Construction Site Assessment & Planning

Above photo by United States Department of Agriculture,
Natural Resources Conservation Service, Iowa 2000, Lynn Betts

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INTRODUCTION TO SITE ASSESSMENT & PLANNING

Construction site assessment and planning is an important part of any construction project. Prior to planning, designing, or laying out a project, it is important for the plan designer to have knowledge of the project site and adjacent areas. To accomplish this objective it is necessary to collect information about the proposed project site. This information can then be used by the plan designer to make informative decisions in regard to project planning, design, and layout. In addition, it allows the plan designer to develop a set of construction plans that will allow for development of the project in an efficient, cost-effective, and environmentally sensitive manner.

Construction site assessment and planning usually involves three steps. Step one is site assessment and data collection. The second step is to analyze the collected data. The third and final step is to begin incorporating this information into a preliminary concept and design.

SITE ASSESSMENT & DATA COLLECTION

Site assessment and data collection is the first step in the planning, design, and layout of any construction project. This step involves collection of resource information applicable to the project site. Information can be obtained through research of existing publications, maps, studies, and other resources. In addition to obtaining information through research of existing documents, it is important to walk the project site to obtain a visual appreciation of the site and site features.

Taking good notes and documenting information is very important in this phase of site assessment and planning. Collected information can be documented in narrative or graphical format. Information that is collected in graphical format such as maps should be of the same scale whenever feasible. This allows the plan designer to overlay different site maps and compare various resources and data at a quick glance.

Key information that should be collected includes but is not limited to the following items.

Vegetative Cover

The type and amount of vegetative cover is one of the easiest forms of data to collect for a project site. This information gives plan designers an understanding of the stability of the site and its current susceptibility to erosion.

Vegetative cover can be documented in narrative and/or graphical format. Graphical documentation should be on a map or overlay and at a minimum include the delineation and identification of existing vegetation such as grass, shrubs, trees, groupings or clusters of trees, unique vegetation, and so on. If the site is farmed, documentation should identify the crop and/or crop residue at the site. Narrative documentation should include the quality and condition of the vegetation, its ecological and aesthetical value, and its potential for use in the planning, design, and layout of the proposed project.

Soils Information

Soils information is another key component in the planning, design and layout of construction projects. Soil types in conjunction with site topography can provide valuable information in determining areas with a high potential for erosion. Soils data can also be used in the selection, sizing, design, and placement of storm water management measures.

Soils information can generally be obtained from the U.S. Department of Agriculture's Natural Resources Conservation Service county soil surveys which are available through local county soil and water conservation district offices. Soils data can also be obtained through the services of private soils consultants or firms who prepare geotechnical reports.

Soils data should be documented in both graphical and narrative form. Soil types should be delineated directly onto an aerial photograph or an overlay of the same scale as the topographic map(s) for the project site. This facilitates the comparison of soil types and their relationship with the topography of the site.

Data collection should also include information pertaining to critical areas or features such as steep slopes (see Topographical Information below), rock outcroppings, seepage zones, and any other unique or noteworthy landscape features.

Soils data should be documented in narrative form as well as graphical form. The narrative should describe the respective soil types including their physical characteristics and their limitations and/or hazards for the intended land use. Soils information that is most commonly collected and useful in the design and layout of a project includes but is not limited to depth of topsoil, soil texture and particle size, infiltration rate, permeability, depth to limiting layers (i.e., bedrock, fragipan, glacial till), shrink-swell potential, low strength, susceptibility to erosion, ponding, and depth to the seasonal water table.

Topographical Information

Site topography is critical to project planning, design and layout. Topographic maps provide useful information that the plan designer can use to determine drainage patterns, slope gradient and length, and the location of ecologically sensitive features such as waterbodies.

