SHERIDAN BEACH AND THE ESPLANADE

Ecological Assessment

Final Report

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Introduction

SmithGroupJJR (SGJJR) was retained by the Michigan City Parks and Recreation Department (Parks Department) to complete an Ecological Assessment, Restoration and Access Plan (Plan) for Sheridan Beach and The Esplanade in Michigan City. It is the intent that this Plan be used as a tool by the Parks Department and the Parks and Recreation Board to objectively inform future land use and land management decisions within the project area. Ultimately, the Plan will be incorporated into the Parks and Recreation Five-Year Master Plan.

Study Area

The project area consists of Sheridan Beach and The Esplanade, a 1.1 mile long, 66 acre stretch of sand beach and dune system along the southern side of Lake Michigan, approximately bound by Lake Michigan to the north, the Dunescape development to the west, the Town of Long Beach to the east, and private residences to the south, per Exhibit A. The Esplanade was dedicated by the original owners and subdividers of the adjacent lands for public use and enjoyment as a "Public Esplanade, Walk, Park and Bathing Beach." Sheridan Beach was also dedicated by the original owners and subdividers of the adjacent lands for public use and enjoyment as a beach. Both The Esplanade and Sheridan Beach are managed and maintained by the City Parks Department.

The base map of the project area used for all exhibits within this report was generated using readily-available digital data from LaPorte County, Indiana Beacon web, and other municipal information. Assistance for this portion of the project was provided by Weaver Boos Consultants of Chicago, Illinois.

Principles

This Plan is based on Guiding Principles and Metrics, as established by the Michigan City Parks and Recreation Board and the consulting team. These guidelines shape the formation of the restoration and access plan concepts, and provide associated metrics that can be used as a gauge for evaluating the success of future plan implementation. The principles are organized by the four tenets of sustainability:

A. Ecological – Sustaining the ability of the landscape to perform ecological functions such as building soil, recharging and cleaning water, cycling nutrients, and enabling biological systems to remain diverse and productive.
B. Economic – Encouraging reinvestment in the community and providing cost effective solutions that preserve or wisely use scarce resources.
C. Social – Providing equitable access to natural resources for the benefit of all community residents and preserving cultural connections between people and place.
D. Human Spirit – Inspiring a deeper, spiritual connection with nature.

The following Guiding Principles and Metrics have been established for Sheridan Beach and The Esplanade:

A. ECOLOGICAL
- Identify, protect, connect and restore sensitive resources.
- Work toward a sustainable, maintainable natural landscape.
- Control invasive weeds.
- Honor natural processes (i.e. wind, wave, succession, fire).
- Maximize native plant cover and minimize bare sand cover in areas outside of the beach.

Metrics:

- Reduce abundance of privet, Oriental bittersweet, catalpa and poison ivy by 90%.
- Maintain palette of 100% indigenous plants to be used for restoration and landscaping.
- Reduce the number of private trails by improving and consolidating remaining trails.

B. ECONOMIC

- Structure restoration and access improvements so that they are fundable and easily phased.
- Minimize maintenance costs for infrastructure as well as natural areas.
- Maintain or increase property values of parcels along the lakefront.

Metric:

- Implement the first phase of restoration within two years of plan adoption.

C. SOCIAL

- Enhance wayfinding and access for a diverse user group (i.e. ADA, children, elderly, etc.).
- Improve access from adjacent homes while limiting negative impacts on ecology.
- Identify additional parking opportunities.
- Be sensitive to the historic relationship between neighbors and beach users.

Metrics:

- Provide additional parking for at least 15 vehicles.
- In addition to the existing beachwalk, construct at least one improved beach access that provides universal accessibility.
- Provide additional wayfinding signage to clearly designate every public access point.
- Develop and enforce trail access regulations that support these principles.

D. HUMAN SPIRIT

- Identify, enhance and protect viewsheds.
- Honor and enhance the native dune landscape (i.e. don't make it something it is not).
- Provide opportunities for quiet contemplation.
- Respect privacy of neighbors, as well as opportunities for the public to experience quiet, unbroken access to open space.

Metric:

- Provide two intentional and additional opportunities for quiet contemplation.

Ecological Assessment Methods

Ecological Communities

Ecological communities including beach, foredune, secondary dune, transitional areas, and developed areas were delineated on an aerial photograph in the field on May 9, 2012 (Exhibit B). The boundaries were based on physiognomic patterns including dominant plant species and topography.

Quantitative Vascular Plants, Mushrooms, and Lichens

Ecological communities were quantitatively sampled using 1 meter square quadrats along transects. Transects were located within foredune, secondary dune and transitional areas, and the end points recorded with GPS. Quadrats were sampled at 5 meter intervals along each transect. A total of 120 quadrats were sampled: 20 quadrats were sampled within the foredune, 50 quadrats were sampled within the secondary dune, and 50 quadrats were sampled within the transitional community. Sampling was performed as follows:

- Herbaceous vascular plants were identified to species. Abundance was measured as percent cover. A comprehensive species list was generated during field visits that occurred on May 9, May 10, and June12 to June 14. Summary statistics (Native Mean C, Native FQI, Relative Importance Value, etc.) are per Wilhelm and Masters (2006).
- Lichens were identified to species (if possible). Abundance was measured as percent cover.
- Mushrooms were identified to species (if possible). Abundance was measured as the number of individuals in the quadrat.
- Insects and herpetofauna incidentally observed while collecting herbaceous data were noted.

Woody Quadrat Data

Shrubs (woody vegetation ≥ 1 meter tall and < 3" diameter at breast height (dbh)) were identified to species along a one meter wide belt quadrat that extended the entire length of each transect described above. Abundance was measured by stem count. The Relative Importance Values (RIV) of shrubs was determined by the number of stems that occurred within the quadrat.

$$RIV_{shrubs} = \text{number of stems/species.}$$

Trees (woody vegetation ≥ 3" dbh) were identified to species along a 10 meter wide belt quadrat that extended the entire length of each transect described above. Abundance was measured by counting individual species and placing them into a 3" to 6" or a 6" to 9" dbh size class. Trees > 9" were measured using a dbh tape. The RIV of trees was determined as follows:

- Each plant in the 3" to 6" size class for each species was given a value of 4.5" dbh and summed.
- Each plant in the 6" to 9" size class for each species was given a value of 7.5" dbh and summed.
- For trees greater than 9", the total dbh was summed for each species.
- The RIV for each species was calculated by summing the total dbh in each of the three size classes described above.

$$RIV_{trees} = \sum 3"\text{-}6" \text{ class}_{dbh} + \sum 6"\text{-}9" \text{ class}_{dbh} + \sum >9" \text{ class}_{dbh}$$

Bird and Insect Transect Data

Four 100 meter long transects parallel to the shoreline were located in each of the four ecological communities: beach, foredune, secondary dune and transitional. The endpoints were recorded using GPS. The investigator slowly walked each transect between 7:45 a.m. and 8:45 a.m. on June 14 and recorded the number and species of birds heard or observed, and the number and species of insects observed. A comprehensive species list of all birds heard or observed in the study area was also generated during field visits that occurred on May 9, May 10, and June12 to June 14.

Invasive Plant Species

An invasive species is a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (ISAC 2006). For purposes of this study, we have also included native species of poison ivy, box elder and black locust which otherwise meet the ISAC definition.

All invasive plant species observed were identified to species and qualitatively assessed as to abundance. The location and extent of specific infestation areas was drawn on an aerial photograph. The relative abundance of specific species was approximated in terms of individuals, or using relative abundance measures per White 2009:

Rare (R):	Few (≤ 4) individuals observed. Rare species likely are observed after prolonged, diligent searching, or by returning to a known location where individuals have been observed in the past.
Occasional (O):	Species that were scattered throughout the site and not immediately located, but were encountered before the entire project area was entirely searched.
Common (C):	Species easily found throughout the project area with no real effort, but not a dominant species.
Very Common (VC):	Occurs in large numbers throughout most or all of an area, but not a dominant species.
Abundant (A):	Predominant and ubiquitous species.

Invasive Plant data was collected independent of quantitative sampling described above.

State or Federal Rare, Endangered, or Threatened Species

All rare, State or Federal threatened and endangered species observed were identified to species and qualitatively assessed as to abundance. The location of specific species of concern was recorded with GPS to provide a point location where practical.

Results

Ecological Communities

In the project area, 164 species of vascular plants were identified including 86 native species. The Total Native Mean C was 3.5. The Native Floristic Quality Index (FQI) was 32.6. Wilhelm and Masters (2006) indicate that in the Chicago Region, sites with a Total Native Mean C of at least 3.5 and an FQI of 35 or more, one can be fairly confident that the site has sufficient floristic quality to be at least of marginal natural area quality.

Four ecological communities were identified: beach, foredune, secondary dune and transitional areas:

1. **Beach Community**: Beach consisted of the area between Lake Michigan and the toe of the first dune. The beach community was completely devoid of vegetation due to beach regular beach grooming, foot traffic, and wave action.

2. **Foredune Community:** The foredune was delineated as the area between the toe of the first lake-ward dune, to the point where the first dune began to drop conspicuously landward in elevation. Characteristic flora observed include beach grass (Ammophila brevilugulata) and scouring rush (Equisetum hyemale affine). The foredune is the only community where the rare American sea rocket (Cakile edentulata lacustris) was found, especially near the toe of the dune. Woody trees and shrubs were rare in this community.

3. **Secondary Dune Community:** Secondary Dune was delineated as the area between the foredune and areas dominated by trees. Characteristic species included beach grass, little bluestem (Schizachyrium scoparium), bluestem goldenrod (Solidago caesia), sand reed (Calamovilfa longifolia), prickly pear (Opuntia humifusa), false boneset (Brickellia eupatorioides), wafer ash (Ptelea trifoliate), black oak (Quercus velutina) saplings, cottonwood (Populus deltoides), and catalpa (Catalpa speciosa).

   The most important **herbaceous** species based on abundance were: poison ivy (Toxicodendron radicans, RIV = 18.4), beach grass (RIV = 16.1), Oriental bittersweet (Celastrus orbiculatus, RIV = 9.9), and little bluestem (RIV = 8.5). The most important **woody shrubs** based on abundance were: green ash (Fraxinus pennsylvanica, RIV = 38), catalpa (RIV = 20), and wafer ash (RIV = 11). The most important **trees** based on abundance were: catalpa (RIV = 52), black oak (RIV = 33), and Eastern cottonwood (RIV = 15).

