STRATEGIC CONCESSIONS:

NEGOTIATING HUMAN LAND USE TO SERVE THE HABITAT NEEDS OF THE EASTERN MEADOWLARK

A THESIS BY RICHARD HAGSTROM
SUBMITTED FOR THE REQUIREMENTS OF THE MASTER
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Richard Evan Hagstrom

Thesis submitted to the faculty of the Virginia Polytechnic Institute
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ABSTRACT

Our civilization is facing increased populations and scarcity of habitat for a variety of species. Encroaching on these landscapes while engaging in habitat fragmentation and destruction, has negatively impacted biodiversity and subsequently put thousands of species at risk of going extinct. Attempts to avoid nature at all costs through the establishment of wildlife reserves has had beneficial outcomes and has enlightened the masses of the need to preserve and retain the biological richness and variety found in our great lands. Within this negotiation of resources, we are faced with the choice of whether to leave the responsibility of species management and care solely for those participating in conservation efforts, or can we attempt to provide situations where the interests of species can be addressed without the need to exclude humans from these landscapes. It is my contention that efforts to engage in Reconciliation Ecology can be mutually benecial for both humans and species, and this engagement can occur in a recognized area of avian species interest. This thesis is an attempt to adhere to the Reconciliation Ecology model, posited by Michael Rosenzweig in his book Win Win Ecology, of accommodating the needs of species, specifically the Eastern Meadowlark, through the designing of our landscape. This is to be accomplished through the analyzing of designated future land use in King William County Virginia, taking measures to accommodate the stormwater runoff of a 5 year/24 hour storm as calculated using the SCS method, and taking ques from the King William County Comprehensive Plan, suggesting engagement of the Pamunkey River while promoting physical activity amongst residents.

STRATEGIC CONCESSIONS

NEGOTIATING LAND USE TO SERVE THE HABITAT NEEDS OF THE EASTERN MEADOWLARK

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GENERAL AUDIENCE ABSTRACT

Our civilization is facing increased populations and scarcity of habitat for a variety of species. Encroaching on these landscapes while engaging in habitat fragmentation and destruction, has negatively impacted biodiversity and subsequently put thousands of species at risk of going extinct.

With humans causing peril for various species via habitat losses and degradation due to our developing of landscapes, as Landscape Architects, we have a responsibility to minimize, negate, or rectify these losses and while still providing serviceable landscapes for our fellow humans. One possible avenue to pursue when motives for the well being of the collective are being considered is designing landscapes that serve both human and species in unison, with services being provided for humans and satisfying the needs of wildlife.

This project is based on a desire to accommodate the needs of a growing community by providing a stormwater retainment system serving as a pedestrian artery to a historic river, while also accommodating the needs of wildlife by establishing a constructed meadow that satisfies habitat requirements for the Eastern Meadowlark. Through analysis of stormwater volumes, building code setbacks regarding waterways, habitat requirements of the Eastern Meadowlark and land volume manipulation, a solution to many obstacles facing community and species has been posited in this project: the Dianna Dayle River Walk.

This work is dedicated to:

my family, I could not have done any of this without your support..

aunt Dianna..we love you and miss you too..

Eleanor, you were my inspiration..
and why I had to try.

TABLE OF CONTENTS DIANNA DAYLE RIVER WALK

IMAGE

IMAGE

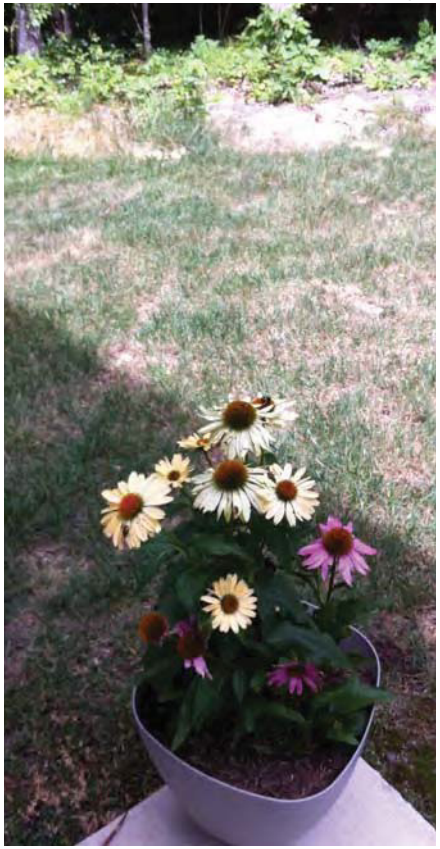
INTRODUCTION

INTRODUCTION

In an attempt to entice bumble bees for observation, I introduced Echinacea (Coneflower) in my backyard this past summer. While the effort facilitated the observation of my target, the bumble bee, this willful interference also produced an instance to observe something I had missed, the majestic and alluring American Goldfinch. My initial impression of this species had me convinced a neighbor had lost their pets. What were these bright, highlighter-yellow hued, window screen-clinging invaders? Why were they attracted to the Echinacea? Reflecting on past experiences with avian species, which were limited to say the least, memories of thinking someone had lost their pet bird were present and subsequently attributed to the observation of American Goldfinch, unbeknownst to me at that time. The occurrence to see this once embarrassingly exotic bird required investigation. American Goldfinch was the species possessing these attributes of horseplay and domesticatible beauty. The introduction of the Echinacea was not only a success for bumble bee observation, but initiated in-depth thought on how we are presented experiences daily to observe beautiful avian species and how my action of interfering with nature to provide a service for myself, and how this interference was beneficial for many species for many reasons. An appreciation was gained; that of the value in experiencing different species, and a level of righteousness was also gained; a feeling of caretaker to things so beautiful and worthy. At the time, I was under the impression, in some minute way, that I may have restored the habitat these American Goldfinch could have lost due to the development of the land and subsequent clearing of vegetation they were so drawn to. The services provided myself, that of enjoyment from engaging and observing wildlife while participating in scholastic activities, was made possible through my actions and provided these American Goldfinches a place to land and be birds. The desire to include a species in a certain habitat, bumble bees, was the catalyst to recognizing the dimension biodiversity can add when experiencing nature and provided myself with the confidence that interfering with habitats could provide mutual benefits for both humans and our fellow inhabitants of Earth. It is through this lens that I intend to provide the public with a solution in which to engage wildlife at a location while providing instances that can also benefit native species found there.

INTRODUCTION BUMBLE BEE WATCH

IMAGE-1



ECHINACEA PLACED IN BACK YARD.

IMAGE-2

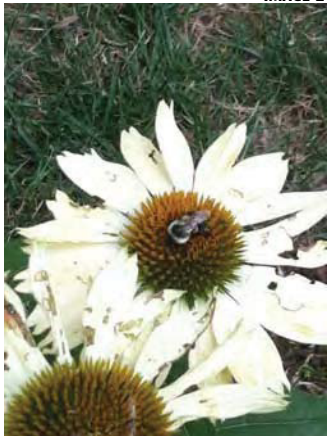


IMAGE-3

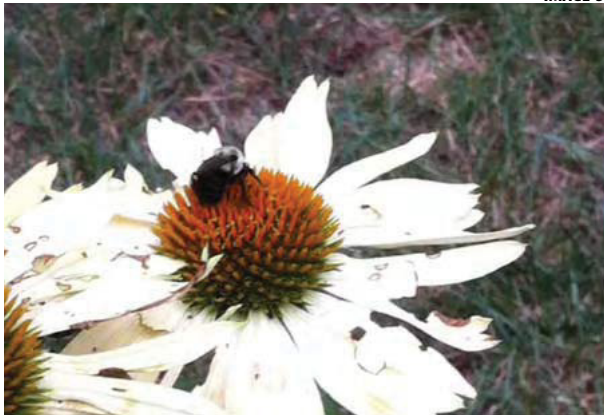


IMAGE-4

BUMBLE BEE ARRIVAL

INTRODUCTION

What is Biodiversity?

Biodiversity is a richness and variety of species in an ecosystem. The benefits of having this abundance of life in any one location are numerous, from providing habitats for each other to providing a food source. Bumble Bees pollinate, allowing for fertilization, thereby producing successive plants which would provide a food source to birds. Birds use the nests of other birds, and in between nest migrations may excrete seeds allowing for future plantings for the biological community to benefit from at a later date. Humans are a part of this biological community, as the plantings birthed from the excreted seeds from avian species may aid in our efforts to reduce the erosion of our landscapes, just as the pollination attributed to the bumble bees also provides an eventual food source for humans. Biodiversity is beneficial to all species, and any negative effects on biodiversity are detrimental to all. A condition facing biodiversity and our subsequent ability to reap the rewards afforded us from this web of biological richness is the human tendency to expand or develop land. According to the U.S. Fish and Wildlife Service, every state contains imperiled or endangered species, with the highest numbers being found in states with high population growth (fws.gov). With biodiversity facing many threats, destruction of habitat has become the most significant (Beatley, 2000). With habitat loss and fragmentation being direct results of urbanization and suburban and exurban growth pressures (Lassila, 1999), and a population that is expected to reach 9.7 billion by 2050 (www.un.org), measures and efforts to maintain biodiversity are thankfully in practice. Ecologists partake in conservation methods meant to maintain biodiversity with minimal human interaction within these locations. Other examples of action taken to enhance biodiversity are restoration based, attempting to return an ecology to a prior state, one in which human interference would be rectified. While both are essential in our pursuit to maintain biodiversity, both achieve a level of disconnect between humans, our activities, and wildlife. Reconciliation Ecology, a biodiversity conservation strategy proposed by Michael Rosenzweig, an ecologist from Arizona State University, is the science of inventing, establishing, and maintaining new habitats to conserve species diversity in places where people live, work, or play (Rosenzweig, 2003). Rosenzweig's Reconciliation Ecology focuses on understanding species' specific habitat requirements in order to design or place species (Morton, 2011). Reconciliation Ecology allows for co-ownership of habitats in a wide variety of landscapes for a magnitude of species, including humans and avifauna.

INTRODUCTION

Reconciliation Ecology

> **"to be successful, conservation must discover how we can blend a rich natural world into the world of economic activity. This revolutionary common ground between development and conservation is called Reconciliation Ecology: creating and maintaining species-friendly habitats in the very places where people live, work, or play"**
> **Win Win Ecology: How Earth's Species Can Survive in the Midst of Human Enterprise**
> **Michael Rosenzweig, 2003.**

The continuous development of our landscapes is directly effecting the habitats of species. In many cases, this development takes valuable land area, once used by native species- and changes it in some way that leaves this land unusable for these species once calling these spaces their home. As with many things, there is often an exception, in this case: "The Bat Bridge" of Austin, Texas-formally known as The Congress Avenue Bridge. Through a renovation of The Bat Bridge occuring in 1980, the redesigned bridge contained new crevices that were perfect roosting habitat for the Mexican free-tailed Bat (*Tadarida brasiliensis*). The new habitat, allowed for the nesting of over a million bats, which caused citizen outcry and a demand for action. "About that time, founder of Bat Conservation International (BCI), Merlin Tuttle, brought BCI to Austin and told the city the surprising truth: that bats are gentle and incredibly sophisticated animals; that bat watchers have nothing to fear if they do not try to handle bats; and that on nightly flights out from under the bridge, the Austin bats eat from 10,000 to 20,000 pounds of insects, including agricultural pests" (batcon.org). Bat Conservational International is dedicated to the enduring protection of the world's 1300+ species of bats and their habitats and creating a world in which bats and humans successfully coexist (batcon.org). The city of Austin has now embraced this species, which brings in 10 million dollars annually in tourist revenue from bat watchers (batcon.org). The redesigning of the Congress Avenue Bridge benefitted both humans and Mexican Free-Tailed Bats. By a fortunate injection of knowledge provided by BCI, a concession was made that would benefit both humans and bats in the long run.

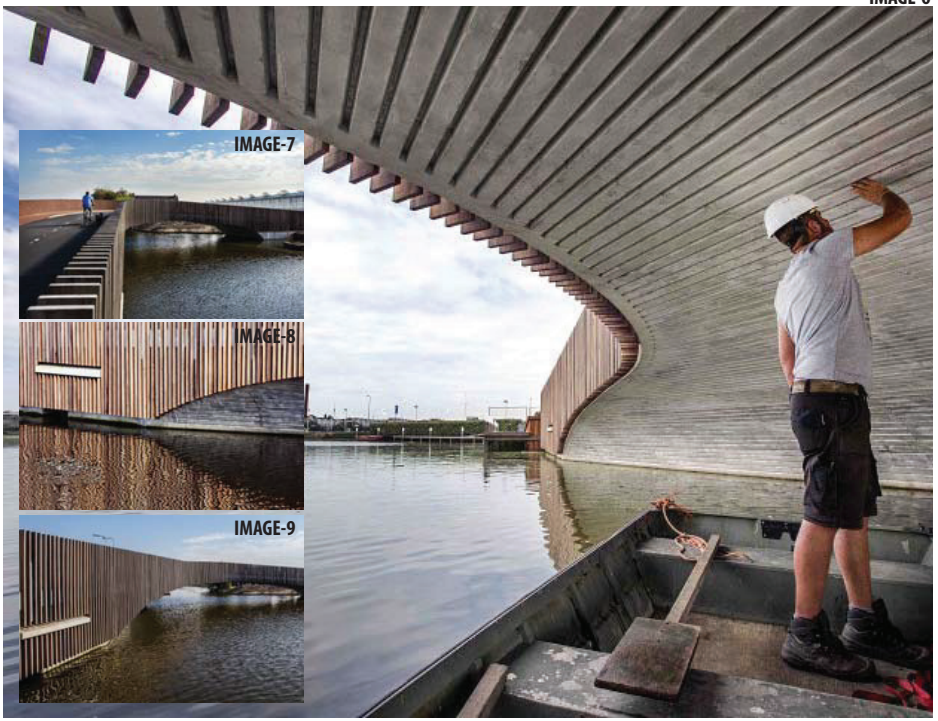
IMAGE-5 austincityguide.com

INTRODUCTION

Reconciliation Ecology

While the Bat Bridge of Austin occurred by chance and needed Bat Conservation International to reconcile what was seen by citizens as a nuisance, Next Arctitects has set forth in their Vlotwateringbrug, also known as "batbridge", to accommodate the habitat needs for bats. This project is described as "A textbook example of how a functional object can at the same time serve nature," by Marcel Schillemans. "The bridge has three specific components that provide roost for several bat species. At the north side the abutment functions as a winter stay. The deck and the brick balustrade accommodate stays for bats during the summer. The bridge design is intended to constitute the ideal habitat for various species of bats, aiming to grow a large colony." nextarchitects.com

IMAGE-6



nextarchitects.com

"The project is located along a flight route of several bat species. To optimize the suitability of the bridge for bats, the structure is made out of concrete. The mass of the concrete provides a stable and pleasant climate. The underside of the bridge is provided with entrance slots. The openings have a rough finish for grip. The slots are part of a pattern of grooves in the concrete arch. Clever use is made of the structural space in the cross section to implement the roosts."

nextarchitects.com

REVIEW OF LITERATURE

HABITAT THREATS WHERE TO BEGIN

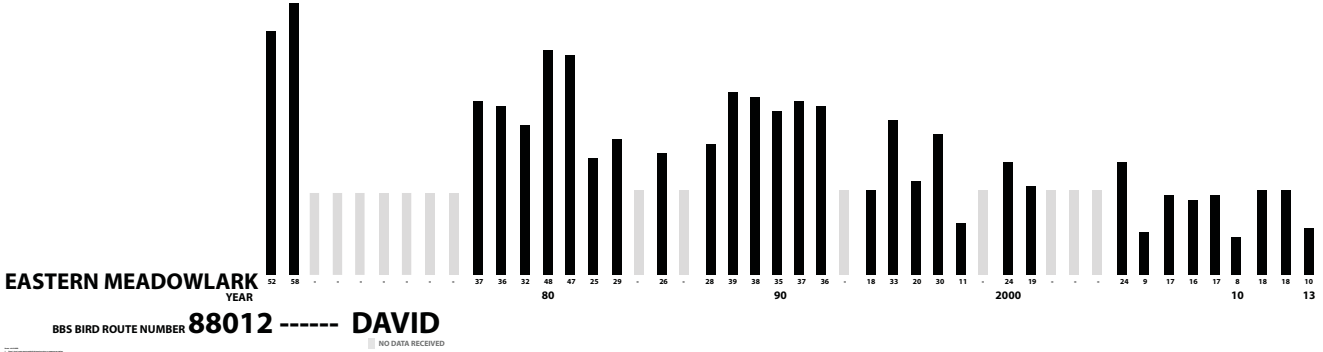
Based on my experiences with observing the American Goldfinch, I began researching bird conservation programs. This research led me to BirdLife International. BirdLife International describes themselves as "a global partnership of conservation organisations (NGOs) that strives to conserve birds, their habitats and global biodiversity, working with people towards sustainability in the use of natural resources. Together we are 120 BirdLife Partners worldwide – one per country or territory – and growing. We are driven by our belief that local people, working for nature in their own places but connected nationally and internationally through our global Partnership, are the key to sustaining all life on this planet. This unique local-to-global approach delivers high impact and long-term conservation for the benefit of nature and people" (BirdLifeInternational.org). Specifically within the BirdLife International program, I began researching the Important Bird Areas effort, which is "an effort to identify, monitor, and protect the most important places for birds" (Audubon.org). The Important Bird Area (IBA) program has designated 719 IBAs within the United States, comprised of more than 330,000,000 acres of land identified as critical to the habitat needs of avian species. Coupled with global warming, habitat loss and fragmentation are the most serious threats facing populations of birds across America and around the world (Audubon.org). With this declaration made by NGO and partner of BirdLife International, Audubon, that habitat loss and fragmentation are major factors affecting populations of avian species, and approaching this project with the agency of a Landscape Architect, the challenge of minimizing habitat loss or habitat fragmentation became paramount. The reality that human development of land is having a negative impact on the habitats of avian species caused further exploration to inquire as to how we are monitoring our negative effects on these habitats. The discovery of the Breeding Bird Survey provided some insight as to how humans monitor avian species.

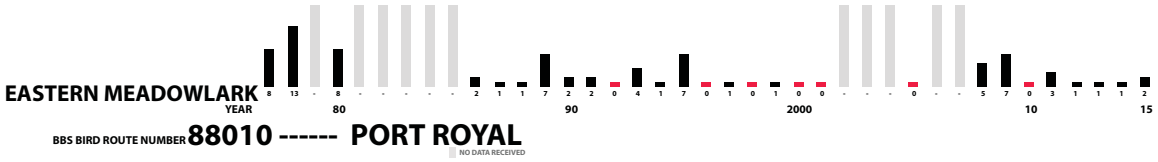
birdlifeinternational.org

BREEDING BIRD SURVEY

When researching the observation of avifauna, I became aware of the Breeding Bird Survey. The Breeding Bird Survey "is a cooperative effort between the U.S. Geological Survey's Patuxent Wildlife Research Center and Environment Canada's Canadian Wildlife Service to monitor the status and trends of North American bird populations." https://www.pwrc.usgs.gov/bbs/

This study provided insight on ways people observe birds, specifically from this program, at a distance of no more than ¼ mile away for proper identification. Observers in this program travel their designated route by automobile.



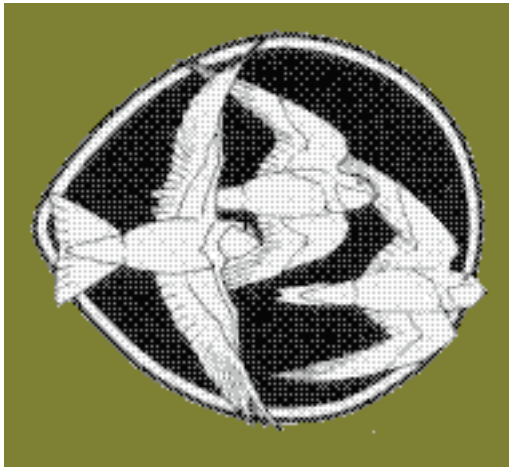


NATIONAL BREEDING BIRD SURVEY ROUTES: 88012 / 88010

Pardieck, K.L., D.J. Ziolkowski Jr., M.-A.R. Hudson, and K. Campbell. 2016. North American Breeding Bird Survey Dataset 1966 - 2015, version 2015.0. U.S. Geological Survey, Patuxent Wildlife Research Center. <www.pwrc.usgs.gov/BBS/RawData/>; doi:10.5066/F7T1R6NB.
Pardieck, K.L., D.J. Ziolkowski Jr., M.-A.R. Hudson, and K. Campbell. 2016. North American Breeding Bird Survey Dataset 1966 - 2015, version 2015.1. U.S. Geological Survey, Patuxent Wildlife Research Center. <www.pwrc.usgs.gov/BBS/RawData/>; doi:10.5066/F7CS3MZ6.

