



# Introduction to the GSI Manual and Tools

Kansas City, Missouri



# Contents

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- StoryMap
- GSI Manual
  - GSI Construction Details
  - Site Activity Plan
    - Instructions for using Excel file
  - GSI Specifications
    - Instructions for using free SpecsIntact software to tailor specification to your project
- Smart Sewer Adaptive Management Plan

# StoryMap

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- Communication & education tool
- Online, map-based tool by ESRI
- *What* happens to stormwater
- *Why* green stormwater infrastructure is an integral part of the cities of tomorrow
- Virtual tour of featured city GSI sites

# GSI Manual

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- Integrated, city-wide framework for GSI design and construction
- *How* to design, build, and maintain
  - Supplement to MARC BMP Manual – not replacement
  - Design guidance and criteria for GSI components
  - Detail template for GSI components
  - GSI Construction Specification
- Lends Consistency to design and construction criteria
- Design tool to help meet Water Quality regulations (MS4, CSO)
- Quality control

# Manual Contents

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- Introduction and Overview
- GSI Component Design Guidelines
- GSI Component Design Details
- GSI Establishment & Maintenance
- Plant List & Characteristics
- Site Activity Plan Instructions
- GSI Construction Specifications



# GSI COMPONENT DESIGN GUIDELINES & DETAILS

## GSI-1 Inlet

### 1.1 Infiltration Inlet

GSI-1.1 Infiltration Inlet

### 1.2 Curb Cut

GSI-1.2.1 Curb Cut

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GSI-1.3 Gutter Apron

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GSI-1.4 Trench Drain

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GSI-1.5 Manufactured Inlet (Rain Guardian Turret Example)

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### 2.1 Splash Pads

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GSI-3.3.1 Wood Bollard

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GSI-3.3.3 Concrete Bollard

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GSI-3.4.1 Stone Boulder

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GSI-3.5.1 Curb Guard

## GSI-4 Permeable Pavement

### 4.1 Pervious Concrete

GSI-4.1 Pervious Concrete

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GSI-4.2 Porous Asphalt

### 4.3 Permeable Pavers

GSI-4.3 Permeable Pavers

## GSI-5 Soil & Aggregate Media

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### 5.2 Sand

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## GSI-7 Landscaping

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GSI-7.1 Existing Tree Protection

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GSI-7.2 Example Planting Plan

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GSI-7.3.1 Deciduous Tree Planting

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GSI-7.3.3 Tree Planting on Slope

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GSI-7.4 Shrub Planting

### 7.5 Grasses, Perennials, and Groundcovers

GSI-7.5 Container Planting (Grasses, Perennials, and Groundcovers)

### 7.6 Landscape Edging

GSI-7.6 Landscape Edging

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GSI-8.1 Underdrain

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GSI-4.2 Distribution Pipe

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GSI-8.3 Cleanout

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GSI-8.4 Observation Well

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GSI-8.5 Anti-Seep Collar

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GSI-8.6 Utility Sleeve

## GSI-9 Outlets

### 9.1 Overflow Riser

GSI-9.1.1 Overflow Riser

GSI-9.1.2 Manufactured Overflow Riser (Nyoplast & Agridrain Examples)

### 9.2 Outlet Control Structure

GSI-9.2 Manufactured Outlet Control Structure (Nyoplast & Agridrain Examples)

The “Building Blocks” of GSI

# GSI Component Design Guidelines & Details



- Design Deliverable Checklist: Baseline expectation of required information for construction documents

## DESIGN DELIVERABLE CHECKLIST

- Plan view of GSI indicating location of inlet structure(s) including northing/easting points.
- Spot elevations to show drainage path towards the inlet structure(s) as well as major overland flow paths and bypass for storm events that exceed the design capacity of the GSI.
- Detail/Section view of inlet structure(s) specifying recommended product/manufacturer, size, dimensions, and elevations (as applicable).