4. **Transitional Community:** The transitional community was delineated as the area between the secondary dune and developed areas. Woody vegetation played a prominent role in the structure of the community. The most important **herbaceous** species based on abundance were: poison ivy (RIV = 17.6), Oriental bittersweet (RIV = 13.7), beach grass (RIV = 8.9), and bluegrass (Poa pratensis, RIV = 7.2). The most important **woody shrubs** based on abundance were: privet (Ligustrum vulgare, RIV = 26), black locust (Robinia pseudo-acacia, RIV = 22), common buckthorn (Rhamnus cathartica, RIV = 13), and tartarian honeysuckle (Lonicera tatarica, RIV = 12). The most important **trees** based on abundance were: eastern cottonwood (RIV = 36), American linden (Tilia americana, RIV = 14), black locust (RIV = 13), and black oak (RIV = 13).

Mushrooms and Lichens

We observed two mushroom species: oak maze-gill (Daedalea quercina), growing on fallen timber, and lawn mower mushroom (Panaeolus foenisecii), growing in sand in the secondary dune community. We observed three lichens, all growing on fallen timber in the secondary dune community: lemon lichen (Candelaria concolor), hooded sunburst lichen (Xanthoria fallax), and mealy rosette lichen (Physcia millegrana).

Invasive Plants

Forty-four species of vascular plants – nearly one third of the 164 species encountered within the project area – were classified as invasive plants per Appendix A. Most of the invasive species occurred in infestation areas mapped as natural resource management zones (Exhibit C). The most frequently encountered invasive species based on the number of management zones in which they appear are: Oriental bittersweet (nine zones), black locust (six zones), tree of heaven (five zones), and catalpa (five zones).

The majority of the management zones occurred within the Transitional Community, which is proximate to homes and access roads. This contiguity likely provides vectors for invasive species to establish within the dunes.

A handful of rare invasive species were encountered during general inventories but did not occur within management zones, including Sweet Vernal Grass, Crossflower, Field Thistle, Lily of the Valley, Common Teasel, Autumn Olive, Chinese Caps and Reed Canary Grass.

The following is a summary of invasive species encountered in each ecological community:

1. **Beach Community:** No invasive species were observed in the beach community.

2. **Foredune Community:** Catalpa saplings were the only invasive species observed within the foredune community. Due to harsh growing conditions, Catalpa is not likely to become a management issue in this community.

3. **Secondary Dune:** Half of the ten most important herbaceous species based on abundance within the secondary dune community were the following invasive species: poison ivy (RIV 18.4), Oriental bittersweet (RIV = 9.9), bouncing bet (RIV = 3.8), bluegrass (RIV = 3.7) and vinca (RIV = 2.5). Bluegrass and vinca likely have escaped from adjacent homes.

   70% (7 of 10) of the shrubs encountered were invasive species with a combined RIV of 43. Catalpa (RIV = 20) was the most important invasive shrub. Catalpa was also the most important invasive species (RIV = 52) encountered in the secondary dune.

4. **Transitional Community:** Four of the ten most important herbaceous species based on abundance within the transitional community were the following invasive species: poison ivy (RIV = 17.6), Oriental bittersweet (RIV= 13.7), bluegrass (RIV = 7.2), and daylily (RIV = 4.6). Nine of the 17 shrubs (52%) encountered within the transitional community were invasive species within a combined RIV of 80. Privet (RIV = 26), black locust (RIV = 22), buckthorn (RIV = 13) and Tartarian honeysuckle (RIV = 12) were the most abundant invasive shrubs. Three of eight trees encountered were invasive with a combined RIV of 36 (black locust RIV = 13, catalpa RIV = 9, white mulberry RIV = 4).

Insects

The identification of insects was limited by what we could see with the naked eye, without the use of nets or traps. We observed several small white and brown moths, monarch butterflies, swallowtail butterflies, and white cabbage butterflies (Lepidopterans); small black sand flies (Dipterans); a common green donner and green damselfly (Odonata); a red milkweed beetle and reddish-brown stag beetle (Coleopteran); and crickets (Orthoptera). In general, the diversity and abundance of insects was very low.

Birds

Forty bird species were identified during field visits. All of the species are common in that they would be readily found in similar habitats in the region.

While only three species (mallard duck, seagull and barn swallow) were identified along the beach transect, this transect was the most abundant with a total of 35 individuals, most of which were seagulls (32).

Three species consisting of five individuals were observed in the foredune community with barn swallows (two individuals) and field sparrows (two individuals) the most abundant.

Six species consisting of seven individuals were observed in the secondary dune community with field sparrow the most abundant (two individuals).

Twelve species consisting of 22 individuals were observed in the transitional community with American robin the most abundant (six individuals).

Rare, Endangered, or Threatened Species

We encountered two plant species of special interest: American sea rocket, which is on Indiana's Watch List, and sticky goldenrod (Solidago simplex gillmanii), which is an Indiana State Threatened Plant. The American sea rocket was observed entirely within the foredune community. 117 individuals were located mapped as shown on Exhibit C. Since American sea rocket typically occurs at the upland edge of the surf line, it is not unreasonable to assume that this species would be more abundant in the absence of beach grooming activities.

16 individuals of sticky goldenrod were observed, located and mapped in the transitional ecological community as shown on Exhibit C. Swink and Wilhelm (1994) refer to this species as dune goldenrod, and calls it a characteristic species of open dunes.

Discussion

Ecological Communities

Open space within the project area consisted of a degraded remnant dune system that nonetheless maintained characteristic and even sensitive native species of foredune, secondary dune and transitional ecological communities. We measured a Native Mean C value of 3.5 and an FQI of 32.6 which qualifies it per Wilhelm and Masters (2006) as at least of marginal natural area quality. These statistics likely would have been slightly higher had we completed additional floristic surveys during the late summer when many species in the Asteracea family bloom. Primary ecological stressors we observed were encroachment by invasive weeds; the absence of fire; and large areas of bare sand caused by pedestrian and ATV traffic that contributed to dune instability and subsequent blowing sand.

The diversity and abundance of non-native and invasive species was remarkable. More than half (86) of the 164 species observed were not indigenous. We classified nearly one-third (44) of the plants observed as invasive species.

In general, dune health, as measured by the abundance of invasive plants, decreases moving landward. The foredune is healthiest in that weeds are practically non-existent. This is because few species other than beach grass and scouring rush can survive the wind, blowing sand, and hot, droughty conditions that occur at the face of a dune. The most degraded areas occurred closest to homes and beach access areas, where soil disturbance and the diversity and abundance of invasive weeds were most evident.

In general, the potential to restore diverse and stabile ecological communities is high. The matrix of characteristic species persists, and plant diversity would increase dramatically with the management of shade-suppressing woody invasive species. Following the completion of remedial restoration activities – in which the most pernicious invasive species are brought under control through selective woody brush removal, the use of herbicide, and supplemental seeding and planting – prescribed fire would provide the most effective and economical tool to maintain and enhance the health of native ecological communities.

Sensitive Resources

We encountered two plant species of special interest: American sea rocket, which is on Indiana's Watch List, and sticky goldenrod (Solidago simplex gillmanii), or dune goldenrod, which is an Indiana State Threatened Plant. The American sea rocket was observed entirely within the foredune community. 117 individuals were located mapped per Exhibit C. Since American sea rocket typically occurs at the upland edge of the surf line, it is not unreasonable to assume that this species would be more abundant in the absence of beach grooming activities. A few specimen of dune goldenrod was observed in the transitional zone.

Areas mapped and specifically called out as having high Restoration Potential (Exhibit C) were secondary dune and transitional areas that, based on an ocular estimate, had a lower abundance of invasive plants, a higher abundance black oak and cottonwood trees or saplings. These areas also had high, long views, and visually characterized a healthier dune system. We recommend enhancing these higher quality areas first, and expanding upon their border. This might also be a suitable area for an interpretive trail.

Wildlife

The diversity and abundance of observed wildlife was low. This was due to the use of the area by people and the degraded condition of the habitat, as well as inherently severe ecological conditions associated with dune systems. Of equal or greater significance is that a detailed and comprehensive quantitative assessment of wildlife was beyond the scope of this study. A quantitative ecological assessment focused on wildlife likely would have resulted in greater wildlife abundance and diversity than was observed.

Adaptive Management

Dunes are dynamic systems that change in response to natural (lake levels, precipitation, wind, natural disturbances, succession, fire, etc.) and anthropogenic (soil disturbance, weeds, etc.) disturbances. Cowles (1899) wrote foundational papers on the natural succession of plants by observing the tension between plant communities associated with dunes on the south and eastern shores of Lake Michigan, and plant communities associated with the ever encroaching or submitting woodlands landward to the dunes.

It is thus appropriate that the management of dune resources for ecological health and use by residents be in accordance with adaptive management principles (Williams et al. 2009):

> Adaptive management is a decision process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a trial and error process, but rather emphasizes learning while doing . . . . Its true measure is in how well it helps meet environmental, social, and economic goals, increases scientific knowledge, and reduces tensions among stakeholders.

While adaptive management is a powerful management tool and strategy, in order to be successful:

- Leadership must support the needed changes;
- Stakeholders must work collaboratively to plan courses of action;
- Leadership and stakeholders must agree with and support goals and objectives.

Adaptive management is not appropriate:

- For single-time decision making;
- If base data is not available;
- If there are irresolvable conflicts between stakeholders as to goals, objectives and strategies;
- If appropriate management is not possible;
- If there is not a commitment to sustained funding, monitoring and assessment.

While the scope of our work is limited to conceptual access planning and the restoration of ecological resources, we acknowledge and emphasize the importance of employing adaptive management principles to maintain the long term viability and health of this dune system, for ecological communities including people.

Beach Pathways

The project scope explicitly stated that we should consider the potential of contouring the dunes to provide more accessible beach pathways. There are eighteen (18) dedicated public rights-of way that provide access to the beach. The slopes and loose sand at some of the access points have made universal access difficult. The Parks Department has expressed an interest in providing better accessibility for all residents by contouring access paths to decrease the slope that park users have to climb in order to get over the dunes and out to the beach. Neighbors have also discussed getting permission from the Park Department to create and maintain reasonably accessible pathways from their homes to the beach.

