CHAPTER 2: SITE ANALYSIS

2.1 PURPOSE AND USE OF THIS CHAPTER

The purpose of the Site Analysis Chapter is to assist the reader in determining the existing on-site conditions before developing a Best Management Practices (BMP) plan for a project. The analysis informs BMP alternatives and enables a designer to select optimal BMPs based on the goals and objectives of the Project. Each site has unique opportunities and constraints for BMP implementation. For example, available open space presents opportunities for BMP installation, while lack of open space may be a constraint. The level and detail of information that needs to be gathered during this phase of planning depends on the land use and scale of the project. A small residential project requires less information to plan for BMPs compared to a jurisdiction scale project in which several more factors affect the BMP design. This chapter should be used in conjunction with Chapter 3, Permanent BMP Planning and Selection to help design the optimal BMPs for a project.

The chapter is organized based on the scale of the project. The reader can reference the section that is applicable to their project scale. The three categories of scale are:

- **Section 2.2** describes methods for Projects Less than 1 Acre and all Single Family Residential (SFR).
- **Section 2.3** describes methods for Projects 1 to 5 Acres and all Commercial, Industrial, Communications and Utilities (CICU).
- **Section 2.4** describes methods for Projects Greater than 5 Acres, which includes most jurisdiction scale projects.

Within each category are three steps to conducting the site analysis and a compilation of information that should be collected during each phase of the analysis. The three steps to the site analysis include:

- Initial Data Gathering (Pre Site Visit): Gather existing site information using available resources. Planning level information is available to assist in the BMP selection and design process, which is referenced in this chapter.
- Initial Site Visit: Towards the beginning of the planning process, an initial site visit should be performed to identify site specific characteristics. This includes characteristics such as pollutant sources and on-site hydrology. Compare the site specific characteristics to the planning level information already gathered. Identify information that require specific tools, expertise, or a TRPA application to accurately depict (e.g. specific soil information, land capability verification) and plan accordingly.
- Additional Data Gathering: Often times an additional site visit will be necessary because the appropriate tools or expertise were not available during the initial site visit, or conditions are believed to be different than information gathered during the pre-site visit. For example, a TRPA Land Capability and Land Coverage Verification may be required to design BMPs, and that requires an additional application and site visit from TRPA staff.

2.2 PROJECTS LESS THAN 1 ACRE AND ALL SINGLE FAMILY RESIDENTIAL PROJECTS

2.2.1 INITIAL DATA GATHERING

Plan Area Statements provide specific land use policies and regulations for a particular geographic area. Community Plans provide historical context and direct future land use and development within that area. All projects and activities shall be consistent with the Plan Area Statement or Community Plan.

2.2.1.1 LAND USE

Identify the land use on-site. Make sure the land use(s) on-site are consistent with the applicable Plan Area Statement or Community Plan. These can all be identified by consulting with the TRPA website at www.trpa.org under TRPA Regulations.

2.2.1.2 PROJECT AREA BASE MAP

Develop a simple base map which may be built upon throughout the site analysis and BMP design process. A map may be obtained from the County Assessor office or assembled by compiling record and field survey information. On the map identify if the project area is located within a scenic corridor, located within the shorezone, or located within a Steam Environment Zone (SEZ) setback. Special consideration shall be taken when planning and designing BMPs within these areas.

2.2.1.3 PARCEL BOUNDARIES

Identify the parcel or project area boundaries and delineate it on the project area map. Include all easements, encroachments, setbacks, and county/city right of ways as BMPs shall not be installed within these areas, unless permission is obtained from the appropriate entity. Parcel scale information may be obtained from the parcel deed or a site survey.

2.2.1.4 TOPOGRAPHIC INFORMATION

Identify basic topography. If a site survey has been done, use that information to identify on-site topography and incorporate the information onto the base map if a site survey has not been done for the project area, basic topography such as low spots and flow lines may be identified on-site during the initial site visit.

2.2.1.5 NRCS SOIL SURVEY

Identify the mapped soil unit(s) within the project area. The Natural Resources Conservation Service (NRCS) published the updated Soil Survey for the Lake Tahoe Basin (Soil Survey) in 2007. The soil survey includes characteristics of soil types that are needed to design BMPs. Soil map units directly correlate with specific infiltration rates and influence rainfall-runoff characteristics and the annual water balance.[1] The soil survey is an order II/III survey, which is performed on a large scale and intended for general planning purposes only. An on-site soils investigation is recommended to get site specific information.

The Web Soil Survey may be found at:

http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

[1] SWQIC, Formulating and Evaluating Alternatives, Appendix A-3 Table A3.8, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf

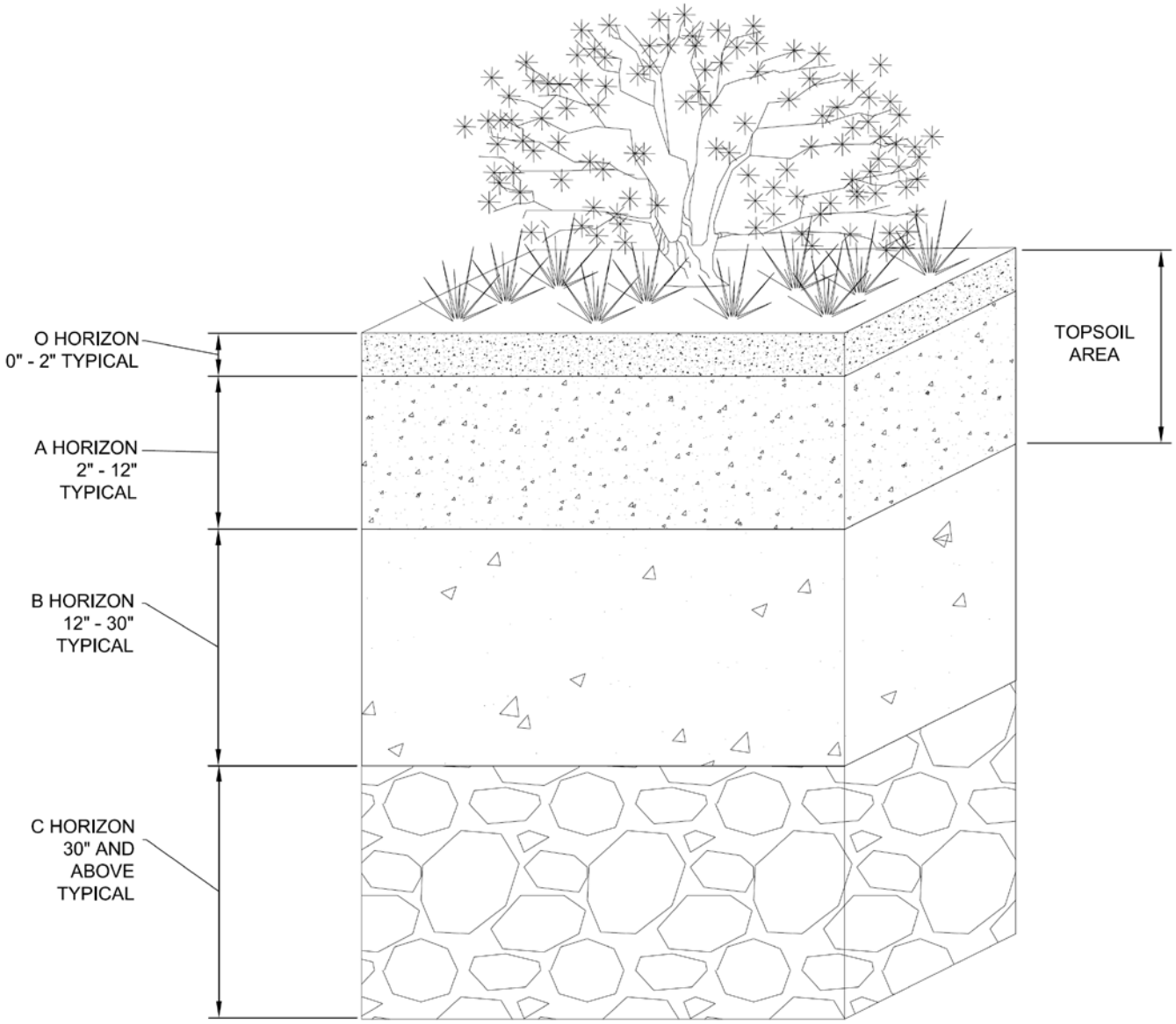
Basic soil information pertinent to designing BMPs is also embedded into the BMP Calculation spreadsheet which can be found at www.tahoebmp.org. The following is applicable soil information needed in designing BMPs on small residential scale projects and is available from the web soil survey.

