



GHE CAD Manual

**Delivery & Operations Division | Engineering &
Technical Services Branch**

May 2023

Acknowledgement

This manual is presented as a team effort, working together in collaboration to create a comprehensive set of CAD instructions. The team for this manual consists of people who gave of themselves to this project with their time, energy, and expertise.

Many thanks to the Geotechnical, Hydraulic and Environmental Program Leads, the members of the CAD Standards Committee, and ODOT designers and CAD Technicians for their expert contributions to making this manual a reality.

Suggested modifications to this document can be submitted to the [GHE Drafting Program Leader](#) who supports the Geotechnical Engineering and Engineering Geology Section, the Hydraulic Engineering Section and the Environmental Section.

We are pleased to share the GHE CAD Manual as the established document of drafting standards for the many disciplines represented, and for use on ODOT public work projects.

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Part 100 Preface and Introduction

Section 100.1 Preface

The Geotechnical, Hydraulics and Environmental (GHE) CAD Manual is part of the suite of discipline specific CAD Manuals provided by the Oregon Department of Transportation (ODOT). The GHE CAD Manual includes instructions, procedures and standards for developing and preparing final plans for Geotechnical, Hydraulics, Roadside Development and Erosion and Sediment Control portions of ODOT's project plans. This manual is in addition to the ODOT CAD Manual (OCM). The OCM provides an overview of ODOT's universal standards, policies, and procedures used by all disciplines to prepare ODOT project plans. Both manuals provide the standards used in the preparation of plans using Computer Aided Drafting (CAD) in MicroStation format. ODOT staff, consultants, and outside agency personnel are to use the OCM and the GHE manuals together in the development of ODOT's project plans regardless of the CAD software used.

This manual is a work in progress and will continue to grow as sections are added and content is completed. Updates to the completed sections will occur at periodically scheduled intervals. Edits are shown highlighted in yellow until the next update. During each update the old edits become permanent and new edits are yellow highlighted.

The procedures and drafting requirements described have been developed for and by the individual disciplines included, and have been vetted by region staff and stakeholders across the state.

ODOT requires all plans be prepared to the standards provided for each discipline. Please share standards modification requests with the appropriate GHE program leader for that discipline or with the CAD Program Leader. Contact information is located on the [Geo-Environmental Webpage](#).

All users are encouraged to submit questions or requests for revisions by contacting the GHE CAD Standards Program Leader at 503.986.3380 or by email at kim.e.taylor@odot.oregon.gov.

Section 100.2 Introduction

The intent of this manual is to provide policies, procedures and discipline specific CAD and drafting standards to use in the development of project plan sheets specific to each individual sub-discipline within ODOT's Geology\Geotechnical, Hydraulics, and Environmental fields.

The GHE CAD Manual consists of separate parts for each discipline. Each discipline specific part will include an *overview* section describing the information covered, a *development* section describing the standards to use in the setup of plan sheets, a drafting *check list*, and finally a link to *example drawings*.

Overview — explains ODOT’s intended purpose for and process used to produce that particular portion of the project plans.

Development — gives detailed instruction for developing that particular portion of the project plans. Included are procedures and standards used for the creation of plan sheets.

Check List — provides the designer/CAD Technician a means to check and verify that all required elements are included on the plan sheets.

Example Drawings — the example drawings are provided as a guide for developing final Project Plans. Not all project scenarios are covered. These drawings are taken from as-constructed plans, reviewed for accuracy and readability, and updated to meet current design and drafting standards. Always rely on the MicroStation workspace for the most current standards. When the example drawings do not provide clear direction, and/or the CAD standards are in question contact the GHE discipline specific program lead, and the GHE drafting program lead, for help in resolving standards issues. [Contact information](#).

The discipline specific parts of this manual are published as they are developed. Some of our disciplines may currently have a technical bulletin to describe CAD and drafting standards, and some are still in need of standards documentation. See our website for links to the current technical bulletins. Eventually the information in the bulletins will be added to this manual, and the bulletins will then be rescinded.

CAD information that pertains to all the disciplines in this manual are described in Part 200 - General Drawing Information. Refer to this when setting up your sheets.

The other parts of this manual provide discipline specific instruction for your project plans.

In conjunction with this manual you will need to adhere to ODOT’s universal standards, policies, and procedures described in the [ODOT CAD Manual \(OCM\)](#). The OCM is used in combination with this and all other discipline specific CAD Manuals.

It is the user’s responsibility to ensure they are using the latest version of any standards document. Always check the web pages referenced in this document, as well as in the OCM, for the latest information and updates.

Section 100.3 References

ODOT CAD Manual

<https://www.oregon.gov/odot/Engineering/Pages/Drafting.aspx>

Roadway CAD Manual

<https://www.oregon.gov/odot/Engineering/Pages/Drafting.aspx>

Bridge CAD Manual

<https://www.oregon.gov/odot/Bridge/Pages/Bridge-Design-Manual.aspx>

Traffic Control Plan Design Manual

<https://www.oregon.gov/odot/Engineering/Pages/TCP-Manual.aspx>

Erosion Control Manual

<https://www.oregon.gov/odot/GeoEnvironmental/Pages/Erosion-Manual.aspx>

Erosion Control Field Manual

<https://www.oregon.gov/odot/GeoEnvironmental/Pages/Erosion.aspx>

Roadside Development Design Manual

https://www.oregon.gov/odot/GeoEnvironmental/Docs_Environmental/Roadside_Development.pdf

Geotechnical Design Manual

<https://www.oregon.gov/odot/GeoEnvironmental/Pages/Geotech-Manual.aspx>

Hydraulics Manual

<https://www.oregon.gov/odot/hydraulics/pages/hydraulics-manual.aspx>

Oregon Standard Drawings & Oregon Standard Details

https://www.oregon.gov/ODOT/HWY/ENGSERVICES/pages/standard_drawings_home.aspx

Oregon Standard Specifications for Highway Construction

https://www.oregon.gov/odot/business/pages/standard_specifications.aspx

Part 200 General Drawing Information

Section 200.1 Overview

Part 200 General Drawing Information is a compilation of all the CAD and drafting standards that equally apply to the development of project plans for all of the GHE disciplines. Discipline specific information is provided in the individual discipline parts of this manual.

ODOT's project plans are part of the set of project documents required for highway projects. Project documents are prepared under the responsible control of the Professional of Record (POR) for the project. In the case of the GHE disciplines this can be:

- A Registered Engineer
- A Registered Landscape Architect
- A Certified Engineering Geologist
- Or other professional

ODOT's CAD standards are a work in progress and are continually being updated, added to, and revised according to changes made with regards to individual discipline industries, and the needs of the user.

For an overview of ODOT's project plans preparation, that encompasses all ODOT disciplines, see the [ODOT CAD Manual \(OCM\)](#).

Section 200.2 MicroStation CAD Workflows

ODOT's most current CAD standards are available in the MicroStation workspace. The standards elements are located within ribbon style CAD workflows that contain the tools applicable to each discipline. These tools provide a selection of the most up-to-date notes, text styles, symbols, line styles, line weights, levels, and cells, by discipline.

See the [Engineering Applications Support Team](#) site for more information about the ribbon style CAD workflows.

Note: It is the user's responsibility to ensure that the ODOT Workspace they are using is the latest version, before and during design of all projects. ODOT reserves the right to update the workspace and associated cells at any time. ODOT's workspace is automatically pushed out to all internal ODOT users on a regular monthly update interval. All users outside ODOT are responsible for updating their own ODOT specific MicroStation workspace on a regular basis. Please see [ODOT Workspace & Updates](#).

Section 200.3 File Naming Convention

All files must be named according to the approved conventions. Standardized naming conventions are provided in the ProjectWise “Naming Tool”. Staff is required to use the naming tool for all new documents. Instructions for using the tool are located in the ProjectWise User Manual located in the ProjectWise network.

The generic file name format is as follows:

OriginID_ProjectID_Filename_##.ext.

Section 200.4 Sheet Numbering and Sequencing

ODOT’s typical sheet arrangement and numbering system is described in the [OCM](#). Tables lay out the sheet order and sheet numbering system for each ODOT discipline.

The GHE disciplines are listed in the sequence they are to appear in a set of project plans, and are noted as to which sheet numbering series they fall into. The Environmental disciplines are in the “F” sheet numbering series, the Geology\Geotechnical disciplines are in the “G” series, and the Hydraulics disciplines are in the “H” series. Place plans in the same sequence as shown in the [OCM](#).

The OCM describes the components of our sheet numbering system, their meaning and how they are used. Our numbering system also provides the option to use a three digit numeric value to further group plan sheets, and is available to all Geo-Hydro and Environmental disciplines.

An example of using the 3 digit option could be for a project containing multiple retaining walls. Following the rules described in the [OCM](#), the option to use the three digit sheet numbering system for this project scenario are:

The first wall sheets are in the GB100’s

The second wall sheets are in the GB200’s

The third wall sheets are in the GB300’s

When using the three digit sheet numbering option, the notes and details sheets follow the plan sheets to which they pertain. If there are notes and details that pertain to multiple structures/features it is allowed to repeat them with each set. There is always the possibility that a different contractor may be building each wall, and having everything together for each is a benefit.

The three digit sheet numbering option is not required for projects with multiple structures/features. You are allowed the option of one or the other.

When using the two digit system for multiple structures/features, provide the plans for each in consecutive order according to where they appear in the project from beginning station to end

station. Follow the general rule of placing the notes and details sheets after all the plan and profile sheets, continuing with the sheet numbering series consecutively.

Details that pertain to more than one structure/feature must list, by name or number, all the structures/features to which they apply. Notes that pertain to multiple structures/features may be grouped together as one set and must say which structures/features they pertain to.

Section 200.5 Plans Sheet Order

GHE plan sets typically **begin with a plan sheet and end with a detail sheet**. Place sheets for location index, profiles, sections and cross-sections, notes, tables, and schedules after the plan sheet(s) and before the detail sheet(s). Profiles/Elevations and sections/cross-sections are placed on the plan sheet, or when space is limited, placed on a sheet following the plan sheet.

Location Index Sheet

Projects may require a **Location Index** sheet. Index sheets aid in locating the appropriate information for larger projects with multiple structures/features/facilities. For example, a project containing multiple retaining walls, or multiple culverts, will need an index sheet showing the location of each specific feature along the length of the project, including discipline specific elements such as the boring locations and their identification numbers. The location index sheet includes the identification number (DFI or Structure #) for all features shown (i.e. retaining walls, culverts, Stormwater treatment facilities, boring holes, etc.).

The position of a **Location Index** sheet for each discipline falls first in the plan set. For projects with stand-alone disciplines, the *"Location Index"* follows after the *"Title"* and the *"Index of Sheets"* sheet (or sheets).

Clearly label reference to each plan sheet containing that structure/feature/facility throughout the project plan set. Each structure/feature/facility plan sheet within the set refers to the *"Location Index"* sheet when used.

Section 200.6 Sheet Naming

Sheet names (titles) are determined by the discipline and the sheet content. The standard sheet names are provided in models, by discipline, within the titleblock seed (Seed_titleblock.dgn). The sheet titles are located on separate levels to be turned on or off according to which sheet name is appropriate for that sheet.

Section 200.7 Standard Text

ODOT's standard fonts for project plans are Lucida Sans Unicode and Franklin Gothic Medium. The standard text styles are available in the text tools within the MicroStation workspace.

Three standard ODOT text styles are used on project plan sheets:

- ODOT Notes
- ODOT Subtitles
- ODOT Titles

Detail titles are accessed in the **“Items for Detail Sheets”** ribbon group, in the **“Old in Design Models Method”** ribbon tab, in the “ODOT Plan Sheet Creation” workflow. Styles are set up by primary, secondary and minor titles. All GHE disciplines use the titles “without underlines” only.

See the [OCM](#) for more information regarding standard text styles, sizes and where to use them.

Section 200.8 Dimensioning

Use the MicroStation dimension tools to dimension a drawing. Standard dimension styles are provided in the ODOT workspace. Dimensions are always read from the bottom or the right side of the sheet.

Stacked fractions are the standard for the GHE disciplines. If you find an occasion where a stacked fraction is not readable, providing unstacked fractions is acceptable. Be consistent within the discipline plan set. If one fraction is unstacked, show all fractions unstacked.

Place labels with leaders as close to the element as possible. Place leader arrows to exact points on the element and keep the area around arrowheads clear of unnecessary graphics. See the [OCM](#) for further information regarding ODOT’s dimensioning standards.

When there is no applicable ODOT standard then resort to industry standards for dimension rules.

Dimensioning mistakes to avoid:

- Crossing a dimension line with an extension line or note leader.
- Duplication
- Use of unnecessary words

Section 200.9 Custom Linetypes

ODOT creates custom line types as requested, and vetted, by the CAD standards committee, the discipline leads, and MicroStation users. The GHE workspace includes ODOT custom line types that are specific to GHE disciplines. Line types are accessed using the tools within the CAD workflows for each discipline.

Section 200.10 Seed and Cache Files

ODOT provides Seed and Cache files to aid in the development of project plans. Following are descriptions of each type of file, and which ones are available for the GHE disciplines.

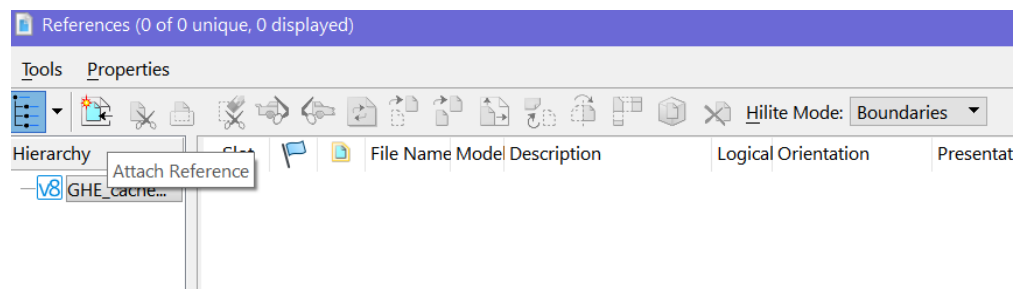
Seed Files

ODOT's seed files are set up with the standard ODOT MicroStation preferences and are chosen when a project file is first created. Before naming and saving a new file, choose the preferred seed by browsing the location of the seed files. When preparing GHE plan sheets, the seed file to use is seed_titleblock.dgn.

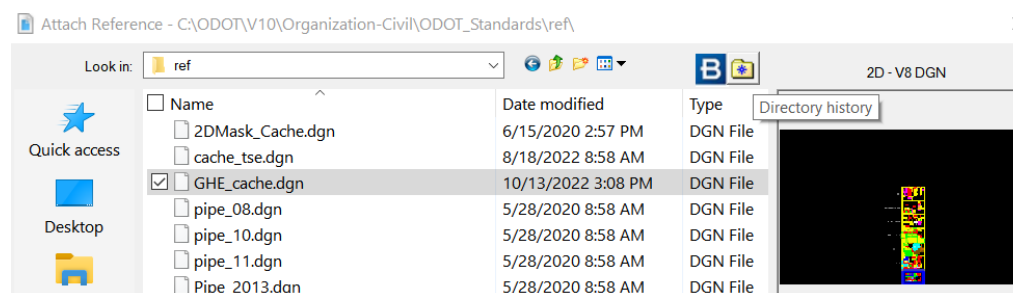
Refer to the [OCM](#) for information regarding ODOT's different seed files, and how to use the title block seed by discipline.

Cache Files

ODOT's cache files are chosen through the MicroStation *Reference* dialog, and added to the newly created plan sheet file. Click on the *Attach Reference* icon in the Reference dialog.



Then click on the *Directory History* icon and choose C:\ODOT\V10\Organization-Civil\ODOT_Standards\ref\. This will bring up a list of all the available cache files.



Each cache provides the most commonly used elements found in the discipline specific cell libraries. Elements can be “copied”, “moved”, or “element matched”.

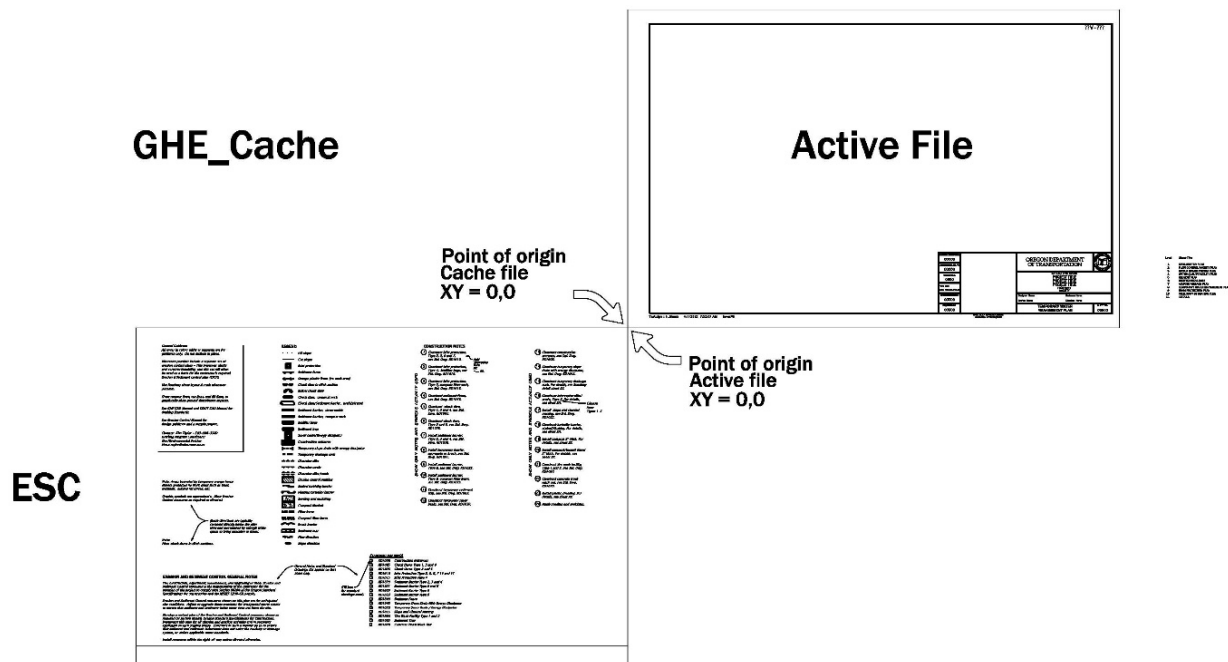
The GHE disciplines are all cached into one file named **GHE_cache.dgn**. The file contains discipline specific groups individually cached within separate standard ODOT yellow sheet borders, stacked in a column formation and labeled by discipline.

The disciplines represented are:

- ESC (Erosion and Sediment Control)
- Geotechnical Data
- Material Source
- Retaining Walls
- Culverts
- TWM (Temporary Water Management)
- OandM (Operational plan)

Groups will continue to be added to the file over time.

The point of origin of the cache file is the top right corner of the top yellow sheet border in the cache. The point of origin will automatically snap to the bottom left corner of the **active** yellow sheet border, which is located at the $xy=0,0$ point within the drawing plane.



Section 200.11 Cell Libraries

ODOT provides discipline specific cell libraries. Some disciplines share a cell library (e.g. the Geology/Geotechnical disciplines of Geotechnical Data, Material Sources and Retaining Walls, share the **Geo.cel** library).

GHE cell libraries include:

- Erosion.cel
- Landscape.cel

- **Geo.cel**
- **Hydro.cel**
- **OandM.cel**

ODOT also provides a universal cell library called **ODOT.cel**. This library contains elements used by most ODOT wide disciplines, including GHE. ODOT.cel is used in conjunction with all other cell libraries, and provides consistency across plan sheets within a project plan set.

Section 200.12 Base Map

Refer to the ODOT ProjectWise User Manual for information on plans assembly and folder locations for base files, design files and plan sheet files.

Section 200.13 Plan Sheets Development

Plan sheets are produced through collaboration between the POR and the drafting resource. The POR is responsible for developing the design and stamping the final plan sheets. The CAD technician is responsible for working with the POR in developing the plan sheets in a format consistent with the current CAD and drafting standards provided.

When questions arise regarding how to best convey design information, decisions are based on the professional expertise of all concerned. The POR is putting their professional stamp to a final product that is expected to be clear, concise and correct. The CAD Technician is responsible for accurately presenting the design. Mutual agreement is essential. Consult the disciplines statewide program lead and statewide CAD Lead for input when needed.

Features, line work and text that do not serve a clear purpose with respect to conveying information about existing site conditions and proposed design items, should be omitted. See Check Lists for elements to remain on in the final plan sheet drawing.

For information on the basics of sheet development that apply to all disciplines, see the [OCM](#) and the [RCM](#).

Project Plan Sheets

Plan sets typically include sheets showing the plan view, profiles / elevations, sections, cross sections and details for the different disciplines involved in a project. Some disciplines may only need plan view sheets plus detail sheets, (e.g. Erosion and Sediment Control plans). Other disciplines may require more information to build from. The added information may be provided as a profile, elevation or cross section in the plan set, (e.g. Retaining Walls plans, Culverts, etc.).

Plan View

Provide a footprint, or general layout, of all existing and proposed structures, features and facilities in the plan view. Locate and label all existing and proposed items that pertain. Structures, features and facilities should be scaled for easy viewing and readability. Display the plan showing the proposed item with the profile along the centerline. The centerline may be the roadway centerline, or the design item centerline.

Alignment stationing should be labeled sufficient to orient the reader and to provide reference points, or stations, to the important elements of the item being constructed. Follow the OCM and the Roadway CAD Manual requirements for displaying stationing. Show the project highway centerline alignment when item alignments are used. Include station and offsets from the highway centerline when applicable. Some project items such as landslides or retaining walls, do not always require an alignment.

When a **body of water** lies within the plan view of the design item, clearly show the boundaries of the water body and include direction-of-flow arrows. Label the name of each body of water. If the waterway is unnamed, label as “unnamed stream”, “unnamed creek”, etc. Intermittent waterways should be shown with appropriate symbology and labeling (i.e. ditch).

Contours are generally shown at 1’ or 2’ intervals as provided by survey for the base mapping on projects. For some GHE disciplines (i.e. Geotechnical Data), contours are best shown at 5’ intervals because the plan views are zoomed in to a larger scale than the standard Roadway scale typically used. When needed, CAD technicians and POR’s work together to determine the correct contour interval for the project.

Major contours must be labeled with the correct elevation at an appropriate interval. The contour interval is stated somewhere on the plan sheet, either as part of the numbered notes or as a stand-alone note (no number).

Contours may be gray shaded to allow feature linework and symbology to stand out, enhancing the readability of the plan. See Section 200.19, this manual, for more information regarding gray shading drawings in the printing process.

Property and right-of-way boundary lines are generally brought forth from the ROW base map. Other boundary line locations may be provided by another discipline. See Technical Bulletin GE09-07(B) for more information on boundaries required by FHWA, which includes Ordinary High Water (OHW), Regulated Work Area (RWA) and No Work Zone (NWZ). Region 2 has published a Procedural Document (PROJDEL 04-20-01) that covers the use of these boundary lines in project plans. This procedural document includes definitions, who’s responsible for what, and the CAD standards to apply.

Identification numbers are required for many of ODOT’s numerous assets, including culverts, stormwater facilities, and retaining walls.

Drainage Facility Identification (DFI) numbers are assigned to stormwater facilities and large culverts. Refer to the [Hydraulics Manual](#) for information about when a DFI number is required and how to request a number.

Structure numbers and **Bridge drawing numbers** are assigned to Retaining Walls over 4' in height and to large culverts that do not have a DFI number. These numbers are acquired through the **Bridge Data System (BDS)**. Refer to the [Geotechnical Design Manual](#) for retaining wall requirements, the [Bridge CAD Manual](#) for Structure Naming Rules, and the [Bridge Data System User Guide](#) for full instruction on acquiring structure numbers, Bridge drawing numbers and adding work to the system.

Provide the identification numbers on the plan sheets at or near the feature they pertain. These numbers, as well as an applicable calc book number, are also listed in the appropriate boxes attached to the standard titleblock.

“V” number – The OCM describes the use of a [V-number](#) as a file number for the A-H, and Q-Z series plan sheets. A V-number is assigned to the project near the end of project development. See the [RCM](#) for the standard format and how to acquire a V-Number.

Stages and Phases

Complex projects will often include **Stages and Phases**. A Stage includes the construction required to complete the work on one portion of the roadway while traffic uses the remaining portion. Subsequent Stages move traffic to the newly constructed portion, and allows work to take place on the portion vacated by traffic.

Some GHE disciplines may take advantage of these construction stages to benefit the various types of construction. The POR and the CAD Technician must work closely with the Traffic Control POR when using the construction stages.

Label the sheets by Stage number and location to match the staging title used by Traffic Control on their plan sheets. The stage title is placed at the center top of each plan sheet to which it pertains. The title includes the stage number and the name of the area for that sheet. For example:

STAGE 1, Phase 2 - 4

ROBERTS MTN. ROAD

Phases are smaller, more distinct portions of a Stage. When using phases label the sheet as **Construction Stage #, Phase #**. Consecutively follow the established sheet numbering already in place in the plan set. Refer to the [TCP Design Manual](#) for more information.

Profile and Elevation Views

Profiles and elevations may be included in any plan set. They are best shown with the plan view but can be provided on a separate sheet as necessary. Profile or elevation views placed below the plan view are placed with all points projecting in-line vertically straight down from the plan view whenever possible.

Profiles are cut along a line, usually a centerline or alignment. **Elevations** are generally the front facing view of a feature. They are both displayed on standard station and elevation grids. Label stations on the x-axis and elevations on the y-axis of the grid. In addition, elevations may also be labeled on the right side of the grid for clarity. Grid lines may be subdued to avoid conflict with the graphics displayed. Profiles are labeled as PROFILE "LINE NAME" (e.g. PROFILE "L" LINE). Elevation views are labeled as ELEVATION or as "DEVELOPED ELEVATION" (for curved walls, etc.)

Designs like retaining walls that are visible from the outside, are curved, or have adjacent non-parallel sides are shown in a "developed elevation" where the elevation view is "flattened" or unfolded".

Plan and Profile/Elevation sheets include construction notes and a legend (if applicable). General notes and tables pertaining to the design item may also be shown on this sheet.

Include structure or facility identification numbers for each feature where applicable. Include these labels on both the plan view and the profile/elevation view. ODOT's standard titleblock contains a space for listing the structure number and a space for the DFI number.

The CAD technician sets up the plan sheets based on the CAD standards provided, using their drafting knowledge and expertise. Consult with the Professional of Record (POR), or the project designer, when uncertainties arise.

See the [OCM](#) and the [Roadway CAD Manual](#) (RCM) for full instructions pertaining to plan and profile sheet layout.

Sections and Cross Sections

A **section** refers to the 'cutting of a solid by or along a plane'. Showing a close up of a particular section or part of the design. The cut line can be at any angle or of any part.

A **cross section** refers to the surface or the shape that is exposed by cutting straight through a solid, usually at right angles to an axis to show the interior of the design.

Sections and/or Cross Sections may be used to supplement the profile for wide features where complex design exists. **Sections** may be drawn at skewed angles to the centerline where needed, to best display the design elements. **Cross Sections** should be considered for wide or skewed structures/features/facilities.

When including sections and cross sections, the cut line should be shown on the Plan View of the primary plan sheet and labeled with the appropriate section arrow and letter designation.

Sections and cross sections should include the existing ground line along the section cut line, plus the graphics of the existing and proposed features of the design area being sectioned. They should also be drawn on a grid with the elevations labeled on the left and right side of the grid and the horizontal offset from centerline labeled on the bottom of the grid.

Sections developed at any angle other than perpendicular should be labeled as “SECTION alpha character–alpha character” (i.e. A-A). **Cross Sections** developed perpendicular to the centerline alignment are labeled as “CROSS SECTION ‘Station’ ”.

Detail Sheets

Detail sheets typically show specific dimensioned elements used in the design that may not be clearly addressed on a plan sheet. Details are generally an enlargement of a design element which allows for further dimensioning and labeling to provide the contractor with more information. Sections, cross sections, notes and tables may also be added to a detail sheet. Place notes and tables near the detail they pertain. Detail sheets fall last within the GHE disciplines plan sets.

Standard Details

Design elements that are used often may be provided as [ODOT Standard Details](#). These details are created by Technical Experts within the disciplines and are provided to avoid duplication of design and drafting efforts. Standard Details can be used as they are, or can be edited to meet the requirements of each individual project. Standard Details are never referenced but are placed on the project detail sheets along with other project specific details.

Standard Drawings

Standard drawings are stamped by a POR, (specifically the disciplines statewide program leader), and supported by engineering analysis, calculations, and/or justification. Standard drawings convey a design standard for a particular design item and cannot be modified on a project-by-project basis.

See [ODOT's engineering](#) website for downloadable files in DGN and PDF formats. Included are all the standard drawings and standard details for each ODOT discipline. The webpage also contains more detailed information regarding the use of these drawings.

As-Constructed Plans

As-construction plans reflect changes made to the project plans during construction. Documenting these changes is important information to have when planning and designing future projects in the same vicinity.

The procedure for preparing an as-constructed plan is documented in Technical Bulletin [TSB08-01\(B\)](#).

Section 200.14 Example Drawings

Example drawings demonstrate typical sheet layouts with regard to the placement of project data and the key CAD components. The example drawings are provided as a guide for developing final Project Plans. Not all project scenarios are covered. The drawings are taken from as-constructed plans, reviewed for accuracy and readability, and updated to meet current

design and drafting standards. Example drawings are located on the Drafting Program page of the [Geo-Environmental website](#).

Always rely on the MicroStation workspace for the most current CAD standards. Example drawings can lag behind in providing the absolute latest CAD standards. [Contact GHE](#) discipline program leads, and the [Drafting Program Lead](#), for help in resolving any standards issues.

Section 200.15 Check Lists

Check lists contain items to be included on the specific discipline sheets described in each Part of this manual. The drafting check lists are intended to assist CADD Technicians in determining which elements are to appear on the plan sheets. The CADD Technician can use the list to check off items as they turn on and off levels, and add CAD elements.

Section 200.16 Milestone submissions

Milestone submissions are dictated by the project schedule and organized in the folder structure within Project Wise.

The ODOT CAD workspace provides individual status cells to use for the different milestone states. These cells are located in the ODOT.cel library and are accessible through the workspace ribbon workflows.

Refer to the [ProjectWise User Manual](#) and the [OCM](#) for instructions regarding milestones, final plans and digital signatures.

Section 200.17 ProjectWise

ProjectWise is the content management tool selected for ODOT's engineering data and associated files. ProjectWise enables collaboration and increased efficiencies within a managed environment for internal and external users.

See Technical Services [ProjectWise directive](#) TSB16-01 (D) for information on the use of ProjectWise in ODOT's highway design process.

See the "Training" folder in ProjectWise for How-to documents and video's.

Contact the [ProjectWise Support Team](#) with questions.

Section 200.18 Common Abbreviations

See the [OCM](#) for a list of ODOT's common abbreviations used by all disciplines in their project plans.

Section 200.19 Printing Project Plans

Full instructions for printing single prints, or using Print Organizer to manage multiple prints, are provided in the User Guide on the [Engineering Applications Support Team](#) website.

Refer to the [Bridge CAD Manual](#) for information regarding the uploading of files into the Bridge Data System (BDS).

Gray shading plan sheet elements is done within the printing process. Some disciplines require gray shading all the referenced files, except the discipline specific design file (i.e. Roadside Development, and Erosion and Sediment Control). This enhances the design line work by printing it in full black while everything else on the drawing is gray-shaded. This technique allows for a clearer view of the discipline specific proposed design.

- To gray shade specific elements, add the text string *exist* to the logical name of each referenced file you wish to print gray-shaded.
- Print the drawing using the **plans.tbl** pen table. The marked files will print at around 50 to 70 percent gray-shaded.

Refer to the User Guide for more information on printing Project Plans, and for full descriptions of the different pen tables available.

Part 300 Geotechnical CAD Introduction

The Geotechnical CAD parts of this manual cover the CAD standards used in the development of plan sheets for [Geotechnical disciplines](#), including: Geotechnical Data, Material Source and Disposal Sites, Retaining Walls, Landslide Mitigation and Rock Slope Mitigation.

For general drawing instruction see [Part 200](#), which collectively covers the GHE disciplines of Geology/Geotechnical, Hydraulic Engineering, Roadside Development and Erosion Control.

Part 301 Geotechnical Data

Geotechnical Data sheets are required for projects involving earthworks or subsurface materials. To determine existing subsurface conditions, skilled interpretation of the exploration data is performed. The resulting geotechnical design parameters are provided to contractors and ODOT design and construction staff. Delivering this information to our contractors in a clear and concise manner provides them with the understanding they need to bid on the project.

Section 301.1 Overview

Subsurface information is used for the design of a structure or feature that may be impacted by conditions under the ground surface, (e.g. bridge and retaining structures, or cuts, fills and embankments). Geotechnical Data sheets must clearly show the subsurface information found at the exploration locations on the project. This chapter provides the methods, procedures and CAD standards, for uniformity and clarity in the presentation of subsurface information in project plans. This helps ensure contractors and ODOT personnel receive the information needed to perform geotechnical-related construction project work.

Section 301.2 Development

Geotechnical Data sheets are produced for project plans through collaboration between the project geotechnical engineer, the engineering geologist, and the drafting resource. The engineer or geologist are responsible for developing the subsurface data, based on the exploration results, to be shown on the Geotechnical Data sheets for the project plans.

The CAD technician is responsible for developing the plan sheets showing the subsurface conditions in a format consistent with the current CAD and drafting standards provided in the ODOT MicroStation workspace, this manual, and the [OCM](#).

301.2.1 CAD Workflows

ODOT's MicroStation workspace contains a work flow for the development of Geotechnical related sub-disciplines sheets. For Geotechnical Data sheets the active workflow is titled **ODOT Geo** and the ribbon tab is titled **Subsurface Data**.

