MARYLAND
STATE HIGHWAY ADMINISTRATION
LANDSCAPE DESIGN GUIDE

DECEMBER 2016

SHA
State Highway
Administration
Maryland Department of Transportation

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CHAPTER 1 - OVERVIEW

1.1 Index of Topics.

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1.3 Glossary of Terms & Abbreviations.

The following terms and abbreviations are used with the indicated meanings without further explanation in the LDG.

Other abbreviations that are not used in the LDG may be found in LDG 11.12 SHA Environmental Guidelines for Construction, and in LDG 11.11 2008 SHA Standard Specifications for Construction and Materials.

Table 1.3 Terms and Abbreviations

Term or Abbreviation	Meaning
AASHTO	American Association of State Highway and Transportation Officials
ACOE	U.S. Army Corps of Engineers
ADA	Americans with Disabilities Act
B&B	Balled and burlapped plant material
Backslope	A cut slope with a positive grade away from the pavement edge; opposite of foreslope.
Blue Folder	A paper file for project documents, correspondence, etc. used by the OED Project Manager.
BMP	Best Management Practices. A set of preferred methods, but not necessarily for SWM.
Brush	Woody vegetation that does not meet the definition of tree. Brush is not protected under the Maryland Roadside Tree Law, although SHA may require mitigation for proposed removal of brush under a District or Access Permit.
Category Code	SHA Category Code System of payment items included in Contract Schedule of Prices (SOP)
CAC	Critical Area Commission
CADD	Computer Aided Design Drafting software. SHA standards are required for landscape plans.
CG	Container grown plant material.
Clear Zone	Area adjacent to a roadway available for safe use by errant vehicles LDG 7.5 and LDG- 7.6
Closed Section	Roadway with curbing at the edge of pavement. Typical in urban and suburban areas.
Critical Area	Sites within the Chesapeake and Atlantic Coastal Bays Areas that are regulated by the CAC.
CWC	Composted Wood Chip mulch
CY	Cubic yard or cubic yards
Cut Slope	A slope created by excavating into a hillside. Generally synonymous with backslope.
DBE	Disabled Business Enterprise
DNR	Maryland Department of Natural Resources
DNR-FS	Maryland Department of Natural Resources – Forest Service
DPCC	Decorative Portland Cement Concrete
DWS	Detectable Warning Surface. A surface treatment of paving materials.
e-Maryland Marketplace	Internet-based contract advertisement website
Engineer's Estimate	Planning tool that includes Category Code items of a Contract with their likely costs.
Environmental Guide	Environmental Guide for Access Permit Applicants. Landscape plan Access and Utility permits
ESD	Environmental Site Design
Estimator	Computer program used by SHA to develop project cost estimates.
Estimating Manual	SHA Highway Construction Cost Estimating Manual, Cat 700 - Landscaping. LDG 11.18
E&S Plans	Erosion & Sediment Control Plans, sometimes called ESC Plans.
FAA	Federal Aviation Administration
FCA	Maryland Forest Conservation Act

Table 1.3 Terms and Abbreviations	
Term or Abbreviation	**Meaning**
FCP	Forest Conservation Plan
FHWA	Federal Highway Administration
Fixed Object	Trees and other hazards in the Clear Zone. See LDG 7.1
FIDS	Forest Interior Dwelling Species of birds.
Fill Slope	The constructed slope of highway embankment. Generally synonymous with foreslope.
FMIS	Financial Management Information System
FMIS Number	An code assigned by SHA to identify projects on invoices and time cards
Foreslope	A fill slope with a negative grade away from the pavement edge; opposite of backslope.
Form 30	SHA Form that makes project funding and a FMIS number available for use.
Form 42-25C	SHA Form for financial approval that summarizes funding, goals, etc. about the project.
FSD	Forest Stand Delineation
GIS	Geographic Information System
HHD	SHA Highway Hydraulics Division
IFB	Invitation for Bids. Book of documents purchased by Contractors that is part of a Contract.
IVMM	Integrated Vegetation Management Manual for Maryland Highways. SHA management guide.
LDG	SHA Landscape Design Guide. Landscape policies and guidelines for landscape construction.
LLOD	Landscape Limits of Disturbance. A delineated area beyond the LOD for landscape activities.
LOA	Letter of Authorization
LOD	Limits of Disturbance
MAA	Maryland Aviation Administration. MAA regulations limit plant installation near airports.
MBE	Minority Business Enterprise
MDE	Maryland Department of the Environment
MDTA	Maryland Transportation Authority
MHT	Maryland Historic Trust
MTA	Maryland Transit Administration
NTP	Notice to Proceed
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NPDES	National Pollution Discharge Elimination System
OED	SHA Office of Environmental Design
OED-ECD	Environmental Compliance Division
OED-EPD	Environmental Programs Division
OED-LAD	Landscape Architecture Division
OED-LOD	Landscape Operations Division
Offset Distance	Lateral distance from edge of traveled way to a roadside object or feature (AASHTO)
OHD	SHA Office of Highway Development
OMT	Office of Materials Technology
Open Section	Roadway without curbing at edges of pavement. Typical in rural areas.
PCC	Portland Cement Concrete
PE	Preliminary Engineering. Phase of project development from concept to award of contract.
PE	Project Engineer. Engineer who supervises construction of a project.
PI	Preliminary Investigation
PIF	Project Information Form. A summary of project details stored in the OED Division files.

Table 1.3 Terms and Abbreviations	
Term or Abbreviation	**Meaning**
PM	Project Manager
Price Index	Summary of actual Contract bid prices of Category Code items, updated in January and July.
ProjectWise	Electronic file library that stores files for Project Team members.
PS&E	Plans, Specifications & Engineer's Estimates
PS&E Checklist	Checklist to assure completion of PSE&E packages for Federal Submission
QA Checklist	SHA-OED quality assurance forms used to evaluate conformance with LDG design principles
Right of Way	Legally delineated public space for travel, including the roadway and shoulder.
Recovery Area	Generally synonymous with Clear Zone (AASHTO)
RLA	Registered Landscape Architect
RLS	Registered Land Surveyor
ROW	Public right of way as platted and owned by SHA
RTE	Rare, threatened, and endangered species
Scope	Project scope of services
Setback Distance	Synonymous with Offset Distance. The distance from the travel lane, etc. to a fixed object.
SF	Square foot or square feet
SHA	Maryland State Highway Administration
SHB	Shredded Hardwood Bark Mulch
SOP	Schedule of Prices; a part of the IFB. Each item corresponds to the Engineer's Estimate.
SP	Special Provisions. Project-specific construction specifications.
SPI	Special Provisions Insert. Approved replacements of the Standard Specifications.
SRED	Structures Remedial Engineering Division
SSM	Soil Stabilization Matting used as mulch with turfgrass or other seeding.
SY	Square yard or square yards
SWM	Stormwater Management. Various types of channels, ponds etc. are SWM Facilities.
TMDL	Total Maximum Daily Load; defines limits of nitrogen, phosphorus and sediment in watersheds. The TMDL efforts of SHA are managed by the Water Programs Division of OED.
Tree	A woody plant of a species capable of growing at least 20 feet tall, with a stem diameter at least 2 inches DBH at the time of measurement. This is the SHA definition for SHA green assets, and the basis of any mitigation requirements for proposed removal under an Access or District permit. This definition may not precisely correspond with legal requirements of MD-DNR for tree removal under the Maryland Roadside Tree Law or other applicable laws.
Trns*Port	SHA software used to track funding, advertisement and award process of formal contracts.
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WBE	Woman-owned Business Enterprise
Workload	A database used by OED to track projects.

1.4 SHA Vision for Roadside Landscape Design.

Since the formation of the Office of Environmental Design (OED) in 1990, a subtle but persistent shift has transformed the design philosophy of SHA towards the ”non-pavement” areas of the highway system. This shift reflects wider changes in society and a growing awareness of environmental and cultural concerns, reinforced by laws that mandate a higher standard of protection and stewardship than previously expected.

Although concepts of “roadside development” were evolving by the 1930’s, the need for a more holistic approach to beautification, cultural preservation, environmental protection and restoration has never been more relevant. Roadside landscaping in the 21st century must go beyond meeting legal obligations or repairing construction scars. It must support a vision of the roadside as a valuable asset of the highway system and everything that supports and surrounds it.

To be effective, this New Vision for Roadside Landscape Design must:

- **Recognize** that the roadside is dynamic, and assess what is most needed now, while anticipating what will be needed many years from now.
- **Integrate** traditional highway safety concerns with a greater appreciation for soil, vegetation, maintainability and financial responsibility.
- **Ensure** highway drainage and sustainable landscape plantings, while controlling invasive species and developing strategic approaches to replanting.
- **Promote** efficient low-maintenance landscapes and encourage the development of meadows and reforested areas that can be managed with limited resources.

The cumulative changes in public perception, legal requirements and the need to conserve resources have altered the vision of highway construction and maintenance. In recognition of these changes and to promote a unified vision, the Office of Environmental Design adopted a Landscape Design Philosophy and produced this Guide for the use of designers working on SHA projects.

1.5 SHA Landscape Design Philosophy.

SHA landscape designs provide durable roadside landscaping that thrives in difficult situations with little need for maintenance or replacement, and is:

- **Context Sensitive**, to harmonize with the natural, cultural, and built features it adjoins and passes through. Context sensitive designs fit the “sense of place” while ensuring the safety of highway users and maintenance staff.

- **Environmentally Appropriate,** to comply with legal requirements and meet stewardship goals of the SHA Business Plan. Environmentally appropriate designs limit impermeable surfaces, promote native species and naturalized elements, and include permits and approvals needed for construction.

- **Cost Effective,** to minimize funding requirements for installation and future maintenance. Cost effective designs fit within budget constraints while maximizing design impact.

- **Sustainable,** to implement design and management strategies. Sustainable designs use an asset -based approach that supports project goals and objectives, while promoting successful roadside vegetation establishment.

The SHA Landscape Design Philosophy is a central focus of the SHA Landscape Design Guide.

1.6 Using the SHA Landscape Design Guide.

The SHA Landscape Design Guide (LDG) summarizes policies, procedures and standards for landscape design and project development. However, it does not consider all subjects that may arise during project development, and should therefore not be construed as a legal document.

Rather, the provisions of the LDG are the defaults to be followed, unless other guidance is provided. In the same way that exceptions to AASHTO design guidelines for highway construction are allowed, the Office of Environmental Design may allow deviations to ensure the best outcomes possible under the circumstances.

The LDG is intended to be a living document that captures the collective experience of landscape architects, horticulturists, agronomists, civil engineers, and many other professionals involved with roadside landscape design. The contents of the LDG are updated periodically, and feedback, ideas, and suggestions are welcomed for its improvement.

- **LDG 1.0** explains the purpose and structure of the LDG, and provides contact information for the Office of Environmental Design.

- **LDG 2.0** explains Capital Project Development for contracts advertised by the Office of Environmental Design.

- **LDG 3.0** explains support provided by the Office of Environmental Design for projects developed by other SHA Offices, Districts, and modal administrations.

- **LDG 4.0 & LDG 5.0** explain compliance and mitigation concerns, and design principles to safely accommodate utilities in landscape design.

- **LDG 6.0 & LDG 7.0** explain context sensitive solutions for landscaping problems, and offset distances to maintain safe clear zones along highways.

- **LDG 8.0 & 9.0** explain soil placement, preferred plant materials, plant use groups and sustainable planting design for highways and related facilities.

- **LDG 10.0** explains estimating methods for landscaping, for use in conjunction with the Estimating Manual, and also methods to calculate costs of future maintenance.

- **LDG 11.0** provides information about references and other documents which are available in appendices within separate folders of the LDG file set.

1.7 OED Divisions and Teams.

The LDG is supported by OED Teams that design, advertise, and manage projects involving plant installation, landscape restoration, reforestation, wetlands and streams. These OED staff also provide assistance for other designers and project engineers within SHA and other modal administrations of the Maryland Department of Transportation.

LDG Table 1.6-D shows key staff of the four Divisions of OED. Updated information may also be available from the OED homepage on the SHA intranet.

Table 1.6-D OED Divisions, Teams, and Contact Information

Division	Team	Phone	Contact
OED-WPD	Division Chief, responsible for TMDL compliance	410-545-8407	Karen Coffman
OED-ECD	Dist. 1, 3 Environmental Coordinator	410-925-5327	Darrin Johnson
	Dist. 2 Environmental Coordinator	443-829-5587	Yasin Gregg
	Dist. 4, 5 Environmental Coordinator	443-622-3656	Dan Stigler
	Dist. 6, 7 Environmental Coordinator	443-677-3988	Eddie Funk
OED-EPD	Dist. 1, 2, 4, 7 Environmental Programs Team	410-545-8632	Mark Smith
	Dist. 3 Environmental Programs Team	410-545-8630	Brian Cox
	Dist. 5, 6 Environmental Programs Team, SRED	410-545-8643	Nora Bucke
	Wetlands and Stream Mitigation	410-545-8582	Bill Buettner
	Quality Assurance Team, Statewide	410-365-0164	Tad Daniel
OED-LAD	Dist. 1, 2 Team; Critical Area Mitigation Coordinator	410-545-2851	Jim Hade
	Dist. 3, 5 Team	410-545-8618	Rob Pearce
	Dist. 4, 6, 7 Team	410-545-8639	Richard Wilke

	Scenic Byways & Recreational Trails Program Note: Program & Staff were transferred to OPPE-RIPD	410-545-8637	Terry Maxwell
	Contract and Program Support	410-545-8598	Gary Wantz
OED-LOD	Dist. 4, 6, 7 Baltimore Metro, Western Regional Team	410-780-6220	Fran Bateman
	Dist. 1,2 Eastern Shore Regional Team, Statewide	410-221-1635	Mark Howard
	Dist. 3, 5 Washington Metro, Southern Regional Team	410-780-6224	Roberta Cowan
	Technical Resources Team, Statewide	410-545-8583	Robert LaRoche
	Forest Mitigation Coordinator, Statewide	410-545-8577	Joel Bush
	Project Review Coordinator, Statewide	410-545-2891	John Krouse

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2.1 Introduction.

2.1-A Development Sequence. The sequence of Chapter 2 represents the expected order of activities to be completed for OED Capital Projects. Plans, specifications, and Engineer's Estimates of SHA projects developed with other Funds are reviewed by OED staff as described in Chapter 3.

2.1-B Responsibility of OED Project Manager. The design of OED Capital Projects is led by OED staff. Thus, Chapter 2 explains project development from the perspective of the OED Project Manager with the following responsibilities:

1. The instructions of the LDG apply to the Project Manager unless stated otherwise.

2. The Project Manager works under the general supervision of the Team Leader.

3. The Project Manager ensures that the OED Capital Project conforms to the philosophy, policies and guidelines of the LDG.

4. The Project Manager ensures that the OED Capital Project conforms to the Standard Specifications for Construction and Materials, SHA CADD Standards, and other applicable SHA policies and guidelines.

5. When a Project Team is established, the Project Manager guides the Team, presides over Team Meetings and makes decisions on behalf of the Team.

6. The Project Manager directs other staff and consultants assigned to the project.

2.2 Candidate Project Selection.

2.2-A Proposed Projects. Potential OED Capital Projects are evaluated by OED Team Leaders as soon as possible after a request is received.

The 'Landscape Project Scope Worksheet' of LDG 11.2-A is completed as part of this evaluation.

Projects are proposed by:

Table 2.2-A Sources of Proposed Projects

SHA Offices, Divisions, Engineering Districts	Residents and Highway Users
MTA, MDTA, other State Agencies	Homeowners Associations and Civic Groups
County and Municipal Governments	Business Groups
Elected Officials	Environmental Groups

2.2-B Project Initiation Form (PIF). The PIF of LDG 11.3-A includes the category and description of the proposed project, including the estimated Scope.

2.2-C Preliminary Feasibility Review. The Team Leader conducts a Preliminary Feasibility Review of the proposed project, and completes the PIF. When needed, the Team Leader schedules a site visit.

When the Review is completed, the Team Leader submits the PIF to the Division Chief for approval, and the project moves to Preliminary Project Coordination. The following resources often assist the Review:

Table 2.2-C Data for Preliminary Feasibility Review

Source	Data Available
Ground & Satellite	Images from public internet websites
SHA	VisiData video footage of SHA highways via SHA intranet
	Field information from OED-LOD and District Offices
	Scenic Byways GIS
	Existing highway plans

2.2-D Preliminary Project Coordination. The Team Leader assigns an OED Project Manager to the project, and Preliminary Project Coordination begins. Preliminary Project Coordination determines whether overlaps with projects of other SHA Offices exist, and which Offices and Divisions will have a supporting role when the project moves forward, including:

Table 2.2-D SHA Offices & Divisions for Coordination

	District Engineer's Offices	OHD	Office of Highway Development
AMD	Access Management Division	OMT	Office of Materials Technology
CDD	Community Design Division	OOC	Office of Construction
DTSD	Design Technical Services Division	OC	Office of Communication
EPLD	Environmental Planning Division	OOM	Office of Maintenance
FMD	Facilities Management Division	OOS	Office of Structures
HDD	Highway Design Division	OOTS	Office of Traffic and Safety
HHD	Highway Hydraulics Division	OPPE	Office of Prelim. Planning & Engineering
ICD	Innovative Contracting Division	ORE	Office of Real Estate
OED-ECD	Environmental Compliance Division	EPLD	Environmental Planning Division
OED- EPD	Environmental Programs Division	PSD	Plats and Surveys Division
OED-LAD	Landscape Architecture Division	RIPD	Regional & Intermodal Planning Division
OED-LOD	Landscape Operations Division	SED	Structures Engineering Division
OED-WPD	Water Programs Division	SIRED	Structures Inspection and Remedial Engineering Division

2.2-E Preliminary Project Parameters. The Preliminary Project Parameters are established, including:

Table 2.2-E Preliminary Project Parameters	
Scope	Project goals, project limits, stakeholders and design program
Schedule	Start date, project milestones, completion date
Estimate	Estimate for preliminary engineering and construction
	Funding Source (State, Federal, Third Party, or combination) and funding type (formal, small procurement)

2.2-F Project Feasibility. The feasibility of the project is determined and the PIF is updated.

2.2-G Project Selection. The Division Chief selects proposed projects based upon funding availability and the input of other stakeholders. Selected projects are prioritized to facilitate design, construction scheduling and future project planning, or placed on hold pending future re-evaluation. Selected projects move to Project Programming.

2.3 Project Programming.

The paperwork required to fund project design is completed. Project data directories and project management tracking software is initiated. The Base Information is compiled and the need for additional field documentation is determined.

2.3-A Funding.

1. **Contract Advertisement Request Form (CARF).** The CARF is completed and submitted to the Division Chief for approval and signature. This form is for OED internal use, primarily to add the project to the OED Advertisement Schedule.

2. **Form 42-25C.** Form 42-25C is submitted to the Team Leader for review and then reviewed and approved by the Division Chief and Director of OED. A Contract number is assigned to the project by the Office of Finance.

   The funding request of Form 42-25C is sufficient for PE costs, or both PE and construction costs, and may contain the project construction estimate and proposed Advertisement Date, if available. For projects where a contract number is necessary for Design PE before the allocation of construction funding, the form 42-25C is revised and resubmitted when the construction estimate of the project is completed. Changes in scope typically require a revision to the Form 42-25C.

3. **Form 30.** To activate funding for PE costs, the Form 30 is submitted to the Team Leader for review by the Division Chief and signature of the Director of OED.

   A FMIS number is provided by the Office of Finance.

2.3-B Data Management.

1. **ProjectWise.** The FMIS number is submitted with a ProjectWise set-up request to the OED ProjectWise Coordinator.

2. **Workload and Blue Folder.** A Workload record is established by the Team Leader and populated with advertisement dates, permit requirements and project updates. A Blue Folder is created for project files.

3. **Base Information.** Base Information is collected from the following sources and others as required:

Table 2.3-B Base Information

Source	Data Available
SHA GIS	SHA field surveys, record plats of ROW
Plats and Surveys Division	Existing utility locations owned by SHA
District Utility Engineer	Original highway plans and as-built documents
OHD and OOS	As-Built Plans, master plans, aerial photography, topography
Highway Hydraulics Division	Extensive data about location, function, etc. of SWM facilities
County, Municipal Governments	Photogrammetry or aerial photography
Project Planning Division	Aerial, satellite and street views
Public Internet Sites	Aerial, satellite and street views

2.4 Project Support.

2.4-A Notice to Support Divisions. Support Divisions identified during Preliminary Project Coordination of LDG 2.2-D are notified regarding project progress.

2.4-B Notice to Agency Representatives. Agencies that issue permits that may require or benefit from involvement in the project are notified. Those often notified include:

Table 2.4-B Agency Representatives

Authorizing Agency	SHA Coordinating Division	Concerns
DNR-FS	OED-LOD	Maryland Roadside Tree Law
	OED-LOD	Maryland Reforestation Law
	OED-LOD	Maryland Forest Conservation Act
MDE	OED-EPD	Wetland, stream and floodplain impacts
	HHD	Drainage and stormwater management facilities
	HHD	NPDES permits, erosion and sediment control permits
ACOE	OED-EPD	Wetland, stream and floodplain impacts
CAC	EPLD, OED-LAD	Critical Area impacts and mitigation

MHT	EPLD	Historic and cultural features
		Corridor Management Plan
Counties and Municipalities	EPLD, OED-LAD	Community concerns
	EPLD, OED-LAD	Compatibility with master plans and zoning

2.4-C Project Team. A Project Team is assembled. Refer to responsibilities of LDG 2.1-B.

2.4-D Scope, Schedule and Estimate.

1. **In-House Designed Projects.** For projects designed by in-house staff, the Project Manager develops the Scope, Schedule and Estimate.

   A well-defined Scope defines the purpose, needs and expectations of the project and prevents ”scope creep” that might impair progress, expand responsibilities or workloads, or result in missed deadlines, budget overruns, or failure of the project.

   To allocate sufficient resources and meet milestones, the Scope of the PIF (LDG 2.2-B) and Preliminary Project Parameters (LDG 2.2-E) are updated to develop the project Schedule and Estimate before initiating site analysis or design. The updated Scope, Schedule and Estimate detail any changes and explain the professional services needed to complete the project.

2. **Consultant Projects.** For projects designed by consulting firms, the Scope, Schedule, Estimate and a Cost Proposal based on the PIF and Preliminary Project Parameters are submitted by the firm in conformance with Consulting Engineers’ Services, Volume II, Section IX, Landscape Architecture.

   The Scope, Schedule, Estimate and Cost Proposal are reviewed, revised, and submitted to the Team Leader. Written NTP is provided by the Division Chief.

2.4-E Community Stakeholders. Contact information for community stakeholders is collected and prepared for project Kick-Off. Those notified typically include:

Table 2.4-E Community Stakeholders

1	Adjoining property owners
2	Nearby business owners, organizations, special interest groups
3	Civic associations, homeowners associations or other civic groups
4	Elected officials of federal, state, county and municipal governments
5	Representatives of police, fire and other emergency service providers
6	Representatives of nearby parks and schools
7	Representatives of state, national and county Scenic Byways
8	Representatives of permit agencies, FHWA, other stakeholders as appropriate

2.5 Project Kick-Off.

2.5-A Site Assessment & Inventory. The Base Information of LDG 2.3-B.3 is reviewed, site visits are performed, data is collected and inventoried and the need for additional field assessment is determined. Consultant firms will obtain additional site information, as required.

2.5-B Kick-Off Meeting & Field Review. The Kick-Off Meeting is scheduled with notice to the Project Team, and to stakeholders and agency representatives as appropriate.

The Kick-Off Meeting includes a Field Review at the project site when feasible and appropriate. For projects where a Field Review at Kick-Off is not held, it is advisable to provide aerial imagery or site photos at the meeting for review.

During the Meeting, the concerns identified in LDG Table 2.5-B are reviewed, and support divisions and additional stakeholders may be added to the Project Team.

Table 2.5-B Concerns for Review at Project Kick-Off & Field Review

1	Discuss projects' concerns and goals.
2	Determine limits of ROW and SHA property.
3	Assess need for additional base information.
4	Identify existing commitments.
5	Identify existing and proposed impervious surfaces.
6	Determine environmentally sensitive areas, Critical Area, wetlands, streams, floodplains.
7	Assess existing vegetation, presence of invasive species, reforestation requirements.
8	Identify tree and forest impacts: champion trees, specimen trees, other significant trees.
9	Assess soil conditions: depth, soil analysis.
10	Identify drainage patterns, slopes and erodible soils.
11	Determine adverse microclimate or wildlife damage potential.
12	Identify landmarks and view-sheds.
13	Assess cultural, archeological and historical resources.
14	Identify concerns that may affect sustainability of Scenic Byways.
15	Assess county and municipal zoning and master plans for future development.
16	Identify surrounding land use: commercial, industrial and residential areas, etc.
17	Identify circulation patterns of pedestrians, bicycles, cars, buses and trucks.
18	Identify easements, covenants, agricultural program restrictions.
19	Determine MAA restrictions, and other legal constraints.
20	Assess community or regional character.
21	Identify opportunities and constraints for landscape design.
22	Identify utility conflicts, signs and areas where sight distance may impact design.
23	Identify concerns that may limit construction or maintenance access.
24	Determine need for additional ROW or property for construction or compliance.

2.5-C Communication Procedures. At the Kick-Off Meeting, the Project Team Communication Procedures are established, including:

1. Schedule of Project Milestones.

2. Procedures for communication by phone and email.

3. Team members who are not able to attend individual meetings submit written comments before the scheduled meetings.

4. The Project Team Communication Procedures are finalized and sent to the participants of the Kick-Off Meeting 7 to 10 days after the Meeting.

5. Project Team Meetings are scheduled as shown in LDG Table 2.5-C.

Table 2.5-C Schedule of Team Meetings

Meeting		Meeting Number & Requirement
a	Introductory Stakeholder	One when required per LDG 2.5-E.
b	Stakeholder Concept Design Review	One or more optional.
c	Stakeholder Concept Design Follow-Up	One required after Stakeholder Concept Design Review.
d	Community Stakeholder	One or more when required per LDG 2.5-E.
e	Preliminary Investigation	One required.
f	Semi-Final Review	One optional.
g	Community Stakeholder Follow-up	One required after Community Stakeholder Meeting.
h	Final Review	One meeting, required.

2.5-D Adjacent Property Owners. Letters are sent to affected property owners with a brief explanation of the project and information about opportunities to review and comment on proposed plans. Refer to SHA policy and the SHA Property Notification System. Depending upon the Scope, the letters may also request permission for Project Team members and survey crews to enter private property impacted by the project.

2.5-E Introductory and Community Stakeholder Meetings. The need for an Introductory Stakeholder Meeting and Community Stakeholder Meeting is determined by the Team Leader in consultation with other Project Team members and the Division Chief. These meetings are required when projects are designed in coordination with community groups, or when state, federal or municipal governments are expected to have comments about design alternatives or final designs.

Concept Design Alternatives or plans related to the project are generally presented at the Introductory Stakeholder or Introductory Community Meeting on the recommendation of the Project Team.

The amount of material presented may vary depending on the stakeholders and the project type and scope though the meetings typically have the following goals:

Table 2.5-E Goals of Introductory Stakeholder Meeting	
1	Present site inventory analysis and information provided by stakeholders
2	Receive input about project goals and objectives
3	Solicit participants for an advisory committee, as appropriate
4	Discuss preliminary project concepts and future maintenance responsibilities

2.5-F Review Scope, Schedule and Estimate. The Team Leader reviews the Scope, Schedule and Estimate of the project. These documents are modified to accommodate reductions or expansions, changes in funding, unexpected conditions, stakeholder requests and changes in regulatory policies such as erosion and sediment control, wetlands permitting, endangered species.

Form 42-25C is revised and resubmitted as needed, per LDG 2.3-A.2. The Division Chief initials the PIF to authorize Concept Development.

2.6 Site Analysis and Concept Design, 15% Design Completion.

2.6-A Site Analysis. After the Project Kick-Off, the initial feasibility evaluation by the Lead Design Division and base information presented at the Kick-Off Meeting is supplemented by site analysis. Concept design may be concurrent with site analysis, but a successful concept can only be developed after site analysis is completed.

2.6-B Concept Design Development.

1. **Site Analysis Plan.** The Site Analysis Plan is an aid for concept evaluation; it is not a presentation graphic, and does not guide construction. The Plan is legibly hand-sketched or produced using CADD per SHA CADD Standards, aerial photos, etc. to provide typical requirements of LDG Table 2.6-B.1.

Table 2.6-B.1 Typical Requirements of Site Analysis Plan	
a	The Plan summarizes the context, constraints and landscape opportunities using bubble graphics and notes. It also graphically conveys such information as: • North arrow • Maryland route numbers, interstate numbers, etc. • Overhead and underground utility offset distances • Sight distance and safety offset distances • Areas of steep slopes or access restrictions • Areas of poor soil as determined by visual assessment or soil testing • Areas and identity of invasive species that should be managed
b	Identifies existing vegetation that does not conform with clear zone offset distance guidelines, and proposes new vegetation to maintain highway clear zones, clear sight distance and accommodate future highway improvements.

c	Illustrates the relevant items shown in LDG Table 2.5-B.
d	Illustrates and explains potential impacts to environmental, historic or cultural resources.
e	May be supplemented with photographs and additional reports as needed.

2. **Concept Design Alternatives.** The Division Chief reviews the Site Analysis Plan and initials the PIF to authorize Concept Design Development. If the Site Analysis Plan is determined to be incomplete, additional analysis is required before authorization of Conceptual Design Development.

   Depending on project complexity and opportunities and constraints, one or more Concept Design Alternatives are developed and submitted to the Team Leader for review. The requirements of LDG Table 2.6-B.2 are developed for each Concept Design Alternative.

Table 2.6-B.2 Requirements of Concept Design Alternatives

a	**Conformance with PIF.** Each Concept Design Alternative conforms to the PIF, Scope, and Estimate of the project.	
b	**Conceptual Plans.** Each Alternative includes conceptual plans that illustrate general landscaping types, including screening, reforestation, revegetation, meadows, etc.	
	Cost Estimate Worksheet. Each Alternative reports cost estimates for construction and future maintenance using the 'Landscape Estimate Worksheet – 15% Completion'. The Worksheet is LDG 11.2-A. The Worksheet includes cost estimates for all Category 700 Landscaping Items required to construct the project in conformance with the Estimating Manual. When street furniture, hardscape, lighting, signs, etc. are included in the concept, a summary of those items and their costs is also reported in the Worksheet.	
c	**Each Alternative s**hows all relevant existing conditions and base information, including	
	1	Site topography and contours
	2	Road centerline and ramp stations every 100 feet, when available.
	3	Road names, right-of-way lines and easements
	4	Paving, curb limits and entrances
	5	North arrow and directional notes for the highway
	7	Environmental resources and existing vegetation
	8	Types of adjacent development
	9	Drainage channels and devices
	10	Utilities, lighting and traffic signals
	11	Highway structures, bridges, retaining walls, culverts, etc
	12	Buildings, sidewalks, fences and walls
	13	Traffic barriers and signs
	14	Other data related to existing conditions, as appropriate

3. **Completion of QA-15 Checklist.** The "QA-15 Design Concept Review Checklist" of LDG 11.1-A is completed for each of the Concept Design Alternatives 7 to 10 days after the Alternatives are received.

4. **Review of QA-15 Checklist and Selection of Preliminary Concept.** The Team Leader reviews the QA-15 Checklists with the Division Chief and selects one or more Alternatives for further design development and presentation at the Stakeholder Concept Design Review Meeting. When necessary, revisions to one or more selected Alternatives are requested with a completion date.

2.6-C Project Management at Concept Design. Project Management includes evaluation of permit needs and submittal schedules, review and approval of Design Concepts, and Coordination with the Project Team and Community Stakeholders.

1. **Required Permits Evaluation.** Because it is often too early to determine project impacts and confirm permit requirements, it is important to identify likely permit requirements and to initiate coordination with the appropriate SHA Divisions.

   To accomplish this, a tentative schedule with typical review timeframes and necessary permit submittal dates is developed in coordination with appropriate SHA Divisions to ensure that required permits are obtained before the Advertisement Date.

   To the greatest extent practicable, design concept alternatives avoid impacts as the first priority. When impacts cannot be avoided, the impacts are minimized, mitigated, and explained in the Concept Design Alternative.

   Typical permit requirements are summarized in LDG Table 2.6-F. LDG 4.0 provides additional information regarding permit compliance and mitigation requirements.

Table 2.6-F Permit Coordination for Concept Design Alternatives

Agency	Legislation and Coordination	Description
DNR-FS	Maryland Roadside Tree Law Coordinate with OED-LOD	Permit and mitigation required for total project impacts to individual trees, groups of trees, or forests of less than one acre, for projects within the public right-of-way.
	Maryland Forest Conservation Act (FCA) Coordinate with OED-LOD	Permit and mitigation required for grading impacts to areas of 40,000 SF or more; for projects that are not part of a linear highway.
	§ 5-103, Maryland Reforestation Law Coordinate with OED-LOD	Permit and mitigation required for impacts to forests or trees totaling one acre or more, for linear highway projects.
CAC	Chesapeake Bay Critical Area Act Coordinate with EPLD, OED-LAD	Permit and mitigation required for impacts to Chesapeake and Atlantic Coastal Bays Critical Area and Buffer (Critical Area).
MDE &	Section 404, Federal and State Wetland	Permit and mitigation required for wetland,

ACOE	and Waterway Regulations Coordinate with OED-EPD	stream and floodplain impacts. Lead time for approval is 1-3 years.
	National Environmental Policy Act NEPA Coordinate with EPLD and HHD	For federally funded projects.
	Maryland Environmental Policy Act MEPA Coordinate with EPLD and HHD	For state funded projects.
	Section 4(f) of the US DOT Act Coordinate with EPLD	For projects impacting parklands, historic sites or wildlife refuges.
	Section 106 of National Historic Act Coordinate with EPLD	For federally funded projects.
USEPA	Coordinate with EPLD	For projects that may impact threatened or endangered species
USFWS	Coordinate with EPLD	For projects that may impact protected wildlife

2. **Review of Scope, Schedule and Estimate.** The Scope, Schedule and Estimate are reviewed and the Design Concept is revised as necessary.

3. **Approval of Project Design Concept.** The PIF, Scope, Schedule, Estimate, Sustainability Worksheet, Blue Folder and other records are updated as necessary and submitted to the Team Leader.

   The Team Leader evaluates the Concept Design and the Division Chief initials the PIF to authorize the project to move forward to PI Design. All future plans developed for the project conform to current SHA CADD Standards.

4. **Stakeholder Concept Review Meeting.** The Stakeholder Concept Review Meeting is scheduled per LDG 2.5-E, or as determined.

   a. **Preparation.** Renderings, displays and illustrative materials for one or more Concept Designs are prepared.

   b. **Preview.** The Project Team previews the prepared Concept Design materials, determines their accuracy and corrects any errors.

   c. **Presentation.** The Concept Design materials are presented at the Stakeholder Concept Design Review Meeting. Discussion of maintenance agreements is initiated. Notes are taken to record stakeholder comments.

5. **Stakeholder Follow-Up Meeting.** The Project Team meets to discuss the following concerns:

   a. **Comments.** Perceptions, preferences and ideas of stakeholders about the Concept Design(s).

b. Maintenance Agreements. Feasibility of maintenance agreements with stakeholders via MOU or MOA are explored, and preliminary concepts for future maintenance are developed.

c. Reviewers. Identification of parties responsible for design review and select community and agency liaisons, if not previously assigned.

6. Form 42-25C. The Form 42-25C is revised and resubmitted to adjust funding, as necessary.

2.7 Preliminary Investigation (PI), Up to 30% Design.

2.7-A PI Plan for Preliminary Design Development. The PI Plan is prepared in accordance with site constraints and opportunities illustrated on the Analysis Plan, the vision of the Concept Design, and the LDG. The PI plans, specifications and engineers estimate and all subsequent updates to plans, specifications and estimates are submitted through ProjectWise, or as approved by the Team Leader.

1. PI Plan. The PI Plan includes the following:

a. Base information of the Site Analysis Plan with any updates.

b. Locations of impacts to natural resources such as the Critical Area, wetlands, floodplains, tree preservation areas.

c. Locations of invasive species to be controlled or removed, illustrated with areas where soil improvements are needed.

d. Illustrative sketches and typical sections to convey design intent or meet other project needs.

e. Proposed planting locations using the Preferred Plant Use Groups of LDG 8.3. Trees, shrubs, other landscaping and design features are illustrated.

f. Location of right of way.

2. Specifications. A list of required Special Provisions (SP) is compiled for the project. Support Divisions provide SP's for use or revision as appropriate.

3. Engineer's Estimate. The Estimating Manual provides information about landscape materials. The 'Landscape Estimate Worksheet - 30% Completion' of LDG 11.1-B. is submitted to the Team Leader.

a. The Worksheet includes cost estimates for all category Code Items required to construct the project in conformance with the Estimating Manual.

b. When street furniture, hardscape, lighting, signs, etc. are included in the concept, those items and their costs are included in the Worksheet.

4. **Completion of QA-30 Checklist.** The QA-30 Checklist is completed for the PI Plan.

2.7-B Project Management at Preliminary Design.

1. **Permit Coordination.** The draft list of required permits from Conceptual Design is updated, and the permit application process is begun.

2. **Soil Disturbance and SWM.** The expected soil disturbance is calculated to determine whether the project is exempt from MDE review for erosion and sediment control and SWM requirements. The Stormwater Management Concept, which indicates locations and types of SWM facilities, is developed prior to PI in consultation with HHD before it is submitted to MDE.