- **Saturated hydraulic conductivity (Ksat)**: The Ksat is a quantitative measure of a saturated soils ability to transmit water when subject to a hydraulic gradient.[2] Ksat varies in the Lake Tahoe Region from slow (less than 1 inch per hour) to very fast (greater than 12 inches per hour). BMP opportunities and constraints vary depending on the Ksat of the soil. Soils with a low Ksat may make infiltration on-site a challenge, especially with large impervious areas. It is significantly easier to infiltrate stormwater on sites with a high Ksat value. Reducing the amount of impervious surfaces and disconnecting impervious surfaces can help infiltrate stormwater on sites with low Ksats.
- **Thickness of O horizon**: A soil horizon is a layer of soil or soil material approximately parallel to the land surface and differing from adjacent genetically related layers in physical, chemical, and biological properties or characteristics such as color, structure, texture, consistency, kinds and number of organisms present, and degree of acidity or alkalinity.[3] The O horizon is the uppermost layer consisting of decomposing organic material. It helps establish and maintain vegetation and increases the soils ability to resist erosion. Many soils in the Lake Tahoe Region are lacking a substantial O horizon so it may be necessary to add humus and soil binding materials to sediment source control projects.

[2] NRCS, 2004, Saturated Hydraulic Conductivity: Water Movement Concepts and Class History, Technical Note 6, http://soils.usda.gov/technical/

[3] Soil Science Society of America, Glossary of Soil Science Terms, https://www.soils.org/publications/soils-glossary#

Figure 2-a: Soil Horizons



- **Depth to Bedrock**: Shallow rocky soils, and rock outcrops are common in the Lake Tahoe Region. These features may hinder the installation of BMPs. They may slow infiltration and reduce BMP effectiveness. Some fractured bedrocks can short circuit the treatment process by providing preferential flow pathways.
- **Depth to seasonal high groundwater**: Groundwater levels and movement affect transport of pollutants, vegetation types, and the feasibility of BMPs[4]; therefore seasonal high groundwater level may limit the depth of infiltration BMPs. To prevent discharge of pollutants into groundwater, TRPA Code states "The bottom of infiltration trenches or drywells shall be a minimum of one foot above the seasonal high water table."[5]

[4] SWQIC, 2004, Formulating and Evaluating Alternatives, Appendix A-3 Table A3.8, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf
[5] TRPA, Lake Tahoe Regional Plan, Code of Ordinances, 60.4.6.A.1

2.2.1.6 UTILITIES

Obtain mapped utility information from the local utility district and incorporate the information onto the base map to ensure BMPs are not designed near a utility. Always call 811 to get utilities marked prior to any excavation. Hitting a utility during construction is avoidable and measures should be taken throughout the project to know utility locations prior to and during construction.

2.2.2 INITIAL SITE VISIT

The initial site visit should identify existing conditions such as landscape features and drainage patterns. Identify the location of discharge points, slope length, aspect, and gradient and natural features including trees, streams, and wetlands. Sensitive areas such as SEZs and erodible slopes shall be protected from disturbance including clearing, grading, and encroachment from vehicles and heavy equipment.[6] The initial site visit should compare these field observations with the information that was previously gathered. If the site visit leads to the assumption that a portion of the mapped information is inaccurate, an additional site visit may be required. As you perform the initial site visit, identify what opportunities and constraints there are for BMP implementation including on-site infiltration capacity, slope stabilization, revegetation, drainage conveyances, and paving requirements.

2.2.2.1 EXISTING SITE CONDITIONS AND USES ON-SITE

COMPACTED AND DISTURBED AREAS

Identify compacted and disturbed areas. Evidence of compacted, disturbed soil includes precipitation not being able to naturally infiltrate and the lack of vegetation compared to surrounding undisturbed areas. Parking off pavement, long-term storage of equipment/materials and heavy foot/animal traffic all cause compaction and disturbance to the natural soil.

Evidence of compacted and disturbed soil from vehicle traffic is shown above. Rainfall and snowmelt will not infiltrate and instead becomes stormwater runoff causing erosion and carrying sediment-laden water with it.

[6] EPA, 2007, Developing your Stormwater Pollution Prevention Plan: A Guide for Construction Sites; Page 11

Coverage:

TRPA defines Land Coverage as "A structure, improvement or covering shall not be considered as land coverage if it permits at least 75 percent of normal precipitation directly to reach the ground and permits the growth of vegetation on the approved species list."

OFF-PAVEMENT PARKING

Identify all unpaved areas that exhibit signs of disturbance, primarily from driving and parking vehicles and/or heavy equipment. All areas used for parking and/or driving shall be paved in accordance with TRPA and local jurisdiction regulations. If a project has unpaved parking or vehicle traffic areas, work with TRPA or the local jurisdiction to bring that property into compliance through either paving or restoring the area.

All properties in the Lake Tahoe Region are subject to land coverage regulations that limit the amount of disturbance in the watershed. The land capability and land coverage shall be verified prior to any changes in coverage (e.g. paving or restoring). Refer to Chapter 4, BMP Toolkit, Sections 4.2-i to 4.2-l Soil Stabilization (Non-Vegetative), and Chapter 7 Permitting for more information.

This unpaved driveway should be paved. It is currently a sediment source when vehicles track dirt onto the roadway and during disturbance from snow plows.

