



APPENDIX

PHASE 1 GREEN INFRASTRUCTURE FRAMEWORK

CONTENTS

A – DATA WISHLIST	4
B – PRECEDENTS	7
C – WORKSHOP MATERIALS	13
D – ANALYSIS PROCESS	124
E – ATLAS & PLAYBOOK DETAILS	156
F – POLICY ANALYSIS	165

B

PRECEDENTS

Biohabitats conducted a brief literature review to identify relevant national and international models that have had a positive impact on increasing the health and connectedness of ecological and human systems. Of the projects selected for review, six examples arose as particularly relevant to the MARC GI Plan, whether in terms of ecological scale, biodiversity, transportation planning, the local ecoregion, or its overall comparable scope and quality.

Below is a list with links to all of the plans reviewed within the scope of the precedent study, followed by the literature review conducted by Biohabitats.

- The George Washington Region 2011 Regional Green Infrastructure Plan
<https://www.gwregion.org/regional-planning/reports-and-studies/regional-green-infrastructure-plan/>
- Land Mosaics for the Barcelona Metropolitan Region
<https://books.google.com/books?id=UlamKfshPCUC&pg=PA230&lpg=PA230&dq=Richard+TT+Forman+Barcelona&source=bl&ots=-2a-AmbT9D&sig=ahVcgSK97pgfXYEpDpsShM98uDs&hl=en&sa=X&ved=0ahUKEwiwxrebh-PPAhWJMx4KHbk-CnwQ6AEIQzAH#v=onepage&q=Richard%20TT%20Forman%20Barcelona&f=false>
- Barcelona Green Infrastructure and Biodiversity Plan 2020
http://w110.bcn.cat/MediAmbient/Continguts/Documents/Documentacio/BCN2020_GreenInfraestructureBiodiversityPlan.pdf
- Baltimore Green Network Plan
<http://www.baltimoresustainability.org/projects/green-network/>
- Regional Advance Mitigation Planning
<http://iopscience.iop.org/article/10.1088/1748-9326/9/6/065001>
- Ecoregional Conservation in the Osage Plains/Flint Hills Prairie
<http://iopscience.iop.org/article/10.1088/1748-9326/9/6/065001>
- London Biodiversity Action Plan
<http://www.gigl.org.uk/about-gigl/londons-biodiversity-action-plan/https://www.cityoflondon.gov.uk/services/environment-and-planning/planning/design/sustainable-design/Documents/Biodiversity-action-plan-2010-2015.pdf>
- Green City, Clean Waters: The Philadelphia Green Infrastructure Plan
http://www.phillywatersheds.org/doc/GCCW_AmendedJune2011_LOWRES-web.pdf
- Portland Watershed Management Plan
<https://www.portlandoregon.gov/bes/article/298042>
- Portland's Green Infrastructure: Quantifying the Health, Energy, and community Livability Benefits, 2010
<https://www.portlandoregon.gov/bes/article/107808>
- Baltimore Watershed Agreement Action Plan
<http://resources.baltimorecountymd.gov/Documents/Environment/Watersheds/bwaactionplanfinal09.pdf>
<http://resources.baltimorecountymd.gov/Documents/Environment/Watersheds/bwaprogressreport030410.pdf>
- Urban Watershed Framework, Triple Bottom Line (TBL) Model Dashboard for San Francisco Public Utilities Commission, Sewer System Improvement Program
<http://sfwater.org/Modules/ShowDocument.aspx?documentid=2552>
- "Sponge City" Program in China
<https://www.austrade.gov.au/ArticleDocuments/6585/China%20Sponge%20City%20Program.pdf.aspx>
- Paris Greening Programme, 2007
http://www.mcrit.com/climagranollers/index.php?option=com_content&view=article&id=24:paris-climate-protection-plan&catid=81:europa&Itemid=74
http://www.energy-cities.eu/cities/cities_actions_detail.php?id=1434
- City Biodiversity Index (Singapore Index): Urban Biodiversity
<https://www.cbd.int/doc/meetings/city/subws-2014-01/other/subws-2014-01-singapore-index-manual-en.pdf>
- San Jose and the Urban Village
<http://greenplanit.sfei.org/books/chapter-3-case-study-san-jose%E2%80%99s-urban-villages>
- Carbon Neutral Cities Alliance 2016 Energy System Transformation Playbook
Playbook available online soon. See the following link for current publicly available materials:
http://gettingtozeroforum.org/wp-content/uploads/sites/2/2016/01/WesterhoffLisa_NetZeroForumDenver-handout.pdf
- Bridgeport, CT Eco-Urban Assessment
<http://tnc.maps.arcgis.com/apps/MapJournal/index.html?appid=4912af1e58394129be9f7a895a755c66>

MEMORANDUM

Date: October 17, 2016

To: Christina Hoxie, BNIM

From: Claudia Browne, Biohabitats
Aiman Duckworth, Biohabitats
Jessica Norris, Biohabitats

RE: MARC Green Infrastructure Plan
Subject: Literature Review- Project Precedents

Literature Review

Biohabitats conducted a brief literature review to identify relevant national and international models that are having the most positive impact on increasing the health and connectedness of natural ecosystems and transportation systems. We began with projects for which we were on the project team and then turned to other published precedents of green infrastructure planning to select a small group of pertinent examples.