- Guideline: Provides design guidance, not criteria
  - Overview
  - Description of where to use
  - Design considerations

A curb cut should be designed with inlet capacity sufficient to intercept the design flow for the GSI practice. On sloped applications, multiple curb cuts may be needed. Curb cut inlet capacity should limit the maximum inflow to the GSI facility to the design storm, allowing for larger stormwater flows to bypass the facility.

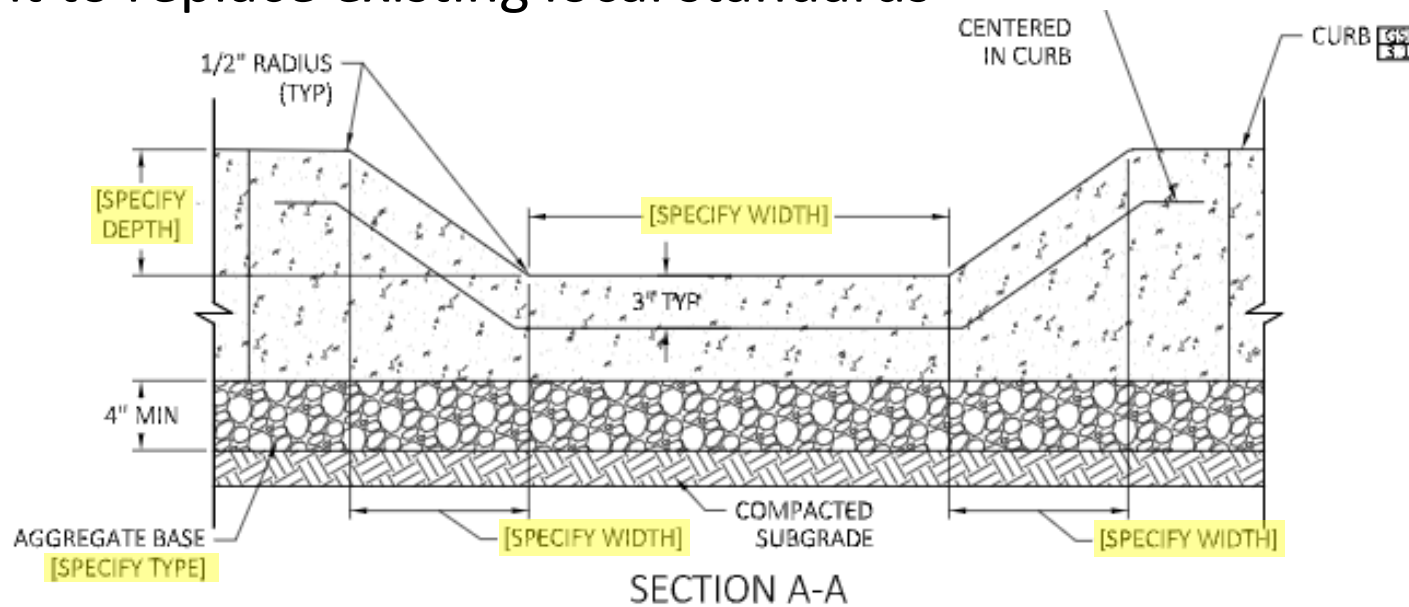
A curb cut should be used in conjunction with an energy dissipation component (GSI-2.1) to limit erosion of GSI surface materials.

The invert of the curb cut should be lower than or equal to the invert of the pavement or gutter line. Gutter aprons (GSI-1.3) may be used in conjunction with curb cuts to maximize capture capacity of the curb cut.