3. **QA Meeting for Review of QA-30 Checklist.** The Team Leader and Division Chief review the QA-30 Checklist at least 3 weeks before the PI Meeting. Deficiencies are corrected before the Meeting.

4. **Preliminary Investigation (PI) Meeting.**

   a. Scheduling and Materials Distribution. The PI Meeting is scheduled per LDG 2.5-C. The Project Team, stakeholders, agency representatives and consultant designers are notified of the meeting time, location and agenda, 2 to 3 weeks before the Meeting.

      1. The PI Plans, Specifications Engineer's Estimate and other supporting documentation are distributed to the Team and other invitees at least two weeks before the Meeting by interoffice mail, email or via ProjectWise.

      2. The PI Meeting may be conducted as an office meeting, a field meeting or both. When feasible and appropriate, the PI Meeting is scheduled in the SHA District of the project. The PI Meeting may be scheduled at the site to facilitate review of opportunities, constraints and the proposed design.

      It may be appropriate to schedule the PI Field Review separately to accommodate Project Team schedules or concerns such as rush hour traffic or limited parking. However, discussion and document review in the field is often difficult because of traffic, wind and noise.

   b. Meeting Agenda and Discussion. Discussion of the PI Materials is facilitated by a representative from the lead Design Division. The Project Manager typically leads the meeting and takes the meeting minutes.

When a consultant is responsible for project management or design, the consultant may facilitate the meeting, respond to questions of attendees and compile the meeting minutes.

The following topics are discussed when reviewing the PI Materials:

Table 2.7-B Topics Discussed at PI Meeting	
1	Non-conformance with Preliminary Design comments.
2	Identification of potential conflicts between proposed design and existing conditions or proposed future improvements.
3	Review of permit needs and application deadlines.
4	Review of potential utilities conflicts or constraints
5	Impacts to private properties.
6	Additional coordination needs, appropriate contacts or responsible parties.
7	Assessment of constructability, access and maintenance requirements.
8	Maintenance of traffic requirements and traffic control restrictions.
9	Potential for Memorandum of Understanding (MOU) or Memorandum of Agreement (MOA) for funding or maintenance by others.
10	Review of OED Landscape Estimating Worksheets.

c. Draft PI Report (Meeting Minutes). A draft of the PI Report is prepared and sent to the Project Team and attendees 7 to 10 days after the PI Meeting. Samples of PI Reports are included in the Appendix. The Team provides any additional comments and the PI Report is revised.

d. PI Report. The PI Report is submitted to the Division Chief, approved and distributed to the Project Team and stakeholders.

5. PI Design Approval. The PIF, Scope, Schedule, Estimate and other records are submitted to the Team Leader for review. The Division Chief provides written approval on the PIF before the Team begins Semi-Final Design.

6. Revise Scope, Schedule and Estimate. The Scope, Schedule and Estimate are revised as necessary. Form 42-25C is resubmitted to adjust funding.

7. Trns*Port. Trns*Port software is used by SHA to track the funding, advertisement, bidding and contract award process of formal contracts. The entry of funding categories, bid items, quantities and the Engineer's Estimate into Trns*Port begins as soon as these data are available after Preliminary Design Approval.

Consultant-prepared designs are submitted with an Engineer's Estimate completed in Estimator, so the file can be imported directly into Trns*Port by SHA staff.

The Engineer's Estimate is requested from the consultant designer with sufficient lead time to allow data entry and refinement in Trns*Port.

8. **District Coordination.** District construction is consulted when substantial engineering is required for project construction.

   Requests regarding the following issues are sent to the District where the project is located:

   a. **Utility Statement** is requested from the District Utility Engineer.

   b. **Traffic Statement** is requested from the District Traffic Engineer.

2.8 Semi-Final Design, up to 60% Completion.

Semi-Final Design typically occurs between the PI and Final Design Stages of larger or complex projects with extensive permit requirements, complicated designs or greater coordination needs. A Semi-Final Review Meeting is an opportunity to minimize major design changes at Final Design but may not be necessary for minor projects.

A review of permit requirements and submittal deadlines is conducted between PI Design and Final Design even when a Semi-Final Design Review Meeting is not conducted.

Permit applications with long review periods, such as wetland and waterway permits, are submitted for evaluation before the completion of Semi-Final Design review to ensure that permits are received before the advertisement date.

2.8-A Semi-Final Design Development.

1. **Semi-Final Plans.** The Plan utilizes information developed through the PI, and addresses concerns raised at the PI Meeting. Semi-Final Plans include the following, or as stipulated in the Scope:

Table 2.8-A Contents of Semi-Final Design Plans	
Part 1 – Existing Conditions & Base Information	
a	Base Information shown on Concept Plans.
b	Updated Information.

	Part 2 – Proposed Information
c	Detailed landscape design.
d	Individual trees and shrubs.
e	Planting beds of shrubs, perennials, ornamental grasses, annuals, bulbs.
f	Areas to be seeded, e.g. Turfgrass, Upland Meadow, Shrub Seeding.
g	Proposed grading, including subsoil and topsoil placement or replacement.
h	Delineation and description of areas of vegetation management.
i	Planting Schedule of each plan sheet includes quantity and plant key for each species and cultivar of trees, shrubs, perennials, plugs, annuals and bulbs, with specification per ANSI Z60.1 for caliper or size, root form, and required spacing.
j	Reforestation or Revegetation Areas.
k	Master Plant Schedule includes aggregated totals of all plant materials shown in Planting Schedules per i above, except required spacing.
l	Hardscape layout and design details.
m	Erosion and Sediment Control Plans.
n	Other data or details appropriate to the Scope, as determined.

2. **Semi-Final Specifications.** Copies of required Special Provisions (SP) are developed and compiled.

3. **Semi-Final Engineer's Estimate.** The Semi-Final Engineer's Estimate is updated with Semi-Final Design Revisions as follows:

   a. It is developed from the 'Landscape Estimating Worksheet - 30% Completion'.

   b. It includes all Items required to construct the project in conformance with the Estimating Manual.

   c. It is produced using Trns*Port, in conformance with standard SHA reporting practices, so that each Category Code Item is included with its Item Number, Item Description, Estimated Quantity, Unit Price, and Amount.

4. **Completion of QA-60 Checklist.** The QA-60 Checklist is completed for the Semi-Final Plan, Specifications, and Engineer's Estimate.

2.8-B Project Management at Semi Final Design.

1. **Permit, Traffic, and Utility Coordination.** Coordination with SHA Support Divisions, District Offices, and permitting Agencies is continued to avoid delays in project advertisement or construction.

a. The traffic statement, with traffic control restrictions, is requested from the District Traffic Engineer and the Utility Statement from the District Utility Engineer.

b. Exemption from MDE review for SWM or erosion and sediment control is confirmed for work on permit submittal documents and details. HHD is consulted as needed.

c. Submittal documents are prepared for permits with longer lead times, such as Critical Area impacts and mitigation plans, Reforestation Site Review, Maryland Forest Conservation Act, and Joint Federal State Permit Application.

2. Review of QA-60 Checklist. The Team Leader reviews the QA-60 Checklist at least a week before documents of the Semi-Final Review Meeting are distributed, or about 3 weeks before the Meeting. Deficiencies are corrected before the Meeting.

3. Semi-Final Review Meeting.

a. Scheduling and Materials Distribution. The Semi-Final Review Meeting is scheduled to ensure maximum participation per LDG 2.5-C, or as determined.

1. Notification. Stakeholders, agency representatives, District staff, consultant designers and others of the Project Team are notified 2 to 3 weeks before the Meeting. The Semi-Final Materials, location and agenda are distributed to the Team and other invitees at least two weeks before the Meeting by interoffice mail, email, or digital copies via ProjectWise.

2. Location. The Semi-Final Review Meeting is typically scheduled in the District where the project is located. It may be held at the project site unless a Field Review was held at PI.

b. Meeting Agenda. A Project Team discussion of the Semi-Final Design Materials is facilitated by a representative from the lead Design Division. Typically the Project Manager leads the meeting and is responsible for taking meeting minutes.

When a consultant is responsible for project management or design, the consultant may facilitate the meeting. The consultant responds to questions of attendees and compiles meeting minutes.

c. Semi Final Review Minutes. Draft Semi Final Review Minutes are prepared and sent to the Project Team and attendees 7 to 14 days after the Meeting. The Team and other stakeholders are requested to provide concurrence or comment on the Draft Minutes. The Draft is revised and the Semi Final Review Minutes are approved by the Division Chief and distributed.

4. **Community Stakeholder Coordination.** The Community Stakeholder Meeting is scheduled, per LDG 2.4-E and 2.5-C, so that appropriate revisions may be incorporated into the project design.

5. **Approve Semi-Final Design.** The PIF, Scope, Schedule, Budget, Blue Folder and other records are submitted to the Team Leader for review. The Division Chief initials the PIF to authorize the start of Final Design.

6. **Revise Scope, Schedule and Estimate.** The Scope, Schedule and Estimate are revised as necessary. Form 42-25C is resubmitted to adjust funding.

7. **Update Trns*Port.** Data required for Trns*Port is entered or updated as necessary.

2.9 Project Final Design, Up to 90% Completion.

Refinements to the project documents are completed, including evaluation and incorporation of reviewer comments. Final Design Development includes detail design development and may require more extensive coordination efforts.

For projects without a formal Semi-Final Design milestone, the activities of the semi-final design stage are completed during the Final Design. Time-sensitive permit submittals, lab testing requests or information requests with substantial lead time may be necessary before Final Design to maintain project schedules and the Advertisement Date.

2.9-A Final Design Development. Final Design Contract Documents are refined versions of Preliminary Investigation and Semi-Final Designs that incorporate design details. Plans, Specifications and the Engineer's Estimate are substantially complete by the Final Review Meeting.

Appropriate coordination and plan reviews ensure that only minor revisions and adjustments are necessary to prepare Final Design documents for the PS&E Submittal or Advertisement.

1. **Final Design Plans.** Final Design Plans are developed to detail design level. Ideally, no revisions are necessary for a Contractor to use the plans to construct the project. In addition to existing and proposed information collected during previous design phases, the Final Design Plans include the following, as appropriate:

Table 2.9-A Contents of Final Design Plans	
1	Vicinity map, north arrow and graphic scale.
2	Design details, sequence of construction, typical sections and elevations as needed for construction.
3	Detailed impact reduction measures and protection measures for environmental or other sensitive areas.
4	Planting Schedule of each plan sheet includes quantity and plant key for each species and cultivar, with specification per ANSI Z60.1 for caliper or size, root form, and required spacing.
5	Master Plant Schedule includes aggregated totals of all plant materials shown in Planting Schedules per 4 above, except required spacing. Note: The Master Plant Schedule is the basis of the lump sum for Tree, Shrub, and Perennials Installation and Establishment and/or the lump sum for Annuals and Bulbs Installation and Establishment. The Master Plant Schedule must be complete and accurate.
6	Landscape notes, with project-specific notes revised as necessary.
7	General notes, as required by the Project Team or by Division or Agency reviewers for permit compliance.

2. **Final Design Specifications.** Special Provisions are revised as necessary for the project and readied for inclusion in the Advertisement Invitation for Bids (IFB). Final drafts of Special Provisions produced by Support Divisions are obtained. Non-standard detail sheets are completed and reviewed by Project Team members.

3. **Final Design Engineer's Estimate.** The Engineer's Estimate is developed as described in LDG 2.8-A.3 for Semi-Final Design, and includes all Category Code Items required to construct the project.

4. **Completion of QA-90 Checklist.** The QA-90 Checklist is completed for the Final Design Contract Documents. At this point, all materials are complete, accurate and in conformance with the LDG. Serious deficiencies may be grounds to postpone the Final Review Meeting or delay Advertisement.

2.9-B Final Design Project Management

1. **Permits and Coordination.** At Final Design, most outstanding coordination concerns are resolved and Permit submittals completed. Depending upon the Scope and schedule, one or more of the following actions are required:

   a. The Traffic Control Plan (TCP) is completed in consultation with the District Traffic Engineer and inserted into the IFB. Where Maintenance of Traffic can be conducted using standard traffic control details in the IFB, it may be sufficient to list the standards in the IFB. Any revisions to project limits may require revisions to the traffic restrictions by District Traffic.

b. Utility Statement and any specialized utility restrictions are inserted into IFB.

c. Construction Liquidated Damages and MBE, WBE, or DBE requirements are requested and are inserted into the IFB as required.

d. Responses are submitted to MDE, DNR, ACOE or other agencies as necessary, and plans and specifications are revised as required to address agency comments.

2. Assembly of Invitation for Bids (IFB). The IFB informs the Bidder of State and Federal labor and wage requirements, provides specialized bidding instructions, and lists any unusual requirements required for successful implementation of the contract.

a. Creation of the IFB. Applicable SPI's and SP's are assembled using IFB Builder. When consultants are not expected to assemble the IFB using IFB Builder, the documents are completed in the required format and delivered to the Project Manager in MS-Word format.

b. Permits, Approvals and Waivers. Permits, Approvals, Waivers and similar documents required before construction begins are included in the IFB for the use of the Bidder and to establish that compliance has been obtained before bid award**.**

c. Schedule of Prices (SOP). The SOP is generated from Trns*Port and may be provided with the Final Review Package. It is typically provided with the PS&E package for Federally Funded projects.

3. Review of QA-90 Checklist. The Team Leader reviews the QA-90 Checklist 7 to 10 days before the distribution of Final Review Meeting Materials. Deficiencies are corrected before the Materials are distributed or revisions may be provided at the Final Review Meeting.

4. Final Review Meeting.

a. Scheduling and Materials Distribution. The Final Review Meeting is scheduled to ensure maximum participation per LDG 2.5-C, or as determined.

Project Team members, stakeholders, agency representatives, additional District staff and consultant designers are notified 2 to 3 weeks before the Meeting.

1. The Final Materials, location and agenda are distributed to the Project Team and other invitees at least two weeks before the Meeting by interoffice mail, email or digital copies are provided via ProjectWise.

2. The Final Review materials contain a specific request for a constructability review from District Construction, District Traffic, the Landscape Operations Division, and other stakeholders as necessary.

b. Conducting the Final Review Meeting. A Project Team discussion of the Final Review Materials and Constructability Review comments is facilitated by a representative from the lead Design Division

1. Typically the Project Manager leads the meeting and is responsible for taking meeting minutes.

2. For consultant-designed projects, the consultant designer conducts the meeting, responds to questions of attendees, and compiles the meeting minutes per LDG 2.4-D.2. The Project Manager provides clarification regarding SHA policies and project scope.

3. If additional field review is necessary, a site visit may be scheduled with SHA and agency representatives immediately before or after the Final Review Meeting.

4. For OED Capital Projects the Final Review includes a Constructability Review, which is typically a separate review for projects advertised by non-OED Divisions.

5. Draft Final Review Report (Meeting Minutes). The draft Final Review Report is prepared, approved by the Team Leader, and sent to the Project Team and attendees within 7 days after the meeting.

The draft Final Review Report is accompanied by a request for review, comment or clarification of outstanding concerns. The deadline for response is typically 1-2 weeks after the date of the request, and is clearly indicated.

6. Final Review Report. The draft Final Review Report is revised to address responses of the Project Team and stakeholders, and is distributed to the Team and agency representatives after approval of the Division Chief.

The approved Final Review Report is distributed to the Team and meeting attendees within 21 days after the Final Review Meeting, although a shorter timeframe may be required to meet the production schedule.

7. Community Stakeholder Coordination. The Community Stakeholder Meeting is scheduled per LDG 2.4-E in consultation with key community stakeholders.

Depending on project scope and degree of Community involvement, the meeting is typically a follow-up to earlier meetings.

2.9-B Final Design Project Management, continued...

8. **Stakeholder Final Design Review.** Project renderings and displays that illustrate the Final Design for projects with community involvement are prepared as required for stakeholder review or coordination with federal, state, municipal or private entities.

    a. The meeting is conducted with Project Team members and consultant designer present as appropriate to answer questions from stakeholders.

    b. For projects with significant community impact, a Public Meeting and Presentation may be scheduled to present the Final Design to the community and provide opportunity for comment.

    c. Topics addressed at the Final Review stakeholder meeting include:

        1. Review of Project Scope, goals and purpose.

        2. Review of projected impacts, especially to private property.

        3. Review of expected construction schedule.

        4. Review of maintenance responsibilities and any MOA or MOU for maintenance by those other than SHA.

        5. Request for review of design by community representatives.

        6. Opportunities for community feedback.

9. **Final Design Approval.**

    a. The Permit Schedule developed through the design process is reviewed to ensure that permits are obtained before Advertisement.

    b. Major concerns identified at the Final Review Meeting and Final Stakeholder Review Meeting are resolved. Additional follow-up Stakeholder Meetings and delay of PS&E and Project Advertisement may be appropriate to maintain community support and reduce construction phase delays.

    c. The Team Leader reviews the Final Review Report, Plans, Specifications, Estimate and other documents, and confirms the Scope, Schedule and Budget.

    d. Changes to the project Scope, Schedule and Estimate during Final Design require approval of the Division Chief.

2.9-B Final Design Project Management, continued...

e. The Division Chief initials the PIF to authorize preparation of the PS&E submittal for federally funded projects.

10. Revise Scope, Schedule and Estimate. The Form 42-25C is revised and resubmitted to reflect changes in Scope, Schedule, Estimate and preliminary engineering costs.

11. Update Trns*Port. Data required for Trns*Port is entered or updated as necessary.

2.10 PS&E Design, 100% Design Completion.

PSE Review is the last milestone before advertisement of federally- funded projects. State-funded projects do not typically have a PS&E review stage.

2.10-A PS&E Design Development. The Plans, Specifications and Engineer's Estimate satisfactorily address all Final Review comments. Substantial changes may require additional submittals to Federal Aid Programming, delaying project advertisement and construction. After the PS&E submittal, any changes to the Contract documents are made by Addendum.

1. PS&E Plans. The PS&E Plans are complete and ready for advertisement, including all plan information listed on the Final Review Plans and according to the following:

a. Planting Schedules for each plan sheet are complete and accurately reflect all tree, shrub, perennial, plug, annual and bulb planting required for the sheet.

b. Master Plant Schedule correctly summarizes and provides an accurate total of all Planting Schedules shown on individual plan sheets. All plan symbols, plant material specifications, and quantities are confirmed. The SOP includes the pertinent Category Code items in conformance with the Master Plant Schedule, and the costs are accurately reflected in the Engineer's Estimate.

c. Required E&S plans, details and notes are included and revised per HHD and MDE comments. The project MDE permit number is included in the contract documents.

d. Constraints such as utilities, lighting, topography, environmental features, roadways, structures, traffic control devices, etc. are shown on the plans.

e. Areas of soil disturbance and other impacts are delineated on the plans.

2. **PS&E Specifications and Detail Sheets.** Final refinements to Special Provisions and non-standard detail sheets are completed to address Final Review comments.

3. **PS&E Engineer's Estimate.** Final refinements are made to the Engineer's Estimate. The Estimate includes all Category Code Items required to construct the project. The Engineer's Estimate is submitted using Trns*Port. A lump sum breakdown for all lump sum Category Code Items is developed and submitted in an Excel spreadsheet that is not included in Trns*port.

4. **IFB Book.** Permits, approvals, waivers and the SOP are inserted into the IFB for the use of Bidders and to establish that requirements that must be met for project compliance have been obtained.

5. **QA Review and QA-100 Checklist.** Plans, details, specifications and estimate are reviewed with the QA-100 checklist.

2.10-B PS&E Project Management.

1. **Permits.** Required permits, approvals and waivers are obtained by PS&E for inclusion in the PS&E Submittal. When required permits are not available at PS&E, they are obtained before Advertisement for compliance with SHA policy.

2. **QA Review Meeting.** The Team Leader and Division Chief review the PS&E documents and the complete the QA-100 Checklist. The Division Chief authorizes submittal to Federal Aid Programming.

3. **Federal Aid Coordination.** At PS&E the Plans, Specifications (IFB), and Engineer's Estimate are provided to the Federal Aid Programming for review. Federal Aid Programming coordinates with the Federal Highway Administration (FHWA) as necessary on behalf of SHA.

4. **PS&E Submittal.** The PS&E package submitted to Federal Aid Programming consists of the Plans, Specifications and Engineer's Estimate and any additional required approvals. The PS&E Checklist is completed and the PS&E package is submitted at least 28 days before Advertisement.

5. **Distribution**. The PS&E documents are distributed to Project Team and stakeholders.

6. **PS&E Review Meeting.** A PS&E Review Meeting is occasionally scheduled for large or complex projects. When appropriate, it is one of the routinely scheduled meetings. The responsibilities are those of the Final Review Meeting, 2.9-B.4.

7. **MOA, MOU, LOA, and Right of Entry Agreements.** The appropriate agreement for construction and maintenance is signed before Advertisement. Right of Entry Agreements for work outside the ROW are signed.

8. **Community Construction Liaison**. For projects with community involvement, a Community Construction Liaison is identified. The liaison is the Project Manager or OED-LOD Inspector. The liaison is responsible for keeping the community informed of project construction schedules.

2.11 Advertisement, Bidding, and Construction.

2.11-A Evolving Role of Project Manager. OED Capital Projects are advertised for bids before award of contract and construction, although certain emergency projects and projects funded and constructed by others may follow a different procurement process.

For many OED Capital Projects, the responsibilities for project management are transferred from the Design Project Manager to the District Construction Project Engineer or the Landscape Operations Division Inspector at some point between contract advertisement and NTP.

After NTP and during construction, the OED Project Manager is typically less involved with the project, but provides assistance with stakeholder coordination, design-related issues and construction-phase revisions as requested.

2.11-B Contract Advertisement and Bidding. The SHA contract advertisement and bidding processes are managed according to legal requirements and SHA procurement policy.

The Advertisement Checklist is completed as required for project advertisement.

The following is a summary of the Contract Advertisement Process.

1. **Duplication.** The IFB and Plans are sent to the Print Shop for duplication, so that 12 sets of two copies each of the plans and IFB are produced.

2. **Advertisement.** The Advertisement documents are submitted to the SHA Advertisement Team and notice of the contract is posted on the SHA website and eMaryland Marketplace.

3. **Distribution of Contract Documents.** The Contract documents (IFB and Plans) are distributed.

   a. **Cashier's Office.** The 12 sets of 2 IFB's and Plans are delivered to the Cashier's Office for purchase by prospective bidders.

b. Project Team. Copies of the Advertised IFB and Plans are distributed to the Project Team for review. Any additional concerns are reviewed and coordinated with the Project Engineer and Landscape Operations Division.

4. **Pre-Bid Meeting.** The Pre-Bid meeting is convened and chaired. Contractor attendance is documented.

5. **Bidder Inquiries.** Bidder inquiries about the Contract are reviewed by the Project Team and answered as required by SHA policy. The need for an Addendum to the Contract is evaluated by the Project Team.

6. **Contract Addendum.** Addenda are formal changes to Contract documents that are prepared to address contractor questions or correct deficiencies or errors that are discovered after contract advertisement, but before the bid opening.

   One or more contract addenda to the IFB and Plans are occasionally necessary, and their preparation and distribution often involve substantial additional cost and efforts.

   Whenever an Addendum is developed, an 'Addendum Letter' from the Deputy Administrator of Planning and Engineering is distributed with the Addendum that explains the reasons for the change.

   a. Request for Addendum. An Addendum to clarify Contractor questions or correct contract documents is authorized by the Team Leader in consultation with the Division Chief.

   b. Submission of Addendum. The Addendum Letter and Contract Addendum, which might involve revisions to the IFB or Plans, are submitted for review by the Division Chief and the OED Contract Advertisement Team.

   c. Signature of Addendum Letter. The Contract Addendum and letter are submitted for signature of the Deputy Administrator of Planning and Engineering.

   d. Distribution. The Contract Addendum is distributed to the purchasers of the Contract documents.

   e. Attachment. The Addendum and Addendum Letter are attached to each unsold copy of Contract documents in the Cashier's Office.

   f. Verification. Written verification of receipt of the Addendum and Addendum Letter by purchasers of the Contract is stored in the Blue Folder before Bid Opening. Digital verification, such as emails, is archived in ProjectWise.

g. **Addendum Verification Letter.** The Addendum Verification Letter, confirming all buyers have confirmed receipt of addendum is provided to OOC-Contract Awards.

7. **Bidding.** The Bid Opening is attended with OOC-Contract Awards for formal contracts.

   a. **Bid Opening** for small procurements is completed in-house with at least one witness.

   b. **Bid Justification Letter** is prepared as requested by OOC-Contract Awards.

2.11-C Pre-Construction. Following the NTP, the Project Engineer or the OED-LOD Inspector hosts a pre-construction meeting with the Contractor and subcontractors.

The OED-LOD Inspector uses the Pre-Construction Checklist of the OED-LOD Project Engineer Toolkit to guide discussion.

Other topics include:

1. **Communication**, responsibilities and conflict resolution procedures of the Project Team, Project Engineer and others involved with construction.

2. **Permit requirements**, commitments and other project-specific concerns.

3. **Modification requests** per 710.03.01 and other changes. Modification requests are approved by the Team Leader.

4. **Construction milestones** and payment schedules.

5. **As-built** procedures and documentation.

2.11-D Construction. During construction, management of the project is the responsibility of the District Construction Project Engineer or the OED-LOD Inspector. The Project Team provides support as requested for the duration of construction as follows:

1. **Redline Revisions.** Redline revisions typically change project costs, and are developed as required to address design changes.

   Redline revisions may be required as a result of errors in contract documents, unforeseen field conditions, or stakeholder requests. The 'Highway Policies and Procedures Manual' provides guidance regarding redline revisions.

2. **Greenline Revisions.** Greenline revisions are adjustments to landscape plans or specifications that do not change project quantities or costs. These revisions are developed as required under direction of the Team Leader.

3. **Partnering Meetings.** Construction partnering and progress meetings are attended. Installation Phase and Establishment Phase Inspections are optional.

4. **Permits.** Assistance is provided as needed for coordination of permit compliance, modifications and renewals.

5. **Construction Support.** Assistance is provided as requested to address concerns of Project Engineer, OED-LOD Landscape Inspector or Contractor. This may involve the review of landscaping stake-out, material samples, substitutions, shop drawings, and submittals from the Contractor.

6. **Community Liaison.** Assistance is provided as needed to the Community Construction liaison and stakeholders, and to any District public outreach staff as required during construction.

2.12 Post Construction Documentation.

2.12-A Post-Construction Evaluation. A post-construction review of projects is scheduled and conducted using the 'As-Built Evaluation Checklist'.

2.12-B As-Built Plans. Construction plans, including redline and greenline revisions are reviewed and revised as required.

The As-Built Plan is prepared for future reference, or a copy of the as-built is obtained from the PE or OED-LOD Inspector and stored in the project records.

2.12-C Photographs. Photo documentation of the complete project is stored in ProjectWise.

2.12-D Archive Final Documents. Paper documents are archived in the project file, and digital documents are archived in ProjectWise.

Chapter 3 - OED Liaison for Non-OED Projects

3.1 Introduction.

3.1-A OED Liaison Support. OED staff provide support to those who manage projects developed by other SHA Offices and Districts, modal administrations and public and private developers. Such projects include roadways, interchanges, bridges, noise barriers, drainage improvements, streetscapes, park & rides and other facilities.

Each Division of OED may assign one or more staff members or consultants to serve as liaisons to the Project Team.

3.1-B Responsibility of OED Liaison. Chapter 3 explains project design from the perspective of the OED Liaison with the following responsibilities:

1. **Supervision.** The OED Liaison works under the general supervision of the OED Team Leader in cooperation with the Project Manager of the lead Design Division.

2. **Process and Direction.** The instructions of Chapter 3 apply to the OED Liaison unless stated otherwise.

3. **Conformance to LDG.** The OED Liaison provides support to ensure that project designs conform to the philosophy, policies and guidelines of the LDG.

4. **Specifications.** The OED Liaison provides support to ensure that project design conforms to the Standard Specifications for Construction and Materials, SHA CADD Standards, and other applicable SHA policies and guidelines.

3.2 Role of OED Divisions.

The OED Divisions assist the development of non-OED projects by providing technical expertise and oversight for environmental stewardship, aesthetics, and compliance with applicable local, state and federal regulations.

Although project management is the responsibility of the Project Manager of the lead Design Division, the design principles and coordination procedures of the LDG are performed to provide effective project support.

The Divisions of OED provide project support as follows:

3.2-A Environmental Compliance Division (OED-ECD) ensures that SHA facilities and operations achieve and maintain compliance with state, federal, and local environmental permits, laws, regulations and best management practices.

OED-ECD provides environmental compliance resources, oversight / guidance, environmental technical expertise and environmental training programs for facility employees.

OED-ECD is also responsible for developing and implementing a comprehensive Environmental Management System (EMS) to ensure sustained compliance in conducting highway and facility operations. OED-ECD is not typically involved in highway projects, but may be involved with facilities development and projects to reduce environmental contamination.

3.2-B Environmental Programs Division (OED-EPD) reviews projects for compliance with federal and state wetlands and waterways laws and regulations to insure that projects are planned, designed, built, and maintained to meet or exceed permit conditions.

1. **Wetlands / Waters Permitting.** OED-EPD works with Project Team planners, designers, and engineers to achieve environmentally sensitive highway, bridge and maintenance projects by avoiding or minimizing impacts to sensitive natural resources in order to obtain all necessary state and federal wetlands and waterways permits.

2. **Wetland / Stream Mitigation.** Prepares and supervises preparation of plans, specifications, and estimates for compensatory wetland mitigation and stream mitigation projects of SHA.

3. **Wetland / Stream Restoration Stewardship.** OED-EPD provides identification, evaluation and delivery of Environmental Stewardship projects to help the State improve water quality of the Bay and its tributaries.

4. **Other Ecological Services.** Provides wetland delineation and functional assessment services, wetland mitigation and stream restoration monitoring and environmental monitoring of construction projects.

5. **Quality Assurance Inspections.** Inspects SHA construction projects for compliance with the approved E&S plans, utilizing a checklist and rating system.

3.2-C Landscape Architecture Division (OED-LAD). OED-LAD incorporates context sensitive solutions to provide design support, stakeholder coordination, review, and oversight for the development of plans, specifications, and estimates, and permit applications for projects along State highways such as:

1. **Highway Projects.** Provides plans, or reviews plans developed by other landscape architects, for aesthetic, screening, and revegetation plantings, and for plantings at signs and gateways, park & rides, median treatments, and on-site mitigation for Critical Area and tree impacts.

2. **Streetscapes.** Provides coordination with SHA Community Design Division and site development for streetscape projects, including plantings, hardscape treatments, site furniture, gateway signs, crosswalk and sidewalk design, utilities, and pedestrian and bicycle circulation.

3. **Structures.** Provides support for the aesthetic design of, and planting plans for, bridges, retaining walls, and noise barriers.

4. **Scenic Byways**. Performs reviews and provides guidance to designers of projects on, or viewed from, state and national scenic byways, to preserve and improve the byway users' experience. Also reviews plans submitted to Access Management Division for projects that impact Scenic Byways. Note: Staff and responsibility for Scenic Byways has been transferred to OPPE-RIPD.

5. **SHA Facilities**. Provides site design, pedestrian and vehicular circulation, site element and lighting design, planting plans, FCA permit applications, and coordination for improvement projects at safety rest areas, welcome centers, maintenance facilities and offices.

6. **Mitigation and Restoration Planting.** OED-LAD provides planting plans, and conducts site searches for off-site mitigation when on-site area is unavailable, inadequate, or unsuitable. OED-LAD coordinates with EPLD for approval of Critical Area plans, and provides plans to mitigate impacts to private property.

7. **Stormwater Management.** OED-LAD assists in the design of SWM facilities.

3.2-D Landscape Operations Division (OED-LOD) OED-LOD develops and implements landscape construction, landscape maintenance, wildflower and meadow establishment, vegetation management, turf renovation, and invasive species control.

1. **Compliance.** Ensures compliance with the Maryland Roadside Tree Law, Maryland Reforestation Law, the Forest Conservation Act, and Nutrient Management Law.

2. **Specifications.** Ensures conformance to Category 700 - Landscaping and Section 920 -Landscape Materials of the SHA Standard Specifications for Construction and Materials.

3. **Construction Support.** Interprets landscape design plans and ensures that design intent is maintained throughout construction.

4. **Invasive Species.** Provides technical expertise for invasive species control, native species establishment, and promotes highway beautification.

5. **Landscape Design.** Establishes standards and guidelines for roadside landscape design and landscape management.

6. **Community Engagement.** Manages the Partnership Planting Program.

3.2-E Water Programs Division (OED-WPD) OED-WPD develops construction plans in conformance with goals of Maryland's Watershed Implementation Plan (WIP) as part of SHA's statewide effort to conform with the Chesapeake Bay TMDL and improve water quality of local streams and the Chesapeake Bay.

Efforts of the WPD are focused in the Maryland counties which must comply with the WIP. These efforts include stream restoration, stormwater management and water quality improvements, and tree plantings to restore forest areas.

3.3 OED Project Support Design Milestones.

For non-OED Capital Projects, the OED Liaisons assist the lead Design Division and provide technical expertise and design support. The timely identification of problems and potential solutions often minimize future design conflicts. The principal responsibilities of the OED Liaison are shown below:

3.3-A Design Initiation and Project Kick-Off. Refer to LDG 2.5. At the Project Kick-Off Meeting, the site and project are evaluated, and the Project Team is advised of regulations, commitments, and other factors that may affect the scope, schedule and estimate.

Identification of resources to avoid or reduce impacts, and documentation of the extent of such impacts is provided as soon as possible to ensure adequate time to modify the scope, schedule and estimate.

1. Consultant support proposals are reviewed as follows:

   OED-LAD reviews proposals for landscape architecture design services, tree or forest impacts, and permitting and mitigation design.

   OED-EPD screens the project for wetland, stream and floodplain impacts to determine the need for delineations and mitigation design. OED-EPD may elect to perform these tasks in-house or with outside consultants.

2. The Project Manager is advised of any discrepancies between proposed project scope and the effort needed for completion.

3.3-B Concept Development, Up to 15% Design Completion. Refer to LDG 2.6. Early project involvement by OED Divisions is necessary to set aside project funds for environmental impact reduction and mitigation, coordination with environmental agencies and other stakeholders. Stewardship of historic, cultural, and environmental resources should be considered throughout the project development process, and not only after project design is substantially complete.

3.3-C Preliminary Investigation (PI), Up to 30% Design Completion. Refer to LDG 2.7. The PI stage is sometimes the first opportunity for OED to participate in a project.

1. OED-EPD provides delineation survey files and Joint Federal State Permit Application as necessary.

2. The PI Review Meeting is attended. OED-LAD attends when projects involve roadside landscaping or Cat. 700 items. OED-EPD may also attend.

3. The QA-30 Checklist is completed, and a memo of concerns is coordinated with the Team Leader for transmission to the Project Manager.

3.3-D Semi-Final Design, up to 60% Completion. Refer to LDG 2.8. Minor projects may skip this milestone. For projects with complex mitigation or extensive landscaping, review at this stage may reduce the need for revisions at Final Review.

1. The review of E&S plans allows OED staff to re-evaluate project impacts and adjust permit applications and mitigation design, or work with the Project Manager to reduce or relocate impacts.

2. The Semi-Final Design Review Meeting is attended, or written review comments are sent to the Project Manager.

3. The QA-60 Checklist is completed, and a memo of concerns is coordinated with the Team Leader for transmission to the Project Manager.

3.3-E Project Final Design, Up to 90% Completion. Refer to LDG 2.9. Contract documents and the Engineer's Estimate are reviewed in preparation for the Final Review Meeting.

1. Changes made since the Semi-Final Review require close review, since even minor revisions may require extensive additional modifications.

2. When extensive review of Final Review documents is required, an informal pre-PS&E submittal and review of revised documents is recommended.

3. OED-EPD provides Wetlands and Waterways permits for insertion into the IFB.

4. The Final Design Review Meeting is attended, and is a priority when major concerns are addressed in the review memo.

5. The QA-90 Checklist is completed, and a memo of concerns is coordinated with the Team Leader for transmission to the Project Manager. The Project Manager is advised of any changes that may require adjusting the project advertisement date.

3.3-F Constructability Review. For larger projects, a Constructability Review Meeting may be scheduled to discuss construction-phase concerns. This review provides an additional opportunity to identify and address potential construction problems before advertisement. OED staff participate as appropriate.

3.3-G PS&E Package, 100% Design Completion. The documents of the PS&E Package are advertised for bidding if no revisions are made. As described in LDG 2.10, state-funded projects usually do not have a PS&E submittal.

If there is insufficient time to make changes to PS&E plans, specifications and Engineer's Estimate before advertisement, an addendum may be required.

1. The PS&E Design Review Meeting is attended when appropriate, and particularly when major concerns were addressed in the review memo.

2. The QA-100 Checklist is completed, and a memo of concerns is coordinated with the Team Leader for transmission to the Project Manager of the project.

3.4 Advertisement and Construction.

LDG 2.11 provides additional information regarding responsibilities performed during project advertisement and construction.

3.4-A Contract Advertisement. The following activities are performed:

1. Advertised plans, IFB and SOP are reviewed and the Project Manager or Project Design Engineer of the lead Design Division is advised of errors or potential problems.

2. Responses are developed for Bidder inquiries as requested by the Project Manager, and the Pre-Bid Meeting is attended when requested.

3. The Project Manager or Project Design Engineer of the lead Design Division is assisted as requested to develop specifications for Contract Addenda or Bid Justification.