SEZ/SEASONAL HIGH GROUNDWATER AREAS AND FLOODPLAINS

Look for indicators of a SEZ, including the SEZ setback, and/or or seasonal high groundwater on all projects as these areas require special protection and certain BMPs are not appropriate. Some indicators of a SEZ and seasonal high ground water are evidence of surface water, presence of riparian vegetation such as meadow species, willow thickets, alder thickets and Lodgepoles, beach soils or certain alluvial soils. If there are indicators of a SEZ or seasonal high ground water request either a TRPA Site Assessment or Land Coverage Verification and a Soil/Hydrologic Report respectively to determine the presence and limits of these features.

Wetland grasses are an indicator of a Stream Environment Zone.

ERODING AND UNSTABLE HILL-SLOPES

Identify all eroding and/or unstable slopes on all projects. Include the length and steepness of the slope as this will determine the appropriate stabilization technique. Steeper slopes contribute more rapid runoff and generally higher peak flows than low-gradient slopes.[7] Gentle slopes may be stabilized through vegetation, while steeper slopes may require structural stabilization alone or in combination with vegetation.

This slope is showing signs of significant gully erosion and should be stabilized. The source of any uncontrolled upslope runoff that is possibly causing the issue also should be identified.

UNMAPPED ROCK OUTCROPS, STEEP SLOPES

Identify the location of all unmapped outcrops and steep slopes. A naturally steep slope that is already stable and not slated for legally permitted construction should be left undisturbed. If the steep slope exhibits signs of erosion it should be stabilized.

EXISTING VEGETATION

Identify existing vegetation including native and adapted species, noxious and invasive species, and uncommon or sensitive species. Native and adapted species should be protected from site disturbance and may be a good reference when revegetating other areas of the property. Invasive and noxious species should be properly removed and disposed of. Refer to the Lake Tahoe Basin Weed Coordinating Group website, www.tahoeinvasiveweeds.org, for more information on invasive weeds. Uncommon or sensitive species, such as SEZ vegetation, have special protection and should be protected from any site disturbance. Identify vegetated areas that may be optimal for stormwater infiltration. TRPA requires the preservation and management of vegetation of significant scenic, recreational, educational, scientific, or natural values of the Lake Tahoe Region, and for management of vegetation to prevent the spread of wildfires. For example, riparian

Refer to the Lake Tahoe Basin Weed Coordinating Group website, www.tahoeinvasiveweeds.org, for more information on invasive weeds.

[7] SWQIC, 2004, Formulating and Evaluating Alternatives, Appendix A-3, Table A3-8, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf

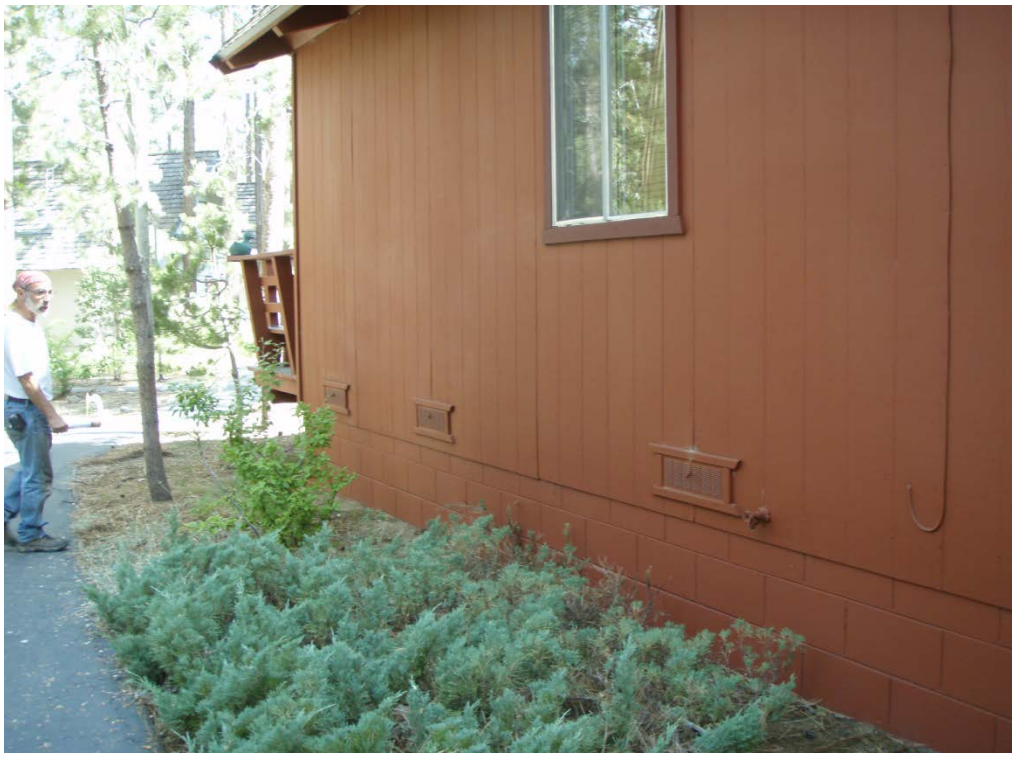
or wetland species within the project area boundaries shall be protected and preserved. Vegetation cover influences rainfall-runoff characteristics and annual water balance.[8]

This well vegetated area is protected from disturbance with parking barriers.

Keep your property lean, clean and green. Refer to the Living with Fire document, www.livingwithfire.info, and request a fire defensible space evaluation from your local fire protection district today.

Fire Defensible Space: All property owners should request a fire defensible space evaluation from their local fire protection district. Refer to the "Living with Fire" document and visit www.livingwithfire.info/tahoe/ for more fire defensible space guidelines. A few basic fire defensible space management principles include removing all combustible materials within 0 to 5 feet of the property and removing dead vegetation within the 5-30- foot "lean, clean, and green" zone.

[8] SWQIC, 2004, Formulating and Evaluating Alternatives, Appendix A-3, Table A3-8, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf



Junipers, as seen here, are an example of flammable vegetation that should be removed from the 5-foot noncombustible zone.

ON-SITE POLLUTANTS

Identify all pollutants, pollutant sources, and pollutant transport processes. Runoff water from impervious surfaces shall meet TRPA discharge standards prior to discharge to groundwater or surface water. On a small residential site the type and amount of pollutants present are typically low enough that treatment of stormwater should not be required prior to infiltration. Table I-1: Pollutants Commonly Found in Urban Runoff has more information on identifying primary pollutants of concern, their sources, and potential impacts to water quality. (Refer to Introduction Chapter for Table I-1) Good housekeeping practices such as proper storage and handling of materials and proper irrigation may help to reduce or eliminate pollutant sources.

The primary pollutants of concern on projects Less than 1 Acre and all SFR are:

A. Sediment: Land disturbance is the primary cause of elevated sediment supply.[9] Identify sediment sources on-site such as unstable and eroding slopes. Erosion control practices BMPs such as revegetation, slope stabilization, and protection of sensitive areas should be implemented at the source.