If contouring dune access paths is selected as a strategy to provide better universal accessibility, the manner and degree to which the contouring occurs will determine the effect on ecological communities. On one extreme, we observed the effect of removing the dunes between a house in Long Beach and Lake Michigan: the ecological community was annihilated, and rows of fencing and walls were installed to reduce blowing sand. On the other hand, incidental contouring caused by volunteer trails had also removed soil-stabilizing beach grasses and caused blowouts. This was especially apparent at the crest of the dunes on many public and private access points, where steep slopes caused people to walk on the beach grass adjacent to the path, which wore away the grasses and caused the bare sand path to increasingly widen.

We believe the judicious contouring of dune access paths could be accomplished to have minimal effect on ecological communities if the following general conditions were observed:

- The path is located to avoid sensitive areas and vegetation;
- Private paths cut through the dune are constructed of a boardwalk, mat, or other hard surface to reduce erosion, prevent blowing sand, and facilitate walking.
- Bare sand adjacent to the cut path is immediately stabilized with native beach grass (Ammophila brevilugulata);
- Volunteer trails in close proximity to each other are consolidated into improved trails so the net result is less exposed sand.

Restoration and Management

Ecological restoration is an intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity and sustainability (SER 2004).

The attributes of a restored ecological system include (SER 2004):

1. The predominance of characteristic species and structure that align with a reference ecosystem;
2. Indigenous species;
3. Appropriate functional groups;
4. Sustainable, reproducing populations of target communities and structure;
5. Normal ecological processes (wind, fire, waves, etc.) are functioning;
6. Contiguity with the larger ecological matrix;
7. Potential ecological stressors have been eliminated or reduced;
8. Resiliency to normal environmental stresses;
9. The ability to sustain itself similar to that of a reference community.

As noted above, managing invasive species is one of the fundamental stressors that must be addressed to restore the health of ecological communities within the project area. The following criteria developed by the National Park Service (NPS 2006) are helpful in guiding the management of specific invasive species:

- Control is prudent and feasible;
- The species interferes with natural processes and the perpetuation of natural features, native species or habitats;
- Disrupts the genetic integrity of native species;
- Disrupts the accurate presentation of cultural landscape;
- Damages cultural resources;
- Significantly hampers management of the park or adjacent lands;
- Poses a public health hazard;
- Creates a hazard to public safety.

Exhibit C indicates management zones where invasive plants or other management activities are proposed. Appendix G provides a summary of the species and relative abundance of invasive species per management zone. Appendix J provides specific management recommendations for each invasive species.

Ecological restoration typically occurs during two phases: a **remedial phase** and **maintenance phase**. The remedial phase is the most intensive and expensive in that invasive species are largely controlled; ecological stressors are removed or reduced; native species and structure are reintroduced as appropriate; and ecological systems (wind, fire, etc.) are restored such that they can maintain community resilience with minimal effort. During the maintenance phase, the focus is on maintaining ecological systems that will sustain ecological communities restored during the remediation phase.

At Sheridan Beach and The Esplanade, areas outside of the mapped management zones per Exhibit C require maintenance level restoration work through the use of prescribed fire; minor replanting of erosion areas; and the monitoring and quick removal of invasive weeds as they appear. Areas within the management zones require extensive remedial work.

Recommendations

We recommend the following activities to address the principles set forth in the introduction, and to reestablish the attributes of a restored ecological system as described above.

1. **Protect and Expand Healthiest Areas First**. The foredune and most of the secondary dune communities are the healthiest in that they most closely meet attributes described above. It is much less effort to maintain and geographically expand a healthy community than it is to conduct remedial restoration work. Therefore, we recommend that the Parks Department maintain and enhance healthy communities as a first priority.

2. **Use Prescribed Fire**. Fire is a natural system that controls woody vegetation and cool season invasive weeds, and stimulates the germination and productivity of native, warm season flora. The use of prescribed fire is the least expensive management tool to restore and maintain healthy communities. In areas where woody vegetation has not encroached, we recommend burning on a three to five year cycle. In areas where

woody material needs to be reduced, we recommend up to annual burning until woody material can be controlled using fire on a three to five year cycle.

3. **Contain and Remove Weeds**. Weeds within management zones should as a first priority be contained, and as a second priority be eradicated. See Appendix J for specific management recommendations for each invasive species.

4. **Reintroduce Native Species**. The native seed bank is largely intact, and will be stimulated by proposed management activities. However, there will be areas where the seed bank has been lost or exhausted. Installing a simple seed mix in areas where severe infestations of weeds have been eradicated will help native species out compete weeds in the future. Please see Appendix H for a list of representative species per zone for restoration seeding and planting.

5. **Improve and Consolidate Access Paths**. Existing access points provide vectors for weeds, and have resulted in numerous, closely-spaced volunteer paths. Improving and consolidating access will reduce invasive weeds, and stabilize blowing sand that contributes to excessive dune growth. See additional discussion under the Public Access Plan section of the report.

6. **Landscaping Guidance**. Develop landscaping guidance for property owners proximate to the park that would preclude the use of plant material that could become an invasive weed in the park.

7. **Minimize Exposed Sand**. Minimizing exposed sand will reduce blowing sand that contributes to dune formation. This can be achieved through improving and consolidating public access as described above, and restoring blowouts in the dunes.

8. **Encourage Sand Accretion and Stabilization Towards the Lake**. Low water levels in Lake Michigan have contributed to a wider beach which has resulted in a larger area where sand can blow, thus leading to higher dunes between the water's edge and adjacent properties. We also speculate that regular beach grooming activities have further widened the beach by keeping dune grasses at bay. While it is difficult to predict exactly how far out the beach grass might extend if these activities were removed, implementing strategies below provide some guidance. We recommend the following:

    a. Sand/snow fence. Dunes form as blowing sand falls out of the air, typically around structures that create turbulence that reduces the energy and particle carrying ability of the wind. We recommend placing sand/snow fence (or something equally functional, but more attractive, such as a split rail fence) perhaps approximately 50' on the lake-ward side of the foredune to encourage dunes to grow out toward the lake, rather than increase the height of the present dunes.
    b. Grooming buffer. We speculate that the extent of beach grass would expand towards the lake if not for such extensive beach grooming. We recommend creating an approximately 50' buffer between the existing toe of the foredune and the lake to encourage the growth of beach grass, thus limiting the expanse of bare sand that contributes to dune formation.
    c. Restore beach grass. Beach grass could be planted behind the experimental sand/snow fences, or within the 50' buffer described above to accelerate the process.

9. **Monitor**. While the implementation of proposed management strategies will result in a dune system that is more maintainable, regular monitoring will ensure that future stressors do not become management issues that require remedial action.

Performance Standards

Performance standards provide managers with a target toward which to work, and signify progress when milestones are reached. Basic performance standards are described below. These can and should be reviewed as part of an adaptive management strategy.

Standard 1: Invasive Weeds – Total cover by invasive weeds should not exceed:

- 1% in the foredune community;
- 15% in the transitional and secondary dune communities.

Standard 2: Total Wood Cover – Total cover by trees and shrubs should not exceed:

- 5% in the foredune community;
- 20% in the secondary dune community;
- 50% in transitional dune community.

Standard 3: Importance Values – the 10 most important herbaceous species in terms of abundance in all zones should be non-weedy native species.

Standard 4: Bare Soil – Areas of bare soil outside of a prescribed path that are ≥ 0.25 square meters should be stabilized with native plant material.

Management Schedule

The following management activities are suggested during the Remedial Phase of restoration, as scheduled by quarter of the year:

	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Selective woody brush removal	x			x								
Herbicide woody re-sprouts				x		x	x			x	x	
Herbicide herbaceous weeds		x	x			x	x			x	x	
Supplemental planting					x			x	x			x
Prescribed Burning	x				x				x			

The following management activities are suggested during the Maintenance Phase of restoration:

- Annual monitoring for infestations of weeds
- Prescribed burn every three years
- Supplemental seeding/planting as necessary
- Supplemental herbiciding, brushing, etc., as necessary

An opinion of probable cost for restoration activities is included in Appendix I, which shows costs per task listed above. Years 1 through 3 are the remedial phase of restoration, while the maintenance phase activities are listed in Years 6 and 10.

Public Access

The original purpose of the public dedication of Sheridan Beach and The Esplanade was to provide public access for Michigan City residents to the shores of Lake Michigan. Given the dynamic nature of the dune environment, a public access plan is critical to balance the desired access with the need to protect sensitive resources and respect neighbors living in immediate proximity to the beach.

To inform the access plan, ecologists and landscape architects experienced in park planning and design visited the site to assess current conditions and note existing opportunities and constraints for access. Weaver Boos Consultants also field located and delineated manmade structures with GPS, including boardwalks, patios, decks, buildings, and other encroachments. Maps showing the manmade structures are included in Exhibit D. This field data was obtained from a handheld GPS device on June 6 and June 12, 2012. Structures that could not be shot due to satellite interference from trees, heavy brush, or overhead structures were manually added to the maps and noted as approximate.

Beach Access Observations and Recommendations

To understand the level of public access needed at Sheridan Beach and The Esplanade, the park must be understood within the overall fabric of the Michigan City park system. The City has approximately 3 miles of magnificent beaches that are open for public enjoyment, of which Sheridan Beach and The Esplanade provide the eastern third of the system. The Washington Park Beach at the western edge fulfills much of the need of the entire regional community for access to the water, with parking located very near to the beach and available restroom and changing facilities. Sheridan Beach and The Esplanade are noticeably quieter, given that users must walk in a greater distance to reach the water's edge. For this reason, this section of the overall beach system tends to serve more local neighbors, both those immediately adjacent to the park and those living or staying within close walking distance. This impacts the recommendations, as pedestrian access appears to be a higher priority than vehicular access or parking.