3.4-B Pre-Construction. Pre-construction activities are similar to OED Capital Projects. Substitution requests for plant materials are typically forwarded from the Project Engineer through OED-LOD to OED-LAD.

1. **Substitutions.** Substitutions recommended by the OED-LOD Landscape Inspector or Project Engineers are reviewed by the OED-LAD Liaison.

2. **Redline Revisions.** Assistance is provided to develop specifications for Contract Redline Revisions as required.

3. **Permits.** OED-EPD attends the Pre-Construction Meeting to address Wetlands and Waterways permit requirements and E&S responsibilities.

3.4-C During Construction. Partnering meetings are attended and materials, finishes, and other submissions are reviewed as requested. The Project Manager and Project Engineer are advised of concerns regarding construction methods or materials.

3.4-D Post Construction. Responsibilities are described in LDG 2.12.

3.5 Design Build Project Support.

This Chapter is under development.

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CHAPTER 4 - COMPLIANCE AND MITIGATION

4.1 Introduction.

SHA complies with AASHTO highway design and safety guidelines, the Americans with Disabilities Act (ADA), and numerous state and federal laws. This chapter outlines several regulations that affect SHA projects, and LDG 11.12 'Environmental Guidelines for Construction Activities' provides additional information regarding compliance and mitigation.

Ultimate decisions regarding compliance are the responsibility of the authorized enforcement agency according to local, state or federal law. SHA policy and design guidelines are monitored for compliance by the authorized Division or Office.

SHA guidelines for compliance often exceed the minimum legal requirements for safety, accessibility, and environmental stewardship. Knowledge of the project site project scope, and changes made during project design help to minimize penalties for noncompliance as well as delays and changes during construction.

4.2 Americans with Disabilities Act (ADA).

4.2-A SHA Accessibility Policy and ADA Guidelines. SHA has established an Accessibility Policy that complies with and often exceeds requirements of ADA in order to promote maximum accessibility at SHA facilities. Thus, projects that generally comply with ADA may require additional measures to comply with SHA Guidelines. LDG 11.13 includes the SHA Accessibility Policy and ADA Guidelines.

4.2-B Innovative Contracting Division. The ADA Compliance Team of the OHD Innovative Contracting Division is primarily responsible for determining compliance with ADA and SHA Accessibility Policy. SHA Accessibility Policies are implemented during Design Concept Development and PI to avoid costly construction changes.

4.2-C Special Consideration. The following issues often require special consideration during design and construction to conform with SHA Accessibility Policy and ADA Guidelines.

1. **5-foot Clear Sidewalk Width.** Although ADA requires a 3-foot minimum clear width of sidewalk for pedestrians, SHA Accessibility Policy requires that sidewalks be at least 5 feet wide, and constructed of one surface treatment within that width.

2. **Waiver.** A waiver is required for each location where a sidewalk is less than 5 feet wide, including 'pinch points' where the clear sidewalk width is narrower than the standard 5-foot width.

   Pinch points can be caused by obstacles such as utility poles, street signs, street furniture, fire hydrants, utility cabinets and other structures that obstruct the clear sidewalk area from ground level to above the head of pedestrians.

The waiver request is reviewed and a waiver is granted or denied by the ADA Compliance Team.

3. **Pre-Existing Conditions.** Utility poles, fire hydrants, traffic signs, street furniture and other obstacles require a waiver to remain in place when a 5-foot clear width sidewalk cannot be constructed around them. Waivers are not typically granted where relocation of pre-existing obstructions is deemed feasible by the Innovative Contracting Division.

4. **New Installation.** New traffic signs, utility poles, guy wires, signal cabinets and street furniture are not specified within the 5-foot clear sidewalk width unless a reasonable alternate access route is adjacent.

5. **Environmental Areas.** To minimize disturbance and impervious surfaces in Critical Area, a waiver may be requested to allow narrower ADA-compliant sidewalks when wider passing zones are provided.

4.2-D Decorative Paving. In locations where aesthetic paving treatments are specified, the sidewalk plans conform to the following:

1. **Decorative Edging.** The 5-foot clear sidewalk width is constructed of a single material. When decorative edging adjoins the sidewalk, such as a band of bricks between curb and concrete sidewalk, the edging is not included in the 5-foot width.

2. **DWS Pavers.** Detectable Warning Surface (DWS) pavers at the base of ADA ramps have a 70% color contrast from adjacent paving. Lighter or darker DWS pavers are specified to ensure the 70% color variance between DWS pavers and sidewalk or decorative edging. A variety of DWS paver colors may be specified.

3. **Crosswalks.** Crosswalks of stamped concrete, asphalt, concrete or brick pavers or other aesthetic materials are constructed with stamping patterns or joints that do not exceed 1/8 in. depth.

4.3 Erosion and Sediment Control.

4.3-A Permit Requirements. Projects that involve soil disturbance are regulated by stormwater management laws that restrict the movement of water and sediment into streams, wetlands and waterways. These laws require treatment of stormwater runoff to remove pollutants and sediment during construction (erosion and sediment control) and permanently (stormwater management).

The MDE Stormwater Plan Review Division is responsible for reviewing and approving E&S plans and stormwater management plans for projects that exceed the following thresholds: 5,000 SF or more of soil disturbance, or 100 CY of soil excavation, placement, or grading.

Projects with soil disturbance less than 5,000 SF do not require MDE approval, but an E&S plan must be developed, and E&S controls must be installed during construction. MDE may consider cumulative effects for areawide projects. Soil disturbance within environmentally sensitive areas such as wetlands, buffers, floodplains or waterways require approval by MDE even when impacts are below the thresholds.

Areawide projects with multiple sites may be exempt from MDE review where no individual site has impacts above the thresholds provided above. Determination of exempt projects is made by HHD in consultation with MDE. Agricultural land management practices are typically exempt from MDE review.

Projects in Montgomery County Special Protection Areas involve additional native planting restrictions and require HHD coordination.

Projects within the Severn River Watershed require approval by the Anne Arundel County Soil Conservation District (AASCD).

LDG 9.1 provides additional information about Roadside Drainage and Stormwater Management.

4.3-B Erosion and Sediment Control Plans.

1. **Professional Staff.** The following professional staff may develop erosion and sediment control plan E&S plans) when licensed in the State of Maryland: Registered Landscape Architect (RLA), Registered Land Surveyor (RLS), or Licensed Professional Engineer (PE).

   In addition, the professional staff who develop E&S plans must completed the SHA Basic Erosion and Sediment Control Training ('Yellow Card') and the SHA Erosion and Sediment Control Designer's Training.

2. **OED-Managed Projects.** For OED capital projects and other OED-managed projects, the development of E&S plans, details and specifications is the responsibility of the OED Project Manager.

   Comprehensive guidance to develop E&S plans for landscape-only projects is provided by OED-LAD.

   Typicals and project-specific E&S plans, details, specifications and sequence of construction are reviewed by HHD before submittal to MDE or AASCD. Plans not submitted via this process may not receive the necessary review priority by MDE.

   To determine whether the project is subject to MDE approval, the project LOD is calculated during the PI stage. For landscape-only projects, the LOD is calculated as the sum of A+B in LDG Table 4.3-B.2.

4.3-B Erosion and Sediment Control Plans, continued...

Table 4.3-B.2 Calculating Area of Disturbance	
A = In Sites of General Construction	
1	Total area of subsoil or topsoil placement and grading
B = In Otherwise Non-Disturbed Areas	
2	Total area of individual planting pits and planting beds*
3	Total area of tilling, seeding, sodding, soil stabilization matting
4	Total area of stump removal or grinding
5	Total area where soil disturbance is likely, e.g. wet areas
6	Total area disturbed for any other reason
* Note: Do not calculate the area of drill seeding, plugging or bulb planting within areas of existing vegetation, as these operations are not 'soil disturbance'	

3. **Non OED-Managed Projects.** For Non-OED-managed projects, the E&S plans, details and specifications are usually the responsibility of HHD or other divisions, and not the OED Liaison. The following factors are considered during design:

   a. **Tree Protection.** Tree and forest protection measures are coordinated with E&S plans before submittal to MDE. E&S controls such as silt fence require excavation that can impact tree roots, and tree root pruning may be required during installation of E&S controls.

   b. **Seed Mixes.** Temporary and permanent seed mixes shown on E&S plans or in specifications may not be appropriate within or adjacent to ecologically sensitive areas.

   c. **Limit of Disturbance (LOD).** Landscaping operations performed in environmentally sensitive areas that cause significant soil disturbance, such as constructing planting beds, tree stump removal, soil placement or soil tilling are included within the project LOD shown on the approved E&S plans.

   d. **Landscape Limit of Disturbance (LLOD).** The LLOD may be appropriate when operations that cause negligible soil disturbance are performed outside the construction LOD.

      Operations permissible within the LLOD include the installation of trees, shrubs, bulbs and plugs in individual planting pits, drill seeding and invasive species management.

      The LLOD is graphically delineated on landscape plans and E&S plans with appropriate notes to clarify permissible operations, and to meet mitigation requirements or other commitments in the situations shown below:

4.3-B Erosion and Sediment Control Plans, continued...

Table 4.3-B.3 When to Delineate LLOD	
1.	When the LOD does not include enough space for mitigation plantings.
2.	When impacts to sensitive environmental areas must be minimized.
3.	When the installation of E&S control measures such as silt fence is not necessary and appropriate.
4.	When the location of the LLOD is approved by HHD and included in plans submitted to MDE.
5.	When the LLOD is approved by District Construction.
6.	When prohibited activities within the LLOD are noted on each plan sheet where the LLOD is delineated, such as grading, clearing and grubbing, placement of soil layers or storage of equipment or materials.

e. Soil Stabilization. Permanent soil stabilization includes perennial vegetation such as turfgrass or meadow as well as stone mulch, pavers, cement and asphalt pavement. The "Estimating Manual" includes design principles for turfgrass, meadow and other permanent vegetation groundcover. Soil Stabilization Matting (SSM) is often used in conjunction with turfgrass or meadow. Biodegradable SSM is often installed on slopes and in mild channels, and non-biodegradable SSM is installed in channels and some steep slopes.

4.4 Maryland Tree and Forest Laws.

Specific regulations and requirements for tree and forest protection and establishment are outlined in the Maryland tree and forest laws. These laws are specific to the type of project and resulting impacts. A summary of each law is provided below, with further detail in LDG 4.5, 4.6, 4.7.

The OED-LAD Landscape Architect and OED-LOD Statewide Forest Mitigation Coordinator are responsible for obtaining the permits and approvals.

OED-LOD tracks project compliance with the Maryland Tree and Forest Laws, and assists in identifying potential impacts in the field during design and construction.

OED-LAD provides impact reduction recommendations, and assists with mitigation planting design.

Maryland Roadside Tree Law regulates impacts to individual trees, and cumulative impacts to trees and forest areas of less than one acre of forest within public road rights-of-way. The installation of trees is also regulated under the Roadside Tree Law. Brush is not regulated under Maryland Roadside Tree Law.

Maryland Reforestation Law regulates cumulative project impacts to individual trees and forest of one acre or greater associated with linear highway projects.

Maryland Forest Conservation Act (FCA) regulates activities that require an application for a subdivision, grading permit or sediment control permit on areas 40,000 SF or greater.

4.5 Maryland Roadside Tree Law / Roadside Tree Permit (RTP).

4.5-A. Overview. The Maryland Roadside Tree Law regulates impacts to individual trees and to areas of trees less than 1 acre.

The Law regulates installation, removal, and any work that may affect the health or growth of a roadside tree, such as branch or root pruning. However, trees that merely overhang the right of way, or whose roots grow into the right of way, are not regulated under the Maryland Roadside Tree Law, although measures to protect such trees from excessive damage may still be appropriate. Dead trees and trees outside the right of way are not governed under the Maryland Roadside Tree Law.

SHA complies with the Maryland Roadside Tree Law, and as the property owner of record when Access or District permit applicants propose tree removal, SHA typically requires 1:1 mitigation for tree removals and may require mitigation for brush removal.

4.5-B Types of Permits.

1. **Individual Project Permit.** This permit, obtained before the Advertisement Date, allows new construction or reconstruction, and is good for one year after issue. When known, the name of the Maryland Licensed Tree Expert is included in the permit application. The application is submitted as soon as possible, and a copy of the permit is included in the IFB so it is available during construction.

2. **Agency Blanket Permit.** This permit is issued to individual SHA Maintenance Shops, municipalities, and utility companies for maintenance activities, including tree removal. The name of the Certified Tree Care Expert is included in the application. This permit requires annual reporting of tree removals, and is renewed each year.

4.5-C. Mitigation Requirements.

1. **Determination of Forester.** When trees are removed, replacement of trees may be required by the Forest Service per Title 08 Department of Natural Resources, Subtitle 07 Forest and Parks, Chapter 2.07 A (10). The mitigation requirement is determined by the DNR-FS Forester after reviewing the impacts in the field.

2. **1:1 Mitigation.** Typically, 1 to 1 replacement is required so that one mitigation tree is installed for every tree removed.

3. **Installation.** Plant materials may be installed onsite or elsewhere within the right of way.

4.6 Maryland Reforestation Law.

4.6-A §5-103 Overview. The Maryland Reforestation Law of COMAR 5-103 regulates linear highway projects, utilizing State funds, that impact one acre (43,560 SF) or more of forest within the project limits. It also includes individual tree impacts within project limits.

The Law is a 'no net loss law' that requires a 1:1 replacement for the loss of forest cover. Forest cleared for highway construction is replaced on an acre-for-acre basis, on public lands, within one year of project completion.

4.6-B Mitigation Site Criteria.

1. **Priorities for Mitigation Sites.** LDG 11.6 includes the text of COMAR § 5-103. Mitigation sites for Reforestation Areas are selected according to the following criteria, from highest to lowest preference:

   1st Installation onsite within the project limits.

   2nd Installation on public lands within the same county and watershed.

   3rd Installation on public lands within the same county or watershed in the State.

   4th Payment into the Maryland Reforestation Fund at the rate of $0.10 per SF or $4,356 per acre for the total cleared area is deposited by SHA into the Reforestation Fund. This fund is used by DNR to install replacement trees on public lands such as schools and parks.

2. **Size of Mitigation Sites.** Reforestation Areas are also subject to the following size requirements to qualify for credit under the Maryland Reforestation Law.

   a. **Adjacent to Forest.** Reforestation Areas adjacent to existing forest are at least 0.25 acre (10,890 SF).

   b. **Not Adjacent to Forest.** Reforestation Areas not adjacent to existing forest are at least 0.50 acre (21,780 SF).

   c. **Strip Planting.** Reforestation Areas that will be combined with existing forest for credit are at least 50 feet wide in the narrowest dimension.

4.6-C Reforestation Design.

1. **General Considerations.** The Maryland Reforestation Law stipulates minimum sizes for Reforestation Areas, minimum species diversity and planting density, but provides limited direction on the design of Reforestation Areas.

   SHA Reforestation Areas exceed the minimum requirements of the Law to achieve increased survivability, reduce maintenance needs, provide screening and obtain wildlife and aesthetic benefits.

   Plan sheets that show Reforestation Areas also include the following:

   a. **'Reforestation Area'** is only noted on plans for areas that are proposed for credit and which meet the legal and design requirements of the Maryland Reforestation Law. A Reforestation Area may also include trees installed within typical landscaped areas.

   b. **SF or acreage** of Reforestation Area is calculated for each contiguous area of reforestation planting, and not merely the area shown on each sheet.

   c. **A list** of species, sizes and quantities of plant material is shown for each Reforestation Area in addition to the Master Reforestation Plant Schedule.

   d. **'Revegetation Area'** is noted on plans to indicate plantings similar to Reforestation Areas, but that do not conform with the requirements for area, width, planting density or other requirements of the Maryland Reforestation Law and DNR-FS.

      Revegetation Areas are not included in the total quantity of Reforestation Areas, and are not credited towards Maryland Reforestation Law Mitigation, except when authorized by MDDNR-FS.

2. **Environmental Considerations.** Reforestation and Revegetation Areas are designed to mitigate the loss of forest areas due to highway construction and provide many of the benefits of naturally growing forest.

   Successful establishment of Reforestation and Revegetation Areas require that environmental challenges be inventoried so that plant material will survive.

   Factors to consider are discussed in LDG 8.0 and summarized below:

   a. **Site microclimate and exposure**. Localized roadside conditions may require specification of plants with greater tolerance of heat, cold and wind.

b. Slopes. Reforestation and revegetation areas on slopes require special consideration regarding their constructability and design. Refer to LDG 4.6-C.3.d.

c. Soil conditions. Soil pH, fertility, depth to bedrock, compaction, and erodibility, may limit plant species, require smaller planting stock sizes, and may require remediation before installation.

d. Moisture and drainage patterns. Select and place species adaptable to available moisture and typical drainage patterns.

e. Salt. Plants with high salt tolerance are specified where road salt is often applied, and near salt domes, snow stockpile areas, and the ocean. However, in many of these locations it may be impossible to maintain plants, and other methods to protect the soil from erosion may be required.

e. Pollution. Plants that are tolerant of air, water, or soil-borne pollutants are specified where appropriate.

g. Wildlife. Deer, beaver, and some other animals can rapidly destroy trees and shrubs. Installation of larger planting stock, with or without tree shelters, can improve the survival of plants installed in Reforestation Areas. Protective sleeves on the trunk can protect trees from beaver chewing and deer antler rubbing.

The additional cost of protection measures is warranted in locations where high animal populations may cause excessive plant mortality. Special Provisions are available for tree protection shelters.

3. Aesthetic Considerations. In addition to meeting legal requirements, Reforestation and Revegetation Areas are expected to enhance roadside aesthetics and environmental values. Thus, these Areas are also designed with consideration of their visibility to highway users and adjoining property owners, as well as to wildlife and nearby natural areas.

The following criteria are considered when designing Reforestation and Revegetation Areas:

a. Location & Visibility. Design detailing or detailed plans for Reforestation Area edges and other highly visible areas is shown when appropriate.

1. Larger sizes of trees are specified in the detail areas, as terrain and access allows.

2. The installation of trees and shrubs on a ‘grid pattern’ is not appropriate.

3. The installation of trees and shrubs by the 'random planting' method rarely provides aesthetically acceptable results.

4. For most locations, the installation of single-species groupings of flowering trees provide masses of color. Such plantings are preferred to randomly installed trees and shrubs.

3. The appropriate number of trees or shrubs in a group is related to the mature size of the plant and visibility to the highway user. For example, a group of three large trees is often appropriate, while a group of seven small shrubs is rarely appropriate.

4. The majority of sentinel trees are specified in highly visible areas for immediate visual impact, or where necessary to protect smaller plantings from mowing damage.

b. **Groundcover Seeding.** Native groundcovers such as Shrub Seeding and Meadow Establishment per Section 706 and 707 are often specified for Reforestation Areas to reduce mowing needs. These plantings often improve aesthetics and increase species diversity as the area matures.

c. **Edge Plantings.** Edge plantings are installed along the perimeter of existing forest and Reforestation Areas. These plantings often require more design than the default random planting. Edge plantings are often highly visible and may also protect interior planting areas from mowing.

The following edge planting designs are installed as appropriate:

1. **Masses of flowering trees and shrubs** are installed along edges and slopes where they are most visible. It may be appropriate to install shrubs in planting beds to promote establishment, although long-term maintenance is reduced by allowing the bed to naturalize.

2. **Sentinel trees** are installed predominantly along highly visible edge for greater visual impact, and to protect smaller plantings from mowing damage.

3. **Small trees and shrubs** are installed exclusively in locations where highway clear zones prohibit the installation of large trees.

d. **Slopes.** Reforestation on slopes is often an appropriate maintenance reduction strategy.

1. **Slope orientation is considered** when designing Reforestation Areas. Cut slopes above a roadway are often highly visible and fill slopes may be visible from lower parallel alignments or adjacent properties.

2. **Slope steepness**, accessibility, drainage and soil depth are considered when specifying planting stock. Smaller sizes of planting stock are specified on steep slopes, but more ornamental species are specified in highly visible area for increased aesthetic benefit.

3. **Engineered or reinforced slopes** are identified and considered to determine planting restrictions.

4. **Trees that fail** usually fall downhill. Increased offset distance from travel lanes or adjacent structures may be specified to avoid hazards.

4. **Construction Considerations.** Reforestation and Revegetation Areas are often located on land unsuited for other uses, which presents constructability challenges due to steep slopes, erodible soils or difficult access. Some constructability issues are shown below; LDG 8.7 includes a more detailed list of concerns.

   a. **Groundcover seeding** is completed before the installation of trees and shrubs to reduce costs, and to avoid damage to plant materials.

   b. **Container grown stock** is installed in locations where access is difficult.

   c. **Steep slopes require smaller sizes.**

      Slopes 3:1 to 2:1 require trees $\leq$ 2.0 in. caliper.

      Slopes 2:1 and steeper require trees $\leq$ 1.5 in. caliper.

   d. **Staking.** Refer to 710.03.11 (a). Although staking is required for many trees, the following trees do not require staking:

      1. **Medium and large** deciduous trees < 1 in. caliper or 6 ft height.

      2. **Small** deciduous trees < 0.75 in. caliper.

      3. **Evergreen** trees < 5 ft height.

      Variations from the Standard Specifications require a Special Provision.

      If trees are not staked on slopes 3:1 and steeper, or in locations with difficult vehicle access, a Special Provision is developed for the installation.

5. **Plant Material and Planting Density.** Trees and shrubs suitable for Reforestation and Revegetation Areas are included in the Preferred Plant List (PPL). RS – Reforestation Sentinel Trees are larger stock, and R – Reforestation are smaller stock of Sentinel Trees and other species of trees and shrubs.

4.6-C Reforestation Design, continued...

a. Species Diversity. A mix of native trees and shrubs from at least 3 different genera are selected. Trees and shrubs that are native and found growing in the nearby area are preferred for installation.

Increased diversity is encouraged, especially where the locations of Reforestation Areas vary in soil, drainage, and microclimate conditions.

Typically, 70% of the planting stock are overstory species (Large and Medium Trees), while 30% are understory species (Small and Medium Trees, Shrubs).

b. Planting Density. The minimum planting densities required by SHA policy are higher than those required by Maryland Reforestation Law.

In general, planting density and total plants per acre increases as the size and spacing of plant materials decrease, as shown in LDG Table 4.6-C.4.

Table 4.6-C.4 Reforestation Area Planting Density

Size		Rootstock	Minimum Stems per Acre	Approximate Spacing Ft on Center
Deciduous	Evergreen			
2 in. cal.	7 ft ht.	B&B or CG	110	20
1.5 in. cal.	5 ft ht.	B&B or CG	150	17
1 in. cal	4 ft ht.	B&B or CG	200	15
5 ft ht.	3 ft ht. #5 CG	CG	250	13
#2 or #3 CG		CG	350	11
Seedlings		CG	700	8

c. Sizes. Maryland Reforestation Law allows plantings of a single size, but Reforestation Areas composed of a mix of plant sizes are preferred for SHA projects. The transplanting success rate and growth rate for each species is considered when specifying plant size and rootstock type.

- Fast-growing evergreen trees such as Loblolly Pine and Eastern Redcedar are often more available and transplant more successfully in smaller sizes.
- Fast-growing trees such as Red Maple are often installed in smaller sizes, but quickly catch up with slower growing trees such as Red Oak.
- LDG 4.6-C.3 provides additional guidance for determining appropriate sizes of plant materials for Reforestation Areas.

6. **Future Maintenance.** Reforestation and Revegetation Areas are designed to recreate and provide the benefits of natural forest with little maintenance.

   a. **Mowing**. Reforestation and Revegetation Areas are not usually mowed after the Establishment Phase is completed. However, mowing before installation and during the Establishment Phase promotes the growth of trees and shrubs.

   b. **Edge Trees.** Installation of sentinel trees and larger planting stock along the edges of Reforestation and Revegetation Areas helps reduce damage from mowing and herbicide application operations. Trees $\geq$ 1.5 in. caliper are less often damaged by mowers.

   c. **Planting Beds.** Planting beds of shrubs, or beds of native grasses and perennials are appropriate on the edges of Reforestation Areas when the beds will require little maintenance, or will be allowed to naturalize.

      Routes through landscaping are left clear of trees and shrubs to allow access for maintenance operations such as mowing where narrow shoulders, traffic barriers, wet or steep terrain or other obstacles will prevent entry.

   d. **Invasive Species.** Invasive trees, shrubs, vines and herbaceous species can outcompete and destroy newly installed trees and shrubs.

      Reforestation and Revegetation Areas near large populations of invasive plants use long-term strategies to manage invasive species, including:

      1. **Specifications** to control invasive species are coordinated with OED-LOD. Removal of invasive species is completed before installation and ongoing maintenance is performed to prevent their regrowth.

      2. **Planting density** of trees and shrubs is increased to shade out and outcompete invasive plants.

4.6-D DNR Park Projects. For impacts to trees and forest areas in State Parks, MD DNR Park Service typically requires more mitigation than the Maryland Reforestation Law. Typical mitigation requirements per project-specific approvals of DNR include:

2 to 1 Replacement for removed individual trees or per acre for forested areas. The details of the 2 to 1 replacement may be a matter of negotiation.

5-Year Maintenance Requirement to ensure successful establishment. Increased planting density is often used to ensure required survival at final DNR inspection.

4.6-E Critical Area. Reforestation Areas that are installed as mitigation for Critical Area impacts are maintained for 2 years after installation to ensure the required survival rates. Seedlings and other small stock involve a 5 year maintenance requirement.

4.7 Maryland Forest Conservation Act (FCA).

4.7-A Overview. Overview. The FCA regulates grading impacts associated with non-linear projects such as salt barns, park & ride facilities, and offices.

- FCA does not apply to linear highway projects
- FCA does not apply to projects in Garrett or Allegany Counties.
- FCA does not apply to wetland creation or stream restoration projects.

Projects that require an application for a subdivision, grading permit, or sediment control permit on areas 40,000 SF or greater are subject to the FCA and require a Forest Conservation Plan prepared by a licensed forester, licensed landscape architect or other DNR qualified professional. Close coordination with SHA divisions is often needed to develop plans that avoid or minimize the need for afforestation or reforestation. Refer to State Forest Conservation Technical Manual, 3rd edition, 1997 by MD-DNR, distributed by Division of State Documents 410-974-2486.

4.7-B Procedure Summary. The main purpose of the Maryland Forest Conservation Act (Natural Resources Article Section 5-1601 thru 5-1613) is to minimize the loss of forest resources during land development by making the identification and protection of forests and other sensitive areas an integral part of the site planning process.

1. **Priorities.** Identification of priority areas before development facilitates retention. Of primary interest are areas within or adjacent to:
   - Streams or wetlands.
   - Wildlife corridors.
   - Steep or erodible soils.
   - Large contiguous blocks of forest.
2. **Forest Stand Delineation (FSD).** The FSD includes the identification of existing forest cover and the environmental features of a proposed development site. It consists of an application, map and summary of specific field data collected.
3. **Forest Conservation Plan (FCP).** The FCP includes a map and narrative describing the limits of disturbance of the project and how the existing forested and sensitive areas are protected during and after development. It also includes an application form and worksheet to show the calculation of forest disturbed and

retained, whether trees are required for replanting, and a plan for the long-term maintenance or protection of the trees.

4.7-C Mitigation Requirements. The Maryland Forest Conservation Act is not a 'no net loss' law. Mitigation requirements are based on a variety of site conditions including net tract area, existing forest, on-site forest retention and surrounding land use. Mitigation requirements are calculated using the FCA Worksheet. Mitigation is based upon the area of soil disturbance, and not upon impacts to trees.

The Worksheet generates Reforestation or Afforestation requirements based on existing conditions.

4.7-D Future Protection. Mitigation sites planted under the FCA are protected in perpetuity by a variety of mechanisms. Any on-site forest that is retained in order to reduce mitigation requirements is also protected.

If on-site forest is retained but will not be used for mitigation credit under the law, then no protection is required. Note: SHA policy prohibits FCA easements on-site if there is a possible future need of expanding the easement area.

4.7-E Future Maintenance. Each approved planting plan includes a binding, 2-year maintenance and monitoring agreement. The agreement explains how trees in the FCP are monitored and maintained to ensure protection and establishment by the end of the agreement.

4.8 Wetlands and Waterways.

This Chapter is under development. Consult OED-EPD.

4.9 Stormwater Management.

This Chapter is under development. Consult HHD and refer to LDG 17.2 - MDE Maryland Stormwater Design Manual, Vol. 1 & 2, and to LDG 17.3 - Stormwater Management Guidelines for Federal and State Projects.

4.10 Critical Area.

4.10-A Overview. The Maryland Critical Area Commission (CAC) regulates impacts and determines mitigation requirements for development activities that impact the Chesapeake and Atlantic Coastal Bays Critical Area (Critical Area). The Critical Area is composed of two parts:

Critical Area. The first 1,000 feet from the edge of tidal waters is the Critical Area.

Critical Area Buffer. The Critical Area Buffer (Buffer) extends 100 feet from the edge of tidal and non-tidal waters within the Critical Area. When slopes greater than 15% are adjacent to the Buffer, the width of the Buffer is expanded at the rate of 4 feet of additional distance for each percent above 15%.
Mitigation is required for two 'layers' of impact in both the Critical Area and Buffer:

1. **Physical impacts** such as clearing, grading and paving require mitigation to restore vegetation.

2. **Projects with impervious surfaces** that are not included in the General Approval MOU of LDG 4.10-C.1 require mitigation to reduce pollutants in runoff.

4.10-B Determination of Impacts. There are three phases of impact.

1. **Buffer Impacts.** Any ground disturbance within the Buffer, regardless of existing conditions, is considered an impact.

   Buffer impacts for minor projects require a 3:1 mitigation ratio.

   Buffer impacts for wetland or Critical Area mitigation projects require a 1:1 mitigation ratio.

   Under current regulations, the CAC may require mitigation multiple times for impacts in the same location if that site is disturbed by more than one project.

2. **Critical Area Impacts.** Trees that are removed between the landward edge of the Buffer and the landward side of the Critical Area is replaced at a 1:1 mitigation ratio.

3. **Pollution Runoff Impacts (10% calculations).** For projects with impervious surfaces within the Critical Area, mitigation is required to reduce pollutant runoff whether or not there is an increase of the impervious area.

   The basis of the calculation is 'Pounds of Phosphorous'. The mitigation ratio is 0.50 acre of mitigation to reduce 1.0 lb. of phosphorous runoff.

10% calculations are performed or verified by HHD in coordination with EPLD and OED-LAD. The impact and mitigation calculation spreadsheet is in LDG 11.5.

4.10-C Approval and Project Coordination.

Projects that involve construction activity in the Critical Area and Buffer are evaluated for impacts. SHA coordinates directly with CAC staff for impact concurrence and mitigation approval.

Approval of the CAC is granted via a written letter of concurrence of impacts and approval of mitigation plans. The Approval is not a permit and is not included in the IFB. Any changes to plant materials, or substantive changes to planting locations, are submitted to the CAC for approval.

1. **General Approval MOU.** Certain minor activities in the Critical Area that meet the requirements under the 2003 MOU between SHA and the CAC for 'General Approval' are exempt from full review by the CAC and mitigation requirements. However, the projects are reported to CAC by EPLD. The MOU primarily involves maintenance and landscape installation projects that do not require clearing in the Critical Area, or an increase of impervious surfaces, and allows the following activities:

   "Installation or repair / modification / replacement of the following safety and traffic management equipment, within the road right of way, which do not increase quantity or lessen quality of runoff, and where clearing in the buffer is not anticipated:

   - *Fencing*
   - *Signs*
   - *Pavement markings*
   - *Snow & ice detectors*
   - *Vehicle loop detectors*
   - *Pavement grooving / rumble strips*
   - *Traffic signals and monitoring equipment*
   - *Signal preemption equipment*
   - *Guardrails & safety barriers*
   - *Railroad warning devices*
   - *Improved crossing surfaces at grade for railroads*
   - *Overhead signs & lighting*
   - *Overhead traffic detectors & cameras*
   - *Streetscaping*
   - *Landscape planting*
   - *Landscape maintenance for existing facilities and / or to fulfill objectives of a beautification program".*

   "Routine Maintenance projects, within the road right of way and easements which do not increase the quantity or lessen the quality of runoff:

   - *Rehabilitation of bridge parapets*
   - *Wetland monitoring and remediation permit activities*
   - *Storm water management inspection and maintenance*
   - *Conversion of existing unimproved stone / asphalt shoulder to paved shoulder*
   - *Maintenance of roadways, intersections, parking lots, sidewalks and bicycle facilities including pavement replacement, patching and / or resurfacing that does not increase impervious surface.*

- *Bridge redecking, overlay and minor rehabilitation, including repair of culverts and headwalls, where clearing in the buffer is not anticipated.*
- *Minor drainage improvements, related to safety, flood control or erosion, within the existing right of way and easements, that would have no adverse impacts on downstream habitat or hydrology, including the replacement of existing riprap slope protection, grout bags, pneumatically applied mortar or lining mortar."*

2. **Physical Impacts and Mitigation Coordination.** Physical impact and mitigation coordination with the CAC is conducted through EPLD. The impact assessment is performed by EPLD, reviewed by OED LAD, and sent to the CAC with the proposed mitigation plan. Evaluations are documented in a Microstation CADD file submitted for error checking and subsequent mitigation planning.

   a. The field investigation is performed at the same time as wetland delineation.

   b. Staff of the CAC are invited to the on-site Buffer delineation to assure concurrence with field designation of tidally influenced wetlands.

   Concurrence at the delineation reduces the need for adjustments to Buffer impact calculations, mitigation site selection, and cost adjustments.

3. **10% Pollution Reduction**. The calculation is performed or reviewed by HHD and included with the physical impact evaluation submitted to CAC by EPLD. The mitigation for the 10% reduction are included with the physical impact and mitigation plans. Pollution reduction impacts are documented in CADD.

4. **Formal CAC Presentation.** The CAC may require a formal presentation of construction projects during the regular monthly meeting of the CAC.

   Projects are submitted for review by the CAC at least 6 weeks before the scheduled meeting. Large projects, or those which may require extended evaluation by CAC are submitted with more lead time.

   Minor projects may be approved directly by staff of the CAC.

4.10-D Mitigation Site Selection. Mitigation site selection and design is the responsibility of OED-LAD. Mitigation plans are approved by the CAC before the project is advertised.

1. **Priority**. Mitigation for construction disturbance is performed in conformance with the Planting Agreement.

   When it is not possible to mitigate within the on-site Buffer or Critical Area of the project, a search is performed to locate land in the Critical Area where mitigation may be performed with approval of the CAC.

Mitigation is provided with the following priorities:

Table 4.9-D.1 Critical Area Buffer Mitigation Priorities	
Highest Priority ⇳ Lowest Priority	On-site within the Buffer
	Off-site within the Buffer in the same watershed
	On-site outside the Buffer within the Critical Area
	Off-site within the Critical Area in the same watershed
	Off-site within the Buffer in a different watershed
	Off-site within the Critical Area in a different watershed

Table 4.9-D.2 Critical Area Mitigation Priorities Including 10% Pollution Reduction Mitigation	
Highest Priority ⇳ Lowest Priority	On-site within the Critical Area
	Off-site within the Critical Area in the same watershed
	Off-site within the Critical Area in a different watershed
	On-site outside the Critical Area, but contiguous to Established Buffer and Critical Area that is permanently protected
	Off-site outside the Critical Area, but contiguous to Established Buffer and Critical Area that is permanently protected

2. **Private Land.** Mitigation on private land is placed in a perpetual easement held by the CAC.

4.10-E Critical Area Mitigation Design.

1. **Mitigation for Physical Impacts** to the Critical Area and Buffer is provided by the installation of vegetation that is native to the site.

   a. **Mix of Plants.** Mitigation consists of a mix of large and medium trees (overstory), small trees (understory) and shrubs. Grasses and perennials may also be allowed for limited credit.

   b. **Ratio.** Mitigation for physical impacts is on a 1:1 ratio, so that one tree is planted for each tree removed.

      In locations where on-site mitigation can only be accomplished with shrubs due to the presence of overhead utilities, the CAC will consider installation plans with utility-compatible native species.

c. Species. The SHA Preferred Plant List is used to determine appropriate native species.

The following may be used to determine the suitability of other species:

- Maryland Native Plants, A Master Checklist by Joseph Metzger Jr.
- Native Plants for Wildlife Habitat and Conservation Landscaping, Chesapeake Bay Watershed, US Fish and Wildlife Service. LDG 11.19.
- Native Plants for Wildlife Habitat and Conservation Landscaping, Maryland: Coastal Plain, US Fish and Wildlife Service. LDG 11.19.

2. 10% Pollution Reduction Mitigation may involve one or more of the following options, coordinated through EPLD and HHD.

a. Removal of existing impervious surfaces or impervious channels.

b. Construction of other stormwater management facilities.

c. Installation of native vegetation.

3. Monitoring and Maintenance. The duration of the monitoring period required by the CAC may vary from two to five years, depending on size of the planting.

Required maintenance includes the control of invasive species and pests that endanger the mitigation or surrounding plant communities.

Mitigation plantings are maintained during the monitoring period to ensure that plant material is established as required in compliance with CAC requirements. During this time, plant materials are replaced as necessary.

4. Planting Credit Calculation. Mitigation planting credit for Critical Area and Buffer impacts is calculated according to the credit values of each planting unit, and not by the total area planted.

a. Density. The CAC typically requires a minimum planting density of 400 trees per acre, but also allows credits to be tabulated on a per plant basis.

b. Credit. The credit awarded by the CAC varies per plant according to the type of plant and the size of the plant at the time of installation. Greater credit may be awarded for mixed groupings of overstory trees, understory trees and shrubs than each plant would receive individually.