1. Fine Sediment: Specifically fine sediment particles less than 16 microns, is of primary concern because it remains suspended in the water column for a long time, contributing significantly to loss in Lake Tahoe water clarity. Once fine sediment gets entrained in stormwater it may be difficult and expensive to treat.

[9] SWQIC, 2004, Formulating and Evaluating Alternatives, Appendix A-4, pg A-81, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf

2. Coarse Sediment: Typically found in areas with heavy applications of road abrasives, stream or channel bedload transport, or gullies and drainage system development, especially where discharge is directly to a Stream Environment Zone (SEZ) or stream.[10] Install a pretreatment system to catch coarse sediment before stormwater discharges to an infiltration system or further treatment. This will reduce the maintenance and increase the longevity of downstream systems.

B. Nutrients: The primary nutrients of concern in the Lake Tahoe Region are nitrogen and phosphorus because they contribute to algae growth in the lake. Common sources of nutrients are fertilizers and animal waste. Nutrient and sediment loads are directly related because a significant fraction of nutrient loads occur as particulates or adsorbed on particles.[11] Direct runoff from urban upland sources, including residential sites, are major contributors of nutrients to Lake Tahoe.

C. Hydrocarbons: Major sources of hydrocarbons are automobile leaks, wear and emissions, and improper disposal of used motor oil.

D. Heavy Metals: Heavy metals may be present from automobile brakes tire, leaks and emissions, metal roofs, and weathering of buildings.

E. Toxic Organics: Toxic organics such as pesticides and herbicides are most commonly associated with lawn care.

F. Organic materials: Organic materials are common because they arise from leave, grass clippings, and pine needles.

G. Trash and Debris: Typical household trash may be a problem if not properly disposed of.

ADJACENT PARCEL RUN-ON AND ENCROACHMENT

Water running on a parcel from an adjacent property is a common issue and may cause problems for the receiving parcel. Property owners are only required to treat stormwater runoff generated from their impervious surfaces; however run-on has the potential to cause erosion on the property or flow into installed BMPs and exceed their capacity. Identify the source of the run-on water such as an adjacent private property, county or city right of way, or upland, overland flows and determine the extent of the run-on. This should help determine a solution.

2.2.2.2 COMPLEX ON-SITE HYDROLOGY

IMPERVIOUS AND PERVIOUS AREAS

Identify and measure the square feet of all impervious surfaces (e.g. rooftops, driveways, roads, patios). On a small residential site this may be done with a tape measure or measuring wheel. Stormwater runoff from impervious surfaces shall be infiltrated within the property boundaries. Infiltration facilities shall be designed to accommodate the volume from the 20-yr/1-hr storm equivalent to one inch per hour). Reference Chapter 1, Urban Hydrology for more information on using this information to size your infiltration BMPs. Explore opportunities to reduce and disconnect impervious surfaces on-site. For example you can install a roof gutter and downspout to direct water to a rain garden that would otherwise drain onto a

[10] SWQIC, 2004, Formulating and Evaluating Alternatives, Appendix A-4, Pg. A-80, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf
[11] SWQIC, 2004, Formulating and Evaluating Alternatives, Appendix A-4, Pg. A-76, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf

driveway. Breaking up stormwater allows for smaller, low impact infiltration systems as opposed to larger, more intrusive infiltration systems.[12]

Identify existing pervious areas that are optimal for infiltration. Low, well vegetated areas, where stormwater already flows or can easily be conveyed to may be optimal areas for infiltration. If there are no pervious areas feasible for infiltration, can some impervious coverage be removed to provide a place for infiltration? If not, then infiltration may have to be sub-surface (e.g. below asphalt). Opportunities for BMPs increase with more pervious areas on-site.

DRAINAGE PATTERNS/TOPOGRAPHY

Identify the existing flow paths for both impervious and pervious surfaces.

There is a huge benefit to performing an on-site visit during a stormwater runoff event to identify the existing flow paths; however, due to lack of frequent storm events and the timing of planning, this may not always be possible. Flow paths may be identified through a visual inspection and running a hose on the impervious surfaces or using a level.

On the map use an arrow to delineate flows. Indicate steep, moderate, and gradual slopes, and identify crowns and low spots in pavement. Drainage patterns include surface drainage features and existing drainage infrastructure. Surface drainage features include streams, ponds, wetlands, lakes, manmade channels, and stormwater runoff from impervious surfaces. Existing drainage infrastructure includes sediment traps, infiltration systems (e.g. linear gravel infiltration, infiltration basins, rain gardens), and conveyance systems (e.g. swales or slotted channel drains). Determine if any existing drainage infrastructure on-site may be used as is or if it can be retrofitted easily to accommodate the design storm. To determine this you will need to know the amount of volume generated from impervious surfaces from the 20-yr/1-hr storm and the capacity of any existing systems.

DISCHARGE LOCATIONS

Identify where stormwater drains. Does it drain to existing infrastructure, a pervious and vegetated dispersion area, pond up on impervious surfaces, or discharge off-site? If water discharges off-site to the county/city right of way a collection and conveyance system shall be installed to direct water to a treatment/infiltration area, unless the site has a constraint that makes infiltration on-site impractical. For example, if water is flowing from a driveway to the street a swale or slotted channel drain shall be installed at the property line to convey water to an area where it can infiltrate on-site.

Collection and conveyance systems convey water to an appropriate infiltration system without causing erosion. If there are existing drain inlets (DI) on the site identify them as well as where they outfall. Does the DI discharge to an area on-site where infiltration exists or is feasible? If so the existing infrastructure may be used to retrofit the site with BMPs. Note the connectedness between DI's and outfalls.

[12] SWQIC, 2004, *Formulating and Evaluating Alternatives, A-49,* http://www.trpa.org/wp-content/uploads/Final_FEA.pdf

Running a hose on a property can help identify flow patterns and discharge locations.

2.2.2.3 SITE LIMITATIONS AND CONSTRAINTS

Properties may have existing conditions that do not lend themselves to implementing all of the BMPs required by TRPA.

Identify potential site limitations/constraints:

HIGH GROUND WATER AND BEDROCK

The presence of high ground water and shallow bedrock may limit the depth of infiltration BMPs. Indicators of seasonal high ground water include evidence of surface water, riparian vegetation including willows, alders, and Lodgepole pines. A Soils/Hydrology Report will identify the depth to seasonal high water table and the presence of bedrock and is recommended if there is the question as to whether or not a site has these features.

SLOW SOILS, LESS THAN 1"/HR

Slow draining soils may be a constrained because they may require large systems to infiltrate the design storm, particularly when they are combined with a large amount of impervious surface and shallow ground water or bedrock. A CHP test is recommended to verify the Ksat of the soil.

UTILITIES AND INFRASTRUCTURE

Utilities locations may be a constraint, depending on their location relative to where collection, conveyance, and infiltration BMPs are scoped. Some utility locations may be obvious; however; you should always call USA DIG prior to any excavation to verify utility locations.