HABITAT THREATS WHERE TO BEGIN

The Breeding Bird Survey (BBS) is a long-term, large-scale, international avian monitoring program initiated in 1966 to track the status and trends of North American bird populations. The USGS Patient Wildlife Research Center and the Canadian Wildlife Service, National Wildlife Research Center jointly coordinate the BBS program. In this program, volunteers travel designated routes and observe avian species. The routes traveled by these observers are done every year during the height of the avian breeding season, June for most of the U.S. and Canada, participants skilled in avian identification collect bird population data along roadside survey routes. Each survey route is approximately 24.5 miles long with stops situated ideally 0.5-mile apart. At each stop, a 3-minute point count is conducted. During the count, every bird seen within a 0.25-mile radius or heard is recorded. Surveys start one-half hour before local sunrise and take about 5 hours to complete. Over 4100 survey routes are located across the continental U.S. and Canada (pwrc.usgs.gov). My previous interaction of only visualizing the American Goldfinch, and not recalling their auditory presence, provided a curiosity as to the observation of avian species achieved by monitoring their sound. The researching of avifauna that is known for their auditory contributions to our landscapes then followed. This was when I came across a species, the Eastern Meadowlark (*Sturnella magna*), that resembled the catalyst to this endeavor, the American Goldfinch (Sibley, 2016).



mbr-pwrc.usgs.gov/bbs

AMERICAN GOLDFINCH

IMAGE-10 AUDUBON.ORG

EASTERN MEADOWLARK

IMAGE-11 AUDUBON.ORG

HABITAT THREATS WHERE TO BEGIN

"habitat loss and fragmentation being direct results of urbanization and suburban and exurban growth pressures" (Lassila, 1999)

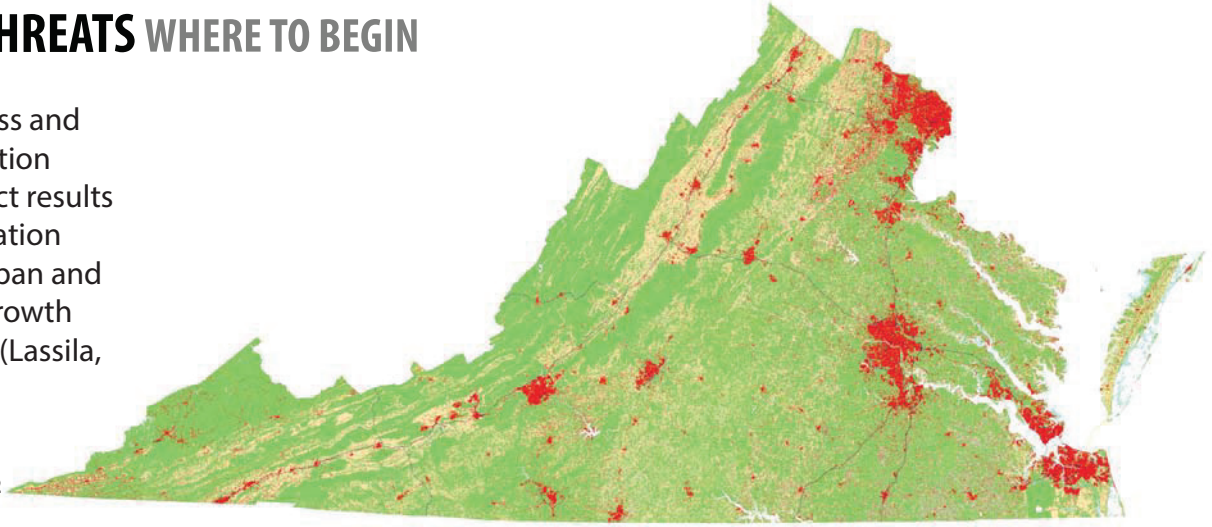


IMAGE-12

2006 DEVELOPED LAND

STATCHAT.ORG

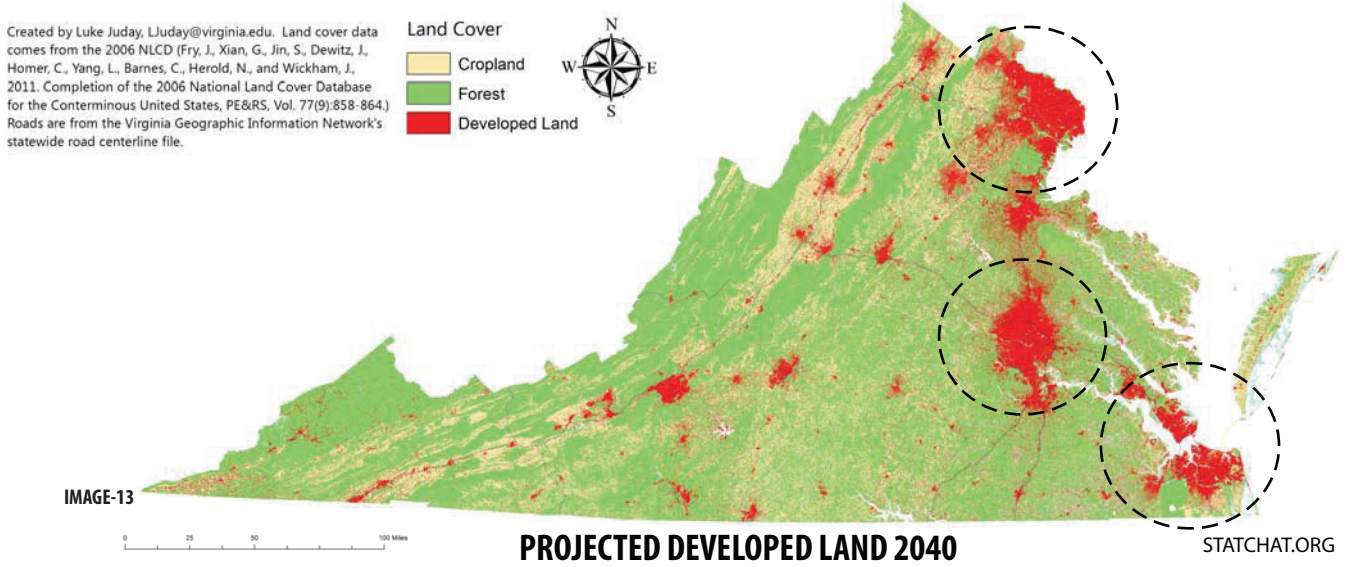


IMAGE-13

PROJECTED DEVELOPED LAND 2040

STATCHAT.ORG

HABITAT THREATS WHERE TO BEGIN

One Important Bird Area that has the classification of Global and is located in an area that is projected to sustain larger than average land development is the Mattaponi and Pamunkey Rivers IBA.

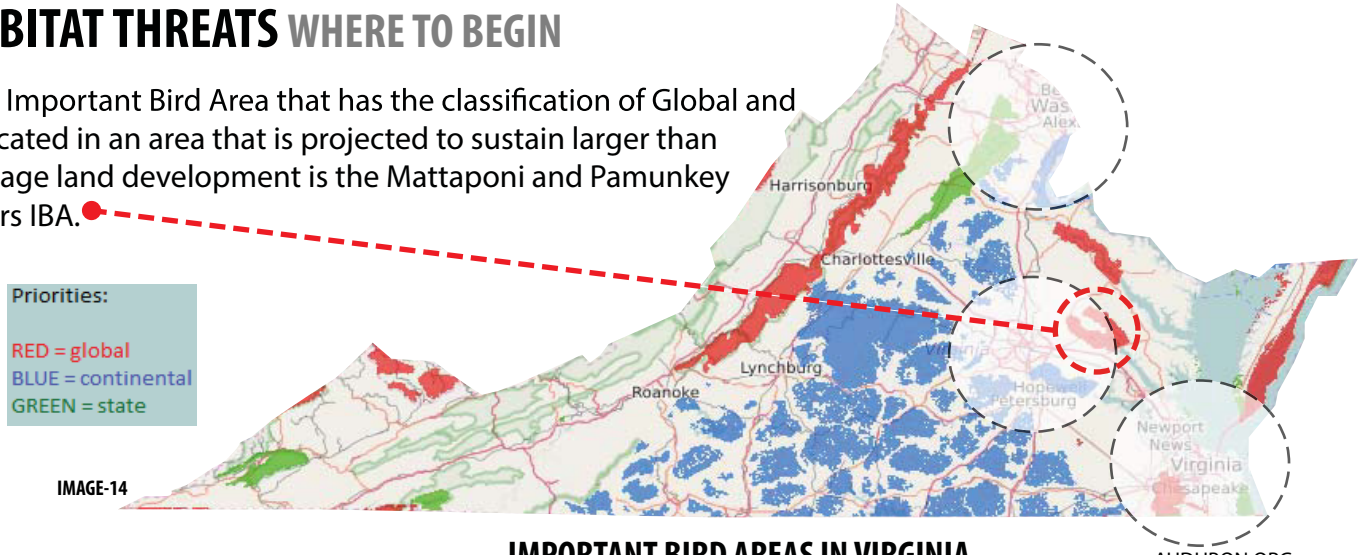


IMAGE-14

IMPORTANT BIRD AREAS IN VIRGINIA

AUDUBON.ORG

Globally Threatened Species
Criterion: The site is known or thought regularly to hold significant numbers of a globally threatened species. BIRDLIFE.ORG

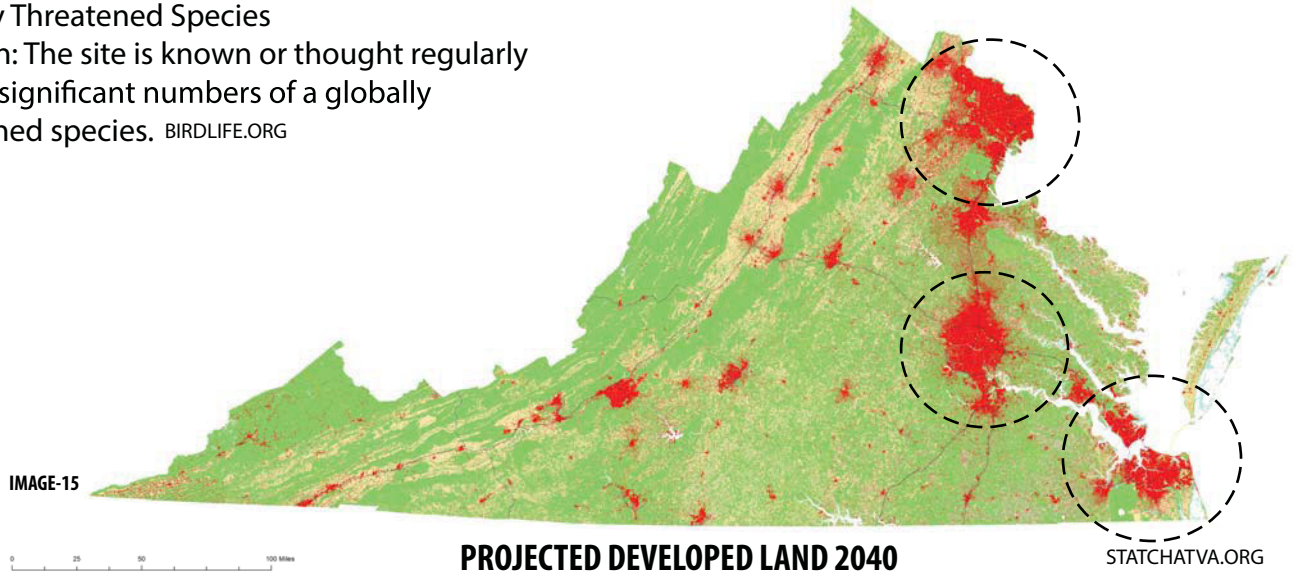


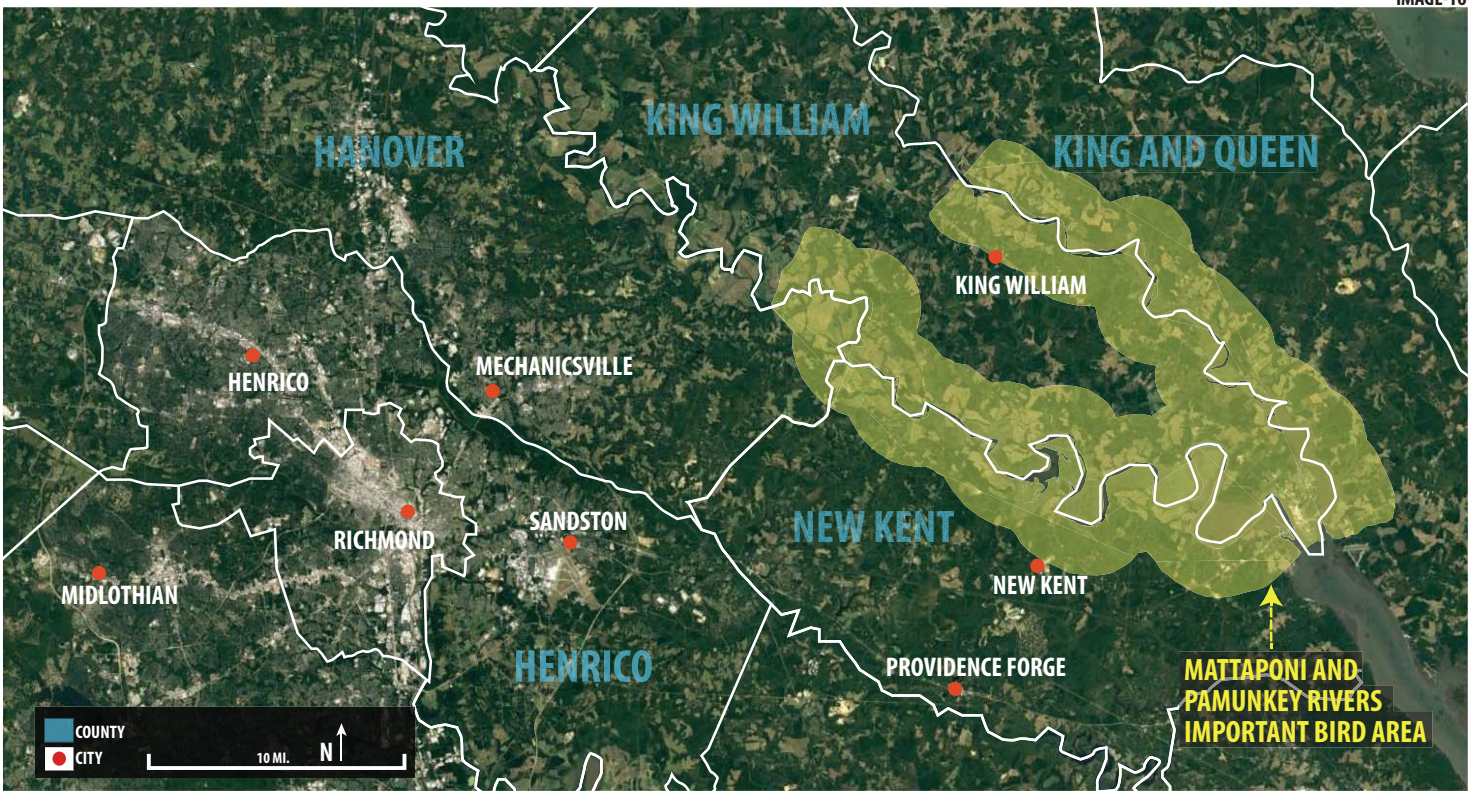
IMAGE-15

PROJECTED DEVELOPED LAND 2040

STATCHATVA.ORG

MATTAPONI AND PAMUNKEY RIVERS
IMPORTANT BIRD AREA

IMAGE-16



Google Earth. "King William VA.." Web.

"The surrounding landscape is home to the Pamunkey and Mattaponi Indian tribes and contains several historic plantations" (deq.virginia.gov).

Location: New Kent, King William, King & Queen, and Hanover Counties
Total Size : 55,931 ha (138,150 acres)
Elevation: 0-54 m (0-177 feet)

MATTAPONI AND PAMUNKEY RIVERS

IMPORTANT BIRD AREA

Early on in this project, I was informed of ancestry I share with Pamunkey tribal members, which was a driver to explore this landscape. The projected development of land in close proximity to the Mattaponi and Pamunkey Rivers IBA, along with the Global designation of the IBA itself, and King William County having both personal touchstones and national relevance guided efforts towards King William County, as opposed to New Kent County, King and Queen County, and Hanover County, other municipalities comprising the IBA. Some current threats and conditions regarding this IBA are cited below.

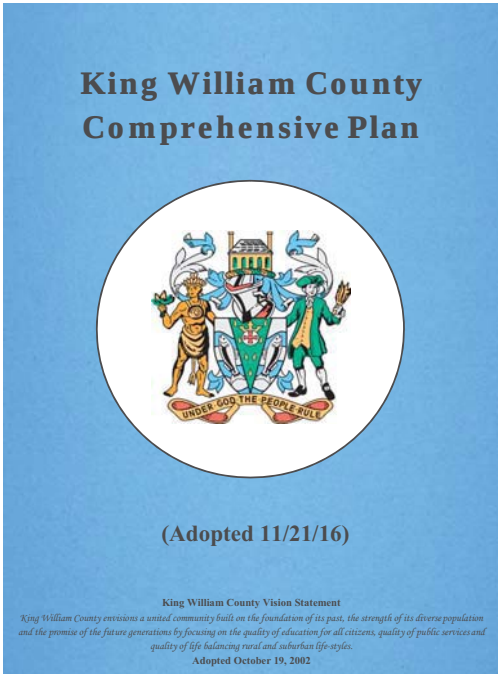
"There are two primary threats that are currently of concern including 1) the loss of marshes to sea-level rise and 2) the conversion of open land to residential development. Over the past decade, the oligohaline marshes have begun to exhibit a transition in vegetational composition related to sea-level rise. Sediment deposition is not keeping pace with subsidence and sea-level rise causing a lowering of the marsh surfaces and a corresponding shift in the vegetation community. This drowning of the marsh will result in a shift in the associated bird community. Because this marsh type is rare within the region, changes will continue to be cause for concern. Until recently, the upland landscape within the area has remained rural with relatively little development pressure. Since 2000 there has been an increase in residential development, particularly along primary shorelines. Many of the species that depend on habitats within the area are sensitive to development" (deq.virginia.gov).

Given that the species I was interested in advocating for was a grassland bird, the concerns regarding the marsh were set aside, as the condition and professed threat of development coincided with the Reconciliation Ecology aspect I was trying to associate this project with. The cause for concern with future development suggested I look into the plans that King William County had pertaining to their possible developing of land and this inquiry led me to the King William County Comprehensive Plan (KWCCP).

HABITAT THREATS WHERE TO BEGIN

After delving into the conditions and current circumstances regarding habitat needs for avian species such as the Eastern Meadowlark within Virginia as provided through the Important Bird Area program, and being presented with population growth projections at a higher than average rate near the three major urban nodes of Richmond, Norfolk, and Northern Virginia, I began researching King William County as a possible location to aid in the effort of habitat conservation, preservation, and possible establishment. In order to gain some understanding of how King William County has addressed their conditions and subsequent plans for moving forward, including the human use aspect of Reconciliation Ecology, I reviewed the King William County Comprehensive Plan (KWCCP). The KWCCP is a strategic long-term plan for the orderly development of a locality. The State Code of Virginia requires that all localities adopt a Comprehensive Plan and review or update it at least every five years (Code of Virginia, 2016). King William County states that "A Comprehensive Plan is much more than just a state mandate and must be a reflection of what the population and its leaders want for the county, not just for tomorrow but decades into the future" (King William County Comprehensive Plan, 2016). King William County also states that the KWCCP is a "roadmap for the future of the County and is instrumental in addressing difficulties faced while working to preserve cherished aspects about King William County (King William County Comprehensive Plan, 2016). This declaration of a desire to address difficulties and preserve things that are cherished appeared to coincide with my intentions for the Eastern Meadowlark.

During the review of the KWCCP, and given the area needed for a healthy population of Eastern Meadowlark being 6acres (Sibley, 2016), one aspect of the KWCCP stood out, which was the desire to construct a new school within King William County in 2018. The possibility to serve a communal need, a new school,



kingwilliam.gov

KING WILLIAM COUNTY COMPREHENSIVE PLAN

FUTURE HUMAN USE

With human use being an initial driver in this project, the King William County Comprehensive Plan was explored. With Reconciliation Ecology hinging on a unison of wildlife habitat and human use, the future needs and wants of this community would have to be addressed. Upon the onset of my research, the desire to adhere to the communal concerns was a top priority. Below is a list of the objectives of the King William Comprehensive Plan.

- Promote social, educational, and cultural institutions to assist in the advancement of citizens;
- Promote the development of a diversified industrial and commercial tax base;
- Promote policies that encourage exurban and commercial development to occur in a compact and contiguous manner in areas of the County with existing infrastructure;
- Maximize the use of existing infrastructure, facilities, and services to ensure economically and financially responsible service delivery and plan for economic and efficient expansion of public facilities to serve a growing population;
- Provide for the independent but harmonious development of separate and distinct agricultural, forestall, and exurban areas of the County for optimal agricultural, forestal, residential, commercial, and industrial uses;
- Provide for the orderly and timed development of land consistent with the County's ability to provide services; and
- Balance the protection of natural resources to maintain environmental health and quality while utilizing them for citizens' recreational uses and economic development.
- Protect life and property while averting dangers from severe storms and floods in low-lying and flood-prone areas of the County.
- Preserve and enhance the natural vegetative riparian buffers along the County's waterways to filter pollution and decrease the potential for erosion and sedimentation.
- Continue to provide opportunities for recreation and enjoyment of parks and open space in the County for all residents.