In 2010, the planting credits were expanded to allow more credit for the installation perennials and grasses. Other changes also limit the percentage of plant types that may be used in mitigation projects in areas with site limitations such as overhead utilities.

The CAC has generally accepted the ANSI Z60.1 American Standard for Nursery Stock plant sizes.

Table 4.10-E Critical Area Mitigation Planting Credits

Vegetation Type	Minimum Size for Eligible Credit	Maximum Credit Allowed (SF)	Maximum Percent of Credit
Canopy tree	2 in. caliper and 8 ft high	200	Not applicable
Canopy tree	1 in. caliper and 6 ft high	100	Not applicable
Understory tree	1 in. caliper and 6 ft high	75	Not applicable
Large shrub	1 gallon and 4 ft high, or the height of a 1 gal container per ANSI Z60.1 for the species	50	30%
Small shrub	1 gallon and 18 in. high	25	20%
Herbaceous perennial	1 quart	2	10%
Planting cluster 1 *	1 canopy tree + 3 large shrubs or 6 small shrubs	300	Not applicable
Planting cluster 2 *	2 understory trees + 3 large shrubs or 6 small shrubs	350	Not applicable
* Note: These options are only available for buffer establishment and buffer mitigation of areas less than 1 acre.			

The Critical Area calculations and worksheets are in LDG 11.5. The LAD Critical Area Mitigation Coordinator will provide assistance.

4.11 Aviation Restrictions for Roadside Landscapes (MAA, FAA).

Projects near airports are regulated by the Maryland Aviation Administration (MAA) and the Federal Aviation Administration (FAA) to ensure that development does not create hazards for aircraft. MAA has jurisdiction over BWI Thurgood Marshall and Martin State airports, while FAA has jurisdiction over all Maryland airports.

4.11-A Height Restrictions. FAA restricts the height of manmade structures and construction equipment, such as cranes, that may obstruct runway flight paths.

In addition, FAA may restrict the height of trees within the runway protection zone (RPZ) and at the end of a runway. Depending on terrain and existing natural and manmade obstructions, the installation of large or medium trees may be prohibited. Concerns of the affected airport, MAA or FAA are coordinated as necessary.

4.11-B Roadside Landscaping Restrictions. Landscaping within 4 miles of airports is less attractive to wildlife that may be hazardous to air traffic.

1. **Attractive Species.** Plants known to be attractive to wildlife are prohibited by MAA. The Preferred Plant List includes MAA approved species. The list of approved species was substantially revised and expanded in 2015.

2. **Meadow.** Large areas of meadow or unmown turf are not permitted adjacent to open water or in locations where flocking birds, such as geese, are likely to land. Because of these restrictions, certain species normally included in SHA Shrub Seeding Establishment and Meadow Establishment per Sections 706 and 707 may not be installed in locations near airports.

3. **MAA Approval.** The approval of MAA is required for the installation of plants that are not already approved species by MAA within 4 miles of BWI and Martin State Airport.

4.11-C Stormwater Management Facility Restrictions. SHA Stormwater Management Facilities are designed to minimize open or standing water, so that areas will drain within 24 hours.

CHAPTER 5.0 - ACCOMMODATING UTILITIES

5.1 Introduction.

The roadside landscape is often a utility landscape where roads share rights-of-way with poles, wires, pipes and other utility structures. These utilities often pose significant design and construction challenges to landscape design.

To reduce hazards, reduce pruning costs, increase tree survival and improve the character of roadside landscaping, it is important that appropriate locations are selected for trees and shrubs near utilities based upon their mature heights and growth forms. The design principles of this Chapter meet or exceed the typical landscape guidelines of utility companies in Maryland.

Accurate information about existing and proposed or relocated utility locations is obtained before trees and shrubs are specified. The review of pole locations on plan sheets is not an adequate substitute for a field review.

5.2 Electric Utilities.

Electric wires and utility structures are present above and below most state highways. For convenience of discussion in the LDG, electric utilities have been classified into aboveground poles and wires, buried wire and structures such as utility vaults, transformers, cabinets and meters. These three groups are discussed below.

5.2-A Aboveground Poles and Wires. Trees installed too close to aboveground wires present the most common hazard, and such trees may be aggressively pruned by utility crews. The consequences of such pruning are often seen along the highway: u-shaped trees, one-sided trees, and flat-topped trees.

In addition to the costs and hazards of pruning operations, significant pruning often weakens the trees and reduces the attractiveness of roadside landscaping. The categories of aboveground electric wires are described below.

1. Categories of Wires.

Category 1 - Transmission Wires. Transmission wires carry electricity at high voltage. These wires are supported by large towers, and serve large regional and local electrical substations.

Utility companies require large offset distances for trees, often the entire utility easement, to avoid the possibility of contact with transmission wires.

The installation of trees and shrubs, including Reforestation of Revegetation Areas, is prohibited within 100 feet (horizontal distance) from Category 1 Transmission Lines.

5.2-A Aboveground Poles and Wires, continued...

Category 2 - Distribution Wires. Distribution wires carry electricity from large electrical substations to smaller substations. Although voltages are lower than transmission wires, these wires require a substantial offset for nearby trees.

The installation of medium and large trees is prohibited within 50 feet of Category 2 wires.

Category 3 - Local Distribution Wires. Local distribution wires carry electricity from substations to residential and commercial transformers. Because the line voltage of these wires are lower than Category 2 wires, small trees and shrubs may be installed under these wires. Refer to LDG Tables 5.2-A.2.a thru d regarding offset distances to center of tree trunk.

Category 4 - Property Service Wires. Property service wires connect individual properties to transformers and local distribution wires. These wires have the lowest voltage, and are usually insulated.

The offset distance for trees and shrubs installed on private property are generally the same as those installed in the right of way, but may be reduced to accomplish landscaping objectives. Refer to LDG Tables 5.2-A.2.a thru d regarding offset distances to center of tree trunk.

2. **Offset Distance for Category 3 & 4 Poles and Wires.** The following tables show offset distances to center of tree trunk for representative examples of trees installed underneath or adjacent to Category 3 & 4 wires.

Table 5.2-A.2.a Typical Small Trees, Under 20 Ft Tall *

Install Under Category 3 & 4 Wires and More than 20 Ft from Poles

Botanical Name	Common Name
Acer ginnala	Amur Maple
Amelanchier laevis ‘Autumn Brilliance’	Autumn Brilliance Serviceberry
Cercis canadensis	Redbud
Cornus kousa ‘Rubra’	Red Kousa Dogwood
Cornus x rutgan ‘Celestial’	Celestial Dogwood
Crataegus viridis 'Winter King'	Winter King Hawthorn
Juniperus virginiana ‘Corcorcor’	Emerald Sentinel Eastern Redcedar
Malus baccata ‘Dolgo’	Dolgo Crabapple
Lagerstroemia x 'Tuskegee'	Tuskegee Crapemyrtle
Prunus x incamp 'Okame'	Okame Hybrid Cherry
Styrax japonicus	Japanese Snowbell

*** Note:** This is an abbreviated list of typical Small Trees; refer to PPL for other trees of Use Group STS or LTS. Shrubs are also acceptable under wires and at least 5 ft from poles.

5.2-A Aboveground Poles and Wires, continued...

Table 5.2-A.2.b Typical Medium Trees, 20 to 50 Ft Tall * Install More than 30 Ft from Category 3 & 4 Wires and Poles	
Botanical Name	**Common Name**
Acer campestre	Hedge Maple
Betula nigra 'BNMTF'	Duraheat River Birch
Carpinus caroliniana	American Hornbeam
Celtis occidentalis	Common Hackberry
Cladastris kentuckea	Kentucky Yellowwood
Gleditsia triacanthos var. inermis 'Christie'	Halka Honeylocust
Lagerstroemia x 'Natchez'	Natchez Crapemyrtle
Tilia cordata 'Greenspire'	Greenspire Linden
Zelkova serrata 'Green Vase'	Green Vase Zelkova
*** Note:** This is an abbreviated list of typical Medium Trees; refer to PPL for other trees of Use Group STM or LTM. Small trees and shrubs are also acceptable per LDG Table 5.2-A.2.a	

Table 5.2-A.2.c Typical Columnar Medium & Large Trees * Install More than 30 Ft from Category 3 & 4 Wires and Poles	
Botanical Name	**Common Name**
Acer x fremanii 'Armstrong'	Armstrong Maple
Acer rubrum 'Bowhall'	Bowhall Maple
Acer rubrum 'New World'	New World Maple
Acer rubrum 'Scarsen'	Scarlet Sentinel Maple
Acer rubrum 'Karpick'	Karpick Maple
Acer saccharum 'Reba'	Belle Tower Maple
Carpinus betulus 'Frans Fontaine'	Frans Fontaine Hornbeam
Ginkgo biloba 'Magyar'	Magyar Maidenhair Tree
Ginkgo biloba 'Princeton Sentry'	Princeton Sentry Maidenhair Tree
Quercus x 'Crimschmidt'	Crimson Spire Oak
Quercus x 'Long'	Regal Prince Oak
Quercus palustris 'Pringreen'	Green Pillar Pin Oak
Quercus robur fastigiata 'Skyrocket'	Skyrocket Oak
Taxodium distichum 'Mickelson'	Shawnee Brave Bald-Cypress
*** Note:** This is an abbreviated list of typical Columnar Trees; refer to PPL for other Medium and Large Trees. Small trees and shrubs are also acceptable per LDG Table 5.2-A.2.a	

5.2-A Aboveground Poles and Wires, continued...

Table 5.2-A.2.d Typical Large Trees, Over 50 Ft Tall * Install More than 50 Ft from Category 3 & 4 Wires and Poles	
Botanical Name	**Common Name**
Acer rubrum 'Franksred'	Red Sunset Maple
Acer saccharum 'Legacy'	Legacy Sugar Maple
Ginkgo biloba 'The President'	Presidential Gold Ginkgo
Gleditsia triacanthos var. inermis	Thornless Honey Locust
Gynocladus dioicus 'Espresso'	Espresso Kentucky Coffee Tree
Nyssa sylvatica	Blackgum
Pinus taeda	Loblolly Pine
Prunus subhirtella 'Autumnalis'	Autumnalis Winter-Flowering Cherry
Platanus x acerifolia 'Bloodgood'	Bloodgood London Plane Tree
Quercus palustris 'Pringreen'	Green Pillar Pin Oak
Taxodium distichum	Bald Cypress
Tilia tomentosa 'Sterling'	Sterling Silver Linden
Ulmus parvifolia 'Emer II'	Allee Chinese Elm
*** Note:** This is an abbreviated list of typical Large Trees; refer to PPL for other trees of Use Group STL or LTL. Small and medium trees and shrubs also acceptable per LDG Table 5.2-A.2.a, b, c	

5.2-B Buried Wire and Vaults. Tree offset distances from buried wires and vaults minimize root impacts and tree removals when buried wires are repaired or replaced, and help protect the Contractor from accidental contact with buried wires.

Note: Offset distances are measured to the center of the tree trunk or shrub, and root balls must be able to fit into the proposed locations.

1. **Buried Wires.** The offset distance from buried wires to trees is at least 5 feet, and the offset distance from buried wires to shrubs is at least 3 feet.

2. **Vaults.** The offset distance from underground vaults to trees is at least 10 feet, and the offset distance from underground vaults to shrubs is at least 5 feet .

3. **Higher Voltage.** For higher voltage buried distribution wires, the local utility is contacted to determine the appropriate offset distance.

4. **Access.** Landscaping allows clear access to buried vaults with space for service vehicles. Plant materials are specified to maintain clear access for staff and vehicles with minimal pruning or other maintenance.

5.2-C Structures. Plant materials and other landscaping is specified to maintain clear access for staff and vehicles with minimal pruning or other maintenance.

1. **Substations.** Depending on context, it may be appropriate to screen substations from view of adjacent properties or roadsides. Screening is coordinated with the District Utility Engineer and the Electric Utility before advertisement.

2. **Cabinets and Meters.** Landscaping installed near electric meters and cabinets for controls such as lights, signals and sensors allows clear access for staff and vehicles with little need for pruning or other maintenance.

3. **Transformers**. Landscaping near ground-mounted transformers allows access to doors, with at least 2 feet of clearance on all sides of the transformer.

5.3 Communication Utilities.

5.3-A Aboveground Poles and Wires. Phone, Cable, and Fiber Optic wires do not require the large offset distances of electric wires. Although the wires are closer to the ground, the voltage is low, and the wires are insulated to reduce the likelihood of arcing or electric shock.

Because communications wires often share space on electric utility poles, compliance with the offset distances of LDG 5.2-A apply, with the following exceptions:

a. **Wire Sag.** Where communication wires sag below 20 feet, only small trees, shrubs and low vegetation are specified.

b. **Utility Poles**. Where communications wires are located on separate poles, the offset distance from the wires to medium trees is at least 20 feet, and the offset to large trees is at least 35 feet, or as directed by the District Utility Engineer in conjunction with the public utility tree policy.

5.3-B Buried Wires and Vaults. The offset distance from buried wires to trees is at least 5 feet, and the offset distance from buried wires to shrubs is at least 3 feet.

The offset distance from underground vaults to trees is at least 10 feet, and the offset distance from underground vaults to shrubs is at least 5 feet.

To reduce potential impacts to fiber optic wires, a note is included in the Contract documents that specifies hand digging within 6 feet of buried fiber optic wires.

5.3-C Aboveground Junction Boxes and Cabinets. Landscaping is specified to allow access with minimal maintenance as plants mature. Screening is not installed in areas where it may be difficult for the utility company to find junction boxes and cabinets.

5.4 Natural Gas.

5.4-A Pipelines. Natural gas pipelines are installed below the rooting depth of most trees. The greatest risk to gas pipelines is during tree installation or removal.

The offset distance for trees and shrubs is measured from the centerline of the pipe. The minimum offset distance is 10 feet. Smaller offsets require approval of the Utility. Planting beds of perennial or ornamental grasses may be installed above gas pipes, but tilling and mechanized digging equipment is prohibited within 7 feet of the pipe.

Tree and shrub offset distances for high pressure gas pipes may be increased at the discretion of the District Utility Engineer in conjunction with the public utility gas policy.

5.4-B Vents and Valves. The offset distance from trees and shrubs to aboveground gas vents and valves is at least 20 feet, unless a smaller offset is approved by the utility.

5.4-C Meters and Manholes. The offset distance of trees and shrubs to meters and manhole covers is at least 10 feet, and the landscaping does not prevent clear access.

5.5 Water and Sanitary Sewer.

5.5-A Pipes. Although tree roots may occasionally grow into shallow sewer pipes, pipe repair work is often damaging to nearby trees, and the presence of trees and their roots can complicate access.

Trees are specified beyond the edge of maintenance easements for large pipes (mains). The minimum offset distance for trees is 7 feet + ½ the pipe diameter, measured from the centerline of the pipe. Smaller offsets require approval of the Utility. Larger pipes may require greater offset distances, as determined by the Utility or District Utility Engineer.

Streetscapes and similar urban projects should be coordinated with local utilities and jurisdictions to avoid conflicts and damage to trees caused by future repair and maintenance activities.

5.5-B Fire Hydrants. The installation of obstructions near Fire Hydrants is regulated by COMAR and municipal fire codes.

1. **Offset Distance.** The offset distance of trees and large shrubs to hydrants or other fire apparatus is at least 15 feet.

2. **Free Access.** Trees and shrubs may not prevent free access to hydrants.

5.5-C Manholes, Meter Vaults, Valves. The offset distance of trees and shrubs to these equipment is does not prevent maintenance access.

5.6 Storm Drains.

Effective drainage is vital to the highway system. Although landscape vegetation absorbs stormwater and prevents soil erosion, drainage problems can also be caused by poorly designed landscaping and lead to hazardous conditions or property damage.

Trees and other landscaping proposed near storm drain inlets, pipes, manholes and other structures is coordinated with HHD to ensure that vegetation will not cause damage or maintenance issues.

5.6-A Pipes. Storm drain pipes vary greatly in installation depth, size and material. Corrugated polyethylene pipe (CPP-S), polyvinyl chloride profile-wall pipe (PPWP) corrugated metal pipe (CMP), and reinforced concrete pipe (RCP) are all commonly encountered. Tree roots can damage or block storm drain pipes, particularly those that are shallow, leaking or degraded.

The offset distance for trees is measured from the centerline of the pipe. The minimum offset distance is 7 feet + ½ the pipe diameter. Deeper pipes and larger pipes may require additional offset distance.

In streetscapes and other locations where space for trees is limited, trees may be installed above pipes that are installed at least 4 feet below the soil surface. The use of root barrier systems should be explored in areas where trees are installed in close proximity to drain pipes.

5.6-B Inlets and Manholes. Mulched tree pits and planting beds are specified at least 7 feet from storm drain inlets, and do not obstruct drainage flows into the inlets except as part of a SWM facility designed to slow, increase infiltration, or filter stormwater. Although manholes may be screened, the vegetation does not restrict or prevent maintenance access.

Planting beds in drainage ways are not mulched with loose organic mulch such as shredded hardwood bark mulch, straw mulch, etc. since these materials may float and block inlets. Soil stabilization matting is appropriate when specified in conformance with the Estimating Manual.

5.7 SHA Utilities.

5.7-A Buried Wire. SHA owns and maintains a network of electric and communications wires that connect traffic signals, lights, signs, cameras and other equipment. Most buried SHA wires provide electric service, but SHA also owns fiber optic wires.

The offset distance from buried wires and vaults to trees is at least 5 feet, and the offset distance to shrubs is at least 3 feet. A note is included in the Contract documents that specifies hand digging within 6 feet of buried fiber optic wires.

5.7-B Streetlights. Trees are specified to minimize screening of street and highway lighting, excepting where screening of adjacent properties is desired.

The offset distance from trees, shrubs and other plant materials to streetlights and light towers is sufficient to allow access for maintenance.

5.7-C Traffic Controls. Landscaping does not block sightlines between traffic signals and signal control cabinets, and allows access for maintenance.

5.7-D Sensors and Weather Stations. Landscaping allows access for maintenance of traffic sensors, weather stations, etc. Trees and shrubs do not block sun from solar panels.

5.7-E Cameras. Trees are not specified where their mature growth will obscure camera views.

5.8 Petroleum Pipelines.

Although petroleum pipelines are infrequently encountered, the offset distances to landscape plantings are coordinated with the District Utility Engineer in conjunction with the petroleum utility.

CHAPTER 6 - CONTEXT SENSITIVE SOLUTIONS

6.1 Process and Context.

The 1998 “Thinking Beyond the Pavement” Workshop significantly expanded the design focus of SHA from the roadway to the roadsides, and toward the use of context sensitive solutions in transportation design.

The idea of “context sensitive solutions” is not new for most landscape architects, to whom aesthetics and extensive site analysis of environmental features and historic resources is an integral part of the design process.

One of the biggest challenges to using context sensitive solutions in the highway design process is that site inventory and stakeholder involvement play a key role in the design process, and there is typically no one correct solution.

As stated in “Context Sensitive Solutions for Work on Maryland Byways” (LDG 11.23):

“Context sensitive solutions is a collaborative, interdisciplinary approach to developing and implementing transportation projects, involving all stakeholders to ensure that transportation projects are in harmony with communities and preserve and enhance environmental, scenic, aesthetic and historic resources while enhancing safety and mobility.”

With the increased costs of maintenance and growing focus on sustainability, it also seems appropriate to add “and minimizing long term maintenance cost”.

Since the effort expended in the development of context sensitive solutions can vary widely according to the scope of the project, context, and community involvement, it is not feasible to address all aspects of context sensitive solutions here. Rather, this Chapter provides an overview of SHA’s approach to context sensitive solutions for roadside landscape design.

6.2 Social Context: Community Stakeholder Involvement.

As a public agency, SHA devotes significant resources to public outreach and provides substantial opportunities for public comment. SHA efforts may include public mailings, websites, project task forces and large community meetings, or just a few one-on-one meetings with affected property owners.

Project scope and private property impacts typically drive the level of public involvement. Coordination efforts are not necessarily related to project size; a small number of property owners with significant property impacts may require significant design and coordination efforts, while a large project may have fewer and less involved stakeholders.

Community outreach and negotiation with government agencies and property owners often require time and practice to perfect. A few useful guidelines are shown below.

Table 6.2 Guidelines for Community Stakeholder Relations	
a	Take the time to listen to the concerns of community stakeholders, and start early in the design process. Record the questions and names of concerned stakeholders.
b	Begin by building common ground regarding issues that must be solved and the goals of the project. Establish trust among the stakeholders and work towards consensus.
c	Members of the community often know more about local concerns, but usually much less about project constraints, engineering, and construction concerns.
d	Technical expertise is only useful to the community when communicated clearly in terms that can be understood.
e	Design constraints such as utility conflicts or maintenance budgets are explored and understood before any promises are made to the community.
f	Winning the argument is rarely as important as winning trust and brokering compromise.
g	All questions and concerns deserve a response. When you don't know something, defer making a response and then research the concern for follow up. A quick but incorrect answer often creates problems and confusion.
h	Realize that it is common for stakeholders to disagree with each other. Facilitate respectful discussion, but avoid taking sides when possible.
i	Be honest when describing temporary and permanent impacts. Though an impact may seem insignificant, it may be important to a property owner.

6.3 Environmental Context.

SHA projects comply with applicable local, state, and federal environmental regulations. NEPA documentation often provides an array of useful information. Additional analysis and design effort is required when projects traverse sensitive environmental areas. Context sensitive solutions are necessary in developing a roadside approach that adjusts according to the varying character of Maryland's physiographic regions; especially as necessary to accommodate the design constraints of natural and man-made topography.

6.3-A Maryland Geography. Maryland includes three very different physiographic regions: The Coastal Plain, Piedmont and Mountain regions. Each of these regions are associated with different terrain, soil types, climate, vegetation and land uses.

Roadside landscaping is also varied to adapt to the physiographic regions. For example, it is impractical to use a design approach suited to the deeper soils of the coastal plain in the shallow, rocky soils of the Mountain region.

6.3-B Topography. Advances in earthmoving technology allow large amounts of cut and fill, yet designing modern highways to fit into existing topography can reduce earthmoving costs and limit visual and environmental impacts. In addition to supporting a roadside design strategy appropriate to environmental constraints, feedback obtained during the "foundational design" of the roadside landscape to helps guide the design process and reduces future maintenance concerns.

Steep slopes can provide challenges to vegetative soil stabilization in poorly drained, shallow, or rocky soils. Decisions regarding the design of cut and fill slopes, the compaction of engineered soils, and the methods site drainage are better informed when future management is included early in the process.

For example, fill slopes 2:1 and steeper are often proposed to reduce fill quantities and minimize impacts to adjacent areas. Unfortunately, such steep slopes are often difficult to stabilize and maintain with vegetation. When the vegetation fails, the cost to restore the eroded areas and vegetation is often very high.

Low topography is common on the Coastal Plain of southern Maryland and the Eastern Shore. These areas present challenges for the design and construction of effective highway drainage.

For example, separated grade interchanges are not easily constructed using natural topography on the Eastern Shore. As a result, extensive areas of fill are often required to avoid exposing water tables and creating areas of standing water. The contextual impacts of such construction methods may have significant impacts upon local communities, viewsheds, environmental and cultural resources.

6.3-C Sensitive or Protected Environmental Areas. Using the processes of context sensitive solutions may lead to design changes that reduce impacts or enhance environmentally sensitive areas.

1. **Green Infrastructure.** Counties and other planning agencies have developed maps of green infrastructure which delineate contiguous tracts of natural areas. Highway development which reduces connectivity should be avoided or mitigated to reduce adverse impacts to green infrastructure.

2. **Critical Area.** Impact avoidance is the first priority when construction is near the Chesapeake and Atlantic Coastal Bays Critical Areas. However, when impacts are unavoidable, mitigation solutions are tailored to the site.

3. **Wetlands and Waters of the US.** Impacts to wetlands and waters of the U.S. may take the form of direct impacts, such as excavation for bridge piers and abutments, channel relocations, and filling or piping. Impacts can also occur over a longer period after construction due to changes in drainage patterns and water table due to site grading and drainage.

   The process of context sensitive solutions can identify methods of avoiding, reducing and mitigating impacts to a resource, using an approach tailored to the health, ecological sensitivity, and local and regional significance of the resource.

   Although low impact designs are usually preferred, designs with significant impacts may be appropriate. For example, the extensive design efforts required to

avoid impacts to a healthy Class I River with a Scenic River designation may take the form of substantial impacts and mitigation efforts in a highly degraded channel.

4. **Floodplains.** Designs that impact floodplains are required to minimize impacts upstream and downstream, or additional mitigation may be required.

5. **Nature Preserves, State Forests, National and State Parks.** Additional mitigation or specific design requirements may be required by MD-DNR Park Service, M-NCPPC, the U.S. National Park Service or other agencies.

   To minimize conflicts, representatives of these agencies are included in the design process when resources of their agencies are impacted. As a rule, projects with greater impacts require more review.

6. **Rare, Threatened or Endangered Species (RTE).** Preservation or habitat recreation may be required to minimize impacts to RTE Species. Relocation or custom protective measures may be required during construction.

6.3-D Design Approach. The health and integrity of a resource is considered before development of the design approach. As a result, context sensitive solutions in environmentally sensitive areas combines impact avoidance, impact minimization, and mitigation efforts.

The principal goal of roadside design in environmental areas is to mitigate impacts while enhancing existing environmental resources by designing for safety, for the environment, for aesthetics, and for construction and maintenance.

1. **Design for Safety.** Although the offset distances of LDG-7.6 are observed when possible, certain pre-existing conditions, cultural resources or environmental features may require special accommodations.

   Per the AASHTO Roadside Design Guide, 2011:

   The typical hierarchy of design options for the treatment of fixed objects should be considered for each location. They are the following, in order of preference:

   - *Remove the object.*
   - *Redesign the fixed object so it can be safely traversed.*
   - *Relocate the fixed object to a point where it is less likely to be struck.*
   - *Reduce impact severity by using an appropriate breakaway device or impact attenuator.*
   - *Redirect a vehicle by shielding the obstacle with a longitudinal traffic barrier.*
   - *Delineate the fixed object if the previous options are not appropriate.*

As part of context sensitive solutions, it may also be appropriate to reduce travel speeds or adjust highway alignments to minimize impacts and protect resources within the roadside landscape.

2. **Design for Environment.** Compliance with minimum environmental regulations may be insufficient to provide successful long-term environmental protection.

   For example, the installation of certain native plants may improve landscape establishment and deter invasive species.

   The installation of larger sizes of plants or increasing planting density may also be appropriate.

3. **Design for Aesthetics.** Environmental mitigation areas often appear unkempt to stakeholders accustomed to highly maintained landscaping. Thus, environmental context sensitive solutions that do not consider aesthetics miss a key opportunity to enhance the experience of highway users. Three points to remember:

   a. Aesthetics help to minimize requests for mowing or other maintenance.

   b. Masses of plants with colorful flowers, autumn foliage or fruits may provide environmental benefits with far more aesthetic appeal than random plantings.

   c. Sometimes it is appropriate to educate the user.

4. **Design for Construction and Maintenance.** Roadsides are typically designed to minimize future maintenance. As a result, project design and future maintenance is strongly influenced by the context of the site.

   Refer to LDG 8.7 regarding actors that affect constructability and future maintenance. For example, it may be necessary to design accessways into landscaped areas to control invasive species or enable utility maintenance.

   LDG 9.0 includes discussion of sustainable design in various contexts.

6.4 Regional Context: Rural, Suburban, Urban.

Regional context is considered in the design approach. Context sensitive designs include landscape mitigation and enhancements that complement the character of the highway corridor and geographic region.

Traffic volume and congestion as well as stakeholder expectations for maintenance vary within urban, suburban and rural areas. Individual projects may involve additional considerations, but the context sensitive approach to rural, suburban, and urban areas is typical as follows.

6.4-A Rural Context Sensitive Solutions. Rural areas include agricultural and natural landscapes, and often involve rapid transitions into suburban or urban contexts. The existing landscape often provides clues about appropriate plant materials and design.

Rural context sensitive solutions focus on minimizing impacts to the landscape and enhancing existing features.

Key Rural Design Goals and Principles:

1. Impacts to environmental, cultural, and historical resources are minimized by adjusting vertical or horizontal alignments.

2. Desirable views are preserved, and undesirable views are screened.

3. Regional and corridor character are maintained. Gateway treatments may be appropriate where rural roads transition into small towns.

4. Low-maintenance landscaping is emphasized for environmental mitigation, aesthetics, mowing area reduction and screening.

5. The installation of high-maintenance features such as planting beds is avoided.

6. The installation of locally native plants is maximized.

7. The installation of Reforestation Areas and Shrub Seeding is maximized.

8. The installation of large, naturalized, masses of trees and shrubs is maximized.

9. The Installation of meadow is maximized where trees and shrubs are not desired.

10. The installation of turfgrass is minimized except where needed to maintain safety sightlines and offset distances to fixed objects.

11. Wildlife accommodations such as “bat trees” and passageways are provided where appropriate.

6.4-B Suburban Context Sensitive Solutions. In many suburban areas, the existing landscape typically contains elements such as parks, lawns and other open space. Suburban highways carry more traffic and receive more maintenance than rural roads.

Suburban context sensitive solutions focus on minimizing impacts from highway improvements to environmental, cultural, and historical resources. The goals established during Project Initiation guide the design.

Key Suburban Design Goals and Principles:

1. Coordination with individual stakeholders and property owners is completed during the design process.

2. Desirable views are preserved, and screening of commercial and residential properties is provided where necessary.
3. The character of the highway corridor and local development is preserved as appropriate.

4. Basic adaptations are provided for pedestrians and bicyclists, such as:

   - Maintaining sightlines at pedestrian and bicycle crossings. Various hazards and obstructions are discussed in LDG 7.2-B.

   - Installing appropriate lighting and signage, while minimizing hazards.

   - Installing decorative hardscaping, street furnishings, and crosswalks.

5. Low-maintenance landscaping is preferred for environmental mitigation, aesthetics, mowing area reduction, and screening.

6. The landscape design connects and incorporates adjacent landscaping where feasible.

7. Geometric planting arrangements are sometimes appropriate, though curvilinear patterns are more typical.

8. Planting beds are specified in high-visibility locations where lower maintenance options are not appropriate.

9. Planting beds are specified where future maintenance will be provided by others.

10. In-kind landscaping mitigation may be appropriate when replacing landscaping on private property for private maintenance.

11. The installation of native plants is emphasized, but non-native, non-invasive plants may be specified where appropriate.

12. The installation of turfgrass sod is maximized near residential and commercial properties, in channels, and where more rapid groundcover establishment is desirable.

13. The installation of meadow is specified where infrequent or annual mowing is sufficient, or where trees and shrubs are not desired.

14. The installation of Shrub Seeding or Reforestation Areas are considered where mowing or meadow is not feasible.

6.4-C Urban Context Sensitive Solutions. Urban roadsides are often composed of hardscapes; sidewalks, parking lots, and buildings. Urban architectures and decorative pavements may provide inspiration for new hardscaping. Green spaces are less frequently encountered, less often naturalized and may be difficult to establish or maintain.

Urban context sensitive solutions focus on the accommodation of human activities, safety and landscape durability. Impacts to cultural and historical resources by highway improvements are minimized at the concept design level, and opportunities for environmental enhancement are explored as feasible.

Key Urban Design Goals and Principles:

1. Coordination with individual stakeholders and property owners is essential.

2. Advanced adaptations for pedestrians, bicyclists and transit users are routinely provided, such as:
   - Wayfinding signage and road markings
   - Gateway features and signage
   - Crosswalk treatments, bike racks, benches
   - Extensive decorative hardscaping
   - Transit shelters, platforms, and waiting areas

3. The character of the highway corridor character and local development is maintained as appropriate.

4. The installation of attractive and resilient plants is emphasized to ensure survival under foot and vehicular traffic, salt and pollution impacts.

5. Hardscaping is emphasized are areas of highest bike or pedestrian use.

6. The design approach is often closely linked to adjacent existing landscaping.

7. Landscaping that creates hazards or provides refuge for criminals is avoided by utilizing principles of Crime Prevention Through Environmental Design (CPTED).

8. Screening is provided as necessary.

9. Geometric planting arrangements are usually appropriate.

10. Higher maintenance requirements may be appropriate in high-visibility locations.

11. Maintenance agreements with property owners and community groups are preferred.

12. In-kind landscaping mitigation may be appropriate when replacing landscaping on private property for private maintenance.

13. The improvement or replacement of existing soils is usually appropriate.

14. Engineered soils and drainage systems may be necessary for plant survival.

15. Turfgrass Sod Establishment is preferred to Turfgrass Establishment (seedling).

6.5 Cultural Context: Cultural and Historical Resources.

Roadside landscapes involve a variety of cultural and historical resources. Context sensitive solutions help to preserve and protect resources identified by federal, state and local authorities. Other resources may be highly valued, but afforded no legal protection.

True context sensitive solutions may require major design changes, including adjustments to horizontal and vertical alignments to avoid impacts to historic structures, heritage sites, archaeological sites and cemeteries.

Context sensitive solutions can also occur at a detail design level with contextually and historically appropriate hardscape treatments and detailing, screening to minimize visual impacts or maintaining scenic views and vistas.

Some typical cultural and resources are discussed below:

6.5-A Historic and Cultural Districts. Context sensitive solutions are frequently appropriate to offset construction impacts of highways passing through historic and cultural districts, or to maintain historic character or significant cultural elements as defined by the Maryland Historic Trust other authority. In cultural districts, context sensitive solutions often involves design enhancements to the roadsides.

6.5-B National and State Parks and Heritage Areas. Context sensitive solutions are used to minimize impacts, and often take the form of enhancements to areas not impacted by a project. Significant coordination with the National Park Service, MD-DNR Park Service, or other authorities who manage parks and heritage areas may be required during design and construction.

6.5-C National and State Designated Scenic Byways. Scenic Byways provide an opportunity for motorists to experience Maryland's scenic landscapes, visit historic sites and experience culturally significant places. Context sensitive solutions are essential to preserving the Byways and maintaining their value for tourism and economic development.

1. **Byway Identification.** The Maryland Byways Map and SHA Byway Coordinator is consulted to identify byway routes.

2. **Defining the Byway.**

   a. Research is conducted to determine if SHA is the only road manager, or if other jurisdictions also hold responsibility.
   b. The Corridor Management Plan (CMP) for National Scenic Byways "Context Sensitive Solutions for Work on Maryland Byways" of LDG 11.23 is consulted to preserve and enhance the scenic and economic benefits of the Byway.

   c. Appropriate treatments to preserve character-defining features are determined to maintain the byway character, or enhance the special character of the road.

   d. Principles of Maryland Byway Context Sensitive Solutions (below) are observed during the design process.

3. **Byway Context Sensitive Solutions.**

   a. Identify character-defining features.

   Identify specific intrinsic qualities of resources.

   Identify elements of the road and roadside that contribute to the scenic or historic character of the byway.

   Preserve character-defining features, vistas and overlooks when possible.

   b. Maintain the overall character of the highway.

   c. Enhance the Byway to support its special character.

   Where character-defining features are missing, develop solutions to meet goals in a manner to complement the characteristics of the byway.

   Include roadside enhancement projects to improve the experience of the highway user.

Note: SHA Scenic Byways Program has been transferred to OPPE-RIPD

6.5-D County and Local Byways. Occasionally, SHA projects may impact County and Local Byways. As with State and National Byways, context sensitive solutions are used where feasible, in coordination with the County or Local Byway Manager.

While County and Local Byways are not managed by SHA, the SHA Byway Coordinator may be able to assist with contacts for the Byway managers as well as the development of context sensitive solutions.

6.5-E Wild and Scenic Rivers. Certain rivers in Maryland have been designated Wild and Scenic Rivers. State, county, and local governments may develop master plans or greenway plans to preserve, repair, and enhance Scenic Rivers.

When a SHA project impacts a Scenic River, coordination with Scenic River advocacy groups is performed as part of context sensitive solutions. Additional information about Wild and Scenic Rivers is obtained from the coordinator of the MD-DNR Wild and Scenic Rivers Program, the U.S. National Park Service, and advocacy groups.

6.6 Highway Context: Scale, Design Speed and Volume.

AASHTO highway design guidelines, including safety offsets and clear sight distance requirements are typically constant for highways with similar alignments, design speeds, and traffic volumes.

To maintain a safe and enjoyable experience for highway users, the evaluation of highway section, alignment, design speed, scale and traffic volume is completed to guide the roadside landscape design process.

6.6-A Highway Scale. The highway section can vary in scale from a rural, two-lane road with no shoulder to multi-lane sections of interstates. While offset distances are primarily determined according to design speeds and topography, context sensitive solutions are tailored to the highway scale.

For instance, a small planting of trees and shrubs that might be appropriate along a low speed, 2-lane road, is aesthetically irrelevant along a high-speed multi-lane highway. Roadside landscaping is usually designed at a much larger scale than landscaping in residential or commercial developments.

6.6-B Highway Alignment and Design Speed. Where feasible, AASHTO design guidelines are used to set vertical and horizontal road alignments according to the desired design speed of the highway. A reduced design speed may be appropriate for highways constructed before current guidelines, or where constraints such as topography, available right-of-way, or protected resources will not allow a new alignment.

As explained in LDG 7.0, variations in roadside slopes, highway alignments and design speeds directly affect required roadside sightline and safety offsets.