# GSI Component Design Guidelines & Details



- Design Detail: standardized starting point for GSI Component details
  - To be tailored to each GSI design
  - Shows minimum information required
  - Consider the constructability of detail
  - Not meant to replace existing local standards







# Sample Photos

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- Wide range of photos showing components in use are included



1.3 Gutter Apron

3.1.4 Ribbon Curb



2.1 Concrete Embedded Splash Pad

# GSI Establishment & Maintenance



- Regular maintenance critical to long-term vitality and sustainability of GSI
- Description of maintenance tasks and typical task frequencies
- Rating Indices for litter, appearance and function
- Photo examples included

## **GSI-1: INLET**

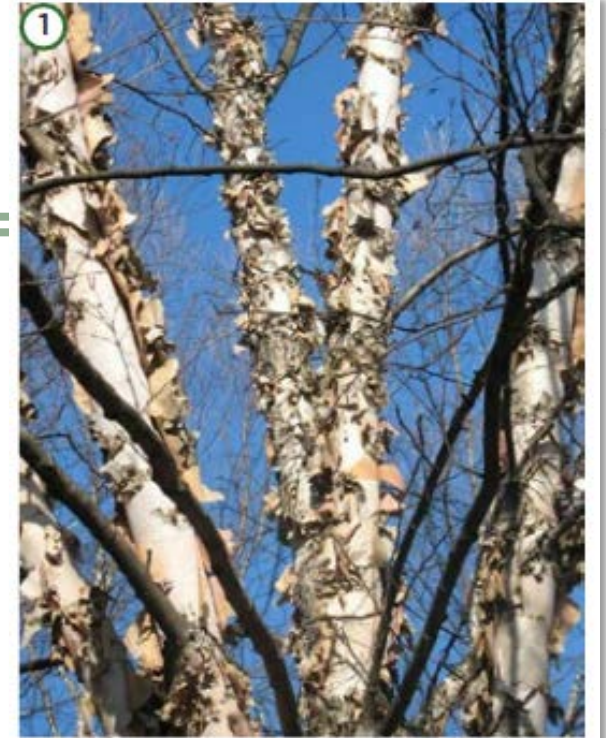
### **Inspect for standing water (1.1.A)**

If there is standing water, note it on the inspection form. Report any observation of mosquito larvae to Owner's attention within 24 hours of observation. Immediately install mosquito Bti (Bacillus thuringiensis) mosquito dunk in location of observed larvae following manufacturer's recommended application rate and instructions. Larger chemical dunks may be allowable for sites with bigger sumps not within public's reach, but must be approved by the owner prior to application.



# Plant List (Appendix A)

- Recommendations based on lessons learned
- Trees, shrubs, perennials and groundcovers
- Photo examples included
- Water, Drought and Light tolerances provided



*Betula nigra* - 'Cully' Heritage Birch

## Recommended Green Stormwater Infrastructure Tree Plant List & Characteristics

Use this plant list as a guideline for plant material selections. As needed, offer suggestions of better plant alternatives for consideration. Aim for 75% minimum native plants (or native cultivars) when possible.

Plant Code	Botanical Name	Common Name	Missouri Native/ Native Cultivar	Height (ft)	Spread (ft)	Water	Inundation Tolerance	Drought Tolerance	Light	Salinity Tolerance
Trees										
AR	<i>Acer rubrum</i>	Red Maple	Yes	40 to 70	30 to 50	Med to Wet	High	Low	Full Sun to Part Shade	No
AS	<i>Acer saccharum</i> 'Bailsta'	Fall Fiesta Sugar Maple	Yes	40 to 80	30 to 60	Med	Med	Med	Full Sun to Part Shade	No
AG	<i>Aesculus glabra</i>	Ohio Buckeye	Yes	20 to 40	20 to 40	Med	Med	Med	Full Sun to Part Shade	No
AG2	<i>Amelanchier x grandiflora</i>	Autumn Brilliance' Serviceberry	Yes	15 to 25	15 to 25	Med	Med	Med	Full Sun to Part Shade	No
BN	<i>Betula nigra</i>	River Birch	Yes	40 to 70	20 to 30	Dry to Wet	High	Med	Full Sun to Part Shade	Yes
BN	<i>Betula nigra</i> 'Cully'	Heritage Birch	Yes	40 to 70	40 to 60	Med to Wet	Med	Med	Full Sun to Part Shade	No