KING WILLIAM COUNTY FUTURE LAND USE MAP

FUTURE LAND USE WITHIN PAMUNKEY AND MATTAPONI I.B.A.

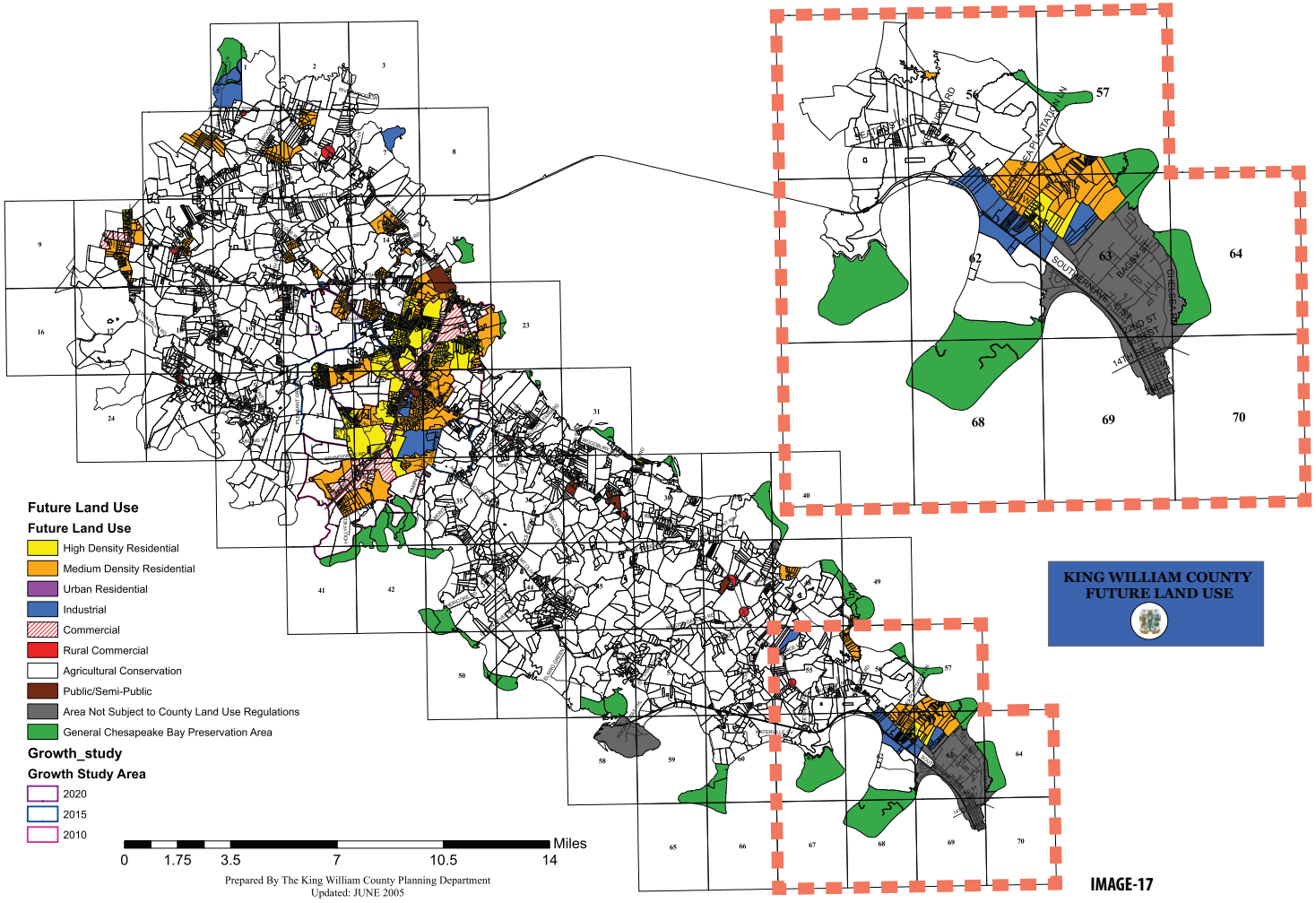
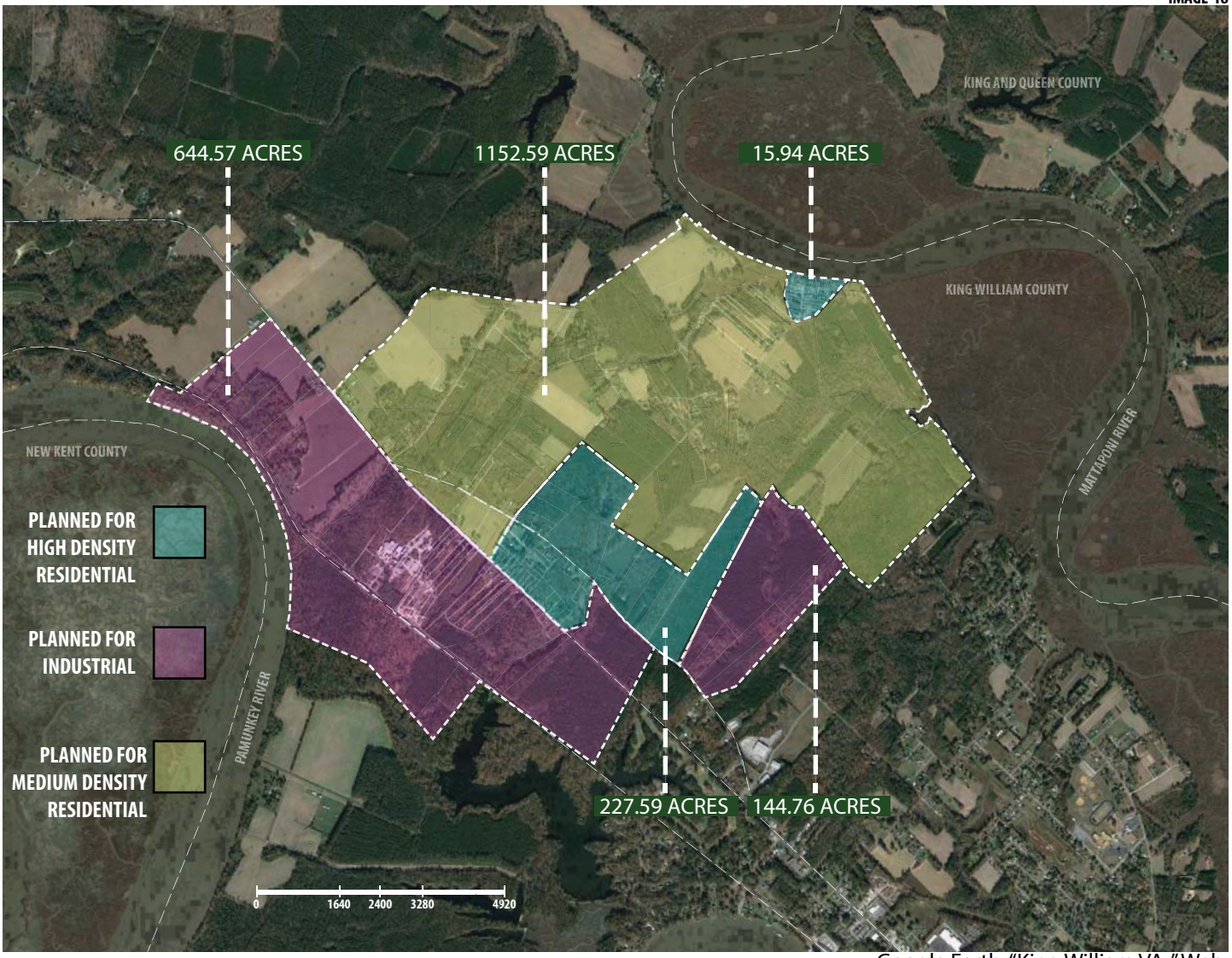


IMAGE-17

KING WILLIAM COUNTY COMPREHENSIVE PLAN

IMAGE-18



Google Earth. "King William VA.." Web.

HABITAT REQUIREMENTS EASTERN MEADOWLARK

To familiarize myself with the habitat requirements for the Eastern Meadowlark, the HABITAT SUITABILITY INDEX MODELS: EASTERN MEADOWLARK, provided by the United States Department of the Interior, was used (Schroeder, 1982). Specific needs from this report are as follows:

General

The Eastern Meadowlark (*Sturnella magna*) is an omnivorous ground feeder (Willson 1974) that nests in open fields throughout the eastern and southcentral United States (Robbins et al. 1966).

Food

Approximately 74% of the annual diet consists of animal matter and includes mainly beetles, grasshoppers, caterpillars, and occasionally flies, wasps, and spiders (Beal 1926, cited by Gross 1958). Crickets and grasshoppers comprise 26% of the annual diet, and beetles make up 25% of the annual diet. The remainder of the diet consists of vegetable matter, mainly grain and weed seeds. Seeds of smartweed (*Polygonum spp.*), ragweed (*Ambrosia spp.*), corn, wheat, rye, and oats are eaten in the winter months when insects are scarce (Gross 1958). Fruits, such as wild cherries (*Prunus spp.*), strawberries (*Fragaria spp.*), and blackberries (*Rubus spp.*), may also constitute a small percentage of the diet. During adverse winter weather, eastern meadowlarks have been observed to feed on road kills (Hubbard and Hubbard 1969).

Water

No data on drinking water requirements for the Eastern Meadowlark were located in the literature, although captive Eastern Meadowlarks do bathe in and drink free water (Gross 1958).

Cover

The Eastern Meadowlark is primarily found in grasslands, meadows, and pastures (Gross 1958). Meadowlarks inhabited old field successional stages in Georgia from 1 (grass-forb) to 15 years (grass-shrub) after the fields were no longer farmed (Johnston and Odum 1956). This species inhabited fields where shrub coverage was less than 35%, regardless of grass cover in the area. Feeding and loafing cover areas in Missouri that had high use were characterized as grasslands with no forbs or scattered

forbs present, while areas where forbs were dominant had little use (Skinner 1975). Maximum use was observed in grazed grasslands between 10 and 30 cm tall (4 and 12 inches), with scattered forbs present.

Reproduction

The preferred nesting habitat of the Eastern Meadowlark in Illinois was pasture, followed in descending order by hayfields, soilbank fields, winter wheat fields, idle areas, and fallow areas (Roseberry and Klimstra 1970). The density of nesting meadowlarks in pastures was inversely related to the intensity of grazing. Highest nesting densities occurred during the 2 years when pastures were not grazed, and numerous dead grass stems and vigorous stands of grass (fescue) were present. Nesting densities in haylands were highest in a mixed-grass hayfield. Use of alfalfa fields, wheat fields, and fallow areas for nesting was low because these areas lacked sufficient grassy cover to provide suitable nesting habitat. Idle areas were little used when shrubs and trees became abundant. The average height of nesting cover was 38 cm (15 inches), with the majority of nests located in cover 25 to 50 cm (10 to 20 inches) high. The presence of dead grass stems at ground level and the absence of woody vegetation or numerous shrubs in the immediate vicinity of the nest site seemed necessary for nesting.

Nests of the Eastern Meadowlark are built in shallow depressions and have a dome-shaped roof constructed of grass, frequently interwoven with clumps of grasses or weeds (Gross 1958). Elevated singing and lookout perches, such as telephone wires, electric power lines, mounds of earth, farm implements, or fence posts, are used by males.

Interspersion

Meadowlark territories in Wisconsin varied in size from 1.2 to 6.1 ha (3 to 15 acres) and were commonly 2.8 to 3.2 ha (7 to 8 acres) (Lanyon 1956). The average size of 15 territories in New York was 2.8 ha (7 acres) (Gross 1958).

Special Considerations

Domestic cats and dogs prey on the eggs and young of the Eastern Meadowlark, and close proximity of nesting sites to human habitations is undesirable (Lanyon 1957). Mowing and heavy grazing by livestock may destroy meadowlark nests (Roseberry and Klimstra 1970). (Schroeder, 1982)

KING WILLIAM COUNTY COMPREHENSIVE PLAN

DESIGNATED DESIRE FOR A NEW SCHOOL IN KING WILLIAM COUNTY

The King William County Comprehensive Plan states that there is a need for a new school within the county, with a date of construction being sometime in 2018. The habitat requirements of the Eastern Meadowlark include having an area of approximately 6 acres to sustain a population with a minimum of 3 acres being feasible (Schroeder, 1982). Having a preconception that school sites would be large enough to meet this requirement, and having the desire to mesh the human need and subsequent development with the habitat needs of the Eastern Meadowlark, the decision was made to analyze existing schools within King William County. King William County has a total of 7 schools, with the enclave of West Point located at the southernmost point of the county having 3, and the rest of the county having 4. An initial investigation showed all schools within the county meeting this land area requirement of preferably 6 acres for a population of Eastern Meadowlark. The process of analyzing existing schools involved using aerial photographs and attributing certain land uses such as automobile, structural, tree and shrub areas, and land cover such as ballfields and common grass-covered areas. The motive of this process was to acquire some determination as to how schools were using their sites, as the 6 acre qualifier posited by Schroeder was leading the discussion, and an effort was being made to see if there was possibly a surplus of land contained within school sites that could be allocated towards habitat for the Eastern Meadowlark.

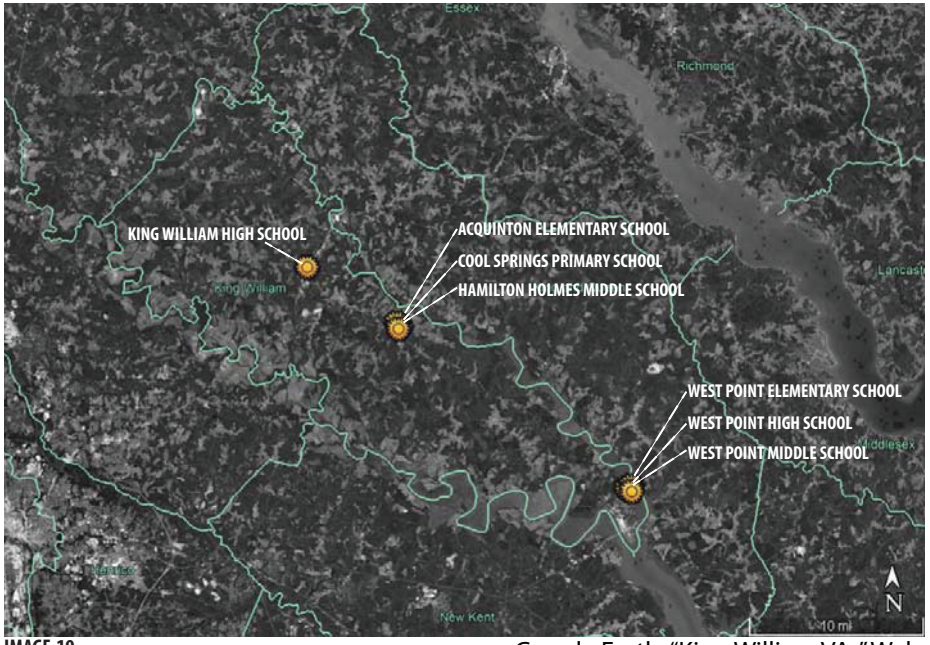


IMAGE-19

Google Earth. "King William VA.." Web.

SCHOOL ANALYSIS REPLICATE TO ESTABLISH HABITAT

The analysis of school land area in King William County and subsequent uses determined there was some concensus as to how land was appropriated at these sites. Automotive land use was based on the determination that vehicles used these areas of the site, which were roadways and parking locations. The building footprint of each school and supporting structures was classified as buildings. The sections of each school campus that contained vegetation other than grass cover was classified as trees and shrubs. The remaining areas that were to be calculated were determined to be either recreation areas such as ballfields or grass covered fields with no specific recreation purpose. These two types of land areas were grouped together and percentages of each site were calculated.

The total percentages for recreational and generic grasses for the 7 schools studied are as follows:

Acquinton Elementery School	**66%**
Cool SPrings Primary School	**59%**
Hamilton Holmes Middle School	**65.5%**
King William High School	**68.1%**
West Point Elementery School	**62.5%**
West Point High School	**70.2%**
West Point Middle School	**66.2%**

The average percentage of the recreational and generic grasses found at these school sites was 65.35%, with the lowest percentage of this classification being 59% at Cool Springs Primary School and the highest percentage of recreational and generic grasslands being 70.2% found at West Point High School. Removing the outliers of this study, the remaining percentages of 66-65.5-68.1-66.2- and 62.5 would remain for Acquinton Elementery School, Hamilton Holmes Middle School, King William High School, West Point Middle School, and West Point Elementery School respectively. Having such a minimal difference in how these two types of land areas are being used at schools in King William County, I began to approach this project in a manner which suggested there could be a solution to the King William County desire for a school that could be addressed by using approximately 65% of

SCHOOL ANALYSIS REPLICATE TO ESTABLISH HABITAT

the site for either ballfields or generic grass covered land with no specific purpose. I took the sizes of these sites- 48.3 acres for the 3 school complex formed by Acquinton Elementery-Cool Springs Primary School-and Hamilton Holmes Middle School, along with the 41.1 acres used for West Point Elementery-Middle-and High school and the 40.8 acres used for King William High School and used these quantities as a starting point to find a site that could support a school campus. From this point I began investigating where a school could be sited, and to do this I began to explore how students could travel to school. The Breeding Bird Survey provided inspiration to site a school where students may travel the designated route to school and possibly observe avifauna on their journey.

SCHOOL SITE TOTAL LAND AREA
100%

AREA CONTAINING MAINTAINED GRASS COVER
65%

AREA FOR BUILDINGS-ROAD SURFACES-TREES AND SHRUBS
35%

SCHOOL ANALYSIS ACQUINTON ELEMENTARY SCHOOL

18550 KING WILLIAM ROAD
KING WILLIAM, VA. 23086-9755

546 STUDENTS/33 TEACHERS
STUDENT TEACHER RATIO - 16.5:1
GRADES 3-5

IMAGE-20

Google Earth. "Acquinton Elementery School - King William VA.." Web.

SCHOOL ANALYSIS COOL SPRINGS PRIMARY SCHOOL

7301 ACQUINTON ROAD
KING WILLIAM, VA. 23086

545 STUDENTS/35 TEACHERS
STUDENT TEACHER RATIO - 13.6:1
GRADES PRE K-2

IMAGE-21

Google Earth. "Cool Springs Primary School - King William VA.." Web.

SCHOOL ANALYSIS HAMILTON HOLMES MIDDLE SCHOOL

18444 KING WILLIAM ROAD
KING WILLIAM, VA. 23086-9755

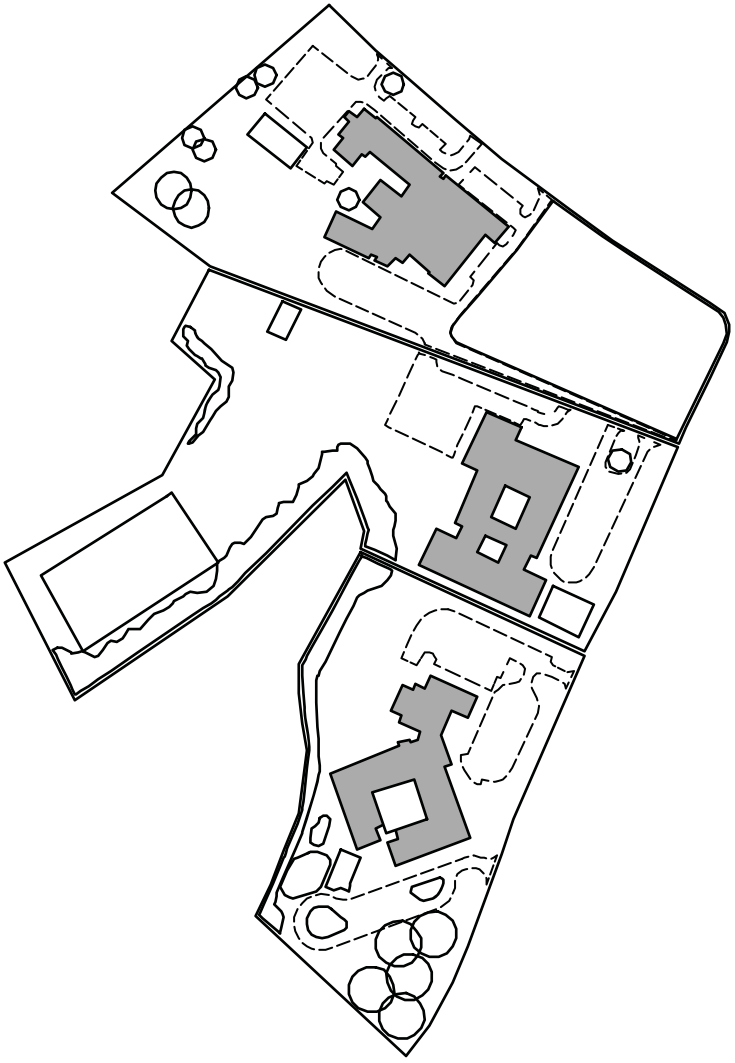
516 STUDENTS/38 TEACHERS
STUDENT TEACHER RATIO - 13.5:1
GRADES 6-8

IMAGE-22

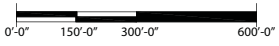
Google Earth. "Hamilton Holmes Middle School - King William VA.." Web.