Topographic elevations for a project site should be documented in graphical form. Topographic information can be obtained from United States Geological Survey quadrangle maps (these may not provide the detail appropriate for site planning) or the data can be collected by conducting an on-site topographic survey. If the data is collected through an on-site survey, the topographic map should show existing contour elevations at intervals that are appropriate to determine drainage patterns and slope of the land. One foot and five foot contour intervals are the most common intervals used when making an on-site topographic survey. However, in areas with steep terrain it may be acceptable to use an interval of ten feet

Hydrological Information

Hydrologic features are critical in planning, designing, and laying out a construction project. It is extremely important to identify, delineate, and record all depressional areas such as ponds, lakes and wetlands and conveyance systems, including swales, ditches, streams, creeks, rivers, and areas of concentrated flow that are on or adjacent to the project site. This information allows the plan designer to determine drainage patterns, evaluate the condition of various drainage features, determine if they can be incorporated into the project, and select storm water management measures to protect ecologically sensitive areas.

Streams, ponds, and other water features located downstream from the project site should be surveyed to determine their carrying capacity and sensitivity to sedimentation and flooding. It is important to consider their potential for channel or shoreline erosion as a result of increased storm water runoff volumes, velocities, and peak discharge flows.

Many Indiana soils have a seasonal high water table. Over the years, landowners have installed numerous subsurface tile drainage systems to manage the seasonal water table for agricultural production. Interconnected subsurface drainage systems frequently cover several parcels of farmland. Breakage or disruption of a subsurface drainage system often affects the drainage on adjacent properties and can result in ponding or flooding of upstream areas. Therefore, when land is converted from agricultural uses to urban uses, it is extremely important to identify and delineate these subsurface drainage systems so that they can be integrated into the planning process. Locating subsurface drainage tile is generally more difficult and requires on-site exploration. Some landowners may have a written record or graphical plans showing the location of subsurface drain tiles on their properties. In extremely rare instances, local soil and water conservation districts may have aerial photographs showing the location of subsurface drain tiles or written records/graphical plans showing drain tile locations.

Hydrologic data of a project site should be documented in graphic and narrative form. Major conveyance systems and waterbodies can generally be identified using U.S. Geological Survey quadrangle maps and U.S. Fish and Wildlife Service National Wetlands Inventory maps. Smaller features may require on-site visual inspection and documentation.

Hydrologic features should be delineated on a topographical map or overlay. All locations where storm water runoff may enter, cross, and/or exit the project site should be clearly identified. Areas where storm water runoff may concentrate on the project site should also be identified on the map or overlay.

Once again, hydrologic features should be documented in narrative form as well as graphical form. The narrative should describe the condition of the drainage feature, its ecological value, its aesthetic value to the project, and its potential for use in the project's overall storm water drainage and management system.

Adjacent Areas

Site assessment and data collection should include an evaluation of adjacent properties and their respective land uses. This information provides the plan designer with valuable information that can be used to determine the effects that storm water runoff and pollutants associated with upstream watershed land uses (e.g., single-family residential, multi-family residential, commercial, industrial, agricultural, woodland, etc.) might have on the proposed project site. It also aids in projecting what impacts a project might have on downstream watersheds and sensitive areas.

Features of significance that should be documented and evaluated include but are not limited to rivers, streams, creeks, lakes, ponds, wetlands, wooded areas, roads, culverts, houses and other structures. Site assessment should include documenting the potential for sediment deposition and damage to adjacent properties as a result of sheet and rill erosion from the project site once construction begins.

Adjacent land uses and site features should be identified and delineated on a site map or overlay. If a particularly important feature(s) is located a significant distance outside the limits of the project site, the feature should be documented in a detailed note on the site map or a smaller scale map should be used to clearly identify the location and specific details of the feature.

Utility & Highway Corridors

Utility and highway corridors and easements on or adjacent to a construction project should be identified and delineated on a project site map. This information is useful when planning, designing, and laying out a project and developing a construction plan for the project.

Existing Infrastructure & Potential Problem Areas

A commonly overlooked aspect of site assessment and data collection is the identification of past activities and potential problem areas associated with the project site. These issues can often delay or even stop a project if they are overlooked.

All existing structures and infrastructure associated with a project site should be identified on a project map. If buildings and other structures are present and are to be demolished, an assessment of the building materials and contents should be characterized and documented in the narrative.

Some of the more common areas of concern that should be identified on a site map or in the project narrative include abandoned wells, underground storage tanks, improper disposal of trash and debris, subsurface drainage tile, buried waste materials, and contaminated soils.