The following access improvements are suggested for Sheridan Beach and The Esplanade:

1. Wayfinding on the beach is well established, with the City's flag color and number system providing critical location identification for emergency personal as well as landmarks for daily beach users. However, from the City street system, markers for the public access points are almost non-existent. Signs from the former bus stops near the access points provide some wayfinding assistance, but the signage is often located far from the actual public access, resulting in confusion. In some instances, adjacent neighbors have taken over portions of the public access right-of-way for vehicular parking and their own use, leading to further ambiguity of whether the public is invited to use the park. In particular, access #8 was difficult to determine. A signage system that reflects the successful beach system should be implemented at every public access point to clearly demarcate the trailheads. A clear signage plan will also reduce the potential for trespassing through private lots by confused public looking for the beach.

2. The City currently provides a single universally accessible trail connection to the beach called the beachwalk, which is centrally located within the project site. This was heavily used by families toting

strollers, coolers, and wagons during our site visit. The beachwalk is in need of minor repairs, such as replacement of individual weathered boards and painting, but otherwise appears to be in good condition. Parking at the beachwalk should remain, but is in need of maintenance to remove silt that has washed onto pavement and to repair curbs.

Given the current low water levels of the lake, the beachwalk also ends a long distance from the water's edge. This limits accessibility and has resulted in numerous parallel paths cut through the dunes to get to the beach. A hard surface path the same width as the existing boardwalk section should be provided from the current end of the boardwalk to the beach edge of the foredune. Multiple options that sit directly on the sand surface are available that are of simple construction and lower cost than the existing structure. These may include a cordwalk, segmented boardwalk sections set end-to-end, or a pre-fabricated product such as the MobiMat RecPath (http://www.mobi-mat-chair-beach-access-dms.com/).

3. The City should also consider a second universally accessible trail option to the beach, as the current beachwalk has limited parking and is located a long distance from the dense housing at the west end of Sheridan Beach. Because of the existing parking available at California Avenue and the potential to increase future parking at Lake Avenue, we recommend that a second accessible trail be constructed at this location. The trail could link to both California and Lake Avenues and provide connections to the residences between these streets, while providing a single access out to the beach. This will dramatically reduce the amount of exposed sand caused by the multitude of interconnecting paths in this section of the project area.

4. Given the City-owned lots adjacent to Lake and Illinois Avenues, parking for beach users can be easily increased by allowing parallel parking along the Colfax Avenue frontage of these lots. The area is currently signed 'No Parking." A permeable gravel parking strip or pervious concrete pavers could be provided along the street edge to prevent rutting of the shoulder while limiting stormwater runoff. If the second universally accessible trail described above is constructed at California and Lake and increases the need for additional parking, a lot could be constructed on the parcel at Lake Avenue.

5. Exhibit C for the Natural Resource Management Zones identifies an area of high restoration potential in the project area near the Carolina Avenue and Shawmutt Drive access points. This area of quality black oak dune savanna provides an opportunity for environmental education and recreation to explore the dune system and take advantage of high points offering long viewsheds. A boardwalk loop could be constructed within this area, with interpretive signage regarding general dune ecology and restoration efforts as well as benches offering areas for quiet contemplation. Connections to the boardwalk could be provided from Nevada Avenue, Carolina Avenue, Shawmutt Drive, and Access Point #6. Also, a small parking area for the boardwalk could be providing by installing angled parking along a new one-way road connection from the end of Colfax to Carolina, using the existing Colfax right-of-way extension.

6. As discussed in the ecological recommendations above for beach paths, there is a need to balance access to the beach with the impacts to the health of the dune system. There are opportunities for compromise with the neighboring landowners to narrow the existing exposed sand paths and reduce the overall number of trails by allowing the neighbors to construct a small hard surface path that provides them easier accessibility to the water's edge as described in the section above. This path repair method should also be considered for the public access points to repair expanding path widths at the crest of the dunes. A hard path surfacing

material could be installed only at the steepest portions of the paths over the dune, which limits overall costs and maintenance responsibilities while preventing additional side-cutting from people walking on the adjacent grassed dune for better traction.

7. In addition to interpretive signage at the proposed Carolina/Shawmutt boardwalk trail loop, educational signage could be provided at highly used access points to promote awareness of characteristic plants, rare species, and the unique dune environment.

Costs associated with any of the capital improvement projects recommended above will vary greatly depending on the final design of the project, including material selection, foundation considerations, and size/scope of structure. For example, the cost of a hard surface path may range from $90/linear foot for a 6.5-foot wide product like the MobiMat RecPath to approximately $430/linear foot for an 8-foot wide boardwalk with full height railing similar to the existing beachwalk. Parking improvements also range in price from a low of gravel surfacing at approximately $1/square foot to high end of pervious concrete pavers at $12 to $15/square foot including base material. Budgets should be individually established for selected improvements once the project scope is determined.

In conclusion, Sheridan Beach and The Esplanade provide an extraordinary public asset to the community. Careful management of the health of this unique ecological system and its valuable public access points will ensure that the dunes and beach contribute to the quality of life in Michigan City for years to come. The Parks Department should work together with the neighbors, beach users, and local environmental groups to gain consensus on implementing recommended improvements and to garner the public support essential for long-term success.

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SMITHGROUP JJR

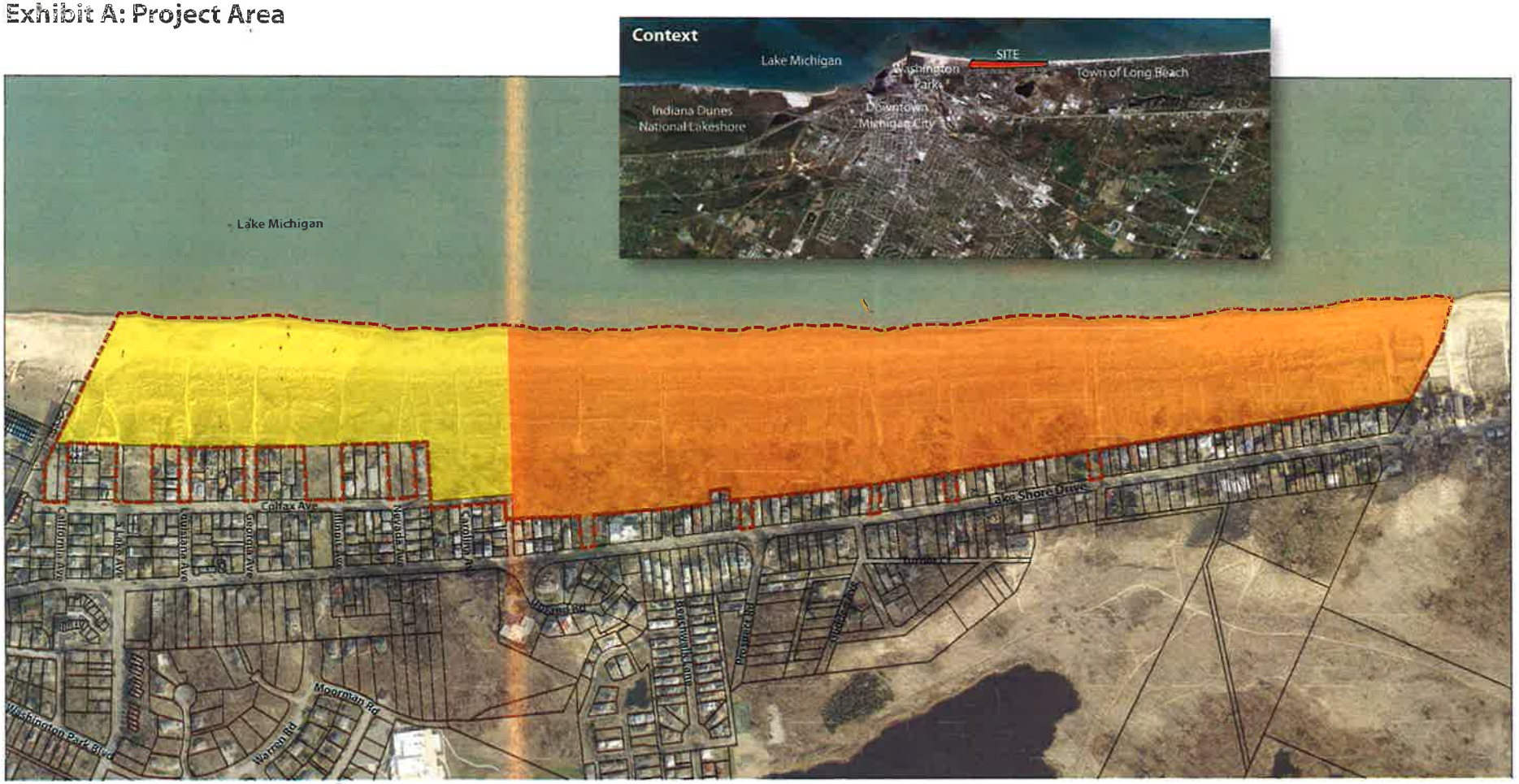
SHERIDAN BEACH PUBLIC WATERFRONT

Ecological Assessment

EXHIBIT A

Project Area

Exhibit A: Project Area



Sheridan Beach Ecological Assessment

Michigan City, Indiana

October 17, 2012

Note: Parcel data and aerial photography based on existing data sources from local and state agencies and has not been field verified for accuracy.