SCHOOL ANALYSIS

HAMILTON HOLMES MIDDLE SCHOOL
ACQUINTON ELEMENTERY SCHOOL
COOL SPRINGS PRIMARY SCHOOL



48.3 ACRES TOTAL AREA
6.17 ACRES AUTOMOTIVE
4.98 ACRES TREES AND SHRUBS
30.9 ACRES FIELDS AND GRASSES
6.24 ACRES BUILDINGS



SCHOOL ANALYSIS KING WILLIAM HIGH SCHOOL

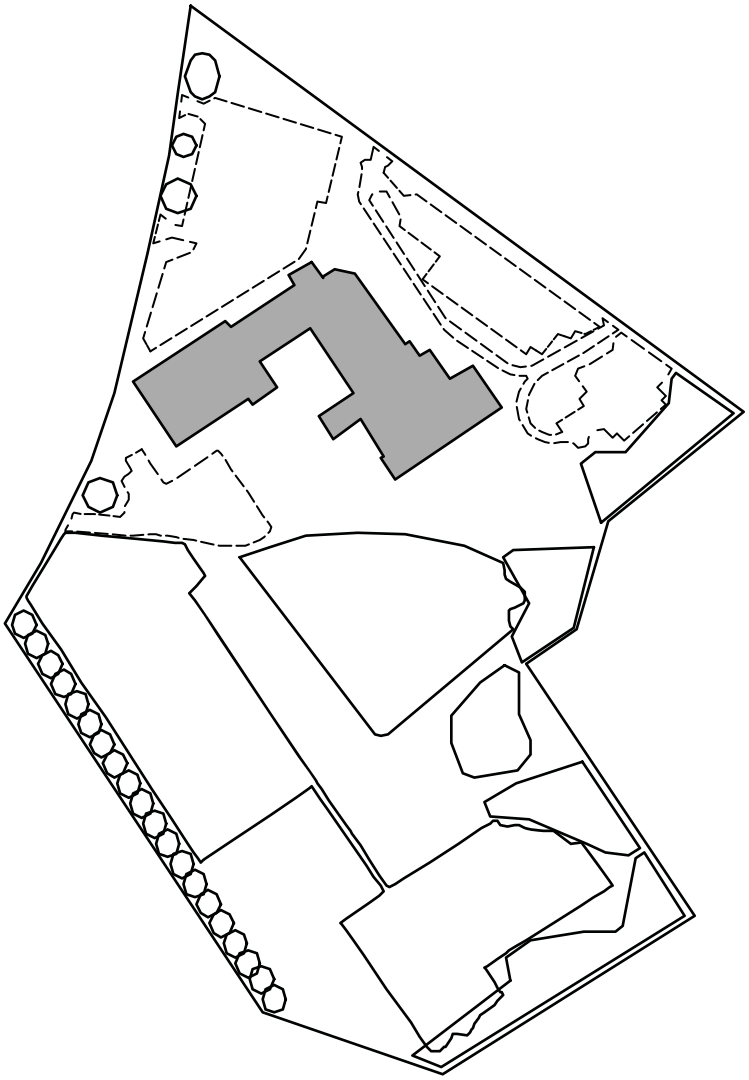
80 CAVALIER DRIVE
KING WILLIAM, VA. 23086-9773

639 STUDENTS/47 TEACHERS
STUDENT TEACHER RATIO - 13.6:1
GRADES 9-12

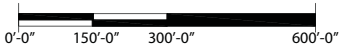
IMAGE-23

Google Earth. "King William High School - King William VA.." Web.

SCHOOL ANALYSIS
KING WILLIAM HIGH SCHOOL



40.8 ACRES TOTAL AREA
5.70 ACRES AUTOMOTIVE
4.36 ACRES TREES AND SHRUBS
27.8 ACRES FIELDS AND GRASSES
2.96 ACRES BUILDINGS



SCHOOL ANALYSIS WEST POINT ELEMENTARY SCHOOL

1060 THOMPSON AVENUE
WEST POINT, VA. 23181-9766

333 STUDENTS/23 TEACHERS
STUDENT TEACHER RATIO - 14.4:1
GRADES PRE K-5

IMAGE-24

Google Earth. "West Point Elementery School - King William VA.." Web.

SCHOOL ANALYSIS WEST POINT HIGH SCHOOL

2700 MATTAPONI AVENUE
WEST POINT, VA. 23181-9304

278 STUDENTS/21 TEACHERS
STUDENT TEACHER RATIO - 13.1:1
GRADES 9-12

IMAGE-25

Google Earth. "West Point High School - King William VA.." Web.

SCHOOL ANALYSIS WEST POINT MIDDLE SCHOOL

1040 THOMPSON AVENUE
WEST POINT, VA. 23181-9304

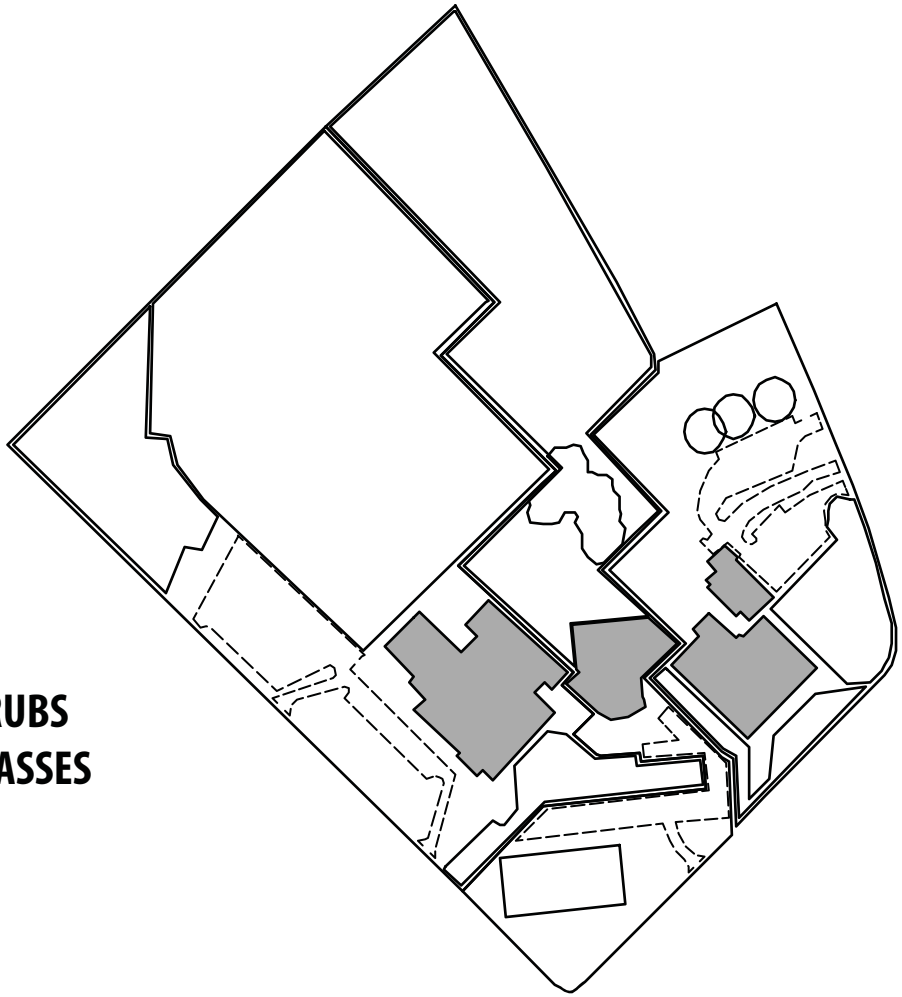
182 STUDENTS/14 TEACHERS
STUDENT TEACHER RATIO - 12.6:1
GRADES 6-8

IMAGE-26

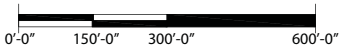
Google Earth. "West Point Middle School - King William VA.." Web.

SCHOOL ANALYSIS

WEST POINT ELEMENTERY SCHOOL
WEST POINT MIDDLE SCHOOL
WEST POINT HIGH SCHOOL



41.1 ACRES TOTAL AREA
5.56 ACRES AUTOMOTIVE
2.91 ACRES TREES AND SHRUBS
27.6 ACRES FIELDS AND GRASSES
3.39 ACRES BUILDINGS



ASCERTAINING THE CENTRAL LOCATION OF A NEW SCHOOL
USING ROUTES TO SCHOOL TO OBSERVE SPECIES

> ***"King William County Public Schools recently completed their 2013-2019 Comprehensive Plan. The Capital Improvements Plan for the schools, contained in the Comprehensive Plan, recommends construction of a new school building around 2018"*** (KWCCP, p.46).

The desire to build a new school within King William County presents an opportunity to establish habitat for species. Schools that were analyzed had land area well over the 6 acre requirement Eastern Meadowlark has for a functioning population (Schroeder, 1982). There was a question as to where the new school should be sited, with such things as existing roadways and future development being drivers in this topic. Referencing back to the Breeding Bird Survery, where observers took specific routes at specific times to observe avian species, the notion that students could take similar actions on their daily routes to school, and possibly observe Eastern Meadowlark, was explored. After locating Noreen C. McDonald's study **Children's Mode Choice for the School Trip: the Role of Distance and School Location in Walking to School** (2007), which states:

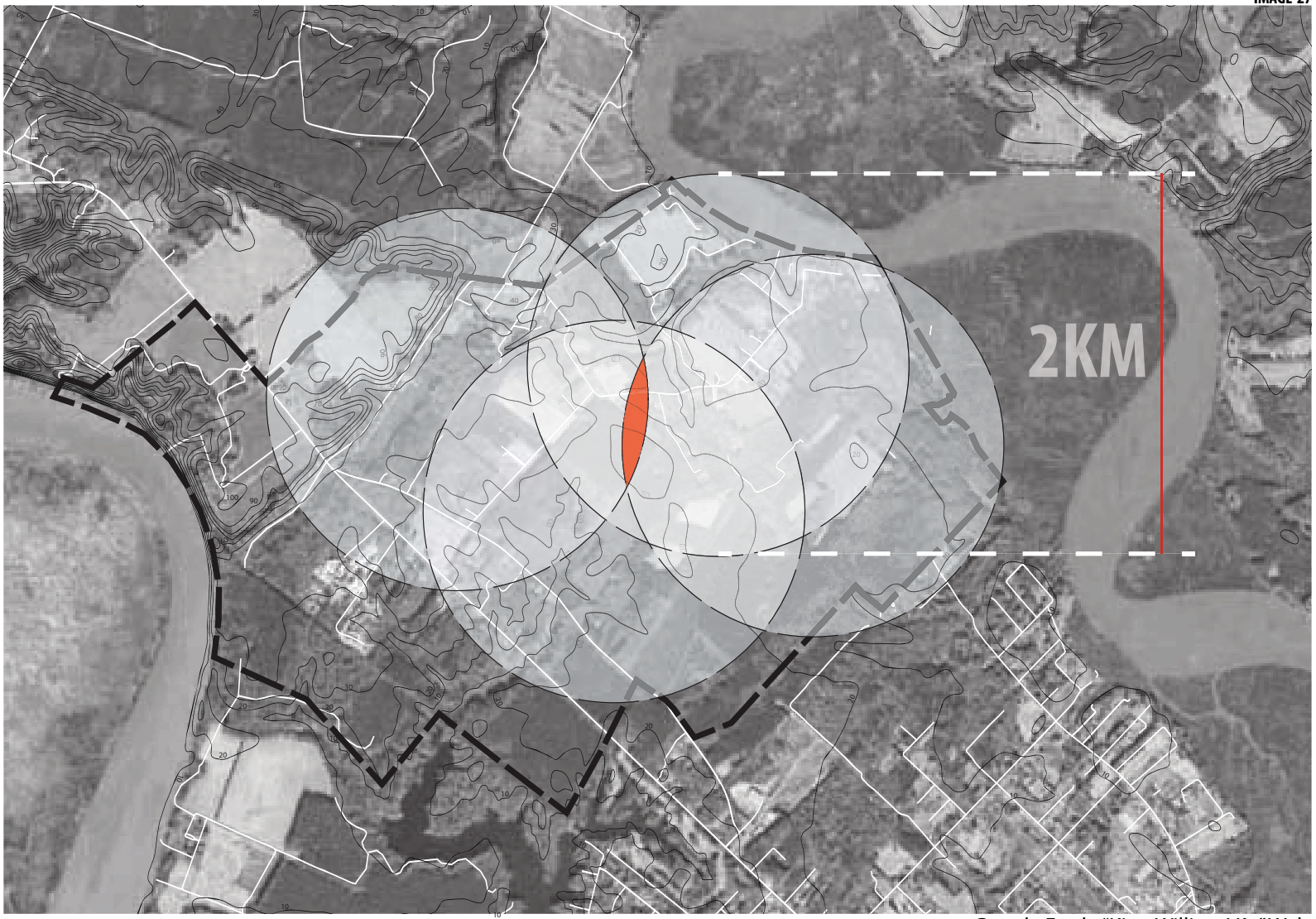
> ***"Using distance to school as a criterion in school siting and renovation decisions would give individual communities a chance to increase walking to school. Building schools near students—within 1–2 km—will result in more students walking and potentially in health benefits."***

This criteria was used to establish a 2km maximum distance, from the furthest edge of proposed development, to locate a central area for which a school could possibly be sited. This central location would promote students walking to the new school, and presumably enable the observance of species such as the Eastern Meadowlark. In the following map, the red represents an overlapping where within this area, any student would have walked the maximum of 2km to reach the future school to be built per the King William County Comprehensive Plan.

ASCERTAINING THE CENTRAL LOCATION OF A NEW SCHOOL

USING THE ROUTE TO SCHOOL TO OBSERVE SPECIES

IMAGE-27



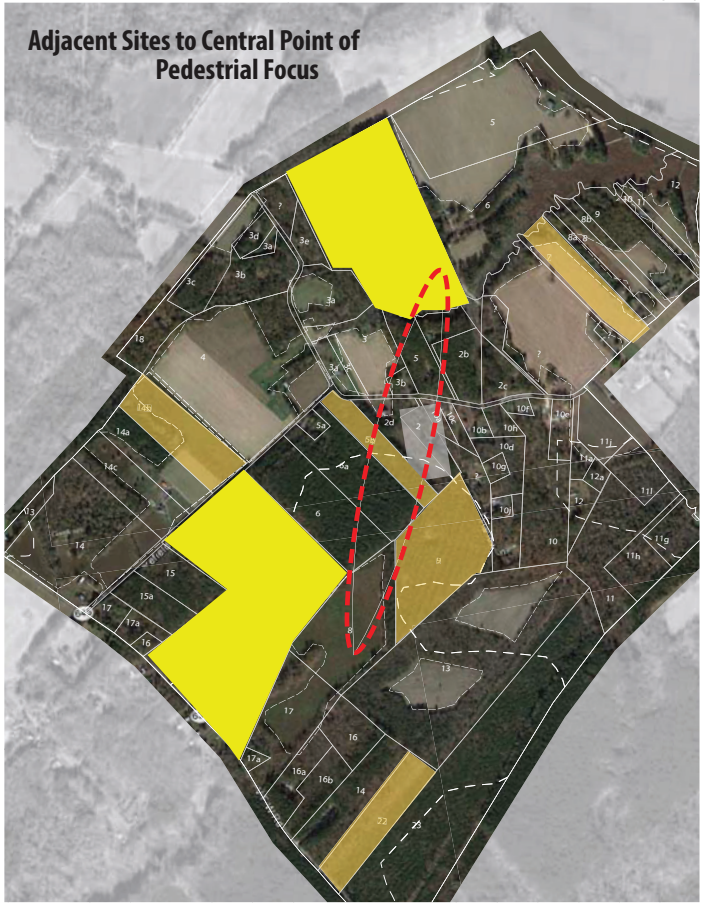
Google Earth. "King William VA.." Web.

VACANT LAND POSSIBLE DEVELOPMENT

After a central location for a new King William County school was established in relation to proposed future development, exploration of adjacent sites commenced through both the searching of county records and analysis of aerial photographs. Reviewing county records revealed many plots with no addresses and aerial photography revealed no structures present.

The study of existing schools within King William County revealed that they were all located at an intersection of two streets. One property owner had adequate land area and what could be described as the preferable corner location. This resident was shown to live in a distant state, and it was at this instance that my effort to suggest a solution for a school site for King William County while establishing habitat for the Eastern Meadowlark, was lost. I found myself making assumptions as to the possibility of the property owner being in a situation were the property was being rented. The next move was not apparent but I did know the assumptions were not productive. During my study of vacant lots, I was fortunate enough to locate an existing pond that forced me to address the responsibility of water management.

IMAGE-28



Google Earth. "King William VA.." Web.

SITE VACANT AND LARGE ENOUGH FOR SCHOOL SITE
VACANT SITE BUT NOT LARGE ENOUGH FOR A SCHOOL
CENTERL LOCATION FROM EXTENTS OF PROPOSED DEVELOPMENT

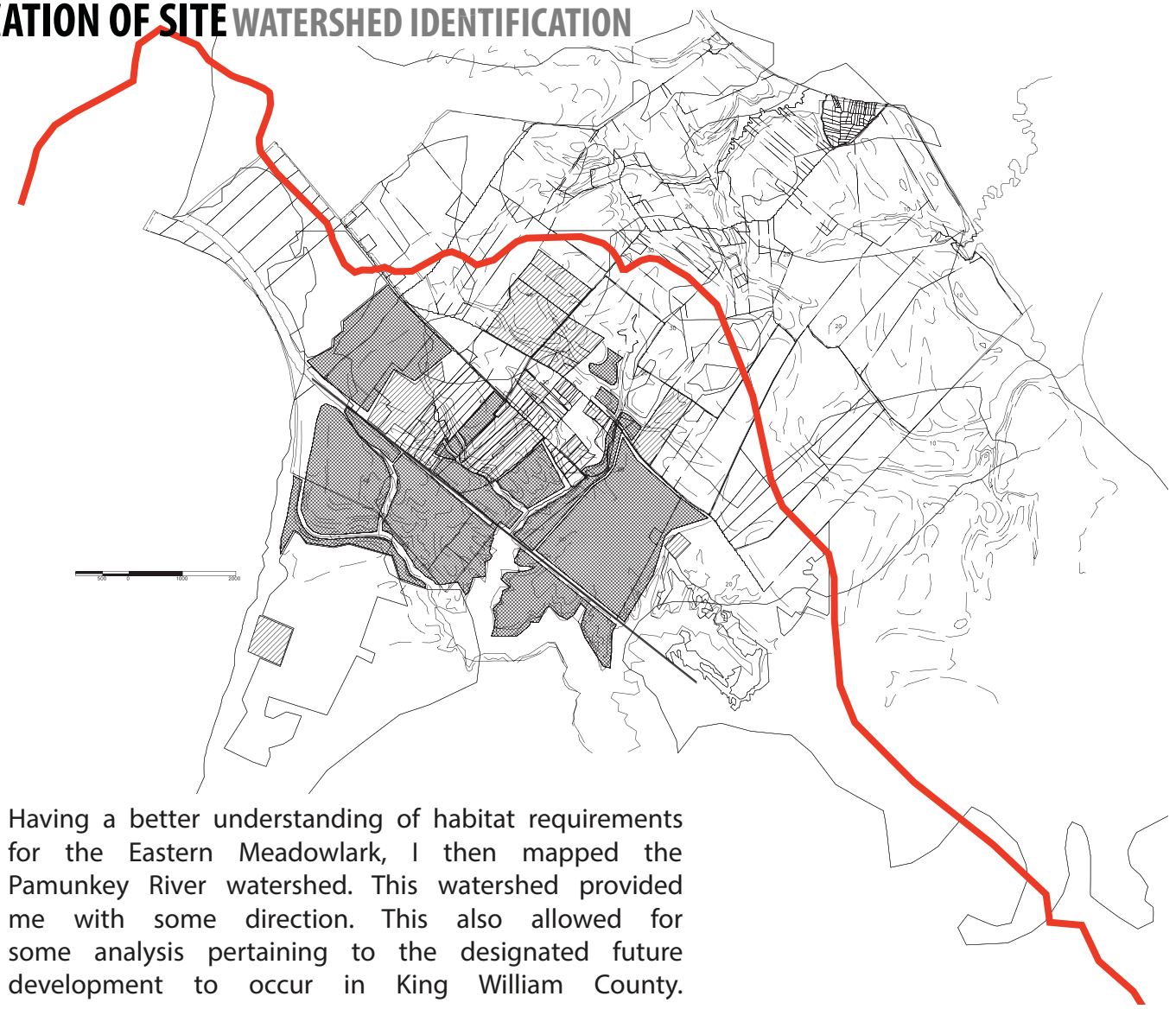
DEPARTMENT OF ENVIRONMENTAL QUALITY OPPORTUNITY FROM RESTRAINTS

After gaining some direction through the discovery of an existing pond, the Department of Evironmental Quality led me to the Chesapeake Bay Preservation Act. This program is "designed to improve water quality in the Chesapeake Bay and other waters of the State by requiring the use of effective land management and land use planning. At the heart of the Bay Act is the concept that land can be used and developed to minimize negative impacts on water quality" (DEQ.virginia.gov). Previously, when studying the land composition of existing schools in King William County, I was essentially studying what has been done, the desire for a new King William County school was there, but did not appear to be a definite. The Chesapeake Bay Preservation Act provided me with definites, things that must happen, specifically the dimension of a 100 foot setback.