This section will further describe the specific CAD tools and other standards; such as text styles, sheet layout, cells, etc., found in the workflow for creating a Geotechnical Data sheet.

Standard Text

To set a standard text style use the change text attributes tool or choose a style from the applicable CAD workflow and ribbon tab. See [Section 207](#) for more information on standard text styles used for GHE plans.

Cell Library

The cell library for the Geology/Geotechnical disciplines is named **Geo.cel**. The elements necessary to complete a Geotechnical Data sheet are located in this cell library. The cell library is accessed by the Subsurface Data ribbon tab. The ribbon includes elements such as; a profile grid, a Unit Descriptions template, a Core Table, Standard Notes, etc.

Levels

Use Geo levels as appropriate (i.e. P_GT_DESIGN_...) for line work and text on Geotechnical Data sheets. Retain the level structure of referenced drawings.

Seed and Cache

Seed and Cache files are provided in the workspace. See [Part 200](#) for more information on seed and cache files.

When creating plan sheets for Geotechnical Data, choose **seed_titleblock.dgn** at the beginning of the sheet file creation.

The cache file to use is included is the **GHE_cache.dgn**. This file contains separate caches for different sub-disciplines of the Geo, Hydro and Environmental Sections. The **Geotechnical Data** cache contains specific notes, a legend, unit descriptions, core tables and a profile grid.

301.2.2 File Naming and Sheet naming

File Name

ODOT uses a set list of CAD file names, based on an approved file naming convention developed for use within ODOT's new data management system called [ProjectWise](#).

The CAD technician must coordinate with the other disciplines involved in the project to determine individual structures/features where Geotechnical Data sheets are required. Each discipline has their own file name assigned to the Geotechnical Data sheets for their structures/features. CAD technicians are responsible for naming individual plan sheet files according to approved discipline specific standards found in the ProjectWise Document Name List and in the ProjectWise File Naming Tool.

Sheet Name (Title)

Geotechnical Data sheets are titled as "Geotechnical Data". The title block seed file, **seed_titleblock.dgn**, contains models for sheet names by discipline. Sheet names are located on separate levels within each model, so the correct sheet name can remain turned on while all

others are turned off. The sheet title for Geotechnical Data plans is located in the “A_Sheets”, “G_Sheets”, “H”_Sheets and the “J”_Sheets models.

Refer to the [OCM](#) for list of available sheet names for each discipline.

301.2.3 Drawing Sequence and Sheet Numbering

Drawing Sequence

Place Geotechnical Data sheets with the corresponding structure or feature they are developed for. This allows those involved with construction to easily find the subsurface information specific to each feature and eliminates the burden of looking elsewhere in the plan set to locate the drawings. For example; features such as cuts, fills and embankments are generally shown on Roadway sheets, and placing the Geotechnical Data sheets after the Roadway profile sheets aids construction crews during that phase of construction.

The point of the standard is to provide the Geotechnical Data information with the structure or feature for which it is intended.

Follow individual discipline guidance for placement of the Geotechnical Data sheets within the plans for the structures or features they are intended. Some disciplines may not provide guidance for the placement of the Geotechnical Data sheets, for example; the location of these sheets within ITS structure plan sets is not specified in their guidance. When geotechnical information is obtained for ITS structures, a Geotechnical Data sheet is required and must be placed, according to the standard, immediately following the plan and elevation views of the structure for which the data is intended. In the case of ITS structure plans, where the elevation views of structures are generally placed on detail titled sheets, the Geotechnical Data sheets for that structure are placed immediately following the “Detail” sheet.

The Geotechnical Data sheets are assigned the same sheet numbering series as the discipline in which they are placed.

Avoid duplication and overlap of information on individual Geotechnical Data sheets, or on multiple sheets within one discipline.

Note: Duplication of information among multiple disciplines may be necessary at times in order to provide all the information available for multiple structures or features. For example: Two bore holes in close proximity to each other used for two separate structures or features, such as a retaining wall and a Signal Pole, will appear the same on the Geotechnical Data sheets for the Retaining Wall as they do on the Geotechnical Data sheets for the Signal Pole. This gives contractors access to the needed data for their portion of the project.

Location Index Sheet

When Geotechnical Data sheets are produced for numerous structures or features an Index sheet depicting the locations covered by the data sheets is required. Index sheets aid in locating

the appropriate information for larger projects with multiple structures or features. Refer to the [OCM](#) for the location of the Index sheet in the 'G' series section of the project plans set.

Title the index sheet "*Exploration Location Index*". Clearly label references to the locations of the Geotechnical Data sheets that appear throughout the project plan set. Each Geotechnical Data sheet within the plan set refers to the Exploration Location Index when one is used.

Show the location of each exploration with an appropriate "exploration target", and label each according to the assigned identification number.

Sheet Numbering

Geotechnical Data sheets placed with plan sheets for a structure or feature will take on the sheet numbering series of that structure or feature. Refer to the [OCM](#) for correct sheet numbers.

The exceptions are the "Geotechnical Data" sheets that do not apply to any specific structure or feature, and the "Exploration Location Index" sheet, when one is included. Place these sheets in the Geology\Geotechnical, or 'G' series, portion of the project plans. The "Exploration Location Index" is the first sheet to appear in the 'G' series and is numbered as GA001, as shown in the [OCM](#).

For further information regarding drawing sequence and sheet numbering please see [Section 204](#) and the [OCM](#).

301.2.4 Plan and Profile Sheets

The content of a Geotechnical Data plan sheet is based on the final bore logs produced by the Project Geologist. The project Geologist is responsible for making sure the unit descriptions for the plan sheet match the corresponding descriptions on the final logs. Exploration data on the individual borings is provided to the CAD technician with location information for the plan and placement requirements for the profile.

The MicroStation workspace provides all the essential CAD elements needed to develop plan sheets according to current CAD standards.

Layout

Arrange Geotechnical Data sheets to clearly depict subsurface conditions. At minimum, display a plan and profile showing subsurface information that underlie the subject structure/feature with the profile along the centerline. The centerline may be the roadway centerline, or the structure centerline. Additional profiles offset from centerline may be included as determined by the geologist to accurately convey the information.

Sections or Cross-sections may be used in place of a Profile, or to supplement the profile for wide features where complex geology exists. Sections may also be drawn at skewed angles to the centerline where needed to best display subsurface conditions, or to show a specific element such as the principal axis of a landslide.

Plan sets may begin with a plan view sheet, followed by a profile sheet, or sections/cross sections sheet. Other details needed to aid in the understanding of the underlying geologic conditions are placed on additional sheets. Depending on the project size and the locations of the borings, the first sheet may have room to display a plan view and a profile view. All sheets displaying the bore logs must include unit descriptions, legend and general notes, and boring identification number. Rock core tables are typically placed below the profile and in line with the corresponding bore log. Core table cells are included in the workflow tools.

Plan View

See [Section 212](#) for instruction regarding the general plan view inclusions of existing and proposed CAD elements.

The location of all explorations must be shown as directed by the Geologist, (whether drill holes, test pits, cone penetrometer tests, seismic lines or other subsurface explorations). Identify each location with the correct symbology and label. Each label should include the exploration number, the name of the alignment, and the station and offset with right (Rt.) or left (Lt.) offset indicated. Per the [OCM](#) standards, show Station-Offset as **Sta. "L" 141+02.12, 73.83' Lt. (or Rt).** (Numbers in red are optional depending on choice of decimal places shown). See Figure 301.2.4.1.

For projects without alignments, provide the coordinates of the explorations. If cone penetrometer, pressure meter, vane shear, packer or other in-situ testing is performed include a note stating the results of these tests are available in the "Engineering Geology Report".

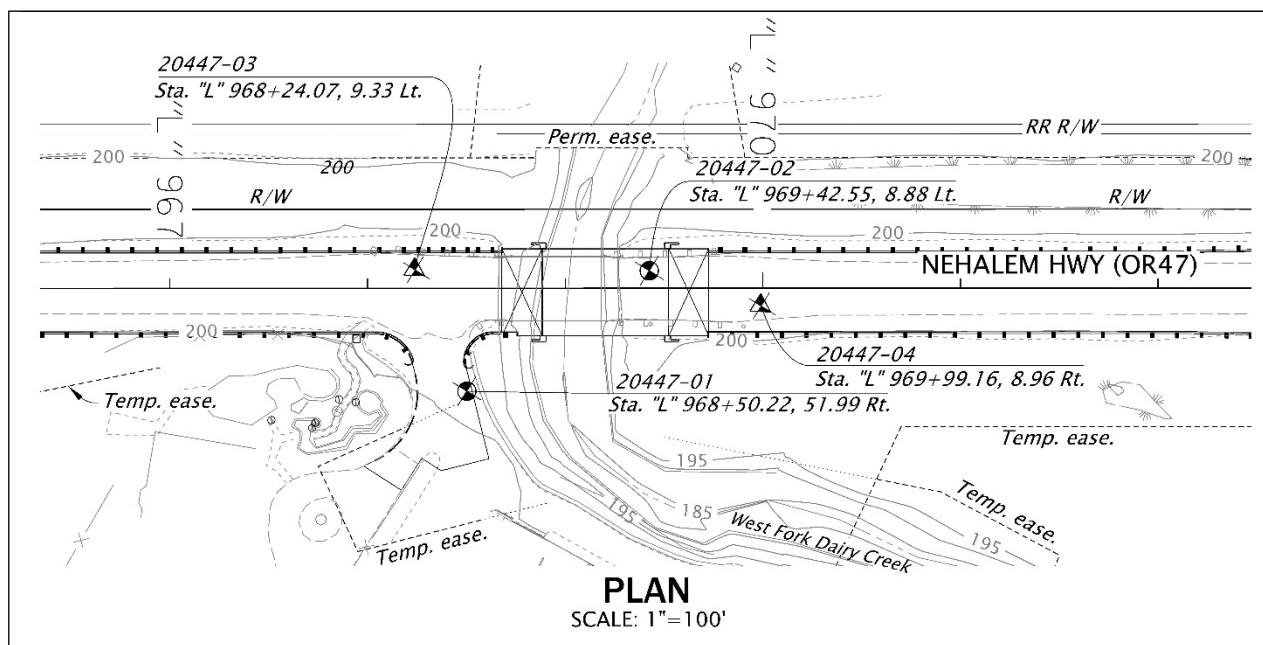


Figure 301.2.4.1 Plan View showing features and structures with respect to drill holes.

Geotech data sheets must display the identification numbers that have been assigned to any structure requiring Geotechnical Data sheets. Structure types may include large culverts, retaining walls and large traffic structures such as truss sign bridges and cantilevers.

Profile View

The profile view shows the engineering geology interpretation of the subsurface conditions along an alignment. The Geologic subsurface data is depicted by graphic columns or “stick logs” that represent each exploration at the station and elevation at which they occur along the alignment. Graphic columns consist of separate sections that represent the subsurface materials by patterned symbology. Unit descriptions are used to describe the materials represented by the patterns, and shown in a legend format located along the far right edge of the sheet. See Figure 301.2.4.2 Profile View for an example of stick logs.

When the plan and profile appear on the same sheet, each graphic column (stick log) should be aligned vertically with the corresponding exploration symbol on the plan view, immediately above the profile. Profiles are displayed on standard station and elevation grids. Label stations on the x-axis and elevations on the y-axis of the grid. Elevations should be labeled on both the left and right sides of the grid. Grid lines may be subdued to avoid conflict with graphic columns showing geologic interpretations or the various graphic column labels. Profiles should be labeled as PROFILE ‘LINE NAME’’. For example ‘PROFILE “SB1” LINE’.

Elevation View

Some project features, such as landslides or retaining walls, do not require an alignment. In these cases the profile view can be labeled as ‘ELEVATION’. The grid and subsurface information is shown exactly the same on an elevation view as it is on a profile view.

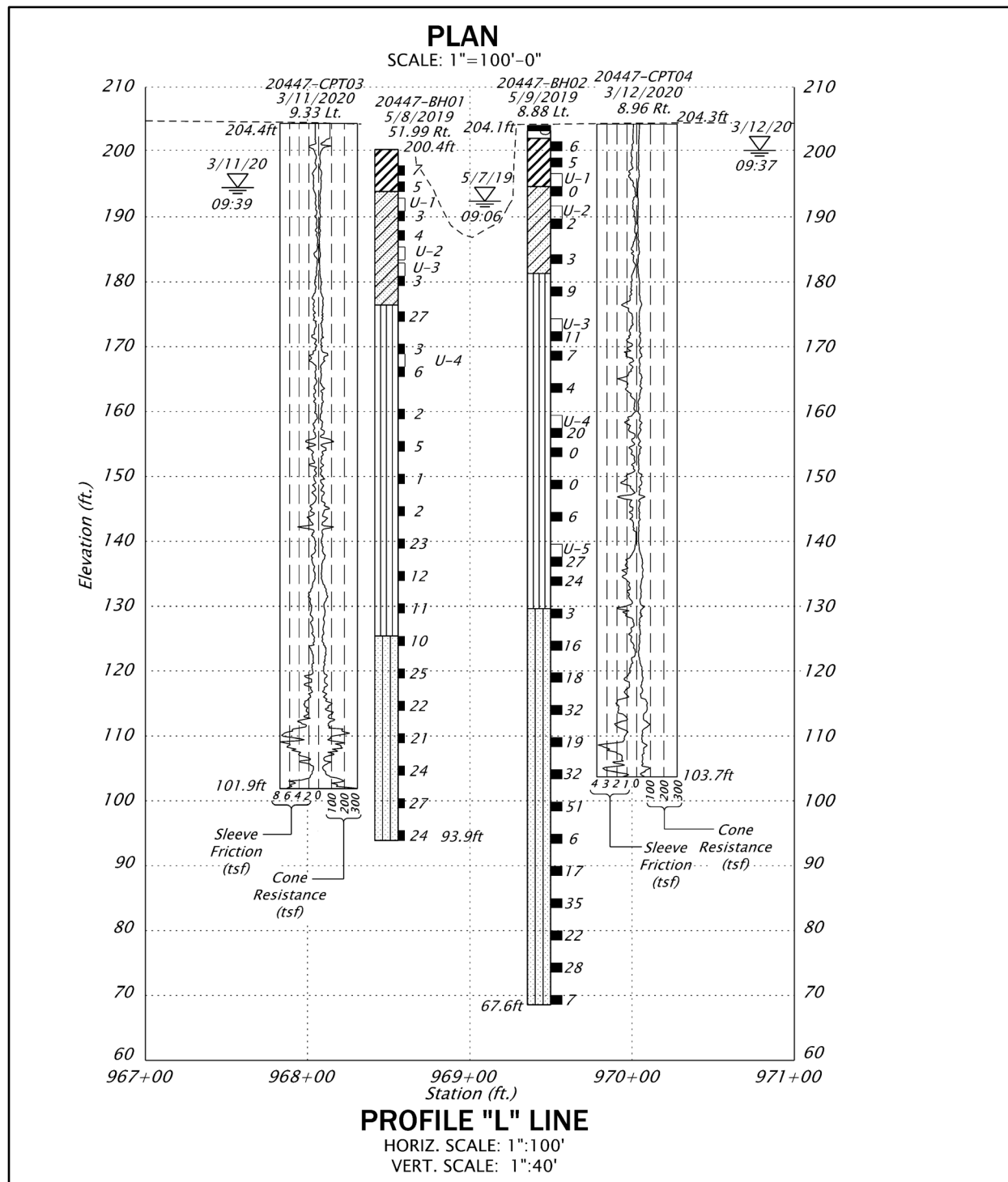


Figure 301.2.4.2 Profile View of stick logs brought into MicroStation from gINT, scaled and placed in a standard profile.

Numerous explorations shown on one single profile can obscure data or lead to a cluttered appearance. Several options can be used to alleviate this situation:

- Expand the horizontal scale of the drawing
- Relocate the exploration and descriptive text to a different point on the drawing with an arrow connecting it to its true location
- Use supplemental sections, profiles, or cross-sections.

Sheets produced for supplemental profiles will be identical in format to the standard Geotechnical Data sheet.

Graphic Columns

Regardless of whether the explorations are presented in profile, elevation, cross section or section views, each graphic column (stick log) displayed **must have** the following information:

- Graphic columns are labeled at the top as: Exploration number = key number and exploration number, date and offset
(XXXXX-XXXX-XX)
Date (MM/DD/YY)
Offset (0.00' Rt. or Lt.).
- Elevation at the top of each hole and at the bottom of each hole.
- Samples and in-situ test results are shown with their designated symbols at the depth they were taken, or performed, along the right side of the graphic column.
- SPT intervals are to be labeled by their N-Value.
- Sample intervals are denoted by the vertical length of the symbol.
- Continuous sampling methods, such as rock coring, are shown by dimensions labeled with the core run.
- Groundwater is typically shown on the left side of the graphic column whenever possible. Space limitations may require them to appear on the right side. Use the standard groundwater symbol placed at the depth of the highest and lowest groundwater levels measured. Groundwater symbols should be labeled with the elevation and date the sample was taken.

Unit Descriptions

Unit descriptions and their corresponding symbols are displayed in a legend-style format. The Project Geologist compiles and provides the descriptions for the geologic units.

- Include only the geologic unit descriptions shown on that sheet.
- Orient the unit descriptions in a manner to allow space on the sheet for a legend of symbols, notes, and core tables.
- Unit descriptions, legends and notes generally appear along the far right edge of the plan sheet.

UNIT DESCRIPTIONS	
	Asphalt (Fill)
	Aggregate Base (Fill)
	CLAY to CLAY with some gravel and trace sand; CH; Brown to Red Brown; Medium to High plasticity; Damp to Moist; Medium Stiff; Fine to coarse grained sand, Gravel to 1-in. max size recovered (Fill)

Figure 301.2.4.3 Unit Descriptions

Specific unit information may be conveyed on a Data Sheet from other project data sources. For example, a note on a boulder-bearing Engineering Geologic unit that did not encounter boulders in borings on that sheet, but were found elsewhere within the same unit.

Rock Core Tables

Rock Core Tables are used to show specific rock core data for each boring that encountered hard rock. Each graphic column with rock coring should have a corresponding table that includes the core run, percent recovery, hardness, and Rock Quality Designation (RQD). Rock core tables are ideally shown below the profile where the corresponding graphic column occurs. When space is limited, use judgement to place tables so they clearly show the information and can easily connect to the corresponding stick log.

ROCK CORE TABLES			
00000-00			
Core	% Rec.	Hardness	RQD
C1	00	R4	0
C2	00	R4	0
C3	00	R4	0
C4	00	R4	0
C5	00	R4	0
C6	00	R4	0

Figure 301.2.4.4 Rock Core Table

Cone Penetrometer Test Data

Cone penetrometer test data (CPT) may be added to a Geotechnical Data sheet as determined by the project Geologist. The Geologist provides this data to the CAD Technician in an Access file format which can be inserted into the MicroStation drawing file using the text editing tools.

CPT data is displayed on the sheet in much the same way as the other borings. Each location on the plan view is shown with a triangle shaped CPT symbol called SYM_CONEPEN.cel, found in the Geo cell library, and labeled with the boring number, station and offset.

In the profile view the CPT data is displayed as a vertical graph laid out directly in line with the center of the CPT targets shown in the plan view above the profile. Each test bore graph is labeled, above the top, with the correct number plus the date of the test.

Additionally these test bores are labeled with the sleeve friction count, which is displayed below the bottom elevation of the test bore on the left side, and with the cone resistance count, displayed on the bottom right side. The extent of the data is labeled with the elevation at the

top and at the bottom of each graph. Elevation labels are placed on the open sides of each graph to avoid crowding. Adjust horizontal and vertical scales as needed for readability. See Figure 301.2.4.5 Example Geotechnical Data sheet.

Include the Cone Penetration Location symbol in the sheet legend, and include mention of it in the notes. See graphics in the Legend and Notes topic to follow.

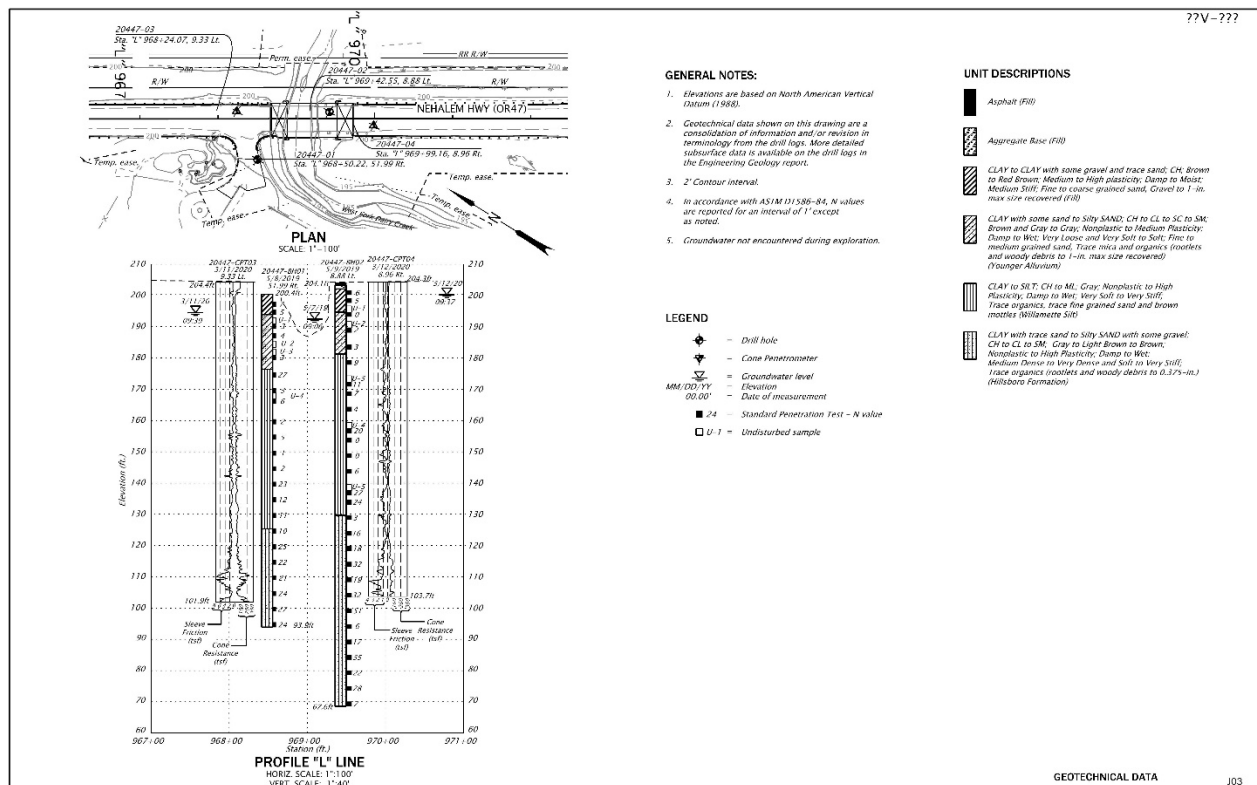


Figure 301.2.4.5 Example Geotechnical Data sheet

Legend and Notes

The workspace contains a **legend** of commonly used symbols and their descriptions. When placing the legend, only include the items found on that sheet. In the following legend graphic the Cone Penetrometer Location is included as described in the CPT Data topic.

LEGEND	
	= Drill hole
	= Groundwater level
00.00'	= Elevation
MM/DD/YY	= Date of measurement
C-1	= Core sample
RQD	= Rock Quality Designation
50/1st #"	= Standard Penetration Test refusal length
■ 24	= Standard Penetration Test – N value
□ U-1	= Undisturbed sample
▣ 15	= Oversized sampler (modified California) – blow count
▤ 7	= Oversized sampler (Dames and Moore) – blow count

Figure 301.2.4.6 Example Legend

Notes clearly convey project specific information. A set of standard notes are included in the workspace to provide further project information. Notes may be edited to address project specifics and can be added to, or deleted from, at the discretion of the project Geologist. As stated in the CPT Data topic, note 2 in the following graphic includes mention of the CPT logs.

GENERAL NOTES:	
1.	Elevations are based on North American Vertical Datum (1988).
2.	Geotechnical data shown on this drawing are a consolidation of information and/or revision in terminology from the drill logs. More detailed subsurface data is available on the drill logs in the Engineering Geology report.
3.	2' Contour interval.
4.	In accordance with ASTM D1586-84, N values are reported for an interval of 1' except as noted.
5.	Groundwater not encountered during exploration.

Figure 301.2.4.7 Example General Notes

301.2.5 Details Sheet

Geotechnical data sheets generally don't have typical details, but often do have sections and cross-sections which can be placed on detail sheets when space is limited on the plan and profile sheets. See [Part 200](#) for more detailed explanation regarding sections, cross-sections and other details.

Sections are required for all landslides and cuts/embankments that require subsurface exploration.

Cross-sections should be considered for wide or skewed structures, structures founded on spread footings, and where variable-lengths of deep foundations result from high local relief or geologic structure.

Section 301.3 Check List

The drafting check list below contains all items to be included on Geotechnical Data sheets. (Depending on the project, some items may not apply).

- | | |
|--|---|
| ☐ Border, title block, sheet title, sheet number | ☐ Proposed roadway with alignment and stationing |
| ☐ Title block information complete | ☐ Assure station name and number agrees with Roadway Plans |
| ☐ Professional of record stamp | ☐ Direction arrow and name of nearest city (both directions along highway) |
| ☐ "V" number or project status stamp | ☐ Proposed structures |
| ☐ Index sheet (if needed) | ☐ All structures labeled with assigned structure numbers |
| ☐ Plan view | ☐ Waterway(s) labeled and flow direction shown |
| ☐ Profile/section view(s) | ☐ Right-of-way lines |
| ☐ North arrow | ☐ Temporary construction easements |
| ☐ Scales noted | ☐ Construction limits |
| ☐ Existing roadway | ☐ Exploration locations with labels (including station and offset) |
| ☐ Traffic flow arrow | ☐ Graphic columns and labels |
| ☐ Existing structures (e.g. bridge, culvert, wall, Sign Bridge, etc.) | ☐ Groundwater marks |
| ☐ Existing utilities | ☐ SPT marks |
| ☐ Existing contours | ☐ Legends, notes, unit descriptions and core tables |
| ☐ Contours labeled | |
| ☐ Cross section(s) | |
| ☐ Section Arrows (when applicable) | |
| ☐ Detail(s) | |

Section 301.4 Example Drawings

Geotechnical Data example drawings are either under development or located on the Drafting page of the [Geo-Environmental website](#). See [Section 213](#) for more information regarding example drawings.

Part 302 Material Source

ODOT's [Material Sources Program](#) focuses on identifying the material, disposal, stockpile, and staging site needs of the agency. The program's purpose is to manage and maintain the availability of all earthen materials useable for construction and maintenance purposes. By developing and managing a material source network, ODOT is able to offer a prospective material source close to most highway projects.

Section 302.1 Overview

Material source, borrow source, and disposal and stockpile site details are used in project plans when it is necessary to require or suggest a contractor either gather or dispose of project materials.

A **Material source** is naturally occurring rock or stone of sufficient quantity to be processed to the required specifications of a specific highway project. This material is used in the construction of roadway surfaces.

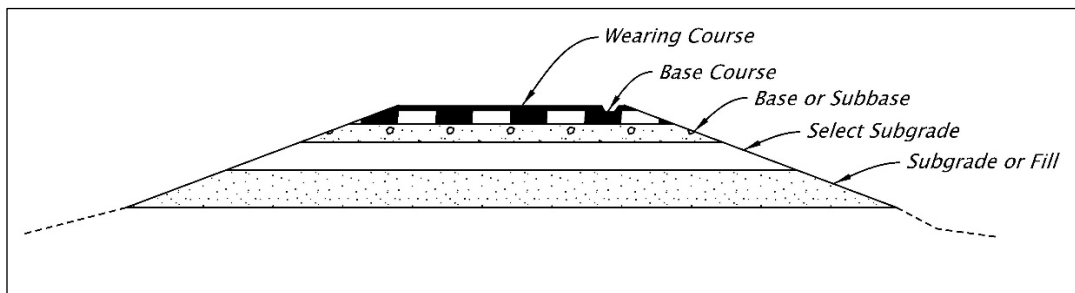


Figure 301.2.5.1 Example of Material Source on a Roadway

Borrow source material is primarily used for roadway embankments, bridge approaches, and culvert and retaining wall backfill.

A **Disposal site** is an area of land where a contractor has been given permission to place excess material. Excess material is any material excavated from a project site. Excess material must be sloped and shaped to drain well and must be seeded according to the project special provisions.

A **Stockpile site** is an area of land suitable for the stockpiling of useable material. This can be excess material from another project, or material for future maintenance or repair projects.

A **Staging area** is an area of land that can be used for the temporary storage of off-shift equipment and construction materials.

Part 302 describes specific CAD standards used in preparing Material Source project plans and includes instruction on sheet layout, sheet order, the location of cells, workflows etc., used to show the Material Source plan for a project.

Section 302.2 Development of Material Source Sheets

All Plan Sheets mentioned in Section 302.1 are produced for ODOT's project plans through collaboration between the project Professional of Record (POR), other discipline specific engineers depending on the project, and the drafting resource. The POR is responsible for developing the plan and for stamping the final plan sheets. The POR provides their design files to the drafting resource or CAD technician.

The CAD technician is responsible for working closely with the POR to develop the plan sheets to best describe the plan intent, and in a format consistent with the current CAD and drafting standards provided in the ODOT MicroStation workspace, this manual, and the [OCM](#).

302.2.1 CAD Workflows

ODOT's MicroStation workspace contains a work flow for the development of Material Source sheets. The active workflow is titled **Geo** and the ribbon tab is titled **Material Source**.

This section will further describe the specific CAD tools and other standards; such as text styles, sheet layout, cells, etc., found in the workspace for creating a Material Source plan.

Standard Text

To set a standard text style use the change text attributes tool or choose a style from the applicable ribbon workflow tabs. See [Part 200](#) of this manual for more information on standard text styles used for project plans.

Cell Library

The elements necessary to complete Material Source sheets are located in cell library **Geo.cel**. The cell library is accessed by the Material Source ribbon and includes elements such as:

- Area boundary lines
- Proposed and existing features
- Notes and symbols.

Levels

Use MS levels as appropriate (i.e. P_MS_DESIGN_.....) for line work and text on Material Source plan sheets.

Seed and Cache

Seed and Cache files are provided in the workspace. See [Part 200](#) of this manual for more information on seed and cache files.

When starting a new Material Source drawing use the **seed_titleblock.dgn** file and reference in the **GHE_cache.dgn** file.

The cache for Material Source is included in the cache file **GHE_cache.dgn**, along with other Hydraulic, Geotechnical, and Environmental discipline specific caches. The Material Source cache contains the most commonly used notes and labels, plus legends, and a top-center sheet title.

302.2.2 File Name and Sheet name

File Name

ODOT uses a set list of CAD file names, based on an approved file naming convention developed for use within ODOT's [ProjectWise](#) data management system.

Project staff are responsible for naming individual files according to approved discipline specific standards found in the ProjectWise Document Name List through the use of the ProjectWise File Naming Tool.

Sheet Name (Title)

Material Source sheets are available in the title block seed file, in the **G_Sheets** model. Sheet names are located on separate levels within each model. The correct sheet name can remain turned on while all others are turned off. Listed are just a few of the numerous sheet title options available for Material Source plans.

- Prospective Material Source
- Mandatory Disposal Site
- Prospective Borrow Site

(Included in this model are sheet titles for other Geotechnical disciplines, such as Retaining Walls, Geotechnical Data, etc.)

Refer to the [OCM](#) for list of available sheet names for each discipline.

Material Source plans require an additional type of sheet title placed at the top-center of the sheets. This title provides the source type, the name and the location of the quarry site. Included in the label are the ODOT source number, DOGAMI number, route number and mile post numbers, plus the Section, Township and Range location. The Geo cell library contains a cell for this called **TITLE_SHEETTITLE**.

PROSPECTIVE MATERIAL SOURCE	
QUARRY NAME	
SOURCE # OR-00-000-0	DOGAMI # 00-0000
ROUTE 000, M.P. 00.0	
SE $\frac{1}{4}$ Sec. 00 & NE $\frac{1}{4}$ Sec. 00, T.00 S., R.00 E. W.M.	

Figure 302.2.2.1 Material Source Sheet Title Example

302.2.3 Drawing Sequence and Sheet Numbering

Drawing Sequence

Material Source plans are located in the **GE** series section of ODOT's Project Plans. Material Source plans follow the Rockfall Mitigation plans and appear fifth in the series. The G series is reserved for the disciplines of Geotechnical Data, Retaining Walls, Sound Walls, Rockfall Mitigation, Material Source, Landslide Correction and Hazardous Material.

See the [OCM](#) for drawing sequencing and sheet numbering tables, for all disciplines plan sheets.

Sheet Numbering

Material Source plans begin with sheet number **GE001**.

The number shown in red is optional and can be used to separate groups of drawings within a discipline specific series. The use of 3 digit sheet numbers in Material Source plan sets is generally not needed, although one possibility where three digit numbers could be used is when a Material Source plan includes the use of two or more separate quarries or other sites designated to be used on one project. The sheets for the first site might be numbered as the GE100 series and the sheets for the second site might be numbered as the GE200 series.

For further information regarding drawing sequence and sheet numbering please see the [OCM](#) and [Part 200](#) of this manual.

302.2.4 Sheet Order

The Material Source sheets generally utilize the same sheet order conventions used by other disciplines. The first sheets are the plan view sheet/s. Followed by the detail sheet/s.

Occasionally a Material Source plan may be a stand-alone project and will begin with a Title sheet. Most Material Source plan sets will begin with the Vicinity Map sheet. The goal is to follow the sheet order as closely as possible for your individual project. Consistency across projects will help eliminate confusion and contractor claims, and will ultimately add efficiencies to the drafting work flow.