6.6-C Highway Traffic Volumes. The volume of traffic often impacts context sensitive solutions for highways. Interstates and major US routes are often congested at rush hour. Roadsides along these routes are often highly visible, but high traffic volumes may also increase hazards to maintenance workers and reduce maintenance access.

Although posted speed and topography are key factors to determine offset distances, roads with higher traffic volume usually have more accidents in problem areas. Thus, larger offset distances may be appropriate to provide larger recovery areas and to minimize recurring damage to landscaped areas.

6.6-D Highway Context Design Approach. Context sensitive approaches to several important considerations are discussed below.

1. **Highway Scale:** Planting designs are appropriate to highway scale in size and level of detail.

   a. Large highway elements, such as noise barriers, bridges and retaining walls may require larger landscape elements or screening to improve visual appeal to the highway user.

   b. Interstate scale plantings are much larger in size than plantings of minor highways and streetscapes.

   c. Plantings that affect highway users' perception of the roadway size, such as a street trees along an urban street or the approach to a roundabout, may be used to discourage speeding.

   d. For maximum visibility and aesthetic interest at highway speeds, effective landscape designs incorporate massed plantings composed of large groups of a single species with single or multiple season aesthetic interest. Plants with notable flowers, foliage, fruit or bark color are often best in mass plantings.

2. **Design Speed.** Roadside design aesthetics are adjusted according to the speed of the highway user.

   a. High Design Speed. A highway user traveling at over 45 mph has little time to observe roadside landscaping. Therefore, "broad brush" design gestures, such as masses of trees, shrubs and ornamental grasses provide more aesthetic benefit.

   Single-species masses that might be monotonous in a residential landscape are often aesthetically effective along roads with higher design speeds.

   b. Lower Design Speed. Smaller massed plantings and individual trees become more appropriate as design speeds are reduced to 35 or 25 mph.

3. **Traffic Volume.** Installation costs and maintenance inputs are adjusted according to traffic volume. It simply isn't worthwhile to install or maintain vegetation where no one will see it.

a. High Volume Highways. Higher volume highways are frequently congested, and prevailing speeds are often lower during rush hour periods.

Higher traffic volumes often pose greater risk to maintenance workers, and access for maintenance may be difficult.

Landscaping in selected locations may be designed for both high and low speeds, and may include higher maintenance areas.

Landscaping along lower design speed, high volume arterials can be used to encourage drivers to slow down.

It may be appropriate to reduce landscaping distractions in areas with high occurrences of crashes.

Large plants may be installed to prevent vehicular or pedestrian access to roadside areas. Temporary barriers may be appropriate during establishment.

b. Lower Volume Highways. Sustainable roadside landscaping reflects the reduced level of maintenance typical of roadsides with lower numbers of users.

For these roads, maintenance access is usually easier and less hazardous, but mobilization costs to maintain small or isolated plantings are often very high.

Because of these factors, higher-maintenance plantings are limited to key gateways along the route or other high-visibility locations where appropriate, and naturalized landscape plantings such are meadow or shrub seeding are often preferred.

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Chapter 7.0 - Safety, Sightlines and Offsets

7.1 Introduction.

AASHTO classifies trees larger than 4-inch diameter as fixed objects and provides guidelines for highway offset distances and clear zones. However, AASHTO only provides general design principles for landscaping along lower speed roads and Scenic Byways. Because of this, the offsets of trees and other plants may be increased or decreased on a project-by-project basis, according to field observation or other criteria where appropriate.

This Chapter builds on the guidelines provided by AASHTO and various sources at SHA to provide clearer direction for the design of safe roadside landscaping.

7.2 Pedestrian Crossings, Bikeways and Trails.

7.2-A General Considerations. For decades, highway engineering emphasized the automobile. Roads were improved for transport of people, goods, and services from city to city, out to the suburbs, and back again. The resulting roadside landscape is often a formidable place for pedestrians and bicyclists.

In recent years, advocates for walkable communities, bicyclists, pedestrians and the disabled have changed the balance. SHA has developed guidelines that require accommodations for bicycles and pedestrians on all projects where feasible, except limited access highways.

As a result, highway improvement projects require evaluation of opportunities for pedestrian and bicycle accessibility and safety. More than ever before, the roadside landscape contributes to the experience of all users.

7.2-B Pedestrian and Bicyclist Safety. Although thoughtful designs may reduce the risk of injury to non-motorized users, poorly designed, constructed or maintained roadside landscapes may pose a danger to pedestrians by creating hazards or obstructing sightlines:

1. **Hazards.** Hazards include trees with low branches, thorns, sharp foliage, and heavy or spiked fruit. Such species can cause injury when they are installed close to pedestrian routes or bikeways. Incorrectly located signs, street furnishings, low retaining walls, planter curbing, etc. may also pose hazards.

   Specific hazards and issues to consider include the following:

   a. **Hazardous Plants.** Plants are specified with foliage, seeds, and fruit that are not likely to be hazardous to pedestrians or bicyclists. Plants that have undesirable features are specified in locations away from traveled routes.

b. Sidewalk Lifting. The growth of roots may disrupt the grade of sidewalks and cause hazards to users. The specified offset distance of proposed trees to existing sidewalks must be sufficient to avoid root lifting and sidewalk damage.

Alternatively, sidewalk installation locations are adjusted to avoid conflicts between trees and sidewalks. The installation of root barriers may be feasible to minimize the impacts of root growth near sidewalks, particularly when paths are installed near existing trees.

c. Head Clearance. Fixtures such as pedestrian lighting, traffic control devices, and banners are specified at heights that will allow pedestrians and bicyclists to pass under them.

d. Unexpected Obstacles. Raised planter curbs and low-site furniture are installed in locations where they will not present unexpected obstacles to pedestrians and bicyclists.

e. Travel Flow. Lighting, signal cabinets, street trees, and other street furnishings are specified where they will not obstruct pedestrian flow or bicyclist routes.

2. Sightline Obstructions. Sightline obstructions cause indirect hazards and injury to pedestrians and bicyclists by blocking sightlines to signs and potential hazards. To avoid these indirect hazards, roadside plantings, landscape furniture and other features are specified where they will not obstruct sight distance for highway users at the intersections of roadways, sidewalks, bikeways and trails.

The following design guidelines reduce indirect hazards:

a. Intersections. Street furnishings and landscaping are specified where they will not obscure sight distance at roadway crossings and intersections of bikeways and pedestrian routes.

b. Pedestrian Routes. A 10 foot offset distance is maintained at the intersections of pedestrian routes and roadways.

- Perennials, grasses, shrubs and other visual obstructions over 24 inch height are specified at least 10 feet away from signs or the edge of the travel lane.

- Trees with canopy lower than 6 feet height are specified at least 10 feet away from signs or the edge of the travel lane.

c. Bicycle and Multi-Use Trails. A 15 foot offset distance is maintained at the intersections of pedestrian routes and bicycle or multi-use trails.

- Perennials, grasses, shrubs and other visual obstructions over 24 inch height are specified at least 15 feet away from signs or the edge of the pavement.

- Trees with a canopy lower than 6 ft are specified at least 15 feet away from signs or the edge of the pavement.

d. Bicycle Routes and Roadways. A 20 foot offset distance is maintained at intersections of bicycle routes and roadways:

- Perennials, grasses, shrubs and other visual obstructions over 24 inch height are specified at least 20 feet away from signs or the edge of the travel lane.

- Trees with a canopy lower than 6 feet are specified at least 20 feet away from the edge of the travel lane.

e. Additional Distance. Additional offset distance may be required according to highway speed, vertical and horizontal alignments, and volume of vehicular, pedestrian and bicycle traffic.

f. Safety Plantings. Plantings may be installed along steep slopes and culverts to prevent falls, to separate different types of users, or to block access to other hazards.

7.3 Clear Zones and Offsets.

Clear zones and clear sightline distances are important elements of highway safety. The LDG strives to conform with the AASHTO Roadside Design Guide regarding landscape design, clear zones, and offset distances to fixed objects.

Important Note: More information about offset distance planting design is in LDG 9.4 (drainage), LDG 9.6 (retaining walls, traffic barriers) and LDG 9.7 (noise barriers).

7.3-A **Clear Zones**, sometimes called recovery areas, are areas with few fixed objects adjacent to the roadway that allow drivers the opportunity to recover control of a vehicle after it leaves a travel lane without striking a fixed object. The width of a clear zone increases with increased highway design speed, increased traffic volume, and in response to changes in vertical or horizontal alignments.

To maximize the function of clear zones and to improve driver safety, the installation of fixed objects such as trees, utility poles, and other highway structures is minimized within the clear zone.

7.3-B Roadside and Median Offsets. Offset distances are generally measured from the edge of the travel lane to the tree trunk, shrub, or other plant material. Offset distances may also be specified from the back of traffic barriers, from the back of curb, or from the edge of pavement.

Larger offset distances may be required to accommodate drainage swales, utilities, and traffic control devices.
Larger offset distances may also be required for safety in areas with frequent traffic accidents, or to provide space for snow storage or other maintenance operations.

Although turfgrass, meadow, or other low plants may be installed within the clear zone, the installation of trees and large shrubs is restricted.

LDG offset distance tables show the MINIMUM offset distances to vegetation.

Trees, shrubs and other vegetation denoted “CZ” in the PPL are not considered to be fixed objects, and these plants may be installed closer to the travel lane when the locations are otherwise consistent with the design principles of the LDG.

7.4 Offset Distance to Traffic Barrier.

LDG Table 7.4 and the shows the minimum offset distance to vegetation from the back of traffic barriers.

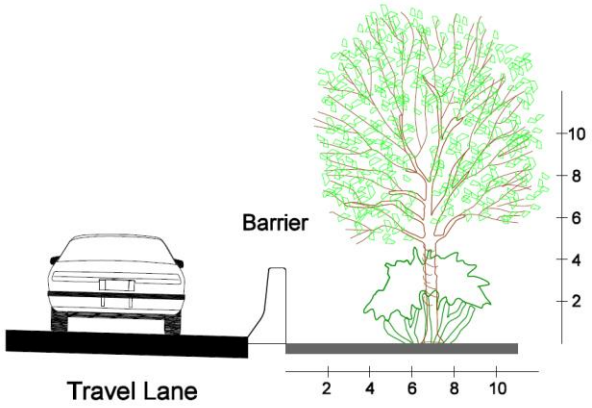
LDG 7.5 and the Tables of LDG 7.6 show the minimum offset distance for highways without traffic barrier.

Table 7.4

Offset Distance to Vegetation from Back of Traffic Barrier

Vegetation Planted Behind Barrier		Minimum Offset Distance from Back of Barrier - Feet*			
		Concrete Fig. 7.4-A	**Concrete** Filled with Soil Fig. 7.4-B,C	**W-Beam** Fig. 7.4-D	**Cable** Fig. 7.4-E
Turfgrass		No Restriction	No Restriction	No Restriction	No Restriction
Perennials Ornamental Grass Small Shrubs	< 30 in. Tall	Not Recommended	No Restriction	≥ 7	≥ 7
Perennials Ornamental Grass Meadow Small Shrubs	≥ 30 in. Tall	≥ 7	At Least 2 ft, or Height of Vegetation	≥ 7	≥ 7
Medium Shrubs Large Shrubs Small Trees		≥ 7	≥ 7	≥ 7	≥ 10
Medium Trees Large Trees		≥ 7	≥ 7	≥ 7	≥ 14

* Note:
The minimum offset distance is based upon typical roadside conditions.
Greater offset distances are appropriate to reduce vegetation growth into shoulder or travel lanes, to reduce sightline impacts, or to avoid conflicts with maintenance operations.



A. Vegetation Outside Barrier

Figure 7.4-A

Distance from Vegetation to Concrete Traffic Barrier

Showing Minimum Offset Distance to Back of Barrier

Refer to LDG 7.4

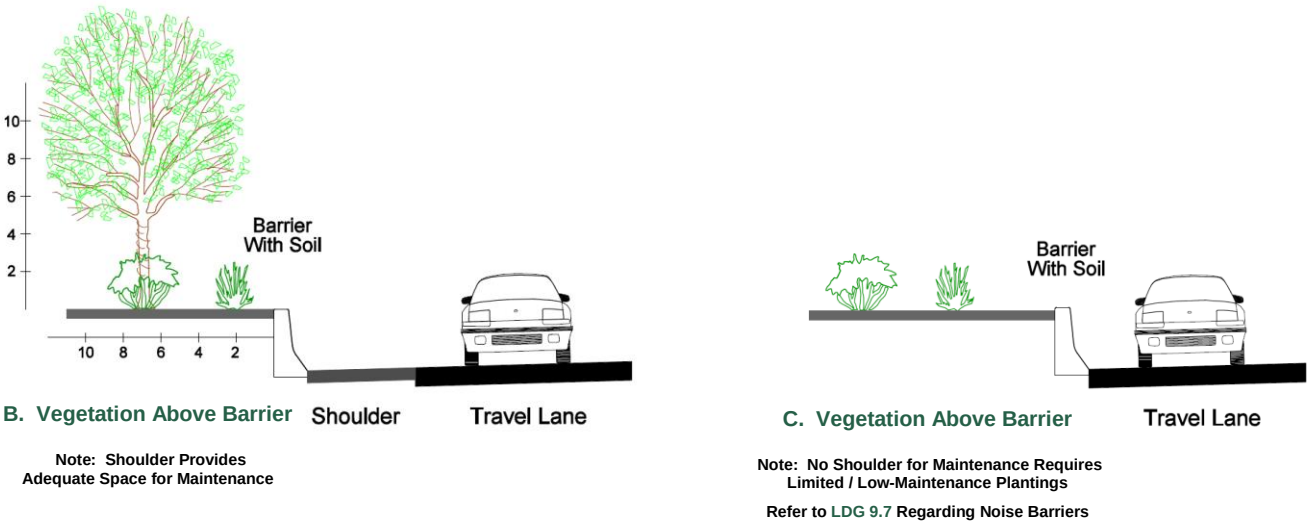


Figure 7.4-B & C

Distance from Vegetation to Soil-Filled Concrete Traffic Barrier

Showing Minimum Offset Distance to Back of Barrier

Refer to LDG 7.4

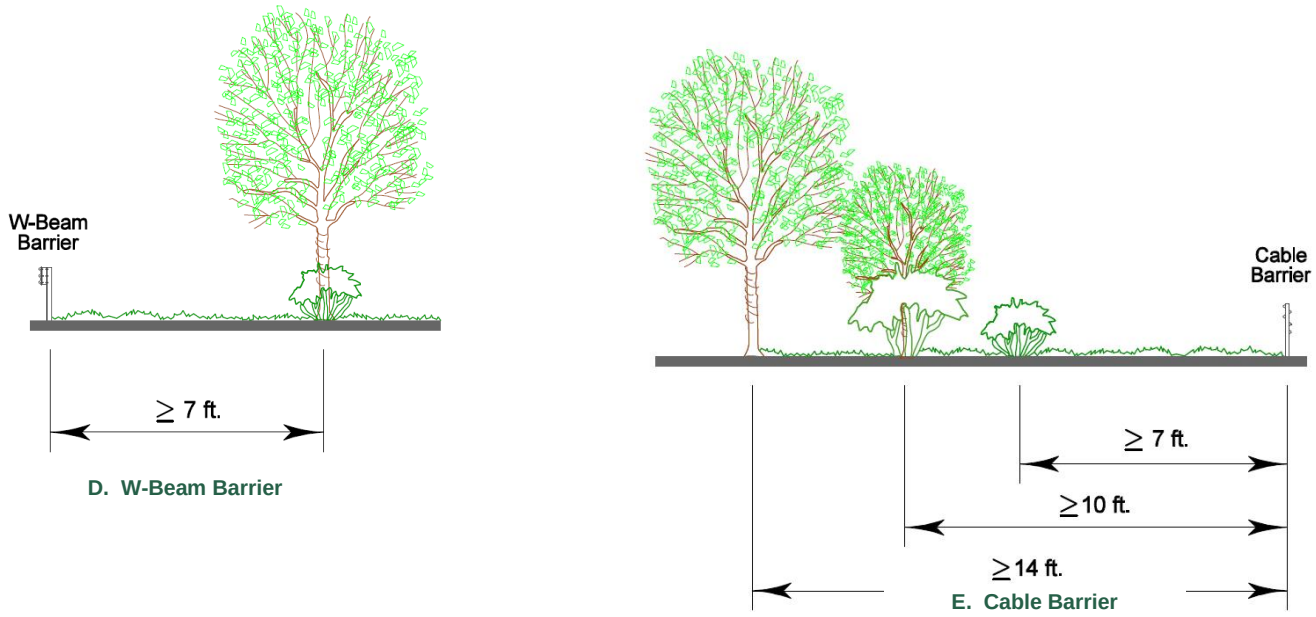


Figure 7.4-D & E

Distance from Vegetation to Metal Traffic Barriers

Showing Minimum Offset Distance to Back of Barriers

Refer to LDG 7.4

7.5 Offset Distance from Roadway. Offset distances to vegetation are shown in LDG Tables 7.6-A thru F. Some important notes about offset distances and the Tables follow below.

a. AASHTO Guidelines. LDG Tables 7.6-A thru F were developed from the 2011 AASHTO Roadside Design Guide. Refer to the AASHTO Guide for further discussion of offset distance.

b. Increased Distance. The Tables are not intended to show typical highway cross sections with drainage ditches etc., but rather the relationship of the pavement to the vegetation. All distances shown are the MINIMUM offset distance to vegetation.

Roads with unusual topography, restricted visibility, greater traffic volumes, or significant accident history will require much greater offset distances to trees and other vegetation than those shown in the Tables.

c. Slopes Between Ranges. When actual roadside slope is not within the range shown in the Tables, the offset distance to vegetation is increased to the distance shown for the next steeper range of slope.

For example: When a slope is steeper than 4:1, then the offset distance is at least the distance shown for 3:1 slopes.

d. Ditches. Regardless of the offset distances shown in the Tables, the mulched edge of tree pits and planting beds is offset at least 7 feet from the centerline of ditches.

e. Constructability and Future Maintenance. Offset distances are increased to improve constructability and to reduce future maintenance requirements. Refer to LDG 8.7.

7.6 Offset Distance from Roadway Tables. Offset distance to vegetation on highway sections without traffic barriers are determined according to the posted speed per LDG Tables and Figures 7.6-A thru F as summarized below.

Table	Posted Speed	Context		Figure
7.6-A	25 or 30 mph	Urban	Curb & Parking	7.6-A.1
			Curb No Parking	
		Suburban & Rural	Various Slopes	7.6-A.2
7.6-B	35 or 40 mph	Urban	Curb & Parking	7.6-B.1
			Curb No Parking	
		Suburban & Rural	Various Slopes	7.6-B.2
7.6-C	45 or 50 mph	Various Slopes		7.6-C
7.6-D	55 mph	Various Slopes		7.6-D
7.6-E	60 mph	Various Slopes		7.6-E
7.6-F	65 mph	Various Slopes		7.6-F

Table 7.6-A Posted Speed 25 or 30 mph
Minimum Offset Distance to Vegetation - Feet
Refer to Figure 7.6-A.1,2

Roadside Area		Trees [a]	Shrubs	Measured From
Urban Context				
With Curb	With Parking	≥ 3	Note [b]	From Back of Curb
	No Parking	≥ 6		
No Curb	With Parking	≥ 6		From Edge of Pavement
	No Parking	≥ 10		
Suburban & Rural Context				
Fill Slope (Foreslope)	6:1 and Flatter	≥ 10	≥ 5 [c]	From Edge of Travel Lane
	5:1 to 4:1	≥ 14		
Cut Slope (Backslope)	3:1	≥ 8	≥ 5 [c]	From Edge of Travel Lane
	4:1 to 5:1	≥ 9		
	6:1 and Flatter	≥ 10		
Median Nose	Plants < 30 in. Height Above Pavement	≥ Height of Vegetation		From Back of Curb
		≥ 10		From Edge of Pavement
	Plants ≥ 30 in. Height Above Pavement	≥ 115 to 140 [d]		From Center of Conflicting Travel Lane

Notes:

[a] Refer to LDG 7.5. The MINIMUM offset distance to tree trunk is shown. Offset to trees marked "CZ" in the PPL may be less than shown, but not less than the distance to shrubs for that roadside area.

[b] Offset distance is determined on project-by-project basis in consideration of mature shrub size, needs for vehicle access, prevailing security conditions, expected future maintenance, snow storage, etc.

[c] Offset distance is at least 5.0 feet to shrub stem, depending upon mature shrub size and requirements for sight distance, expected future maintenance, snow storage, etc.

[d] Refer to LDG 11.8. Offset distance is calculated per AASHTO Sight Triangles Method - Exhibits 9-50 and 9-51 - for 25 or 30 mph.

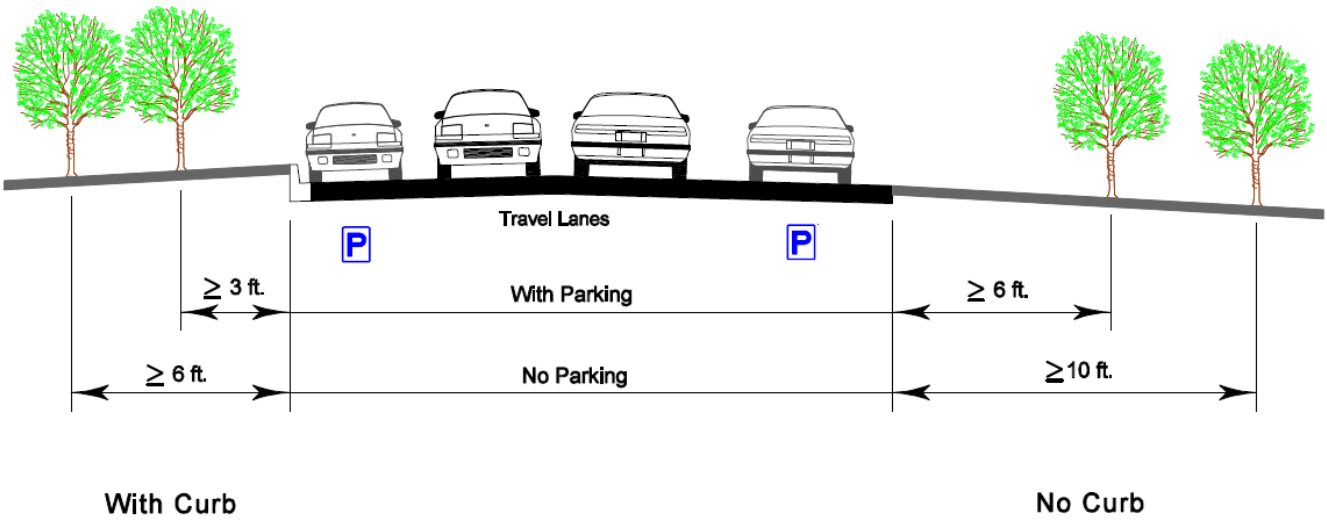


Figure 7.6-A.1

Urban Context - Posted Speed 25 or 30 mph

Showing Minimum Offset Distance to Vegetation

Refer to LDG Table 7.6-A

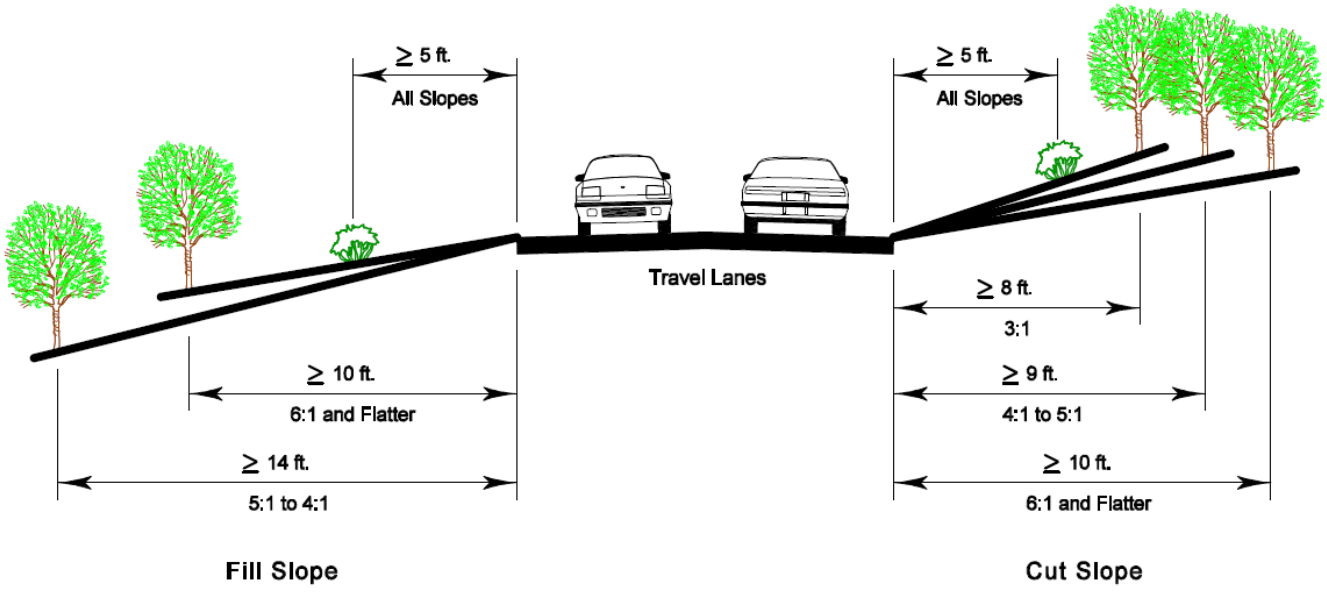


Figure 7.6-A.2

Suburban & Rural Context - Posted Speed 25 or 30 mph

Showing Minimum Offset Distance to Vegetation

Refer to LDG Table 7.6-A

Table 7.6-B Posted Speed 35 or 40 mph
Minimum Offset Distance to Vegetation - Feet

Refer to Figure 7.6-B.1,2

Roadside Area		Trees [a]	Shrubs	Measured From
Urban Context				
With Curb	With Parking	≥ 3	Note [b]	From Back of Curb
	No Parking	≥ 8		
No Curb	With Parking	≥ 8		From Edge of Pavement
	No Parking	≥ 14		
Suburban & Rural Context				
Fill Slope (Foreslope)	6:1 and Flatter	≥ 14	≥ 6 [c]	From Edge of Travel Lane
	5:1 to 4:1	≥ 18		
Cut Slope (Backslope)	3:1	≥ 10	≥ 6 [c]	From Edge of Travel Lane
	4:1 to 5:1	≥ 12		
	6:1 and Flatter	≥ 14		
Median Nose	Plants < 30 in. Height Above Pavement	≥ Height of Vegetation		From Back of Curb
		≥ 10		From Edge of Pavement
	Plants ≥ 30 in. Height Above Pavement	≥ 165 to 195 [d]		From Center of Conflicting Travel Lane

Notes:

[a] Refer to LDG 7.5. The MINIMUM offset distance to tree trunk is shown. Offset to trees marked "CZ" in the PPL may be less than shown, but not less than the distance to shrubs for that roadside area.

[b] Offset distance is determined on project-by-project basis in consideration of mature shrub size, needs for vehicle access, prevailing security conditions, expected future maintenance, snow storage, etc.

[c] Offset distance is at least 6.0 feet to shrub stem, depending upon mature shrub size and requirements for sight distance, expected future maintenance, snow storage, etc.

[d] Refer to LDG 11.8. Offset distance is calculated per AASHTO Sight Triangles Method - Exhibits 9-50 and 9-51 - for 35 or 40 mph.

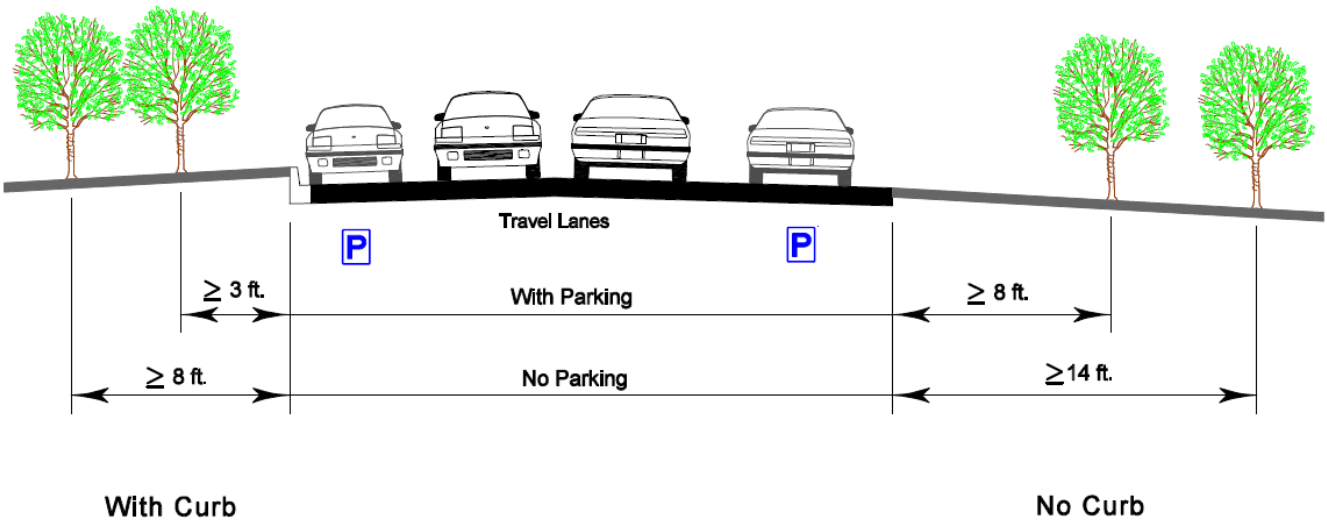


Figure 7.6-B.1

Urban Context - Posted Speed 35 or 40 mph

Showing Minimum Offset Distance to Vegetation

Refer to LDG Table 7.6-B

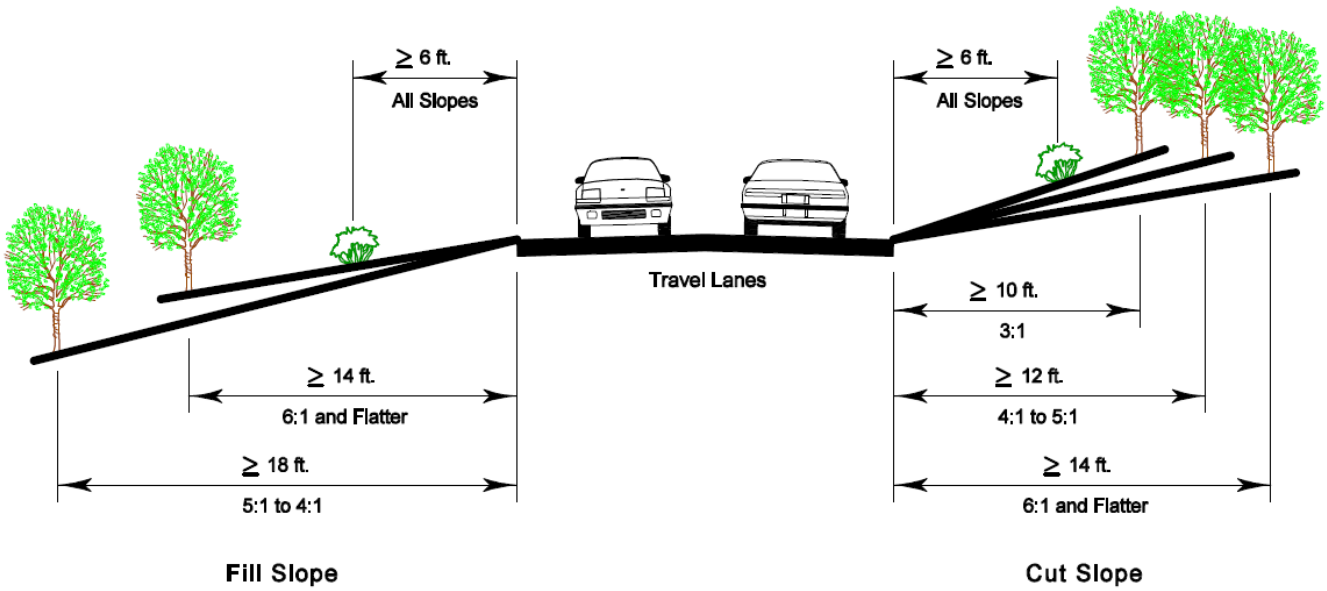


Figure 7.6-B.2

Suburban and Rural Context - Posted Speed 35 or 40 mph

Showing Minimum Offset Distance to Vegetation

Refer to LDG Table 7.6-B

Table 7.6-C Posted Speed 45 or 50 mph
Minimum Offset Distance to Vegetation - Feet

Refer to Figure 7.6-C

Roadside Area		Trees [a]	Shrubs	Measured From
Fill Slope (Foreslope)	6:1 and Flatter	≥ 20	≥ 10 [b]	From Edge of Travel Lane
	5:1 to 4:1	≥ 24		
Cut Slope (Backslope)	3:1	≥ 14	≥ 10 [b]	From Edge of Travel Lane
	4:1 to 5:1	≥ 18		
	6:1 and Flatter	≥ 20		
Median Nose	Plants < 30 in. Height Above Pavement	≥ Height of Vegetation		From Back of Curb
		≥ 15		From Edge of Pavement
	Plants ≥ 30 in. Height Above Pavement	≥ 220 to 245 [c]		From Center of Conflicting Travel Lane

Notes:

[a] Refer to LDG 7.5. The MINIMUM offset distance to tree trunk is shown. Offset to trees marked "CZ" in the PPL may be less than shown, but not less than the distance to shrubs for that roadside area.

[b] Offset distance is at least 10.0 feet to shrub stem, depending upon mature shrub size and requirements for sight distance, expected future maintenance, snow storage, etc.

[c] Refer to LDG 11.8. Offset distance is calculated per AASHTO Sight Triangles Method - Exhibits 9-50 and 9-51 - for 45 or 50 mph.

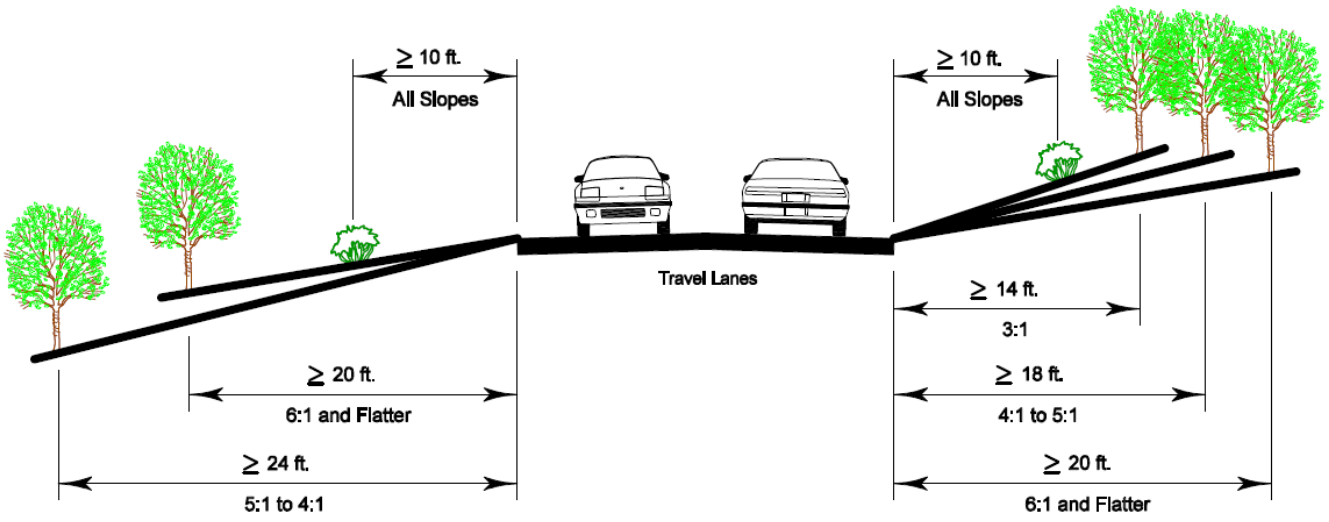


Figure 7.6-C

Posted Speed 45 or 50 mph

Showing Minimum Offset Distance to Vegetation

Refer to LDG Table 7.6-C

Table 7.6-D Posted Speed 55 mph
Minimum Offset Distance to Vegetation - Feet

Refer to Figure 7.6-D

Roadside Area		Trees [a]	Shrubs	Measured From
Fill Slope (Foreslope)	6:1 and Flatter	≥ 30	≥ 15 [b]	From Edge of Travel Lane
	5:1 to 4:1	≥ 30		
Cut Slope (Backslope)	3:1	≥ 16	≥ 15 [b]	From Edge of Travel Lane
	4:1 to 5:1	≥ 20		
	6:1 and Flatter	≥ 30		
Median Nose	Plants < 30 in. Height Above Pavement	≥ 15		From Edge of Pavement
Gore Areas	Plants ≥ 30 in. Height Above Pavement	≥ 285 [c]		From Center of Conflicting Travel Lane

Notes:

[a] Refer to LDG 7.5. The MINIMUM offset distance to tree trunk is shown. Offset to trees marked "CZ" in the PPL may be less than shown, but not less than the distance to shrubs for that roadside area.

[b] Offset distance is at least 15.0 feet to shrub stem, depending upon mature shrub size and requirements for sight distance, expected future maintenance, snow storage, etc.

[c] Refer to LDG 11.8. Offset distance is calculated per AASHTO Sight Triangles Method - Exhibits 9-50 and 9-51 - for 55 mph.