King William County is one of 29 counties that participates in the Chesapeake Bay Preservation Act. One element of this program is their recognition of Resource Protection Areas (RPA), which are defined as "that component of the Chesapeake Bay Preservation Area comprised of lands adjacent to water bodies with perennial flow that have an intrinsic water quality value due to the ecological and biological processes they perform or are sensitive to impacts which may result in significant degradation to the quality of state waters" (Cheapeake Bay Preservation Act). RPA regluations require "a 100-foot wide buffer area of vegetation that is effective in retarding runoff, preventing erosion, and filtering nonpoint source pollution from runoff shall be retained if present and established where it does not exist" (Chesapeake Bay Preservation Act).

Having this circumstance of locating a required dimension of 100 feet, King William County being a participant of the program requiring this criteria, and the language of establishing something that is based from vegetation was where the Dianna Dayle River Walk began to take shape. The location of these streams, which were already providing a service, could now be manipulated to facilitate a need. My thoughts were now leading towards using this opportunity to establish a buffer that would serve as habitat for the Eastern Meadowlark. How was the future development of King William County going to impact the hydrologic dynamic of these development sites? What role would these streams play and could there be an opportunity to provide habitat for the Eastern Meadowlark? This is when I began mapping these streams, identifying the Pamunkey River Watershed and subsequent sub-watersheds.

LOCATION OF SITE WATERSHED IDENTIFICATION



Having a better understanding of habitat requirements for the Eastern Meadowlark, I then mapped the Pamunkey River watershed. This watershed provided me with some direction. This also allowed for some analysis pertaining to the designated future development to occur in King William County.

PAMUNKEY RIVER WATERSHED

IMAGE-29

Google Earth. "King William VA.." Web.

LOCATION OF SITE SUB-WATERSHED IDENTIFICATION

Having the Pamunkey River watershed mapped, I then divided that into sub watersheds.

A WAY IN THROUGH STORMWATER

The locating of the pond during the school site discovery process provided some direction to pursue further, specifically, the locating of watersheds. After identifying the Pamunkey River watershed, subwatersheds were then mapped. This process led to the identifi cation of existing streams.

With these streams, I now had existing elements that were performing functions. These streams were conveyance systems for stormwater, connecting the Pamunkey River and land cover within the Pamunkey River Watershed. Investigating the regulating of stormwater, I became aware of the Virginia Department of Environmental Quality. The Virginia Department of Environmental Quality (DEQ), "is the lead agency for developing and implementing statewide stormwater management and nonpoint source pollution control programs to protect the Commonwealth's water quality and quantity" (www.deq.virginia.gov).

"Stormwater runoff from streets, lawns, parking lots, construction sites, industrial facilities and other impervious surfaces occurs as a result of precipitation events (for example, rain water or melted snow). The stormwater runoff may enter surface waters directly or through natural and constructed channel systems. Activities occurring in developed and urban areas contaminate stormwater runoff with pollutants such as automobile oil, grease, metals, sediment, bacteria from animal waste, nutrients and pesticides, as well as deposits from airborne pollutants. Unmanaged stormwater can cause erosion and flooding. It also can carry excess nutrients, sediment and other contaminants into rivers and streams. Properly managed stormwater can recharge groundwater and protect land and streams from erosion, flooding and pollutants" (www.deq.virginia.gov).

The declaration in the DEQ quote above, "activities occurring in developed and urban areas", and the classificating of land cover such as streets, industrial facilities, and parking lots brought previous explorations of school sites and housing developments back into the discussion. While evaluating land use and variables such as the number of land users and land areas designated for these uses, the aspect of stormwater responsibilities was now relating what was previously just numbers and percentages.

A WAY IN THROUGH STORMWATER

Collectively as a group of sites, with all contributing their stormwater to these streams and eventually the Pamunkey River, and as King William County has determind these sites will be developed in the future, stormwater is something that needed to be addressed. The first step towards addressing this variable was determining how much water would be present after future development. Enter the SCS method. The SCS Runoff Curve Number method is developed by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS) and is a method of estimating rainfall excess from rainfall (Hjelmfelt, 1991). Variables used in the SCS method include:

Q =ACTUAL RUNOFF **P** =POTENTIAL MAXIMUM RUNOFF (NO INITIAL ABSTRACTION)
S =POTENTIAL RETENTION AFTER RUNOFF BEGINS **CN** =CURVE NUMBER **Ia** =INITIAL ABSTRACTION

This method of arriving at runoff produced during a storm event requires the rate of precipitation to be determined prior to executing calculations. Various rates specified by such things as rate of occurrance and duration of event are used in specifying stormevents, which affect rates of precipitation. Using the U.S. Dept. of Commerce Technical Paper No. 40 "Rainfall Frequency Atlas of the United States" May 1961 Washington D.C., and using the 5 year / 24 hour rate of precipitation as the standard (a storm event occurring at a rate of once every 5 years that persists for 24 hours) , it was determined that the maximum potential runoff would be 4.66" at the sub-watershed sites. Using the following equations:

$$Q = \frac{(P - Ia)^2}{(P - Ia) + S} \qquad S = \left(\frac{1000}{CN}\right) - 10$$

The sub-watersheds A-B-C were then analyzed to determine quantities of water produced in such an event. This investigation would lend some basis as to what these locations will be forced to accommodate when future development occurs.

A WAY IN THROUGH STORMWATER

Using Technical Paper No. 40, from the U.S. Department of Commerce, to find the amount of precipitation projected in a 5 year/ 24 hour storm event in King William County.

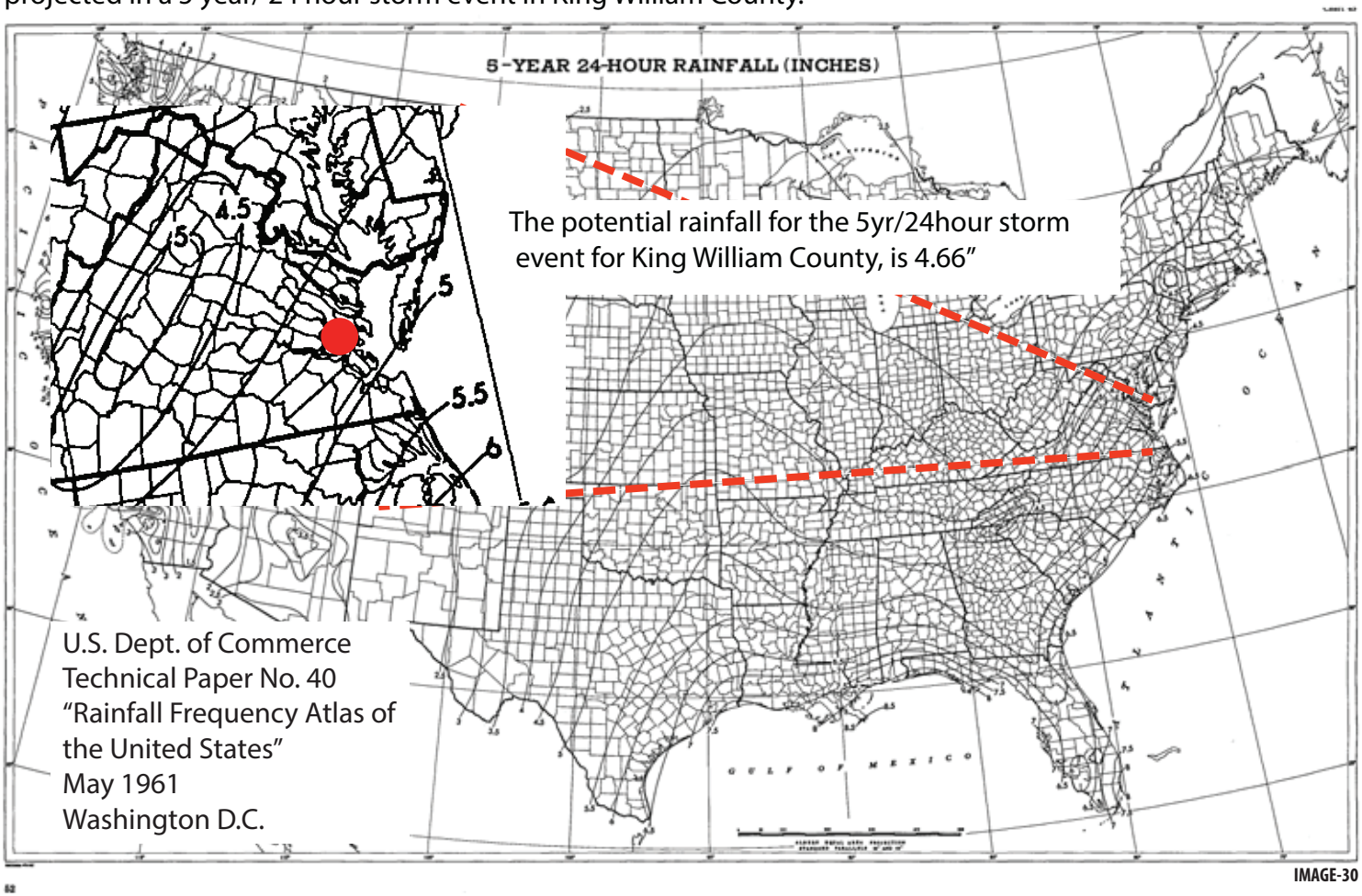


IMAGE-30

A WAY IN THROUGH STORMWATER

In order to calculate runoff for the 5 year/ 24 hour storm, a soil map was needed to identify existing soils within the proposed development areas. The two soils located at the site are SHIRLEY FORMATION and TABB FORMATION.

Soils are classified into hydrologic soil groups (HSG 's) to indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting. The HSG 's, which are A, B, C, and D, are one element used in determining runoff curve numbers (see chapter 2). For the convenience of TR-55 users, exhibit A-1 lists the HSG classification of United States soils.

The infiltration rate is the rate at which water enters the soil at the soil surface. It is controlled by surface conditions. HSG also indicates the transmission rate —the rate at which the water moves within the soil. This rate is controlled by the soil profile. Approximate numerical ranges for transmission rates shown in the HSG definitions were first published by Musgrave (USDA 1955). The four groups are defined by SCS soil scientists as follows:

HSG	Soil textures
A	Sand, loamy sand, or sandy loam
B	Silt loam or loam
C	Sandy clay loam
D	Clay loam, silty clay loam, sandy clay, silty clay, or clay

Shirley Formation - Interbedded gravel, sand, silt, clay, and peat; at altitudes to 35-45 ft. (top of unit).

Tabb Formation - Sedgefield Member - Pebbly to bouldery, clayey sand and shelly sand, at altitudes to 30 ft. (top of unit).

usgs.gov

Group A soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sand or gravel and have a high rate of water transmission (greater than 0.30 in/hr).

Group B soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15-0.30 in/hr).

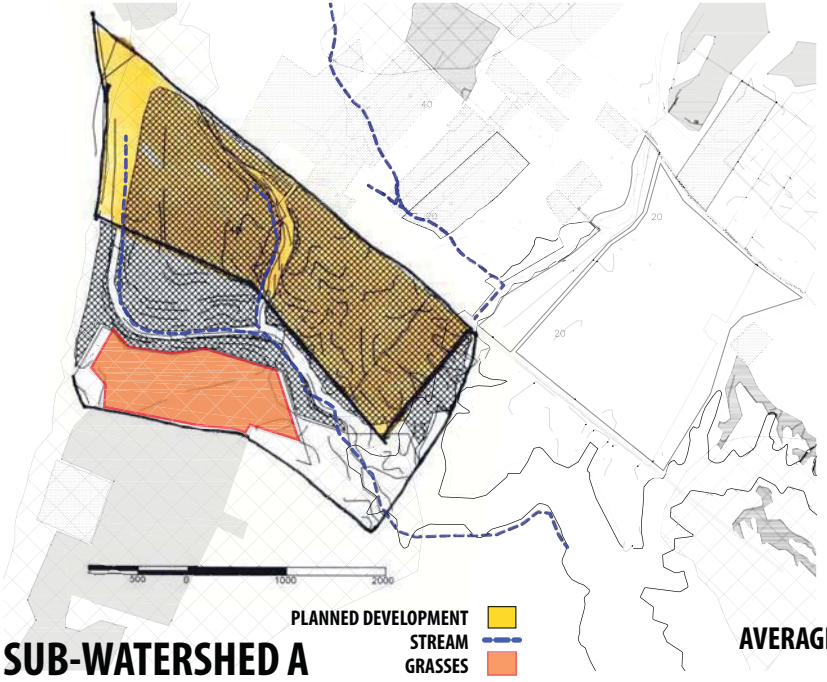
Group C soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission (0.05-0.15 in/hr).

Group D soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 in/hr).

SOURCE TECHNIAL REPORT 55, U.S.D.A.

A WAY IN THROUGH STORMWATER

One variable contained in the SCS method is the CN number/value. The CN value is based on the permiability of ground cover in a certain location. When determining the CN number for sub-watersheds A, B, and C- designations of medium density residential, high residential, and industrial were discovered. This finding was rewarding to say the least, as these were the determined catagories designated for future development. The CN value ranges from 0-100, with 100 denoting that the surface is totally impervious to water. In this instance, sub-watershed B of the proposed development site had a CN value of 81 due to it being entirely composed of industrial designation, while the average CN values of sub-watersheds A and B had CN values of 61 and 57, respectively. Average CN values were derived through an analysis of ground cover and finding the mean CN value based from land area.



SUB-WATERSHED A

TOTAL LAND AREA 111,542,638 SQ. FT.

FOREST 101,758,197 SQ. FT.
GRASS PASTURE 9,784,442 SQ. FT.