Natural, Historical & Archeological Features

Natural, historical, and archeological features can also delay or stop a project if not addressed in the planning, design and layout of a project. This element of site assessment and data collection should include features that may be impacted by the overall project, from initial construction through the final land use.

The project site should be assessed for the presence of any historical or archeological features. This includes but is not limited to historic buildings/features, burial sites, and artifacts. Common artifacts include spear points, arrowheads, knives, chipped or broken stone debris, ground stone axes, grinding stones, mortars and pestles, awls, gouges, pottery, clothing and ornamental pins, decorative items and ornaments, scraping tools, hammerstones, bone fishhooks, stone perforators, and beads. For more information regarding historical and archeological issues, please contact the Indiana Department of Natural Resources, Division of Historic Preservation and Archeology.

Natural features such as bodies of water, floodplains, wetlands, sinkholes, unique habitat, and presence of endangered or threatened species should be identified on a site plan map or in the project narrative.

Regulations

While is it still early in the planning, design and layout process and many decisions still need to be made, it is not too early to start evaluating what permits may be needed for the project.

Regulatory requirements can influence land use and project layout decisions. Often, a project's design or layout can be modified or adjusted to avoid the need for a specific permit or to meet specific regulatory requirements. Therefore, site assessment and data collection should include documentation identifying the need or potential need for local, state, and federal regulatory permits. The types of permits needed will be dependent on the nature and scope of the project.

ANALYSIS OF COLLECTED DATA

As the site assessment and data collection phase nears completion, a picture of the project site's potential and limitations will begin to emerge. The next step in the planning, design, and layout process is to analyze, interpret, and compare the site resource information and data that has been collected. As the data is analyzed it may be necessary to conduct additional research on one or more items associated with the project or to return to the site to make additional field observations.

The remainder of this section of the manual provides insight into the decision-making process and gives guidance in the review and interpretation of the data that was collected during the site assessment and data collection process.

Vegetative Cover

Analysis of vegetative cover should begin by identifying vegetation that is of high quality and value and may enhance the aesthetics of the overall project. Vegetative cover or features that may be of particular interest include but are not limited to unique habitat areas and riparian corridors. Trees in particular can be a very valuable asset and can significantly increase the aesthetics and salability of lots within a project. Some communities in Indiana have requirements to preserve trees when land is developed. When evaluating and assessing trees, it is often times very beneficial to consult a professional forester. They can identify which trees will add the greatest value to a project and identify which trees are diseased or may not survive construction activities.

Soils Information

As soils information is evaluated, it is often beneficial to group soils with similar characteristics. For example, grouping of soils with similar seasonal water table depths can help determine which areas of a residential project are best suited for home construction verses which areas might be used for common areas or greenways. Grouping of seasonal water table depths can also provide insight into which soils have limitations for roads and streets because of frost action.

Part of the data analysis process should include an understanding of state and local regulatory agency on-site waste disposal regulations. While grouping of soils with rapid permeability or slow permeability can help determine overall areas best suited for on-site sewage treatment disposal systems, it is generally recommended that specific on-site soil evaluations be performed on each individual on-site waste disposal system site to determine the soil's adequacy to support such a system.

In regard to water quality, soil erodibility is one of the first soil characteristics to review and evaluate. Soil erodibility will help determine the location and size of storm water management and treatment measures. For example, soils with a high percentage of mineral particles that are 0.02 mm or smaller in size will stay in suspension in the water column for long periods of time and will be difficult to remove via basic storm water quality treatment measures. In fact, these small soil particles often require extensive sediment basin design in conjunction with other storm water management and treatment measures. Land grading can also compound this effect because it typically results in the mixing of surface soil material with higher clay content subsoil materials.

Topographical Information

Slope gradient and length are the two primary factors to consider when analyzing and interpreting topographic information. This information is critical when designing and laying out the project because it will ultimately affect the decisions that will need to be made when selecting appropriate construction and post-construction water quality management and treatment measures. For example, decisions made in regard to areas of land disturbance and the removal of vegetation on steeper slope gradients will affect the selection, design, and location of storm water management and treatment measures (i.e., as unvegetated slope gradients increase the size and cost of the storm water management and treatment measures will also increase).