Sheet Type	Example
Title Sheet	<i>Provide when Material Source and other plan types mentioned in Section 302.1, are a stand-alone project. This sheet is the same as the standard title sheet used for multidiscipline plan sets. See the OCM for sheet numbering sequence of this sheet. See RCM for development of this sheet.</i>
Vicinity Map	<i>A zoomed-out view of the site at a scale that fills the sheet. Becomes first Material Source sheet in multi-discipline projects.</i>
Site Plan (Plan View)	<i>Follows same layout as all other disciplines plan view sheets. See the RCM and Part 200 of this manual for development of this sheet.</i>
Details	<i>Mainly cross sections are displayed. Include inserts of areas for detail clarification. Other details as needed.</i>

Table 302.2.4.1 Sheet Order Table

302.2.5 Plan Sheets Development

When laying out the sheets for a project always work closely with the POR when determining any adjustments to the layout of individual sheets in order to clearly show the Material Source plan. See [Part 200](#) of this manual for more information regarding plan sheets.

Title sheet and Drawing Index

All project plan sets begin with a **Title Sheet**, including stand-alone projects. All title sheets use the same standard layout and sheet number for each project. Title sheets are assigned sheet number "A01", regardless of discipline. See the [OCM](#) for sheet numbering sequence of this sheet. See [RCM](#) for development of this sheet.

The title sheet for a stand-alone Material Source project is developed the same as for a multi-discipline project with one difference. There is not a BEGINNING OF PROJECT nor END OF PROJECT, so the labels for this are eliminated.

Material Source title sheets and multi-discipline title sheets, display the source site. Source sites are designated using specific site type labels provided in the workspace. Each site is shown with a symbol and label on the vicinity map of the title sheet.

A circle symbol containing an X designates a Material/Borrow source. A square symbol containing an X designates a Disposal Site. The site labels consist of a leader arrow labeled with the source/site type and mile point designation. These labels are placed on the Title sheet vicinity map regardless of whether it is a stand-alone project or a multidiscipline project.

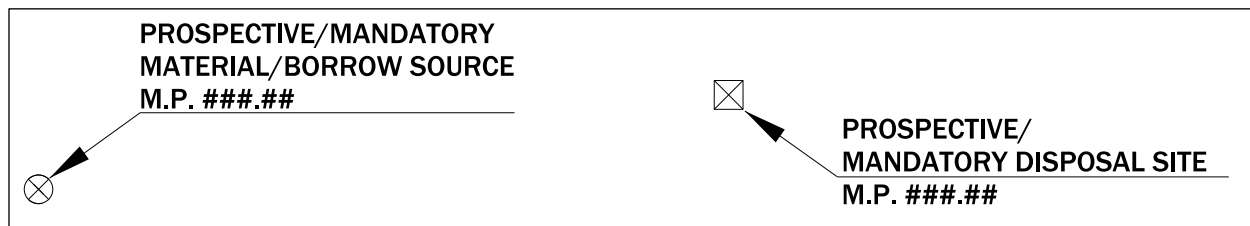


Figure 302.2.5.1 Material Source site labels used on Title sheets

The site type labels are located in the **Geo.cell** cell library. The two symbol types are separate cells from the two labels. The four cells are named as follows.

TSHEET_BORROWMP

TSHEET_BORRSYMB

TSHEET_DISPOSALMP

TSHEET_DISPSYMB

Align the leader arrow with the appropriate symbol as shown in Figure 302.2.5.1 Material Source site labels used on Title sheets.

After placing the label remove the words that do not apply to the project specific site, (i.e. a PROSPECTIVE BORROW SOURCE label would remove the words MANDATORY and MATERIAL). Make sure these labels match the sheet names used on the sheets to follow.

Small projects with few sheets may include the **drawing index** on the title sheet. Place the index in the upper left area of the sheet whenever possible.

Vicinity Map Sheet

A **Vicinity Map Sheet** is provided, when needed, following the title sheet. This could also be considered the first plan sheet. A Vicinity sheet contains a zoomed out view of the Material Source site and surrounding features. This view should include the nearby highway and any other roads accessing the site. See example project **Error! Reference source not found.**

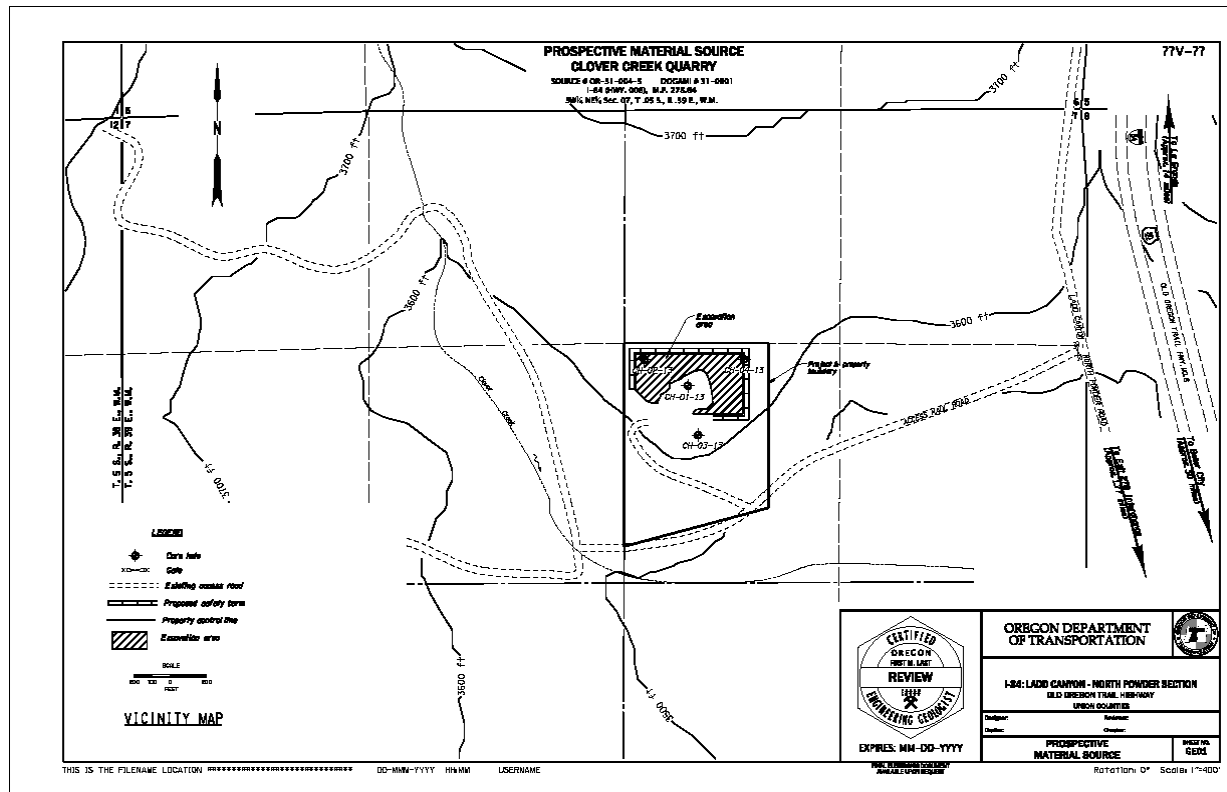


Figure 302.2.5.2 Example Vicinity Map sheet

Existing features to include on the Vicinity Map.

- Major contours.
- Section, Township, and Range lines.
- Waterways.
- Access roads in and out of the site.
- Nearby highway/s.
- Project and property boundaries.
- All area designations.

Items to label:

- Beginning or end of the overall project, whichever is nearest. If not visible within the view, note the direction and distance along the nearby highway from the access road.
- Approximate distance and direction to nearest interchange/town from the access road.
- Property and project lines.
- Area boundaries within the site (e.g. excavation area).

- Waterways.
- Section, Township, and Range.
- North arrow.
- Legend
- Scale bar
- Notes
- Drawing title of **Vicinity Map**

The titleblock information for this, and all sheets to follow, mainly consists of project information obtained by referencing in the project .nam file. This file is usually developed by the Roadway team for the purpose of maintaining the correct project information throughout the plan set. Information not filled in by the .nam file is the responsibility of the discipline team to compile and add. Stand-alone projects require the discipline specific team create their own .nam file.

Site Plan (Plan View) Sheet

The purpose of the Site Plan sheet is to show, in detail, the plan for the specific Material Source site. This view is generally zoomed in to an even larger scale than the vicinity map sheet. Always use appropriate standard scales and follow standard plan view sheet layout rules, where the plan view generally appears on the left to center portion of the sheet, and notes, etc., appear in the right side portion of the sheet. See Figure 302.2.5.3 Example Site Plan.

In this example the shape and size of the site allows for a more central placement of the plan on the sheet. The right side provides plenty of space to place the North arrow, legend, scale bar, drawing title and notes.

Other items to be displayed and labeled accordingly include:

- Project, permits and property boundaries.
- Utilities on or near the site
- Access road/s.
- Major and minor contours (label the Majors).
- All area boundaries and labels (e.g. stockpile area).
- Section, Township, and Range lines within the view.
- Hatch the areas of importance.
- All features to be constructed, such as access roads, berms, etc.
- All subsurface exploration locations, within the site, with appropriate target symbol and boring number and location data.

- Section cut lines with direction arrows and labels.
- Quarry Name and location title
- Drawing title of **Site Plan**, (near or below the plan view).
- Titleblock information.
- North arrow.
- Legend.
- Notes.
- Scale bar.

Display cut lines for the sections using the standard line, arrow and label found in the workspace. Extend section cuts to cross project and property boundaries whenever possible. This provides further information in the section views by displaying the correlation of source limits to boundary lines. Collaborate with the POR in determining the location of section lines when needed.

When all or part of a site is owned by another entity, and a portion of it is controlled or managed by ODOT, make note of it along the boundary lines. Boundary lines can be either property, project or designated area lines. Regardless of the type of boundary line, the Site map must be drawn at a scale that allows the lines to be displayed.

Place the title containing the source type, quarry name, source #, DOGAMI #, Highway and MP, Section, Township and Range in the top-center of the sheet.

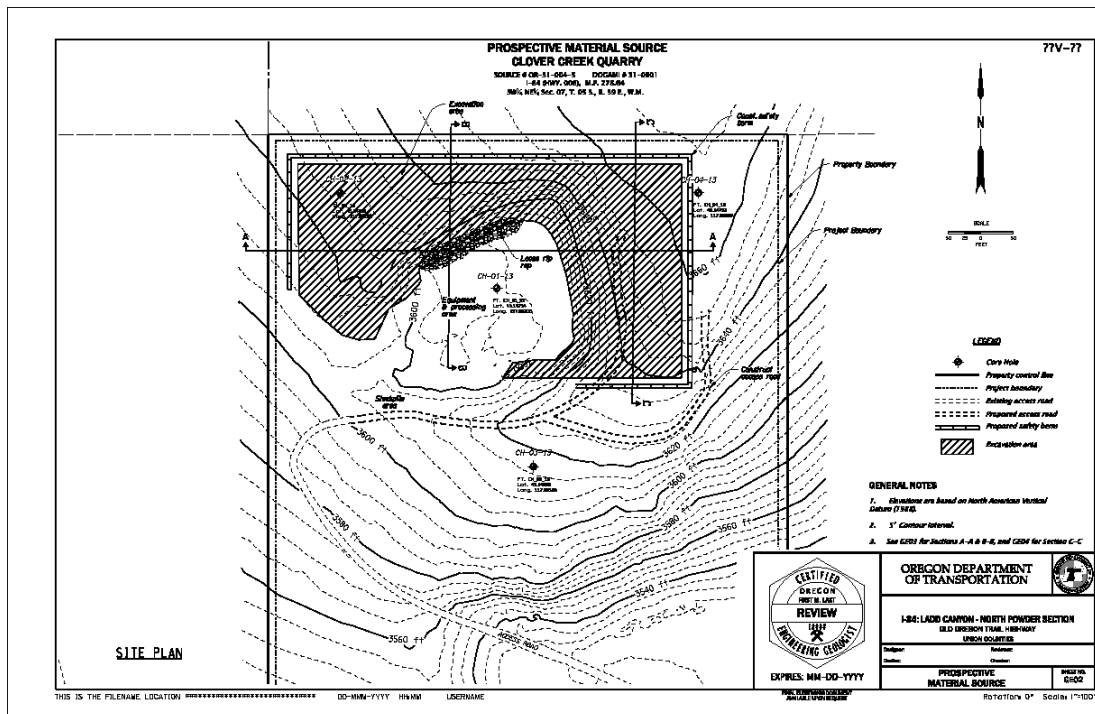


Figure 302.2.5.3 Example Site Plan sheet

Sheet Specific Notes and Legends

Sheet specific notes and legends pertain to plan features appearing on the individual sheets. ODOT's MicroStation workspace contains cells of standard note and legend (templates) for individual GHE disciplines. These can be modified to meet the requirements of each project as well as each sheet. Use them as a base to edit according to the POR's instructions.

Detail Sheets

Material Source detail sheets generally only contain the section cuts displayed on the site plan. The sections are drawn at a scale to clearly show the work being planned. Label each section accordingly as SECTION A-A, SECTION B-B, etc. Use a standard distance and elevation grid marked in even increments along the bottom and at both ends. Display the original ground line, hatch and label the area of concern (i.e. Excavation Area, Disposal Area, etc.) and label slope angle. Include features to be constructed, such as berms and access roads. Do not clutter sections with unnecessary information; and do not use any vertical exaggeration.

In Figure 302.2.5.3 Example Site Plan, there is to be a safety berm constructed around the excavation area of the site. The section is drawn at a scale that covers the extent of the section cut, and fills the sheet. At this scale the berm is too small to be clearly labeled and dimensioned.

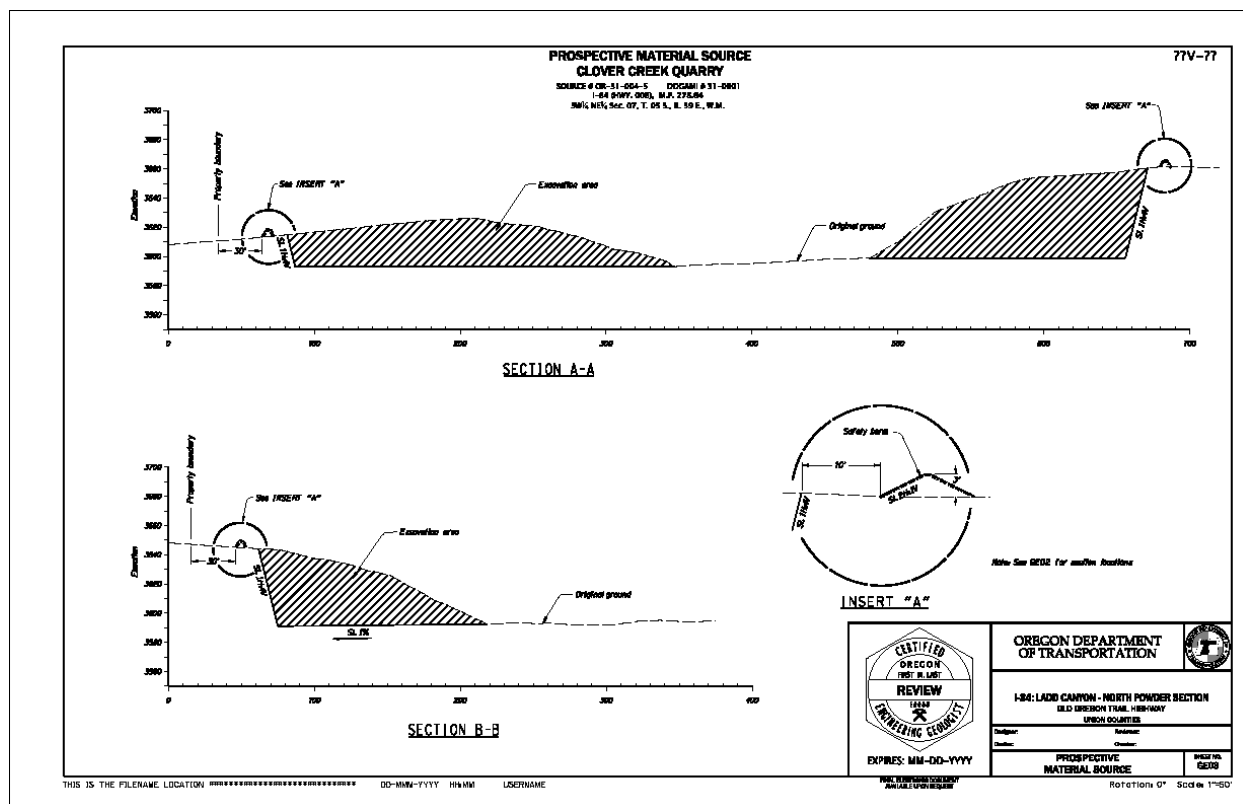


Figure 302.2.5.4 Example Sections sheet with insert of berm

Providing an insert drawing of the berm itself is recommended, so that it can be constructed accurately. See Part 400 of the [RCM](#) for more information on insert standards.

When creating the section views, always provide context by dimensioning the distance from the project or property boundaries to the nearest plan feature at either end of the section where applicable.

See Part 200 of the [OCM](#) for ODOT's Dimension Style standards.

Standard Drawings and Details

Material Sources does not have any standard drawings or standard details at this time.

Section 302.3 Check List

The drafting check list contains all items to be included on Material Source plan sheets. (Depending on the project, some of the items listed may not apply).

- ☐ Border, title block, sheet title, sheet number
- ☐ Title block information complete
- ☐ Professional of record stamp
- ☐ Designed/Drafted/Reviewed by names
- ☐ "V" number or project status stamp
- ☐ North arrow
- ☐ Construction notes
- ☐ Legend, notes and tables
- ☐ Scale bar
- ☐ Drawing titles
- ☐ Site type labels
- ☐ Vicinity map view
- ☐ Site plan view
- ☐ Section lines
- ☐ Existing roadway
- ☐ Existing structures (e.g. work shack, etc.)
- ☐ Existing utilities
- ☐ Existing contours
- ☐ Major contours labeled
- ☐ Existing and proposed features
- ☐ Exploration location targets with labels
- ☐ Waterway(s) labeled
- ☐ Right-of-way lines
- ☐ Section, Township, and Range lines
- ☐ Project, Permit, and Property Boundaries
- ☐ Distance and direction to nearest interchange/town along highway

Section 302.4 Example Drawings

Material Source example drawings are either under development or located on the Drafting page of the [Geo-Environmental website](#). See [Section 200](#) of this manual for more information regarding example drawings.

Part 303 Retaining Walls

Retaining walls are used on highway projects for grade separation, bridge abutments, slope stabilization, and excavation support.

Section 303.1 Overview

Part 303 describes the procedures for developing retaining wall project plans and should be used in conjunction with the [ODOT CAD Manual](#). The ODOT CAD Manual contains information for the use of MicroStation CONNECT, ProjectWise, plans development business process, plan sheet numbering, seed files, and plan sheet title blocks, and general overall drawing information. Additional general drawing information, specific to the GHE disciplines, is found in [Part 200](#) of this manual.

Retaining wall contract plans need to identify, locate and show design information, construction details as well as existing and proposed features, plus constraints such as utilities, other structures, no-work areas, and right-of-way. This information is used for project bidding, construction and a record of ODOT assets.

Section 303.2 Development of Retaining Wall Plan Sheets

Coordination between the retaining wall designer, the CAD technician, the roadway designer, and other project disciplines with work items in the wall vicinity is necessary for retaining wall layout. The responsibility for retaining wall design may be given to the geotechnical designer, the structural designer, or shared between the disciplines. The retaining wall design engineer is responsible for developing the design to be shown on the retaining wall sheets in the contract plans and providing the CAD technician with the necessary information for the plans.

The roadway designer is a key resource and is responsible for providing alignment, topography, and cross section models that can be used to design the retaining walls, develop wall layout and cross sections, excavation/fill limits, show obstructions and location constraints, and evaluate constructability.

The CAD technician is responsible for preparing retaining wall plans in a format consistent with the current CAD drafting standards provided in the ODOT MicroStation CONNECT workspace, this manual, and the ODOT CAD Manual.

Good engineering combined with good drafting are needed to create concise project plans resulting in successful construction, and as-constructed documentation.

The following retaining wall categories are used by ODOT to help assist in making decisions regarding retaining wall function, design, asset management and drafting.

- Bridge Abutment
- Bridge Retaining Wall
- Highway Retaining Wall
- Minor Retaining Wall

See the [Geotechnical Design Manual, Chapter 15](#) for full definitions of all retaining wall types.

The retaining wall plan sheets, when not part of a bridge, should use the roadway base mapping, plus bridge information if needed. This keeps plan graphic elements consistent with roadway plan sheets and prevents reproducing work unnecessarily.

Wall plan sheets that are part of a bridge will follow directions in the [Bridge CAD Manual \(BCM\)](#). For additional information on bridge abutments and Bridge Retaining Walls, refer to the [Bridge Design Manual and Guidance Materials](#).

This GHE CAD Manual addresses the development of plan sheets for **Highway and Minor retaining walls**.

303.2.1 CAD Workflow and Ribbon Tabs

This section describes the specific CAD tools and standards, such as text styles, sheet layout, and cells, found in the MicroStation workspace for drafting a Retaining Wall plan.

ODOT's MicroStation workspace contains workflows for the development of Retaining Wall sheets. Currently there is a workspace **ribbon tab** called **Other Structures** within the **workflow** titled **Bridge** that contains several items for drawing retaining walls.

The **Retaining Wall ribbon** contains wall specific items referenced from the GEO cell library.

- Custom linestyles (Geotextile, Geomembrane, etc.)
- Notes (Soil Nail Wall Const. Sequence, Design Soil Properties, etc.)
- Tables (Index of Wall Drawings, Soldier Pile Length, etc.)
- Details (Soil Nail Joint, MSE Coving Joints, etc.)

Standard Text

To set a standard text style use the change text attributes tool or choose a style from the applicable workflow ribbon. See [Part 200](#) of this manual for more information on standard text styles used for GHE plans.

Cell Library

The cells used in the preparation of retaining wall plans are located in the cell library named **GEO.cel**. The cell library is accessed by the ribbon tab.

Levels

Use Geotech levels as appropriate (i.e. P_GT_DESIGN_.....) for line work and text on Retaining Wall plan sheets.

Seed and Cache

Seed and Cache files are provided in the workspace. See [Part 200](#) of this manual for more information on GHE seed and cache files.

When starting a new Retaining Wall drawing use the **seed_titleblock.dgn** file and reference in the **GHE_cache.dgn** file.

The cache for **Retaining Walls** is included in the GHE cache file, along with other Hydraulic, Geotechnical, and Environmental discipline specific caches. The Retaining Walls cache contains the most commonly used tables and notes, plus legends and a couple of details.

303.2.2 File Name and Sheet name

File Name

ODOT uses a set list of CAD file names, based on an approved file naming convention developed for use within ODOT's [ProjectWise](#) data management system.

Project staff are responsible for naming individual files according to approved discipline specific standards found in the ProjectWise Document Name List through the use of the ProjectWise File Naming Tool.

Sheet Name (Title)

The sheet title **Retaining Wall Plan** is available in the title block seed file, in the **G_Sheets** model. Sheet names are located on separate levels within each model. The correct sheet name can remain turned on while all others are turned off. Use this title for all your retaining wall sheets and change each accordingly, based on which sheet in the sheet order Table 303.2.4.1, you are creating for the project. Included in this model are sheet titles for other disciplines within the Geology/Geotechnical series. Refer to the [OCM](#) for the list of available sheet names for each discipline.

Retaining walls that wrap around the bridge abutment, physically attach to the bridge, or are located between end bents are considered associated with the bridge and belong on the **"J"** series sheets. Refer to the [Bridge CAD Manual](#) for work on "J" series sheets. Retaining walls not meeting this criteria are placed on **"G"** series sheets.

303.2.3 Drawing Sequence and Sheet Numbering

Drawing Sequence

The **G series** is reserved for the Geotechnical disciplines of Geotechnical Data, Retaining Walls, Sound Walls, Rockfall Mitigation, Material Sources, Landslide Correction and Hazardous Material. When included in the G series section of ODOT's Project Plans, retaining wall plan sheets (GB series), follow Exploration Location Index sheet when one is provided.

See the [OCM](#) for drawing sequencing and sheet numbering tables, for all disciplines plan sheets.

Sheet Numbers

Retaining Wall plans, containing a **single wall**, in the "G" series begin with sheet number **GB01**.

For projects containing **multiple walls** use sheet number GB01 for the "Wall Layout and Index" sheet, when one is included. Use the three digit numbering option for the wall plans and begin numbering the sheets for the first wall with **GB101**. The plans for the second wall then begin with sheet number **GB201**, and so on.

The General Notes and Typical Section, Geotechnical Data and Detail sheets are placed with the wall plans to which they pertain and numbered accordingly.

For further information regarding drawing sequence and sheet numbering please see [Part 200](#) of this manual and the [OCM](#).

Other Required Names and Numbers

All retaining wall categories, except minor retaining walls, require:

- a structure number
- a structure name
- a structure drawing number (BDS)
- a calculation book number

Retaining walls that require a **structure number** are placed on plan sheets in the number series "**G**" or "**J**", as described above. For asset management purposes, the retaining wall structure number is unique to the retaining wall and not shared with other structures. Structure plans are assigned BDS filing system **drawing numbers** and include the bridge plan sheet title block add-on, pictured below, for placing these numbers on the sheet.

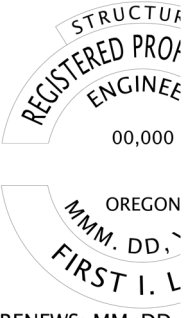
STRUCTURE NO. 00000	
BDS DWG NO. 00000	
CALC. BOOK 0000	
HWY: 000 M.P.: 000.00-000.00	
COUNTY County Name	
DATE MO/YR	
RENEW: MM-DD-	

Figure 303.2.3.1 Example drawing numbers

Minor retaining walls do not require a structure number, and are placed on “G” sheet number series. Minor retaining wall plans will be placed on plan sheets having a standard title block. See [OCM](#) Part 500 Plan Sheet Title Block for more information regarding title block standards, which includes information regarding the V- number appearance for specific sheet series.

The designer is responsible for determining if retaining wall(s) are considered a single structure (with a single structure number), or multiple structures (with multiple structure numbers) using guidance from the [GDM](#) Chapter 15; among other rules it covers the criteria for where adjacent retaining walls must be considered separate walls with separate structure numbers for asset management purposes.

The drafter typically obtains **structure numbers** along with **bridge drawing numbers** using the procedure in the [ODOT Bridge Data System \(BDS\)](#). The designer provides the drafter with input as needed.

Structure Name

The wall **structure naming** convention (developed for retaining walls in 2018) should be followed. The Structure Naming Rules document is found in guidance material on the [Bridge Engineering](#) website.

Bridge Data System (BDS) Drawing Numbers

As presented in the [BDM](#), a **Bridge Drawing Number** is assigned to the drawing as a reference number for use in the Bridge Data System except when the structure is mounted to a Bridge.

Calculation Book Numbers

Retaining wall category definitions (Bridge Abutment, Bridge Retaining Wall, Highway Retaining Wall, and Minor Retaining Wall), naming convention, and the procedures to obtain **calculation book numbers**, are discussed in the [GDM](#) Chapter 15. The designer is responsible for determining the wall category and providing this information to the CAD technician.

303.2.4 Sheet Order

Drawing Order within the Discipline

Retaining Wall plan sets generally follow the order shown in the following Table 303.2.4.1. Listed are the possible sheets, their purpose and their order within the plan set. Not all projects contain all the sheet types listed.

Sheet Order Table

Sheet Type	Example
Wall Layout and Index	<i>Provide for large projects containing multiple walls</i>
Wall Plan and Elevation	<i>May include General notes, tables and sections when space allows Becomes first sheet if there is no Wall Layout and Index sheet</i>
Geotechnical Data Sheets	<i>Refer to Part 301 of this manual for development and placement</i>
General Notes and Typical Section	<i>General notes for all sheets Includes wall typical section Could be located with applicable plan and elevation sheets depending on available sheet space To be included with each pertinent wall, in multiple wall projects</i>
Construction Staging, Temporary Retaining Wall and Temporary Shoring	<i>When needed. Follow standard plan and elevation sheet layout. Follow Construction Staging instructions this manual Part 200.</i>
Details	<i>All wall details, followed by details for temporary wall and temporary shoring when applicable To be included with each pertinent wall, in multiple wall projects</i>

Table 303.2.4.1 Sheet Order Table

For large projects with multiple retaining walls, a Wall Layout and Index sheet is generally provided as the first sheet, followed by the plan sets for each wall. Single retaining wall plan sets will begin with a Plan and Elevation sheet, followed by a Geotechnical Data sheet, etc.

The goal is to follow the sheet order as closely as possible for your individual project. Consistency across projects will help eliminate confusion and contractor claims, and will ultimately add efficiency to the drafting work flow.

303.2.5 Plan Sheets Development

When laying out the sheets for a project always work closely with the POR when determining any adjustments to the layout of individual sheets in order to provide all the possible information a contractor will need to build the project. See [Part 200](#) of this manual for more information regarding plan sheets.

General Layout, Orientation, Scales

The Wall Control Line (WCL) is the construction baseline line for the retaining wall. The WCL is identified in the plan to show the horizontal layout of the wall and it's relation to the roadway or bridge baseline stationing. The location of the wall control line is also identified in section views to define the vertical geometry control.

In selecting the location and direction of the WCL consider how this information will be used for construction survey staking, construction, and inspection. There is no predefined rule that must be followed in setting the direction of the WCL. In reviewing past projects, the direction of WCL has predominantly been consistent with the direction of the highway baseline that it is offset from, whether the wall is located on the left or right side of the road, or above or below the roadway. If the project team considers another method as better suited for the project, just be consistent within the project.

There are various possible orientations of retaining walls. A retaining wall may:

1. Support the left or right side of the roadway
2. Retain a slope adjacent to the left or right side of the roadway
3. Cross and extend on both sides of roadway baseline (MSE walls at bridge abutments for example).

When drafting the retaining wall plans, orient the Retaining Wall Plan and Elevation so the exposed face of the wall is shown in elevation whether the resulting stationing is shown increasing or decreasing, from left to right on the sheet.

The corresponding plan view, aligned with the elevation, should always include the north arrow and clearly identify the direction of increasing station. See Figure 303.2.5.2 Example Plan and Elevation Sheet (Highway Retaining Wall – “GB” series). This example plan view is shown with increasing stationing left to right (consistent with roadway plan sheets); the elevation view A-A shows the wall elevation looking at the exposed face, and the WCL stationing decreases left to right. *(Note the WCL station line origin is for layout and construction purposes and does not need to coincide with the same end of the wall used in the structure naming convention).* As previously mentioned the project team may choose another method if it is clear and consistent.

For retaining walls that cross and extend on both sides of the roadway centerline (MSE walls at bridge abutments for example), orient the WCL to increase stationing from left to right in the developed elevation. See Figure 303.2.5.3 Example Plan and Elevation Sheet (Bridge Retaining

Wall – “J” series). This example shows an MSE wall that crosses and extends on both sides of the roadway baseline. The wall elevation is shown looking at the exposed face and the plan is rotated to be in alignment above the elevation. Wall control points in lieu of WCL are identified at wall geometry change points, and station, offset and elevation of the wall control points are tabularized.

Include a list of “accompanied by” drawings on the first plan sheet for each wall as described in the Bridge CAD Manual.

Wall Layout and Index Sheet

Retaining Wall Layout and Index sheets are provided for projects containing multiple retaining walls or as they relate to other structures. The main purpose of this drawing is to clearly show the location of the walls within the project, with respect to the projects roadway alignments. See Figure 303.2.5.1 Example Retaining Wall Layout & Index sheet for an example of how this sheet is laid out.

Provide a Retaining Wall Index sheet with the overall project map showing the locations of the structures and a table listing the structure numbers, wall numbers, structure names, types of structure, and sheet numbers. Each wall is labeled with an individual wall number. Provide all the data required for each wall in the Index of Retaining Wall Drawings table. The table is available in the GEO cell library and is named TBL_Wall_LOC.cel

Sequence the wall plan set along the project limits with increasing road alignment stationing.

Provide enough information to allow the user to easily identify the proposed location of each wall. Avoid providing so much information that the drawing becomes cluttered and unclear.

Edit the *Retaining Wall Plan* title, provided in the titleblock seed file, to read as **Retaining Wall Layout and Index**.

Follow the order of sheets shown in Table 303.2.4.1 for placement of sheets within the set.