# Site Activity Plan (Appendix B)

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- Collection of standard forms for Designer and Contractor use
- Create PDF of forms and include as attachment to Site Activity Plan to be included with contract documents
- Information in Site Activity Plan should be updated for each project
- Ensure all information is visible when printed

*Instructions for use available within spreadsheet tabs and GSI Manual*

# Site Activity Plan – Designer

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## **TAB 1 - GSI Sites & Components**

- Fill in header information
  - Will auto-populate other tabs
- Add GSI site designation and location information
  - Select GSI Type from drop down menu
  - Types are described in Manual
  - Will auto-populate other tabs
- Select applicable GSI components and delete *red text*

# Site Activity Plan – Designer

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## **TAB 2 - GSI Construction Schedule**

- Select applicable components for each GSI Site
  - If component is not an option, go back and selected on Tab 1
  - If additional components should be added, type into list and checkmark
- Provide brief description of components at each site
  - If proprietary product, use product name on plans
- Filter to hide any unused rows and delete **red text**
- Contractor will fill in the procurement or date fields

# Site Activity Plan – Designer

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## TAB 3 - Maintenance Schedule

- Select project applicable components
  - Does not auto-populate from Tab 1
  - If component unchecked on Tab 1, be sure to uncheck here
- Review required tasks; uncheck any that are not applicable
- Add names of applicable sites for maintenance tasks
- Filter to hide any unused rows and delete *red text*
- Contractor will fill in frequencies or responsible party



# Site Activity Plan – Designer



## TAB 4 - GSI Quality Assurance

- Select the project's applicable GSI Specifications
- Should match project manual Table of Contents

### GREEN STORMWATER INFRASTRUCTURE QUALITY ASSURANCE QUALIFICATIONS

<b>Project Title:</b> <u>Test Project</u>							
<b>Project Number:</b> <u>12345</u>							
<b>Contractor:</b> <u>ABC Contracting</u>							
<b>Date:</b> <u>1/1/2020</u>							
Specification Section	Experience Requirement	Reference Number	Project Location	Owner Name	Contact Number	Completion Date	Dollar Value
02939	Landscaping/GSI experience, within previous 3 years	1					
		2					
		3					
02942	ACI Certified Flatwork Finisher and Technician	1					
		2					
		3					

# Site Activity Plan – Contractor



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*Contractor should be provided editable version of the updated Site Activity Plan*

## **TAB 1 – GSI Sites and Components**

- Update with submittal/revision date

## **TAB 2 – GSI Construction Schedule**

- Update procurement lead time, dates and add notes

## **TAB 3 – GSI Maintenance Schedule**

- Updated frequency of tasks and responsible party

## **TAB 4 – GSI Quality Assurance Qualifications**

- Provide 3 references for each specification; fill in remaining project information



# Site Activity Plan – Contractor

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- Tabs 5 through 10 are optional forms to document maintenance
- Use separate form for each site
- Contractor to update header section for each site
  - Reference the GSI Manual for Appearance and Function rating values
  - Include before and after rating
  - Once all tasks are complete, record total, cumulative hours for crew
- Some project may use computerized maintenance management systems instead of form

# GSI Construction Specifications (Appendix C)

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# GSI Construction Specifications (Appendix C)

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- Supplemental department standard specifications used on any project incorporating GSI
  - GSI specific construction requirements/considerations
  - Consistent City-wide criteria
- SpecsIntact Software
  - Reduce time spent developing/re-developing technical specs
  - More efficient specification development/review process
  - Automated numbering and reference system
  - Free software developed by NASA