RETAINING WALLS AND STEEP CUT AND FILL SLOPES

Identify retaining walls and steep cut and fill slopes, particularly those adjacent to driveways as they may prohibit the installation of an infiltration system.

If it is determined that a project has a site constraint, alternative BMPs may be approved by the permitting authority. By preserving natural drainage patterns, trees, native vegetation, riparian buffers, and wetlands, you may be able to construct smaller structural stormwater controls to cope with runoff from your site. You should aim to reduce the volume and velocity of the runoff and reduce the pollutants in the stormwater that does leave your site.[13]

2.2.3 ADDITIONAL DATA GATHERING

After the initial site visit, you should know if a follow up site visit is required to complete the existing conditions site analysis. The following tools are used to identify site specific conditions that require specific expertise or a TRPA application to get an accurate characterization of on-site conditions. The more site specific information obtained, the better the BMPs can be designed and the better they will function.

CONSTANT HEAD PERMEAMETER (CHP)

The CHP will identify the Ksat of the soil, giving more accurate information than the soil survey. A CHP should be requested if you think the Ksat may be different than the mapped soil survey. For example, if the soil survey indicates a Ksat of less than 1"/hr and the soils on site seem sandy there is a chance the Ksat is greater than 1"/hr and you will want to verify it with a CHP test. Designing infiltration BMPs based on inaccurate soils information may cause the system to be over or under sized. Request a CHP from the Nevada Tahoe Conservation District for properties in Nevada and the Tahoe RCD for properties in California.

A Constant Head Permeameter (CHP) test being conducting on a residential site to determine the on-site Ksat of the soil.

[13] EPA, 2007, Developing your Stormwater Pollution Prevention Plan: A Guide for Construction Sites

SOILS HYDROLOGY REPORT

The soils hydrology report identifies the depth of seasonal high groundwater. It is required for all excavation greater than 5 feet or if there is a reasonable possibility of interference or interception of groundwater. A Soils/Hydrology Report application needs to be completed. The application can be found at www.trpa.org in the Permitting/Application and Forms section.

Soil pit dug in preparation for a soils/hydrologic investigation to determine the depth of seasonal high ground water.

SITE ASSESSMENT AND LAND CAPABILITY/LAND COVERAGE VERIFICATION

If an unpaved, compacted, and disturbed area is slated for restoration, it is recommended that the Land Capability and Land Coverage be verified prior to restoration taking place. If it is restored before being legally verified, any potential legal coverage may be permanently lost.

The land capability and land coverage are verified through a Land Capability Verification and Land Coverage Verification for multi-family residential properties and through a Site Assessment for single family residential properties. They are required if there is the potential that coverage will be added in order to comply with BMPs. The main reason coverage would be added for BMP purposes is paving a dirt driveway or parking area. If an unpaved, compacted, and disturbed area is slated for restoration, it is recommended that the Land Capability and Land Coverage be verified prior to restoration taking place. If it is restored before being legally verified, any potential legal coverage may be permanently lost. These applications can be found at www.trpa.org.

Land capability and allowable land coverage are determined using the land capability classification system and allowable coverage limitations developed by Bailey (1974). The Land Capability identifies how sensitive a parcel is and how well it will recover from development. Land capability 7 is the least sensitive, therefore allowing the most development and variety of land uses, while land capability 1 is extremely sensitive and limited in the amount of development and allowable uses. Baseline Land Capability overlay maps are available from TRPA, but this is not field verified.

Table 2-1: Base Land Coverage per Land Capability District

LAND CAPABILITY DISTRICT	1a, 1b, 1c	2	3	4	5	6, 7
BASE COVERAGE	1%	1%	5%	20%	25%	30%

1a	=	Steep mountainous land (slope >30%) with very shallow soils.
1b	=	Naturally wet and poorly drained lands, including SEZs. SEZs are directly influenced by the presence of surface water or near surface groundwater. The natural functions of an SEZ include wildlife habitat, protection of soil resources, and filtration of nutrients and sediments from tributary or storm runoff. SEZ mapping (riparian and wetland delineation): SEZs are located in land capability class 1b. Disturbance should be avoided in SEZs, including but not limited to excavation or fill, and removing vegetation.
1c	=	Mountainous uplands having little or no soil mantle. The harsh climate and lack of soil limit plant growth and wildlife.
2	=	Steep land suitable for limited recreation, restricted grazing, and selective timber harvest.
3	=	Slope ranges from 9% - 30%, well suited for forestry and low-density housing.
4	=	Land is moderately sloping and well suited for forestry and low-density housing.
5	=	Land is flat to moderately sloping and well suited for urbanization, active recreation, and forestry.
6	=	Land is gently sloping and well suited for urbanization, active recreation, and forestry.
7	=	Land is nearly level and the soil is deep and supports a dense forest cover. It is very well suited for urbanization, active recreation, or forestry.

TOPOGRAPHIC SURVEY

A topographic survey is required for any TRPA permit including a BMP Retrofit permit. Refer to Chapter 7, Permitting, for more information on when projects require a permit.

ON-SITE UTILITY VERIFICATION

All projects that are doing any excavation should always call 811 before any digging occurs.

811 Know what's below. Call before you dig.

2.3 PROJECTS 1 TO 5 ACRES AND ALL COMMERCIAL INDUSTRIAL COMMUNICATIONS UTILITIES SITES (CICU)

Projects of this scale often require a licensed professional civil engineer to design and stamp the final BMP plans; however on simple projects the permitting authority may waive the requirement to consult with a licensed professional civil engineer. Large redevelopment projects may be subject to more thorough review and therefore benefit from following the Stormwater Quality Improvement Committee (SWQIC) process.

2.3.1 INITIAL DATA GATHERING

Obtain the following information by compiling existing information from available resources.

Plan Area Statements provide specific land use policies and regulations for a particular geographic area. Community Plans provide historical context and direct future land use and development within that area. All projects and activities shall be consistent with the Plan Area Statement or Community Plan.

2.3.1.1 LAND USE

Identify the land use(s) for the project area. Make sure the land use(s) are consistent with the applicable Plan Area Statements or Community Plan. These can all be identified by consulting the TRPA website at www.trpa.org under TRPA Regulations. Different land uses may have different BMP requirements. For example a restaurant will require pretreatment prior to infiltrating stormwater, whereas a small office building may not.

2.3.1.2 PROJECT AREA BASE MAP

Develop a base map that may be built upon throughout the existing conditions analysis and BMP design process. A map may be obtained from the County Assessor office, or if accurate property boundary information is not available, a map may be assembled by compiling record and field survey information. On the map identify if the project area is located within a scenic corridor, the shorezone, or within an SEZ including the SEZ setback. Special consideration shall be taken when planning and designing BMPs within these areas.

2.3.1.3 PARCEL AND PROPERTY BOUNDARIES

Identify the parcel or project area boundaries and delineate it on the project area map. Include all easements, encroachments, setbacks, and county/city right of ways as BMPs should not be installed in these areas unless permission is obtained from the appropriate entity. The project implementer shall identify the boundaries of the project if it encompasses multiple parcels.