The purpose of the current effort was not to provide a comprehensive list of green infrastructure techniques, but rather to canvass some of the innovators and leaders in the field, which serve as touchpoints in green infrastructure planning. As would be expected, green infrastructure strategies vary depending on the regional context, types of environmental issue, and the selected focal metrics of the lead groups. The attached “MARC GI Precedents, dated 10/17/16” spreadsheet includes a focused list of select reference projects.

The six examples described below comprise a short list that each have a special relevance to the MARC GI Plan, whether in terms of ecological scale, biodiversity, transportation planning, the local ecoregion, or its overall comparable scope and quality.

Six Models in Green Infrastructure Planning

1. The George Washington Region 2011 Regional Green Infrastructure Plan
<https://www.gwregion.org/regional-planning/reports-and-studies/regional-green-infrastructure-plan/>

Comparable in scale and scope to the MARC GI Plan, this set of documents provides a useful model on several fronts, from assigning metrics at the initial stages of goal setting, to offering a comprehensive

policy review (*Green Infrastructure Toolkit*) for the coordinating municipalities. It is interesting for the approach to assessment and goals, which relies heavily on land cover designations and remotely sensed data. Land cover and tree canopy change over time was analyzed to identify trends. It also presents a scenario planning approach in support of a regional long-range transportation planning program by identifying regional goals and community values. The scenarios explored and evaluated alternatives for growth, development, and transportation investments. The final goals addressed various scales including total regional tree cover and modifications to tree considerations in the site plan review process.

2. Regional Advance Mitigation Planning

<http://iopscience.iop.org/article/10.1088/1748-9326/9/6/065001>

The RAMP framework is a cooperative model developed in California to leverage transportation mitigation projects into effective regional conservation actions. RAMP offers a model for development of cooperative regional planning that has met with success in its earliest examples. Using RAMP, state and federal agencies consider the environmental impacts of several planned infrastructure projects at once. Working together, natural resource and infrastructure agencies can estimate mitigation needs early in the projects' timelines. This can avoid permitting and regulatory delays and allowing public mitigation dollars to stretch further by securing and conserving valuable natural resources on a more economically efficient scale, before related real estate values escalate.

3. Ecoregional Conservation in the Osage Plains/Flint Hills Prairie

https://www.conservationgateway.org/ConservationPlanning/SettingPriorities/EcoregionalReports/Documents/final_plan.pdf

Although dating back to 2000, the TNC plan that encompasses the southern half of the MARC region is a useful model for several reasons. First, the ecoregional description and considerations remain pertinent even over a decade after its writing. Secondly, the planning process uses science to determine conservation targets and goals through a formal framework that is a precursor of the [Open Standards for the Practice of Conservation](#) and may prove useful to MARC's goal setting.

4. Green City, Clean Waters: The Philadelphia Green Infrastructure Plan

http://www.phillywatersheds.org/doc/GCCW_AmendedJune2011_LOWRES-web.pdf

Philadelphia's success story over the last five years of implementation of their Green City, Clean Waters program has several explanations. One of the key early policy decisions was instrumental in restructuring the departments that had to be involved in order to meet with success. Three formerly separate departments, Combined Sewer Overflow, Stormwater Management, and Source Water Protection were restructured around watersheds that are ecological coherent units, instead of around the anomalous regulatory structure. This restructuring was critical to moving them forward. Philadelphia is also a good example of flood risk reduction and flood abatement through GI practices.

5. City Biodiversity Index (Singapore Index): Urban Biodiversity

<https://www.cbd.int/doc/meetings/city/subws-2014-01/other/subws-2014-01-singapore-index-manual-en.pdf>

The Singapore Index is the pioneering assessment tool for developing steps to improve biodiversity conservation efforts over time. It emerged from the Convention on Biological Diversity, an international treaty body that recognized the need to incorporate biodiversity alongside other environmental indicators for developed areas. The resulting City Biodiversity Index was endorsed in 2010 and has been applied to

hundreds of cities and regions since. As a science-driven tool, the index is specifically designed to provide a formal basis of comparison for measuring progress through time. Through all of its permutations, the index retains a focus on addressing the primary biodiversity threats in developed regions – loss and fragmentation of natural areas.