Area of Interest

Parcel Boundary

Sheridan Beach

Esplanade

Feet
0 200 400 600 800

SMITHGROUP JJR

SMITHGROUP JJR

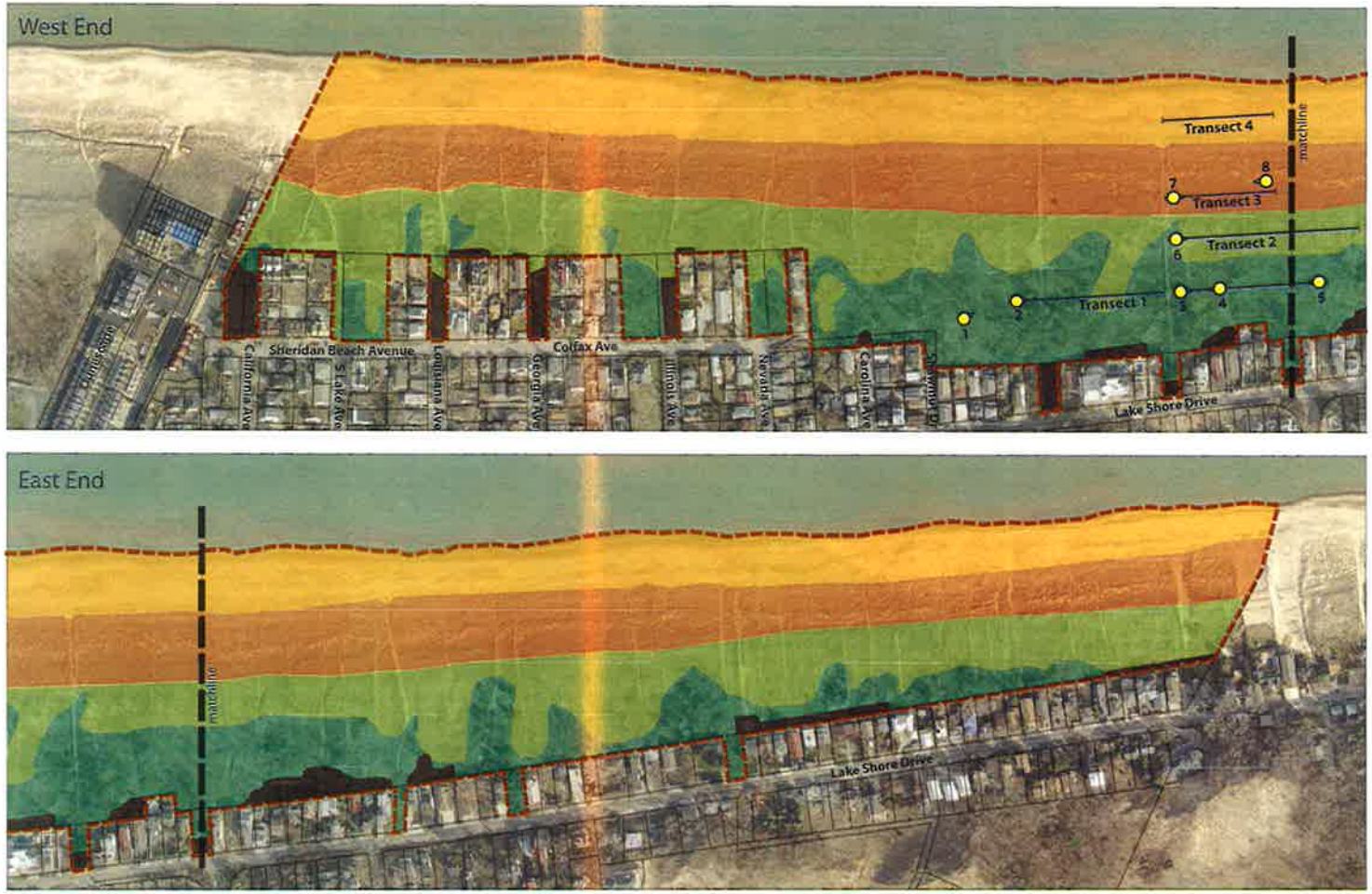
SHERIDAN BEACH
PUBLIC WATERFRONT

Ecological Assessment

EXHIBIT B

Ecological Communities and Transect Locations

Exhibit B: Ecological Communities and Transect Locations



Area of Interest

Parcel Boundary

Beach

Foredune

Secondary Dune

Transitional Area

Developed Land

Photo Point

Transect

0 75 150 300 450 600 Feet

Sheridan Beach Ecological Assessment
Michigan City, Indiana

October 17, 2012

Note: Parcel data and aerial photography based on existing data sources from local and state agencies and has not been field verified for accuracy.

SMITHGROUP JJR

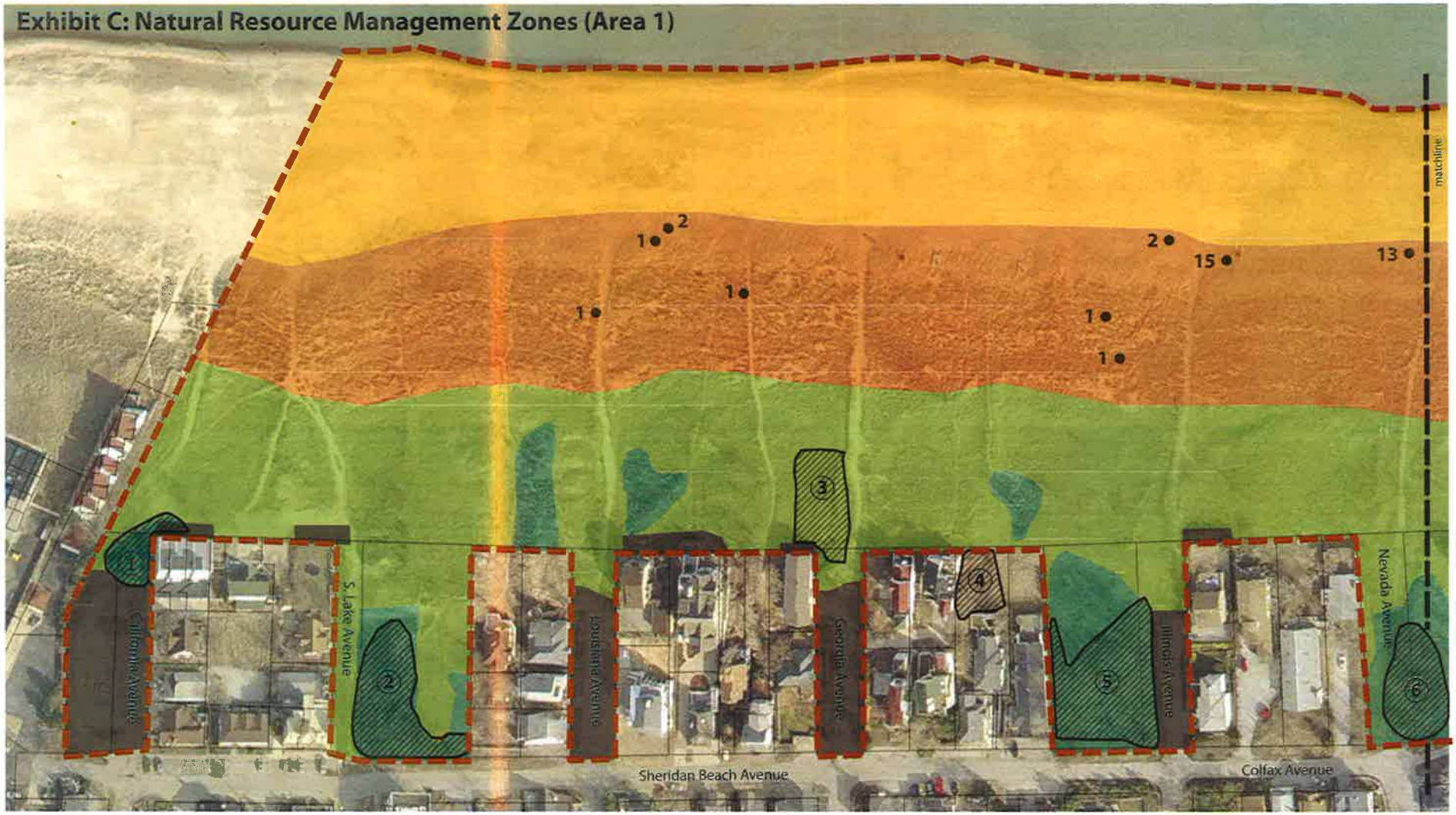
SMITHGROUP JJR

SHERIDAN BEACH PUBLIC WATERFRONT

Ecological Assessment

EXHIBIT C

Natural Resource Management Zones



Sheridan Beach Ecological Assessment

Michigan City, Indiana October 17, 2012

Note: Parcel data and aerial photography based on existing data sources from local and state agencies and has not been field verified for accuracy.

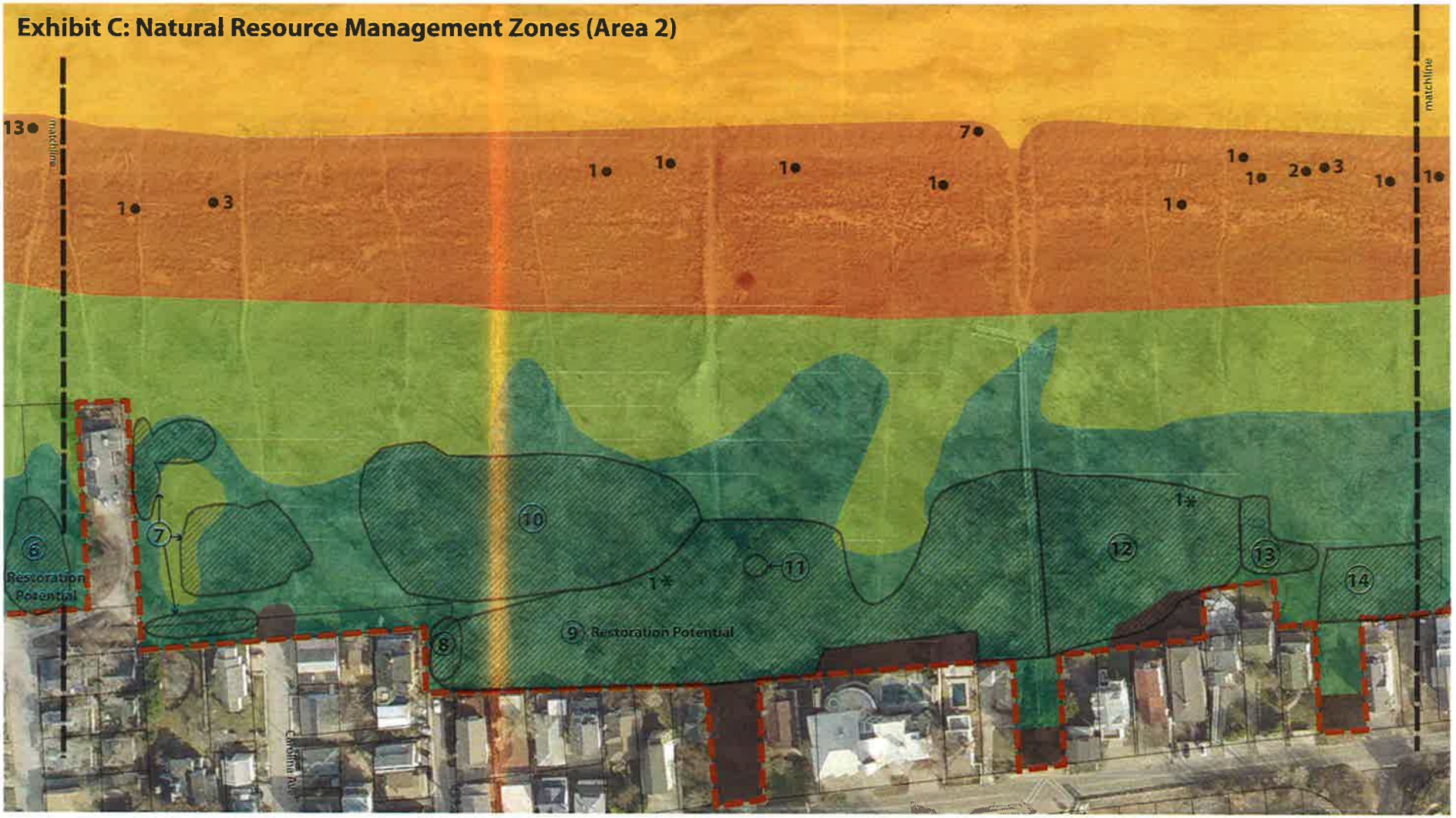
- Area of Interest
- Natural Resource Management Zone
- Parcel Boundary
- Beach
- Foredune
- Secondary Dune
- Transitional Area
- Developed Land
- 1 ● Rare Plant: Cakile edentula
- 1 ✳ Rare Plant: Solidago simplex