# GSI Construction Specifications (Appendix C)

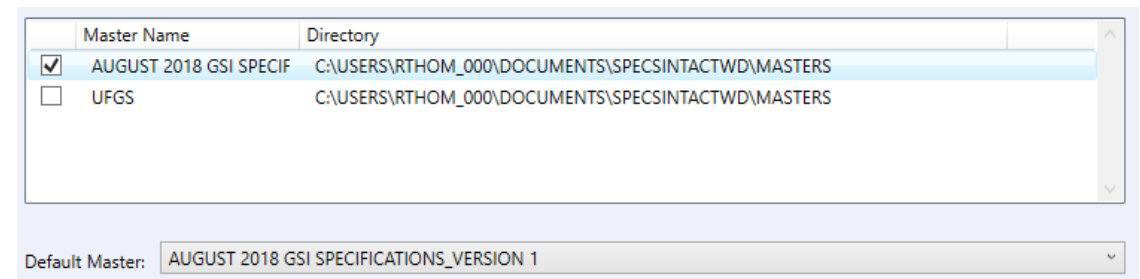
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- First, download free software and follow installation Wizard  
<https://specsintact.ksc.nasa.gov/Software/Software.shtml>
- The GSI Master Standards available on the server
- Master is the standard information the project specifications will be developed from
- Create Jobs to tailor the specifications to certain projects
- Decision points allow for editing information that might frequently change from one project to another

# Linking the Master Specification File



- Within File Explorer:
  - Copy the August 2018 GSI Specification\_Version 1 from the server
  - Paste into the Masters Folder (within the SpecsIntactWD program)
- Within SpecsIntact:
  - Click Connect Masters
  - Checkmark the GSI Specification
  - Under the Default Master dropdown, select the GSI Specification
  - Un-checkmark the UFGS Specification





# Creating a new Job

- Click New Job



- General tab

- Fill in required fields, marked with red asterisk
- Confirm GSI Specifications are selected in the Primary Master dropdown

- Options tab

- Paragraph format - Alphanumeric

The screenshot shows the 'General' tab of a software interface. On the left is a sidebar with tabs: General (selected), Specifiers, Options, Schedule, and Comments. The main area contains the following fields:

- Job name: \* (text input)
- Title: \* (text input)
- Contract: (text input)
- Location: (text input)
- Lead specifier: (dropdown menu)
- Source: (text input)
- Path: (text input with value: C:\Users\rthom\_000\Documents\SpecsIntactWD)
- Date Created: 9/27/2019 3:24:40 PM
- Working Directories (orange button)
- Primary Master section: Name: AUGUST 2018 (dropdown), Connect Masters (blue button)
- Default Settings section: Submittal Register Format: UFGS, CSI MasterFormat: Current

The screenshot shows the 'Options' tab of the software interface. On the left is a sidebar with tabs: General, Specifiers, Options (selected), Schedule, and Comments. The main area contains the following options:

- Job Options section:
- Units of Measure: English (selected), Metric, Both
- Use this setting when printing
- Use Revisions
- Paragraph Format for Automatically Numbered Sections: Numeric (selected), Alphanumeric



# Selecting Applicable Sections and Tailoring




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- When a new Job is created, a window with sections will appear
- Select only the specification sections that are applicable
  - Not all sections will be applicable to all projects
  - Click ok to continue with the current MasterFormat
- After clicking ok, another window to tailor will appear
- Tailoring options are designed to make specification editing easier by pre-editing certain repetitive information
  - For example, Consent Decree or Non-consent decree can be applied to all specifications at one time
  - Program may take a few minutes to update after clicking ok

# SpecsIntact Editor



- Click the Specification to be edited
- Click Edit in the top row of tabs 
- Tailoring window will appear to select section wide information
  - Shaded lines will be preserved, unselecting lines will remove that information
- Be sure the Revisions button is selected (done by default) 
- Click the Replace Brackets button 
  - Can keep the suggested text
  - Can create new text by changing the editing options

Replace Bracketed Text With:

Selected Item(s), Above

Existing Text (remove brackets)

No Text

New Text, Below

Insert Text Here

# Smart Sewer Adaptive Management Plan



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- Includes Green Stormwater Infrastructure (GSI) opportunities for the watersheds in the combined sewer system area of Kansas City