For ease of interpretation and comparison of data, slope gradients are typically grouped into the following four general ranges.

- 0 to 2 percent
- 2 to 6 percent
- 6 to 12 percent
- Over 12 percent

These ranges or groupings can be used to categorize various topographic limitations such as soil erodibility. A slope range of zero to two percent usually has a low erosion hazard whereas a two to six percent slope range has a low to moderate erosion hazard. A six to 12 percent slope range has a moderate to high erosion hazard, and slopes over 12 percent have a severe erosion hazard.

Slope length is another aspect that is important in identification of a site's erodibility hazard. As slope length increases within a slope gradient range, the potential for erosion increases exponentially. As a general rule, the erosion hazard will become critical if slope lengths exceed the following lengths within each respective slope range.

- 0 to 2 percent 300 feet
- 2 to 6 percent 200 feet
- 6 to 12 percent 100 feet
- Over 12 percent 50 feet

Hydrological Information

Natural drainage patterns and other hydrologic features exist on the land and include overland flow, conveyance channels, swales, depressions, and other watercourses and natural waterbodies. It is important to evaluate these features for their potential to be incorporated into the project's overall storm water management system.

Understanding how storm water flows onto and off a project site is critical to project design and layout. Evaluation of hydrologic data often begins by examining areas up slope of the project site and determining the volume and velocity of storm water that will enter the project area. This information will be used to determine the type, location, and design of storm water measures that will be needed to manage storm water entering and/or flowing across the project site.

When subsurface tile drainage systems are encountered on a project site, it is important to evaluate the size of the drain tiles and the watershed area that they drain. Subsurface drainage systems should be evaluated to determine if rerouting of the system is necessary to maintain drainage of adjacent properties and prevent upstream ponding/flooding problems. Subsurface drain tile should not be used as storm drains. They are typically not designed for this purpose and their capacity is often exceeded, resulting in failure of the drainage system.

Another important aspect of evaluating hydrologic data is the assessment of existing construction and post-construction storm water runoff volumes, velocities and peak flow discharges from the project site, and determining what impacts they will have on downstream hydrologic features and land areas. This evaluation should include an assessment of potential streambank erosion in the downstream receiving channel(s). It should include an evaluation of the potential for sediment pollution from sheet and rill erosion. Once project planning, design and layout begins, it may be necessary to recalculate storm water discharge volumes and peak flows to assess the impact those decisions will have on off-site features such as channels and culverts. Once again, this information will provide insight into identifying the type, location, and design of storm water measures that will be needed to minimize off-site resource impacts to downstream areas.

Adjacent Areas

Data that has been collected in regard to adjacent properties should be evaluated to determine what effect adjoining land uses might have on the proposed project. Evaluate if these land uses will require the installation of storm water management measures on the project site to manage runoff quantity and treat storm water runoff and pollutants associated with the upstream land use(s). Also evaluate what effects storm water runoff and potential pollutants from the proposed project might have on adjoining properties located down slope from the project site.

Utility & Highway Corridors

Utility and highway corridor data should be assessed to determine how the proposed project's infrastructure might be tied into these corridors or whether or not these corridors can be incorporated into the overall project design. Evaluate what effect these land uses might have on the proposed project.

Existing Infrastructure & Potential Problem Areas

Potential problem areas identified during the site assessment and data collection phase should be reviewed and evaluated to determine what effect they will have on the project. Assess data to determine if any remedial actions will be needed to reclaim or restore areas of concern on the proposed project site.

Natural, Historical and Archeological Features

Proper analysis of natural, historical, and archeological data is critical in preventing the delay of a project. Identification of many of these features often requires the developer to apply for local, state, or federal permits. Therefore, this data should be analyzed to determine what permits might be needed.

Regulations

As the data for the project is reviewed and analyzed, the designer should keep in mind the permits that may be required for the project.

Permit application processes can often delay construction projects. During this phase of planning, it is important to identify the permits that will be required. If feasible and not dependent on design decisions, the permitting process should begin. This may include actual submittal of permits or, at a minimum, a dialogue with the regulatory agency to identify specific information that will be required to obtain a permit.