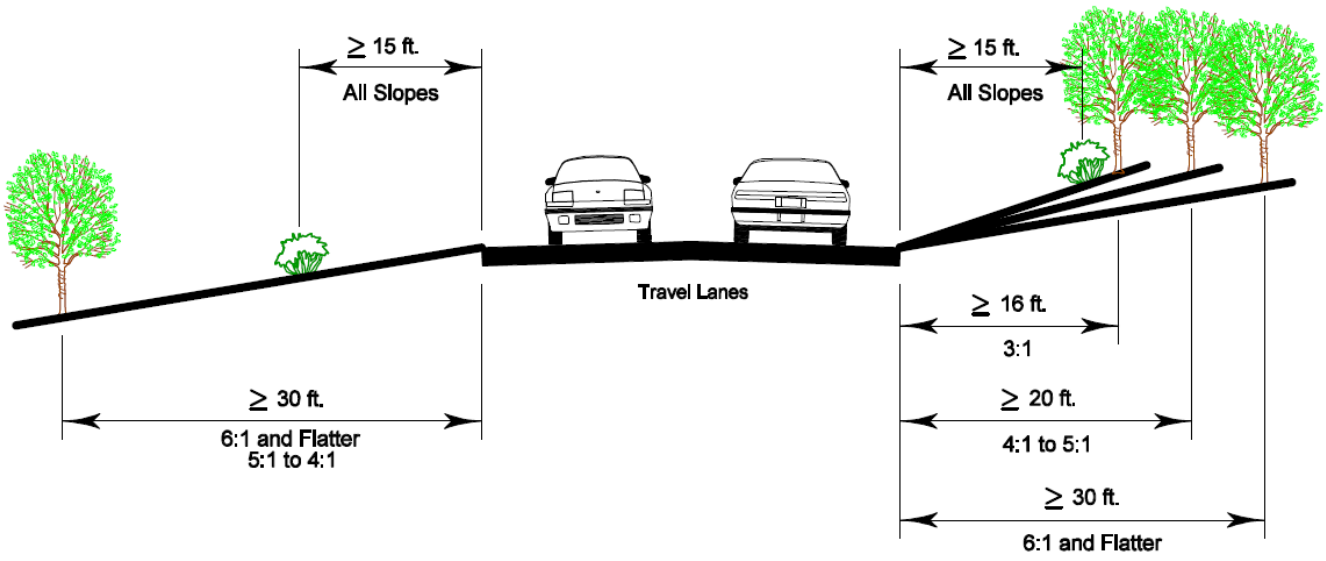


Figure 7.6-D

Posted Speed 55 mph

Showing Minimum Offset Distance to Vegetation

Refer to LDG Table 7.6-D

Table 7.6-E Posted Speed 60 mph
Minimum Offset Distance to Vegetation - Feet

Refer to Figure 7.6-E

Roadside Area		Trees [a]	Shrubs	Measured From
Fill Slope (Foreslope)	6:1 and Flatter	≥ 30	≥ 20 [b]	From Edge of Travel Lane
	5:1 to 4:1	≥ 40		
Cut Slope (Backslope)	3:1	≥ 22	≥ 20 [b]	From Edge of Travel Lane
	4:1 to 5:1	≥ 26		
	6:1 and Flatter	≥ 30		
Median Crossover	Plants < 30 in. Height Above Pavement	≥ 20		From Edge of Pavement
Gore Areas	Plants ≥ 30 in. Height Above Pavement	≥ 320 [c]		From Center of Conflicting Travel Lane

Notes:

[a] Refer to LDG 7.5. The MINIMUM offset distance to tree trunk is shown. Offset to trees marked "CZ" in the PPL may be less than shown, but not less than the distance to shrubs for that roadside area.

[b] Offset distance is at least 20.0 feet to shrub stem, depending upon mature shrub size and requirements for sight distance, expected future maintenance, snow storage, etc.

[c] Refer to LDG 11.8. Offset distance is calculated per AASHTO Sight Triangles Method - Exhibits 9-50 and 9-51 - for 60 mph.

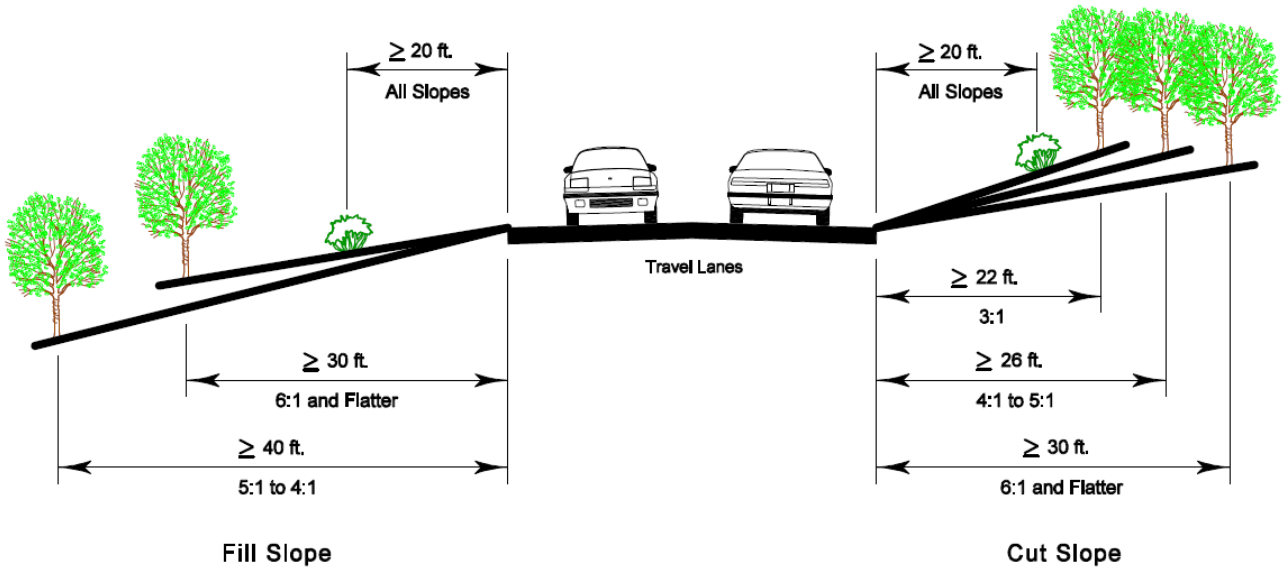


Figure 7.6-E

Posted Speed 60 mph

Showing Minimum Offset Distance to Vegetation

Refer to LDG Table 7.6-E

Table 7.6-F Posted Speed 65 mph
Minimum Offset Distance to Vegetation - Feet

Refer to Figure 7.6-F

Roadside Area		Trees [a]	Shrubs	Measured From
Fill Slope (Foreslope)	6:1 and Flatter	≥ 35	≥ 20 [b]	From Edge of Travel Lane
	5:1 to 4:1	≥ 45		
Cut Slope (Backslope)	3:1	≥ 25	≥ 20 [b]	From Edge of Travel Lane
	4:1 to 5:1	≥ 30		
	6:1 and Flatter	≥ 35		
Median Crossover	Plants < 30 in. Height Above Pavement	≥ 20		From Edge of Pavement
Gore Areas	Plants ≥ 30 in. Height Above Pavement	≥ 365 [c]		From Center of Conflicting Travel Lane

Notes:

[a] Refer to LDG 7.5. The MINIMUM offset distance to tree trunk is shown. Offset to trees marked "CZ" in the PPL may be less than shown, but not less than the distance to shrubs for that roadside area.

[b] Offset distance is at least 20.0 feet to shrub stem, depending upon mature shrub size and requirements for sight distance, expected future maintenance, snow storage, etc.

[c] Refer to LDG 11.8. Offset distance is calculated per AASHTO Sight Triangles Method - Exhibits 9-50 and 9-51 - for 65 mph.

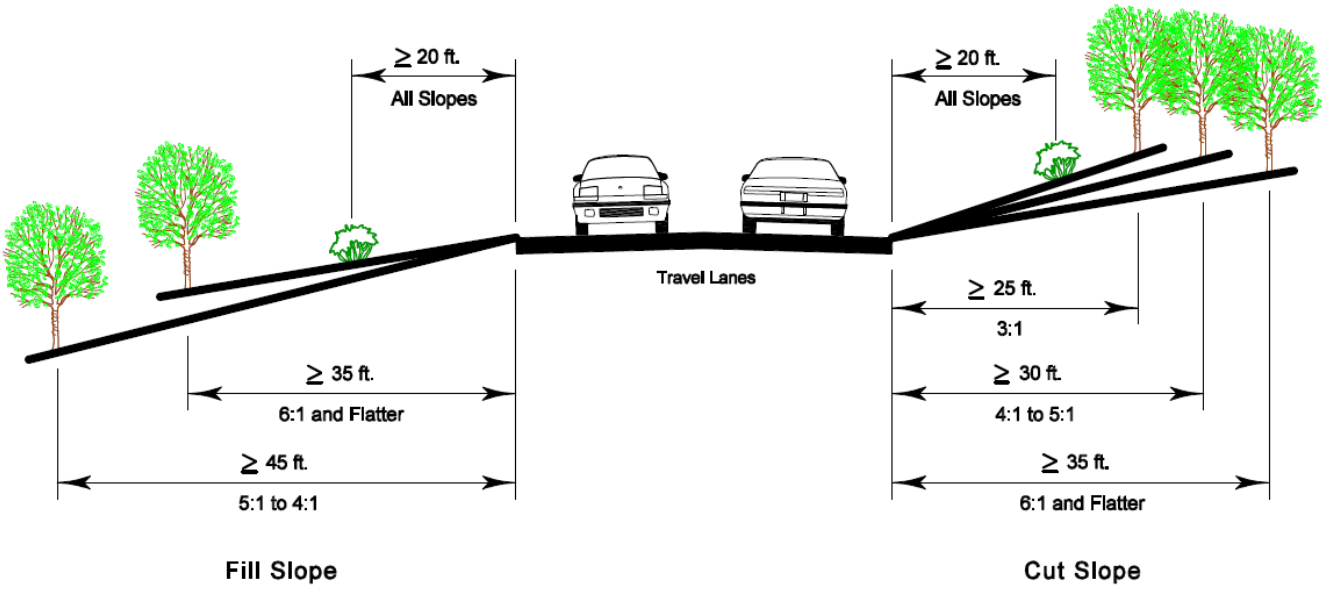


Figure 7.6-F

Posted Speed 65 mph

Showing Minimum Offset Distance to Vegetation

Refer to LDG Table 7.6-F

7.7 Horizontal and Vertical Curves.

7.7-A General. Offset distances and clear zone widths are primarily based on traffic speed and shoulder topography. However, road terrain and highway alignment are also important in determining offset distances.

The combination of straight segments, horizontal curves, and vertical curves are analyzed during highway design. Curves provide a transition between tangential horizontal segments and vertical segments of varying grades. Curve radii are determined according to AASHTO Guidelines to accommodate design speed, and curves are adjusted to conform to existing terrain.

For highways with gentle elevation changes along straight or gradually curving alignments, the offset distances and clear zones are generally the same as shown in LDG 7.6. However, highways with rapid changes in elevation, sharp curves, or switchbacks generally require larger offset distances and clear zones in addition to reductions in posted speeds.

Design engineers of the Community Design Division, Highway Design Division, or Engineering Districts will provide assistance to determine appropriate sight distance and clear zones.

7.7-B Horizontal Curves. Horizontal curves provide a transition between two straight roadway segments that are tangent to one another. Horizontal curves are tangent to both straight segments. On highways with higher design speeds, curve segments of different radii may be combined to provide smoother turning movements for drivers.

Horizontal curves are also adjusted according to the expected maximum size of vehicles using the roadway. On higher design speed roads, horizontal curves may be superelevated, or banked, to improve vehicle stability and reduce the likelihood of overturning or loss of control.

Additional site distance is required on the inside radius of horizontal curves to allow drivers to see traffic ahead of them. In locations where traffic backs up around a curve, such as high volume interstate ramps, additional offset distance to trees and shrubs is provided to increase sight distance and reduce rear-end collisions.

Clear zone widths are typically increased on the outside radius of horizontal curves as vehicles are more likely to leave the roadway on the outside of a curve.

7.7-C Vertical Curves. Vertical curves form the transition between two roadway segments of different grades. Segments may transition from a gradual to steeper slope and from an uphill, positive grade to a downhill, negative grade.

For vertical curves, sight distance is a function of sight clearance above the roadway surface rather than along the roadsides. On steep grades, the road itself is the sight obstruction. Even a slight rise in the roadway can reduce sight distance.

In locations where sightline distance is impacted by vertical curves, tree canopy height may be increased to improve vertical sight distance. On lower speed roads with hilly terrain, tree branches with ordinarily sufficient branch clearance above the road may unacceptably reduce the visibility of a traffic signal.

Trees are specified in locations where branches will not obscure traffic signals within the minimum safe sightline distance.

Where vertical curves are not combined with sharp horizontal curves, the offset distances of LDG 7.6 are usually sufficient. Increased offset distances are appropriate at the base of steep grades where vehicles may reach excessive speeds.

7.8 Traffic Control Device Sightlines.

7.8-A Overview. Clear sightlines to traffic control devices such as signs and traffic signals are essential. A traffic control device that is blocked by vegetation may result in serious accidents and fatalities. For this reason, stop signs, traffic signals and pedestrian walk signals are kept clear of vegetation, and appropriate sightline distances are provided to ensure that these devices will be visible to motorists.

7.8-B Coordination. Landscape plans are coordinated with traffic control plans, which may include signing plans, signal plans, or signing and marking plans. Coordination during design minimizes conflicts between landscaping and traffic control devices.

Traffic control devices are referenced into landscape plans. Adjustments to tree locations, and adjustments to sign locations can resolve conflicts during design that may be costly to change after installation.

7.8-C Maintaining Sightlines. Plant sizes, especially tree canopy heights, may increase considerably from the time of installation to the ultimate mature growth. Vegetation is specified to avoid obscuring traffic control device sightlines when the vegetation is installed, and to minimize pruning needs to keep sightline clear as plants mature.

7.8-D Sightline Distance. The Project Engineer, OOTS, or the District Traffic Engineer are consulted to confirm project-specific offset distances. For planning purposes, the sightline distances of LDG Table 7.8-D are generally acceptable for typical highway conditions.

Table 7.8-D Sightline Distance to Traffic Control Devices		
Traffic Control Device	**Posted Speed mph**	**Distance Feet**
Traffic Signal	25 or 30	200
	35 or 40	250
	45 or 50	300
	55	500
Traffic Control Sign These include Stop Sign, Yield Sign, and others	25 or 30	150
	35 or 40	250
	45 or 50	300
Advance Warning Sign These show symbols for curve, steep grade, stop/signal ahead, merge, etc.	25 or 30	150
	35 or 40	200
	45 or 50	300
	55 or 60	500 to 750
	65	1000
Navigational Sign These include Exit Ahead, City Limits, etc.	25 or 30	100
	35 or 40	150
	45 or 50	250
	55 or 60	1000
	65	1500

7.9 Intersection and Interchange Sightlines.

Note: This Chapter is under development.

7.9-A Overview.

7.9-B Intersections.

1. **Uncontrolled Intersections.**
2. **Roundabouts.**
3. **Controlled Intersections.**

7.9-C Interchanges.

1. **Exit Gores.**
2. **Merge Areas.**
3. **Ramp Curves.**
4. **Bridges and Other Structures.**

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Chapter 8.0 - Elements of Sustainable Design

8.1 Introduction.

Sustainability in landscape design involves many elements that affect the survival and long term success of landscaping. This Chapter describes how soils, vegetation groundcover, future maintenance, plant species and spatial design elements affect sustainability of roadside landscaping.

The landscaping elements specified for the project are expected to provide long-term success of the landscape, one of the principal goals of the SHA Landscape Design Philosophy.

More extensive guidance regarding existing soil, subsoil, and topsoil choices and their pertinent Category Code items and costs is provided in the Estimating Manual.

8.2 Soils and Vegetation Placement Choices.

A close relationship exists between the soil and the landscaping it supports. Therefore, in keeping with the SHA Landscape Design Philosophy, the placement of soil layers is coordinated with the vegetation and anticipated future maintenance of the project area.

To reduce costs, soil resources are allocated to the priority turfgrass areas and planting beds that are closest to the roadway. Naturalized vegetation such as meadow and shrub seeding is maximized in those areas where soil quality or quantity is a limiting factor.

To accomplish this, soil testing is performed by OMT to determine the suitability of existing topsoil, or the suitability and available quantity of salvageable subsoil and topsoil for stockpiling and reuse for the project. Furnished soils are specified as necessary to meet the landscaping objectives of the project when existing topsoil and salvaged soils are insufficient to meet anticipated needs.

A soil profile that includes layers of topsoil and subsoil placed over a suitable base (subgrade) is required for most landscaped areas. Because the depth of these layers affects vegetation survival and future management options, landscaped areas are constructed with the soil profiles described in this Chapter for best economy and long-term sustainability.

8.2-A Soil Placement Profiles. The soil needs of every project are unique. Soils are included in the Engineer's Estimate as necessary to balance the landscape objectives of the project with soil availability and costs.

Although many projects allow the use of existing topsoil, or the use of salvaged subsoil and salvaged topsoil at depths that provide good conditions for plant growth, other projects may require extensive use of furnished soils for landscaped areas.

LDG Table 8.2.A shows the relationship of subsoil placed in 6 in., 12 in., or 18 in. depth increments with topsoil thickness of 2 in., 4 in. or 6 in. depth in conjunction with the adapted vegetation, future landscape maintenance, and typical locations.

- **Fair.** Soil profiles that provide "Fair" plant growth are appropriate where site conditions are challenging, or where soil resources and vegetation maintenance expectations are severely limiting.

- **Good or Better.** Soil profiles that provide "Good" or "Better" plant growth are required for most roadside areas. Areas within 10 feet of the pavement edge, in channels, and in most pedestrian areas typically require "Better" plant growth.

- **Best.** Soil profiles that provide "Best" plant growth are appropriate to meet landscaping objectives in sites with high maintenance expectations such as facilities and curbed medians.

Table 8.2-A Vegetation for Various Depths of Subsoil and Topsoil

	Subsoil	Topsoil	Plant Material	Annual Mowing	Annual Maint.	Typical Location
FAIR	**6 in. Subsoil** or Common Borrow	**2 in. Topsoil**	Meadow Establishment	0	None	Non-maintained areas and slopes This option is only appropriate for areas where soil resources and future maintenance are severely limiting
			Shrub Seeding Establishment	0	None	
			Reforestation	0	None	
GOOD	**12 in. Subsoil**	**2 in. Topsoil**	Turfgrass Establishment	0 - 1	Low	Typical rural and suburban areas more than 10 feet from pavement edge Non-maintained areas and slopes
			Meadow Establishment	0 - 1	Low	
			Shrub Seeding Establishment	0	None	
			Reforestation	0	None	
			Tree & Shrub Planting Pits	0	Low	
BETTER	**12 in. Subsoil**	**4 in. Topsoil**	Turfgrass Establishment	1 - 3	Medium	Rural, suburban and urban areas Most areas less than 10 feet from pavement edge Most pavement removal areas High foot traffic or high vehicle traffic areas Curbed medians
			Turfgrass Sod Establishment	1 - 3	Medium	
			Tree & Shrub Planting Pits	0	Medium	
			Planting Beds	0	Medium	

Table 8.2-A, *continued…*						
	Subsoil	**Topsoil**	**Plant Material**	**Annual Mowing**	**Annual Maint.**	**Typical Location**
BEST	**18 in. Subsoil**	**6 in. Topsoil**	Turfgrass Sod Establishment	3+	High	Urban streetscapes & medians
			Tree & Shrub Planting Pits	0	High	High expectation landscape areas
			Planting Beds	0	High	Facilities

8.2-B Soil, Slope, Soil Stabilization Matting (SSM) & Vegetation.

- Refer to Table 705-A - Flowchart for Permanent Groundcover Vegetation and Mulch included in Chapter 705 of the Estimating Manual, which provides a methodology for determining appropriate matting and vegetation groundcover based on erosion risk.

- Refer to Table 709-D - SSM Use in Channels and Table 705-E - SSM Use of Slopes included in Chapter 709 of the Estimating Manual, which provides guidance for matting selection based upon slope and expected flow velocity of surface water.

- LDG Table 8.2-C shows the relationship of soil placement on various slopes and the appropriate types of permanent vegetation as a function of soil stabilization matting. The table is organized by soil stabilization matting cover from sites with low erosion risk (no matting) to sites with the highest erosion risk (Type C SSM).

It is important to note that LDG Table 8.2-C shows recommended combinations of soil, slope, matting and vegetation based upon the design limitations of the materials.

- While certain other combinations may be feasible, any non-standard materials and applications will require Special Provisions for the work.

- Special Provisions developed for channel applications must be reviewed and approved by the Landscape Operations Division and the Highway Hydraulics Division.

- Special Provisions developed for slope applications must be reviewed and approved by the Landscape Operations Division and the Engineering Geology Division.

Table 8.2-C Vegetation, Soil Stabilization Matting and Soil Placement

Low Erosion Risk

No Matting Note: Straw mulch lasts 2-4 months	**Areas Flatter than 4:1** **BSM**	**Areas Flatter than 4:1** **6 in. Topsoil**	**Areas Flatter than 4:1** **4 in. Topsoil**	**Slopes 4:1 and Flatter than 2:1** **4 in. Topsoil**	**Slopes 4:1 and Flatter than 2:1** **2 in. Topsoil**	**Slopes 2:1 & Steeper** **2 in. Topsoil**
Flow Velocity < 1.5 fps	Turfgrass Sod Establishment SHB Mulch	Turfgrass Sod Establishment SHB Mulch	Turfgrass Sod Establishment Turfgrass Establishment Meadow Establishment Shrub Seeding Establishment SHB Mulch	Turfgrass Sod Establishment		
Flow Velocity 1.5 to 5.0 fps	Turfgrass Sod Establishment	Turfgrass Sod Establishment	Turfgrass Sod Establishment	Turfgrass Sod Establishment		
Flow Velocity 5.0 to 7.5 fps **Flow Velocity 7.5 to 10.0 fps**						

Table 8.2-C, *Continued...*

Low or Moderate Erosion Risk

Type E Biodegradable SSM; Lasts 2-6 months	**Areas Flatter than 4:1** **BSM**	**Areas Flatter than 4:1** **6 in. Topsoil**	**Areas Flatter than 4:1** **4 in. Topsoil**	**Slopes 4:1 and Flatter than 2:1** **4 in. Topsoil**	**Slopes 4:1 and Flatter than 2:1** **2 in. Topsoil**	**Slopes 2:1 & Steeper** **2 in. Topsoil**
Flow Velocity < 1.5 fps	Turfgrass Establishment Meadow Establishment		Turfgrass Establishment Meadow Establishment Shrub Seeding Establishment	Turfgrass Establishment Meadow Establishment Shrub Seeding Establishment	Turfgrass Establishment Meadow Establishment Shrub Seeding Establishment	
Flow Velocity 1.5 to 5.0 fps						
Flow Velocity 5.0 to 7.5 fps						
Flow Velocity 7.5 to 10.0 fps						

Table 8.2-C, *Continued...*

Moderate Erosion Risk

Type A Biodegradable SSM; Lasts 6-12 months	**Areas Flatter than 4:1** **BSM**	**Areas Flatter than 4:1** **6 in. Topsoil**	**Areas Flatter than 4:1** **4 in. Topsoil**	**Slopes 4:1 and Flatter than 2:1** **4 in. Topsoil**	**Slopes 4:1 and Flatter than 2:1** **2 in. Topsoil**	**Slopes 2:1 & Steeper** **2 in. Topsoil**
Flow Velocity < 1.5 fps	Turfgrass Establishment		Turfgrass Establishment	Turfgrass Establishment	Turfgrass Establishment	Turfgrass Establishment
Flow Velocity 1.5 to 5.0 fps			Turfgrass Establishment	Turfgrass Establishment	Turfgrass Establishment	Turfgrass Establishment
Flow Velocity 5.0 to 7.5 fps **Flow Velocity 7.5 to 10.0 fps**						

Table 8.2-C, *Continued...*

Low to Moderate Erosion Risk

Type D Biodegradable SSM; Lasts 2-3 years	**Areas Flatter than 4:1** **BSM**	**Areas Flatter than 4:1** **6 in. Topsoil**	**Areas Flatter than 4:1** **4 in. Topsoil**	**Slopes 4:1 and Flatter than 2:1** **4 in. Topsoil**	**Slopes 4:1 and Flatter than 2:1** **2 in. Topsoil**	**Slopes 2:1 & Steeper** **2 in. Topsoil**
Flow Velocity < 1.5 fps	Meadow Establishment Shrub Seeding Establishment		Meadow Establishment Shrub Seeding Establishment	Meadow Establishment Shrub Seeding Establishment	Meadow Establishment Shrub Seeding Establishment	
Flow Velocity 1.5 to 5.0 fps	Meadow Establishment Shrub Seeding Establishment		Meadow Establishment Shrub Seeding Establishment	Meadow Establishment Shrub Seeding Establishment	Meadow Establishment Shrub Seeding Establishment	
Flow Velocity 5.0 to 7.5 fps			See Note	See Note	See Note	
Flow Velocity 7.5 to 10.0 fps			See Note	See Note	See Note	

Note: Type D SSM is used for stream restoration with flow velocity up to and exceeding 10 fps where a biodegradable matting is appropriate. Stream restoration may involve Meadow Establishment or Shrub Seeding Establishment in conjunction with Meadow Plugs or Live Stakes.

Table 8.2-C, *Continued...*

Significant Erosion Risk

Type B Synthetic, Non-Biodegradable SSM	**Areas Flatter than 4:1** **BSM**	**Areas Flatter than 4:1** **6 in. Topsoil**	**Areas Flatter than 4:1** **4 in. Topsoil**	**Slopes 4:1 and Flatter than 2:1** **4 in. Topsoil**	**Slopes 4:1 and Flatter than 2:1** **2 in. Topsoil**	**Slopes 2:1 & Steeper** **2 in. Topsoil**
Flow Velocity < 1.5 fps						
Flow Velocity 1.5 to 5.0 fps						
Flow Velocity 5.0 to 7.5 fps			Turfgrass Establishment	Turfgrass Establishment		
Flow Velocity 7.5 to 10.0 fps						

Table 8.2-C, *Continued...*

Severe Erosion Risk

Type C Synthetic, Non-Biodegradable SSM	**Areas Flatter than 4:1** **BSM**	**Areas Flatter than 4:1** **6 in. Topsoil**	**Areas Flatter than 4:1** **4 in. Topsoil**	**Slopes 4:1 and Flatter than 2:1** **4 in. Topsoil**	**Slopes 4:1 and Flatter than 2:1** **2 in. Topsoil**	**Slopes 2:1 & Steeper** **2 in. Topsoil**
Flow Velocity < 1.5 fps			See Note			
Flow Velocity 1.5 to 5.0 fps			See Note			
Flow Velocity 5.0 to 7.5 fps			See Note			
Flow Velocity 7.5 to 10.0 fps			Turfgrass Sod Establishment Turfgrass Establishment + Type B SSM	Turfgrass Sod Establishment Turfgrass Establishment + Type B SSM		

Note: Type C SSM is appropriate for use with Turfgrass Sod Establishment in gores, median crossovers and similar sites where permanent turf reinforcement is required to improve vehicle bearing strength, to reduce rutting, and to improve turfgrass survival under traffic.

8.2-C Soil Placement Keys. This chapter is under development.

8.3 Preferred Plant Use Groups.

Species and cultivars preferred by SHA are discussed in LDG 8.5 and shown in the Preferred Plant List (PPL) of LDG 11.19. Each species and cultivar of the PPL is assigned to one or more "Plant Use Groups". For each Plant Use Group, the sizes of LDG 8.4 are generally preferred by SHA. Abbreviations for Plant Use Groups shown below are those which appear in the PPL.

8.3-A Seed Components of Standard Mixes are native species included in one or more shrub or meadow seed mixtures of Sections 706 and 707. These species are less expensive to grow from seed, and are often preferred to plugs in naturalized areas.

F = Meadow Forb Seed
G = Meadow Grass Seed
S = Shrub Seed
T = Turf & Temporary Seed
W = Wildflower Seed

8.3-B Naturalized Area Plugs are small-size, inexpensive, perennial nursery stock installed in meadows, along streams and riparian areas, and in stormwater management facilities and other naturalized areas. All are native to Maryland. Species with expensive seed, or species that are difficult or slow to establish from seed in a naturalized area are often installed as plugs.

Note: Larger stock described in LDG 8.3-C should be considered for installation in Bioretention Soil Mix (BSM) and other environmentally challenging locations.

PF = Plug Forb
PG = Plug Grass

8.3-C Landscape Planting Beds Perennials & Ornamental Grasses are long-lived plant species installed in planting beds. These plants are native to Maryland, or are introduced species and cultivars; they may be specified for general roadside landscaping, streetscapes, park & rides, offices, and maintenance facilities.

BP = Broadleaf Perennial
OG = Ornamental Grass

8.3-D Landscape Planting Beds Annuals & Bulbs are ornamental species installed in planting beds (annuals), or in planting beds and naturalized areas (bulbs). These species may be specified for general roadside areas, streetscapes, and facilities.

AN = Annual
BU = Bulb

8.3-E Facilities & Focal Points are often designed with trees, shrubs and other plants that may not be native to Maryland, but which are appropriate for high-interest areas such as SHA facilities, gateways, etc. Most plants that are appropriate for roadside landscaping and streetscapes are also appropriate for installation at facilities. However, plants designated F&F are only specified at facilities and focal points.

F&F = Facilities & Focal Points

8.3-F Street Trees are larger, caliper-sized, deciduous trees that are specified in streetscape projects and at facilities where greater installation costs can be justified. Street Trees are typically matched specimens of improved cultivars.

STL = Street Tree Large
STM = Street Tree Medium
STS = Street Tree Small

8.3-G Landscape Shrubs and Vines are appropriate for general roadside landscaping, streetscapes and facilities. These plants are native to Maryland, or are introduced species and cultivars. Although large or medium shrubs may be installed in individual planting pits, shrubs and vines are often installed in planting beds. Note: Dioecious species planted for their fruits (e.g. hollies) are specified with one male plant per 10 female plants, or as appropriate for the species and landscape use. Refer to the PPL.

SL = Shrub Large
SM = Shrub Medium
SS = Shrub Small
VI = Vine

8.3-H Landscape Trees are deciduous and evergreen trees of sizes specified for general roadside landscaping. Landscape Trees include both native and introduced species and cultivars.

LTL = Landscape Tree Large
LTM = Landscape Tree Medium
LTS = Landscape Tree Small

8.3-I Reforestation Trees & Shrubs are species native to Maryland that are used for establishing reforestation and revegetation areas, and also within adapted areas of stream and stormwater facilities.

R = Reforestation

Reforestation Sentinel Trees are larger caliper stock of Reforestation Trees.

Smaller sizes of Sentinel Trees are also appropriate for reforestation and revegetation areas, and also within adapted areas of stream and stormwater facilities. Typical stocking rates, including percentages of Sentinel Trees, are specified in LDG 4.6.

RS = Reforestation Sentinel

8.3-J Stream and Stormwater Facilities are vegetated with native species adapted to consistently moist and occasionally inundated conditions, including stream banks, floodplains and other riparian areas, the mesic portions of SWM facilities, retention basins, and similar areas adjacent to freshwater wetlands and ponds.

The installation of trees, shrubs and other plants in stream and stormwater facilities are not appropriate where a higher level of maintenance is required to maintain safety or sightlines, or where the mature growth of these plants will impair required drainage. Refer to the Estimating Manual regarding the use of Turfgrass Sod Establishment or Turfgrass Establishment with or without soil stabilization matting (SSM) in swales, channels and similar conveyance facilities.

SST = Stream and Stormwater Trees. Mature sizes are as for LTS, LTM, LTL
SSS = Stream and Stormwater Shrubs. Mature sizes are as for SS, SM, SL
SSP = Stream and Stormwater Plants. Most are also noted BP, OG, PF, PG

8.3-K TMDL Trees and Shrubs are native species typically used by the TMDL Program of OED-WPD. A mix of deer resistant species, pioneer species, and climax species are included in TMDL plantings; the TMDL Program has more information and guidance regarding the mix of species. Small, Medium and Large sizing of plants corresponds to sizes discussed elsewhere in LDG Chapter 8 for species included in the PPL.

SM = TMDL Shrub Medium
SL = TMDL Shrub Larger
TS = TMDL Tree Small
TM = TMDL Tree Medium
TL = TMDL Tree Large
D = Deer Resistant Species
P = Pioneer Species
C = Climax Species

8.4 Preferred Plant Sizes.

8.4-A Sizes by Use Group. Plant material of the various Plant Material Use Groups is specified in the sizes shown in LDG Table 8.4-A unless larger or smaller stock is justified for specific landscape situations.

Table 8.4-A Preferred Plant Sizes

Use Group and Description		Preferred Sizes
SEED COMPONENTS OF STANDARD MIXES		
F	**Meadow Forb Seed**	These are seeds, not live plants. Standards for purity and germination are in Section 920 of the Standard Specifications.
G	**Meadow Grass Seed**	
S	**Shrub Seed**	
T	**Turfgrass & Temporary Seed**	
W	**Wildflower Seed**	

Table 8.4-A Preferred Plant Sizes, *continued...*					
Use Group and Description		**Preferred Sizes**			
NATURALIZED AREA PLUGS					
PF	**Forb Plugs** Broadleaf, flowering.	38 = 2 in. dia. x 5 in. depth			
PG	**Grass Plugs** incl. sedges and rushes.	38 = 2 in. dia. x 5 in. depth			

Table 8.4-A Preferred Plant Sizes, *continued...*					
Use Group and Description		**Preferred Sizes**			
LANDSCAPE PLANTING BEDS ANNUALS & BULBS					
AN	**Annuals** Flower and foliage plants	4 in.			
BU	**Crocus Bulbs** In planting beds or naturalized	Large 8cm	Topsize 9cm+		
	Daffodil Bulbs In planting beds or naturalized	Topsize DN-1	Large DN-2	Topsize RD-1	Large 11cm.

Table 8.4-A Preferred Plant Sizes, *continued...*					
Use Group and Description		**Preferred Sizes**			
LANDSCAPE PLANTING BEDS PERENNIALS & ANNUALS					
BP	**Broadleaf Perennials** Flowering and foliage	#SP3	#SP4	#1	
OG	**Ornamental Grasses** Including sedges and rushes	#SP4	#1	#2	

Table 8.4-A Preferred Plant Sizes, *continued...*		
Use Group and Description		**Preferred Sizes**
FACILITIES AND FOCAL POINTS		
F&F	**Various Plant Types**	Sizes of plants specified at SHA facilities and roadside focal points such as at gateways, monuments, etc. are selected to suit individual project needs. Most are specified in conformance with the sizing of other Plant Material Use Groups.

Table 8.4-A Preferred Plant Sizes, *continued...*					
Use Group and Description		**Preferred Sizes**			
STREET TREES					
STL	**Street Tree Large** Deciduous broadleaf, single stem > 50 ft mature height	2.0 in. cal.	2.5 in. cal.	3.0 in. cal.	
STM	**Street Tree Medium** Deciduous broadleaf, single stem 20 to 50 ft mature height	1.75 in. cal.	2 in. cal.	2.5 in. cal.	
STS	**Street Tree Small** Deciduous broadleaf, single stem < 20 ft mature height	1.5 in. cal.	1.75 in. cal.	2.0 in. cal.	2.5 in. cal.

Table 8.4-A Preferred Plant Sizes, *continued...*					
Use Group and Description		**Preferred Sizes**			
LANDSCAPE SHRUBS & VINES					
SL	**Large Shrub** > 6 ft mature height	30 in. ht.	3 ft ht.	4 ft ht.	
SM	**Medium Shrub** 30 in to 6 ft mature height	18 in. ht./sp.	24 in. ht/sp.	30 in. ht.	
	Shrub Rose < 6 ft mature height	Grade 1 #2	Grade 1 #3		
SS	**Small Shrub** < 30 in. mature height	18 in. ht./sp.	24 in. ht./sp.		
VI	**Vines**	#SP4	#1 2 yr. plant		

Table 8.4-A Preferred Plant Sizes, *continued...*					
Use Group and Description		**Preferred Sizes**			
LANDSCAPE TREES					
LTL	**Large Deciduous Trees** Single stem > 50 ft mature height	1.75 in. cal.	2.0 in. cal.	2.50 in. cal.	
	Large Evergreen Trees Single stem > 50 ft mature height	4 ft ht.	6 ft ht.	8 ft ht.	
LTM	**Medium Deciduous Trees** Single stem 20 to 50 ft mature height	1.5 in. cal.	1.75 in. cal.	2.0 in. cal.	2.5 in. cal.
	Medium Evergreen Trees Single stem 20 to 50 ft mature height	4 ft ht.	6 ft ht.	8 ft ht.	
	Medium Multistem Trees Two or more stems > 20 ft mature height	4 ft ht.	6 ft ht.		
LTS	**Small Deciduous Trees** Single stem < 20 ft mature height	1.25 in. cal.	1.5 in. cal.	2.0 in. cal.	
	Small Evergreen or Multistem Trees Single or multistem < 20 ft mature height	4 ft ht.	6 ft ht.	8 ft ht.	