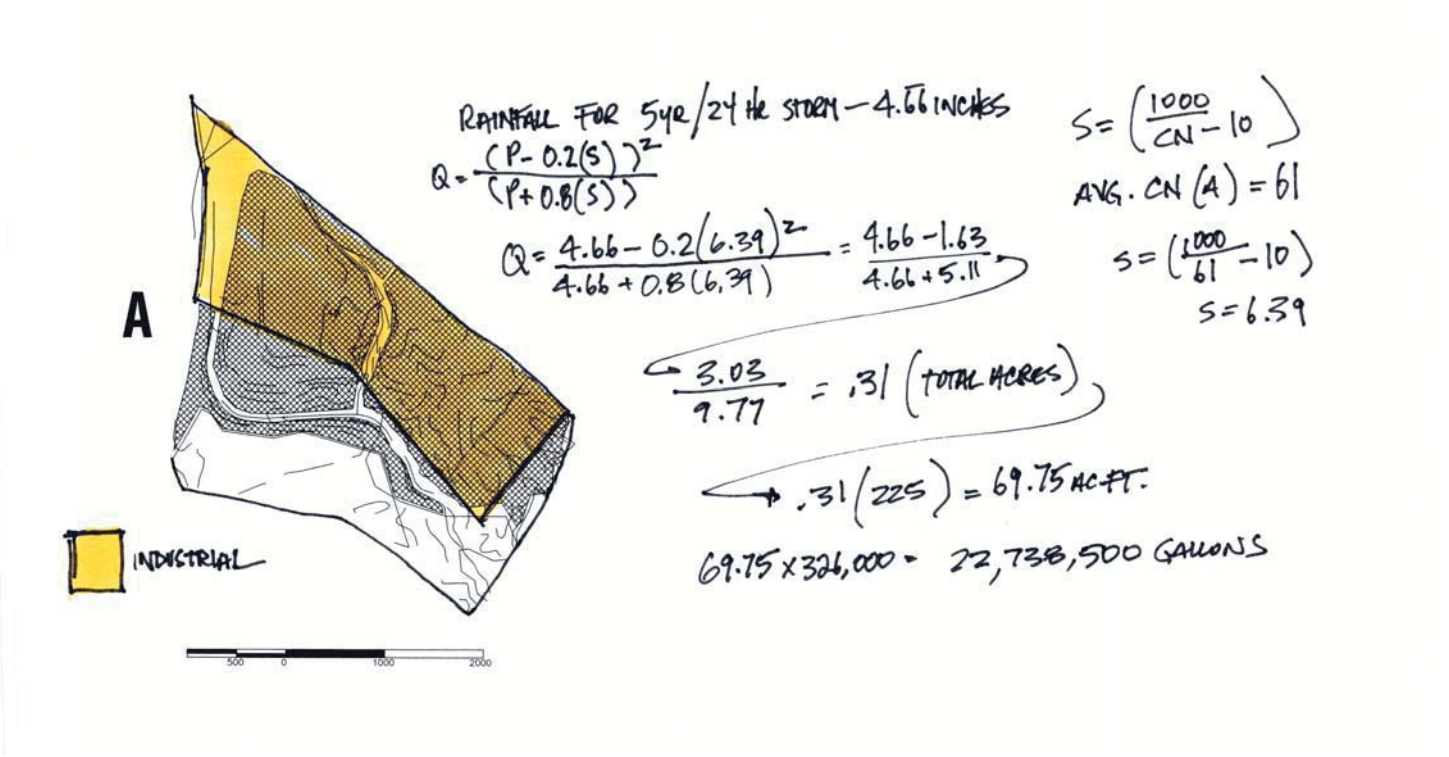
CN VALUE FOR GRASS PASTURE -- 30
CN VALUE FOR FOREST -- 39

89.6% = 89.6(30) FOREST
10.4% = 10.4(39) GRASS PASTURE

2,688
\+ 405.6
3,096.6
DIVIDED BY 100

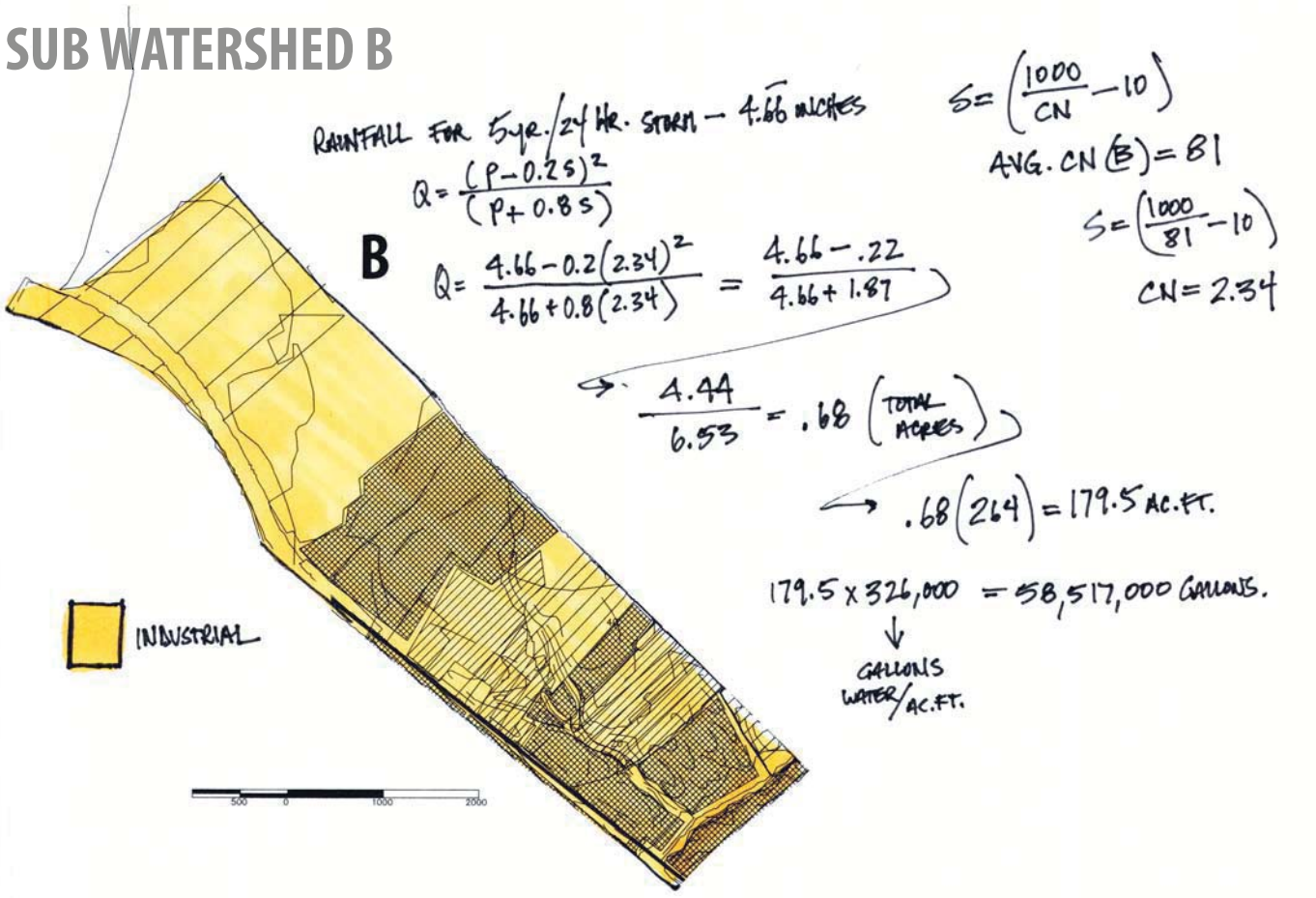
AVERAGE CN VALUE FOR SUB-WATERSHED A IS 31

SUB WATERSHED A



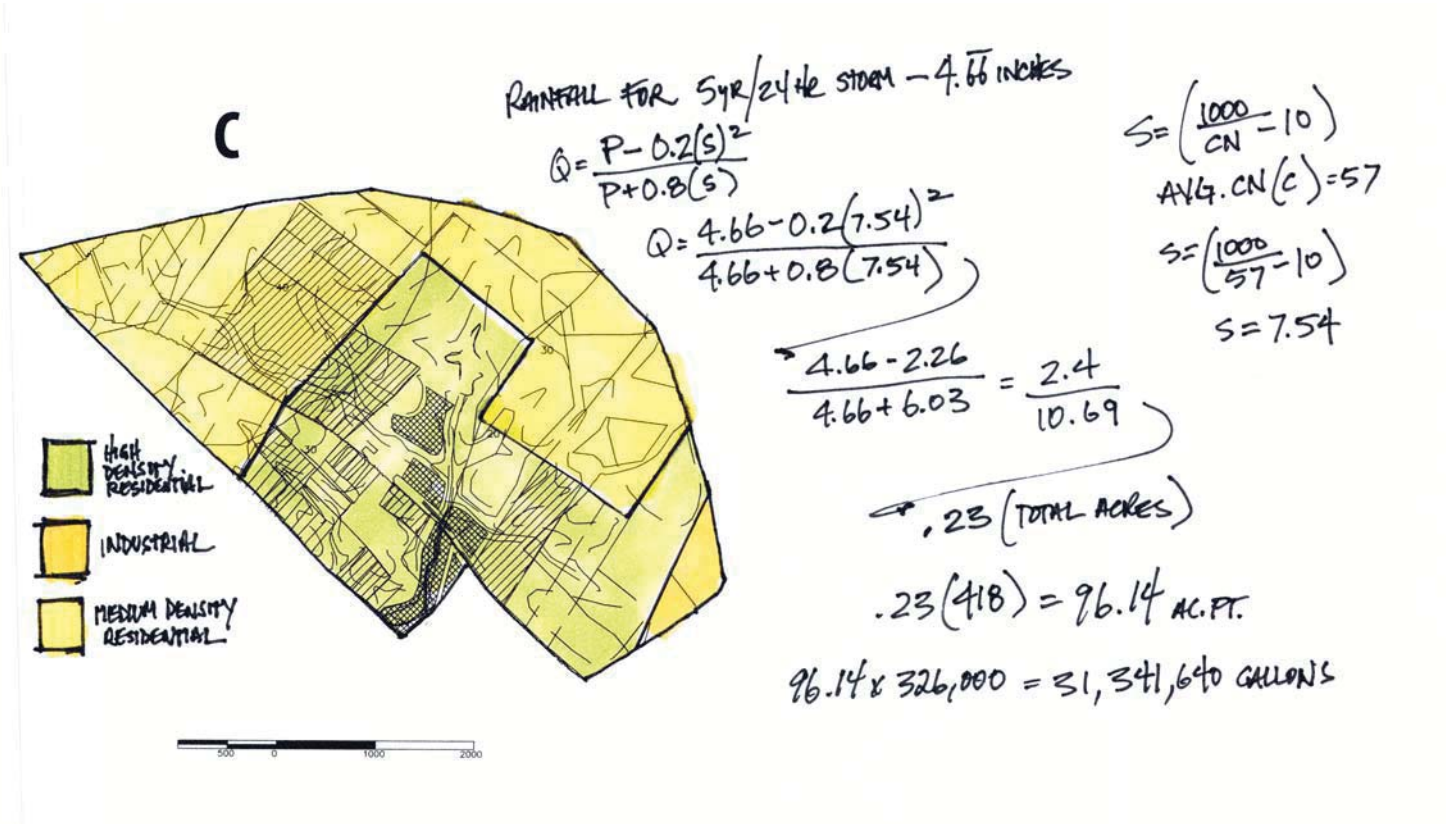
In sub-watershed A, a need to accommodate 22,738,500 gallons of water in a land area consisting of 225 acres, required a depth of 2.55ft. over the 200 foot wide (due to waterway setback) 5,949ft. long run of the waterways. This circumstance suggested that efforts to alleviate the sub-watershed B 5year/24hour storm would be better utilized, as the 179.5ac. ft. being produced in sub-watershed B presents more of a dilemma to King William County.

SUB WATERSHED B



In sub-watershed B, a need to accommodate 58,517,000 gallons of water in a land area consisting of 264 acres, required a depth of 13.2ft. over the 200 foot wide (due to waterway setback) 2,963ft. long run of the waterways. This circumstance suggested that efforts to alleviate the sub-watershed B 5year/24hour storm would be explored, as the 179.5ac.ft. being produced in sub-watershed B presents more of a dilemma to King William County.

SUB WATERSHED C



In sub-watershed C, a need to accommodate 31,341,640 gallons of water in a land area consisting of 418 acres, required a depth of 2.86ft. over the 200 foot wide (due to waterway setback) 7,313ft. long run of the waterways. This circumstance suggested that efforts to alleviate the sub-watershed B 5year/24hour storm would be better utilized, as the 179.5ac. ft. being produced in sub-watershed B presents more of a dilemma to King William County.

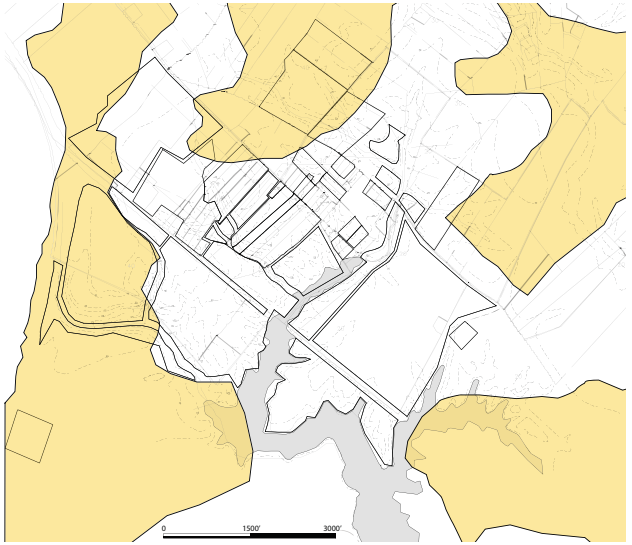
PURSUING A DIRECTION OF ASSISTANCE

The following maps show vacant land, previous grasslands from 1865, and currently occupied land. Previous grasslands were depicted to show the lack of grasslands at the Dianna Dayle River Walk site. An attempt was made to re-establish historic grasslands early on in this project, however this never materialized. One reason for the abandoning of this approach was there was little opportunity to intervene without affecting occupied land. Occupied parcels provided some limits, as the notion of inconveniencing others for an underlying motive of establishing habitat for Eastern Meadowlark cast a willful shadow on this project. Many decisions were made under the premiss that this project must be built. This desire to interfere with little or no detriment to others and their current circumstances was now the driving force. The locating of county records showing families living together on the same streets but in different homes with these home purchase dates dating back to a time when moon exploration was science fiction, provided a rejuvenated sense of humbleness. Motives to design prestigious landscapes such as a school campus or a new golf course were now gone, as the day to day living that appeared to commence without my interference was revealing itself. The relief of not having to find vacant land or land that was not already serving a purpose invited new motives to not create but rather to help. Unfortunately, much time was spent in the early stages of site exploration focusing on what can I design and how wonderful it must be when it happens. A sense of groundedness was provided when the scale of exploration reached real people, the actual audience I should have considered at the forefront. The strategy of intervening for accolades and trying to shoe horn habitat for Eastern Meadowlark did not work. There were too many decisions I was making and it did not appear as if I was communicating with the site, Eastern Meadowlark, or the residents of King William County. The locating of a small pond when searching for a proper site for the new school was a turning point. The jarring loose of a mindset determined to impress made way for the realization that we must proceed, in many cases, with the mindset to protect.

SITE MAP AT SUB-WATERSHEDS

OCCUPIED LAND PARCELS

VACANT LAND PARCELS



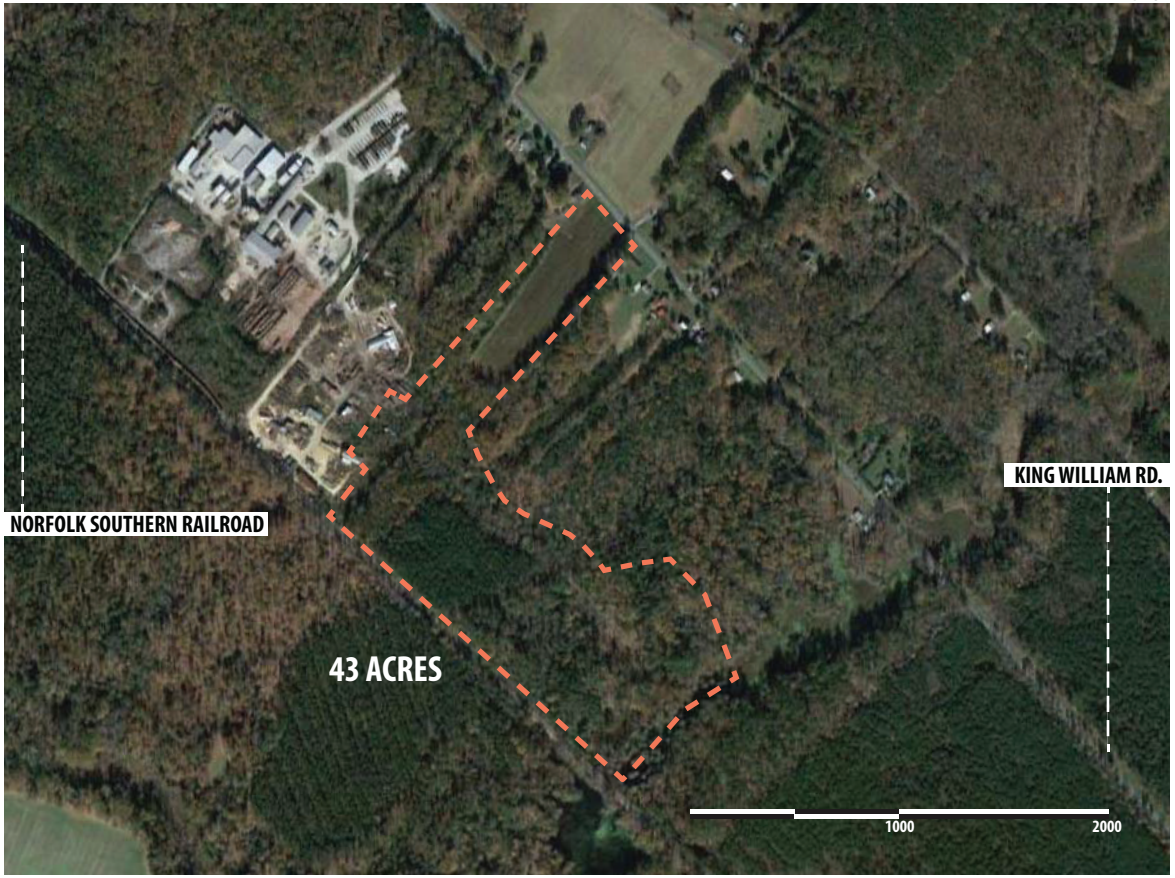
PREVIOUS GRASSLANDS-1865

DISCUSSION

SITE CENTRAL LOCATION

Taking cues from the existing stream, and taking in consideration occupied land, the site is located. Positioned in both sides by Norfolk Southern Railroad and King William Rd., the site provides access through existing infrastructure while having stream frontage to the south.

IMAGE-31

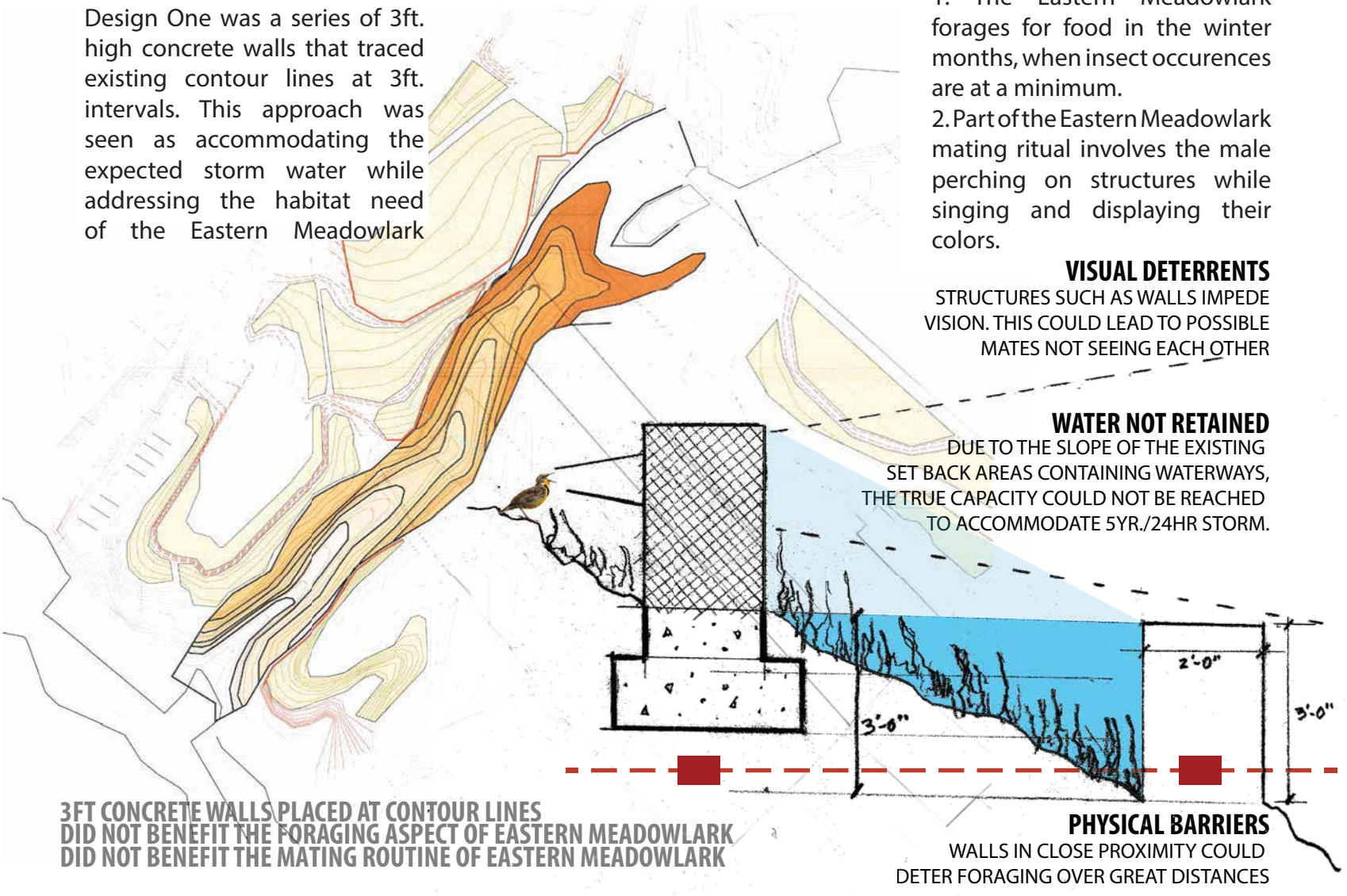


Google Earth. "King William VA.." Web.

DESIGN ONE

Design One was a series of 3ft. high concrete walls that traced existing contour lines at 3ft. intervals. This approach was seen as accommodating the expected storm water while addressing the habitat need of the Eastern Meadowlark

1. The Eastern Meadowlark forages for food in the winter months, when insect occurences are at a minimum.
2. Part of the Eastern Meadowlark mating ritual involves the male perching on structures while singing and displaying their colors.



VISUAL DETERRENTS
STRUCTURES SUCH AS WALLS IMPEDE VISION. THIS COULD LEAD TO POSSIBLE MATES NOT SEEING EACH OTHER

WATER NOT RETAINED
DUE TO THE SLOPE OF THE EXISTING SET BACK AREAS CONTAINING WATERWAYS, THE TRUE CAPACITY COULD NOT BE REACHED TO ACCOMMODATE 5YR./24HR STORM.

PHYSICAL BARRIERS
WALLS IN CLOSE PROXIMITY COULD DETER FORAGING OVER GREAT DISTANCES

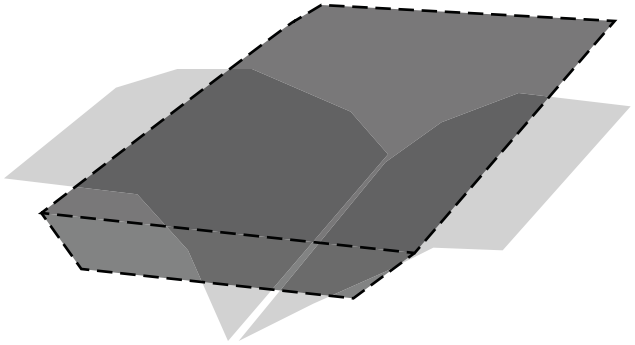
3FT CONCRETE WALLS PLACED AT CONTOUR LINES
DID NOT BENEFIT THE FORAGING ASPECT OF EASTERN MEADOWLARK
DID NOT BENEFIT THE MATING ROUTINE OF EASTERN MEADOWLARK

DESIGN TWO SLOPED VERSUS TIERED

Design One traced the existing contour lines with 3 foot walls, spaced at every third contour line. This walled system was an initial attempt to account for the three feet of water that the site would have to account for if accommodating the 5 year / 24 hour storm event would be successful. Theoretically, this would have been successful if the existing topography was not at a slope. The water that was hoped to be retained would not be in many of the areas of the River Walk. The hinderence of this slope required a manipulation of existing soils, the recognition of slope being a deterrent to retaining water suggested an approach of establishing flat basins that could retain the water from the 5 yr / 24 hr storm.