PLAN DEVELOPMENT & PROJECT LAYOUT

The final step in construction site planning and assessment is to incorporate the collected data and information into the overall project plan, design, and layout. This section will provide a broad overview and insight into that process. Later sections of the manual will go into much more detail in planning, designing, and laying out a project, including the selection of appropriate storm water measures.

Vegetative Cover

Vegetative cover is probably the most important factor in terms of preventing erosion. Vegetation is also valuable in its ability to act as a buffer and filter pollutants from storm water runoff. Therefore, every effort should be made to preserve and incorporate existing vegetation into the proposed project.

In the analysis of collected data phase of the construction site planning and assessment process the designer has identified areas of vegetation that are of value and should be preserved on the project site. As part of the planning, design, and layout process, these areas should be delineated on the project's construction plans. Delineate major areas or groupings of trees, grass, cultivated land, etc. on the overall project site. Delineate areas that are designated for protection and specify how these areas are to be protected (i.e., a physical barrier such as a fence).

Identify areas that have a dense vegetative cover that can be used to provide effective erosion control as long as the area is not graded, or areas where existing vegetation can be used to filter storm water runoff and allow suspended soil particles to settle out. Identifying vegetative cover that is suitable for use as a vegetative filter also allows the plan designer to substitute these filters for other sediment trapping measures which in turn will reduce the overall cost of a project.

In situations where existing vegetation cannot be saved or where there is no vegetation on-site, consider staging construction activities. Staging of construction activities involves stabilizing part of the project site before disturbing another section of the site. This minimizes the length of time that soil is exposed to the erosive forces of wind and water.

Temporary seeding and mulching can be used to stabilize unvegetated areas that would otherwise be exposed for long periods of time, thus reducing the erosion hazard.

Vegetated riparian buffers located adjacent to waterbodies and other sensitive areas are an effective means of protecting these features from storm water runoff pollutants. Existing riparian buffers should be delineated or identified on the construction plans and the plans should identify measures to protect or, where necessary, enhance or re-establish existing buffers.

Soils Information

Soils generally have the greatest impact on project planning, design and layout. Their inherent properties, limitations, and hazards can literally dictate the layout of building lots/pads, roads and streets, storm sewers, on-site sewage disposal facilities (where applicable), and other project infrastructure. Soil characteristics such as depth to bedrock, depth to the seasonal water table, permeability, shrink-swell potential, texture, and erodibility need to be evaluated and factored into the design and layout of the project.

Soils data must be taken into account when evaluating, selecting, locating, and designing storm water management measures that will be used to manage storm water runoff during active construction. Areas of highly erodible soils should be identified on the construction plans and the plans should identify management measures that can be used to minimize erosion on these areas.

Soils data must also be taken into account when selecting storm water management measures for post-construction activities. For example, infiltration measures will be ineffective in soils that have a high clay content or soils that have an extremely high gravel content. The use of filtration and infiltration measures may be severely restricted or impractical in soils with a seasonal high water table unless there is some way to artificially lower the water table.

Project planning, design, and layout should take into account critical areas such as steep slopes (see Topographical Information below), rock outcropping, seepage zones, and any unique or noteworthy landscape features that were identified in the site assessment and data collection phase. Many critical area features can impact the layout of roads and streets, building lots/pads, and on-site sewage disposal facilities. Often, critical area features can be incorporated into common areas and greenways within the development and can actually add aesthetic value to the project.

Topographical Information

Topographic information that has been collected should be used to delineate areas with similar slope gradients. Slope gradients are typically grouped into the four general ranges of zero to two percent, two to six percent, six to 12 percent, and 12 percent or greater. Many building/construction parameters and storm water management measure design specifications are based on these slope gradient ranges.

Using collected topographic information, delineate all major watershed boundaries that are associated with the project site. Often, these watershed boundaries will extend up slope or down slope of the actual project site boundaries. Delineation of the watersheds will help identify the direction of surface water flow. If a delineated watershed exceeds five acres, the plan designer should subdivide the watershed into smaller watersheds. Smaller watersheds are more manageable units when predicting storm water runoff volumes and selecting storm water management measures. It is also important to keep in mind that many storm water management measures have design and application parameters well under the five acre threshold. In fact, the design and application of many measures are typically for one or two acres.