Table 8.4-A Preferred Plant Sizes, *continued...*					
Use Group and Description		**Preferred Sizes**			
REFORESTATION TREES & SHRUBS					
R	**Large Deciduous Trees** Single stem > 50 ft mature height	5 ft ht.	0.75 in. cal.	1.0 in. cal.	1.25 in cal.
	Medium Deciduous Trees Single stem 20 to 50 ft mature height	4 ft ht.	0.75 in. cal.		
	Small Deciduous Trees Single stem > 20 ft mature height	3 ft ht.	4 ft ht.	5 ft ht.	
	Medium and Large Evergreen Trees Broadleaf or conifer, single stem > 20 ft mature height	3 ft ht.	4 ft ht.		
	Medium and Large Multistem Trees Broadleaf or conifer, two or more stems > 20 ft mature height	3 ft ht.	4 ft ht.	5 ft ht.	
	Large Shrubs > 6 ft mature height	24 in.	30 in. ht.	3 ft ht.	

	Medium Shrubs 30 in. to 6 ft mature height	18 in. ht.	24 in. ht.		
REFORESTATION SENTINEL TREES					
RS	**Large Deciduous Trees** Single stem > 50 ft mature height	1.75 in. cal.	2.0 in. cal.	2.50 in. cal.	
	Medium Deciduous Trees Single stem 20 to 50 ft mature height	1.5 in. cal.	1.75 in. cal.	2.0 in. cal.	
	Medium and Large Evergreen Trees Broadleaf or conifer > 20 ft mature height	4 ft ht.	6 ft ht.		
	Medium and Large Multistem Trees Deciduous > 20 ft mature height	4 ft ht.	6 ft ht.	8 ft ht.	

Table 8.4-A Preferred Plant Sizes, *continued...*

Use Group and Description		Preferred Sizes
STREAM AND STORMWATER FACILITIES		
SST	**Stream and Stormwater Trees**	Sizes are those specified for LTS, LTM, LTL, R, and RS
SSS	**Stream and Stormwater Shrubs**	Sizes are those specified for SS, SM, and SL
SSP	**Stream and Stormwater Plants**	Sizes are those specified for BP, OG, PF, and PG

Table 8.4-A Preferred Plant Sizes, *continued...*

Use Group and Description		Preferred Sizes
TMDL TREES AND SHRUBS		
SM	**TMDL Shrub Medium**	Sizes are those specified for SM
SL	**TMDL Shrub Large**	Sizes are those specified for SL
TS	**TMDL Tree Small**	Sizes are those specified for Deer Resistant Species, Pioneer Species, or Climax Species
TM	**TMDL Tree Medium**	
TL	**TMDL Tree Large**	
D	**Deer Resistant**	0.75 in. cal. or as otherwise specified for LTS, LTM, LTL, R, and RS
P	**Pioneer Species**	1.25 in. cal. and 7-8 ft minimum, or as otherwise specified for LTS, LTM, LTL, R, and RS
C	**Climax Species**	1.75 in. cal. and 7-8 ft minimum, or as otherwise specified for LTS, LTM, LTL, R, and RS

8.4-B Other Plant Sizes. Larger or smaller plant materials are specified when appropriate, as follows.

1. **High Expectation Areas.** Trees larger than the Preferred Sizes may be appropriate for use at offices, maintenance facilities, and park & rides, in streetscapes, and as replacements for significant trees. Larger trees may be recommended as replacements for mature trees removed on private properties to accommodate SHA improvements.

2. **Difficult Access Areas.** Trees and shrubs smaller than the Preferred Sizes may be appropriate in locations where plants are moved by hand for long distances across difficult terrain or steep slopes.

3. **Steep Slopes.** Trees and shrubs smaller than the Preferred Sizes, and containerized stock is specified to minimize transportation and handling costs, and to reduce the need for soil berming on slopes.

   LDG 4.6-C.4 provides information about selecting tree and shrub sizes based upon slope steepness.

8.4-C Specifying Plants with ANSI Z-60.1. The American Standard for Nursery Stock (ANSI Z-60.1) is used to specify the sizes of plant material in landscape plan sheets and specifications.

For most projects, the plant size specifications of LDG Table 8.4-C are observed when specifying plant material in plans and other contract documents.

Table 8.4-C Plant Size Specifications per ANSI Z-60.1

For All Plants	***Specify This...*** Specify a single size, not a range. For example, specify: *Ilex glabra*, Inkberry, B&B, 3 ft ht.	
Type I & II **Shade Trees**	***Specify This...***	
Field-grown trees	Caliper	Inches
Bare root and container-grown trees up to 8 ft tall	Height	Feet
Container grown trees larger than 8 ft tall	Caliper	Inches
Plants delivered in fabric bags	Caliper	Inches
Multistem trees	Height	Feet
Type III & V **Small Upright and Small Spreading Deciduous Trees**	***Specify This...***	
Field-grown, bare root, and container-grown trees up to 6 ft tall	Height	Feet
Field-grown and container-grown trees over 6 ft tall	Caliper	Inches
Plants delivered in fabric bags	Caliper	Inches
Multistem trees	Height	Feet
Trees often available in single stem and multistem form, such as Autumn Brilliance Serviceberry	Specify the desired form and caliper or height	

Table 8.4-C Plant Size Specifications per ANSI Z-60.1, *continued...*	
Container-Grown Trees	***Specify This...***
	Container class, such as #3, #7
	Height or caliper for the type
Container-Grown or B&B Shrubs	***Specify This...***
	Container class, such as #2, #3
	Height or spread for the species
	Indicate CG or CONT, or B&B
	Indicate "B&B/CG" when the Contractor may install either
Perennials, Annuals,	***Specify This...***
	Specify the ANSI container class
	Do not indicate height or spread unless required per ANSI
Plugs	***Specify This...***
	Number per tray, plug diameter and depth.

8.5 Preferred Plant List (PPL).

The PPL is a Microsoft Excel spreadsheet that is arranged alphabetically by genus, species and cultivar. The PPL is in LDG 11.19.

In addition to establishing standard use of plant material nomenclature, the PPL provides information about appropriate uses of these materials, and how they are designated in plans and specifications.

Although species and cultivars that are not included in the PPL may be specified in landscape designs, justification for their use may be required by the Team Leader. The Office of Environmental Design also maintains a list of Promising Species and Cultivars (PSC) which includes species currently under evaluation by SHA.

Each entry in the PPL includes the following information in columns of the spreadsheet, from left to right.

8.5-A Also Known As & Other Info. Other names and certain other information is shown in red text. Although the names shown in red are often found in nursery catalogs, they are not the accepted names of the NRCS Plants Database. Only the "Botanical Name for Landscape Plans" and the "Common Name for Landscape Plans" are shown on plans or included in Contract documents.

8.5-B NRCS Botanical Name. The full name of the species accepted by the NRCS Plants Database, including botanical author names, is shown in red text. This name is not shown on plan sheets and contract documents.

8.5-C Plant Key Prefix for Landscape Plans. The Plant Key Prefix consists of 2 to 5 capitalized letters that roughly correspond to the genus, species, and cultivar of the plant material. See LDG 8.6 Plant Keys.

8.5-D Prohibited Plants. These species and cultivars are marked with XX in the PPL. Prohibited Plants are not specified for SHA landscaping projects, and are not proposed for use on landscape plans.

LDG 11.19 includes the DNR "Do Not Plant List". Species included in this list are not installed in SHA projects. The PPL includes several of these species, but does not include those which are not typically offered for sale in the nursery trade.

8.5-E Botanical Name for Landscape Plans. The Botanical Name is the botanical name of the species and cultivar approved for landscape plans and other contract documents.

Although Section 920.06.01 establishes the NRCS Plants Database as the standard authority for names of plants, the Botanical Names of the PPL does not include the botanical author.

Only the Botanical Name of the PPL is shown in landscape plans and other contract documents.

8.5-F Common Name and Cultivars. The Common Name shown in the PPL is the accepted common name of the species in the NRCS Plants Database. The Common Name of the PPL, including the designated cultivar, is shown in landscape plans and other contract documents.

1. **Cultivars**, sometimes called varieties, are selected strains of certain species or a cross of multiple species. Many cultivars with a proven record of success in Maryland are included in the PPL. When these cultivars are specified, the name of the cultivar forms part of the Common Name and Scientific Name as indicated.

   When a plant material with a designated cultivar name is included in the PPL, only that cultivar is preferred for use. When the preferred cultivar is not commercially available or is not desirable for the project, an alternative cultivar may be proposed for installation with an explanation for the selection.

2. **Cultivars for Maintained Areas.** Selected cultivars of trees and shrubs are often preferred for streetscapes, facilities, and general roadside projects.

   Selected cultivars of perennials, bulbs, and annuals are typically specified for installation in planting beds.

3. **Cultivars for Naturalized Areas.** Locally adapted "non-cultivar" or wild types of species native to Maryland are preferred for meadows, wetlands, stream restoration, and reforestation projects.

8.5-G Highway Clear Zone. Species designated "CZ" are generally appropriate for installation within highway clear zones, in conformance with the AASHTO Roadside Design Guide and design principles of the LDG. These species are not fixed objects.

8.5-H MAA Approved Near Airport. Species designated "MAA" are approved by the Maryland Aviation Administration for installation within 4 miles of BWI and Martin State airports. The complete list of species approved by MAA, including many that are not preferred by SHA, is in LDG 11.19.

8.5-I Native Species. Species native to Maryland are designated "NAT" in the PPL. Native species are preferred for roadside uses, although non-native species and cultivars of native species may be appropriate in high visibility urban areas and facilities.

8.5-J NWPL Wetland Indicator Status Codes. Indicator status codes of the National Wetland Plant List included in the USDA Plants Database for the "Atlantic and Gulf Coast Coastal Plain" or the "Eastern Mountain and Piedmont" of Maryland are included in the PPL with these meanings:

Table 8.5-I NWPL Wetland Indicator Codes

Indicator Code	Wetland Type	Meaning
OBL	Obligate Wetland	The species occurs almost always (estimated probability 99%) under natural conditions in wetlands.
FACW	Facultative Wetland	The species usually occurs in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands.
FAC	Facultative	The species is equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%).
FACU	Facultative Upland	The species usually occurs in non-wetlands (estimated probability 67%-99%), but occasionally found on wetlands (estimated probability 1%-33%).
UPL	Obligate Upland	The species may occurs in wetlands in the US, but in Maryland it occurs almost always (estimated probability 99%) in non-wetlands.
(blank)	The species is not native to Maryland, or does not occur in wetlands anywhere in the US, or the wetland indicator status is not known.	

8.5-K Mountain, Piedmont, and Coastal Regions. Because the three physiographic regions of Maryland involve very different climate and growing conditions, plant material appropriate for these regions is specified, based upon the "M" "P" or "C" designations of the PPL.

M Indicates plants specified in mountain areas with elevation $\geq$ 600 feet in Garrett, Allegany, Washington and Frederick counties.

P Indicates plants specified in piedmont areas of Carroll, Baltimore, Montgomery and Howard counties. Portions of Frederick, Harford and Cecil counties are also in the Piedmont region.

C Indicates plants specified in the coastal plain, which includes the Eastern Shore, Southern Maryland, and Chesapeake Bay areas with elevation less than 200 feet., including parts of Cecil, Baltimore and Cecil counties.

8.5-L Plant Material Use Groups. The abbreviations are those of the Plant Use Groups described in LDG 8.3. Each Plant Use Group has its own column in the PPL.

8.6 Plant Keys.

"Plant Keys" are used to standardize the abbreviations of plant materials in landscape plans and other contract documents. Each Plant Key compactly indicates the identity and size of plants to be delivered for installation.

Samples of acceptable Plant Keys are shown below.

Table 8.6 Sample Plant Keys

Plant Key	What It Means
AR2.0	Acer rubrum, 2 in. caliper
CK5H	Cornus kousa, 5 ft height
IVHG18H	Itea virginica 'Henry's Garnet', 18 in. height
IOAF5H	Ilex opaca 'Angelica' (female) 5 ft height
AST1Q	Asclepias tuberosa, #SP4 (1 quart)

The Plant Keys may vary slightly in conformance with this style, as long as they are consistently used in the plans. When a species or cultivar is not included in the PPL, the designer will develop a Plant Key like those of this Chapter for that plant material.

To use this system, the appropriate Prefix of the PPL is followed by the specified Size and Suffix to establish one Plant Key for each plant material in the contract.

Plant Key Prefix. The Prefix consists of 2 to 5 capital letters that correspond to the genus, species, and cultivar of the plant material. The Preferred Plant List includes a Plant Key Prefix for each species and cultivar in the List.

Plant Key Size and Suffix. The Size is a number that corresponds to the size specification of plant material.

- The suffix indicates the meaning of the size number.
- Numbers without suffix indicate caliper.

- Suffix “H” indicates height.

  Plants < 36 in. tall are specified in inches.

  Plants ≥ 3 ft tall are indicated in feet.

- Suffix “S” indicates spread in inches.
- Suffix “Q” indicates #SP4 (quart).
- Suffix “G” indicates #1 (gallon).

8.7 Constructability and Future Maintenance.

8.7-A General Considerations. Sustainable roadside design ensures that roadside landscape is durable and able to thrive in difficult situations with little need for maintenance or replacement. Intensively-landscaped designs that require comprehensive maintenance are limited to urban and suburban areas with high visibility for maximum aesthetic impact.

To create more sustainable roadsides, construction cost and installation access considerations are balanced with future maintenance costs and accessibility. Sustainable designs can provide opportunities to reduce construction costs, but reductions must also minimize adverse effects on future maintenance operations.

Some key issues:

1. **Access.** Where plant material cannot be safely delivered or installed, or where access for future maintenance is uncertain, other design alternatives are considered during project design.

2. **Maintenance.** Regardless of the degree of maintenance required, design adjustments that reduce maintenance are strongly encouraged.

3. **Lane Closure.** Closure of a travel lane of a major highway to perform landscape installation or maintenance activities is rarely allowed. Even where permitted on a limited basis, temporary traffic control measures add significant cost and may be uneconomical to provide in following years.

4. **Long Term Costs.** For projects where lane closures are necessary, such as highway widening or bridge replacement, the long-term costs of maintenance are evaluated, and design adjustments are evaluated to reduce those costs.

8.7-B Construction, Establishment and Maintenance Challenges. Difficult or restricted access complicates plant installation and establishment activities. Future maintenance may also be prohibitively expensive or hazardous where safe access is not available. Landscape designs must fully consider constructability, establishment activities and future maintenance in terms of accessibility, safety, and cost.

1. **Terrain, Natural and Manmade features.** Steep slopes, poorly drained or erodible soils, streams, wetlands, and other sensitive areas, as well as manmade structures such as retaining walls, bridge abutments, SWM facilities, and traffic barriers can impede installation, and make maintenance such as mowing and weed control very difficult.

2. **Traffic Volume, Prevailing Speeds, and Lane Alignments.** Construction and maintenance activities along high-volume or high-speeds roads in areas with little safe haven for vehicles and workers often require substantial traffic control, including protection vehicles (crash trucks). Lane shifts and extensive traffic control operations for routine landscape maintenance incur substantial costs, may create large traffic backups, and are rarely feasible as a result.

   While it may be less expensive to plant a narrow median than it is to install hardscape such as stamped concrete or pavers, the combined construction and maintenance cost of hardscape is much lower, especially on a busy highway.

3. **As-Built Conditions.** Access for landscape maintenance may be more difficult after construction due to the removal of long-term maintenance of traffic devices such as concrete barrier, because of regrowth of existing vegetation, or when construction access routes are obstructed by installed landscaping.

4. **Insufficient Right of Way.** In locations, where construction causes impacts outside the SHA ROW, or access though property owned by others is necessary for construction or future maintenance, SHA may do the following:

   a. Purchase the necessary property.

   b. Develop a Temporary Construction Easement.

   c. Obtain temporary permission in the form of an Entry Agreement.

   d. Purchase rights for a Perpetual Easement to allow access for specific purposes.

8.7-C Temporary Construction Easement (TCE) and Entry Agreement. Both the TCE and Entry Agreements are used to obtain and document permission for construction impacts off SHA property. These easements are usually developed by the Office of Real Estate (ORE).

Entry agreements are typically developed to obtain permission for work that causes minor or temporary impacts, although an entry agreement may be used to allow tree planting or landscape improvements. Where property owners are agreeable, SHA prefers to provide financial compensation for plantings impacted by construction, rather than providing in-kind replacement by a SHA Contractor.

TCE's are developed for impacts to commercial properties, or are developed as part of an exhibit for appraising impacts for compensation. Where access to landscaping from SHA property will not be impossible after construction is complete, such as behind sound walls, a temporary construction easement is developed with provisions to allow maintenance during the Establishment Phase for plant materials.

The Establishment Phase of trees, shrubs and perennials is 12 months after installation unless a Special Provision is developed for a longer or shorter timeframe. When access will not be possible after installation acceptance, a Special Provision is developed to modify the Establishment Phase.

8.7-D Maintenance Agreements. With the exception of mitigation plantings on DNR Park Property, and where agreements are negotiated as part of a compensation package for property impacts, landscaping installed by SHA Contractors outside the SHA ROW is not maintained by SHA. Therefore, where plantings are proposed outside the ROW, maintenance responsibilities are clearly outlined in the Entry Agreement.

Municipalities, communities, developers, civic associations, and other organizations may install or provide funding to SHA for the installation of landscaping within the SHA ROW. Where landscaping activities can be safely accommodated, SHA may allow landscape work performed by others when funding is also provided for long term maintenance.

A maintenance agreement (MOU or MOA) is developed by SHA and approved by all parties before PS&E review. A clear list of maintenance responsibilities is included in the agreement.

In addition, the agreement clearly indicates the landscaping to be installed, the communication procedures for notification by SHA of unsatisfactory maintenance, the timelines for corrective action, and the penalties that will be applied when corrective actions are not be performed.

8.7-E Mowing. Mowing is one of the most common SHA roadside management practices. Reductions in maintenance funds and increased emphasis on environmental enhancement and sustainability have necessitated the reduction of mowed areas along SHA roadsides.

LDG 11.28 includes the SHA Vegetation Management Policy. Information about landscape maintenance practices is included in the Integrated Vegetation Manual for Maryland Highways of LDG 11.27.

The Estimating Manual of LDG 11.18 includes extensive guidance in the selection of areas for meadows and shrub seeding where mowing is not required for safety. The Manual also includes design guidance to improve the efficiency of mowing operations where mowing is required.

Roadside landscapes are designed to accommodate mowing operations in many ways, including:

1. **Mowing Reduction.** Landscape designs include the installation of contiguous, naturalized areas with minimal mowing needs wherever feasible.

2. **Naturalized Slopes.** Landscape designs specify the installation of meadow, shrub seeding and tree planting on steep slopes and areas with difficult access.

3. **Simple Maintenance.** Landscape designs allow mowing without the need for specialized equipment or string trimming.

4. **Large Mowers.** Landscape designs in rural areas allow turfgrass to be mowed with 10-foot wide mowing machinery, with few stops or sharp turns.

5. **4 ft Mowers.** Landscape designs in urban and suburban areas allow turfgrass to be mowed with 4-foot wide mowing machinery, without the need for tight turns.
6. **Elimination of Buffer Strips.** Landscape designs avoid turfgrass buffer strips less than 3 feet wide between curb and sidewalk, and avoid vegetated median strips less than 6 feet wide.

7. **Tree Spacing. Landscape designs space i**ndividual tree pits to allow easy mowing between the pits, or including trees within planting beds.

8.7-F **Pruning.** Pruning and the removal of trees, shrubs, and vines is necessary to minimize obstruction of sightlines; to reduce hazards to motorists, bicyclists, and pedestrians; for security and aesthetic purposes; and to preserve clear access for equipment, signs, lights, etc.

Pruning and removal of invasive plants and certain fast-growing native species such as Black Locust and Eastern Red Cedar is a necessary part of effective roadside management. However, roadside landscapes are designed to minimize future pruning requirements as much as possible.

Roadside pruning requirements are greatly reduced by the following methods:

1. **Plant Form.** Landscape designs that specify trees and shrubs with appropriate branching structure and form allow plants to develop to their potential without conflicts with traffic, bicyclists or pedestrians. Compact or narrow cultivars are often appropriate where space is not available for the growth of full-size forms.

2. **Planting Offsets.** Landscape designs that specify appropriate offset distances from trees and shrubs to intersections, travel lanes, pedestrian and bicycle routes, etc. allow plants to reach mature size without pruning.

3. **Planting Locations.** Landscape designs that specify trees and shrubs in locations that avoid conflicts with other highway features also reduce the need for pruning and removal.

   LDG Table 8.10-F shows frequently encountered "conflict points" for trees and shrubs. For each of these areas, the LDG provides guidance for appropriate offset distances to minimize the need for pruning.

Table 8.10-F Tree & Shrub Conflict Points			
Utility poles	Streetlights	Traffic signals	Cameras
Overhead wires	Building lights	Signal cabinets	Hydrants
Buried utilities	Street signs	Accessways	Scenic features
	Commercial signs	Access doors	

8.8 Planting Beds.

8.8-A Maintenance Reduction. Since 2011, the construction of planting beds that involve soil preparation, mulch, edging and maintenance by SHA has been restricted in order to reduce costs. The Estimating Manual provides guidance about Category Code 710170 Constructing Planting Beds SY.

Some guidelines for Constructing Planting Beds follow below:

- Planting beds of shrubs are appropriate where shrub masses will be allowed to naturalize.
- Planting beds of perennials, ornamental grasses, annuals, and bulbs should be avoided in median and splitter island plantings. In general, medians less than 6 ft wide should be hardscaped, and turfgrass installed elsewhere as appropriate.
- Masses of large native ornamental grasses and their cultivars may be allowed, pending OED approval when the plantings are will be allowed to naturalize.
- Exceptions to these restrictions will be reviewed on a case-by-case basis by the Office of Environmental Design.
- Prior commitments made to communities or other customers may be grounds for reducing rather than eliminating landscape beds in projects under design.
- Design-Build projects currently under design or construction will be addressed during the review of design submittals by LAD.
- The ongoing emphasis will be landscapes that maximize the use of low-maintenance, naturalized landscapes for aesthetic and environmental benefit.

8.8-B General Design Principles. The layout of planting beds is adjusted to accommodate changes in terrain, and to avoid obstruction of structures, utility cabinets, and maintenance or emergency access routes.

The effect of slope on surface area is discussed in the Estimating Manual included in LDG 11.18. Because more surface area is available for planting than is shown in plan view, the quantity of "Constructing Planting Beds" and the number of plant materials are adjusted accordingly. Multipliers to adjust areas to account for slope steepness are included in Table 700-B of the Estimating Manual.

Planting bed edges are designed in the form of gradual curves and straight lines as opposed to sharp curves or wavy bed edges. At typical highway speeds, planting beds with many indentations or curves in a short distance may appear jagged, and are difficult for mowers to navigate.

Individual tree pits within 5 feet of the edge of a planting bed are included in the bed.

The offset distance of planting beds from drainage swales must be sufficient to avoid erosion of plants and mulch by stormwater flows and to allow for swale maintenance.

8.8-C Shrubs. For linear beds composed entirely of shrubs, double staggered rows are specified when feasible. Single rows with reduced spacing between plants may be specified where there is insufficient planting area for multiple rows.

The loss of individual shrubs in a shrub bed with multiple rows is less noticeable to the highway user, and the increase in planting density significantly increases the aesthetic interest of shrubs such as Winterberry Holly.

The distance between individual shrubs may be reduced up to 60% to encourage rapid development of solid cover in shrub beds, to reduce the need for weeding, and to compensate for poor growing conditions.

8.8-D Perennials & Ornamental Grasses. In linear beds, large ornamental grasses such as Switchgrass are specified in double, or triple staggered rows. For larger massings, triple staggered rows are the minimum.

The spacing of ornamental grasses is often reduced to compensate for poor growing conditions, and to reduce weed growth. Since larger grasses typically reach their mature size under highway conditions, reduced spacing is more commonly used in narrower rows rather than large mass plantings.

Planting beds of perennials are installed where they have the most visual impact, as they require more maintenance than beds of shrubs or ornamental grasses.

8.8-E Weed Control. Information about herbicide and weed control operations of the Integrated Vegetation Manual for Maryland Highways is in LDG 11.27.

A mix of broadleaf shrubs and perennials in a planting bed with ornamental grasses increases maintenance costs, complicates weed control operations, and may lead to increased plant mortality due to misapplication of herbicides.

To the greatest extent feasible, the design of planting beds does not mix broadleaf shrubs and perennials with ornamental grasses.

Chapter 9.0 - Principles of Sustainable Design

9.1 Introduction.

The essential principles of sustainable roadside design are discussed in LDG 1.0, and elements of sustainable design such as soil and plant material are discussed in LDG 8.0. However, truly sustainable roadside landscaping requires that all LDG Chapters be understood and addressed. Thus, compliance and mitigation is ultimately as important to a sustainable landscape as safety, accommodating utilities, and context sensitive solutions.

This Chapter provides additional details for the design of roadside areas and facilities. The purpose is to provide an overview of frequently encountered issues, although extensive information related to streetscapes and roundabouts is also provided.

The order of topics range from the most rural and least intensively managed settings such as stormwater management areas, to the most urban and high maintenance areas such a SHA facilities for the public and employees.

9.2 Wetland Design.

This Chapter is under development.

9.3 Stream Design.

This Chapter is under development.

9.4 Drainage and Stormwater Management.

9.4-A Introduction. Although the development of highway drainage plans begins in the early stages of project development, it is not uncommon for SWM designs to change late in the process. Coordination with the Highway Hydraulics Division is required during all stages of project development.

9.4-B Role of Highway Hydraulics Division (HHD).

The Highway Hydraulics Division has broad responsibility for highway drainage and stormwater management facilities and serves in the following roles:

- Provides engineering design services, technical services, project management and plan reviews on environmental issues.
- Develops policies, procedures and standards related to small waterway crossings, stormwater management, erosion & sediment control, and highway drainage.

- Participates in environmentally sensitive designs, preparation of environmental permits, and coordination with regulatory agencies.

- Obtains permits required under the National Pollutant Discharge Elimination System (NPDES) program, and MDE permits for SWM and E&S.

- Provides inspection services for SHA stormwater management facilities, and maintains inventories of SWM facilities owned by SHA, or which treat SHA stormwater on private property.

9.4-C Key References. The following references are used to develop landscape design involving channels and stormwater management facilities (SWM):

LDG 11.7 SHA Highway Drainage Manual, including all guidelines and supplements, provides design criteria and procedures used by hydraulic engineers to develop drainage and stormwater management facilities.

9.4-D Design Details. The design context of SWM facilities is generally the same as the rural or suburban pattern of roadside areas. Most SWM facilities are designed to keep installation and maintenance costs to the minimum needed for vegetation establishment and future maintenance needs.

Some key issues:

1. **Bioswales, Bioretention Facilities and Channels.** Turfgrass, whether seeded or sod, is the preferred groundcover vegetation for many bioswales and most channels because it is easily established, resists erosion, is easily maintained, and absorbs water and nutrients from runoff water.

   The Estimating Manual explains the use of turfgrass and other vegetation on slopes and in channels, and provides alternatives in the selection of soil stabilization matting as a function of slope and water flow velocity.

2. **Native Species.** Native vegetation is appropriate for most SWM facilities such as ponds, basins and infiltration areas. Seeding is usually the preferred method for establishing permanent groundcover of native grasses and forbs.

   Small sized stock of native species are listed under “Natural Areas Plugs” in the PPL. Although many showy species such as Swamp Milkweed, Rose Mallow, etc. are costly or difficult to grow from seed, many are also adapted to installation as plugs in naturalized areas and SWM facilities. Such plugs will provide additional aesthetic benefit in high-visibility areas where the additional costs can be justified.

   The PPL shows the species included in standard meadow and shrub seed mixes, as well as a variety of species adapted for use as plugs.

Larger planting stock of the plug species may also be available (at higher cost) and these larger sizes are listed under Landscape Planting Beds.

3. **Special Concerns and Offset Distances.** A few special concerns and offset distances are observed to avoid problems or minimize maintenance costs.

   a. **Trees and shrubs** are specified as follows:

      At least 25 feet from riser pipes and structures.

      At least 15 feet from the toe of embankments.

      Rarely specified below the permanent waterline of ponds.

      Never specified on pond embankments or dams, or in swales.

   b. **Organic Mulch** such as straw mulch and shredded hardwood bark (SHB) mulch are not specified where these materials might wash away, float, or obstruct risers, inlets or drains.

      Notes on plans or Special Provisions in the Contract documents prohibit the installation of SHB, etc. with plant materials within SWM facilities that are subject to concentrated water flow or inundation.

      To avoid problems with organic mulch:

      - Organic mulch is generally restricted below the 10-year flood elevation within SWM facilities, and especially ponds.
      - The mulched edge of planting pits and planting beds is at least 7 feet from the centerline of drainage swales to avoid obstruction of flow in high volume or high-velocity swales.

        The offset distance may be reduced to 5 feet for low volume, gently-sloped swales.

      - The mulched edge of planting beds is at least 3 feet from stone check dams.
      - Type D SSM is specified with Meadow Establishment instead of the usual straw mulch in SWM facilities where straw might be dislodged.

9.5 Screen Plantings.

9.5-A Introduction. Screening of undesirable views is an important function of roadside landscaping. Although studies have not demonstrated noise reduction benefits from typical roadside landscaping, public feedback indicates that there is some truth to the saying: “out of sight, out of mind”.

1. **Screening Within ROW.** Screening is provided as funds allow where there is sufficient space within SHA ROW. Screening that is funded by others is permitted with approval by the District under a District Utility Permit or other written agreement. The agreement stipulates that maintenance for the screening is the responsibility of the party who funded the installation.

2. **Screening Outside ROW.** Screening beyond the limits of SHA ROW is not provided except as mitigation for project impacts outside the ROW.

   Except where in-kind mitigation is requested by the property owner, monetary compensation for impacts to privately-owned trees and landscaping is preferred by SHA. Landscaping installed outside the ROW is maintained by others after completion of the Establishment Phase of the plant material.

9.5-B Screening Requests. Screening requests may come from a variety of sources but most are of two types: screening views of highways and other SHA facilities from adjacent properties, and screening adjacent properties from SHA Highways and facilities.

9.5-C Screening of Highways and Facilities. Accessibility to state highways can be a selling point for residential neighborhoods, especially for commuters. However, views of nearby highways are not often prized by homeowners.

Requests for noise barriers or plantings to shield adjacent residences from highway noise, or landscaping to screen undesirable views often originate from residential communities. However, parks, schools, businesses may also request screening.

Communities ineligible for noise barriers may be provided with landscape screening as a compromise. Studies have shown very little noise reduction from landscaping, but landscape screening can reduce undesirable views of SHA highways, offices and maintenance facilities while providing aesthetic benefits.

9.5-D Screening of Adjacent Uses. Aesthetic improvements can enhance the experience of highway users by screening views from the highway.

Providing screening of new development and other undesirable views from Scenic Byways is a key to preserving and enhancing viewsheds, and may be a requirement of

byway corridor management plans. Concepts for screening may be included in NEPA documents, and may help to guide landscape designs.
SHA Maintenance Facilities, particularly salt domes, salt barns and similar utilitarian sites, are routinely screened from highways where feasible.

The screening of SWM facilities deserves special consideration. To residents in rural areas, a naturalized SWM facility may be a normal and even valuable part of the landscape. For many urban and suburban residents, however, the unkempt appearance of a SWM pond or other facility may be unacceptable.

The removal of trees and shrubs from SHA rights-of-way by adjoining property owners to improve visibility of businesses and signs is a violation of State law and SHA policy. Thus, to minimize conflicts and loss of vegetation, new plantings should be coordinated with nearby property owners.

9.5-E Screening Design. Screening typically consists of landscape plantings and may be combined with a privacy or stockade fence. Because the design and installation of screening may involve complex negotiation with adjoining property owners, these discussions should be coordinated with the Project Engineer and LAD Team Leader.

1. **Fencing** is typically reserved for locations where insufficient width is available to provide landscape screening in urban or suburban areas or where necessary to discourage unwanted pedestrian cut-through. Screen fence may also be specified to replace existing fence removed or damaged during construction.

   The salvage of existing fence is discouraged when privately owned fencing is impacted by SHA. Monetary compensation is preferred by SHA in lieu of installation of a new fence by an SHA contractor except where the property owner requests in-kind replacement. Replacement of the fence by the homeowner provides the homeowner with greater control over installation of the fence, and minimizes requests for future fence maintenance by SHA.

2. **Landscape Plantings** for screening vary based on budget, available planting area, site context, growing conditions, and stakeholder preferences. Some important considerations in landscape screening design are shown below:

   Weigh the options with adjacent property owners before committing to a final design. Let them determine desirable and undesirable views and whether instant screening or long-term success is a priority.

   Short-term results may not provide long-lasting screening. Fast-growing trees may be inexpensive to install but may have short life spans or thin out with age. Leyland Cypress transplant easily and provide an inexpensive, fast-growing screen but are prone to bagworms and snow or ice damage. White Pines are also inexpensive but typically limb up with age, often outgrow planting areas, and are prone to snow damage and sensitive to salt spray.

Appropriate plants are selected to suit site conditions and screening needs. Individual plants are spaced closely to provide screening, but not so close that lower branches die or plants will be crowded out.

Future maintenance requirements are minimized by careful plant selection. Appropriately specified screening does not require regular pruning to maintain visibility of traffic control devices or safety sightlines. Design plantings to reduce potential for mower damage by edge plantings that tolerate accidental impacts, such as ornamental grasses.

Intricate planting plans are avoided. A small palette of readily available plant species reduces costs and simplifies future maintenance.

Single species plantings are avoided for large screens. A mix of species reduces the chance that a disease, insect pest or unfavorable site condition may damage the entire planting. Species with varying forms and heights can provide a more effective screen.

9.6 Highway Structures.

9.6-A Introduction. A variety of SHA-owned structures are located in the right of way. Depending upon the function of the structure, need for inspection or access, and aesthetics of the structure itself, landscaping is customized to the structure. In general, views of unattractive structures are often screened, while landscaping may be used to augment the appearance rather than hide other structures.

Important Note: LDG 7.6 provides offset distances to trees and other vegetation from different types of traffic barrier, as well as offset distances for different posted travel speeds and topography.

9.6-B Bridges. The offset distance of trees and large shrubs is at least 30 feet from bridge abutments and parapets.

The offset distance of medium and small shrubs is at least 10 feet from bridge abutments and parapets.

Plant material is not installed under bridges except where bridge height and width will allow sufficient water and sunlight to sustain the plant material.

9.6-C Retaining Walls. Landscaping is unlikely to compromise the structural integrity of properly designed and constructed retaining walls, but “green walls” with clinging vines and trellis systems may be appropriate to soften the appearance of concrete and to reduce available spaces for graffiti.

Certain types of construction pose challenges for establishing vegetation on or near retaining walls. Rapidly draining structural fills and compacted crushed stone behind retaining walls may limit root growth and reduce plant survival.

The offset distance of trees and shrubs from the face of the wall must be sufficient to prevent vegetation from growing into or above traffic lanes, bicycle or pedestrian ways or creating safety, aesthetic, or maintenance concerns. The following offsets are observed for trees and shrubs planted above retaining walls:

Table 9.6-C Offset Distance to Wall

Vegetation	Minimum Offset Distance to Wall
Large & Medium Trees	25 ft *
Large & Medium Columnar Trees	20 ft *
Narrowly Columnar Evergreen Trees	15 ft *
Medium & Small Trees	15 ft
Large Shrubs	7 ft
Medium Shrubs	5 ft **
Ornamental Grass, Perennials > 3 ft	4 ft
Ornamental Grass, Perennials ≤ 3 ft	1 ft **
Vines	1 ft **

Notes:

* Larger offsets may be required where a reduced shoulder width occurs adjacent to retaining walls or on steep slopes above retaining walls.

** Shrubs, perennials, and vines intended to drape over and screen the wall may be installed immediately adjacent to the back of the top of wall.

9.6-D Steel Traffic Barriers. W-beam, box beam, and three-strand cable are different types of steel traffic barriers. This category also includes steel-backed timber traffic barrier. Regardless of roadway section, roadside terrain, or posted speed, the following design standards apply to landscaping adjacent to steel traffic barriers:

1. **Visibility of Landscaping.** Ornamental vegetation must be visible on at least one side of the barrier. Sometimes vegetation is visible from both sides, but if no one can see it, turfgrass or meadow are more appropriate alternatives.

2. **Back of Barrier.** The offset distances to trees and other vegetation to the back of metal barriers conforms to LDG 7.4.

3. **Face of Barrier.** The offset distance of trees and other vegetation to the face of metal barriers must conform to LDG 7.5 and be consistent with SHA guidelines so that clear zones are maintained, that visibility and function of the barrier is not compromised, and that future maintenance of the barrier and the landscaping will be feasible. Where appropriate, ornamental plantings are specified at least 7 feet from the face of the barrier to avoid damage caused by barrier maintenance.

9.6-E Concrete Traffic Barriers. Concrete traffic barrier, including Jersey Walls, F-Shape Barrier, etc. are specified in narrow divided highway medians where there is insufficient deflection area for steel traffic barrier, and on roadsides where slopes cannot be readily graded to meet roadway grades.

Concrete barriers are also specified to raise roadside grades to reduce noise barrier panel heights. Particularly where right-of-way costs are high, placement of concrete traffic barriers or retaining walls may be required along the edge of the roadway to minimize grading impacts.

Unlike steel traffic barriers, concrete traffic barriers are not regularly sprayed with herbicides as turfgrass trimming is not required due to the absence of vertical posts. As a result, the offset distance for ornamental grasses, perennials, and smaller shrubs can be reduced, provided when the vegetation will not obscure sight distance or encroach into the roadside shoulder.