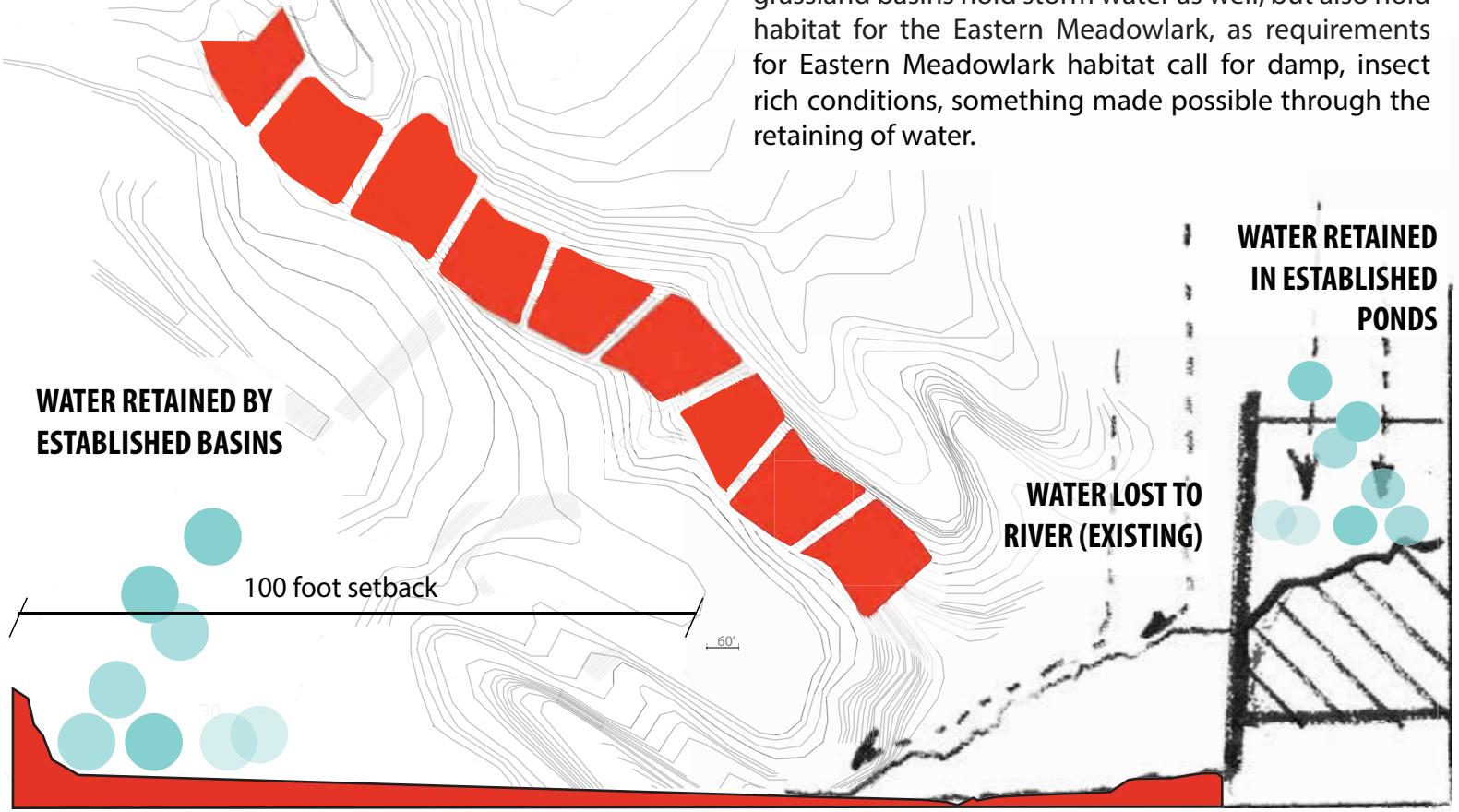
It was at this time that experimentation with cutting and filling of soil was undertaken. The rivine in which the existing stream was located needed to be flattened out, and the 100 foot setback suggested in the Chesapeake Bay Preservation Act provided a cross-stream dimension, which was replicated to establish the head and foot dimension of each basin, which would stagger their way down to the Pamunkey River.

The cut and fill calculations required 16,425 more cubic yards of soil to accomplish the tiered structure to the river. The retaining pools would provide this needed soil, with opportunity to provide other streamed rivines as needed.

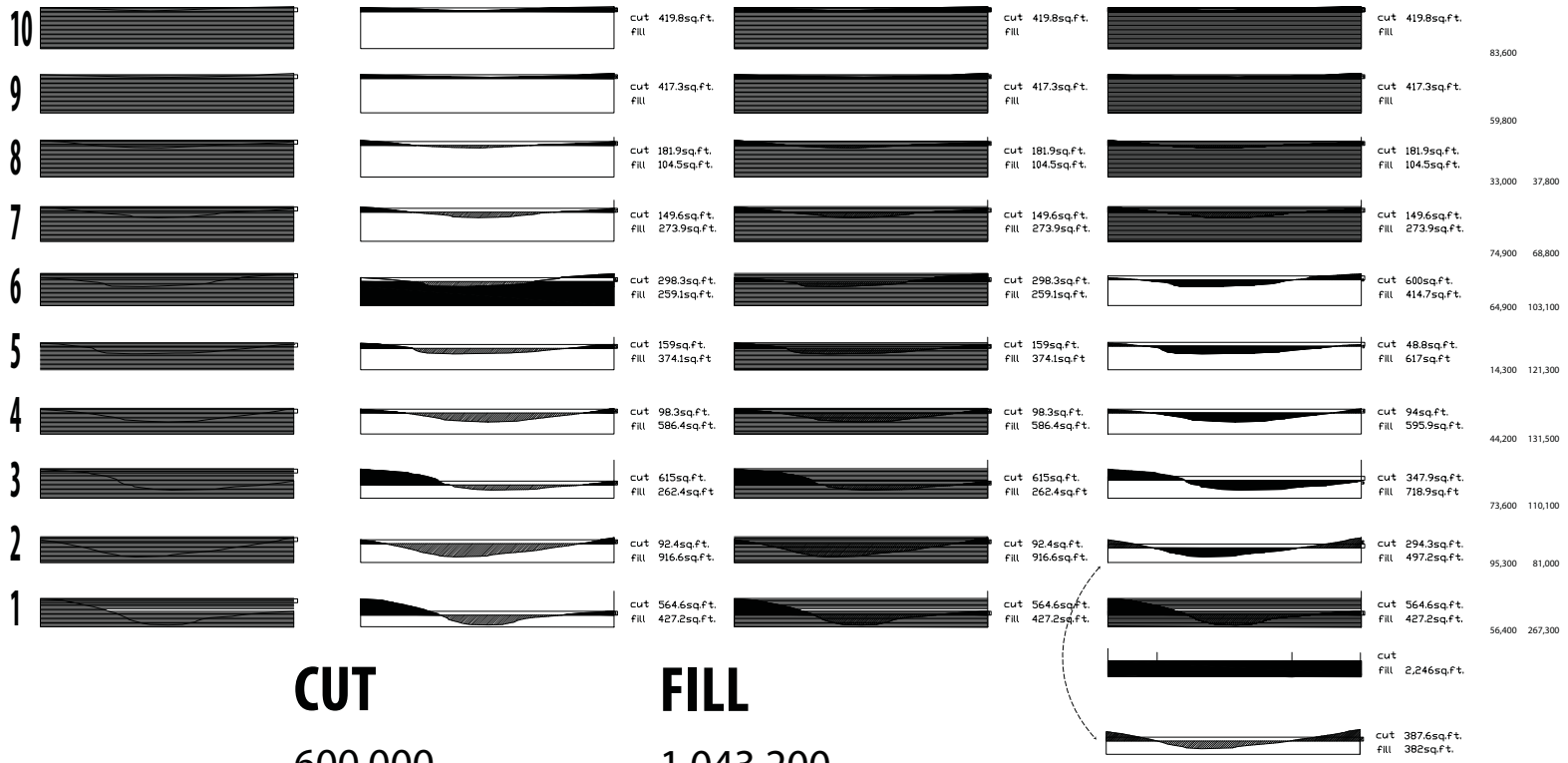


USING CONSTRUCTION SETBACKS: EMPHASING THESE LIMITATIONS TO PRODUCE HABITAT AND OUTDOOR SPACES FOR COMMUNITY

The established basins and established retention ponds serve both the Eastern Meadowlark and the community. The retention ponds hold storm water, providing a possible source for potable water- a concern stated in the King William County Comprehensive Plan. The grassland basins hold storm water as well, but also hold habitat for the Eastern Meadowlark, as requirements for Eastern Meadowlark habitat call for damp, insect rich conditions, something made possible through the retaining of water.



DESIGN TWO



CUT

600,000

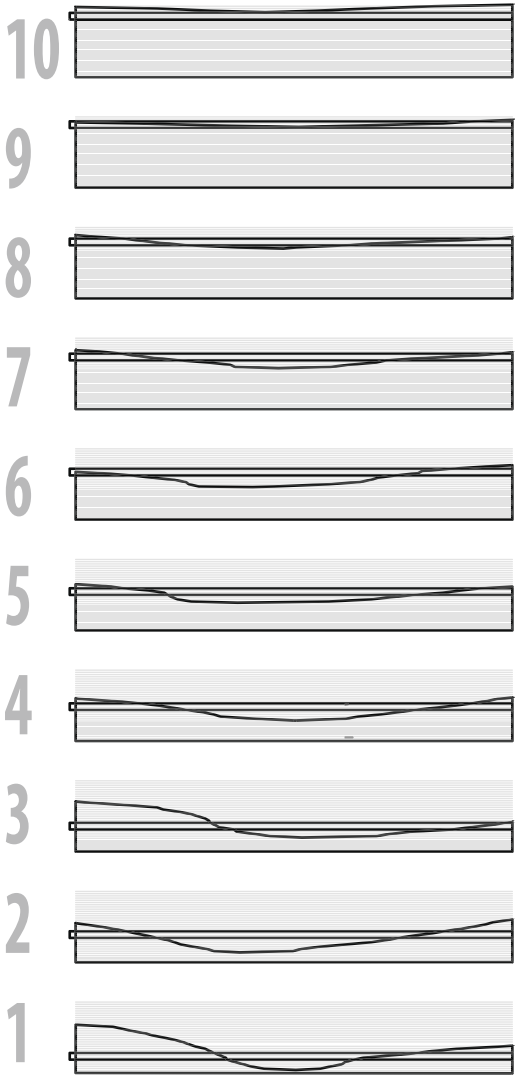
22,222YRDS

FILL

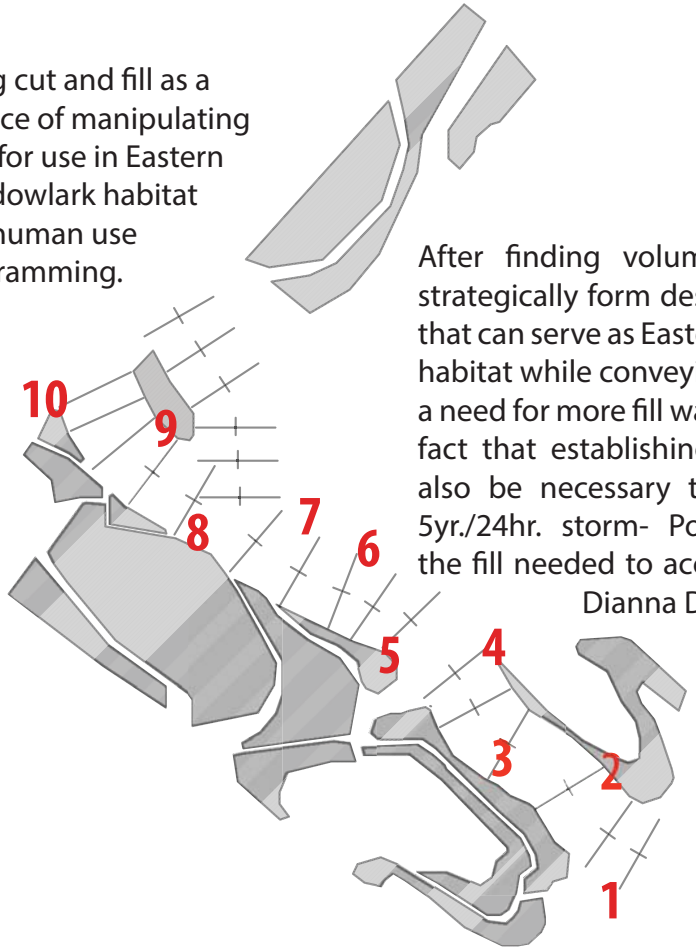
1,043,200

38,637YRDS

16,425 YRDS SHORT

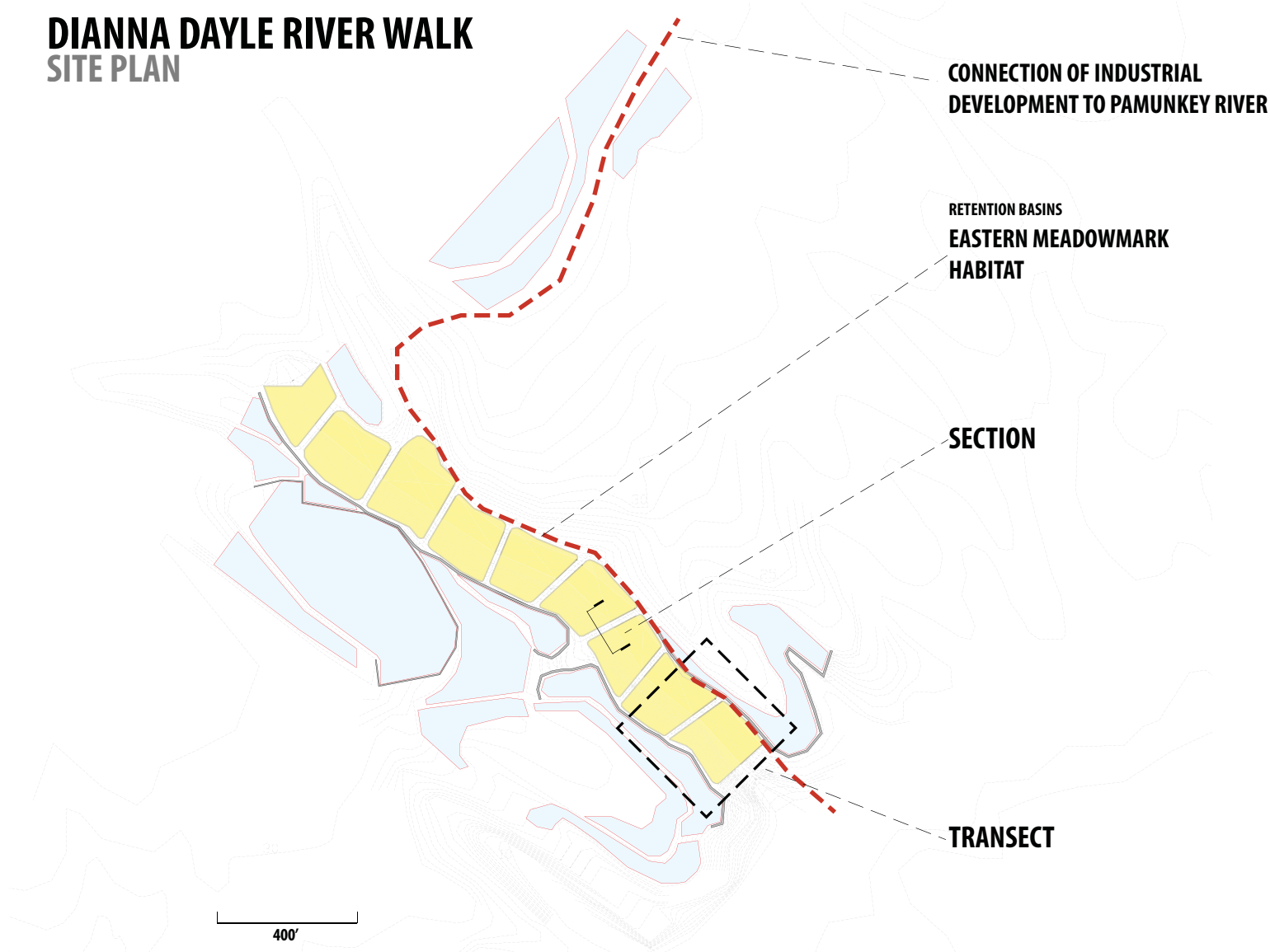


Using cut and fill as a preface of manipulating land for use in Eastern Meadowlark habitat and human use programming.



After finding volumes needed to strategically form descending basins that can serve as Eastern Meadowlark habitat while conveying storm water, a need for more fill was apparent. The fact that establishing ponds would also be necessary to facilitate the 5yr./24hr. storm- Pond 1 provides the fill needed to accommodate the Dianna Dayle River Walk.