2.3.1.4 TOPOGRAPHY INFORMATION

A topographic survey is typically required to accurately design BMPs. The permitting authority may waive the requirement depending on the complexity of the project. Consult with the permitting authority to determine if a topographic survey will be required. Schedule a topographic survey at this point if one has not already been completed for the project area.

2.3.1.5 PRECIPITATION INFORMATION

Precipitation drives the processes that generate runoff and transport sediment, nutrients, and other pollutants in the Lake Tahoe Region. Precipitation in the region

varies with the geographic location and elevation. Precipitation also varies in form between rain and snow. Precipitation data are useful for estimating the rate of runoff that occurs for a range of storm events which can be used to estimate annual runoff and selecting and sizing BMPs. Most projects of this scale will be able to size BMPs based on the 20-yr/1-hr storm unless the site is complex and more accurate information is required. Refer to Chapter 1, Urban Hydrology for more guidance on when the design storm is sufficient or when a more specific method should be used. Ultimately it is up to the permitting authority to determine the level of information required to design BMPs for a project.

2.3.1.6 NRCS SOIL SURVEY

Identify the mapped soil unit(s) within the project area. The NRCS published the updated Soil Survey for the Lake Tahoe Basin (Soil Survey) in 2007. The soil survey includes characteristic of soil types that are needed to design BMPs. Soil map units directly correlate with specific Ksat rates and influence rainfall-runoff characteristics and the annual water balance.[14] The soil survey is an order II/III survey, which is performed on a large scale and intended for general planning purposes only. An on-site soils investigation should be conducted to get site specific information.

The Web Soil Survey may be found at: **http://websoilsurvey.nrcs.usda.gov/app/**.

Basic soil information pertinent to designing BMPs is also embedded into the BMP Calculation and Sizing Spreadsheet which can be found at www.tahoebmp.org. The following is applicable soil information needed in designing BMPs and is available from the web soil survey and/or the BMP Calculation and Sizing Spreadsheet.

A. Saturated hydraulic conductivity (Ksat): The Ksat is a quantitative measure of a saturated soils ability to transmit water when subject to a hydraulic gradient;[15] therefore informing the size of infiltration BMPs. Ksat varies in the Lake Tahoe Region from slow (less than, 1 inch per hour) to very fast (greater than 12 inches per hour). BMP opportunities and constraints vary depending on the Ksat of the soil. Soils with a low Ksat may make infiltration on-site a challenge, especially with large impervious areas. It is significantly easier to infiltrate stormwater on sites with a high Ksat value. Reducing the amount of impervious surfaces and disconnecting impervious surfaces can help infiltrate stormwater on sites with low Ksats.

B. Thickness of O horizon: A soil horizon is a layer of soil or soil material approximately parallel to the land surface and differing from adjacent genetically related layers in physical, chemical, and biological properties or characteristics such as color, structure, texture, consistency, kinds and number of organisms present, and degree of acidity or alkalinity.[16] The O horizon is the uppermost layer consisting of decomposing organic material. It helps establish and maintain vegetation and increases the soils ability to resist erosion. Many soils in the Lake Tahoe Region are lacking a substantial O horizon so it may be necessary to add humus and soil binding materials to revegetation and other source control projects.

C. Depth to bedrock: Shallow rocky soils, and rock outcrops are common in the Lake Tahoe Region. These features may hinder the installation of BMPs. They

[14] SWQIC, 2004, *Formulating and Evaluating Alternatives,* Appendix A-3 Table A3.8, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf
[15] NRCS, 2004, *Saturated Hydraulic Conductivity: Water Movement Concepts and Class History, Technical Note 6*, http://soils.usda.gov/technical/
[16] Soil Science Society of America, *Glossary of Soil Science Terms*, https://www.soils.org/publications/soils-glossary#

may slow infiltration and reduce BMP effectiveness. Some fractured bedrocks can short circuit the treatment process by providing preferential flow pathways.

D. Depth to seasonal high groundwater: Groundwater levels and movement affect transport of pollutants, vegetation types, and the feasibility of BMPs;[17] therefore seasonal high groundwater level may limit the depth of infiltration BMPs. To prevent discharge of pollutants into groundwater, the bottom of infiltration trenches or drywells shall be a minimum of one foot above the seasonal high water table.

E. Bulk density and soil strength: Bulk density helps access soil function and determine when soil amendments or loosening is necessary.[18] The soil strength is a transient localized soil property which is a combined measure of a given pedons, horizons, or other soils subunits solid phase adhesive and cohesive status.[19] It is important to know the soil strength for engineered structures such as retaining walls.

F. Erosion Hazard Rating: A relative rating of the potential for soil erosion on a given site. Commonly used to estimate the erosion response expected from a given land management activity. Ratings are the result of a composite analysis of the following factors: soil, topography, climate, and soil cover.[20]

G. Texture and Erodibility: Soil texture is the relative properties of the various soil separates in a soil as described by the classes of soil texture.[21] Soil Erodibility is the degree or intensity of a soil state or condition, or susceptibility to, being erodible (K factor in the universal soil loss equation).[22] This information can be useful for slope revegetation projects such as ski-slope, road cut, and similar projects. This information is generally gathered for larger projects and typically not required for smaller sites.

2.3.1.7 LAND CAPABILITY CLASSIFICATION AND ALLOWABLE LAND COVERAGE

Determine if a land capability verification and land coverage verification has already been completed for the project area by accessing TRPA's public records at http://aaweb.trpa.org/CitizenAccess/Welcome.aspx. If they have been completed incorporate the verifications into the BMP project map.

Land capability and allowable land coverage are determined using the land capability classification system and allowable coverage limitations developed by Bailey (1974). The Land capability identifies how sensitive a parcel is and how well it will recover from development. Land Capability 7 is the least sensitive, therefore allowing the most development and variety of land uses, while land capability 1 is extremely sensitive and limited in the amount of development and allowable uses. Land coverage is a man-made structure, improvement of covering that prevents normal precipitation from directly reaching the surface of the land underlying the structure, improvement of covering. Baseline Land Capability overlay maps are available from TRPA, but this is not field verified.