Location and Number of Plants

SMITHGROUP JJR

0 25 50 100 150 200 Feet

Exhibit C: Natural Resource Management Zones (Area 2)



Sheridan Beach Ecological Assessment

Michigan City, Indiana October 17, 2012

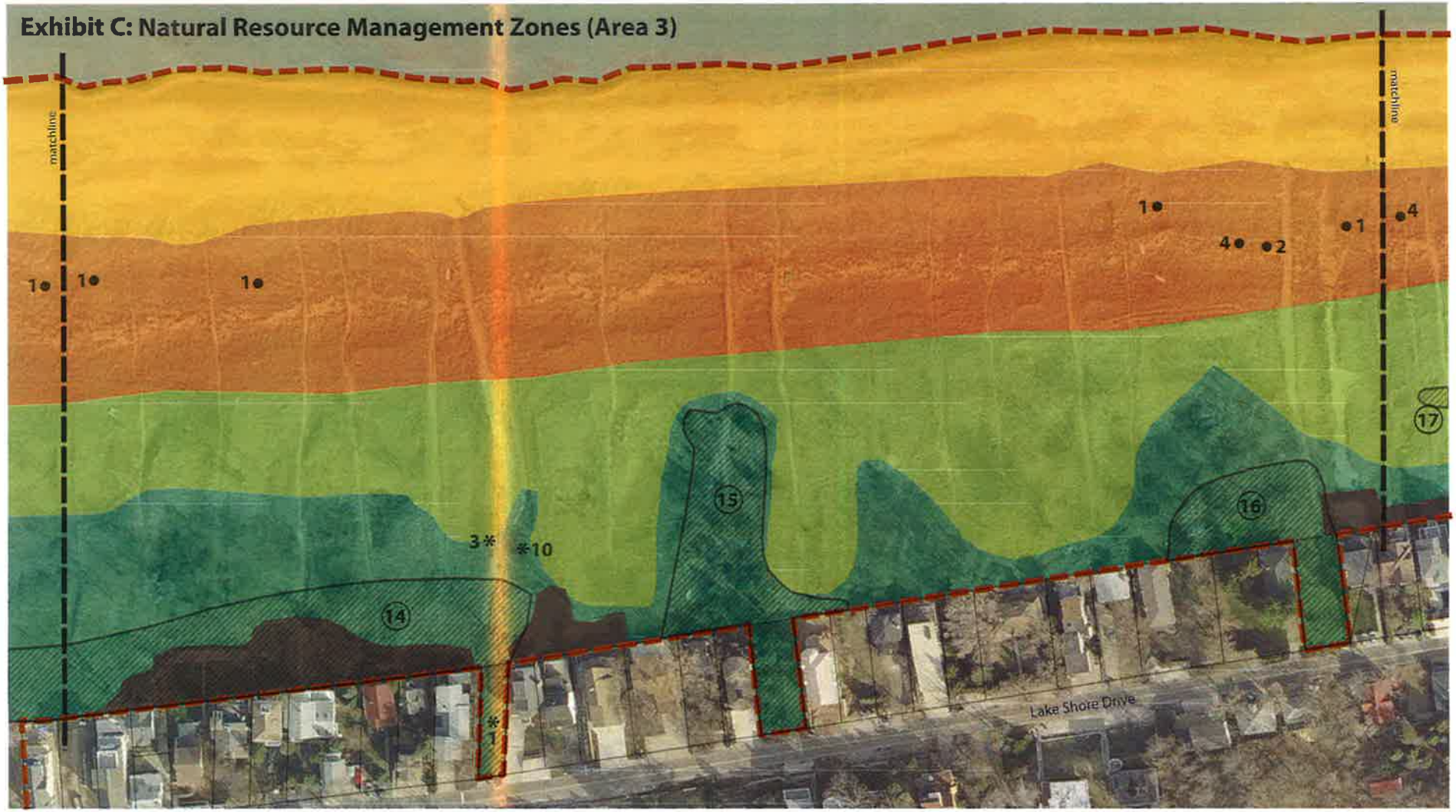
Note: Parcel data and aerial photography based on existing data sources from local and state agencies and has not been field verified for accuracy.

- Area of Interest
- Natural Resource Management Zone
- Parcel Boundary
- Beach
- Foredune
- Secondary Dune
- Transitional Area
- Developed Land
- 1 ● Rare Plant: Cakile edentula
- 1 * Rare Plant: Solidago simplex

Location and Number of Plants

SMITHGROUP JJR

0 25 50 100 150 200 Feet



Sheridan Beach Ecological Assessment

Michigan City, Indiana October 17, 2012

Note: Parcel data and aerial photography based on existing data sources from local and state agencies and has not been field verified for accuracy.

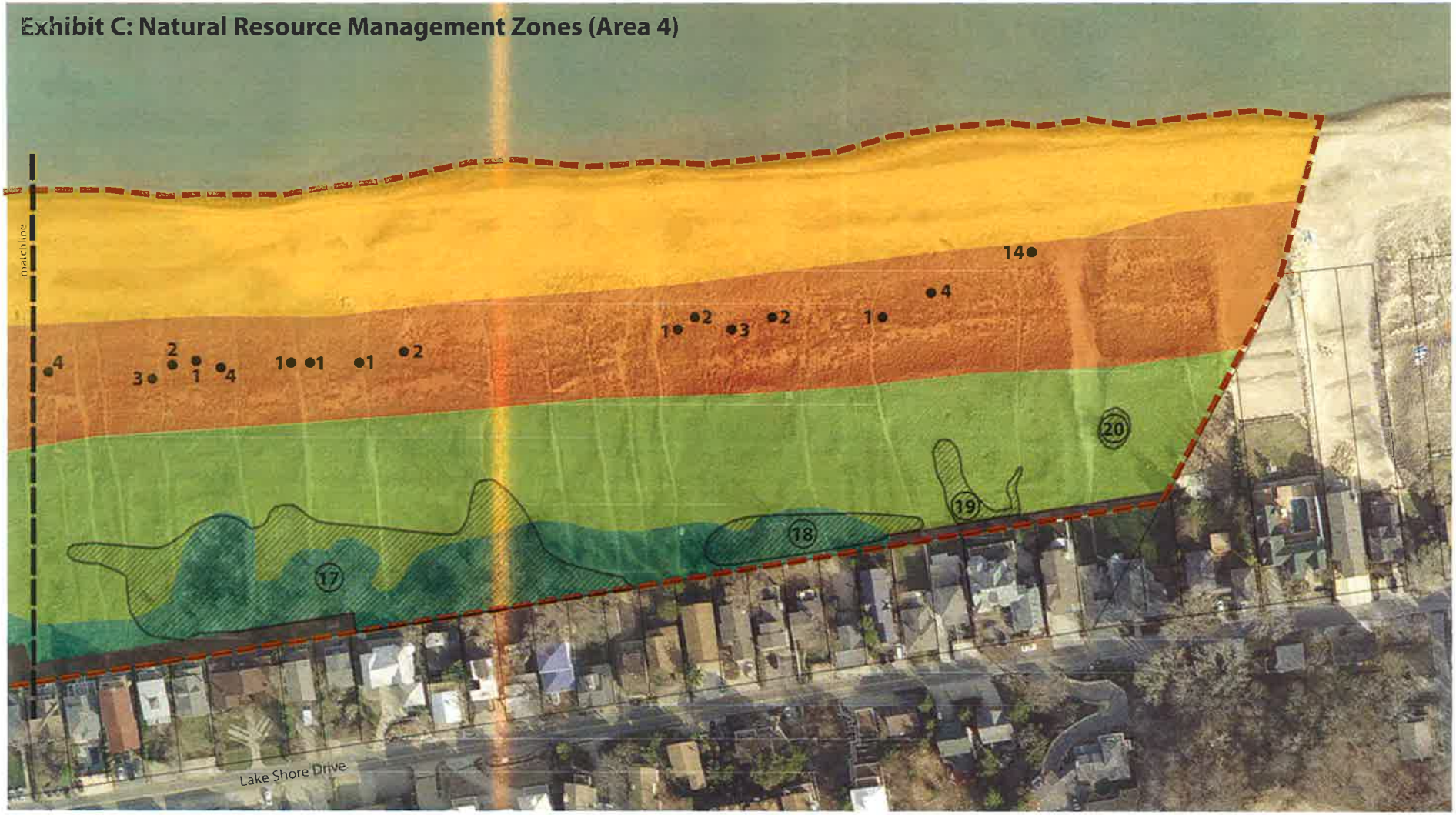
- Area of Interest
- Natural Resource Management Zone
- Parcel Boundary
- Beach
- Foredune
- Secondary Dune
- Transitional Area
- Developed Land
- 1 ● Rare Plant: Cakile edentula
- 1 ✱ Rare Plant: Solidago simplex

Location and Number of Plants

SMITHGROUP JJR

0 25 50 100 150 200 Feet

Exhibit C: Natural Resource Management Zones (Area 4)



Sheridan Beach Ecological Assessment

Michigan City, Indiana October 17, 2012

Note: Parcel data and aerial photography based on existing data sources from local and state agencies and has not been field verified for accuracy.