DIANNA DAYLE RIVER WALK
SITE PLAN



DIANNA DAYLE RIVER WALK KING WILLIAM COUNTY

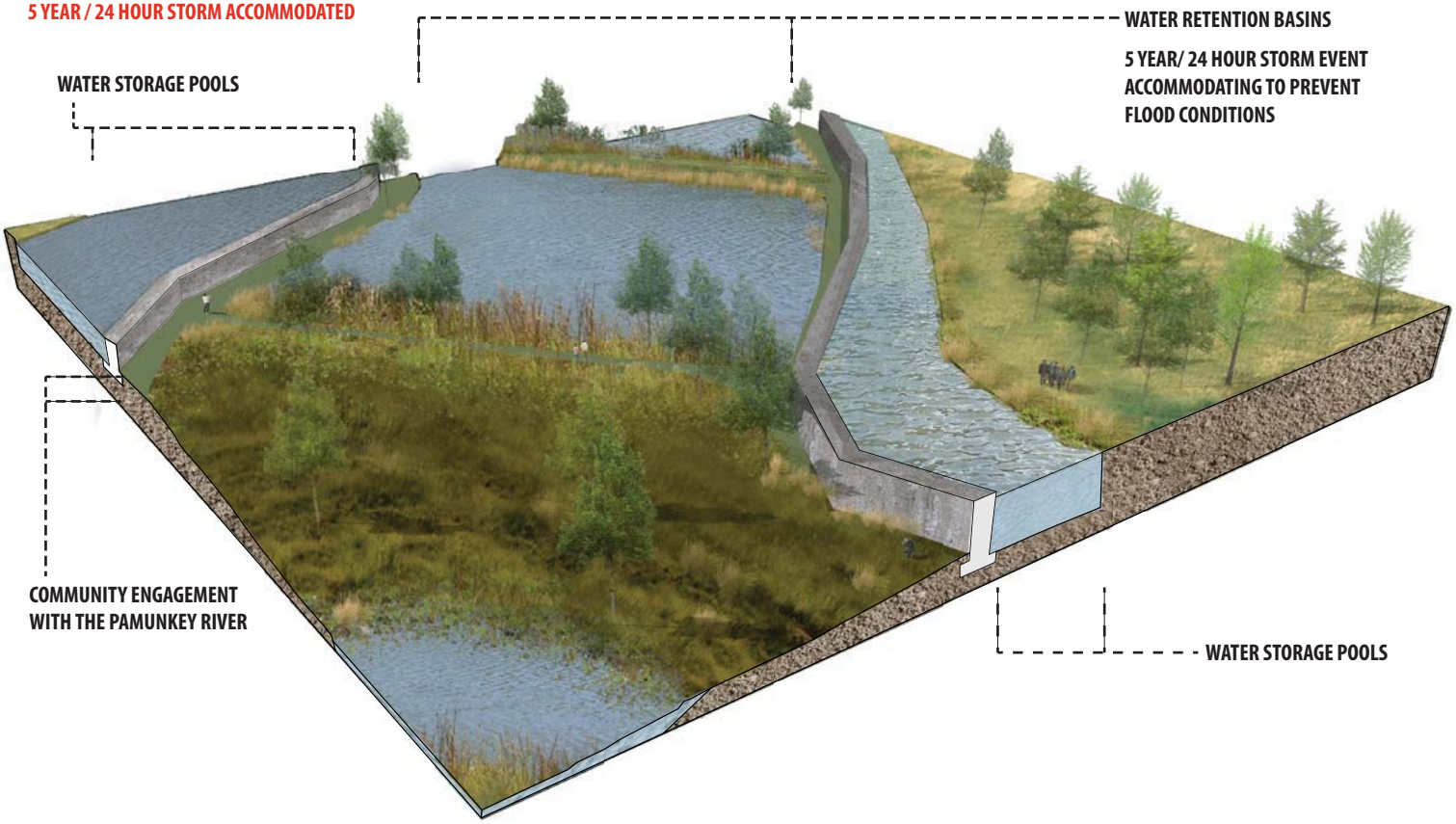
HEAVEY PRECIPITATION - BASIN INUNDATED - SERVING COMMUNITY FLOOD CONCERNS

PROTECTION FROM EROSION ACCOMMODATING FOR STORMWATER OUTDOOR RECREATION

TRANSECT ONE

STORMWATER INUNDATING BASINS

5 YEAR / 24 HOUR STORM ACCOMMODATED



DIANNA DAYLE RIVER WALK KING WILLIAM COUNTY

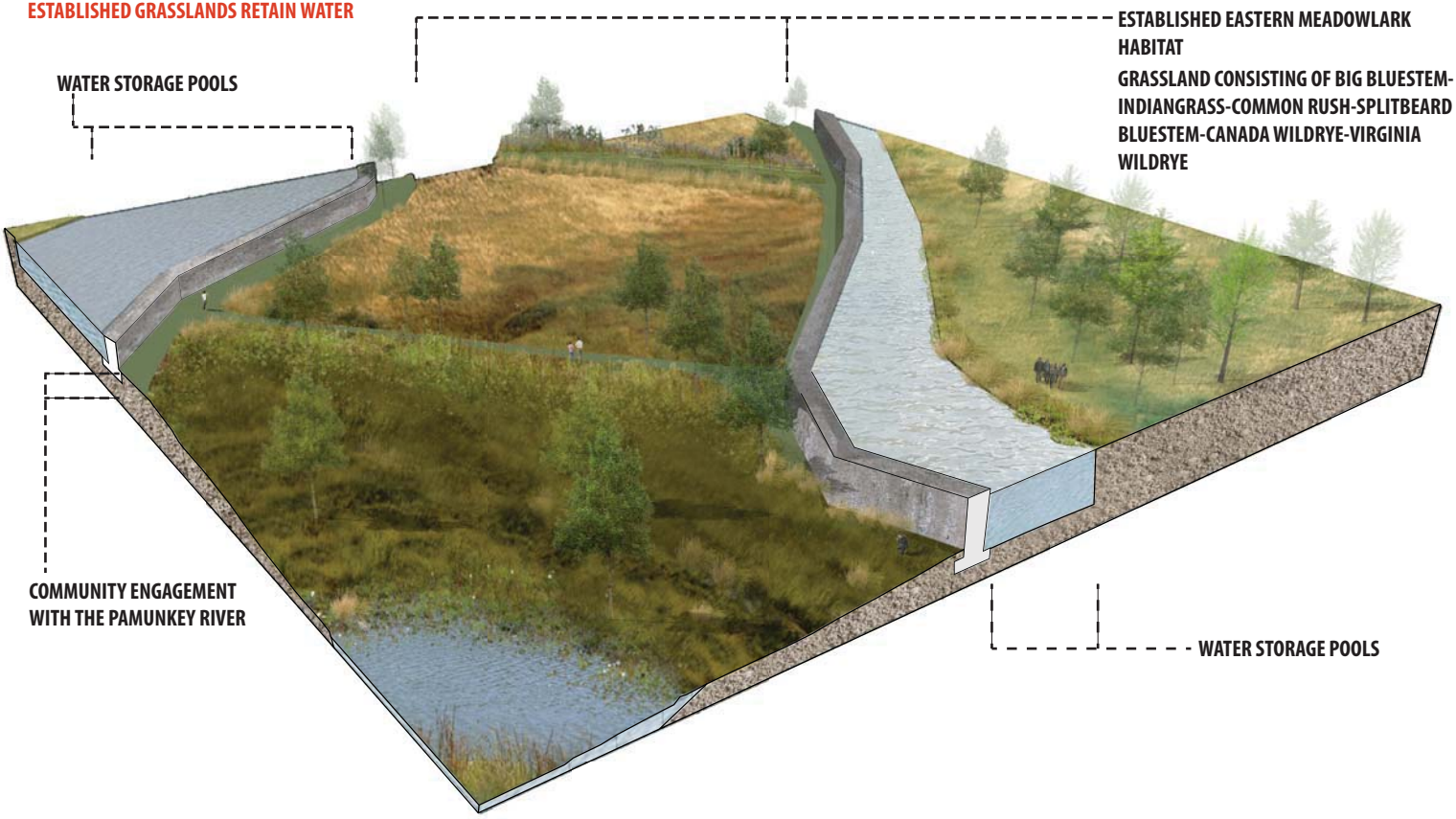
AVERAGE PRECIPITATION - BASIN SERVING AS EASTERN MEADOWLARK HABITAT

VEGETATION SUPPORTING WINTER FORAGING ESTABLISHED GRASSLANDS LESS THAN 15% CANOPY COVER

TRANSECT TWO

AVERAGE PRECIPITATION

ESTABLISHED GRASSLANDS RETAIN WATER



DIANNA DAYLE RIVER WALK KING WILLIAM COUNTY
PERSPECTIVE AT BASIN RIDGE

DIANNA DAYLE RIVER WALK KING WILLIAM COUNTY
SECTIONS AT BASIN RIDGE

HEAVY PRECIPITATION - BASIN INUNDATED - SERVING COMMUNITY FLOOD CONCERNS

PROTECTION FROM EROSION ACCOMMODATING FOR STORMWATER OUTDOOR RECRECATION

AVERAGE PRECIPITATION - BASIN SERVING AS EASTERN MEADOWLARK HABITAT

VEGETATION SUPPORTING WINTER FORAGING ESTABLISHED GRASSLANDS LESS THAN 15% CANOPY COVER

HABITAT REQUIREMENTS EASTERN MEADOWLARK

The establishment of basins, by way of cutting and filling, will disturb soil which will have to be addressed. From Schroeder's Habitat Suitability Index (1982), habitat requirements suggest vegetative communities that provide grasses that can accommodate the construction of ground nests while providing cover, and seed producing species that can facilitate the Eastern Meadowlark's need to forage during winter months. Bringing Home Nature, by Douglas W. Tallamy, suggests the following grass species for moist sites that coincide with Schroeder's requirements for the Eastern Meadowlark.

CANADA WILDRYE

ELYMUS CANADENSIS

Canada wildrye is a short-lived, cool-season grass found on sandy shores and dunes; wooded areas, especially along trails, rivers and streams; and other disturbed sites throughout much of the North America. Seedlings are vigorous and establish quickly, but are not highly competitive with other grasses.

SPLITBEARD BLUESTEM

ANDROPOGON TERNARIUS

Splitbeard bluestem grows in poor or sandy soils. This plant grows on medium and coarse textured soils with a pH ranging from 4 to 7.5. Splitbeard bluestem prefers open woods or woodland pastures on sandy soils.

COMMON RUSH

JUNCUS EFFUSUS

Soft rush is tolerant of diverse site conditions, but thrives in direct sun, finely textured soils, salinity less than 14ppt., pH from 4.0 to 6.0, and shallow water (less than 6 inches). It inhabits fresh to brackish marshes, swamps, ditches, and moist seasonal wetlands and meadows

INDIANGRASS

SORGHASTRUM NUTANS

Indiangrass is adapted to the Northeast west to Texas and North Dakota. It grows best in deep, welldrained floodplain soils. However, it is highly tolerant of poorly to excessively well-drained soils, acid to alkaline conditions, and textures ranging from sand to clay.

BIG BLUESTEM

ANDROPOGON GERARDII

Big bluestem is climatically adapted throughout the Midwest and Northeast on moderately well drained through excessively well drained soils. Big bluestem is a top choice for erosion control plantings on sites with moderately well drained to excessively well drained soils.

VIRGINIA WILDRYE

ELYMUS VIRGINICUS

Virginia wildrye prefers moist soils, high soil fertility, heavier soil textures, and it is shade tolerant. It can be found scattered on shaded banks, along fencerows and in open woodlands

USDA.GOV

VEGETATIVE DEVELOPMENT FUTURE GRASSES

BIG BLUESTEM

ANDROPOGON GERARDII

IMAGE-32

Robert H. Mohlenbrock
USDA NRCS 1995
Northeast Wetland Flora
@USDA NRCS PLANTS

Birds and mammals use big bluestem for nesting and escape cover in summer and winter. It resists lodging under snow cover almost as well as switchgrass, thereby contributing to spring nesting habitat.

INDIANGRASS

SORGHASTRUM NUTANS

IMAGE-33

Robert H. Mohlenbrock
USDA NRCS 1991. Southern Wetland Flora
@USDA NRCS PLANTS

Indiangrass can be used singly or in mixtures for livestock forage on rangeland, pastureland, and hayland.

There are about 175,000 seeds per pound.

COMMON RUSH

JUNCUS EFFUSUS

IMAGE-34

Robert H. Mohlenbrock
USDA NRCS 1989
Midwestern Wetland Flora
@USDA NRCS PLANTS

There are an estimated 18,000,000 seeds per pound

The seed and vegetative parts of soft rush are utilized by waterfowl, muskrats, nongame birds, moose and domestic livestock for food or cover.

USDA.GOV

VEGETATIVE DEVELOPMENT FUTURE GRASSES

SPLITBEARD BLUESTEM

ANDROPOGON TERNARIUS

IMAGE-35

USDA.GOV

The seed should be planted in late winter as a dormant seeding.

Birds and mammals utilize this grass for cover.

The plant produces seed from September to November.

CANADA WILDRYE

ELYMUS CANADENSIS

IMAGE-36

© W. L. Wagner
Smithsonian Institute
@USDA NRCS PLANTS

There are approximately 115,000 seeds per pound.

Planting may be completed in the spring or late fall

It also provides nesting, brood, winter, and escape cover.

VIRGINIA WILDRYE

ELYMUS VIRGINICUS

IMAGE-37

Alan Shadow
USDA NRCS East Texas Plant Materials Center

Virginia wildrye is a good forage producer. It can produce as much as 3,300 lbs of dry weight forage per dryland acre.

Virginia wildrye contains approximately 80,000 seeds per pound

USDA.GOV

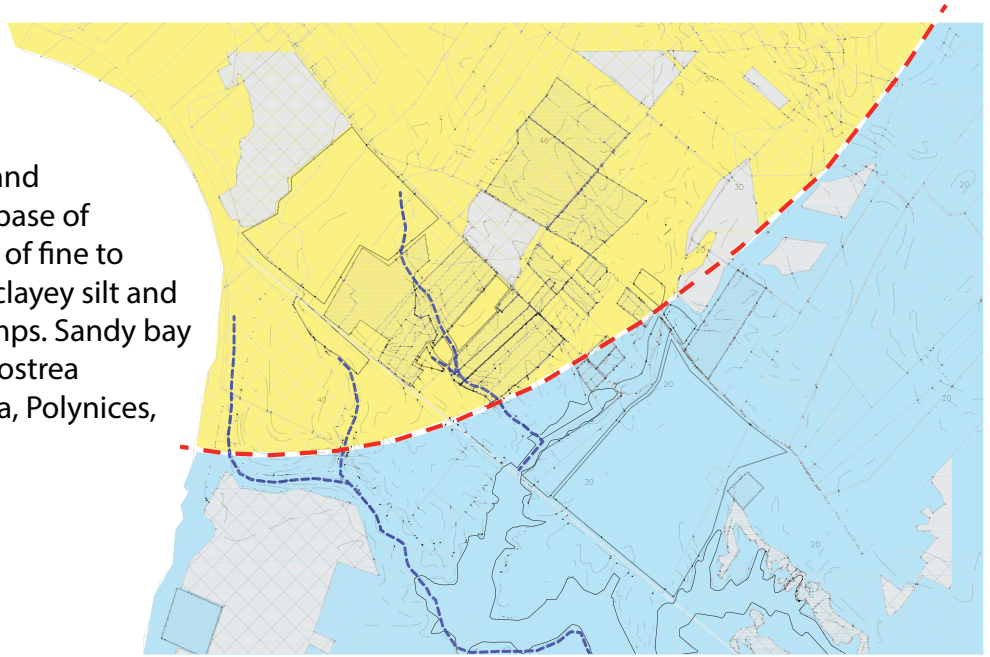
SOIL LOCATION FUTURE VEGETATIVE DEVELOPMENT

SHIRLEY FORMATION

Fluvial-estuarine facies comprises (1) a lower pebble to boulder sand overlain by (2) fine to coarse sand interbedded with peat and clayey silt rich in organic material, including in-situ tree stumps and leaves and seeds of cypress, oak, and hickory, which grades upward to (3) medium- to thick-bedded, clayey and sandy silt and silty clay. Marginal-matrix facies in lower James River and lowermost Rappahannock River areas is silty, fine-grained sand and sandy silt containing Crassostrea virginica, Mulinia, Noetia, Mercenaria, and other mollusks.

TABB FORMATION

Pebbly to bouldery, clayey sand and fine to medium, shelly sand that grades upward into sandy and clayey silt; locally channel fill at base of unit includes as much as 50 feet of fine to coarse, cross-bedded sand and clayey silt and peat containing in-situ tree stumps. Sandy bay facies commonly contains Crassostrea biostromes, Mercenaria, Anadara, Polynices, Ensis, and other mollusks.

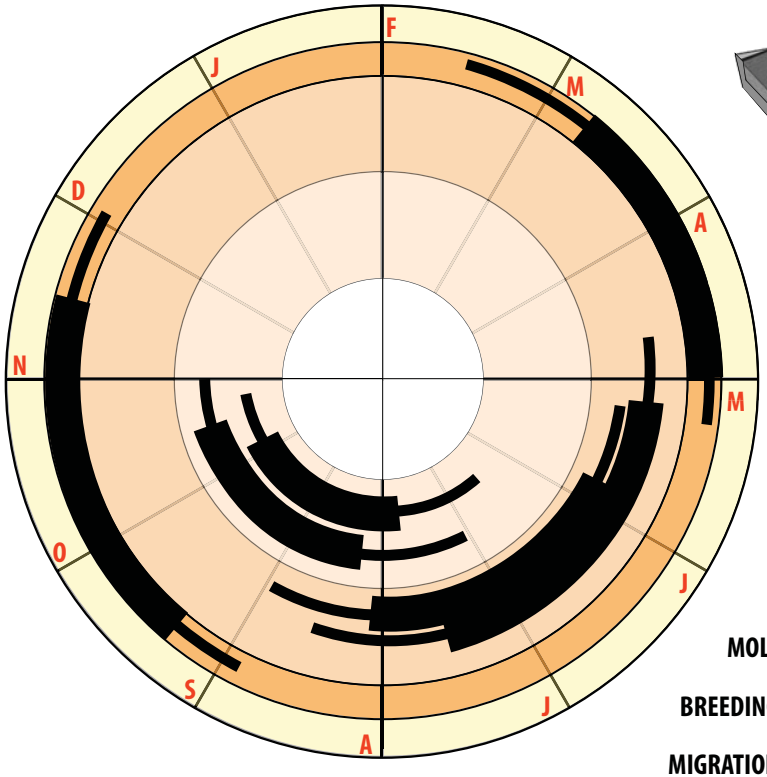


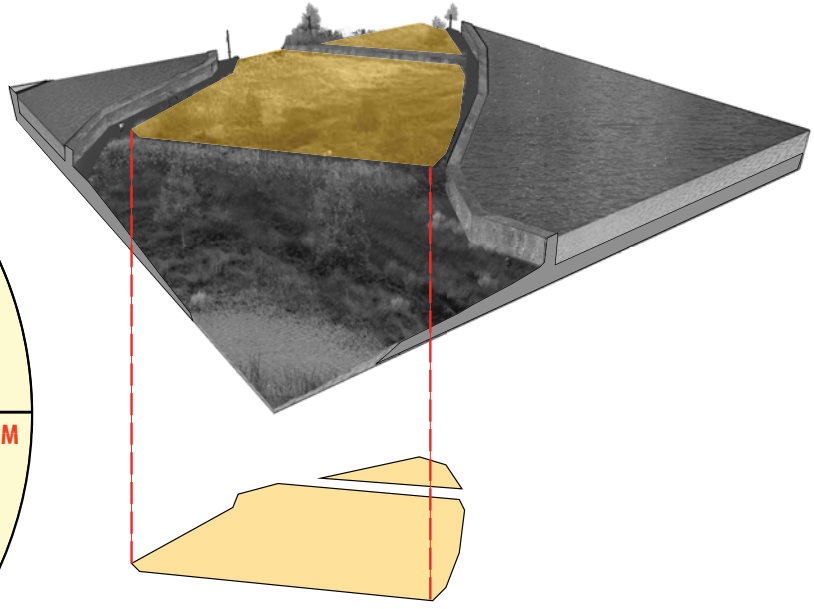
usgs.gov

MAINTENANCE SCHEDULE

AVOIDING BREEDING DISTURBANCES

The best grass heights for nesting for the Eastern Meadowlark are between 10-20 inches (Schroeder, 1982). Breeding starts for the Eastern Meadowlark in mid April and continues through late August (birdsna.org). Maintenance of the basins should occur sometime between late March and early April.





MOLT PRIMARIES BODY :to shed hair, feathers, shell, horns, or an outer layer periodically. Birds molt once or twice a year.
www.merriam-webster.com

BREEDING YOUNG EGG :the action or process of bearing or generating
www.merriam-webster.com

MIGRATION :the act, process, or an instance of migrating
watched the migration of the birds overhead
www.merriam-webster.com

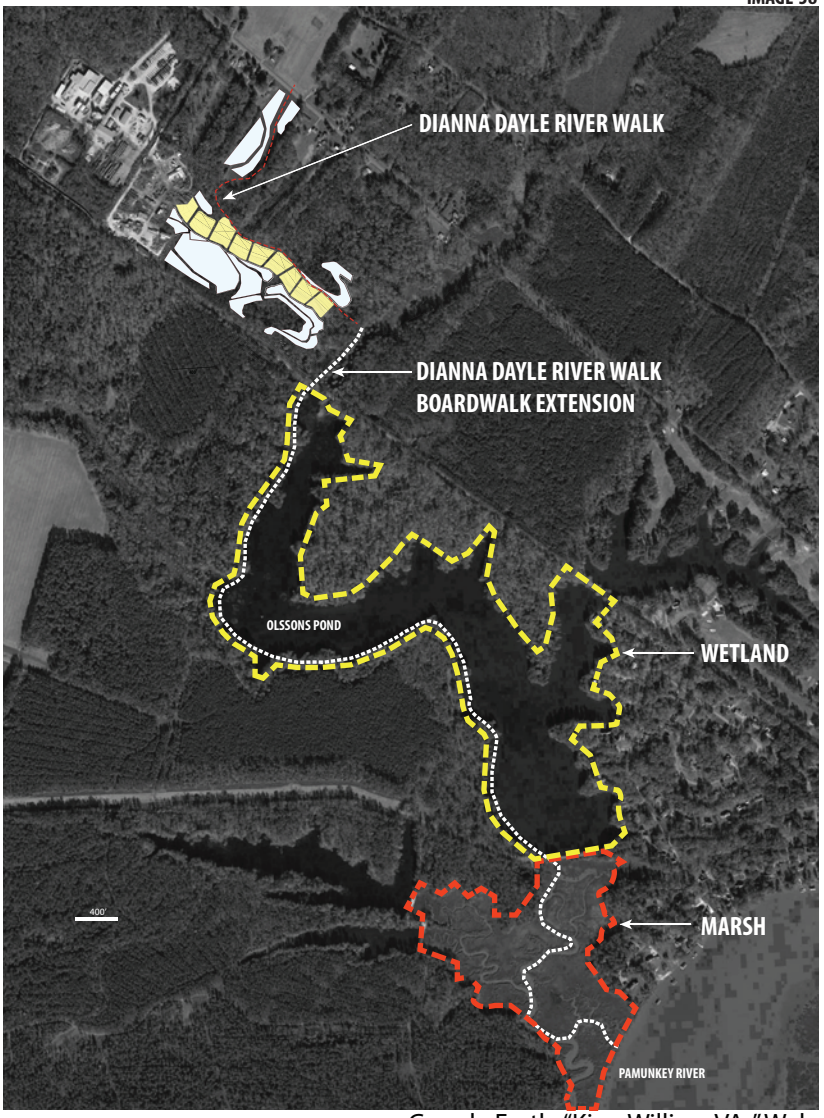
BIRDSNA.ORG

DIANNA DAYLE RIVER WALK EXTENSION

BOARDWALK TO CONNECT OLSSONS POND AND PAMUNKEY RIVER

Being as the Dianna Dayle River Walk connects to Olssons Pond, and has no direct connectivity to the Pamunkey River, a future boardwalk would facilitate this final connection to engage the patrons and residents of the future development with the Pamunkey River. The focus of this project was to provide for human use while accommodating the habitat needs of the Eastern Meadowlark. The method of identifying a human need was done through recognizing a responsibility humans have when we are developing land, the handling of stormwater. We need to ensure that our developing of landscapes will not introduce conditions that would promote flooding. The future boardwalk extension of the Dianna Dayle River Walk would be constructed in wetland and marsh conditions, which would bring on various other habitat requirements that are not specific to grassland avifauna such as the Eastern Meadowlark. In addition, these other ecosystems may have different concerns besides the accommodating of stormwater and land consumption associated with urban and suburban development. Further analysis of other avifauna within the Mattaponi and Pamunkey Rivers IBA along with analysis of our future intentions with regards to development in King William County would be needed to connect directly to the Pamunkey River.

IMAGE-38



Google Earth. "King William VA.." Web.

CONCLUSIONS

CONCLUSIONS

The final design of the Dianna Dayle River Walk is a multi-purpose solution that some may say adheres to the Reconciliation Ecology model. The habitat requirements of having wild grasses ranging in lengths from 4-20 inches is met, as is the requirement of having a canopy that is at least 85% open. Land area requirements of having at least the preferred 6 acres (Schroeder, 1982) to support a population is surpassed, with 8.26 acres being the final product of established grassland. Human uses for the Dianna Dayle River Walk are also present, as the stated goals of the King William County Comprehensive Plan of promoting human engagement with waterways and reducing physical inactivity are met by way of the option to walk to the Pamunkey River. With establishing habitat for wildlife being the driver of this project, the Dianna Dayle River Walk also provides opportunities for scholastic exploration by residents who may not have been afforded such opportunities had habitat establishment not been a focus. These attributes contained in this design are joined by the functionality of accommodating the stormwater of a 5 year/ 24 hour storm event. The responsibility of stormwater management coupled with the habitat requirements of the Eastern Meadowlark provided circumstances where these dilemmas could be solved through plan, study, and design- through Strategic Concessions. The need to retain water in basins allows for vegetation that does not require frequent mowing. The damp nature of these basins promotes insect activity, which is a staple in the diet of the Eastern Meadowlark. (Schroeder, 1982). The form of these basins retain seeds from vegetation, which feed Eastern Meadowlark in the winter months.

As that I can see no way out but through— "A Servant of Servants" Robert Frost -1915

In all, I feel this project accommodates the needs of many, from the Eastern Meadowlark to the community of King William County. This endeavor has changed the way I view my role with the engagement of other living creatures. An early effort of addressing the responsibility of water management may not have provided me with such admiration for finding what I feel is a success in something that is required on almost every project, everyday. The struggle to find agreement with land use and habitat needs for the Eastern Meadowlark provided insight on the differences we can make if we are unwavering in our desire to make things work for the collective. Oh, and not giving up helps too. Thank you-

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REFERENCES

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"Welcome to the United Nations, it's your world." United Nations, United Nations, www.un.org/.

APPENDIX A

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