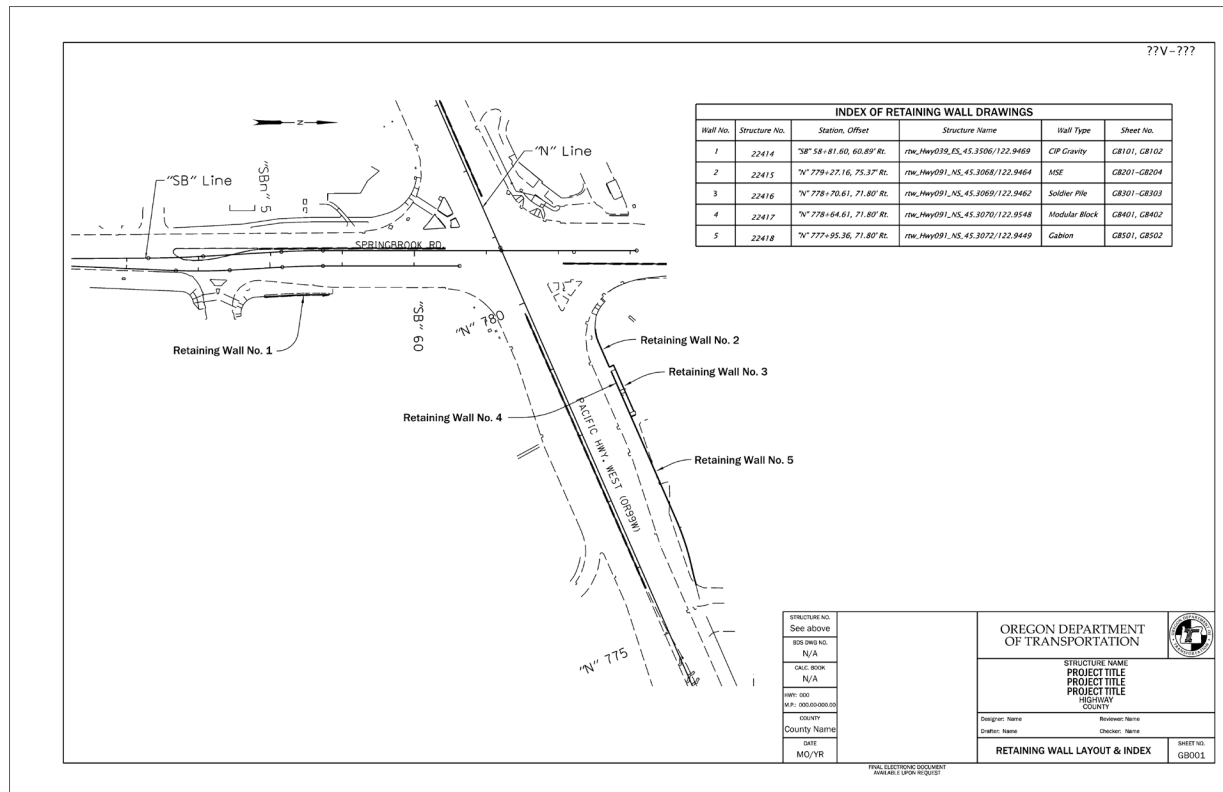


Figure 303.2.5.1 Example Retaining Wall Layout & Index sheet

Plan and Elevation Sheet

The **Plan and Elevation** sheet provides the overall view of the retaining wall components and geometry. The plan and elevation sheet contains the plan view, showing the horizontal alignment of the wall, plus an elevation view of the wall. Each of these views include station and offset between the wall control line and the roadway alignment line. All projects are to include existing features that will remain, plus all proposed design features. A typical section and general notes are included on the sheet if space allows. Similar to bridges, walls that are given structure numbers should have a location map.

The design base drawing should reference in the existing files for topography, contours, and highway right-of-way, plus the roadway, bridge, or other applicable design files. The drawing should appear on the plan sheets as though the roadway, bridge, etc., portions of the project have been completed. Remove features that are scheduled for removal or relocation during construction, such as existing vegetation, utility poles, fences, buildings, etc.

Use the same scale as the roadway plans unless graphic clarity requires a different scale to produce clear, readable plans. In some cases you may need to zoom into the design area as much as possible for your plan view to show clearly. In this case use standard scales of 1"=10', 1"=20', 1"=30', 1"=40', and so on for the plan and elevation views. If unsure of the proper scale to use consult with the project POR.

The **plan view** also shows all other structures in the area, existing and proposed, plus information from the roadway plans, such as roadway alignment line with stationing, edge of pavement, slope lines or finished contours. Choose contour intervals that are appropriate to the scale of the plan and the density

of the contours. Annotate the major contour lines. Existing structures and features are to be printed gray-shaded. This allows the retaining wall design elements to show more prominently. See [Part 200.19 Printing Project Plans](#) for further instructions regarding gray shading.

The **elevation view** shows the general appearance of the wall face, overall length of the wall, footing and top and bottom of wall vertical geometry, appurtenances such as barrier, railing, wall drains, and culverts that pass through the wall. Display all major dimensions of the wall in the elevation view. Include existing and future ground lines at the wall. Include an elevation bracket to the left of the structure. Orient the retaining wall so the exposed face of the wall is shown in elevation.

The wall elevation should be drawn at a horizontal to vertical scale ratio of 1:1 using the same scale for the elevation view as is used for the plan view. Although not a preferred practice for structural drawings, the vertical scale of the elevation view may be exaggerated if necessary. Following is an example of how to label this type of scale designation.

Elevation

Horiz. scale: 1" = 20'

Vert. scale: 1" = 5'

The following list provides a preferred standard approach to the layout of Retaining Wall Plan and Elevation sheets. The project team has discretion to revise if a clear and consistent alternate approach is chosen.

- Show the exposed face of the wall in elevation, with the wall control line stationing increasing from left to right.
- Align the plan and elevation on the left side of the sheet, with the plan view above and the elevation projected below. Use standard scales of 1"=10', 1"=20', 1"=30', 1"=40', and so on. (Long walls may require multiple sheets and match lines). Based on the location of the wall, the roadway alignment could be increasing or decreasing from left to right relative to the wall alignment. The corresponding plan view should always include the north arrow and clearly identify the direction of the roadway alignment stationing and wall control line stationing. See Figure 303.2.5.2 Example Plan and Elevation Sheet (Highway Retaining Wall – "GB" series). This sheet layout shows wall elevation projected from the plan view, the exposed face shown, wall control line stationing increasing from left to right. In this example it was necessary to rotate the roadway plan so the roadway alignment line stationing decreases from left to right. The north arrow, labeled alignment stationing, and begin and end wall stations and offsets define this plan and elevation for wall construction. A location map is shown in the top right corner of the sheet. As previously mentioned the project team may choose another method if it is clear and consistent.

- For retaining walls that cross and extend on both sides of the roadway centerline (MSE walls at bridge abutments for example), draw the developed elevation showing the exposed wall face and orienting the WCL to increase stationing from left to right. Show the plan view above, with the plan to be in-line with the elevation. See Figure 303.2.5.3 Example Plan and Elevation Sheet (Bridge Retaining Wall - "J" Series). This example shows an MSE wall that crosses and extends on both sides of the roadway alignment. The wall elevation view is shown looking at the exposed face and the plan view is rotated to be in alignment above the elevation. Wall control points, in lieu of WCL, are identified at wall geometry change points. Each wall control point is tabularized and includes the station and offset, and the top of wall and the bottom of wall elevations at that point.
- For walls with structure numbers, the upper right corner of the plan and elevation sheet is reserved for a location map. If there is no space in the upper right hand corner, the lower left corner could be used. The location map shows the project limits and identifies the retaining wall location within those limits. A location map aids prospective bidders in locating the wall, as well as providing a location record for asset management and future inspections. A location map is not required if a Retaining Wall Layout and Index sheet is created.
- When space allows, the typical cross section, details and/or notes and tables are placed in the remaining area of the plan and elevation sheet. Space limitations may require these items be displayed on the general notes sheet or a detail sheet.

See Part 200 General Drawing Information for more information regarding profiles and elevations.

For a list of elements to include on retaining wall plan sheets see the checklist in [Section 303.4](#). See Figures 303.2.5.2 and 303.2.5.3 for examples of Retaining Wall Plan and Elevation sheets in the "G" Series and in the "J" series.

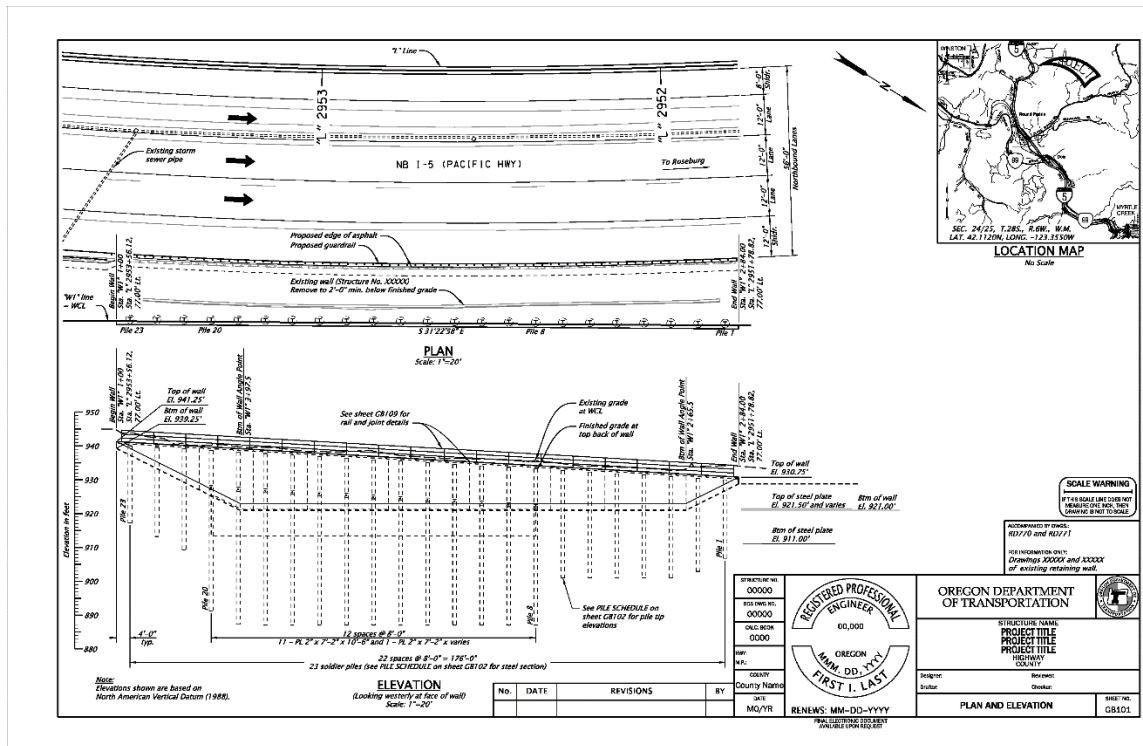


Figure 303.2.5.2 Example Plan and Elevation Sheet (Highway Retaining Wall—“GB” series)

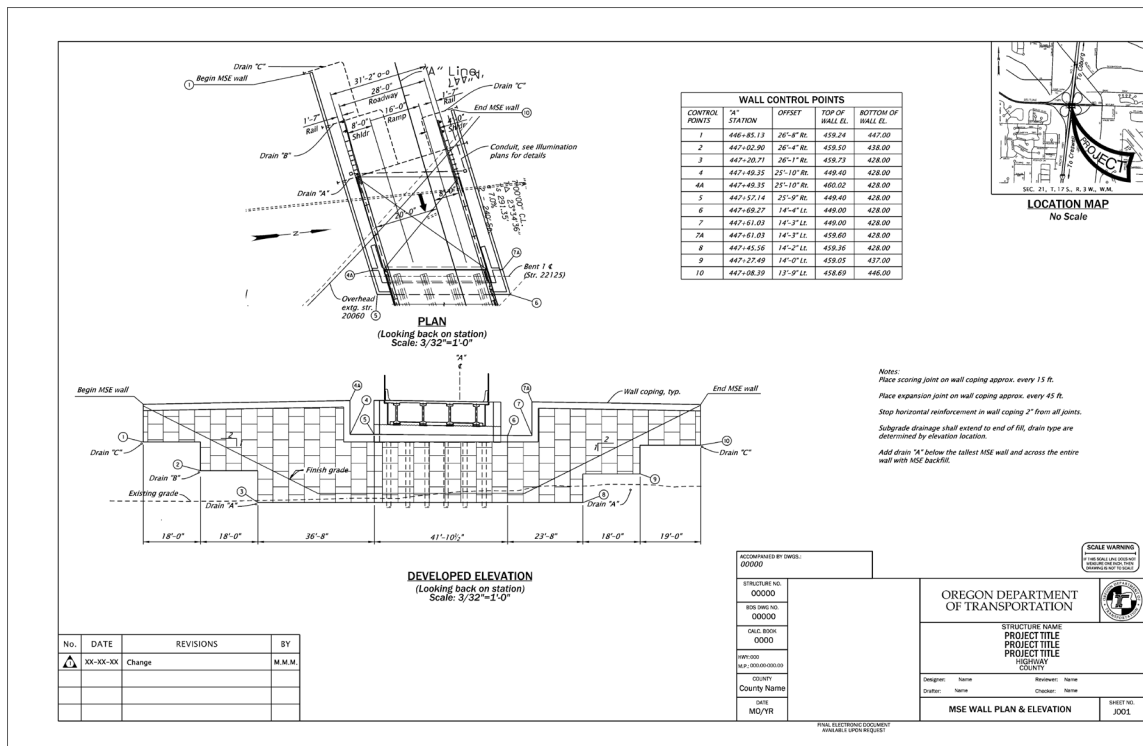


Figure 303.2.5.3 Example Plan and Elevation Sheet (Bridge Retaining Wall—“J” series)

Geotechnical Data Sheet

Refer to **Part 301 Geotechnical Data Sheets** in this manual for information on the creation of this sheet/s.

General Notes and Typical Section Sheet

The **General Notes** sheet provides project specific notes pertaining to all, or most, of the sheets within the plan set.

Provide general notes on the individual Plan and Elevation sheet to which they pertain; if room does not allow, place them on the next sheet. See the *example* column in the Sheet Order Table for note placement options.

The purpose of general notes is to give the Contractors work-related information about the site and to provide a record of retaining wall design and construction information.

The **Typical Section** should show the typical cross section of the wall, the type of wall and components, location of the WCL, wall face batter, original and finished ground, barrier or railing, drainage detail, wall dimensions, including minimum wall embedment, excavation and backfill limits.

Sheet specific notes and legends pertain to design features appearing on the individual sheets. ODOT's MicroStation workspace contains standard note and legend (templates) that can be modified to meet the requirements of each project as well as each sheet. Use them as a base to edit according to the POR's instructions.

Details, Cross Sections, Notes and Tables Sheet(s)

Detail sheets include separate drawings of single elements of the design generally drawn at a larger scale to emphasize the smaller parts, and to provide specific dimensions, labels, or different views of an element.

Detail sheets may also include **sections, cross-sections, notes and tables**. Use sections and cross-sections to better describe the wall design. Sections allow for inclusion of further dimensioning and labeling, and provide further clarification of the wall components. Place notes and tables near the detail they pertain.

Draw wall Typical Section and Details using an architectural scale ($3/4" = 1' - 0"$ for example). Choose the scale for readability and avoid using No Scale or Not-To-Scale (NTS) as much as possible.

The wall Typical Section may be placed to the right of the elevation on Plan & Elevation sheet if space allows. When necessary to further provide clarity of the wall design, use cut sections to dimension and detail unique, significantly different wall cross sections. The section(s) may be cut on the plan and elevation sheet and shown on that sheet if there is sufficient room, otherwise include them on the detail sheets. If there are no such points along the wall, provide a single cross section cut from any convenient point along the wall and display it at a scale ratio of 1:1.

Special wall details such as drainage features, utility openings, fences, concrete barriers and other appurtenances mounted on or passing through the wall should be designed and shown. Other details could include a concrete finish diagram, aesthetic feature details, and expanded details of components.

Inserts may be needed to enlarge a detailed portion of the drawing that is difficult to read at the base scale. Generally, the scale is double that of the original, but can be altered to provide maximum clarity. Inserts may be placed in any convenient location on the same sheet and general vicinity.

Projects with multiple retaining walls may have detail sheets that apply to more than one retaining wall. For asset management filing it is preferred that each wall consist of a full set of drawings; this will result in some details being duplicated for each wall. Although not recommended, there could be a special circumstance for a plan sheet to be shared by multiple walls, in this case, enter “see above” in the title block structure number box, list the retaining wall structure numbers above the title block, and clearly identify walls that each detail applies.

Retaining wall standard details DET 3700-3799 are located on the standard details engineering web page in the Bridge Series. They may be inserted into wall plan detail sheets and stamped by the EOR for the project. ODOT’s Standard Details can be copied and modified as needed to fit the project. All details must be approved by the Professional of Record prior to finalization of project plans.

Figure 303.2.5.4 provides an example detail sheet including general notes and typical section

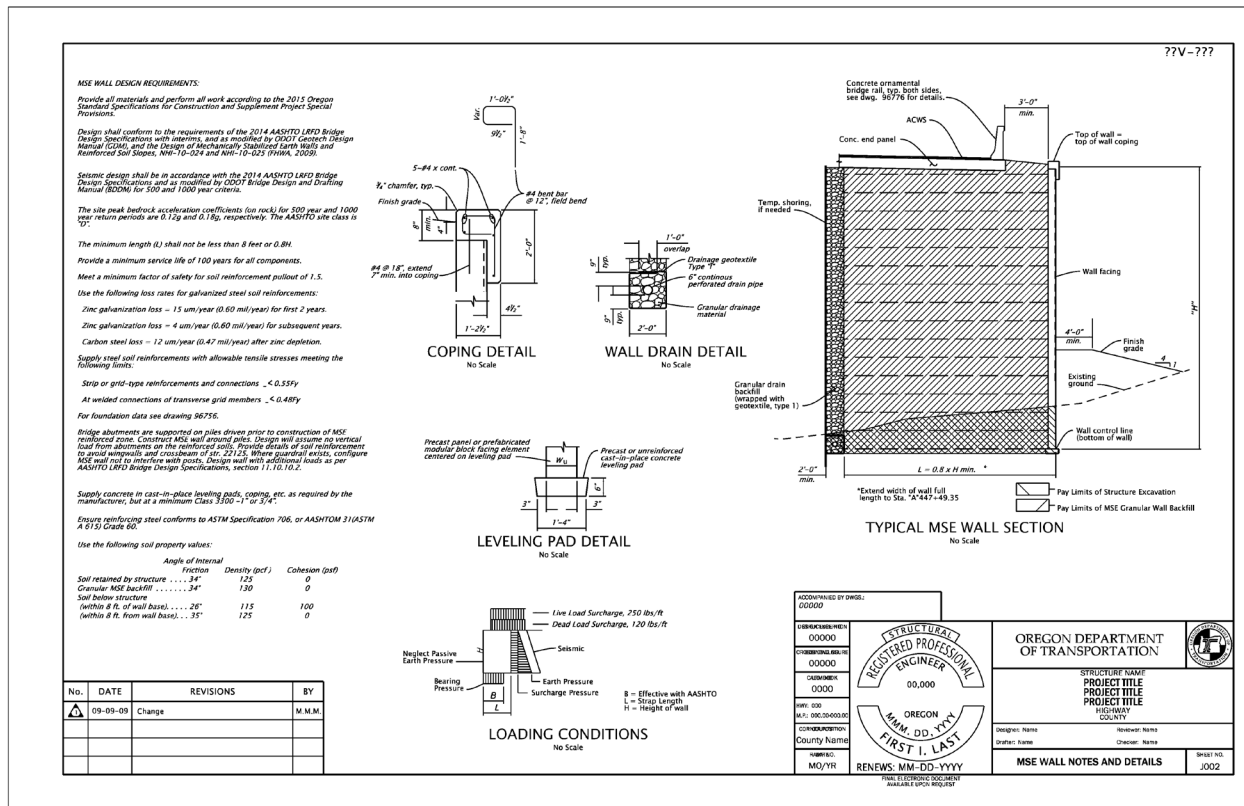


Figure 303.2.5.4 Example Notes and Details Sheet

Section 303.3 Plans Content by Wall Design Category

The type of design also further defines retaining wall plans content.

1. Proprietary design by manufacturer
2. Standard drawing design
3. Fully detailed design

Proprietary Retaining Wall Plans

Proprietary walls used on ODOT projects are MSE wall systems and modular wall systems. The design engineer selects the proprietary wall systems from GDM Appendix 15-D that are applicable and acceptable for the project and provides a list in the project special provisions. Bid plans for proprietary retaining walls are "control plans". Control plans present partially designed and detailed plans providing location (required horizontal and vertical alignment, minimum cross-section width), drainage details, barrier or railing, location of features affecting

construction, design loading, and design requirements. After the project award, the retaining wall manufacturer performs the final of the stamped design calculations and engineered shop drawings for the contractor to submit to ODOT for review.

Standard Drawing Design Referenced Retaining Wall Plans

ODOT Standard Drawings BR705 through BR709 contain general notes and design drawings for cast-in-place semi-gravity retaining walls. The designs, based on properties and assumptions identified in the general notes, are tabularized by wall height, backfill slope (horizontal, 3H:1V, 2H:1V) and seismic horizontal coefficient ($k_h = 0.10, 0.20, 0.30$). Based on the **project** site-specific conditions, the Engineer is responsible to evaluate whether or not the Standard Drawing is acceptable for use or if a special design is needed. If the Standard Drawings are used, they are included in the list of Standard Drawings following the index of sheets in the “A” series plans and included with other standard drawings at the end of the project plans set. The retaining wall plans (“G” or “J” series) in the project plans are needed to show the layout, geometry, (plan, profile, typical section) project specific design evaluation such as bearing resistance and settlement, drainage and other project specific design and detail, and provide reference to the applicable design values from the Standard Drawing.

Fully Detailed Retaining Wall Plans

Examples of retaining walls that are fully detailed in the project plans without accompanying standard drawings are non-patented, nonproprietary retaining walls, cast-in-place semi-gravity retaining walls outside the scope of BR705 through BR709, soil nail wall, cantilever or anchored soldier pile and sheet pile walls, etc. The project documents must completely identify materials, dimensions, and constraints to construct the retaining wall including general notes, layout, geometry, (plan, elevation, typical section), design loading, drainage and other project specific details.

Standard Drawings and Details

ODOT currently has a set of [10 Standard Drawings](#) for Retaining Walls and one Standard Detail drawing, [DET2000 Gabion Retaining Wall details](#).

For more information regarding standard drawings and details, and their use in project plans see the [Engineering webpage](#).

Section 303.4 Check Lists

The following drafting check lists contain all items to be included on Retaining Wall plan sheets. The list is intended to be fairly comprehensive, but additional checklist items may be necessary. (Depending on the project, some of the items listed may not apply).

ALL SHEETS

- ☐ Border, title block, sheet title, sheet number

- ☐ Professional of record stamp
- ☐ BDS filing system drawing number, structure number, calculation book number in title block for retaining walls except minor retaining walls; project “V” number in upper right hand corner for minor retaining walls.
- ☐ Title block information complete
- ☐ “V” number or project status stamp
- ☐ Scales noted
- ☐ Structure Number
- ☐ Bridge drawing Number
- ☐ Calculation Book Number

WALL INDEX (projects with multiple walls)

- ☐ Plan of project limits with each wall called out
- ☐ Table of walls listing wall number, structure number, structure name, type of wall and sheet numbers for each retaining wall.
- ☐ Vicinity Map in upper right hand corner (unless project limits map clearly shows location)

PLAN

- ☐ North Arrow
- ☐ Existing edge of pavement, surface, subsurface and overhead utilities/objects to remain that could affect or be affected by wall construction
- ☐ Boring locations
- ☐ Existing contour lines when useful to convey topography in the wall vicinity
- ☐ Wall control line (WCL) with station ticks and horizontal alignment shown (if not directly offset from roadway baseline, provide horizontal geometry/curve data (delta, radius curve, tangent, and length)
- ☐ Begin and end stations of WCL, and roadway stationing offsets at begin and end of wall and changes in alignment
- ☐ Plan limits of the wall footprint, such as varying width of the footing, minimum MSE strap length, limits of soil nails, etc.
- ☐ Consider delineating construction or excavation limits to verify work does not impact right of way or obstructions
- ☐ Right of way lines and easements
- ☐ Coordinate with design team to attempt to avoid or move obstructions outside the limits of MSE reinforcement, tie-back, soil nail, etc. zones where possible.
- ☐ Temporary retaining walls or shoring as needed for construction
- ☐ Bridge retaining wall plans should show the location of bridge as well as the bridge structure number.

- ☐ Use match lines when necessary for long retaining walls extending over the sheet width
- ☐ Cross section cut lines as needed

ELEVATION

- ☐ Horizontal to vertical scale ratio of 1:1 is preferred. In some instances of very long walls, if an exaggerated vertical scale relative to horizontal is unavoidable, ensure the wall dimensions for construction are clear and show representative segments at 1:1 on details sheets.
- ☐ Dimension and label overall wall length and wall type
- ☐ Dimension and label coping/rail/barrier on wall if applicable. A special detail identifying post or joint spacing coordinated with wall expansion/projection joints may be necessary.
- ☐ Survey datum for vertical alignment
- ☐ Elevations and dimensions to show design heights and respective wall lengths
- ☐ A grade line diagram at the wall control line, this may include a table at station intervals (20 ft. or other) or include curve data, if applicable
- ☐ Top of wall elevations, clear vertical geometry: linear or vertical curve, provide table or label elevations at station intervals needed.
- ☐ Elevations along bottom of wall (if wall has footings), along top of footing (if wall has footings), along top of leveling pad (if wall has leveling pad)
- ☐ Stations, offset, elevations, dimensions as needed at expansion/score joint locations, bottom of wall/leveling pad or footing elevations, steps, discontinuities, etc. Consider assumed block/MSE panel size in developing location of wall steps.
- ☐ Existing and finished grade lines at front and back face of wall
- ☐ Minimum wall embedment
- ☐ Locations of expansion and projection joints (cast-in-place concrete)
- ☐ Soldier pile size, spacing, minimum tip elevations
- ☐ Drain locations
- ☐ Architectural treatment of wall (if used)
- ☐ Show vertical and horizontal spacing of soil nails (soil nail walls)
- ☐ Identify proof test and verification test nail locations (soil nail walls)
- ☐ Tie back location and spacing
- ☐ Above and below ground utilities/objects
- ☐ Location, depth and extent of any unsuitable material to be removed and replaced
- ☐ Coping/barrier/rail/fencing
- ☐ Use match lines when necessary for long retaining walls extending over the sheet width

GEOTECHNICAL DATA SHEET

- ☐ See Part 301 Geotechnical Data of this manual

GENERAL NOTES

- ☐ Design standard and construction specifications
- ☐ Design loading diagram, magnitude, location and direction of applicable external loads:
 - dead load surcharge
 - live load surcharge
 - barriers (vehicle, bicycle, and/or pedestrian)
 - luminaire and sign supports
- ☐ Geotechnical design criteria
- ☐ Seismic design criteria
- ☐ Material designations/ requirements for concrete, structural and reinforcing steel, if needed: material for facing, temporary/permanent lagging, tie back anchors, soil nails, other
- ☐ Architectural treatment
- ☐ Minimum reinforcement length for overall and external stability (MSE walls)
- ☐ Design criteria for contractor designed items such as soil nails

SECTION

- ☐ Wall type
- ☐ Wall batter (if used)
- ☐ Wall control line location
- ☐ Original ground line
- ☐ Finished grade on both sides of wall; slope rate above and below the wall
- ☐ Minimum Wall embedment
- ☐ Minimum reinforcement length for overall and external stability (MSE walls)
- ☐ Excavation and backfill limits
- ☐ Backfill type
- ☐ Wall drainage features
- ☐ Railing or fencing on top of wall (if used)
- ☐ Barrier or railing or fencing on top of/adjacent to wall (if used)
- ☐ Concrete finish diagram if applicable
- ☐ Temporary railing/barrier, if needed for adjacent traffic during construction (show its placement relative to the wall)
- ☐ Additional wall cross sections shall be included for those locations where the wall layout line in relation to the right of way line is critical. Each sheet of the wall plans, depending on type of wall, shall have a note included on them, such as: "THIS PLAN ACCURATE FOR RETAINING WALL WORK ONLY."
- ☐ Show soil nail angle, size, and length

DETAILS

- ☐ Pay limits for bid items

-
- ☐ Detail of architectural treatment/aesthetic features
 - ☐ Construction sequence requirements, if applicable, including traffic control, access, stage construction sequences, temporary shoring, and ground improvement
 - ☐ Details of applicable retaining wall appurtenances including utilities and drainage facilities (e.g., storm sewer pipes), copings, barriers or rails (e.g., vehicle, bicycle, and/or pedestrian), guardrail posts, luminaire and sign supports (including conduit locations), fencing, etc.
 - ☐ Identify drainage outlet/connection to road drainage pipe, drainage cleanout
 - ☐ Soil nail details including corrosion protection
 - ☐ Tie back anchor details including corrosion protection

Section 303.5 Example Drawings

Retaining Wall example drawings are either under development or located on the Drafting page of the [Geo-Environmental website](#). See [Section 200](#) this manual for more information regarding example drawings.

Part 400 Hydraulics CAD

The Hydraulics CAD parts of this manual cover the CAD standards used in the development of plan sheets for each of the [Hydraulics disciplines](#), which includes:

- Stormwater Facilities
- Culverts
- Open Channel and Bank Protection
- Fish Passage and Waterway Enhancement
- Temporary Water Management

Also included are CAD standards for developing operational plans for:

- Operation and Maintenance Manuals

See [Part 200](#) for general drawing instruction that collectively covers the Geotechnical, Hydraulics, and Environmental disciplines.

Part 401 Facility Identification Markers

ODOT installs standard “Facility Identification” field markers at each **culvert** and each **stormwater facility** owned, operated and maintained by the department. Field markers help maintenance crews, scoping teams, and asset management employees, identify facilities when field locating structures within ODOT’s system.

Section 401.1 Overview

Each facility is assigned a unique Drainage Facility Identification number (DFI) which is typically included on specified markers. See the [Hydraulic Design Manual](#) Chapter 17 for instructions on how to obtain a DFI number, what information is to be provided on the project plans for each marker and where to locate the markers in the field.

ODOT’s standard drawings, [RD398 Culvert ID Marker](#), and [RD399 Stormwater Treatment and Storage Facility Field Markers](#) specify the marker types and locations for each type of facility. See the [Hydraulic Design Manual](#) Chapter 17 for standard field marker types and descriptions.

Culvert field marker standards are different from **Stormwater Facility field marker standards**. Part 404 Facility Identification Markers addresses them both, but separate from each other to avoid confusion. **Section 401.2 – Section 401.5** address **Culvert Identification Markers**, and **Section 401.6 – Section 401.9** address **Stormwater Facility Identification Markers**. These sections provide the methods and procedures for how and where each field marker type is displayed on the plan sheets. Specific CAD elements, such as standard cells, are described along with instructions on sheet layout and ribbon workflow tabs specific to facility identification marker plans.

Section 401.2 Development of Culvert Identification Marker Sheets

Culvert ID Marker sheets are produced for project plans through collaboration between the project EOR, the culvert designer, and the drafting resource. The engineer/designer are responsible for developing the Culvert identification marker plan, based on their design of the culvert itself, (whether a new culvert, or a replacement or repair of an existing culvert).

The CAD technician is responsible for developing the plan sheets showing the culvert design with the locations of identification markers in a format consistent with the current CAD and drafting standards provided in the ODOT MicroStation workspace, this manual, and the [OCM](#).

401.2.1 CAD Workflows

ODOT's MicroStation workspace contains a work flow for the development of Hydraulics disciplines sheets. For Culvert Plan sheets the active workflow is titled **Hydro** and the ribbon tab is titled **Culverts**.

This section will further describe the specific CAD tools and other standards; such as text styles, sheet layout, cells, etc., found in the workflow for creating a Culvert Identification Marker plan.

Standard Text

To set a standard text style use the change text attributes tool or choose a style from the applicable workflow ribbon tab. See [Section 207](#) for more information on standard text styles used for GHE plans.

Cell Library

The cell library for the Hydraulics disciplines is named **Hydro.cel**. The elements necessary to complete a Culvert ID Marker sheet are located in this cell library. The cell library is accessed by the Culverts ribbon tab. The tab includes elements such as; boulders and root wads for culvert details, along with notes, tables and symbols.

Levels

Use Hydro levels as appropriate (i.e. P_HY_DESIGN_...) for line work and text on Culvert plan sheets. Retain the level structure of referenced drawings.

Seed and Cache

Seed and Cache files are provided in the workspace. See [Part 200](#) for more information on seed and cache files.

When starting a new Culvert drawing use the **seed_titleblock.dgn** file and reference in the **GHE_cache.dgn** file.

The cache for **Culverts** is included in the GHE cache file, along with other Hydraulic, Geotechnical, and Environmental discipline specific caches. The Culvert cache contains the most commonly used tables and notes, plus graphic details for fish passage, bank protection and waterway mitigation.

401.2.2 File Name and Sheet name

File Name

ODOT uses a set list of CAD file names, based on an approved file naming convention developed for use within ODOT's [ProjectWise](#) data management system.

Project staff are responsible for naming individual files according to approved discipline specific standards found in the ProjectWise Document Name List through the use of the ProjectWise File Naming Tool.

Sheet Name (Title)

Culvert sheets are titled as “Culvert Plan” and may include one or several sheets titled “Details”. A title block seed file, named *seed_titleblock.dgn*, is available in the workspace. The titleblock seed is a reference file containing models for sheet names by-discipline. Sheet names are located on separate levels within each model, so the correct sheet name can remain turned on while all others are turned off. The sheet title for culvert plans is located in the “H_Sheets” model.

Refer to the [OCM](#) for list of available sheet names for each discipline.

401.2.3 Drawing Sequence and Sheet Numbering

Drawing Sequence

Place Culvert Plan sheets before Fish Passage sheets and after Stormwater treatment sheets. See the [OCM](#) for drawing sequencing and sheet numbering tables, for all disciplines plan sheets.

Title Sheet

When a Culvert plan is a stand-alone project, include a title sheet. The title sheet is the first sheet of a Project Plans set. This includes discipline specific stand-alone plan sets, such as Roadside Development projects, MCM Culvert renewal projects and other types of maintenance projects. Title sheets are assigned sheet number “A01”, regardless of discipline. For title sheet development guidance see the [RCM](#).

Location Index Sheet

Large projects with multiple structures/features of the same type may need a “Location Index” sheet. See [Part 200](#) of this manual for instruction on what to include, and where to place this sheet within the plan set.

Sheet Numbering

Culvert sheets appear in the ‘H’ series sheet numbering sequence. Culvert plans begin with sheet number HB101, the number in red being optional and used when a project contains more than one culvert. The ‘HB’ series follows the HA series for Stormwater plans and precedes the HC series for Fish Passage sheets. For further information regarding drawing sequence and sheet numbering please see [Section 204](#) and the [OCM](#).