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[17] SWQIC, 2004, Formulating and Evaluating Alternatives, Appendix A-3 Table A3.8, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf

[18] Sierra Business Council, 2009, Sediment Source Control Handbook

[19] https://www.soils.org/publications/soils-glossary#

[20] USDA Forest Service Region 5, 2000, Water Quality Management for National Forest System Lands in California Best Management Practices

[21] Soil Science Society of America, Glossary of Soil Science Terms, https://www.soils.org/publications/soils-glossary#

[22] Soil Science Society of America, Glossary of Soil Science Terms, https://www.soils.org/publications/soils-glossary#

Table 2-2: Base Coverage per Land Capability District

LAND CAPABILITY DISTRICT	1a, 1b, 1c	2	3	4	5	6, 7
BASE COVERAGE	1%	1%	5%	20%	25%	30%

1a	=	Steep mountainous land (slope >30%) with very shallow soils.
1b	=	Naturally wet and poorly drained lands, including SEZs. SEZs are directly influenced by the presence of surface water or near surface groundwater. The natural functions of an SEZ include wildlife habitat, protection of soil resources, and filtration of nutrients and sediments from tributary or storm runoff. SEZ mapping (riparian and wetland delineation): SEZs are located in land capability class 1b. Disturbance should be avoided in SEZs, including but not limited to excavation or fill, and removing vegetation.
1c	=	Mountainous uplands having little or no soil mantle. The harsh climate and lack of soil limit plant growth and wildlife.
2	=	Steep land suitable for limited recreation, restricted grazing, and selective timber harvest.
3	=	Slope ranges from 9% - 30%, well suited for forestry and low-density housing.
4	=	Land is moderately sloping and well suited for forestry and low-density housing.
5	=	Land is flat to moderately sloping and well suited for urbanization, active recreation, and forestry.
6	=	Land is gently sloping and well suited for urbanization, active recreation, and forestry.
7	=	Land is nearly level and the soil is deep and supports a dense forest cover. It is very well suited for urbanization, active recreation, or forestry.

Table 2-3: Basis of Capability Classification for Lake Tahoe Basin Lands[23]

CAPABILITY LEVELS	TOLERANCE FOR USE	SLOPE PERCENT	RELATIVE EROSION POTENTIAL	RUNOFF POTENTIAL	DISTURBANCE HAZARDS
7	Most	0-5	Slight	Low to moderately low	Low Hazard Lands
6		0-16	Slight	Low to moderately low	Low Hazard Lands
5		0-16	Slight	Moderately high to high	Low Hazard Lands
4		9-30	Moderate	Low to moderately low	Moderate Hazard lands
3		9-30	Moderate	Moderately high to high	Moderate Hazard Lands
2		30-50	High	Low to moderately low	High Hazard Lands
1a	Least	30 +	High	Moderately high to high	High Hazard Lands
1b		Poor natural drainage Fragile Flora and Fauna			
1c					

2.3.1.8 UTILITIES

Incorporate mapped utilities onto the BMP map to ensure BMPs are not designed near a utility. Local utility districts will have information on mapped utilities. Hitting

[23] Bailey, Robert G., 1974, Land Capability Classification of the Lake Tahoe Basin, California-Nevada

a utility during construction is avoidable and measures should be taken throughout the project to know all utility locations prior to and during construction.

2.3.2 INITIAL SITE VISIT

The initial site visit should identify existing conditions such as landscape features and drainage patterns. The initial site visit should compare these field observations with the information that was previously gathered. If the site visit leads to the assumption that a portion of the mapped information is inaccurate, an additional site visit may be required. This is the step where you should determine if permits or a follow up site visit should be performed to verify information. As you perform the initial site visit, think what opportunities and constraints there are for BMP implementation including on-site infiltration capacity, slope stabilization, revegetation, drainage conveyances, and paving requirements.

2.3.2.1 EXISTING SITE CONDITIONS AND USES ON-SITE

COMPACTED AND DISTURBED AREAS AND EROSION

Identify compacted, disturbed areas and any sign of erosion. Evidence of compacted, disturbed soil includes precipitation not being able to naturally infiltrate and the lack of vegetation compared to surrounding undisturbed areas. Various forms of erosion that can visually be identified include sheet, rill, and gully erosion.

Evidence of bare, compacted and disturbed soil includes evidence of heavy use and lack of vegetation.

OFF-PAVEMENT PARKING

Identify all unpaved areas that exhibit signs of disturbance, primarily from driving and parking. All areas used for parking and/or driving shall be paved in accordance with TRPA and local jurisdiction regulations. If a project has unpaved parking and dirt vehicle traffic areas, work with TRPA or the local jurisdiction to bring that property into compliance through either paving or restoring the area.

Parking off of paved surfaces compacts the soil, preventing stormwater from naturally infiltrating and causes erosion and sediment laden stormwater runoff.

All properties in the Lake Tahoe Region are subject to land coverage regulations that limit the amount of disturbance in the watershed. The land capability and land coverage shall be verified prior to any potential increase in coverage (e.g. paving a parking lot). Refer to Chapter 4, BMP Toolkit, Section 4.2-i Paving Parking Areas and Roads, and Chapter 7, Permitting for more information.

SEZ/SEASONAL HIGH GROUNDWATER AREAS AND FLOODPLAINS

Look for indicators of an SEZ, including the SEZ setback, and/or or seasonal high groundwater on all projects as these areas require special protection and certain BMPs are not appropriate. Some indicators of a SEZ and seasonal high ground water are evidence of surface water, presence of riparian vegetation such as meadow species, willow thickets, alder thickets, and Lodgepole pines, beach soils or certain alluvial soils. If there are indicators of a SEZ or seasonal high ground water request either a Land Capability Verification or a Soil/Hydrologic report respectively to determine the presence and limits of these features.

ERODING AND UNSTABLE HILL-SLOPES

Identify all eroding and/or unstable slopes on all projects. Include the length and steepness of the slope as this will determine the appropriate stabilization technique. Steeper slopes contribute more rapid runoff and generally higher peak flows than low-gradient slopes.[24] Gentle slopes may be stabilized through vegetation, while steeper slopes may require structural stabilization alone or in combination with vegetation.

24 SWQIC, 2004, Formulating and Evaluating Alternatives, Appendix A-3 Table A3.8, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf

This cut slope is eroding, delivering sediment to the paved roadway.

UNMAPPED ROCK OUTCROPS, STEEP SLOPES

Identify the location of all unmapped outcrops and steep slopes. A naturally steep slope that is already stable and not slated for legally permitted construction should be left undisturbed. If the steep slope exhibits signs of erosion it should be stabilized.

EXISTING VEGETATION

Identify existing vegetation including native and adapted species, noxious and invasive species, and uncommon or sensitive species. Native and adapted species should be protected from site disturbance and may be a good reference when revegetating other areas of the property. Invasive species should be properly removed and disposed of. Refer to the Lake Tahoe Basin Weed Coordinating Group website, www.tahoeinvasiveweeds.org, for more information on invasive weeds. Uncommon or sensitive species have special protection and should be protected from any site disturbance. TRPA requires the preservation and management of vegetation of significant scenic, recreational, educational, scientific, or natural values of the Lake Tahoe Region, and for management of vegetation to prevent the spread of wildfires. For example, riparian or wetland species within the project area boundaries shall be protected and preserved by fencing off the individual population or habitat and restricting access to the areas. Vegetation cover influences rainfall-runoff characteristics and annual water balance.[25] Identify vegetated areas that may be optimal for stormwater infiltration.

Keep your property lean, clean, and green. Request a fire defensible space evaluation from your local fire protection district and visit www.livingwithfire.info/tahoe/.