- Area of Interest
- Natural Resource Management Zone
- Parcel Boundary
- Beach
- Foredune
- Secondary Dune
- Transitional Area
- Developed Land
- Rare Plant: Cakile edentula
- Rare Plant: Solidago simplex

Location and Number of Plants

SMITHGROUP JJR

0 25 50 100 150 200 Feet

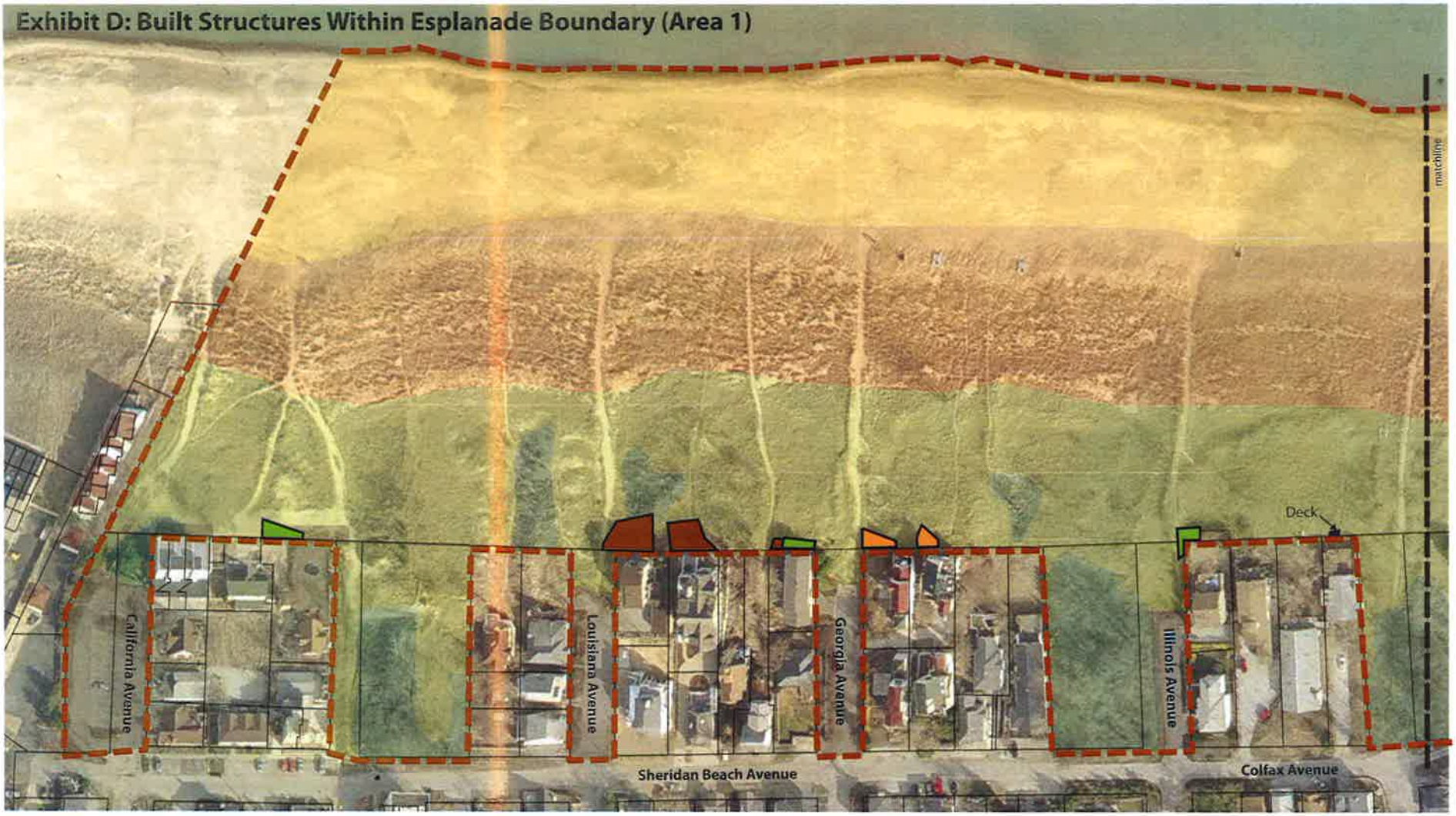
SMITHGROUP JJR

SHERIDAN BEACH PUBLIC WATERFRONT

Ecological Assessment

EXHIBIT D

Manmade Structures



Sheridan Beach Ecological Assessment

Michigan City, Indiana

October 17, 2012

Note: Parcel data and aerial photography based on existing data sources from local and state agencies and has not been field verified for accuracy.

Area of Interest

Parcel Boundary

Building

Patio

Deck

Concrete Structure, as labeled

Fence

Approximate designation given to encroachments that were unable to be located by GPS due to satellite obstructions.

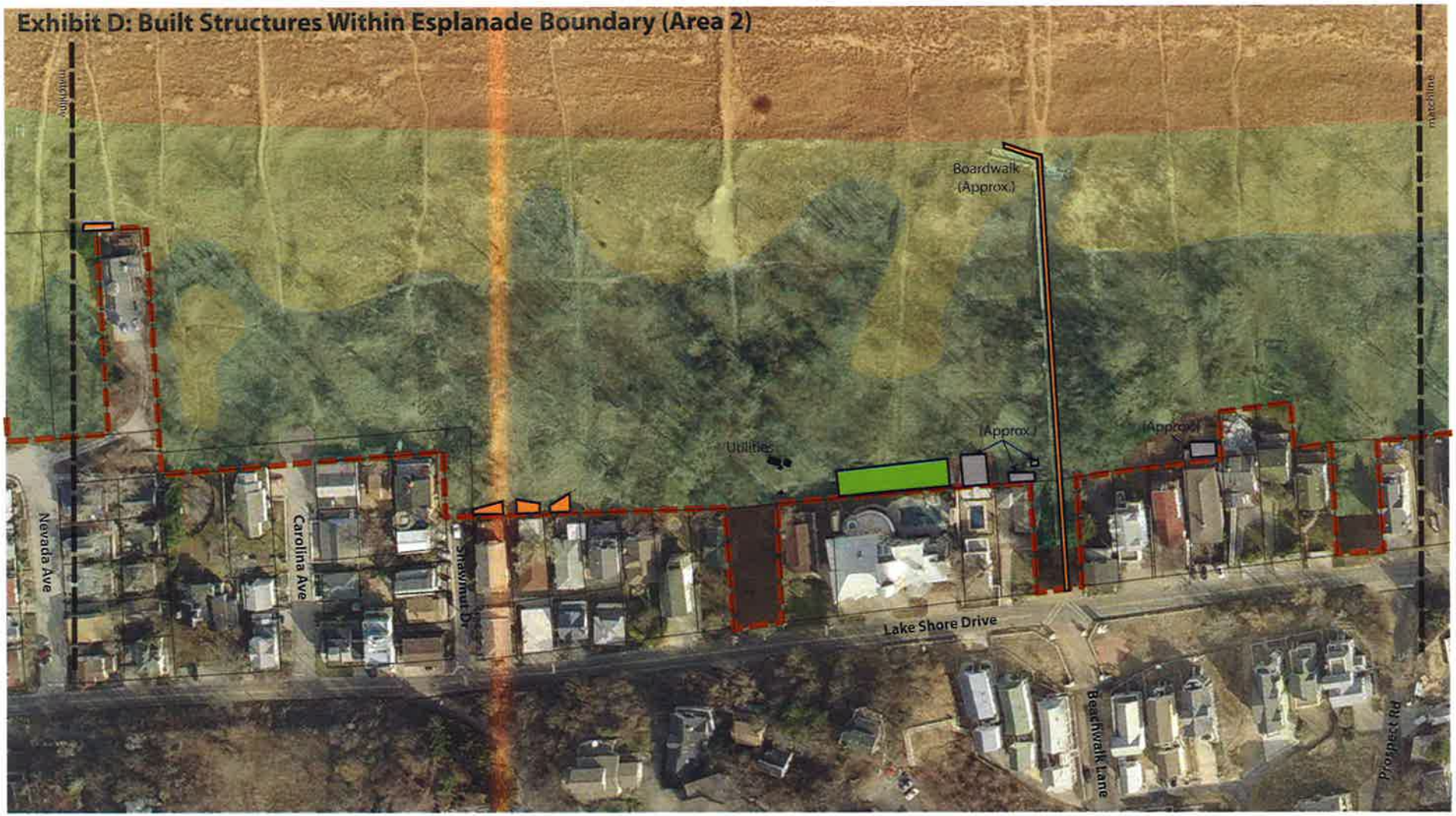
SMITHGROUP JJR

WEAVER BOOS CONSULTANTS

Feet

0 25 50 100 150 200

Exhibit D: Built Structures Within Esplanade Boundary (Area 2)



Sheridan Beach Ecological Assessment

Michigan City, Indiana

October 17, 2012

Note: Parcel data and aerial photography based on existing data sources from local and state agencies and has not been field verified for accuracy.

Area of Interest
Parcel Boundary
Building
Patio
Deck
Concrete Structure, as labeled
Fence

Approximate designation given to encroachments that were unable to be located by GPS due to satellite obstructions.

SMITHGROUP JJR
WEAVER BOOS CONSULTANTS

Feet
0 25 50 100 150 200

Exhibit D: Built Structures Within Esplanade Boundary (Area 3)

Sheridan Beach Ecological Assessment

Michigan City, Indiana

October 17, 2012

Note: Parcel data and aerial photography based on existing data sources from local and state agencies and has not been field verified for accuracy.