401.2.4 Plan View

Layout

Arrange Culvert sheets to clearly show the culvert design. Provide a plan view with a profile or elevation view, of the culvert, directly below the plan view. See [Section 212](#) for Plan Sheet Development, and See Chapter 2 of the [Roadway CAD Manual](#) for plan and profile sheet layout options.

Clearly show the location of all culvert facility identification markers on the plan view. Culvert ID marker locations are shown on the plan sheet for each culvert when there are more than one. Specify the exact information that must be included on the field marker in the construction notes, and include a reference to ODOT's Standard Drawing **RD398 Culvert ID Marker**. See following Figure 404.2.4.1.

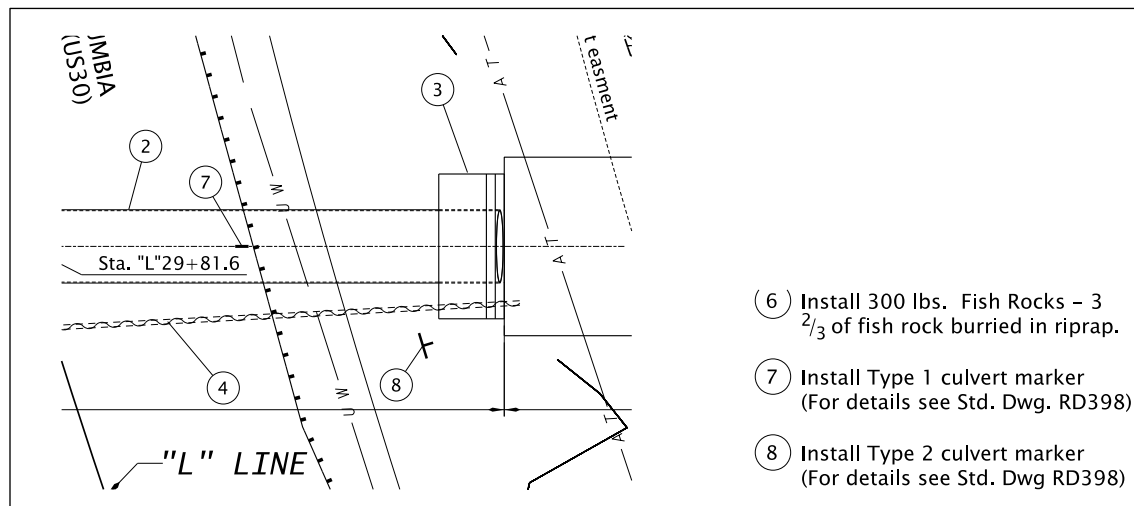


Figure 401.2.4.1 Culvert Plan with ID Marker Locations and Construction Notes

Include a “Culvert ID Marker Table” (See Figure 401.2.4.2) on the plan sheet. The cell for the table is called TABL_CULVMRKR, and is included in the hydro cell library. The table can also be accessed from the culvert ribbon tab.

The marker table provides space for listing each culvert location by station and MP, and includes the DFI. Marker types are included with check boxes. There are two types of culvert ID markers, type 1 and type 2. See Section 401.3 for more information on marker types.

The approved DFI number will be either a Bridge Structure number, or a DFI that begins with a ‘D’. The DFI will default to the bridge structure number, if one is assigned and entered into the Drainage Facility Management System (DFMS). [Geo-Environmental Section’s](#) Culvert-Hydraulic Engineer assigns and provides approved DFI numbers upon request.

CULVERT ID MARKER TABLE							
Culvert Location		Structure Number	DFI Number	Type 1 Marker		Type 2 Marker	
Station	MP			Inlet	Inlet & Outlet	Inlet	Inlet & Outlet
"LC" 000-000.00 Rt.	000.00	00000	D01234	✓		✓	

See Std. Dwg. RD398

✓ Check where appropriate

Figure 401.2.4.2 Culvert ID Marker Location Table

Culverts with a span of six feet and greater are assigned a bridge structure number. Structure numbers are obtained by using the [Bridge Data System](#) (BDS). See also [ODOT Structure Numbering Rules](#).

Section 401.3 Culvert ID Marker Types

The EOR is responsible for providing the CADD Technician with the location and type of each marker, along with the culvert identification numbers. The CADD Technician is responsible for providing this information on the plan view by placing the appropriate cell, label, construction notes and table onto the plan sheets. In the construction notes always include reference to the standard drawing (when one applies).

Type 1 Culvert ID Marker

Type 1 culvert ID markers are a green preformed fused thermoplastic tape installed along the edge of pavement at the inlet end of the culvert.

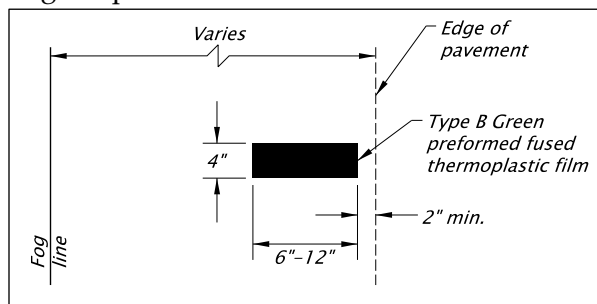


Figure 401.2.4.1 Type 1 Marker Size and Placement

Type 1 culvert markers are required for all culverts regardless of size. See the [Hydraulics Design Manual](#) Chapter 17 for complete Type 1 Culvert Marker guidance.

Culverts with a span of 48" and less:

- The Project Roadway Engineer determines the marker location. Culverts 48 inches and less are typically placed on the Roadway Drainage and Utility plans within the "D" series sheets. See the [OCM](#).

Culverts with a span greater than 48" and less than 20':

- The Project Hydraulic Engineer determines the marker location. Culverts in this size range are placed in the Culvert plans within the "H" series sheets. See the [OCM](#).

Type 2 Culvert ID Marker

The Type 2 culvert ID marker is a white non-reflective aluminum paddle with black lettering and green strip, mounted onto a steel post or permanent feature. When placing the type 2 marker symbol, face the paddle parallel to the roadway on the plan view. (Paddle style markers are installed facing parallel to the roadway to avoid distracting the traveling public, but are clear to maintenance crews.) The type 2 style marker paddle displays the mile point and DFI assigned to the culvert. See [Hydraulics Design Manual](#) Chapter 17 for more information on Type 2 Culvert Markers.

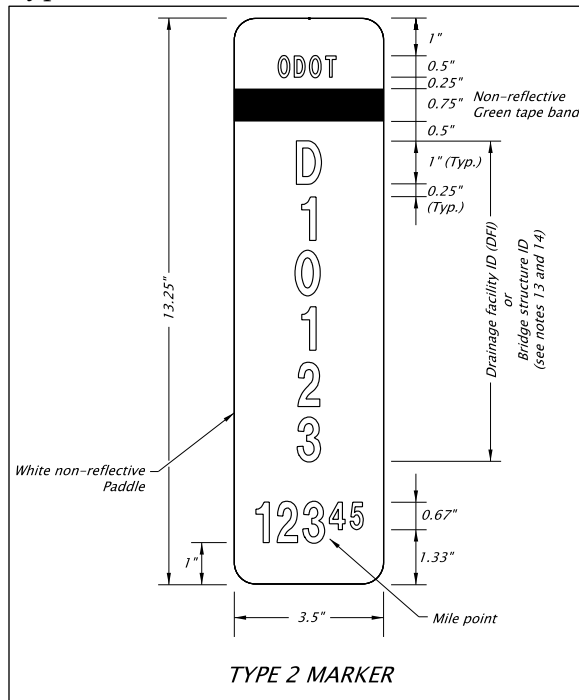


Figure 401.2.4.2 Type 2 Paddle Style Marker as shown on Standard Drawing RD398

Paddle dimensions, paddle mounting guidance, and installation details are included on [Standard Drawing RD398 – Culvert ID Marker](#)

Standard drawing RD398 describes the culvert identification markers in detail and includes size, color and installation guidance. Include reference to RD398 in all culvert plan sets with culvert ID markers.

See ODOT's [engineering website](#) for downloadable DGN's and PDF's of each standard drawing.

Section 401.4 Check List

The drafting check list below contains all items to be included on Culvert sheets. (Depending on the project, some items may not apply).

- ☐ Border, title block, sheet title, sheet number
- ☐ Title block information complete
- ☐ Professional of record stamp
- ☐ "V" number or project status stamp
- ☐ Index sheet (if needed)
- ☐ Plan view
- ☐ Profile view
- ☐ North arrow
- ☐ Scales noted
- ☐ Existing roadway
- ☐ Existing structures (e.g. bridge, culvert, wall, sign-bridge, etc.)
- ☐ Existing utilities
- ☐ Existing contours
- ☐ Contours labeled
- ☐ Proposed roadway with alignment and stationing
- ☐ Proposed structures
- ☐ Proposed utilities
- ☐ Proposed contours
- ☐ All facilities labeled with assigned numbers
- ☐ Waterway(s) labeled and flow direction shown
- ☐ Right-of-way lines
- ☐ Temporary construction easements
- ☐ Construction limits
- ☐ Detail(s)
- ☐ Legend, notes and field Marker table
- ☐ Marker type
- ☐ Marker location
- ☐ Correct marker Symbol
- ☐ Marker callout
- ☐ Marker label information

Section 401.5 Example Drawings

Culvert ID marker example drawings are either under development or located on the Drafting page of the [Geo-Environmental website](#). See [Section 213](#) for more information regarding example drawings.

Section 401.6 Development of Stormwater Facility Identification Marker Sheets

Stormwater treatment sheets are produced for project plans through collaboration between the project Hydraulic or Roadway engineer/designer and the drafting resource.

The project EOR is responsible for developing the stormwater design to be shown on the sheets for the project plans, and providing the CADD Technician with the design files.

The CAD technician is responsible for developing plan sheets that reference the project base files and the stormwater treatment facility design files, in a format consistent with the current CAD and drafting standards provided in the ODOT MicroStation workspace, this manual, and the [OCM](#).

401.6.1 CAD Workflows

ODOT's MicroStation workspace contains a workflow for the development of Hydraulics disciplines sheets. For stormwater treatment plan sheets the active workflow is titled **Hydro** and the ribbon tab is titled **Stormwater**.

This section will further describe the specific CAD tools and other standards; such as text style, sheet layout, cells, etc., found in the workflow for creating a facility identification marker plan.

Standard Text

The approved standard text styles are available in the annotation tools located in the **Drawing** workflow.

Three standard ODOT text styles are used on stormwater treatment facility identification marker sheets:

- ODOT Notes – used for labels, notes, dimensions, and table data.
- ODOT Subtitles – as implied by the name.
- ODOT Titles – as implied by the name.

Text styles can be set in the change text attributes tool, or you can take advantage of the workflow ribbon tabs where styles are set automatically.

Cell Library

The cell library for the Hydraulics disciplines is named **Hydro.cel**. The elements necessary to complete a stormwater treatment facility identification marker sheet are located in this cell library. The cell library is accessed by the Stormwater ribbon tab. The tab includes elements such as; Facility symbols and custom linestyles, along with notes and tables.

Levels

Use Hydro levels as appropriate (i.e. P_HY_DESIGN_.....) for line work and text on stormwater treatment facility plan sheets. Retain the level structure of referenced drawings.

Seed and Cache

Seed and Cache files are provided in the workspace. See [Part 200](#) for more information on seed and cache files.

401.6.2 File Name and Sheet name

File Name

ODOT uses a set list of CAD file names, based on an approved file naming convention developed for use within ODOT's [ProjectWise](#) data management system.

Project staff are responsible for naming individual files according to approved discipline specific standards found in the ProjectWise Document Name List through the use of the ProjectWise File Naming Tool.

Sheet Name (Title)

Stormwater treatment facility plan sheets are titled as either;

- Stormwater Plan
- Flow Control Facility Plan
- Storm Sewer System Plan
- Water Quality Facility Plan

Each type of plan may include one or several sheets titled "Details". A title block seed file, named *seed_titleblock.dgn*, is available in the workspace. The titleblock seed is a reference file containing models for sheet names by discipline. Sheet names are located on separate levels within each model, so the correct sheet name can remain turned on while all others are turned off. The sheet titles for stormwater treatment plans are located in the "H_Sheets" model.

Refer to the [OCM](#) for list of available sheet names for each discipline.

401.6.3 Drawing Sequence and Sheet Numbering

Drawing Sequence

Place Stormwater Plan sheets before Culvert Plan sheets. They appear first in a set of Hydraulics plans. See the [OCM](#) for drawing sequencing and sheet numbering tables, for all disciplines plan sheets.

Title Sheet

When a stormwater treatment facility plan is a stand-alone project, include a title sheet. The title sheet is the first sheet of a Project Plans set. This includes discipline specific stand-alone plan sets, such as Roadside Development projects, MCM Culvert renewal projects, along with other types of maintenance projects. Title sheets are assigned sheet number “A01”, regardless of discipline. For title sheet development guidance see the [RCM](#).

Location Index Sheet

Large projects with multiple structures/features of the same type may need a “Location Index” sheet. See [Part 200](#) of this manual for instruction on what to include, and where to place this sheet within the plan set.

Sheet Numbering

Stormwater treatment sheets appear in the ‘H’ series sheet numbering sequence. Stormwater treatment plans begin with sheet number HA101, the number in red being optional and used when a project contains more than one stormwater facility. The ‘HA’ series places first in a set of hydraulics plans. For further information regarding drawing sequence and sheet numbering please see the [OCM](#).

401.6.4 Plan View

Layout

Arrange stormwater treatment sheets to clearly show the facility design. Some facility types may require a plan view with a profile or elevation view of the facility. See [Section 212](#) for Plan Sheet Development, and See Chapter 2 of the [Roadway CAD Manual](#) for plan and profile sheet layout options

Clearly show the location of all facility identification markers on the plan view. Facility identification marker locations are shown on the plan sheet for each facility when there are more than one. Specify the exact information that must be included on the field marker in the construction notes, and include a reference to ODOT’s Standard Drawing [RD399 Stormwater Treatment and Storage Facility Field Markers](#). See following Figure 401.6.4.1.

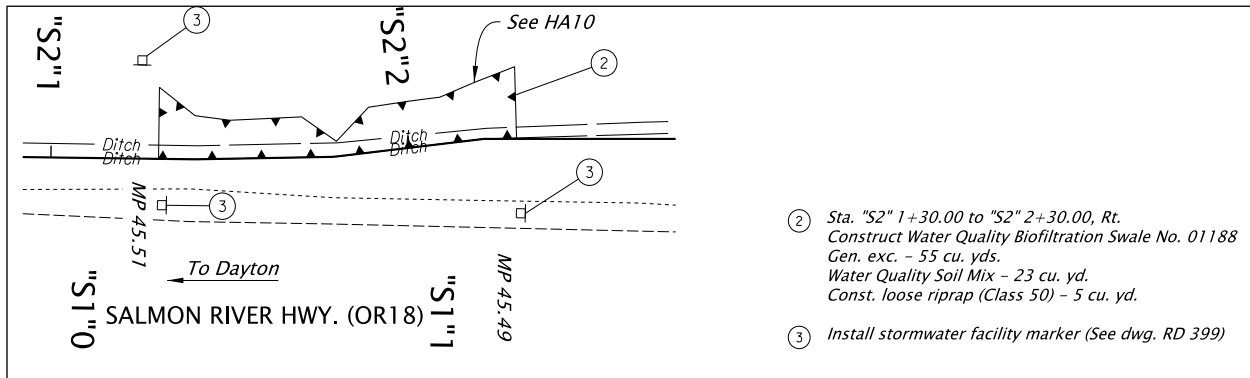


Figure 401.6.4.1 Figure 401.6.4.1.4.1 Facility Plan with ID Marker Locations and Construction Notes

Include the Facility ID Marker Table to provide the location and type of each marker for the facility. See Figure 401.6.4.2.

FACILITY ID MARKER TABLE						
FACILITY LOCATION		DFI #	TYPE S2 MARKER		TYPE S1 MARKER	
STATION	MP		BEGIN	END	RED	GREEN
Sta. "LC" 000-000.00 Rt.	000.00	D01234	✓	✓	✓	

✓ Check where appropriate
 Red = Beginning of facility
 Green = End of facility

Figure 401.6.4.2 Facility ID Marker Location Table

The cell for the table is called TABL_FACMRKR, and is included in the hydro cell library. The table can also be accessed from the stormwater ribbon tab. The marker table provides space for listing each facility location by station and MP and includes the DFI and check boxes for marker types. There are two types of stormwater facility ID markers, type S1 and type S2.

Section 401.7 Facility Identification Marker Types

The EOR is responsible for providing the location and type of each marker. The CADD Technician is responsible for providing this information on the plan view by placing the appropriate cell, label, construction notes and table. In the construction notes always include reference to the standard drawing when applicable.

Type S1 Stormwater Facility ID Marker

Type S1 Stormwater Facility ID markers are non-reflective flexible plastic posts embedded into the ground. Type S1 markers are red or green in color. The red plastic post marks the beginning

of the facility maintenance area and the green plastic post marks the end. Placement of these markers is 4 to 6 feet from edge of pavement or face of curb.

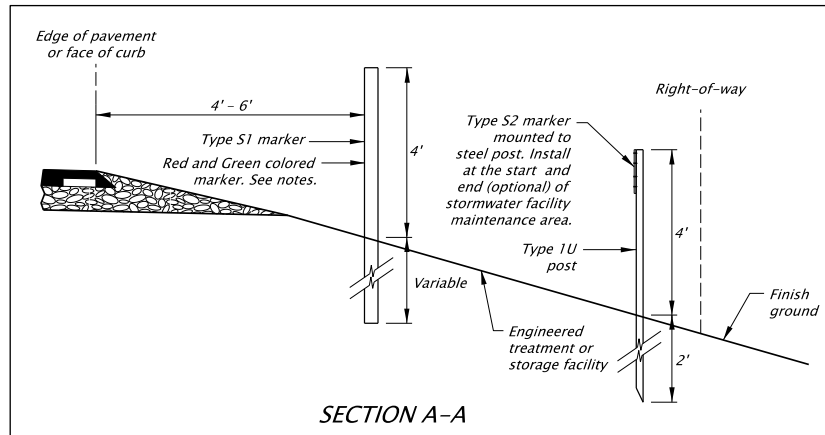


Figure 401.6.4.1 Type S1 and S2 Markers Placement

See [Hydraulics Design Manual](#) Chapter 17 for complete Type S1 Culvert Marker guidance.

Type S2 Stormwater Facility ID Marker

The type S2 stormwater facility ID marker is a white non-reflective aluminum paddle with black lettering and green strip, mounted onto a steel post or permanent feature. The paddle displays the mile point location of the facility and the Drainage Facility Identification (DFI) number assigned to the facility. Placement of these markers is at the beginning of the facility near the right-of-way boundary, see Figure 401.6.4.2 Paddle style markers are installed facing parallel to the roadway to avoid distracting the traveling public.

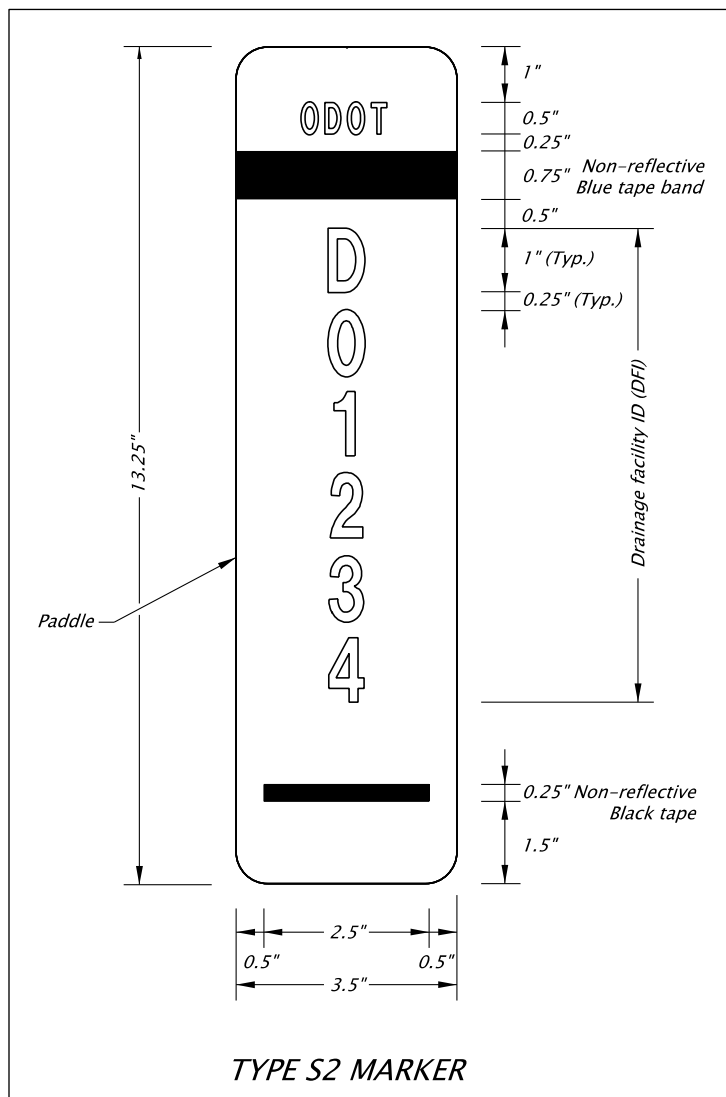


Figure 401.6.4.2 Type S2 Paddle Style Marker

Paddle dimensions, paddle mounting guidance and installation details are shown on [Standard Drawing RD399](#). See [Hydraulics Design Manual](#) Chapter 17 for complete Type S2 Field Marker guidance.

[Standard Drawing RD399 – Stormwater Treatment and Storage Facility Field Markers.](#)

Standard Drawing RD399 describes the stormwater facility ID markers in detail and includes size, color and installation guidance. Include RD399 in all stormwater treatment facility plan sets with identification markers. Standard drawings are stamped by an EOR, specifically the discipline program leader, and are supported by engineering analysis, calculations, and/or justification. Standard drawings cannot be modified by designers on a project-by-project basis.

See ODOT's [Engineering website](#) for more detailed information regarding the use of standard drawings.

Section 401.8 Check List

The drafting check list below contains all items to be included on Stormwater Facility plan sheets. (Depending on the project, some items may not apply).

- | | |
|--|---|
| ☐ Border, title block, sheet title, sheet number | ☐ Proposed structures |
| ☐ Title block information complete | ☐ Proposed utilities |
| ☐ Professional of record stamp | ☐ Proposed contours |
| ☐ "V" number or project status stamp | ☐ All facilities labeled with assigned numbers |
| ☐ Index sheet (if needed) | ☐ Waterway(s) labeled and flow direction shown |
| ☐ Plan view | ☐ Right-of-way lines |
| ☐ Profile view | ☐ Temporary construction easements |
| ☐ North arrow | ☐ Construction limits |
| ☐ Scales noted | ☐ Detail(s) |
| ☐ Existing roadway | ☐ Legend, notes and field Marker table |
| ☐ Existing structures (e.g. bridge, culvert, wall, sign-bridge, etc.) | ☐ Marker type |
| ☐ Existing utilities | ☐ Marker location |
| ☐ Existing contours | ☐ Correct marker Symbol |
| ☐ Contours labeled | ☐ Marker callout |
| ☐ Proposed roadway with alignment and stationing | ☐ Marker label information |

Section 401.9 Example Drawings

Stormwater Facility ID marker example drawings are either under development or located on the Drafting page of the [Geo-Environmental website](#). See [Section 213](#) for more information regarding example drawings.

Part 405 Temporary Water Management (TWM)

Temporary water management (TWM) is the temporary control of water within a work area. Temporary water control measures, or (BMP's) are installed to isolate the work area by either redirecting water or controlling water flowing into and out of the work area during construction activities. When construction is complete the water is restored to its original flow by removing the temporary measures.

Section 405.1 Overview

A TWM concept plan identifies the measures to be used on a project to manage the water during construction in and around a water body.

TWM can include:

- Routing streamflow around or through the work area
- Isolating the work area from streamflow or surrounding water
- Removing water within and blocking water entering the work isolation area
- Reducing sediment levels from water pumped out of the work area prior to releasing the water back into the main water body
- Preventing fish and other aquatic creatures from entering the worksite during construction
- Providing fish passage during or after working hours

There are three TWM concept design options that ODOT uses.

Full isolation is implemented when work will occur from bank to bank of a stream. Barriers are placed upstream and downstream of the work area and span the width of the active channel. The barriers keep streamflow out of the work area while a temporary bypass system reroutes the water around the work area.

Partial isolation is implemented when work will occur along or near the bank of a water body. Barriers are placed next to and along the bank to establish a work area. Partial isolation allows for flow conditions to continue through the non-isolated area.

Working in the wet is implemented when equipment does not need to enter the channel. A barrier is placed between the work area and remaining portion of the active channel and serves to contain turbid water, preventing it and sediment from spreading into the waterway and disturbing aquatic resources.

See the [Hydraulic Design Manual](#) - Chapter 18, for more information on the different concept design options applied to temporary water management.

This Part 405 describes the development of a TWM concept plan and should be used in conjunction with the [ODOT CAD Manual](#). The ODOT CAD Manual contains information for the use of MicroStation CONNECT, ProjectWise, the plans development business process, plan sheet numbering, seed files, plan sheet title blocks, and general overall drawing information. Additional general drawing information, specific to the GHE disciplines, is found in [Part 200](#) of this manual.

Section 405.2 Development of a TWM concept plan

Coordination is essential between the hydraulic engineer, the CAD technician, the roadway designer, and other project disciplines with work items occurring within a water body. The responsibility for the TWM design is generally given to the hydraulic engineer. Designers from other disciplines involved in the project are key resources in the process of determining the extent and type of temporary water management required by the specifics of the project. The CAD technician is responsible for providing the concept design information on a plan sheet as part of the overall project plan set, in a format consistent with the current CAD and drafting standards provided in the ODOT MicroStation workspace, this manual, and the ODOT CAD Manual.

This Part of the GHE CAD Manual addresses the development of TWM concept plan sheets for the two most commonly used water management isolation options: Full Isolation and Partial Isolation.

405.2.1 CAD Workflow and Ribbon Tabs

ODOT's MicroStation workspace has a **Hydro** work flow that contains a **ribbon tab** called **TWM**, which contains groups of details, symbols, notes, etc. for drafting TWM concept plans.

This section will further describe the specific CAD tools and other standards; such as text styles, sheet layout, cells, etc., found in the workspace for creating a TWM concept plan.

Standard Text

To set a standard text style use the change text attributes tool or choose a style from the applicable workflow ribbon. See [Section 200](#) this manual for more information on standard text styles used for GHE plans.

Cell Library

The cells used in the preparation of TWM plans are located in the cell library named **Hydro.cel**. The names of the temporary water management cells begin with TWM. The contents of the TWM ribbon tab access the cell library for these elements.

Levels

Use Hydro levels as appropriate (i.e. P_HY_DESIGN_.....) for TWM line work and text on plan sheets. Other disciplines referenced into the TWM design plan are to be left as is. Do not change levels or line types in the referenced files.

Seed and Cache

Seed and Cache files are provided in the workspace. See [Part 200](#) for more information on seed and cache files.

When starting a new TWM drawing use the **seed_titleblock.dgn** file and reference in the **GHE_cache.dgn** file.

A cache for TWM is included in the cache file **GHE_cache.dgn**, along with other Hydraulic, Geotechnical, and Environmental discipline specific caches. The TWM cache contains the most commonly used details of sections and cross sections, a fish screen sump detail and a sandbag footprint detail. Included are a discharge table, a legend, general notes and one set each of full isolation notes and partial isolation notes.

405.2.2 File Name and Sheet name

File Name

ODOT uses a set list of CAD file names, based on an approved file naming convention developed for use within ODOT's [ProjectWise](#) data management system.

Project staff are responsible for naming individual files according to approved discipline specific standards found in the ProjectWise Document Name List through the use of the ProjectWise File Naming Tool.

Sheet Name (Title)

The sheet title **Temporary Water Management Plan** is available in the title block seed file, in the **H_Sheets** model. Sheet names are located on separate levels within each sheet series model. The correct sheet name can remain turned on while all others are turned off. Included in the H_Sheets model are sheet titles for other disciplines within the Hydraulic series. Refer to the [OCM](#) for the list of available sheet names for each discipline.

You may add the word **Concept** to the TWM plan sheet title if preferred. When the extent of TWM design requires a second sheet for details, change the word **Plan** in the sheet title, to **Details**.

405.2.3 Drawing Sequence and Sheet Numbering

Drawing Sequence

The **H series** sheet numbers are reserved for the Hydraulic disciplines of Stormwater, Culverts, Fish Passage, Temporary Water Management, Bank Protection and Waterway Mitigation. See the [OCM](#) for drawing sequencing and sheet numbering tables, for these and all other disciplines plan sheets.

Sheet Numbers

The TWM plan sheets begin with sheet number HD01, and they follow the Fish Passage sheets in the set when provided.

For further information regarding drawing sequence and sheet numbering please see the [OCM](#) and [Section 200](#) of this manual.

405.2.4 Sheet Order

Drawing Order within the Discipline

TWM plan sets follow the sheet order shown in the following Table 405.2.4.1. Listed are all possible sheets, their purpose and their order within the plan set. Not all projects contain a second sheet for details.

Sheet Type	Example
Temporary Water Management Plan	<i>Includes plan view, discharge table and notes. May also include sections, cross sections and details when space allows</i>
Temporary Water Management Details	<i>When space is limited on the plan sheet, use a second sheet for additional details and notes</i>

Table 405.2.4.1 Sheet Order Table

405.2.5 Plan Sheets Development

When laying out the sheets for a project always work closely with the POR when determining design elements to include and any adjustments to the layout in order to provide all the possible information a contractor will need to build the project. See [Part 200](#) for more information regarding plan sheets.

Design Base

The design base map for a TWM concept plan includes the current project files for topography and right-of-way, and includes the proposed road design, bridge, culvert,

fish passage, or stream bank restoration designs as needed. See the ProjectWise user manual and the EAST website for more information regarding design base files.

General Sheet Layout

TWM concept plan sheets contain a plan view of the work area where TWM measures will be installed, plus cross sections, notes and details.

The plan view is placed in the left area of the sheet. Zoom into the plan view enough to show only the parameters of the work area receiving TWM. Use standard scales of 1"=10', 1"=20', 1"=30', and so on. Use a scale appropriate for the area being shown. If contours are needed, choose intervals that are appropriate to the chosen scale of the plan and the density of the contours. Annotate the major contour lines.

Turn off elements not necessary to the TWM plan, such as trees, utilities, etc., this will help keep the plan clear and readable. See the [check lists](#) for items to include.

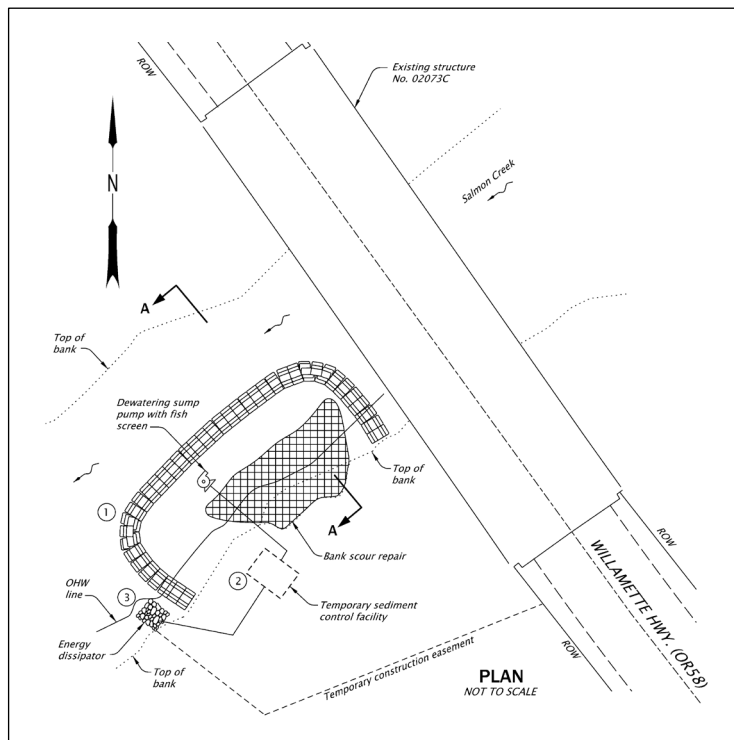


Figure 405.2.5.1 Plan View Example

The plan view must clearly show the location of the TWM measures required for the type of water management being used on the project.

Symbols for each measure are accessed from the Hydro cell library using the TWM ribbon. Place a legend of symbols in the far bottom right area of the sheet below the construction and general notes, when space allows. Otherwise place the legend elsewhere in the lower portion of the sheet. Remove symbols from the legend that are not used in the plan.

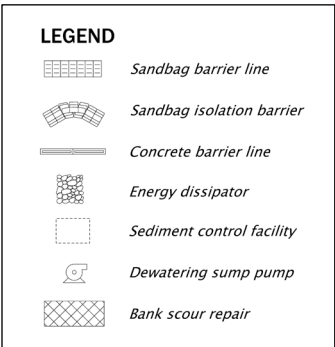


Figure 405.2.5.2 Example Legend

Fill the far right edge of the sheet with full isolation, or partial isolation notes. Include the general notes, and the legend below that. Any remaining space between the plan view and the notes area can be filled with sections or cross sections, and the estimated discharge table. (Data for the estimated discharge table is provided by the project engineer or designer).

The standard Width-to-Height Ratio Sandbag Barrier detail, the Fish Sump detail and any other project specific details can also be placed between the plan view and the notes column. When space is limited use a second sheet for these additional details.

Elements are added using the TWM ribbon in the Hydro workflow, the cache file, and the Hydro cell library. Fill the sheet/s accordingly in a clear and concise manner.

