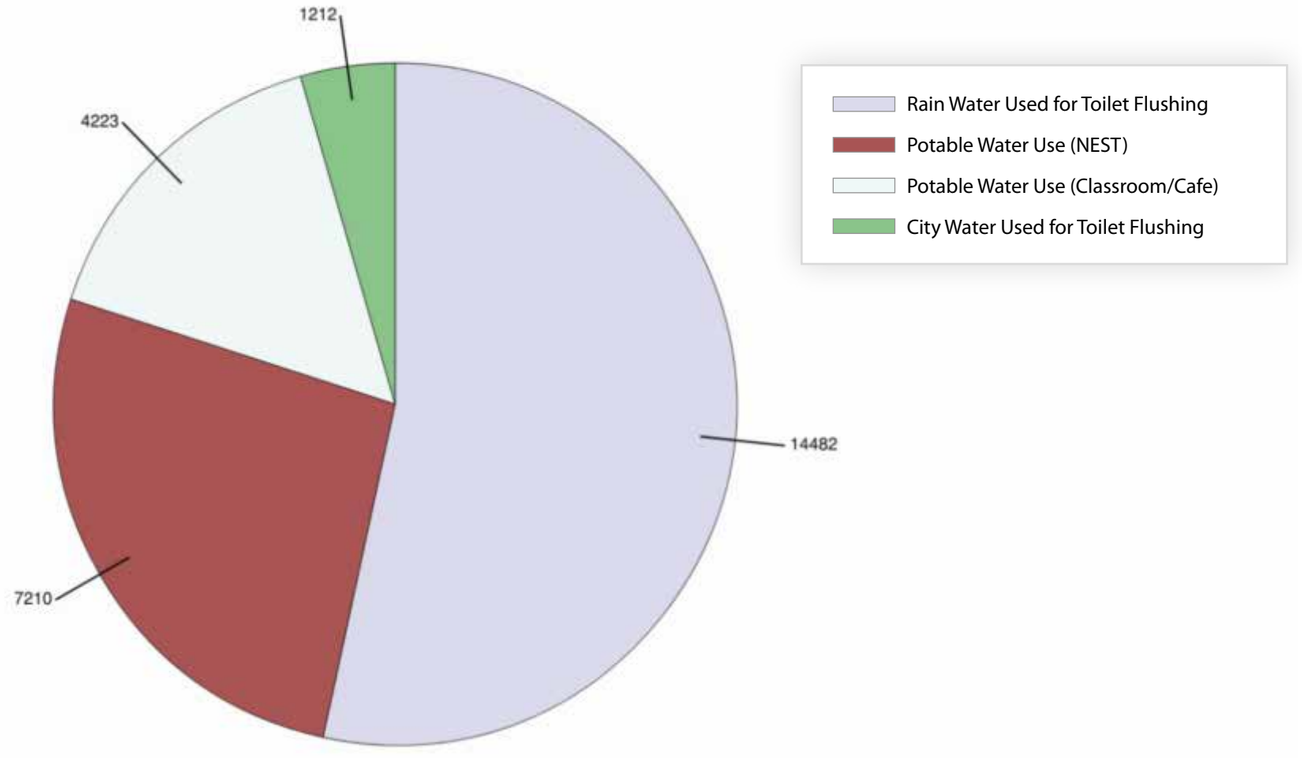
METERING & VERIFICATION

Energy and water sub-metering is critical to understanding and managing energy and water use on campus. In addition to installing physical meters for electricity, gas, and water, the meter data must be stored and accessible in a useful location. Data storage, display, and access is most easily done through building management systems (BMS). There are several building management system manufacturers currently on campus including Andover, Siemens, and Delta; however, the zoo is currently transitioning to a common Delta head-end. All metering data should be stored in one common software.

Many existing buildings on campus have extensive sub-metering; however the data is not well stored, labeled or displayed in a useful manner to zoo and Metro employees. The electrical and water sub-meters at the existing education center are an exception in that the data is stored, labeled and routinely accessed by staff. At other locations, including polar bear and primates, the meters are installed but the data is not well labeled or routinely accessed. Inadequate set-up of sub-metering systems is an industry wide problem that frequently occurs and is often never resolved.

A comprehensive inventory of existing meters should be performed, meter data should be labeled, stored, and trended electronically in a single location that is easily accessible to and understood by the zoo and Metro. The metering systems should automatically generate a monthly report indicating water the zoo's and energy consumption for each building/exhibit/landscape and the zoo total. The reports should compare the total of sub-meters to the zoo total consumption, and flag and report unidentified consumption (water leaks, unidentified energy consumption). All future projects should include a robust specification that requires all energy and water sub-meters to be integrated into the system as described above,commissioning of those systems, and trend data and graphics as a required close out submittal before the control contractor's scope is considered complete.

The appendix includes an example table which has a metering inventory framework for existing buildings.



EXAMPLE MONTHLY WATER REPORT FROM THE EDUCATION CENTER

Historical (TMY3): *https://energyplus.net/weather*

2050 w/emissions reduction: *https://www.weathershift.com/*

2050 w/o emissions reduction: *https://www.weathershift.com*

2050 CCWGen: *a.https://energy.soton.ac.uk/ccworldweathergen/*

2020 NZ Fellowship: *https://www.energytrust.org/wp-content/uploads/2020/06/Download-research.zip*