6. San Jose and the Urban Village

<http://greenplanit.sfei.org/books/chapter-3-case-study-san-jose%E2%80%99s-urban-villages>

Although not a complete GI planning effort in itself, this account of the application of the GreenPlan-IT toolkit is a useful example that includes specific data sets and decisions. The step by step presentation of GIS data and decision points may serve as a useful illustration. In addition, this GIS tool is oriented entirely on watersheds as the most ecologically sensible planning unit. San Jose is identified as one of MARC's Peer Metros on Metro Dataline.

Refer to attached spreadsheet for additional information on the above approaches and comparison to other relevant examples.



Category	City	Document/Related Project	Scale	Entity	Description	Primary Ecosystem Service Focus	Other Ecosystem Services Highlighted	Threats to Ecosystem Services	Focal Metric Topics	Effectiveness Measurement Type	Weblinks
Regional Green Infrastructure Plan	City of Frederickburg, VA and four surrounding counties	George Washington Regional Commission, Regional GI Plan, 2011	Region	George Washington Regional Commission	GI plan includes a regional ecosystem assessment, water resource scenario planning, policy review, findings, and GI recommendations. Landscape ecology research, with major regional natural systems as a framework for diverse human uses. Three planning scenarios are presented based on a gradient of projected ecological health. Plans feature multiple corridor typologies.	Water Quality, Air Pollutant Removal, Carbon Sequestration, Human Health & Wellbeing		Land Conversion, Habitat Fragmentation, Stormwater Pollution	Landcover Types, Tree Canopy, Number of GI SMM Projects	Post Implementation Measurement - Landcover Change (to be completed in the future)	http://www.gwrc.com/Portals/0/Regional%20GI%20Plan%202011.pdf
Regional Green Infrastructure Plan	Barcelona Metropolitan Region, Spain	Land Mosaics for the Barcelona Metropolitan Region	Region	Barcelona Metropolitan Area	Regional plan focused on assessment and recommendations related to biodiversity and typologies of urban green space.	Biodiversity, Water Quality, Human Health & Wellbeing	Cultural Resources	Land Conversion, Habitat Fragmentation	Multiple quantitative and qualitative.	Projective Modeling	http://www.barcelona.cat/eng/urban-planning/urban-planning-projects/land-mosaics-for-the-barcelona-metropolitan-region
Regional Green Infrastructure Plan	Barcelona Metropolitan Region, Spain	Barcelona Green Infrastructure and Biodiversity Plan 2020	Region	Barcelona Metropolitan Area	Regional plan focused on assessment and recommendations related to biodiversity and typologies of urban green space.	Biodiversity, Water Quality, Human Health & Wellbeing		Land Conversion, Habitat Fragmentation	Multiple quantitative and qualitative.	Projective Modeling	http://www.barcelona.cat/eng/urban-planning/urban-planning-projects/barcelona-green-infrastructure-and-biodiversity-plan-2020
City Green Infrastructure Plan	Baltimore, MD	Baltimore Green Network Plan	City	City of Baltimore	A city-wide green infrastructure plan focused on leveraging existing greening and evaluation programs associated with vacant land into a connected network.	Habitat Connectivity, Human Health & Wellbeing	Multiple	Land Vacancy, Land Conversion, Habitat Fragmentation	Land uses and community access to open space.	Projective Modeling	http://www.baltimore.gov/Portals/0/Files/2014/07/14/Baltimore-Green-Network-Plan-2014.pdf
Regional Mitigation Planning	Mine San Francisco Bay, CA Area Counties	Regional Advance Mitigation Planning (RAMIP)	Region	UC Davis, The Nature Conservancy, Metro Trans Commission	A cooperative model to leverage transportation mitigation projects into regional conservation actions.	Biodiversity	Water Quality, Food Production	Land Conversion, Habitat Fragmentation	Landcover Types, Transportation Impacts to Species of Concern	Projective Modeling	http://www.nature.org/usa/conservation/transportation-mitigation-projects
Regional Conservation Planning	Multiple Counties in MO, KS and OK	Ecoregional Conservation in the Ozarks Prairie/Rain Hills Profile	Region	The Nature Conservancy	A science based plan for conservation using a precursor to the Open Standards for the Practice of Conservation	Biodiversity	Water Quality, Food Production	Land Conversion, Habitat Fragmentation	Landcover Types, Transportation Impacts to Species of Concern	Projective Modeling	http://www.nature.org/usa/conservation/ozarks-prairie-rain-hills-profile
Biodiversity Planning	London Metropolitan Area, UK	London Biodiversity Action Plan	City Metro Area	Greater London CC	Habitat and species based conservation, restoration, and enhancement program that includes the London Lea Valley Olympic Legacy Plan.	Biodiversity	Multiple	Land Conversion, Habitat Fragmentation	Biodiversity, Species and Habitat Specific Measurements	Post Implementation Measurement	http://www.london.gov.uk/Portals/0/Files/2014/07/14/London-Biodiversity-Action-Plan-2014.pdf