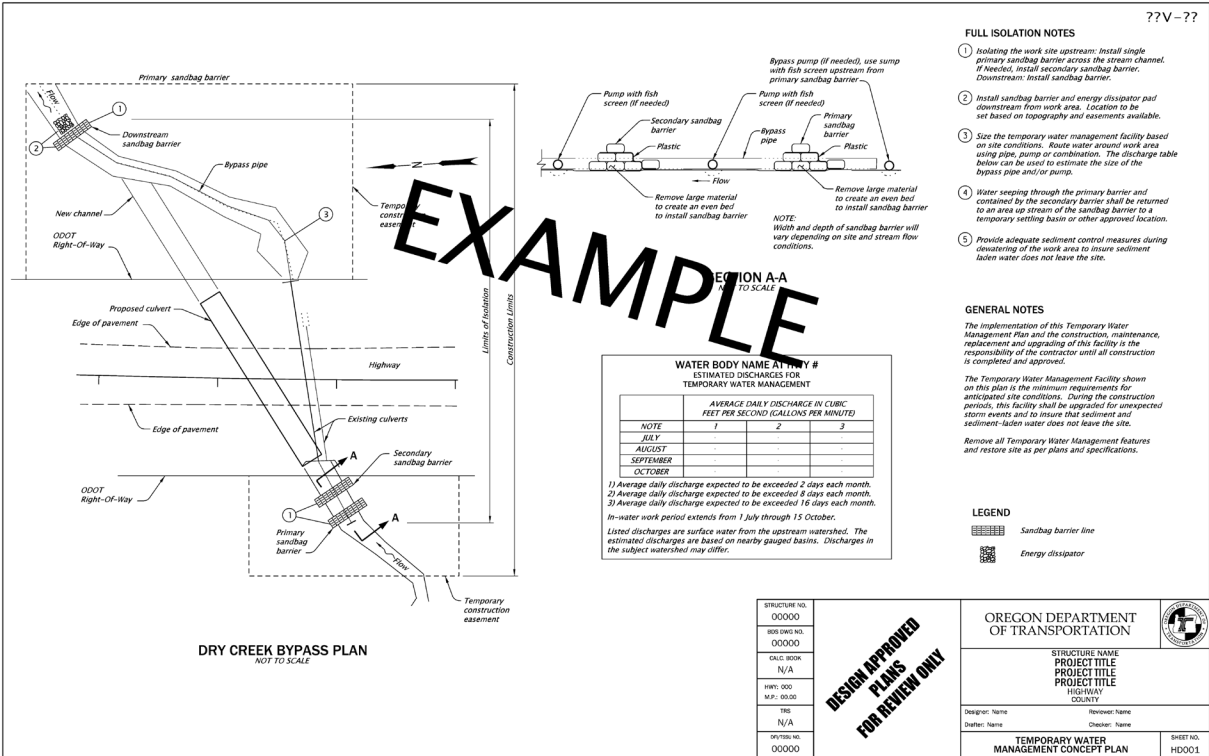


Figure 405.2.5.3 Example Plan Sheet

Plan Sheet Complete

In preparing a TWM concept plan drawing for review by the Engineer of Record, complete the following.

1. Include only the set of isolation construction notes that apply to the project
2. Include a plan view of the TWM concept design
3. Add general notes, cross sections and details
4. Add a completed estimated discharge table
5. Delete unused items from the legend.
6. Complete the title block information

Section 405.3 Check Lists

The following drafting check lists contain all items to be included on TWM plan sheets.

ALL SHEETS

- ☐ Border, title block, sheet title, sheet number
- ☐ Professional of record stamp
- ☐ Title block information complete
- ☐ "V" number or project status stamp
- ☐ Scales noted

PLAN VIEW

- ☐ North Arrow
- ☐ Existing and proposed edge of pavement
- ☐ Structure footprints
- ☐ Extents of water body (top of bank)
- ☐ OHW line
- ☐ Water body flow direction arrows
- ☐ Existing contour lines when useful to convey topography
- ☐ Project stationing of structures, roadway, etc.
- ☐ Right of way lines and easements
- ☐ Cross section cut lines as needed
- ☐ TWM measures with labeling

NOTES and TABLE

- ☐ General notes
- ☐ Full isolation notes, or Partial isolation notes
- ☐ Legend (remove unused items)
- ☐ Estimated discharge table

DETAILS

- ☐ Isolation sections or cross sections
- ☐ System layout (if needed for clarity)
- ☐ Sandbag footprint
- ☐ Fish screen sump
- ☐ Isolation barrier

Section 405.4 Example Drawings

TWM example drawings are located on the Drafting page of the [Geo-Environmental website](#).
See [Section 200](#) for more information regarding example drawings.

Part 406 Operational Plans for Stormwater Facilities

Every ODOT stormwater facility built requires an operation and maintenance (O&M) manual. These manuals provide information about the maintenance and operation of each stormwater control facility managed by ODOT. Operation and maintenance manuals provide full documentation of the stormwater asset, describes the type of facility and how it operates, includes the drainage facility identification (DFI) number, outlines an inspection schedule, summarizes maintenance actions for the facility and includes an **operational plan**. These manuals are used by personnel who maintain and operate the asset. Each stormwater flow control or treatment facility system requires a unique facility specific O&M manual.

Section 406.1 Overview

The purpose for having an operational plan in every O&M manual is to provide maintenance personnel with a graphic representation of the facility, its components, and functionality, as described in the content of the manual. Each operational plan must show:

- Location of facility (e.g. milepoints, left or right side of highway)
- Footprint and type of facility
- Location of each facility component, such as a flow splitter manhole, pollution control manhole, flow spreaders, forebay, outlet flow control structure, and the outfall
- Location of maintenance access to the facility
- Footprint of the drainage piping
- Stormwater flow path into and out of the facility

An operational plan is not the same as a stormwater facility design for project plans. An operational plan is not part of the contract plans for construction, but does show what was actually constructed and exists on the ground today. Operational plan sheets are a general graphic representation of the type, size and location of the facility and will not be used for any other purpose than as part of a stormwater facility maintenance and operations manual. These operational plans use many of the same CAD standards as the contract plans, but are limited in the amount of design/as-constructed information provided. Information not necessary to the maintenance and operation of a facility is removed from the plan, keeping it simple and easy to use for this specific purpose. The following are instructions on what is included and what is not, where to find the necessary CAD elements, and where example operational plans are located.

Section 406.2 Development of an Operational Plan

Coordination is essential between the Engineer of Record (EOR) and the CAD technician. The responsibility for each O&M manual lies solely with the EOR of the stormwater control facility system for which it is being developed. Incomplete O&M manuals in the ODOT inventory backlog are assigned as appropriate.

The EOR is responsible for the content and accuracy of the stormwater control facility operational plan and for providing the necessary details to the CAD technician, including the DFI number for the facility which is acquired from the HQ (Head Quarters) Senior Stormwater Hydraulic Engineer, in the Hydraulic Engineering Section- Engineering and Technical Services Branch

The CAD technician is responsible for providing a clear and accurate operational plan, using the approved CAD standards provided in ODOT's MicroStation workspace and described in this manual. The available CAD standards provide users with the necessary tools to prepare stormwater control facility operational plans in accordance with the "O&M manual development guidelines" provided in the [Hydraulics Design Manual](#). These standards give all project staff (including consultant staff), the same tools for developing operational plans; ensuring statewide consistency. The CAD and drafting standards for stormwater control operational plans development are reviewed, recommended, approved and owned by ODOT's HQ Senior Stormwater Hydraulic Engineer.

Operational plans:

- Are for operation and maintenance manuals only, (not part of the contract plans document)
- Have their own titleblock specific to operational plans
- Generally use only one plan sheet, (occasionally multiple sheets as needed)
- Are greatly simplified, as compared to a contract plan sheet
- Are clear and concise in showing the details of the components and their relation to each other

When creating an operational plan sheet always keep in mind how maintenance personnel will be using it to perform their job. Only include what is absolutely necessary for that purpose. If a piece of information is not part of the facility, or an adjacent facility, and does not directly contribute to the overall workings of the facility, and does not need to be maintained for the facility to operate correctly, consider it to be unnecessary for the purpose of this plan drawing and do not include it. When in doubt consult the EOR/designer for instruction.

Described in the following pages are:

- The O&M CAD and drafting standards, their use and location
- Instructions for the layout and completion of a stormwater control facility operational plan
- Drawing check lists

- Location of example drawings

406.2.1 CAD Workflow and Ribbon Tabs

ODOT's MicroStation workspace contains an **ODOT Hydro** work flow. The workflow includes several Hydraulic specific ribbons including one called **OM Operational Plan**. This ribbon contains groups of details, symbols and notes, an operational plan specific titleblock, etc., for use in drafting an operational plan.

This section will further describe the specific CAD tools and other standards; such as text styles, sheet layout, cells, etc., found in the workspace for creating an operational plan.

Standard Text

To set a standard text style use the change text attributes tool or choose a style from the applicable workflow ribbon. See [Section 200](#) of this manual for more information on standard text styles used for GHE plans.

Cell Library

The cells used in the preparation of operational plans are located in the cell library named **OandM.cel**. The names of the cells begin with the letters OM for ease of locating when using the "Display all cells" option. The library includes cell drawings for:

- Standard text items
- Symbols specific to stormwater facility operational plans
- Several common facility details, (e.g. manholes, inlets, cleanouts, etc.)

The cell library is accessed by the "OM Operational Plan" ribbon for most elements used on operational plans. Always consider the cell library when looking for specific items that may not be available in the ribbon workflow.

Levels

Use Hydraulic levels as appropriate (i.e. P_HY_DESIGN_.....) for line work and text on operational plan sheets. Levels in referenced design files are to be left as-is. There may be instances when personnel must compare the operational plan to the as-constructed plans for clarification.

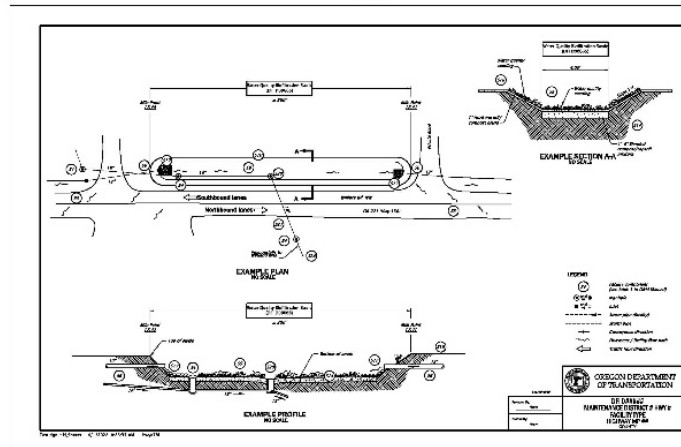
Note: Operational plan sheets are a general graphic representation of the type, size and location of the facility and will not be used for any other purpose than as part of a stormwater facility maintenance and operations manual; therefore the levels do not carry the same importance as they do in project construction plans.

Seed and Cache

When starting a new operational plan drawing use the seed drawing titled **Seed2D.dgn** and reference in the **GHE_cache.dgn** file.

The **GHE_cache.dgn** file contains discipline specific caches for Geotech, Hydraulics, and Environmental (GHE). Each cache is contained within a separate yellow sheet border and all are displayed together in a column style format in the same drawing model.

OandM
(Operational Plan)



Included in the cache file is a cache sheet for **Operational Plans**, which contains the correct titleblock and legend, plus standard “required” labeling examples. Included are examples of a plan, a profile and a cross section. All are placed in their standard layout locations within ODOT’s standard sheet border. The examples can be element matched for the most common line types and symbols used on operational plans.

When the operational plan is complete, delete the **GHE_cache.dgn** reference.

406.2.2 File Name and Sheet name

Operational Plan File Naming Convention

ODOT’s “Document Naming” tool in ProjectWise is the only approved method for naming project documents, including these O&M operational plans. Using the tool is required to maintain naming accuracy and consistency. File names for O&M “Operational Plans” include an assigned DFI number, per facility, per project. Contact the Engineer of Record for the DFI number assigned to the facility.

The ProjectWise website contains more information on the practices and procedures for working in ProjectWise. Links to training and other user documents are included.

Internal users: <http://transnet.odot.state.or.us/hwy/projectwise/SitePages/Home.aspx>

External users: <http://www.oregon.gov/ODOT/Business/Pages/ProjectWise.aspx>

For assistance, contact the ProjectWise Support desk at: ProjectWiseAdmin@odot.oregon.gov or call 503.986.3190.

Sheet Name (Title)

Rather than a standard contract plans sheet title, an area of the operational plan title block is reserved for the necessary sheet name information based mainly on the drainage facility identification number. The block of text includes the DFI number, the maintenance district number, the highway number, plus the type of stormwater control facility system, with the highway mile point location and the county name included. Each operational plan sheet also requires the name of the plan preparer and the CAD Technician as part of the titleblock information.

Sht. ## of ##		 OREGON DEPARTMENT OF TRANSPORTATION
Prepared By: Name _____	DFI D##### MAINTENANCE DISTRICT # HWY # FACILITY TYPE HIGHWAY MP ## COUNTY	
Drafted By: Name _____		

Sheet Number Convention

Most operational plans require only one sheet for displaying all the necessary information. Occasionally multiple sheets may be required. Operational plan sheets are numbered as sheet per total sheets, (i.e. Sht. 1 of 1, Sht. 1 of 2, or Sht. 2 of 2).

The purpose for this type of sheet numbering is to let personnel know how many sheets to expect for this facility in this particular O&M manual. The sheet number is located near the titleblock in the area just above the “prepared by” box.

406.2.3 Operational Plan Sheet Layout

When laying out the operational plan sheet always work closely with the EOR when determining drainage and stormwater elements to include, and any adjustments to the layout in order to provide all the information needed by maintenance personnel. Locate any design/as-constructed drawings or field sketches needed to create an accurate base map.

Base map

The base map plan view for an O&M operational plan includes the line work from project files, the as-constructed files, or field sketches. Include topography, right-of-way, edge of pavement, bridge footprint, access roads, gates, fences, storm drainage (pipes and ditches), plus the stormwater facility. Use the “Base Map Elements List” to

determine items to include. Everything else is to be turned off or deleted from the drawing.

O&M operational plan sheets contain a **plan view** of the stormwater facility feature and includes all drainage features entering and exiting the facility. The plan view may also show parts of adjacent facilities when appropriate. Consult the EOR for when to include parts of adjacent facilities.

There are 3 ways to create a base plan view.

Method 1 – Draw the facility line work from a sketch.

Method 2 – Trace the facility line work from an imported PDF

Method 3 – Reference in either the as-constructed plans, or the contract plans design file

When creating an operational plan for a facility that has been built and is in use, and an O&M manual is being created or updated, locate the as-constructed PDF documents in ODOT's filing system FileNet and locate the original contract plans (.dgn) in ProjectWise. When using the .dgn file make the necessary corrections as shown on the as-constructed PDF.

Always use **as-constructed** drawings when available. Actual field collection may be necessary when as-constructed drawings cannot be located. Refer to the EOR for field data. This information may be provided to the CAD technician as a hand drawn sketch or a marked-up copy of the design plan sheet. This information can be added to the active drawing file by importing an image of the sketch, or referencing in the original contract plans dgn file. An imported image is traced by hand, and then deleted upon completion, revealing only the traced elements. A referenced plan dgn is copied in, the reference file is then deleted, and revisions are made to the line work, etc., per the as-constructed mark-up.

Note: Finalization of operational plans generally occurs after the facility has been built, so there is no need to retain the references. A single operational plan file is all that's needed with each O&M manual for the purposes of printing, storage and use by maintenance personnel.

To locate original electronic drawing files for facilities designed and built prior to ODOT's use of ProjectWise, use the County name and Key number information found on the as-constructed plans and search the Engineering archives.

Internal users: [Engineering Archives](#)

External users: Contact the [Senior Stormwater Hydraulic Engineer](#) to request the files.

When using electronic files for creating a base map, include only the levels and line work needed. The following is a list of features and drawing elements to retain.

Base Map Elements List

(When using a referenced contract plans design file for line work, do not include construction notes or labels).

Retain/draw the following elements when producing a **plan view** base map.

- Edge of Pavement or gravel
- Any side streets near facility
- Adjacent sidewalks and curbs
- Adjacent traffic features (i.e. barriers, signs, bridges, walls, etc.)
- Facility access points (roads, gates, etc.)
- Facility (Pond, swale, structure, etc.)
- Drainage piping in and out of the facility
- Manholes and Inlets (upstream and downstream)
- Median lines (if necessary to clarify the drawing)
- Highway Right of Way
- Ditches
- Features (i.e. fencing, riprap, topography, etc.)
- Structures footprint (when applicable)
- Flow Directions (conveyance, drainage and traffic)
- North Arrow

The intent of an operational plan is to provide maintenance personnel with a simple graphic representation of the constructed components of a facility. The inclusion of surrounding roadside elements and other nearby facilities on the plan, along with the written content of the O&M manual itself, aids personnel in locating and accessing each facility on the ground and determining components to be maintained.

Primary and Secondary Facilities

The main facility and all related components shown on each operational plan are considered **primary** elements. Nearby facilities shown on the same plan are considered **secondary** elements. CAD Technicians work closely with the design engineer/EOR in determining which elements are to be included in each category. The engineer will specify which elements are primary to the facility, and which are secondary. The CAD Technician will assign the correct linestyle and line weight to the primary elements and secondary elements, as described here and shown in the example drawings.

Primary elements of a facility, such as the pond *top of slope* shown in Figure 406.2.3.1 below, and the pipes flowing into and out of the pond are shown using a line weight of 3. The line work of primary pipes are a custom linestyle located in the workspace. The idea is to have all line work pertinent to the primary facility display bolder than all other lines. Labeling of the primary components is directed by the designer/EOR and is shown by placing the corresponding component label bubble from the workspace.

Secondary elements and line work remain as-is from the design file, or drawn at a weight of 1. Secondary elements are those items considered not a part of the primary facility, but may be connected to it in some way (e.g. the surrounding drainage pipes). Secondary elements may be part of the drainage coming into or going out of the primary facility, or may be part of a neighboring facility. Secondary elements are not given component labels.

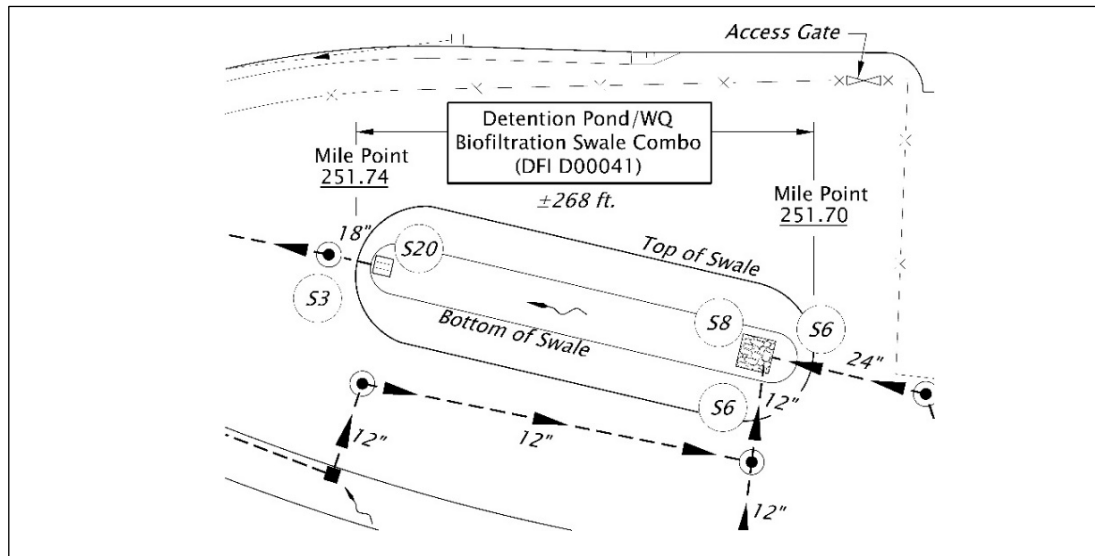


Figure 406.2.3.1 Biofiltration Swale Plan and the Use of Line Weights on Primary and Secondary Elements

The graphic **Symbols** used on these plans are accessed directly from the OandM cell library and through the OM Operational Plan ribbon. They can also be copied or element matched from the cache. Include all symbols used on the plan in a legend to be placed in the bottom right area of the sheet, either to the left of the title block or just above the title block depending on available space.

General Sheet Layout

Follow the basic standards for laying out a plan sheet. Provide a plan view and profile view (or isometric view when needed), plus cross sections, details and a legend on each operational plan sheet. Cross sections, details, and the legend are placed in the right side area of the sheet. Place the **plan and profile** views in the left portion of the sheet. Zoom into the views enough to show only the parameters of the facility area. Standard scales do not apply to operational plans. Scale the drawings to fill the available space on the sheet as much as possible. This allows each drawing to be sized to fill the available space and to provide clarity of the components for maintenance personnel when using the operational plan to determine necessary maintenance of the facility. Address the scale of the drawings by providing the second line in the view title as - No Scale (i.e. drawing is proportionally shown but not to a standard scale)

Turn off elements not necessary to the operational plan, such as trees, utilities, etc., this will help keep the plan clear and readable for maintenance crews. See the [check list](#) for items to include.

Note: More than one facility (each with an assigned DFI) can be included in one operational plan and O&M manual when all the following conditions are met.

- (1) same type of facility*
- (2) drains to same outfall*
- (3) installed at the same time.*

When providing cross sections or details of multiple same type facility in one operational plan, only display them one time and note that it pertains to all the facilities of the same type. If one facility contains even one difference, display a separate cross section or detail for that facility.

When several facilities are in close proximity to each other but do not meet all 3 conditions, the adjacent facilities can be shown on each operational plan using secondary line work and labeling. Each of these facilities will have their own DFI number and individual operational plan and

Profile View

The **profile view** is generally shown along the center line of the facility and runs the length of the overall facility. The project designer/EOR will determine the length of the profile. For example; the profile of the pond in Figure 406.2.3.2, may need to include the manhole labeled S3, but not the manhole near the other end. The profile or section from the contract plans file may be used when available. Always make the as-constructed updates to the drawing.

The profile view is placed directly below the plan view, aligning with components in the plan view. Profiles include the following:

- All drainage running into or out of the facility.
- Components connected to the drainage, or contained within the facility.
- Align the facility components in the profile view with the same components shown above it in the plan view.
- When necessary scale up the profile to clearly show the sizes and locations of multiple components.
- Label all components of the facility with the appropriate component bubble labels.
- Label all other parts of the facility and surrounding features with standard text and leader labels.

Profiles or sections are generally used for pond and swale type facilities. They must be clear and readable for maintenance personnel to determine which components need their attention. All the major parts of the facility must be labeled and graphically readable. When the length of

a facility causes the profile to appear too small for clarity, use one or both of the following options to clearly show the facility components and their parts.

- Expand the Horizontal/Vertical scale of the profile.
- Use supplemental sections, cross-sections and/or details.

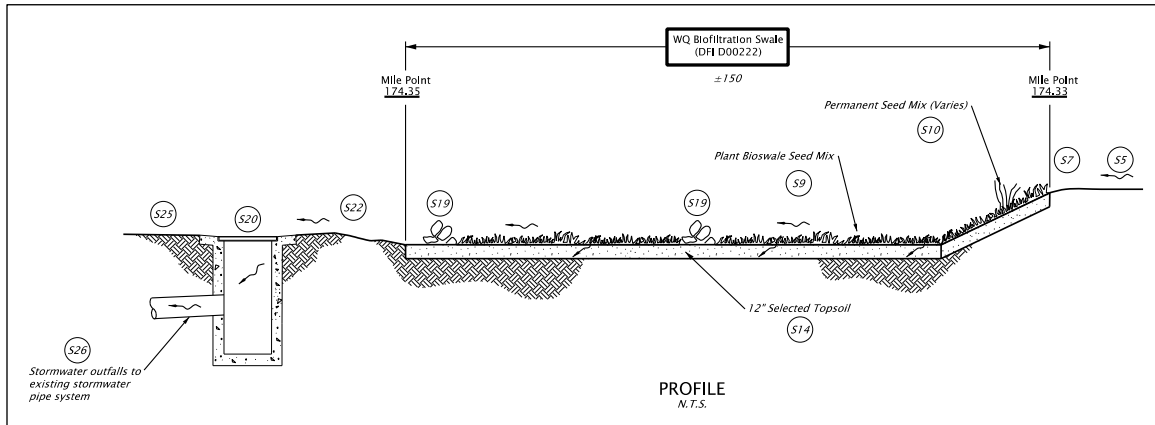


Figure 406.2.3.2 Biofiltration Swale Profile

Isometric Schematics

Complex drainage pipe and structure type facilities often require **isometric schematics** in place of standard profiles in order to clearly show the multiple components and their relationship to each other. When providing a drainage pipe schematic use correct isometric drafting techniques, including correct angles, to clearly demonstrate the relationship of parts, one to another. An isometric view shows exactly what type of components are included in the system, the pipe sizes and connections from component to component, and the direction of flow.

Providing this type of graphic representation assists maintenance personnel in locating the individual components necessary to complete their maintenance work. Some basic isometric components and pipe sections are located in the cell library.

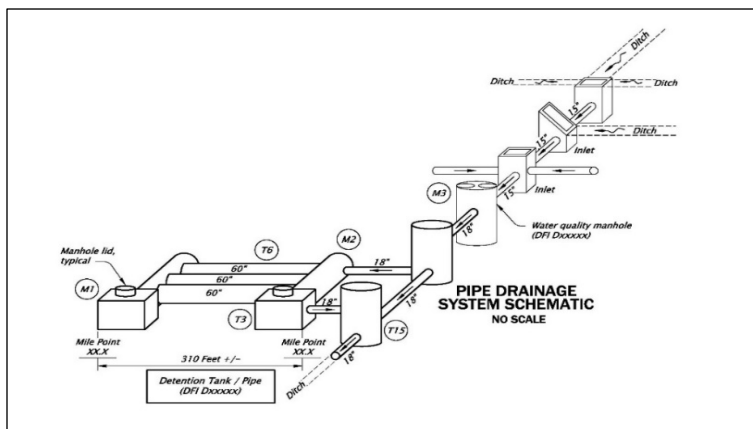


Figure 406.2.3.3 Drainage Pipe System Isometric Schematic

Cross Sections and Details

Place **cross sections and details** in the right side area of the sheet from the top down. Leave room for a legend in the area just above or to the left of the title block. Add standard elements and linestyles from the workspace for items such as; facility component labels, pipe sizes, gates, access points, primary system pipe, patterns, etc. Refer to the project EOR for appropriate facility component labels per facility type.

Adding **cross sections and details** from the project design or as-constructed drawings, pdfs, or field sketches will help aid personnel in performing regular maintenance duties on the facility. Copy or trace them into the active file and clearly show all the parts of the detailed components.

Modify the **details** to match as-constructed information. Remove any notes, labels, or dimensions directing the construction of the facility and replace them with operational information, including flow direction arrows, as directed by the EOR. When complete remove the reference files.

Details with cross section views

When a detail includes a cross section view, place each piece next to each other with the cross section either to the right, or just below, the corresponding detail. , as shown in Figure 406.2.3.4. Aligning the two views by projecting the key points from one view to the other maintains the relationship between the two views.

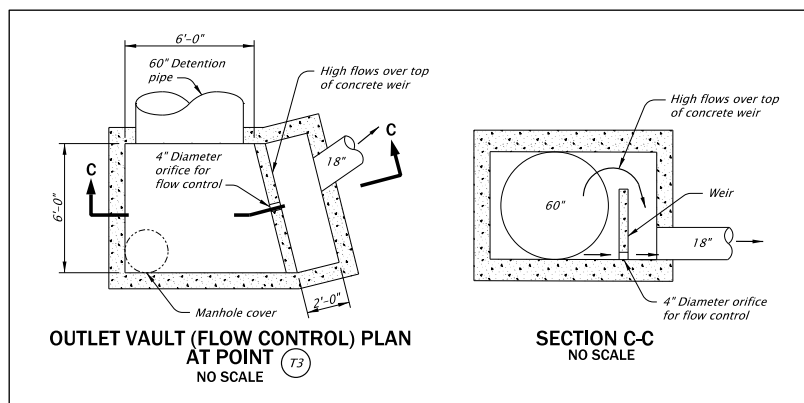


Figure 406.2.3.4 Outlet Vault Detail with Cross Section

Each operational plan must have the following elements included from the workspace standards, prior to final submittal.

- Numbered Callouts for facility components (available in the Hydro bubble notes tools) (See the Hydraulics Guidance Materials for component lists)
- Primary and adjacent facility DFI labels
- Mile Point label
- Drawing title
- Highway and Street names
- Flow arrows (drainage flow direction, road surface sheet flow and traffic flow direction)
- Symbols (i.e. manholes, inlets, etc.)

- Custom lines (Primary System Pipe)
- Legend

Completion of an Operational Plan

Complete the check lists provided and submit the electronic DGN file and a PDF file of the final operational plan to the designer/EOR for each stormwater control facility O&M manual. The operational plan is then included in the O&M manual for that facility and submitted to ODOT's Senior Stormwater Hydraulic Engineer. The Senior Stormwater Hydraulic Engineer will publish them to ODOT's TransGIS for access by maintenance personnel and customers.

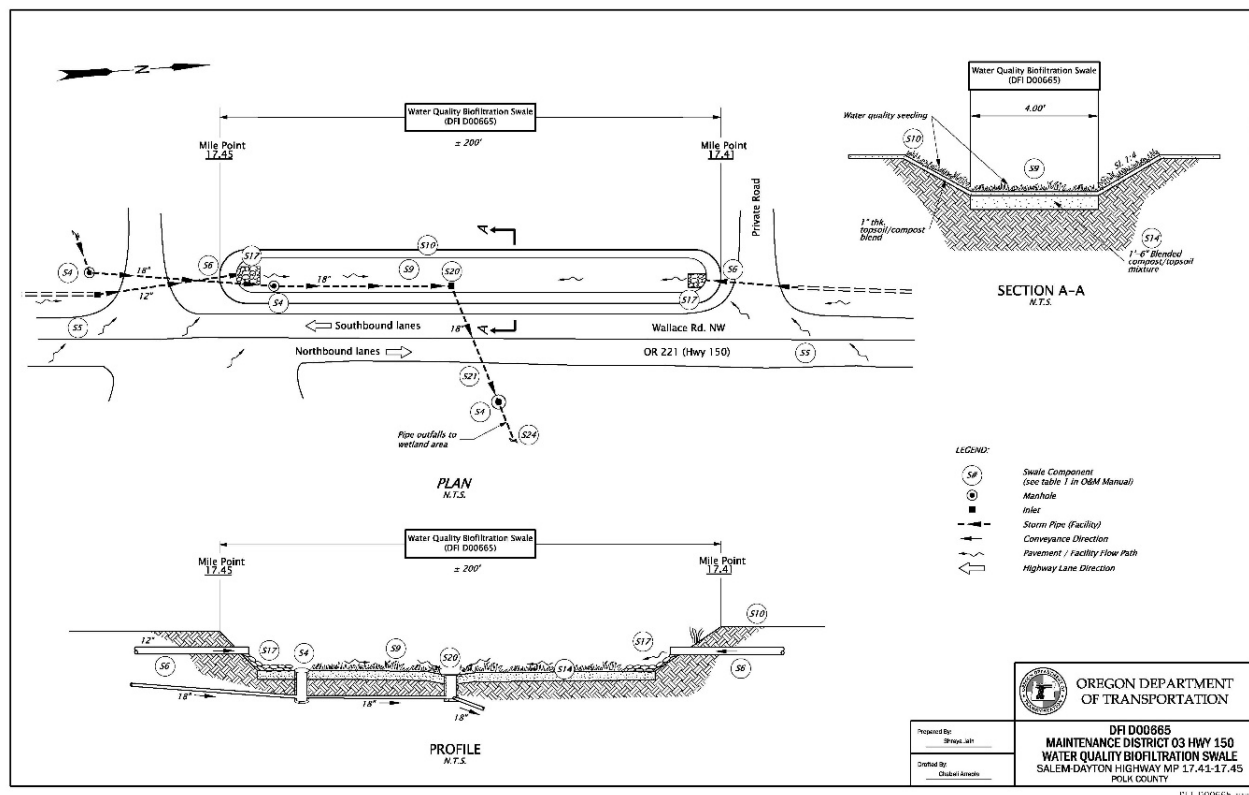


Figure 406.2.3.5 Example Completed Operational Plan Using Standard Sheet Layout

Section 406.3 Check List

The following drafting check lists contain all items to be included on O&M operational plan sheets.

- ☐ Border and title block
- ☐ Fill in the title block (DFI#, district #, hwy #, facility type and hwy mile point), (refer to the example plans, and also the Hydraulics Manual, Chapter 4).
- ☐ Draft a plan view of the facility

- ☐ Right-of-way lines
- ☐ Edge of pavement
- ☐ Ditch lines
- ☐ Facility access points
- ☐ Structure foot prints (bridge, culvert, etc.)
- ☐ Facility footprint
- ☐ Facility structure symbology (manholes, inlets, scour basins, etc.)
- ☐ Maintenance access points
- ☐ Pipes connecting into and out of the facility
- ☐ Pipe sizes
- ☐ Features (fences, gates, riprap, ditches, sidewalks and curbs, etc.)
- ☐ Flow direction arrows (pipe, ponds/swales, sheet flow and traffic direction)
- ☐ Highway/Road names
- ☐ Primary and Adjacent Facility DFI labels
- ☐ Facility mile points at each end
- ☐ Primary and Secondary feature line weights
- ☐ Section cut lines and direction arrows (remove line where crosses facility)
- ☐ Section or profile
- ☐ Isometric Schematic view (replaces profile for pipe only facilities)
- ☐ Details and cross sections (use a second sheet if necessary)
- ☐ Numbered callouts on Primary Facility components
- ☐ North arrow
- ☐ Legend
- ☐ Delete everything outside the sheet border, including the GHE_cache.dgn reference.
- ☐ Create a final PDF for submittal

Section 406.4 Example Drawings

O&M operational plan example drawings are located on the Drafting page of the [Geo-Environmental website](#). See [Section 200](#) for more information regarding example drawings.