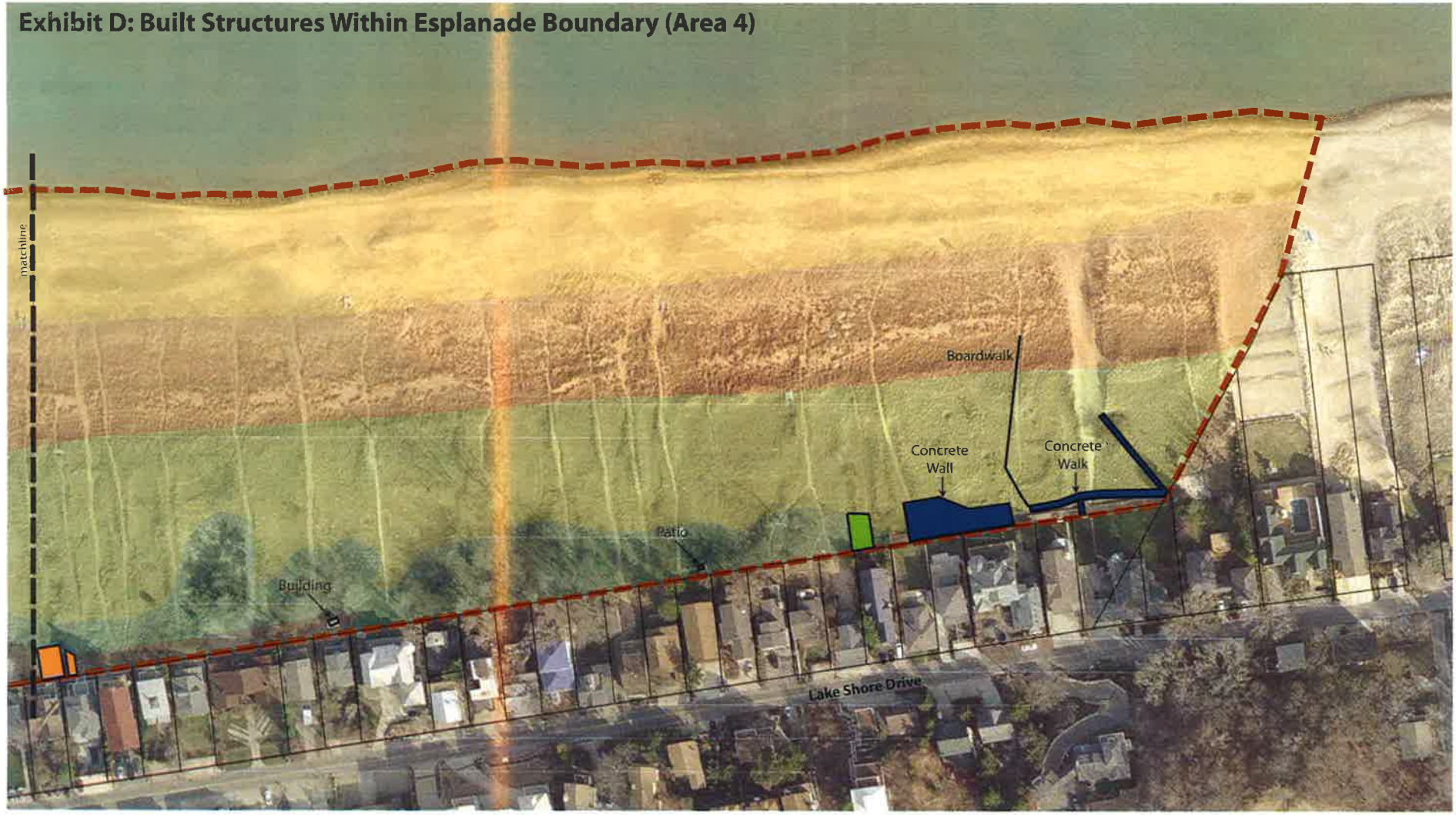
Area of Interest
Parcel Boundary
Building
Patio
Deck
Concrete Structure, as labeled
Fence

Approximate designation given to encroachments that were unable to be located by GPS due to satellite obstructions.

SMITHGROUP JJR
WEAVER BOOS CONSULTANTS

Feet
0 25 50 100 150 200

Exhibit D: Built Structures Within Esplanade Boundary (Area 4)



Sheridan Beach Ecological Assessment
Michigan City, Indiana
October 17, 2012

Note: Parcel data and aerial photography based on existing data sources from local and state agencies and has not been field verified for accuracy.

Area of Interest
Parcel Boundary
Building
Patio
Deck
Concrete Structure, as labeled
Fence

Approximate designation given to encroachments that were unable to be located by GPS due to satellite obstructions.

SMITHGROUP JR
WEAVER BOOS CONSULTANTS

0 25 50 100 150 200 Feet

SMITHGROUPJJR

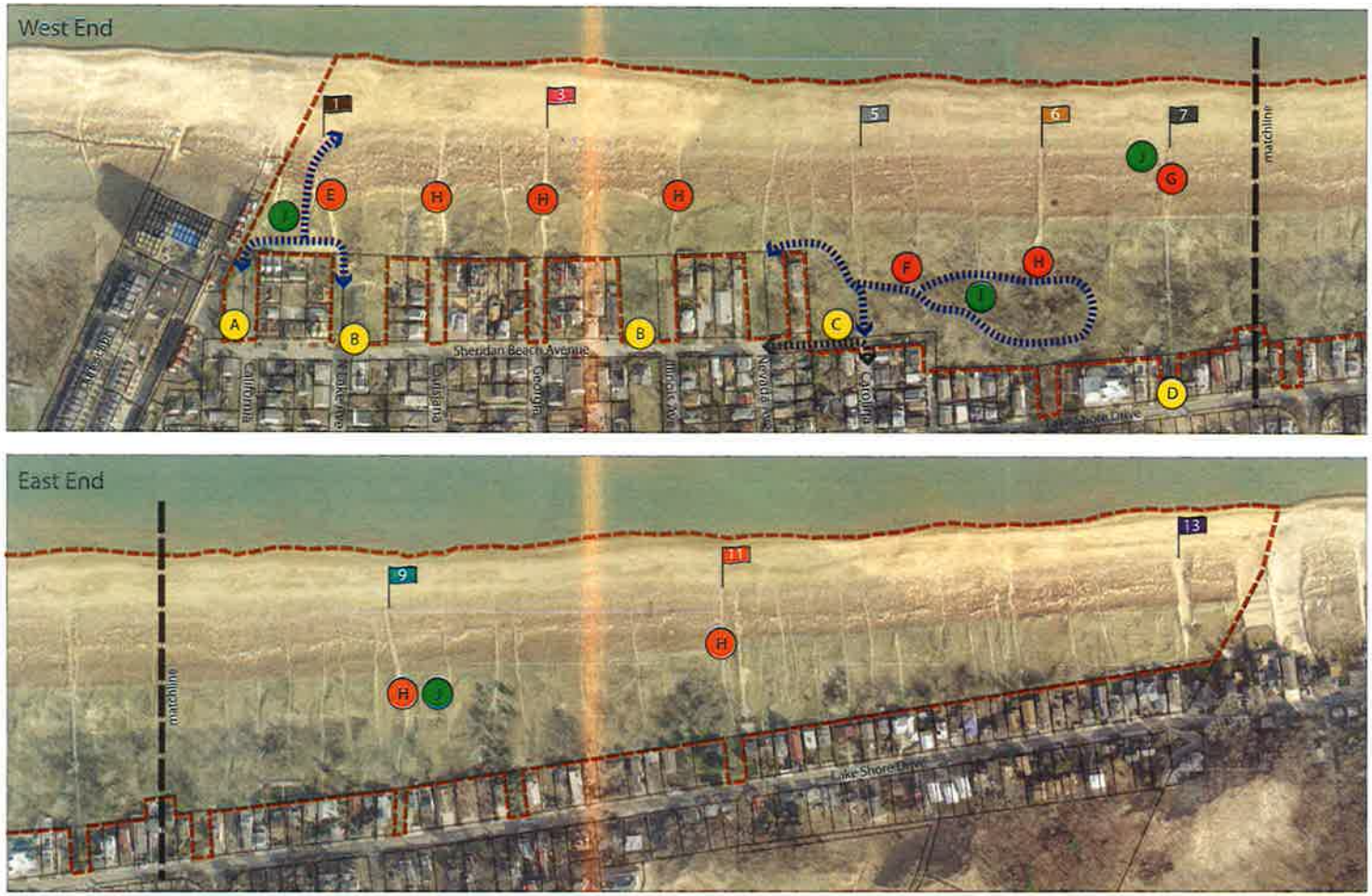
SHERIDAN BEACH
PUBLIC WATERFRONT

Ecological Assessment

EXHIBIT E

Public Access Plan

Exhibit E: Public Access



Vehicular Access and Parking

- A California Avenue - Maintain existing parking lot.
- B Lake and Illinois Avenues - Provide parallel parking along frontage of adjacent City-owned lot.
- C Nevada/Carolina Avenues - Consider connection between streets using extension of Colfax Avenue. Provide angled parking along street extension.
- D Beachwalk - Maintain existing parking lot.

Pedestrian Access

- E California/Lake Avenues - Combine trails into a single path to the beach. Provide a universally accessible path surface.
- F Nevada/Carolina/Shawmutt Avenues - Provide boardwalk trail that explores secondary dune/transitional habitat zones and capitalizes on views.
- G Beachwalk - Extend hard surfacing to edge of grass with on-sand accessible surface option, consolidating path network. Assess structure and repair/repaint as needed.
- H Other Public Access Points - Consider use of on-sand, accessible surface at trail high points to limit path side-cutting.

Ecology Education

- Provide interpretive signage on boardwalk loop regarding general dune ecology and restoration efforts.
- Provide signage on characteristic plants to promote awareness of the unique dune habitat.

Sheridan Beach Ecological Assessment

Michigan City, Indiana

October 17, 2012

Note: Parcel data and aerial photography based on existing data sources from local and state agencies and has not been field verified for accuracy.

Area of Interest

Parcel Boundary

Beach Location Flag

Pedestrian Circulation

Auto Circulation

0 75 150 300 450 600 Feet

SMITHGROUP JJR

SMITHGROUP JJR

SHERIDAN BEACH
PUBLIC WATERFRONT

Ecological Assessment

REPRESENTATIVE PHOTOGRAPHS

A. Native Dune Grasses

B. Prickly Pear Cactus

Representative Photographs

C. Poison Ivy Cover

D. Transect Line

E. Looking West Down Beach

F. Sea Rocket