Concrete traffic barrier functioning as a retaining wall may be planted when sufficient soil volume is installed for their growth. Consideration should also be given to the impact of the barrier on subsurface water drainage, and to systems that may concentrate flows from pipes or openings in the base of the barrier.

Low perennials and grasses may be installed where the barrier allows them to be seen. Drainage swales may require larger offsets, and additional offset distance may be required for trees where the roadway shoulder is reduced.

The offset distances to trees and other vegetation to the front and back of concrete barriers must conform to LDG 7.4 and LDG 7.5.

9.7 Noise Barriers.

9.7-A Introduction. In urban and suburban areas, roadside noise barriers absorb and deflect highway noise to improve living conditions for residences near major highways. Although studies have shown that landscaping provides minimal noise reduction along highways, vegetation can be used to soften the appearance of a wall, screen it from view and reduce opportunities for graffiti.

While landscaping and future maintenance on the highway side of a noise barrier is often feasible and appropriate, the installation of trees and other plant materials on the back side of noise barriers requires careful consideration. Such plantings may involve the need for entry agreements with property owners, a MOU or other arrangements to accommodate installation, establishment and maintenance activities.

9.7 Noise Barrier Design Principles, continued...

9.7-B Design Aesthetics. Landscape design for noise barriers must consider the character of the surrounding landscape, the design of the adjacent roadside, and the materials and design of other nearby noise barriers.

Reforestation plantings may be appropriate where barriers are offset farther from the pavement edge, however, noise barriers are often constructed in urban and suburban areas where naturalized landscaping may not be appropriate.

While walls with less attractive surface treatments are candidates for extensive screening, walls with decorative stone, brick patterns, or bass-relief murals are often landscaped to break up the mass of the wall while leaving much of the wall visible.

9.7-C Planting Design. Noise barriers are often constructed in areas with minimal soil volume, and where there is little space for landscaping or future growth. Because the growing conditions on the highway side of noise barriers is often very harsh, these plantings typically experience higher mortality and maintenance costs. The plant materials selected for such sites must be tolerant of heat, drought and salt.

While dwarf cultivars often have poor survival, compact or columnar cultivars of trees, shrubs, and ornamental grasses are often appropriate. For example, Green Pillar Pin Oak is often appropriate, while the wider crown and downward branching of other Pin Oak cultivars may cause problems.

Very upright trees, shrubs and grasses are usually appropriate in the narrow planting areas between concrete traffic barriers or retaining walls and a noise barrier.

Many cultivars of Feather Reed Grass and Switchgrass are often successful, but larger cultivars such as ‘Cloud Nine’ Switchgrass or ‘Dallas Blues’ Feather Reed Grass are often too large.

9.7-D Planting Area Width. Different plant use groups are specified for planting area widths adjacent to noise barriers are shown offset distance.

Table 9.7-D Planting Area Width for Noise Barrier

Planting Area < 2 ft Wide	**Plant Use Groups ***
Closed Section Soil backfilled retaining wall or Concrete traffic barrier	Vines
Other roadside conditions.	No planting
* Note: Plant Use Groups of LDG 8.3 and species of the PPL	

9.7 Noise Barrier Design Principles, continued...

Planting Area 2 to 6 ft Wide	Plant Use Groups *
Closed section soil-backfilled retaining wall or Concrete traffic barrier	Ornamental grass with compact, upright growth Perennials with high drought tolerance
Closed section concrete traffic barrier	Vines. Ornamental grass with compact, upright growth
Other roadside conditions	No planting
* Note: Plant Use Groups of LDG 8.3 and species of the PPL	

Planting Area 6 to 15 ft Wide	Plant Use Groups *
Closed section soil backfilled retaining wall or Concrete traffic barrier	Vines Ornamental grass with upright growth Perennials with high drought tolerance Shrubs
Closed or open section with w-beam barrier	Vines. Ornamental grass with upright growth Small or medium shrubs
* Note: Plant Use Groups of LDG 8.3 and species of the PPL	

Planting Area 15 to 25 ft Wide	Plant Use Groups *
Closed section backfilled retaining wall or Concrete traffic barrier	Vines Ornamental grass with upright growth Perennials with high drought tolerance Shrubs and small trees Medium trees of columnar form
Closed or open section w-beam barrier	Vines Ornamental grass with upright growth Shrubs and small trees Medium trees of columnar form
Closed or open section without traffic barrier	Vines Ornamental grasses Shrubs and small trees of multistem form
* Note: Plant Use Groups of LDG 8.3 and species of the PPL	

9.7-E Plant Material Offset Distance. Plant offset distances shown in LDG Table 9.7-E are the minimum required setback distances from the face of the wall to the center of the plant. Larger offset distances are required where gabion baskets or crushed stone are present for underdrainage at the foot of the wall.

9.7 Noise Barrier Design Principles, continued...

Larger offset distance may be required to accommodate other site features, swales, maintenance access routes, future inspection and maintenance activities, signs, utilities, etc.

Note: The offset distances are based upon plant height and width at maturity in the typical environmental conditions near noise barriers, and that the plant species are provided only as examples; refer to the PPL.

Table 9.7-E Plant Offset Distance to Noise Barrier

Tree	Offset Distance	Examples*
Large and Medium Trees Standard Form	20 ft from face of wall	Red Maple
		Blackgum
		Oaks
Large and Medium Trees Columnar Form	12 ft from face of wall	Bowhall Red Maple
		Armstrong Red Maple
		Upright European Hornbeam
Large and Medium Trees Columnar Evergreen Form	8 ft from face of wall	Eastern Redcedar
		Emerald Sentinel Redcedar
		Fosters Holly
Small and Medium Trees Single or Multistem Form	12 ft from face of wall	Okame Cherry
		Eastern Redbud
		Allegheny Serviceberry
		Nellie R. Stevens Holly
Large Shrubs	5 ft from face of wall	Arrowwood Viburnum
		Prague Viburnum
		Meserve Hybrid Holly
		Purple Sandcherry
Medium Shrubs	3 ft from face of wall	Winter Red Winterberry Holly
		Snowmound Spiraea
		Black Chokeberry
Ornamental Grasses Perennials Vines	18 in. from face of wall	Switchgrass
		Feather Reed Grass
		Daylily
		Blackeyed Susan

* Note:
These are examples of various Plant Use Groups.
Refer to Preferred Plant List (PPL) for other preferred species and cultivars

9.7 Noise Barrier Design Principles, continued...

9.7-F Access Doors and Hydrants. Because noise barriers block access to adjacent roads and properties, emergency responders and maintenance staff must use access doors through the wall. Fire standpipes and hydrants are usually installed near access doors, and the areas around the doors and the vicinity of the devices must be kept clear of obstructions.

9.7-G Visibility and Access: Landscape plantings must allow unimpeded visibility from the road to hydrant signs and other signs for emergency responders. Unimpeded visibility and access is also required from the road to doors, hydrants, etc.

a. Roads with design speed ≥ 55 mph. The offset distance of plant materials over 30 inches tall is at least 15 feet from the centerline of access doors and hydrants.

Additional offset distance is required to improve visibility and access when fire hydrants or hydrant signs are installed on the noise barrier.

Minimal offset distance may be required to maintain visibility when fire hydrants and hydrant signs are installed closer to the roadway.

b. Roads with design speed < 55 mph. The offset distance of plant materials over 30 inches tall is at least 10 feet from the centerline of access doors and hydrants.

9.7-H Maintenance & Construction Concerns. Noise barriers are often constructed in areas where high traffic volumes, limited right-of-way, or limited access complicate landscape installation, establishment, and maintenance.

Consideration of these factors during design often reduces problems during construction, and reduces future maintenance needs.

9.7-I Mulch for Planting Beds. Noise barrier landscaping is often installed where there is little access for maintenance activities. Landscape designs that increase planting densities and reduce mowing requirements are usually appropriate for these areas.

Shredded Hardwood Bark Mulch (SHB) is the standard mulch for planting pits and planting beds, but stone mulch such as gravel, cobbles, or crushed stone may be installed where a more durable mulch is desired, or where runoff may erode SHB.

Stone mulch is also used in “empty beds” without plant materials, or under guardrails to reduce needs for weed control. The use of stone mulch requires a SP to define the materials and installation.

9.7-J Mulch Offset Distance. In locations where mowing access is limited or landscaped areas are narrow, mulch is specified as follows:

9.7 Noise Barrier Design Principles, continued...

Table 9.7-J Mulch Offset Distance to Noise Barrier

Area	Mulch	Offset Distances*
Closed or Open Section Without Traffic Barrier	Shredded Hardwood Bark	Closed Section: SHB mulch may be specified from curb edge to face of noise barrier. Open Section: Turfgrass is specified from 6 to 12 ft from pavement edge, then SHB mulch is specified to face of noise barrier.
	Crushed Stone	Closed Section: Crushed stone may be specified from curb edge to face of noise barrier. Slope grades ensure that stone is not able to move onto paved areas. Open Section: Turfgrass is specified from 6 to 12 ft from pavement edge, except where extending crushed stone to edge of paving is needed for erosion control. Then crushed stone may be specified to face of noise barrier.
	Creek or River Stone	Closed Section: Creek or river stone may be specified from curb edge to face of noise barrier. Slope grades ensure that stone is not able to move onto paved areas. Open Section: Turfgrass is specified from 6 to 12 ft from pavement edge, then creek or river stone may be specified to face of noise barrier.
Concrete Retaining Wall or Traffic Barrier	Shredded Hardwood Bark	SHB mulch is specified from edge of concrete retaining wall or traffic barrier to face of noise barrier.
	Crushed Stone	Crushed stone is specified from edge of concrete retaining wall or traffic barrier to face of noise barrier. Slope grades ensure that stone is not able to move onto paved areas.
	Creek or River Stone	Creek or river stone is specified from edge of concrete retaining wall or traffic barrier to face of noise barrier. Slope grades ensure that stone is not able to move onto paved areas.
Closed or Open Section W-Beam or Cable Traffic Barrier	Shredded Hardwood Bark	Turfgrass is specified from curb or pavement edge to traffic barrier, and 6 to 12 ft behind traffic barrier, then SHB mulch may be specified to face of noise barrier.
	Crushed Stone	Open Section: Turfgrass is specified from pavement edge to traffic barrier, except where extending crushed stone to edge of paving is needed for erosion control; then crushed stone may be specified to face of noise barrier. Closed Section: Crushed stone may be specified from curb to face of noise barrier. Slope grades ensure that stone is not able to move onto paved areas.
	Creek or River Stone	Open Section: Turfgrass is specified from pavement edge to traffic barrier, then creek or river stone may be specified under traffic barrier to face of noise barrier. Closed Section: Creek or river stone may be specified from curb to face of noise barrier. Slope grades ensure that stone is not able to move onto paved areas.
* Note: Mulched areas are the minimum required to meet landscaping objectives. Turfgrass and Meadow Establishment are preferred where mowing is feasible; Shrub Seeding is preferred where maintenance access if difficult.		

9.8 Roundabouts. This Chapter is under development.

9.9 Streetscapes.

9.9-A Introduction. Streetscape projects go beyond vehicular and pedestrian safety upgrades to include improvements to streetscape elements such as sidewalks, street trees and landscaping, lighting, signage and street furniture.

Streetscape projects require a balance between the needs of the community and other demands for space within the ROW. However, streetscapes also provide opportunities for design detail that are often impractical for high-speed roads.

Effective streetscape design accommodates pedestrians, traffic and parking, aboveground and buried utilities, lighting levels, business and roadway signs, constricted planting areas, compacted soils, pollution, winter salt application, and the impacts caused by foot traffic, parking, bus stops and loading zones.

The publication "When Main Street is a State Highway" of LDG-11.24 and the SHA Community Design Division are important resources for SHA streetscape design.

9.9-B Community Involvement.

1. **During Design.** Community involvement during design of streetscapes is a routine aspect of design. Refer to LDG 6.0.

2. **Maintenance Agreements.** The degree of future maintenance may vary greatly between agencies and from place to place. The likely maintenance determines how hardscape, street furnishings and plant materials are selected and installed RIPD will assist with other issues such as safety, work zone traffic control, surety, liability, insurance, etc.

9.9-C Utility Conflicts. The offset distances for trees and shrubs height of trees and shrubs under and adjacent to aboveground utilities are discussed in LDG 5.0.

9.9-D Soil Quality and Planting Volume. Since most tree roots grow within 18 inches of the soil surface, the presence of sufficient soil volume and quality is verified during Preliminary Investigation.

Where trees are specified in highly compacted soils such as abandoned roadbeds after pavement removal, subsoil and topsoil is replaced or added as necessary to ensure tree survival and growth.

While larger soil volumes and good soil quality improves the survival of street trees, it is also important to install species that will not quickly outgrow the available planting area. Trees with surface roots such as Red Maple, or large root flares such as

American Elm may not be suitable for constricted planting areas, especially those adjacent to sidewalks.

Trees with root systems that are sensitive to soil compaction, or that require large areas to thrive such as American Beech, are not suitable for streetscapes. The planting pits of most trees are at least 36 feet^2 (6 feet x 6 feet, or approximate).

Root channels, aeration devices, or other systems to promote root growth below paved areas are installed when planting pits are less than 40 feet^2 or where soil is poorly drained, compacted, or clayey.

9.9-E Street Trees. Street trees filter pollutants, provide shade, reduce thermal impacts, absorb sound, and generally improve the appearance of neighborhoods.

1. **Formal Design.** Although regularly spaced, symmetrical tree plantings are often desirable, existing street trees may not fit within a rigid design scheme, and all trees must accommodate signs, lighting, utilities, and highway clear zones.

   As such, a strictly formal approach to landscape design may be neither practical nor possible. In some locales, limited ROW width, utilities, extensive hardscaping and other restrictions may preclude installation of street trees throughout much of the highway corridor. In those areas, plantings of groups of trees along the road corridor in locations where area permits may be a more feasible alternative.

2. **Preferred Species.** The challenging conditions of streetscapes require careful selection of tree species to minimize future problems and maximize the chances of survival of new tree plantings. Street trees preferred by SHA are designated STS, STM, and STL in the PPL.

   Multistemmed or low branched trees may be suitable under utility wires, but not close to sidewalks, travel lanes, or parking areas unless their size and height will allow the lower branches to be removed without harm to the trees. These trees may also obscure sightlines more than single-stemmed trees when planted near driveways, crosswalks, intersections, or near traffic control signs or signals.

   Small trees with upright or narrow vase-shaped branching may be the best-suited for narrow spaces with aboveground utilities.

3. **Native Species.** Although native species are preferred for most roadside landscaping, selected cultivars are often appropriate for improved survival, maintainability and aesthetics.

   Context is often an important factor in the selection of native trees or cultivars. Some counties and municipalities may require native plants throughout their jurisdiction, or only in ecologically sensitive areas. However, the installation of locally native species is most appropriate for sites adjacent to natural areas.

4. **Availability.** Because construction delays or substitutions may be caused when trees are not locally available in the specified quantity at the time of installation, it is important that trees that are not commonly available in the trade be specified in limited quantities.

   If the cultivar or specified form is atypical or requires unusual production methods, such trees are avoided because they may not be available at the time of construction.

9.9-F Turfgrass. Turfgrass Sod Establishment is preferred to Turfgrass Establishment (seeding) for projects with decorative paving, fixtures, street furnishings, etc. Refer to Section 708 of the Estimating Manual. Large areas are usually seeded, as are areas where slopes are too steep for sod installation.

9.9-G Planting Beds. The context and maintenance regimes of streetscapes allows more complex planting designs than highways.

Planting beds of shrubs, perennials, ornamental grasses, and groundcovers adjacent to pedestrian walkways provide aesthetic interest and may provide additional screening between the streetscape and adjacent properties, when maintenance agreements are developed with adjoining property owners or community groups. Planting beds may be specified to protect tree plantings from pedestrian traffic or mowing damage, to reduce mowing requirements on steep slopes, or to provide screening where tree plantings are not feasible.

In lower speed residential areas where there is insufficient space to install trees between the curb and sidewalk, it may be appropriate to install the sidewalk adjacent to the curb and install the trees at 3 feet beyond the sidewalk.

Where the offset between the curb and the sidewalk is narrow, turfgrass or hardscape are the most appropriate options.

Installing trees where there isn't room for them to grow may create maintenance problems and rarely produces the tree-lined street envisioned during the planning process.

Streetscape planting beds are often subject to harsh growing conditions. Plants may be damaged by pedestrian and vehicular traffic, limited soil volumes, soil compaction, urban pollutants, salt, drought and poor drainage. Hardy and abuse-tolerant plants are specified for best survival, although other selections may be appropriate under less demanding conditions.

9.9-H Hardscape Materials and Other Elements. Tree grates are installed when street trees are surrounded by paving on at least 3 sides. Tree grates are matched to the species, and modifiable to accommodate tree growth.

Tree lawns are installed where pedestrian traffic is not excessive. Special root protection measures such as unit pavers, raised sidewalks, cobblestone may be appropriate.

Other structural elements such as gateway treatments, community signage and context sensitive street furnishings may be appropriate for consideration.

For most projects, however, the selection and design of appropriate hardscape materials is often the most costly and challenging factor in streetscape projects. The context, type of materials, and future maintenance of hardscape materials all impact the selection and installation of hardscaping.

Context: Consider historic, urban / rural / suburban context, existing landscaping to remain, architectural materials and scale when selecting hardscape.

Type: Hardscape may consist of unit pavers (concrete, asphalt, or clay), stamped concrete, finished concrete, or asphalt. Much depends upon the context and budget, as well as the width, extent, and intensity of use of the paving.

Maintenance: Consider maintenance concerns in areas where subsurface infrastructure may require access. Also consider additional offset distance to structures or hardscape to avoid foundation damage by roots, and to limit pruning and other maintenance as trees mature.

9.9-I Safety & Security. It is important to maintain the view of pedestrians to traffic, and to maintain the view of motorists to pedestrians preparing to cross at both pedestrian and vehicular intersections.

Shrubs and herbaceous plants are installed within median noses per LDG 7.6. The offset distance may increase due to median grading, horizontal or vertical curves of the roadway, and other factors affecting sight distance.

Vegetation that could provide hiding places close to sidewalks, bus stops and other walkways is avoided in urban and suburban areas. Required offsets vary according to local regulations and transit organizations.

Shrub plantings may be specified to discourage mid-block pedestrian crossings and passage across steep slopes. Flowering shrub species that attract bees and wasps are evaluated according to adjacent uses.

Vehicular, bicycle and pedestrian clear zones and sightlines are maintained at intersections and where otherwise necessary.

9.9-J Maintenance. The layout and design of planting beds reflect the maintenance expectations. Planting beds require mulching, weeding, and pruning to maintain an attractive appearance, and cost much more per SY than turfgrass. Shrubs that can grow together densely without pruning are preferred.

When full or supplemental maintenance responsibilities by others are included in an MOU or other formal document, additional plant materials, furnishings and other landscaping may be appropriate if the community has the means to maintain it.

Flowering bulbs provide added seasonal color when installed in masses. Crocus may be installed in turfgrass, but Daffodils do not tolerate mowing before June and cannot be installed in turf areas unless an un-mowed appearance is acceptable.

Installation of flowering bulbs in planting beds is often successful. However, bulbs installed in dense plantings of shrubs, ornamental grass or Liriope may not survive.

Planting beds installed in areas impacted by snow removal stockpiles require species able to tolerate salt and the weight of snow.

9.10 Facilities.

9.10-A Introduction. Several different types of facilities are constructed along the highway system. Facilities owned by SHA often include specialized structures and parking lots. In addition to varying by rural, suburban, and urban settings, facilities vary widely in orientation from industrial, to semi-public and fully public uses.

Very often, the development of SHA facilities follow a more traditional site design approach, and sometimes require conformance with different laws and regulations than roadway projects. Facility projects also may involve safety and security measures that are rarely considered during highway design.

9.10-B Design and Build Options. The construction of new facilities often involves the Design-Build process for design development and construction, while modifications to existing facilities may be design-build or the traditional Design-Bid-Build process.

The design principles of the LDG are generally used for concept development and evaluation of Design-Build contracts as well as Design-Bid-Build contracts.

9.10-C Salt Domes and Communication Towers. Landscaping around communication towers may be necessary to screen unattractive buildings containing electrical transformers and ground-level communications equipment. It is not practical to plant large trees in close proximity to communication towers. Screening for towers in remote locations or in wooded areas is not typically necessary, though tree planting to mitigate tree impacts may be required.

9.10-D Maintenance Shops and Weigh Stations. Landscape Design for maintenance shops is typically consists of screening from adjacent properties, stormwater management facility planting, and low-maintenance landscaping around the building and in parking areas where feasible.

Salt Domes and Brine Tanks at Maintenance Shops and in satellite locations create a hostile environment for vegetation. Landscaping is provided for screening of domes where feasible, and in SWM facilities adjacent to facilities.

High concentrations of salt will prevent the growth of vegetation in areas such as a drainage swale from a salt dome. Even salt-tolerant plants cannot survive without measures to reduce salt runoff.

9.10-E Offices and Laboratories. SHA Offices and Laboratories are landscaped to provide screening, and to create an attractive work environment. These facilities may have landscape areas for use by employees during lunch or for other outdoor activities.

The landscaping of offices and laboratories typically requires more maintenance than roadsides, as these facilities often provide public meeting space.

The parking areas and stormwater management facilities of offices and laboratories provide additional opportunities for shading, and the removal of sediment and pollutants.

9.10-F Welcome Centers and Rest Areas. Welcome Centers and Rest Areas often provide added benefit as outreach centers, serving as locations to educate highway users. Pedestrian landscapes, often including scenic views, picnic areas and playgrounds, provide an added challenge and additional technical expertise not as common on typical highway projects.

9.10-G Park & Rides. SHA maintains many park & ride facilities, and the number has increased in recent years as a strategy to encourage car pooling and transit use while reducing rush-hour congestion and the need to widen roads.

Site constraints and functional needs determine lot layout and size. Stormwater management needs may also limit the area that may be paved or hardscaped.

Adjacent uses can result in additional design requirements, e.g. additional landscape screening for facilities located adjacent to a National Scenic Byway. Adjacent land uses and aesthetic design considerations are evaluated early in the design process to minimize the need for major changes or redesign in later stages of project development.

1. **Planning.** Park & rides that are not constructed as part of a linear highway project are regulated under the Maryland Forest Conservation Act (FCA) rather than the Maryland Reforestation Law.

9.10-G Park & Rides, continued...

Projects that are regulated under FCA require a longer approval process by DNR, including a public comment period. Thus, the FCA process is begun early in project planning to avoid delays in Advertisement or Construction. Projects exempt under FCA may still be required to comply with the Roadside Tree Law.

2. **Safety, Security and Visibility.** Where feasible, park & ride designs separate car, bus, and pedestrian traffic to minimize conflicts and increase safety. Park & ride landscaping allows visibility for motorists and other users, and discourages criminal activity by employing the techniques of Crime Prevention Through Environmental Design (CPETD) that have been used to reduce the incidence of crime in public spaces.

   While thefts and other crimes are often reduced in locations with good visibility, surrounding land uses also influence criminal activity. Landscaped areas designed with CPETD principles minimize the locations where criminals can hide near parked cars.

   - Views into park & rides from adjacent highways are retained where screening is provided.
   - Shrubs and perennial plants that reach a height over 3 feet are not specified within 6 feet of parking spaces or pedestrian walkways.
   - Screening between park & ride lots and highways allows sufficient visibility into the lot.
   - Breaks in landscape screening between the lot and adjacent properties are not required, but hiding locations are minimized.
   - Site grading may require additional restrictions of landscaping to reduce opportunities for criminal activity.

3. **Turfgrass and Groundcovers**. Park & ride parking islands are typically planted with turfgrass that is regularly mown for aesthetic and safety reasons.

   In high visibility locations such as park & rides, specification of turfgrass sod rather than turfgrass establishment (seeding) is appropriate. Sod provides very rapid soil stabilization and safer walking surfaces than seeding.

   Other heat and drought-resistant groundcovers may be appropriate in planting islands, although turfgrass is usually preferable in these locations.

9.10-G Park & Rides, continued...

4. **Planting Beds.** The installation of planting beds is minimized at park & ride facilities except in urban areas or where necessary to provide screening.

   a. **Shrub beds** are offset from the edge of paving or curb to allow for snow storage in regions with heavy snowfall.

   b. **Perennial beds** and ornamental grass beds have greater maintenance needs than shrub beds, and are only installed where future maintenance will provided. SHA will not provide this maintenance.

5. **Trees.** Large and medium trees provide shade, filter vehicle emissions and stormwater, and enhance the appearance of park & ride lots. Careful placement during the design of park & rides is essential for long-term tree survival.

   Trees in parking lots are subject to harsh temperatures reflected off cars and paved surfaces and suffer from soils compacted by pedestrian traffic, drought conditions in raised planting islands, and damage from vehicles.

   Tree are specified as follows:

   a. **Tree planting islands** have a minimum planting area of 8 feet in the narrowest dimension, and are usually at least one car parking space in length (18 feet). Large trees are installed in areas with sufficient soil volume for root development.

   b. **Trees are set back** at least 4 feet from the back of any curb, with a minimum of 6 feet is required from any curbed drive aisle. Larger offsets may be required for locations adjacent to bus or truck accessways.

   c. **Offset distance** of trees from the edge of pavement in open section islands is least 6 feet. Barrier placement may be required to deter parking in uncurbed planter islands in park & ride lots that typically operate at capacity or beyond.

   d. **Mature growth of evergreen trees** used for screening is at least 6 feet away from pedestrian walkways and parking area edges. White Pines are not installed where the canopy will cover parking areas.

   e. **Parking lot lighting** is coordinated with tree locations. It may be necessary to place lighting bases outside of planting islands where there is insufficient area for trees and lighting. Lighting placed along outside edges of the lot can be set in between proposed trees to minimize conflicts.

f. **Thorny trees** such as Holly and Hawthorn are appropriate when specified where they will not be hazardous to pedestrians or bicyclists.

g. **Lighting wire** is buried at sufficient depth to allow for tree installation above the wire, or the lighting wire is specified along the edges of island planting beds where trees are specified.

Chapter 10.0 - Landscape Estimating

10.1 Introduction.

This information is primarily applicable to the OED Project Manager.

Detailed information about Category 700 - Landscape Category Code items which are used to develop SHA construction contracts, and which are summarized in the Schedule of Prices of the IFB and shown in the Engineer's Estimate, are explained in the Estimating Manual.

The order of Chapter 10 represents the chronological stages of estimating that are completed from initial project development to project advertisement by the OED Project Manager. Formal processes for estimating the cost of project design and the materials required for project construction are completed throughout the course of project development.

10.2 Project Scope Worksheet.

Format and Contents. The Landscape Project Scope Worksheet is LDG 11.2-A, and provides a very "rough estimate" of materials costs, since many details of the project are not yet known.

The Worksheet estimates the total cost of a landscaping project, including time costs for plan preparation and other preliminary engineering costs, as aggregated costs of landscape materials required to construct the project.

Submission. The Worksheet is completed and submitted as directed in LDG 2.2-A.

10.3 Landscape Estimate Worksheet - 15% Completion.

Format and Contents. The "Landscape Estimate Worksheet - 15% Completion" is LDG 11.2-B, and provides a more accurate estimate of project materials costs.

The Worksheet estimates the total cost of a landscaping project with more refined, analysis of the plants, hardscape, signs, furniture, etc. required to construct each of the Concept Design Alternatives submitted for review.

Variations & Submission. One Worksheet is completed and submitted for each Concept Design Alternative, as directed in LDG Table 2.6-B.2.

10.4 Landscape Estimate Worksheet - 30% Completion.

Format and Contents The "Landscape Estimate Worksheet - 30% Completion" is LDG 11.2-C.

The Worksheet estimates the total cost of the Concept Design approved for the Preliminary Engineering stage of project development, and includes analysis of materials required to construct the project.

Submission. The Worksheet is completed and submitted as directed in LDG 2.7-A.3.

10.5 Estimate for Semi-Final Review - 60% Completion.

10.5-A Preparing Engineer's Estimate. The Engineer's Estimate developed for the Semi-Final Review is produced using Trns*Port, and follows standard SHA protocols for project estimating. The estimate uses the same format as the Engineer's Estimate for the Final and PS&E Reviews.

The Engineer's Estimate for the Semi-Final Review, Final Review and PS&E Review is developed concurrently with plans and specifications for the project.

All Landscape Category Codes that are anticipated for construction are included in the Semi-Final Estimate with Quantities and Unit Prices developed from the LDG and Estimating Manual of LDG 11.13.

The Estimating Manual includes information about the Category Code Items required to develop the Engineer's Estimate for all Category 700 Items except the two Items discussed below, which involve trees, shrubs and planting beds that are discussed in the LDG.

10.5-B 710150 Tree, Shrub, and Perennial Installation and Establishment LS This Item is a single combined cost of trees, shrubs, vines, ornamental grasses, and perennial plant materials installed per Section 710, based upon the prevailing cost to install each plant.

Incidental Costs. The cost of mulch, fertilizer, water, etc. required to complete the Installation Phase and Establishment Phases are incidental to this Item, as specified in 710.04.01.

Establishment Phase. The Establishment Phase involves maintenance care and replacement for 12 months after Installation Phase Acceptance. Establishment Phase operations are specified in 710.03.22.

Planting Beds. The costs of compost, rototilling, edging, berming, mulch and other operations required to install planting beds are not included in this item, but in 710170 Constructing Planting Beds SY.

Quantity. The specified number of plants is reported in plant lists, plans, or Contract documents as necessary, but the Quantity of this Item in the Engineer's Estimate is always "1.000" since it is a lump sum.

10.5-C 711100 Annuals and Bulbs Installation and Establishment LS This Item is a single combined cost of annual plants and bulb plant materials installed per Section 711, based upon the prevailing cost of installation.

Incidental Costs. The cost of mulch, fertilizer, water, etc. required to complete the Installation Phase and Establishment Phases are incidental to this Item, as specified in 711.04.01.

Establishment Phase. The Establishment Phase involves maintenance care and replacement for one planting season after Installation Phase Acceptance. Establishment Phase operations are specified in 711.03.17.

Planting Beds. The costs of compost, rototilling, edging, berming, mulch and other operations required to install planting beds are not included in this item, but in 710170 Constructing Planting Beds SY.

Quantity. The specified number of plants is reported in plant lists, plans, or other Contract documents as necessary, but the Quantity of this Item in the Engineer's Estimate is always "1.000" since it is a lump sum.

The Schedule of Prices (SOP) developed for the IFB is developed from the Engineer's Estimate.

10.6 Estimate for Final Review -90% Completion.

The Engineer's Estimate for Final Review is developed from the Semi-Final Review Engineer's Estimate. The Estimate includes all Category Code Items, Quantities, Unit Costs and Estimated Quantities required to construct the project.

10.7 Estimate for PS&E Review - 100% Completion.

The Estimate for PSE Review is the same as the Engineer's Estimate produced for Final Review, including any corrections made after the Final Review Meeting.

The PS&E Engineer's Estimate meets FHWA Guidelines for Federally-funded projects, and includes all Category Code Items, Quantities, Unit Costs and Estimated Quantities required to construct the project.

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Chapter 11.0 - Appendices

The numbers and names of the Appendix correspond to the electronic files of the online "SHA Landscape Design Guide". GREEN CAPITALS TEXT indicates different categories of documents.

CHECKLISTS & WORKSHEETS - OED

11.1 LDG Landscape Design QA Checklists. Includes worksheets used by the Project Manager for OED Capital Projects Development (LDG 2.0), and by the OED Liaison for Non-OED Projects (LDG 3.0).

A. QA-15 Design Concept Review Checklist

B. QA-30 PE Review Checklist

C. QA-60 Semi-Final Review Checklist

D. QA-90 Final Review Checklist

E. QA-100 PS&E Review Checklist

11.2 LDG Landscape Estimating Worksheets. Includes worksheets used by the Project Manager for OED Capital Projects Development (LDG 2.0), and by the OED Liaison for Non-OED Projects (LDG 3.0).

A. Landscape Project Scope Worksheet

B. Landscape Estimate Worksheet - 15% Design

C. Landscape Estimate Worksheet - 30% Design

PROJECT FUNDING, PERMITS, MITIGATION, LAWS

11.3 SHA Landscape Project Documents. Includes various documents used for OED Capital Projects management and contract development.

A. Project Identification Form (PIF)

B. Form 42-25C Completion Instructions & Sample Form 42

C. Form 30 Completion Instructions & Sample Form 30

D. MOU and MOA Forms

11.4 SHA Landscape Permit Documents. Includes various documents used to develop landscape construction contracts.

A. Roadside Tree Permit

B. Reforestation Site Review

C. Forest Stand Delineation

D. Forest Conservation Act Exemption

E. Forest Conservation Act Application

11.5 **Critical Area Calculations and Worksheet.** Includes documents used to calculate mitigation requirements within the Chesapeake and Atlantic Coastal Bays Critical Area (Critical Area).

11.6 **Reforestation Act COMAR § 5-103.** This is the language of the Maryland Code regarding the Forest Conservation Act (FCA).

STORMWATER MANAGEMENT, EROSION AND SEDIMENT CONTROL

11.7 **SHA Highway Drainage Manual**, including all guidelines and supplements as well as CADD standards. A valuable reference. Contact HHD for additional information.

11.8 **MDE 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control.** Current standards of the Maryland Department of the Environment. A revised edition is expected in 2012.

11.9 **MDE Maryland Stormwater Design Manual, Vol. 1 & 2.**

11.10 **Stormwater Management Guidelines for Federal and State Projects.**

SPECIFICATIONS, POLICIES, GUIDELINES

11.11 **SHA Specifications and Special Provisions.** Includes the 2008 Standard Specifications for Construction and Materials; approved Special Provisions Inserts (SPI) which replace sections of the 2008 Specifications; and a library of Special Provisions (SP) for project-specific landscape contract specifications.

11.12 **SHA Environmental Guidelines for Construction.** A valuable reference released in September 2010. Contact the OED Environmental Programs Division for additional information.

11.13 **SHA Accessibility Policy & ADA Guidelines.** Design standards for sidewalks and ADA accessibility.

11.14 **SHA Roundabout Policy.** Recently adopted standards for design and landscaping of highway roundabouts.

11.15a **SHA Utility Coordination Policy Guidelines.** A valuable reference document.

11.15b SHA Utility Policy March 1998. Obsolete and under revision. Contact OED for guidance when utility construction will impact Scenic Byways, Chesapeake Bay Critical Area, SHA-maintained landscape areas, and other sensitive areas. Refer to SHA Environmental Guide for Access Permit Applicants.

11.15c SHA Environmental Guide for Access Permit Applicants April 2013 (Environmental Guide**).** Provides guidance regarding environmental concerns and standards for preparation of landscape plans in conformance with OED standards.

11.16 AASHTO Guidelines. Intersection Sight Distance Guidelines and Vegetation Management Guidelines.

STANDARDS, CATEGORY CODES, PLANT MATERIALS, PRICES, PLAN SHEETS

11.17 SHA Book of Standards, Landscape Design. Includes illustrations and text which describes landscape installation operations performed by the Contractor, but which are not shown in landscape plan sheets.

11.18 SHA Highway Construction Cost Estimating Manual (Estimating Manual). Includes detailed landscape design and estimating information for Category Code Items associated with Category 700 - Landscaping. The Estimating Manual includes just the portion related to landscaping.

11.19 SHA Preferred Plant List PPL & Other Lists. Plants specified in SHA contracts conform to the species and cultivars of the PPL. The requirements of the MAA plant list as well as the DNR "Do Not Plant List" have been incorporated into the PPL. Both lists are provided for reference.

11.20 ANSI Z60.1 - 2014 Nursery Standards. These standards are those adopted by SHA to define the height, caliper, container size, and other specifications of trees, shrubs, and other plant materials.

11.21 SHA Price Index. Includes the cost of Category Code Items of recently awarded SHA construction contracts. The past several years are included in this appendix. Note: the Unit Prices of the Estimating Manual are weighted averages derived from the SHA Price Index.

As discussed in the Estimating Manual, the Unit Price of Engineer's Estimate varies from project to project. The SHA Price Index shows the variation of Unit Prices for contracts in different parts of the state, over several years.

11.22 LDG Sample Landscape Plan Sheets. Sample plan sheets are under development. The Landscape Architecture Division will provide CADD files of landscape plans to illustrate accepted design principles.

CONTEXT SENSITIVE SOLUTIONS

11.23 OED-LAD Maryland Byways - Context Sensitive Solutions. An excellent document with many good photos.

11.24 SHA When Main Street is a State Highway. Interesting reference reading.

11.25 OED-LAD Md. Historic National Road - Context Sensitive Solutions. An excellent document with many good photos.

11.26 DelDOT Enhancing Delaware Highways. An outstanding landscaping guide for areas that are similar to Southern Maryland and the Eastern Shore.

VEGETATION MANAGEMENT

11.27 SHA Integrated Vegetation Management Manual for Md. Highways. IVMM. An extensive reference, but some parts are obsolete and under revision. Contact the LOD Technical Resources Team for information.

11.28 SHA Vegetation Management Policy. The policy of the SHA Chief Engineer is provided. Contact the LOD Technical Resources Team for more information.

11.29 SHA Environmental Guidelines for Maintenance. Generally obsolete. Contact the LOD Technical Resources Team for more information.

Revision History
SHA Landscape Design Guide

August 22, 2012

November 1, 2013

February 26, 2014

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The End