Part 502 Environmental CAD Introduction

The Environmental CAD parts of this manual cover the CAD standards used in the development of plan sheets for each of the Environmental disciplines.

- Roadside Development (Landscape and wetlands)
- Erosion and Sediment Control

See [Part 200 of](#) this manual for general drawing instruction that collectively covers the Geotechnical, Hydraulics, and Environmental disciplines.

Part 503 Roadside Development

ODOT's [Roadside development program](#) consists of Landscape Architects who design roadway landscape facilities that blend into the surrounding natural and cultural corridor. Roadside work generally occurs in areas that are outside the roadway itself, and can lie beyond ODOT's right-of-way boundary. Roadside development work includes mitigation, compensation and enhancement of areas such as Roadside Parks, Vista's, Rest Areas and Wetlands. The work consists of many different types of projects, from transportation enhancements to impacts on waterways, parks and historical locations.

Section 503.1 Overview

Project documents for Roadside development are typically prepared for preservation, clearing, grubbing, grading, pedestrian facilities, wetland and water quality facilities, and planting and irrigation designs. Potential areas included in a project are:

- Demolition, clearing, vegetation removal/pruning/protection
- Grading/drainage
- Site Layout
- Hardscape (walkways, paths, walls, etc.)
- Irrigation
- Planting

Part 501 describes specific CAD standards used in preparing Roadside Development project plans and includes instruction on sheet layout, sheet order, the location of cells, and workflows etc., used to show the landscape design for the project.

Section 503.2 Development of Roadside Development Sheets

Roadside Development sheets are produced for project plans through collaboration between the Landscape Architect (POR), other discipline specific engineers depending on the project, and the drafting resource. The POR is responsible for developing the landscape design and for stamping the final plan sheets. The POR provides their design files to the CADD Technician.

The CAD technician is responsible for working closely with the POR to develop the plan sheets to best describe the design intent, and in a format consistent with the current CAD and drafting standards provided in the ODOT MicroStation workspace, this manual, and the [OCM](#).

Roadside Development generally falls at the end of the project plans development, and when changes occur up-stream Roadside Development can be affected at the last minute. This is to be expected and is considered part of the plans development process. Because these occurrences greatly impact the design and the drafting resources, the importance of good communication and cooperation is vital to the success of the project.

503.2.1 CAD Workflows

ODOT's MicroStation workspace contains a work flow for the development of Roadside Development sheets. The active workflow is titled **Enviro** and the ribbon tab is titled **Roadside Development**.

This section will further describe the specific CAD tools and other standards; such as text styles, sheet layout, cells, etc., found in the workspace for creating a Roadside Development plan.

Standard Text

To set a standard text style use the change text attributes tool or choose a style from the workflow ribbon tabs. See [Part 200](#) of this manual for more information on standard text styles used for GHE plans.

Cell Library

The cell library for the Roadside Development discipline is named **Landscape.cel**. The elements necessary to complete a Roadside Development sheet are located in this cell library. The cell library is accessed by the Roadside Development ribbon tab. The tab includes elements such as; tree and shrub symbols, notes and tables, along with several pattern styles.

The cells for the tree and shrub symbols are non-annotation cells. Non-annotation cells, when placed in a drawing, will always measure the same size no matter what the scale of the drawing is set to. Whether the scale of the drawing is 1"=100' or the scale is 1"=50', the diameter of the tree symbols will always measure 20' and the diameter of the shrub symbols will always measure 5'.

Levels

Use LDSC levels as appropriate (i.e. P_LDSC_DESIGN_.....) for line work and text on Roadside Development plan sheets.

Some wetland features may use a Hydro level such as E_HY_STORM_OHW..... (Ordinary High Water). Always retain the level structure in the referenced drawings.

Seed and Cache

Seed and Cache files are provided in the workspace. See [Part 200](#) of this manual for more information on seed and cache files.

When starting a new Roadside Development drawing use the **seed_titleblock.dgn** file.

A Roadside Development cache is currently not available.

File Name

ODOT uses a set list of CAD file names, based on an approved file naming convention developed for use within ODOT's [ProjectWise](#) data management system.

Project staff are responsible for naming individual files according to approved discipline specific standards found in the ProjectWise Document Name List through the use of the ProjectWise File Naming Tool.

Sheet Name (Title)

Roadside Development sheets are available in the title block seed file, in the **F_Sheets** model. Sheet names are located on separate levels within each model. The correct sheet name can remain turned on while all others are turned off. Numerous sheets are included in a Roadside Development plan set, such as Demolition Plan, Site Layout, Planting Plan, etc. Included in this model are the sheet titles for Erosion and Sediment Control and Wetland Mitigation.

Refer to the [OCM](#) for list of available sheet names for each discipline.

503.2.2 Drawing Sequence and Sheet Numbering

Drawing Sequence

Roadside development plans are located in the **F** series section of ODOT's Project Plans. Roadside development plans follow the traffic control plans and appear first in the series. The **F** series is reserved for the disciplines of Roadside Development, Erosion and Sediment Control and Wetland Mitigation.

See the [OCM](#) for drawing sequencing and sheet numbering tables, for all disciplines plan sheets.

Sheet Numbering

Roadside Development plans begin with sheet number **FA001**. The **FA** series is followed by the **FB** and **FC** series for Erosion and Sediment Control and Wetland Mitigation sheets respectively.

The number shown in red is optional and can be used to separate the subsections of a roadside development plan set, especially on very large projects with multiple sheets per section. For example, separating types of sheets from each other, such as Irrigation plan sheets from Planting plan sheets. The Irrigation plan sheets might be numbered as **FA100** series and the Planting plan sheets might be numbered as **FA200** series.

For further information regarding drawing sequence and sheet numbering please see [Part 200](#) of this manual and the [OCM](#).

Drawing Order within the discipline

Roadside development plan sets generally follow the order shown in Table 501.2.4.1. Listed are all possible sheets, their purpose and their order within the plan set. Not all projects contain all the sheet types listed.

503.2.3 Sheet Order

Table 503.2.4.1 Sheet Order Table

Sheet Type	Example
Cover Sheet	<i>Provide when Roadside is a stand-alone project.</i> <i>Cover (or Title) sheet includes a vicinity map, title, sheet index, etc. This sheet is the same as the standard title sheet used for multidiscipline plan sets and may consist of 2 sheets. See the OCM for sheet numbering sequence of these two sheets. See RCM for development of these sheets.</i>
Plan Sheet Layout	<i>Provide as needed for complex projects (map of sheets layout).</i>
General Notes	<i>General notes/specific notes for all sheets.</i> <i>Could be located with applicable plans sheets.</i> <i>Becomes first sheet if there is no Title or Index Sheet</i>
Schedules	<i>Plants and materials.</i> <i>Could be located with applicable plans on complex projects.</i>
Demolition Plan	<i>Waters / Wetland, Vegetation, Contours, Tree Preservation, No Work Zones, Built Features, Clearing and Grubbing, Weed Control, etc.</i> <i>Could be shown on Site Layout Plan, Site Preparation Plan or Planting Plan.</i>
Site Layout Plan	<i>May include:</i> • <i>Site Prep</i> • <i>Grading</i> • <i>Planting</i> • <i>Etc.</i>
Grading Plan / Section	
Site Preparation Plan / Section	

Sheet Type	Example
Soil Preparation Plan	<i>Could include temp seeding areas. Could be part of Site Preparation plan.</i>
Irrigation Plan / Schedule	<i>Follow same layout as Site plan</i>
Planting Plan/Section	<i>Could include planting plans for:</i> • <i>Roadside Dev.</i> • <i>Restoration</i> • <i>Wetland Mitigation.</i> <i>(These sub areas can be separate).</i>
Restoration Plan/Section	<i>Follow same layout as Site plan</i> <i>May include:</i> • <i>Site Prep</i> • <i>Grading</i> • <i>Planting</i> • <i>Etc.</i> <i>(Could be for Stream Bank or a meadow)</i>
Wetland Mitigation Plan/Section	<i>Follow same layout as Site plan</i> <i>May include:</i> • <i>Site Prep</i> • <i>Grading</i> • <i>Planting</i> • <i>Etc.</i>
Site Details	<i>All details organized as above, in same order as plan sheets.</i>

503.2.4 Plan Sheets Development

The Roadside Development sheets generally utilize the same drawing conventions as the Roadway Engineering plans. The Roadside Development section of the project plan sheets may include plans for site layout, contour grading, irrigation, planting, plus various supporting details, notes, and legends.

Most Roadside Development plan sets will begin with the General Notes sheet. Occasionally a Roadside Development plan may be a stand-alone project and will begin with a Title sheet. Some projects will have a demolition plan and some will not. The goal is to follow the sheet order as closely as possible for your individual project. Consistency across projects will help eliminate confusion and contractor claims, and will ultimately add efficiency to the drafting work flow. Refer to the sheet order table [501.2.4.1](#) for list of possible sheets and their order within the set.

When laying out the sheets for a project always work closely with the POR when determining any adjustments to the layout of individual sheets in order to clearly show the landscape design. See [Part 200](#) of this manual for more information regarding plan sheets.

Title sheet and Drawing Index

When a Roadside Development plan is a stand-alone project, include a title sheet. The title sheet is the first sheet of a Project Plans set. Many disciplines provide stand-alone plan sets at times. For instance MCM Culvert renewal projects, and different types of maintenance projects, are commonly stand-alone. Roadside Development can be a stand-alone project.

INDEX OF SHEETS	
SHEET NO.	DESCRIPTION
A01	Title Sheet
FA01 - FA04	Roadside Development

STATE OF OREGON
DEPARTMENT OF TRANSPORTATION
PLANS FOR PROPOSED PROJECT
SCOPE OF WORK
SCOPE OF WORK
**PROJECT
PROJECT
HIGHWAY**
COUNTY
DATE

Overall Length Of Project - XXXX Miles

ATTENTION:
Oregon Law Requires You To Follow Rules Adopted
By The Oregon Utility Notification Center.
Those Rules Are Set Forth In OAR 952-901-0001
Through OAR 952-901-0050.
You May Obtain Copies Of The Rules By Calling
The Center (note: The Telephone Number For
The Oregon Utility Notification Center Is
800.375.1837).

LET'S ALL
WORK TOGETHER
TO MAKE THE
JOB SAFE

OREGON TRANSPORTATION COMMISSION
Robert Van Bruntle CHAIR
Alejo Simpson COMMISSIONER
Lyle Brown COMMISSIONER
Sharon Smith COMMISSIONER
Markus Henderson COMMISSIONER
Klausner W. Siskler DIRECTOR OF TRANSPORTATION
These plans were developed using ODOT design standards.
Exceptions to these standards, if any, have been submitted
and approved by the ODOT Chief Engineer or their delegated
authority.

Approving Authority: _____
Signature and date
Print name and title
Concurrence by ODOT Chief Engineer

PROJECT TITLE
PROJECT TITLE
PROJECT TITLE
HIGHWAY
COUNTY

FEDERAL HIGHWAY DIVISION	PROJECT NUMBER FED01-12345	SHEET NO. A01
-----------------------------	-------------------------------	---------------------

THIS ELECTRONIC DOCUMENT
REPLACES THE ORIGINAL
REVISION: 07 Scale: 1"=100'

Figure 503.2.4.1 Example Stand-alone Project Title Sheet

The title sheet for stand-alone plans is the same as the standard title sheet used for multidiscipline plan sets. Title sheets are assigned sheet number "A01", regardless of discipline.

For small projects the drawing index may be included on the title sheet and is to be placed in the upper left area of the sheet as shown in the above figure. When space is limited provide the index on a second sheet. See the [OCM](#) for sheet numbering sequence of these two sheets. See [RCM](#) for development of these sheets.

Plan Sheet Layout

Provide a plan sheet layout sheet for large/complex projects when needed. This sheet gives the contractor an easy reference as to the order the plan sheets will follow within the set. See [OCM](#) for more information regarding the layout and order of sheets and how to show them on a plan sheet layout sheet.

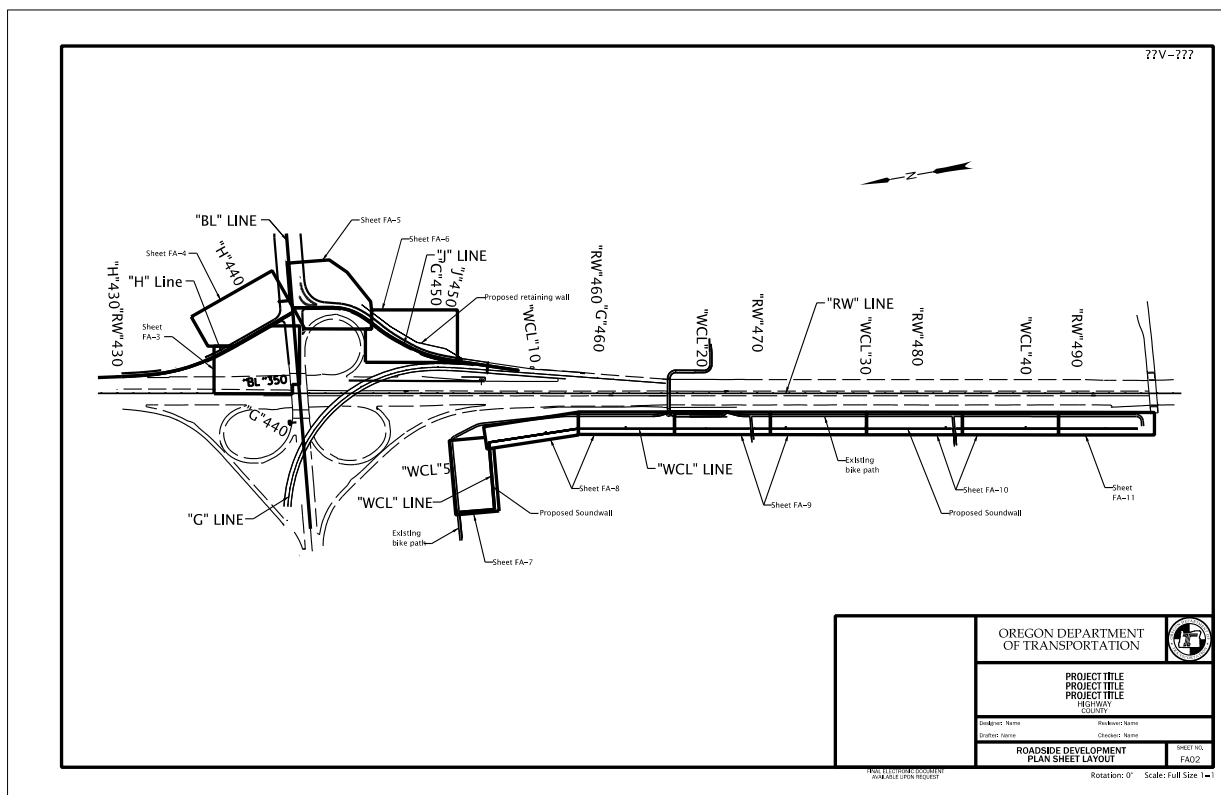


Figure 503.2.4.2 Example Plan Sheet Layout sheet

General Notes

The General notes sheet provides project specific notes pertaining to all, or most, of the sheets within the plan set. The general notes sheet becomes the first sheet in the plan set when there is no title sheet or plan sheet layout sheet. On small projects, this sheet may also include the planting schedule and possibly the project details, if space allows.

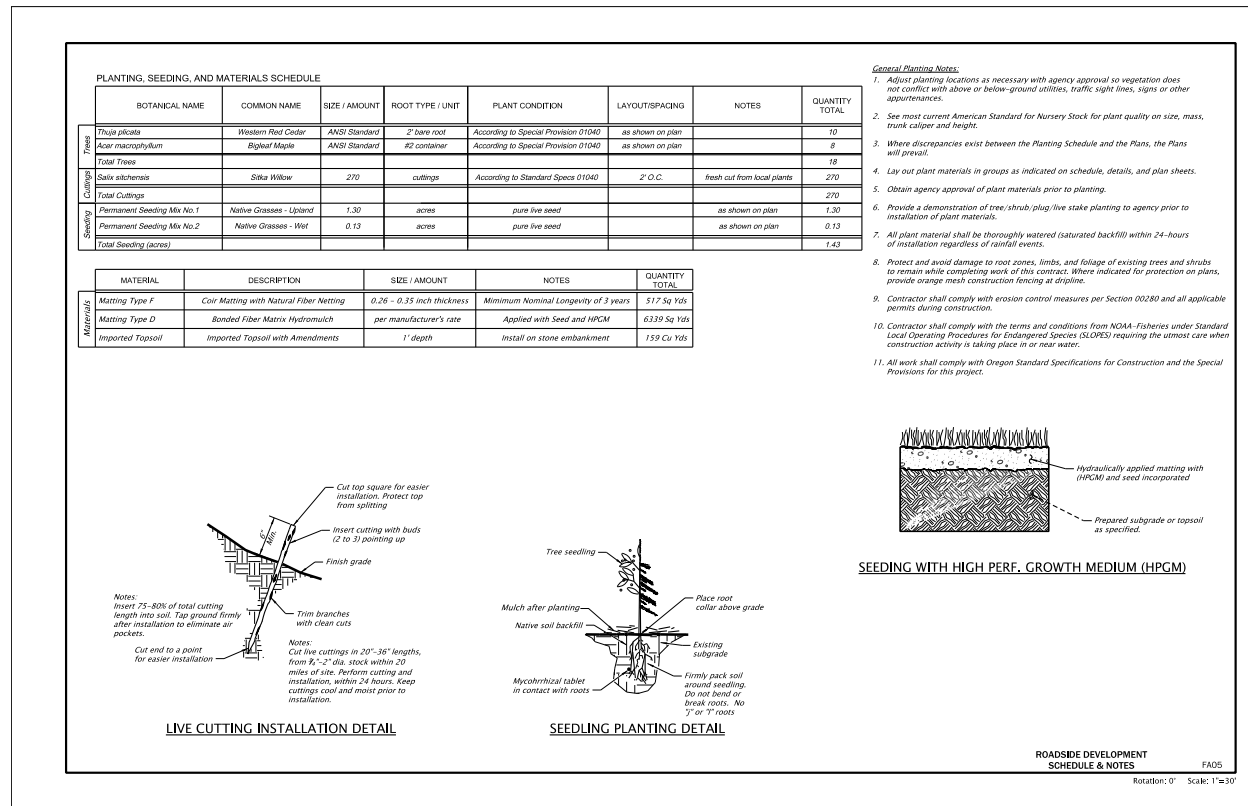


Figure 503.2.4.3 Example Combination General Notes/Schedule/Details sheet

Plant and Material Schedules

Plant and material schedules appear next in the plan set and are project specific. Schedules can easily fill an entire sheet. On small projects, and when space allows, the planting schedule may be added to the general notes sheet, as shown in the preceding figure.

Schedules are created by the POR and laid out according to the requirements of the project design. Each project is different and requires a different set of data. For this reason there is no standard schedule layout. The POR is responsible for providing their project specific schedule to the CADD Technician. The CADD Technician is responsible for inserting the schedule onto the sheet using the text tools provided in MicroStation.

The following figure displays 3 examples of different styles of Planting/Seeding/Materials Schedules.

PLANTING, SEEDING AND MATERIALS SCHEDULE									
	BOTANICAL NAME	COMMON NAME	ROOT TYPE / UNIT	LAYOUT/ SPACING	A.S.N.S. SPECS	NOTES	QTY.		
   	Dec. Trees (Riparian)	Alnus rhombifolia	white alder	1 Gal. Tall Container	10' O.C.	2014	7	Randomly intermix riparian species	
		Populus trichocarpa	black cottonwood	1 Gal. Container	10' O.C.	2014	7		
	Shrubs (Riparian)	Ribes aureum	golden currant	1 Gal. Tall Container	10' O.C.	2014	25		
		Rosa woodsii	Wood's rose	1 Gal. Tall Container	10' O.C.	2014	25		
		Salix exigua	coyote willow	3" x 18" Long Tube Cont.	10' O.C.	2014	75		
		Cornus sericea	redosier dogwood	1 Gal. Tall Container	10' O.C.	2014	12		
		Amelanchier alnifolia	serviceberry	1 Gal. Tall Container	10' O.C.	2014	13		
	Shrubs (Upland)	Artemisia tridentata	Big Basin sagebrush	1 Gal. Container	10' O.C.	2014	1000		
		Clematis ligusticifolia	western white clematis	1 Gal. Container	10' O.C.	2014	20		
		Chrysothamnus nauseosus	grey rabbitbrush	1 Gal. Container	10' O.C.	2014	300		
		Ribes cereum	wax currant	1 Gal. Tall Container	10' O.C.	2014	20		
		Salvia dorrii	purple sage	1 Gal. Container	10' O.C.	2014	180		
 	Plant Cuttings	Salix exigua	coyote willow	Plant Cutting 4-6" x 1/4" min.	As Directed	2014	In damp stream bed material	200	
		Juncus balticus	Baltic Rush	0.04 Gal. Plug	12" O.C. Grouped w/ Like Species	2014	7 groups of 10 as shown on plan	70	
	Tubelings	Carex praegracilis	clustered field sedge	0.04 Gal. Plug		2014		70	

PLANTING, SEEDING AND MATERIALS SCHEDULE									
	BOTANICAL NAME	COMMON NAME	SIZE / AMOUNT	ROOT TYPE / UNIT	PLANT CONDITION	LAYOUT/SPACING	A.S.N.S. SPECS	NOTES	QUANTITY TOTAL
Dec. Trees	Alnus rubra	red alder	2' Ht.	# 1 Container	single trunk	as shown on plan	2014	as shown on plan	132
	Populus trichocarpa	black cottonwood	2' Ht.	# 1 Container	single trunk	as shown on plan	2014	as shown on plan	88
	Quercus garryana	Oregon white oak	2' Ht.	# 1 Container	single trunk	as shown on plan	2014	as shown on plan	88
	Total Trees								308
Shrubs	Archostaphylos patula	Greenleaf Manzanita	12" Ht.	Bare Root	full branching	as shown on plan	2014	Upland plant	176
	Ceanothus velutinus	Snowbrush Ceanothus	12" Ht.	Bare Root	full branching	as shown on plan	2014	Upland plant	176
	Holodiscus discolor	Oceanspray	12" Ht.	Bare Root	full branching	as shown on plan	2014	Plant near riparian bench	220
	Rosa gymnocarpa	Bald-Hip Rose	12" Ht.	Bare Root	full branching	as shown on plan	2014	Plant near riparian bench	132
	Total Shrubs								704
Plant Cuttings	Cornus sericea	Red-Twig Dogwood	3' x 1/2-3/4"	Plant Cutting, less than 1"	Dormant & Fresh	15" O.C. in groups of 10 as shown	2014	On riparian bench	660
	Salix scouleriana	Scouler's willow	3' x 1/2-3/4"	Plant Cutting, less than 1"	Dormant & Fresh	15" O.C. in groups of 10 as shown	2014	On riparian bench	660
	Total Plant Cuttings								1320
Wetland Plants	Juncus effusus	Common Rush	8" Ht.	0.04 Gal. Plug	Fresh	12" O.C. in groups of 10 as shown on plan	2014	as shown on plan - water adjacent	1320

PLANT MATERIAL SCHEDULE							
SYMBOL	BOTANICAL NAME	COMMON NAME	PLANT TYPE	CONDITION	SIZE	SPACING	TOTAL
 	SEED MIXES						
	Native Roadside Seeding		seed				2.67 AC
	Native Water Quality Seeding		seed				0.34 AC
    	TREES						
	Cornus Stellar Pink	Stellar Pink Dogwood	tree	---	2" cal., B&B	As Shown	7
	Parrotia persica	Persian Ironwood	tree	---	2" cal., B&B	As Shown	14
	Quercus buckleyi	Texas Red Oak	tree	---	2" cal., B&B	As Shown	20
	Quercus laceyi	Texas Blue Oak	tree	---	2" cal., B&B	As Shown	35
	Stewartia koreana	Korean Stewartia	tree	---	2" cal., B&B	As Shown	10
	BARK MULCH					3" depth	0.41 AC

Figure 503.2.4.4 Examples Plant and Material Schedule styles

Plan View Sheets

The POR will determine which plan types to include based on the project needs and their design. Most Roadside Development plans include a Planting plan, but some may also include a Demolition plan, or an irrigation plan, etc. When there are more than one plan types, follow the plan sheet order shown in the sheet order table [501.2.4](#).

The design base drawing should reference in the existing files for topography, contours, and highway right-of-way, plus the roadway, bridge, or other applicable design files. The drawing should appear on the plan sheets as though the roadway, bridge, etc., portions of the project have been completed. Remove features that are scheduled for removal or relocation during construction, such as existing vegetation, utility poles, fences, buildings, etc.

Sheet to sheet *Match Lines* are optional per POR.

Use the same scale as the roadway plans unless graphic clarity requires a different scale to produce clear, readable plans. Many Roadside Development plans are developed for specific smaller areas of the project and may need to be shown at a larger scale. Zoom into the design area as much as possible for your plan view. Use standard scales of 1"=10', 1"=20', 1"=30', 1"=40', and so on. If unsure of the proper scale to use consult with the POR for the project.

Choose contour intervals that are appropriate to the scale of the plan and the density of the contours. Annotate the Major contour lines.

Distinguish between proposed and existing grades by using these linestyles:

- solid for proposed grades
- dashed for existing grades

Existing structures and features are to be shown gray-shaded. This allows the landscape design elements to show more prominently. See [Part 200.19](#) Printing Project Plans for further instructions regarding gray shading.

For a list of elements to include in a Roadside Development plan the check list. Depending on the project some elements do not apply. All projects are to include existing features that will remain, and all proposed design features. The plans must clearly show how the landscape design merges with the overall project design.

Layout the plan view sheets as you would any ODOT plan sheet, with the plan view located in the top left and central area of the sheet and the construction notes located in the top right area. Use available space below the construction notes or below the plan view, for legends, notes and tables. See the following Figure 503.2.5.5.

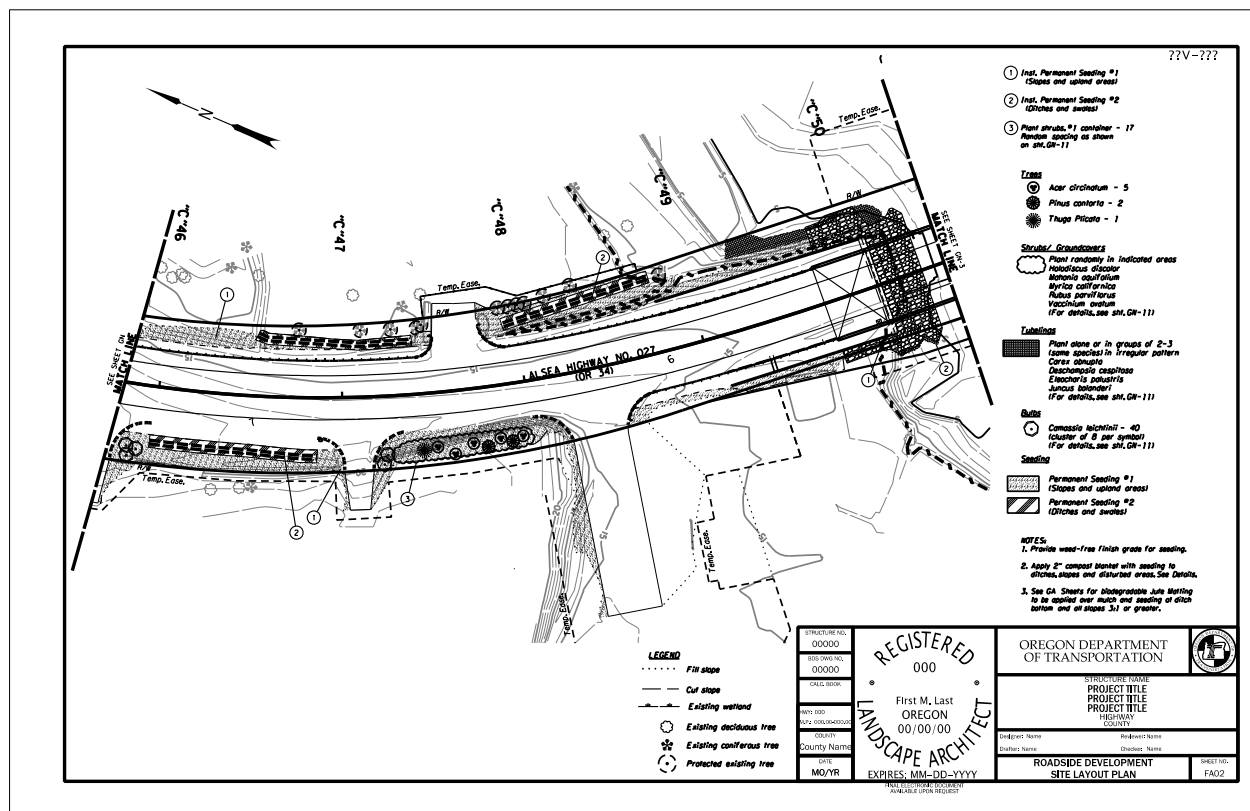


Figure 503.2.4.5 Example Site Layout Plan Sheet

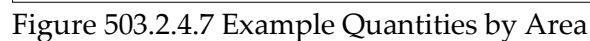
This same sheet layout applies to all plan view sheets in the set. Whether it's a planting plan, a grading plan, a wetland mitigation plan, etc.

Sheet Specific Notes and Legends

Sheet specific notes and legends, including construction notes, pertain to design features appearing on the individual sheets. ODOT's MicroStation workspace contains standard note and legend (templates) that can be modified to meet the requirements of each project as well as each sheet. Use them as a base to edit according to the POR's instructions.

6	Plant shrubs, #2 container - 12 <i>Cornus sanguinea</i> 'Arctic Sun' Dwarf yellowtwig dogwood	
7	Plant shrubs, #2 container - 18 <i>Salvia greggii</i> - Autumn Sage	
8	Plant deciduous trees, 2" caliper - 7 <i>Acer palmatum</i> 'Emperor 1' Japanese maple	
9	Plant deciduous trees, 2" caliper - 1 <i>Carpinus carolinia</i> 'Musclewood' American hornbeam	
10	Plant perm. seeding mix No. 1	

Showing quantities by area is another option, as seen in the following figure. This option may not be viable for all projects.



503-12

Detail Sheets

Detail sheets include separate drawings of single elements of the design generally drawn at a larger scale to emphasize the smaller parts, and to provide specific dimensions, labels, or different views of an element.

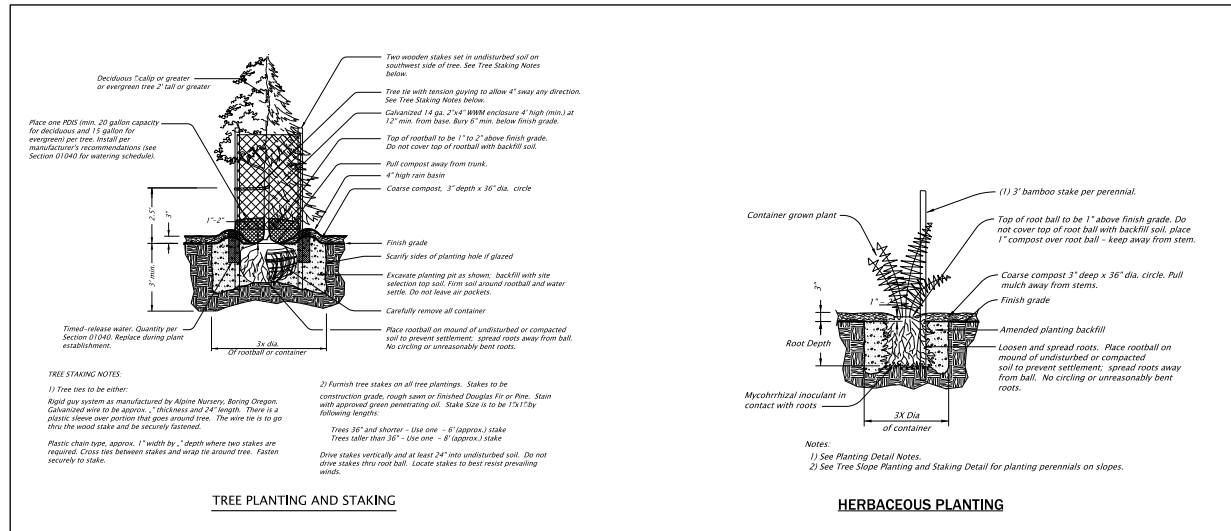


Figure 503.2.4.8 Example of Detail Drawings of Single Elements

Roadside Development details may include planting instructions for the various shrubs and trees included in the design, or different views of hardscape elements, including dimensions. See Part 200 of the [OCM](#) for ODOT's Dimension Style standards.

Sections, Cross Sections, Notes and Tables

Detail sheets may also include sections, cross-sections, notes and tables. Place notes and tables near the detail they pertain. Use sections and cross-sections to better describe design elements that may need further clarification from what is shown in the plan view. Sections allow for inclusion of further dimensioning and labeling, and provide another view of how the landscape design integrates with the rest of the project. The use of sections, as shown in the following graphic, are highly recommended in Roadside Development plans.