Watershed boundaries will be used many times throughout the planning, design, and layout process. For example, they will be used when calculating storm water runoff volumes, assessing erosion potential, estimating sediment yields, and selecting appropriate storm water management measures.

Hydrological Information

It is critical that the plan designer understands how water flows onto and off of a project site. Where possible, natural drainage systems should be incorporated into the project's design and layout and used to convey storm water runoff through and from the project site.

Using information and data collected on upstream watersheds, analyze the volume and velocity of storm water runoff from adjacent areas that may enter the project site. Evaluate and identify storm water management runoff measures that need to be installed or constructed on the project site to divert the storm water run-on away from construction zones and minimize impacts to the construction project.

Using the hydrologic data that has been collected and the watershed areas that have been delineated, calculate storm water runoff volumes, velocities and peak flows associated with existing site conditions, and begin laying out and designing the project site's drainage system. As drainage system planning, design, and layout decisions are made, it may be necessary to recalculate discharge volumes and peak flow discharges and assess their impact on off-site features such as channels and culverts.

The next step is to evaluate and determine what impact the project's proposed drainage system will have on downstream waterbodies. Storm water management measures must be incorporated into the construction plans to ensure that there is little or no impact to the carrying capacity and sensitivity to sedimentation and flooding of the downstream waterbodies.

In situations where subsurface drainage tile have been identified on the project site, tile locations should be marked on the construction plans. Where applicable, rerouting of these tiles should be identified and the new tile location shown on the plans.

Adjacent Areas

Special attention should be given to planning a project when there is potential for the project to impact adjoining properties and ecologically sensitive features. It is important to address downstream discharge points, the potential for sediment pollution, and/or downstream channel erosion and deposition and the effects they can have on downstream waterbodies. This includes the impacts that sheet and rill erosion could potentially have on adjoining properties located downstream of the project site. Appropriate storm water management measures must be identified and built into the construction project to minimize impacts to the previously identified downstream land use(s) and waterbodies.

Utility & Highway Corridors

Lay out lots/building pads, streets and roads, and on-site sewage disposal systems (if applicable) so that they do not interfere with existing utility and highway corridors. Utility corridors must be kept free of obstructions, especially if they require regular maintenance activities or if they present a safety hazard.

Identify specific storm water management measures that need to be installed on the proposed project site to address runoff from these land uses. For example, it may be necessary to incorporate storm water measures into the proposed project to provide for the runoff from roads and impervious surfaces.

As the project layout and design begins to take shape, tie proposed utilities, utility easements, and roads and streets into existing utility and highway corridors. Identify storm water measures needed to protect these corridors from erosion, sedimentation, and construction traffic. In addition to protecting the integrity of the corridors, it may be necessary to incorporate signage or safety fence to notify or restrict construction operations in these highly dangerous areas.

Existing Infrastructure & Potential Problem Areas

Identify and incorporate into the construction plans appropriate or remedial measures that will address potential problem areas that were identified in the site assessment and data collection phase. In situations where remedial action is delayed or it is impossible to correct or eliminate problem areas, allow for provisions to work around the area(s).

Natural, Historical & Archeological Features

Natural, historical and archeological features identified in the site assessment and data collection phase should be incorporated into the project plan, design, and layout. These features often can be incorporated as an aesthetic element in the design of common areas or greenways. Construction plans should include the identification of measures that must be installed to protect culturally and environmentally sensitive natural, historical, or archeological areas from construction equipment and construction activities.

In situations requiring permits, the permit application process can take anywhere from days to weeks or months. Therefore, the permit application process should be started as soon as possible.

Regulations

Permit application processes can often delay construction projects. As project decisions are made, the designer should evaluate each decision and how these decisions will affect the need for permits. This will require knowledge of local, state, and federal regulatory requirements. Part of this process may require additional research or dialogue with the appropriate regulatory agency. If permits are required, start the permit application process as soon as possible. Where feasible, consider adjusting the project design and layout to eliminate the need for the permit(s).

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