Watershed Planning	Philadelphia, PA	Green City, Clean Waters: The Philadelphia Green Infrastructure Plan	City	City of Philadelphia	Watershed based plan that included the restructuring of water-related municipal departments around watersheds.	Water Quality	Biodiversity, Human Health & Wellbeing	Stormwater Pollution, Flooding	Aquatic Health, Greened Areas - Improves Cover managed by GI	Projective Modeling Post Implementation Measurement	http://www.phila.gov/Portals/0/Files/2014/07/14/Green-City-Clean-Waters-Philadelphia-Green-Infrastructure-Plan-2014.pdf
Watershed Planning	Portland, OR	Portland Watershed Management Plan, Portland's Green Infrastructure Quantifying the Health, Energy, and Community Livability Benefits, 2010	City	City of Portland	Watershed based assessment and improvement plan. A related study looks at seven of the City's Green BMP strategies and quantifies the positive and negative effects of each to eight metrics.	Water Quality	Human Health & Wellbeing, Climate Regulation, Clean Air, Carbon Sequestration	Multiple	Multiple by Ecosystem Service	Projective Modeling, Post Implementation Measurement	http://www.portland.gov/Portals/0/Files/2014/07/14/Portland-Watershed-Management-Plan-2010.pdf
Watershed Planning	Baltimore City and County, MD	Baltimore Watershed Agreement Action Plan	City Metro Area	Baltimore City and Baltimore County	A cross-jurisdiction plan for water quality or granted around watersheds.	Water Quality	Human Health & Wellbeing	Stormwater Pollution, Land Conversion		Timeline for Action Items and Progress Reports	http://www.baltimorewater.com/Portals/0/Files/2014/07/14/Baltimore-Watershed-Agreement-Action-Plan-2014.pdf
Watershed Planning	San Francisco, CA	Urban Watershed Framework, Triple Bottom Line (TBL) Model Dashboard for San Francisco Public Utilities Commission, Sewer System Improvement Program	City	City of San Francisco	Each potential project within the green and grey infrastructure program is assessed with a Triple Bottom Line (TBL) tool to prioritize the most beneficial component projects.	Multiple	Multiple	Floodplain development, land conversion, climate change	Environmental, Social, Life Cycle Economic	Projective Modeling	http://www.sfpuc.org/Portals/0/Files/2014/07/14/Urban-Watershed-Framework-Triple-Bottom-Line-Model-Dashboard-for-San-Francisco-Public-Utilities-Commission-Sewer-System-Improvement-Program-2014.pdf
Watershed Planning	16 Pilot Cities, China	"Sponge City" Program	City	16 Pilot Cities, China	A nationally led initiative to address urbanization-driven flooding problems through green infrastructure. "Sponge Cities" retain and reuse water within their boundaries.	Flood Control, Probable Water Provision, Human Health & Wellbeing	Water Quality	Floodplain development, land conversion, climate change	Flood reduction	Projective Modeling, Post Implementation Measurement	http://www.spongecity.com/Portals/0/Files/2014/07/14/Sponge-City-Program-2014.pdf
Urban Forest Plan	Paris, France	Paris Greening Programme, 2007	City	City of Paris	An adaptation strategy of the Paris Climate Plan, born out of high-level talks from the 2003 Intergovernmental Panel on Climate Change.	Human Health & Wellbeing through air/carbonate regulation	Biodiversity, Habitat, Carbon Sequestration	Urban heat island effect, climate change	Tree planting and Conservation	Measurement - Landcover Change (to be completed in the future)	http://www.paris.fr/Portals/0/Files/2014/07/14/Paris-Greening-Programme-2007.pdf
Assessment Tool	San Jose, CA	Greenplan -IT Toolkit	City	City of San Jose	GIS based tool for summarizing opportunities and constraints for urban stormwater-focused GI retrofits.	Water Quality	Human Health & Wellbeing	Stormwater Pollution	Landcover Types	Projective Modeling	http://www.sanjoseca.gov/Portals/0/Files/2014/07/14/Greenplan-IT-Toolkit-2014.pdf
Assessment Tool	Multiple Cities Globally	City Biodiversity Index	City	Multiple Cities	Globally used, science-driven tool to measure change in biodiversity progress through time. Includes metrics for existing physical conditions, ecosystem services, and governance and management.	Biodiversity	Water Quality and Quantity, Climate Regulation, Human Health & Wellbeing	Land Conversion, Habitat Fragmentation	Biodiversity by Species Type, Governance and Management	Scoring Assessment, Repeated Scoring Over Time	http://www.cbd.int/biodiversity/indicators/

Note: Precedents in bold italics are described in more detail in the literature review memorandum under "Six Models of Green Infrastructure Planning."