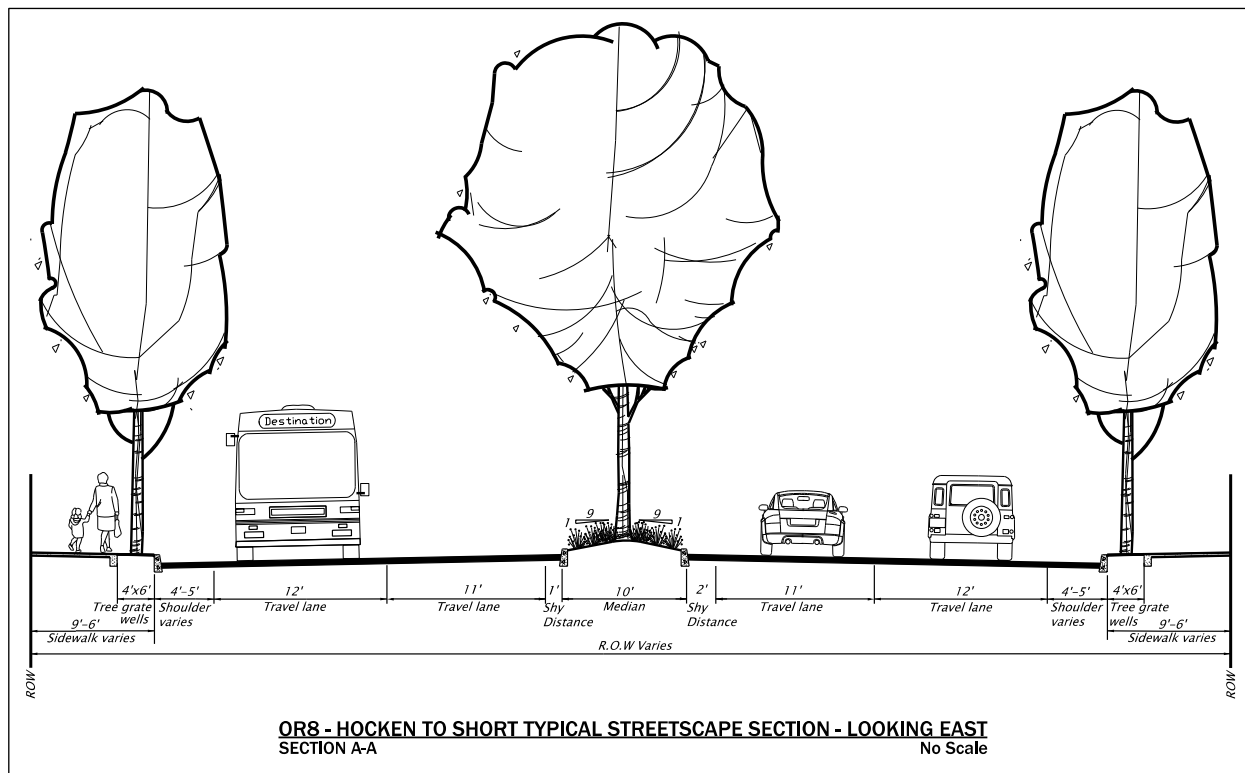


Figure 503.2.4.9 Example Section - Enhances Design Information

Grading Plans use cut sections, and profiles to clearly show existing ground and finish grade. Grading is usually included in the Roadway portion of the plans but can reside in the Roadside Development portion. When a Roadside Development plan set includes a grading plan, the sheet for the profile and sections will follow the grading plan view sheet. See the sheet order table [501.2.4](#) for the location of a Grading Plan within a Roadside Development plan set. Be sure to include section cut arrows on the plan view with the arrows pointing in the direction of the section view and labeled as A-A, B-B, etc., as shown in the following figure.

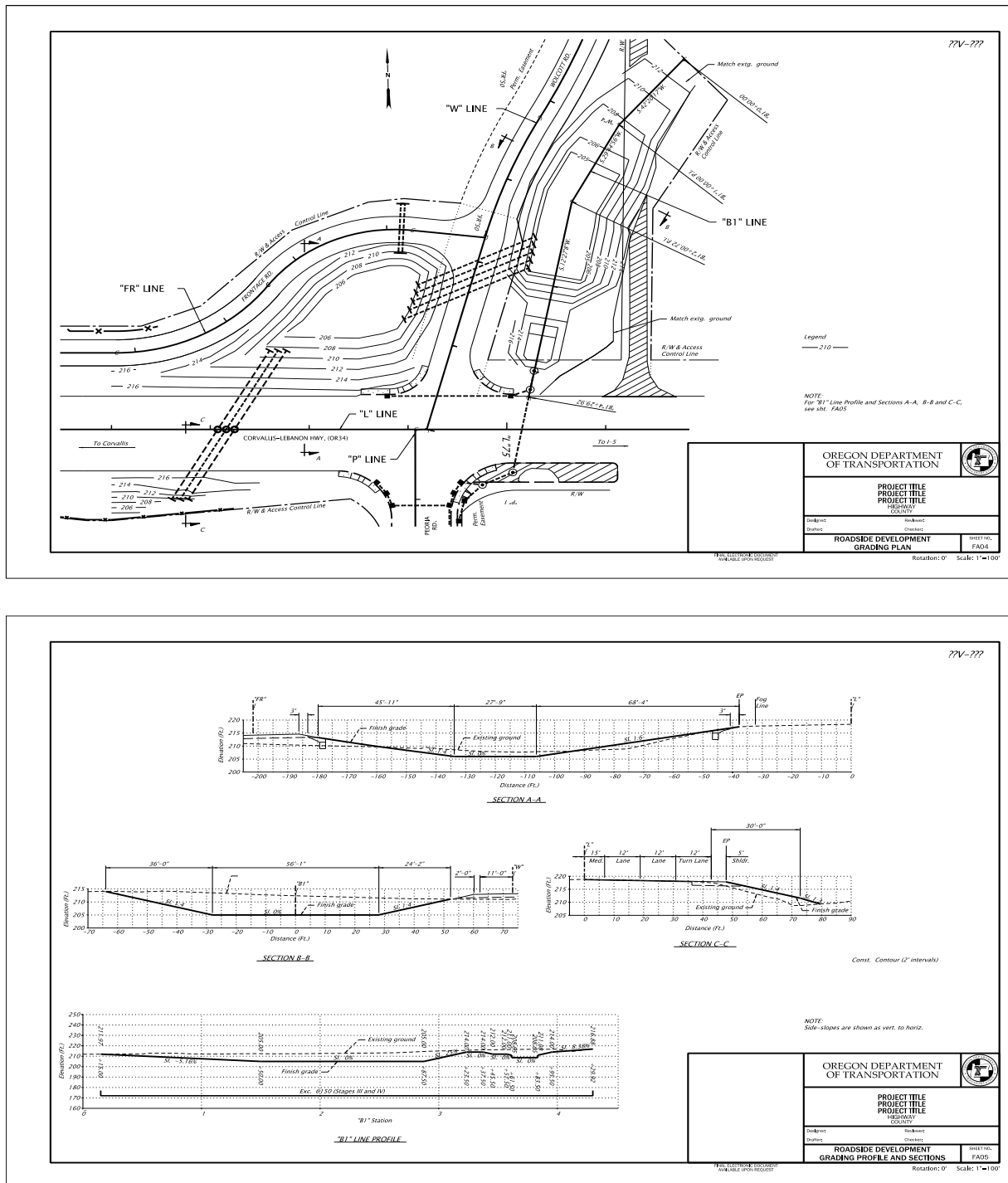


Figure 503.2.4.10 Example Roadside Development Grading Plan

The current standard of practice for ODOT disciplines is to provide the detail sheets at the end of the set of plans for each discipline. Roadside Development plans that are small/simple,

containing just one aspect of roadside landscaping (e.g. a planting plan), work well with this concept.

For larger, or more complicated, projects containing multiple aspects of roadside landscaping such as a planting plan, a site preparation plan, a restoration plan, and an irrigation plan, it can make more sense to provide the details following each different portion of the plans. In other words provide the planting details immediately after the planting plans, and the grading profile and sections after the grading plan, and so on. This helps eliminate confusion, and helps the contractors locate all the plan sheets needed for their particular portion of the project construction.

Stages and Phases

Complex projects will often include Stages and Phases. See [Part 200 of this manual](#) and the [Traffic Control Plan Design Manual](#) for more information.

Roadside Development may take advantage of these construction stages to benefit the landscape work completion. The POR and the CADD Technician must work closely with the Traffic Control POR when using the construction stages. Label the sheets by Stage # to match the stages used by Traffic Control and reference the Traffic Control sheets.

Roadside Development may also use phases within a stage when deemed advantageous to the completion of the project. When using phases, label the sheet as Construction Stage #, Phase #. Consecutively follow the established sheet numbering already in place in the plan set.

Standard Drawings and Details

Roadside Development does not have any standard drawings but does have a set of eleven [Standard Details](#).

Standard Details are available for use, as is, or they can be modified to fit the needs of the project. They are the responsibility of the POR, and can be added to the project detail sheets and stamped by the POR.

For more information regarding standard drawings and details, and their use in project plans see the [Engineering webpage](#).

Section 503.3 Check List

The drafting check list contains all items to be included on Roadside Development plan sheets. (Depending on the project, some of the items listed may not apply).

- ☐ Border, title block, sheet title, sheet number
- ☐ Title block information complete
- ☐ Professional of record stamp
- ☐ "V" number or project status stamp
- ☐ Index sheet (if needed)
- ☐ Plan view
- ☐ Profile view
- ☐ North arrow
- ☐ Scales noted
- ☐ Existing roadway
- ☐ Existing structures (e.g. bridge, culvert, wall, sign-bridge, etc.)
- ☐ Existing utilities
- ☐ Tree preservation noted
- ☐ Existing contours (linestyle is dashed)
- ☐ Major Contours labeled
- ☐ Proposed roadway with alignment and stationing
- ☐ Proposed structures
- ☐ Proposed utilities
- ☐ Proposed contours (linestyle is solid)
- ☐ All facilities labeled including assigned asset numbers
- ☐ Waterway(s) labeled and flow direction shown
- ☐ Wetland boundary
- ☐ Right-of-way lines
- ☐ Temporary construction easements
- ☐ Construction limits
- ☐ Construction notes and note bubbles
- ☐ Detail(s) with titles and scale noted
- ☐ Legend, notes and tables
- ☐ General notes (i.e. detail and sheet notes)
- ☐ Bid Items and quantities
- ☐ Plant list
- ☐ Materials list

Section 503.4 Example Drawings

Roadside Development example drawings are either under development or located on the Drafting page of the [Geo-Environmental website](#). See [Part 200](#) this manual for more information regarding example drawings.

Part 504 Erosion and Sediment Control

ODOT's [Erosion and Sediment program](#) governs how we prevent pollution of water resources in and around our construction projects. ODOT is bound by Laws, permits and other agency agreements to establish soil erosion measures to be used on ODOT projects.

In order to prevent site run-off pollution, ODOT requires an Erosion and Sediment Control (ESC) plan on every project with any significant ground disturbance.

Section 504.1 Overview

ESC plans are part of the project plans and are intended to provide a plan for the temporary installation of measures to minimize erosion, and control sediment from our highway construction projects. These measures are called Best Management Practices (BMP's) and are included in ODOT's CAD standards as MicroStation workspace items, and as [Standard Drawings and Details](#).

Project documents for ESC plans are typically prepared by a Landscape Architect, but can be prepared by any POR with Erosion and Sediment knowledge acquired through specialized training/certification.

Part 502 describes specific CAD standards used in preparing Erosion and Sediment Control project plans. Instructions on sheet layout, location of cells, and workflow, etc., are included.

Section 504.2 Development of Erosion and Sediment Sheets

ESC sheets are produced for project plans under the responsible control, and in collaboration with, the project Landscape Architect or other discipline specific engineers (POR), depending on the project, and the CAD technician. The POR is responsible for designing an ESC plan covering all BMP's required by the project, and for providing it to the project CAD technician with clear instructions for what is to appear on the plan sheets.

The CAD technician is responsible for drafting a clear and consistent set of plans using the design files, and the CAD standards available in the workspace. The two parties must work closely to ensure the design is presented correctly, provides enough information for ease of construction, and is in accordance with ODOT's standards.

The ESC drawings must include basic topographic features, grading limits, and proposed design features, (i.e. bridges, retaining walls, culverts, etc.), plus intended ESC measures. See [Check List](#) for features to include.

504.2.1 CAD Workflow

ODOT's MicroStation workspace contains a work flow for the development of the Erosion and Sediment Control sheets. The active workflow is titled **ODOT Enviro** and the ribbon tab is titled **Erosion Control**.

This section will further describe the specific CAD tools and other standards; such as text styles, sheet layout, cells, etc., found in the workspace for creating an Erosion and Sediment Control plan.

Standard Text

To set a standard text style use the change text attributes tool or choose a style from the workflow tools. See [Section 200.7](#) for more information on standard text styles used for GHE plans.

Cell Library

The cell library for Erosion and Sediment is named **Erosion.cel**. The elements necessary to complete an ESC sheet are located in this cell library. The cell library is accessed by the Erosion Control tools. The ribbon tab includes elements from the cell library such as; check dam, scour basin, inlet protection, notes, a legend, and patterns specific to Erosion control measures.

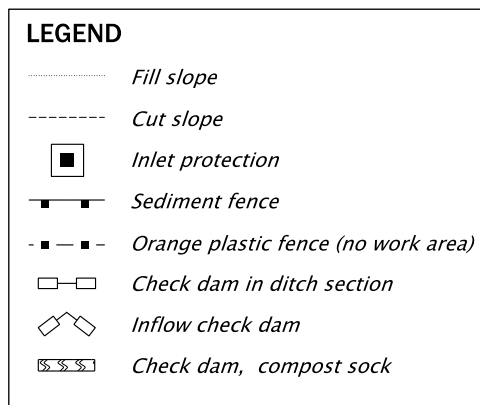


Figure 504.2.1.1 Portion of NOTE_ERO_LEGEND.cel

Ribbon Tab

Aside from elements located in the cell library, the Erosion Control ribbon tab also contains custom line styles for elements such as; diversion fence and sediment fence, compost sock, brush barrier, etc. Other BMP's included are patterns for compost blanket, seeding and mulching, and EC matting.

Levels

Use Erosion levels as appropriate (i.e. P_EC_DESIGN_.....) for line work and text on Erosion plan sheets. Retain the level structure of the referenced drawings.

Seed and Cache

Seed and Cache files are provided in the workspace. See [Part 200](#) of this manual for more information on GHE seed and cache files.

When starting a new Erosion and Sediment Control drawing use the **seed_titleblock.dgn** file and reference in the **GHE_cache.dgn** file.

The cache for **ESC** is included in the GHE cache file, along with other Hydraulic, Geotechnical, and Environmental discipline specific caches. The ESC cache contains the most commonly used construction notes and general notes, plus a legend and a standard drawing list (to be placed on the first plan sheet).

504.2.2 File Name and Sheet Name

File Name

ODOT uses a set list of CAD file names, based on an approved file naming convention developed for use within ODOT's [ProjectWise](#) data management system.

Project staff are responsible for naming individual files according to approved discipline specific standards found in the ProjectWise Document Name List through the use of the ProjectWise File Naming Tool.

Sheet Name (Title)

Erosion and Sediment Control plan sheets are titled as "Erosion and Sediment Plan" and may include one or several sheets titled "Details". A title block seed file, named **seed_titleblock.dgn**, is available in the workspace. The titleblock seed contains models for sheet names by-discipline. Sheet names are located on separate levels within each model, so the correct sheet name can remain turned on while all others are turned off. The sheet titles for Erosion plans are located in the "F_Sheets" model.

Refer to the [OCM](#) for list of available sheet names for each discipline.

504.2.3 Drawing Sequence and Sheet Numbering

Drawing Sequence

Erosion plans are located in the "F" series section of ODOT's project plans. Place Erosion plan sheets after Roadside Development sheets and before Wetland Mitigation sheets, when they are included. See the [OCM](#) for drawing sequencing and sheet numbering tables, for all disciplines plan sheets.

Sheet Numbering

Erosion sheets appear in the 'F' series sheet numbering sequence. Erosion plans begin with sheet number FB001.

The number shown in red is optional and can be used to separate the ESC plans by area, which can be common on very large projects with multiple sheets per area. The project may have more than one center line road alignment, and the ESC plans may cover more than one separate area along those alignments. One area, or alignment, could use a FA100 sheet numbering series and another could use a FA200 sheet numbering series. An example of this is shown in [Figure 501.2.4.1 Example Plan Sheet Layout Plan](#).

For further information regarding drawing sequence and sheet numbering please see [Part 200](#) this manual, and the [OCM](#).

504.2.4 Plan Sheets Development

The Erosion and Sediment Control sheets generally utilize the same drawing conventions as the Roadway Engineering plans. When creating the design base drawing reference the existing files for topography, contours, and highway right-of-way, plus the roadway, bridge, (or other) design files when applicable.

Layout

Arrange each Erosion sheet to clearly show the Erosion and Sediment Control measures required for the project. Provide a plan view using the same scale and area as shown on each Roadway sheet for the project, when applicable. Include the design files for all construction being proposed. This could include the bridge files or retaining wall files, etc.

ESC plan sets begin with a *Plan Sheet Layout Plan* sheet (when needed), followed by the *Plan View* sheets and ending with the *Details* sheets.

Plan Sheet Layout Plan

If a *Plan Sheet Layout Plan* is included in a project, it becomes the first sheet of the ESC set and is followed by the first *Plan View* sheet. The Plan Sheet Layout is generally only one sheet and encompasses the entire project. Only display the alignment lines and the locations of the plan sheets. The layout of the plan sheets starts at the left side of the sheet, and runs along the road alignment. Sheets are numbered consecutively from left to right.

Plan sheet layouts are shown for all project alignments or project areas, see the following figure for an example of a multi alignment project. In the example, the three digit sheet number concept is used to separate the sheets by area within the project. (i.e. one area of sheets are number in the FB100 series and the other area are numbered in the FB200 series).

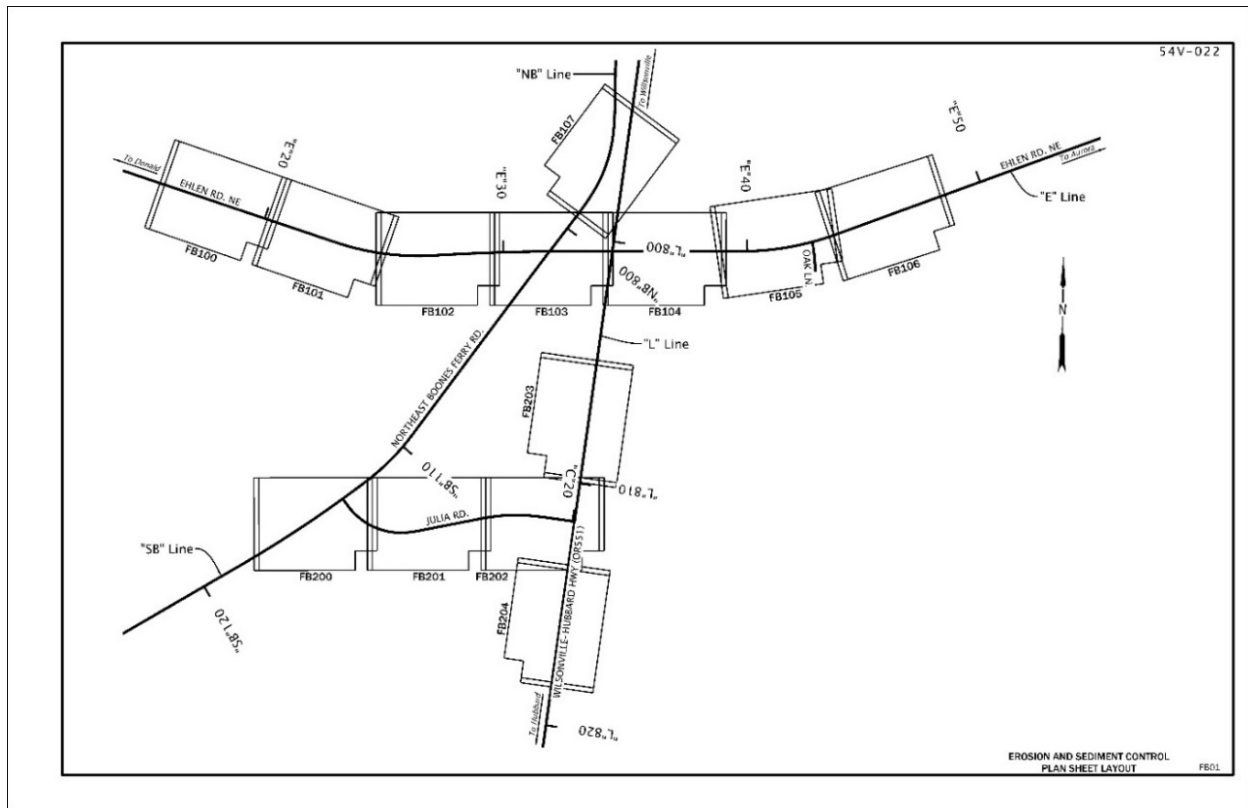


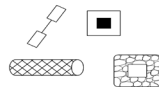
Figure 504.2.4.1 Example Plan Sheet Layout Plan

Plan View

Each **plan view** sheet clearly shows the location of the Erosion Control measures, or BMPs, required for that section of the project. The correct symbol and label for each BMP is placed at each location.

Available **BMP symbols** include, but are not limited to:

- Check dam
- Bio filter bag
- Inlet protection
- Scour Basin



Custom line styles for items such as the orange plastic mesh fence, or different types of sediment fence are included in the workspace along with area patterns and standard notes.

Some elements are provided in multiple styles for different types of the same BMP, such as the sediment fence types. There are 3 types of sediment fence for 3 different types of erosion control measures. Each type is a different custom line style.

Another symbol provided in multiple types is the check dam symbol. According to the [Oregon Standard Specifications for Construction](#), there are 6 different types of check dams that can be

used on projects. Each type is displayed using the same symbol, but each type has a different cell name, (i.e. DET_CKDMTYPE1, DET_CKDMTYPE2, etc.). This aids in calculating project quantities of each type of check dam to be installed.

Each cell drawing for each type of check dam has a text label to designate which type it is. This aids in the process of calculating quantities by hand. The text labels are “construction elements” and will not print.

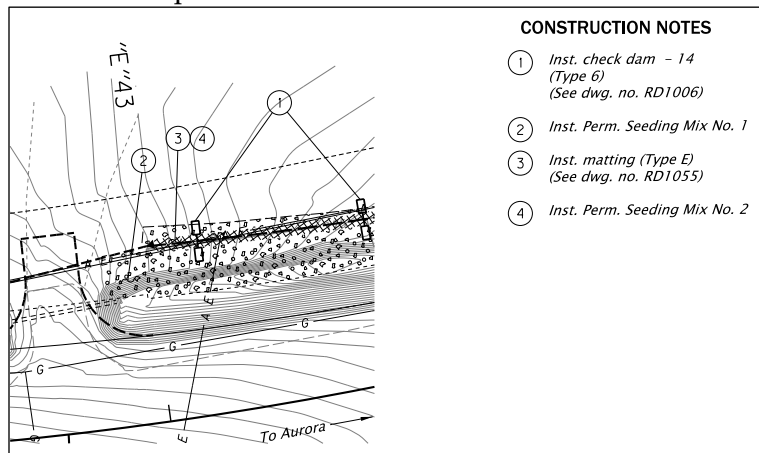


Figure 504.2.4.4 Example Bubble Labels and Construction Notes.

To **Label** each BMP, use the bubble note tools, provided in the ODOT Roadway workflow, to mark each BMP with a numbered bubble and straight leader line. The number within the bubble must correspond with the correct number in the construction notes, which are shown along the right hand side of the sheet.

An ESC **standard construction note template** is provided in the Erosion Control ribbon tab. Construction notes are to be placed on the note margin line, or (note ladder) found in the ODOT Roadway workflow and in the Road.cel library. In the construction notes always include reference to the standard drawing when one applies. Quantities per sheet may also be shown in the construction notes per POR instruction. See the [OCM](#) for standards on note composition and configuration.

Some projects will include a stormwater design. Reference in this design, when applicable, to the Erosion Control design file. Stormwater features such as Water Quality Biofiltration Swales will usually require Type E matting be installed as an erosion and sediment control measure. Always include in the construction notes, reference to the Stormwater Facility sheet containing that feature. The seeding and mulching of features to be constructed is required to be shown on the Erosion and Sediment Control sheets per the latest NPDES Construction Permit 1200-CA.

Plan View sheets also include a legend and specific notes pertaining to the individual sheet. **Legend and notes** can be placed directly below the construction notes, or along the bottom portion of the sheet when space allows.

Place the **General Notes** and the **Standard Drawing List** in the bottom portion of the **first** plan view sheet only. Other individual notes that pertain to the project as a whole can be placed just

above the title block, in alignment with the note ladder. Individual notes pertaining to just that sheet should appear on that sheet only.

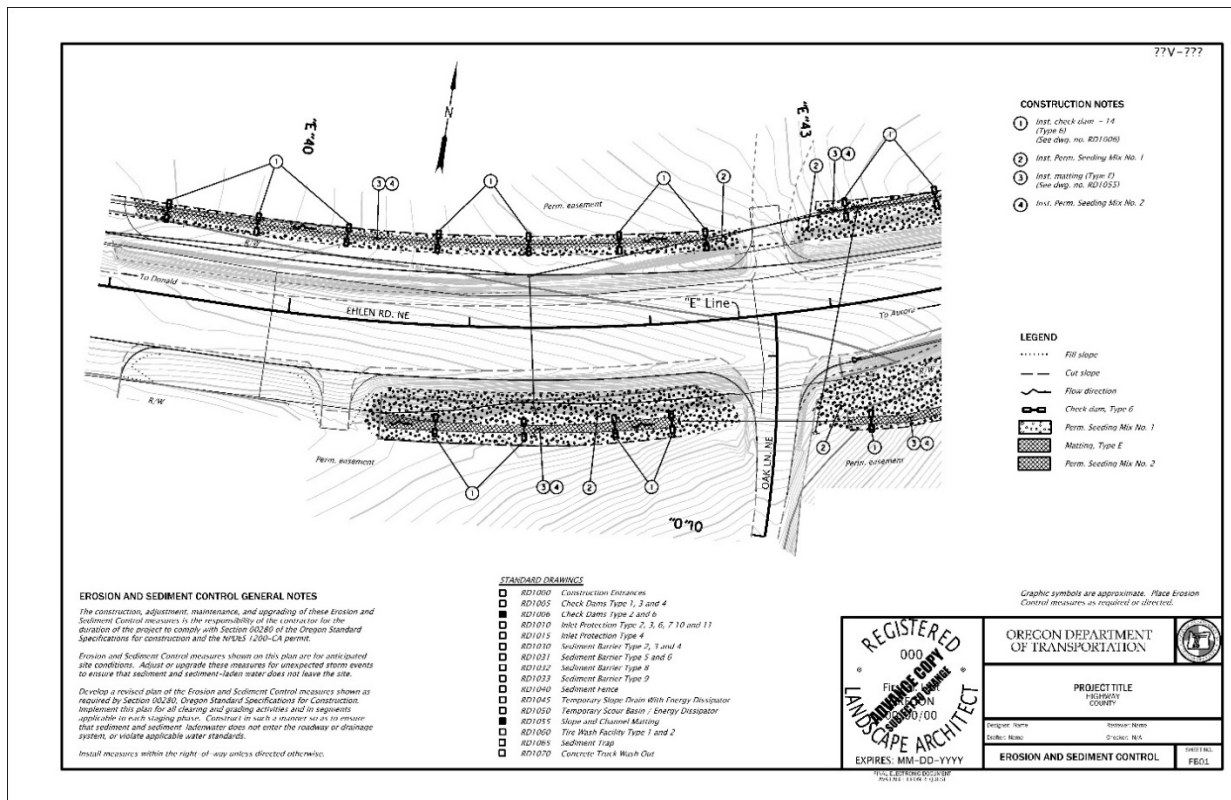


Figure 504.2.4.5 Example First Plan View Sheet with General Notes and Standard Drawing List

Smaller projects may require the Erosion Control plans be included on the Roadway sheets instead of having their own set of plan sheets. In this type of scenario the General Notes and the Standard Drawing List are included on the **first** Erosion Control *Details* sheet.

Stages and Phases

Complex projects will often include **Construction Stages and Phases**. Erosion and Sediment Control plans may take advantage of these construction stages to benefit the work completion and the project overall. The POR and the CADD Technician must work closely with the Traffic Control project team when using the construction stages. Label the sheets with the correct Stage number, matching the stages used by Traffic Control.

Label the sheet in the same way as the Traffic Control sheets are labeled, with the Stage number noted as a title at the center top of the sheet. Label as Stage #, Phase #, (phases will only apply when stages are broken down into smaller parts). Follow the POR's direction per project. For more information on Stage and Phase sheet titles, see Part 200.13 Plan Sheets Development in this manual, and also the [Traffic Control Plan Design Manual](#).

Details sheet

All GHE disciplines end their plan sheet sets with the details sheet/s. ESC has [9 Standard Detail drawings](#) in the Environmental series. Details 6000-6099 are available for use on any project. Each standard detail fills one sheet and can be used in their entirety, or can be added to/or taken away from, to meet the requirements of the project. New project specific details may also be included. All details are the responsibility of the POR and are stamped accordingly.

Standard Drawings

ESC currently has [16 Standard Drawings in the RD 1000 Series](#) available for use on projects. Standard Drawings are referred to in the drawing index of the entire project plans set and can also be check boxed in the Standard Drawings list placed on the first ESC plan view sheet.

Access the Standard Drawings list from the Notes ribbon tab within the Erosion Control workflow, and place in the bottom area of the sheet near the titleblock. Mark the standard drawings to be included in the plans by placing an opaque box, or check mark, in the appropriate check box. [See Figure 502.2.4.3.](#)

504.2.5 Cover Sheet/s for DEQ Permit 1200-CA Submittal

All ODOT erosion and sediment control plans (ESCP) must comply with the requirements of the NPDES 1200-CA permit (Permit) administered by the Department of Environmental Quality (DEQ). Requirements for submittal of a Permit package will always include the ESCP along with several cover sheets and standard drawings of BMPs used. At times, the package may include sheets and documentation as decided by the POR.

This package *is not* part of the project contract plans but will always contain a copy of the ESCP produced for the project plus **cover sheet/s** required for the submittal package. Please see the [Erosion and Sediment website](#) for more information regarding the DEQ requirements.

The purpose of these cover sheets is to inform DEQ of all the necessary information they require about the project for purposes of the permit. Drafters must modify the site and vicinity maps and title block only unless directed otherwise by the POR's.

Note: The cover sheet is not included in the Contract Plans, and is not stamped by the POR.

A template for the cover sheet/s, complete with standard sheet border and titleblock, is provided as a single MicroStation CAD drawing file with multiple sheets provided in separate models named DEQ01, DEQ02 and DEQ03. The drawing file is downloadable from the [Erosion and Sediment website](#) and is named [DEQ 1200-CA ESC Cover Sheet](#).

Each cover sheet has sections that require project specific information to be filled in, with the first sheet (DEQ01) to be completed by the Professional of Record (POR) and the third sheet

(DEQ03) to be completed by the contractor after Notice to Proceed is issued. The second sheet, DEQ02, is Permit language which should never be altered.

The first sheet of the cover sheet template includes information about the project and the Erosion Control measures being used. Depending on the size and scope of the project, some projects may have a longer or shorter BMP Matrix, or the Sheet Index list may contain more sheets or less sheets than other projects. Information unique to each project, such as narrative or BMP matrix, can be rearranged by the POR to some degree to allow room to display complete tables, lists, and written descriptions. Always provide the Site Map and Vicinity Map in the upper left corner of the sheet, at the same size as provided in the template. Do not move the Title block, it is in the standard position expected for all ODOT CAD products. The other cover sheets, DEQ02 and DEQ03, of the set are to be used as they are. Never rearrange or delete items on these sheets, unless directed by the POR.

NOTE: *Always download a new cover sheet file from the web for each project. The cover sheet is subject to periodic changes and using the latest version will ensure the best results moving forward with each project.*

The cover sheet drawing file is to be included in the ProjectWise file system using these 'committee approved' standards for location and file name.

Folder: Erosion Control

Document Description: Erosion and Sediment Control Drawing Cover Sheet for 1200-CA Permit for DEQ Submittal

Document Name: EE_K#####_DEQ_CS_##

POR's may request drafters to provide the drawings (plans and cover sheets) in PDF format for the DEQ submittal package. The POR or Resident Engineer submits the permit package to DEQ concurrent with the Advanced Plans review cycle. Drafters are not responsible for submitting the permit package to DEQ.

Section 504.3 Check List

The drafting check list below contains all items to be included on ESC sheets. (Depending on the project, some items may not apply).

- ☐ Border, title block, sheet title, sheet number
- ☐ Title block information complete
- ☐ Professional of record stamp
- ☐ "V" number or project status stamp
- ☐ Index sheet (if needed)
- ☐ Plan view
- ☐ North arrow

-
- ☐ Scales noted
 - ☐ Legend
 - ☐ Notes (Construction, General, sheet specific)
 - ☐ Existing roadways with names
 - ☐ Existing structures (e.g. bridge, culvert, wall, sign-bridge, etc.)
 - ☐ Existing utilities
 - ☐ Existing and proposed contours
 - ☐ Contours labeled
 - ☐ Flow direction arrows in and around the area
 - ☐ Proposed roadway with alignment and stationing
 - ☐ Proposed structures
 - ☐ Proposed utilities
 - ☐ Existing and Proposed storm water drainage systems (culverts, pipes, inlets, ditches, etc.)
 - ☐ Waterway(s) labeled and flow direction shown (Includes wetlands, ponds, etc.)
 - ☐ Right-of-way lines
 - ☐ Temporary construction easements
 - ☐ Boundaries of environmentally sensitive areas such as wetlands, no access areas, etc.
 - ☐ Construction Stages (when applicable)
 - ☐ BMPs shown and labeled
 - ☐ Detail(s)

Section 504.4 Example Drawings

Erosion and Sediment Control example drawings are either under development or located on the [Drafting Program](#) page of the [Geo-Environmental](#) website. See [Part 200](#) this manual for more information regarding example drawings.

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