Fire Defensible Space: Identify combustible materials within 5 feet of any structure, any dead vegetation on-site, and accumulation of pine needles so they can be managed according to Fire Defensible Space requirements as specified in Chapter 5 – Soil and Vegetation Management, Section 5.3.2.5 – Fire Defensible Space.

[25] SWQIC, 2004, Formulating and Evaluating Alternatives, Appendix A-3 Table A3.8, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf

ON-SITE POLLUTANTS

Identify all pollutants, pollutant sources, and pollutant transport processes. Runoff water from impervious surfaces shall meet TRPA discharge standards prior to discharge to groundwater or surface water. Depending on the type and amount of pollutant, the water may meet discharge standards through infiltration alone as the water is cleansed as it moves through the soil profile. Treatment prior to infiltration may be required depending on the type and amount of pollutant(s). Refer to Introduction Chapter, Table I-1: Pollutants Commonly Found in Urban Runoff for more information on identifying primary pollutants of concern, their sources and potential impacts to water quality. Good housekeeping practices such as proper storage and handling of materials and proper irrigation may help to reduce or eliminate pollutant sources.

Soils may be contaminated due to existing or previous uses such as a leaky gas tank or hazardous waste spill not properly cleaned up. Identify the presence of soil contamination. Contaminated soil shall be removed and properly disposed of. Infiltration systems shall not be installed within the vicinity of a contaminated soil because it may facilitate the migration of the contamination into groundwater or surface water. Cleanup and abatement of contaminated soils require a permit from the Lahontan Regional Water Quality Control Board in California and the Nevada Department of Environmental Protection in Nevada.

Make sure all hazardous materials are properly contained, controlled, and managed.

The primary pollutants of concern are:

Sediment: Land disturbance is the primary cause of elevated sediment supply.[26] Identify sediment sources on-site. Erosion control practices BMPs such as revegetation, slope stabilization, and protection of sensitive areas should be implemented at the source. There are several methods to quantitatively estimate the sediment supply including RUSLE, MUSLE, and SWMM. These calculations

[26] SWQIC, 2004, Formulating and Evaluating Alternatives, Appendix A-4, pg A-81, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf

should be done by a qualified professional or consultant. Refer to Chapter 1, Urban Hydrology for more information on these formulas.

A. Fine Sediment: Specifically fine sediment particles less than 16 microns, is of primary concern because it remains suspended in the water column for a long time, contributing significantly to loss in Lake Tahoe water clarity. Once fine sediment gets entrained in stormwater it may be difficult and expensive to treat.

B. Coarse Sediment: Typically found in areas with heavy applications of road abrasives, stream or channel bedload transport, or gullies and drainage system development, especially where discharge is directly to a SEZ or stream.[27] Install a pretreatment system to catch coarse sediment before stormwater discharges to an infiltration system or further treatment. This will reduce the maintenance and increase the longevity of downstream systems.

C. Nutrients: The primary nutrients of concern in the Lake Tahoe Region are nitrogen and phosphorus because they contribute to algae growth in the lake. Common sources of nutrients on large projects are fertilizers, animal waste, detergents, failing septic systems, atmospheric deposition, leaking sewage pipes, and spills/illicit discharges. Nutrient and sediment loads are directly related because a significant fraction of nutrient loads occur as particulates or adsorbed on particles.[28]

D. Hydrocarbons (oil/grease): Parking lots, roads, automobile leaks, industrial areas, gas stations, improper disposal of motor oil, and illicit connections to storm drain systems are all major contributors of hydrocarbons from a project.

E. Heavy Metals: Industrial areas, automobile brakes and tires, automobile leaks and emissions, metal roofs, and weathering of building and structures are all major contributors of heavy metals from a project.

F. Toxic Organics: Toxic organics such as pesticides and herbicides commonly derive from lawn care, agricultural lands, industrial areas, illicit connections to storm drain systems and road salting and improper salt storage.

G. Organic Materials: Organic materials originate from leaves, grass clippings, and pine needles.

H. Trash and Debris: Trash and debris may become a pollutant of concern through improper site management including waste management, open or uncovered dumpsters, and spills.

ADJACENT PARCEL RUN-ON AND ENCROACHMENT

Water running on a parcel from an adjacent property is a common issue and may cause problems for the receiving parcel. Property owners are only required to treat stormwater runoff generated from their impervious surfaces; however run-on has the potential to cause erosion on the property or flow into installed BMPs and exceed their capacity. Identify the source of the run-on water such as an adjacent private property, county or city right of way, or upland, overland flows and determine the extent of the run-on. This should help determine a solution.

[27] SWQIC, 2004, *Formulating and Evaluating Alternatives, A-4, Pg. A-80*, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf
[28] SWQIC, 2004, *Formulating and Evaluating Alternatives, A-4, Pg. A-76*, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf

2.3.2.2 COMPLEX ON-SITE HYDROLOGY

IMPERVIOUS AND PERVIOUS AREAS

Identify and measure the square feet of all impervious surfaces (e.g. rooftops, driveways, roads, patios). On sites with simple drainage areas, this may be done with a tape measure or measuring wheel. On larger more complex sites with multiple large drainage areas, engineering tools may be needed to accurately and efficiently measure impervious surfaces. It is critical to know the square feet of impervious surfaces to determine the volume of stormwater that needs to be infiltrated. For a small site this will be based on the 20-yr/1-hr storm. A more complex site will require a quantitative analysis of stormwater runoff rates, volumes, and quality. Reference Chapter 1, Urban Hydrology for guidelines on the appropriate method for sizing infiltration BMPs.

Explore opportunities to reduce and disconnect impervious surfaces. For example install a roof gutter to direct stormwater to a rain garden that would otherwise drain to a parking lot. Disconnecting impervious surfaces and breaking up the stormwater allows for smaller, low impact development (LID) designs as opposed to conventional BMPs like storm drain piping and centralized BMPs. An increase in impervious coverage affects the magnitude and timing of runoff in a watershed. The amount of precipitation that runs off is greater due to decreased interception, storage, and infiltration of precipitation and it increases the speed and efficiency of runoff, making the peak flows more sensitive to short-term intense precipitation.[29]

Identify existing pervious areas that are optimal for infiltration. Low, well vegetated areas, where stormwater already flows or can easily be conveyed to optimal areas for infiltration. If there are no pervious areas feasible for infiltration, can some impervious coverage be removed to provide a place for infiltration? If not, then infiltration may have to be sub-surface (e.g. below asphalt). Opportunities for BMPs increase with more open, pervious areas on-site.

DRAINAGE PATTERNS/TOPOGRAPHY

Identify the existing flow paths for both impervious and pervious surfaces and existing drainage infrastructure.

There is a huge benefit to performing an on-site visit during a stormwater runoff event to identify the existing flow paths; however, due to lack of frequent storm events and the timing of planning, this may not always be possible. Flow paths for relatively small impervious surfaces may be identified by running a hose on the surface or using a level. Large projects, with multiple sub-drainage patterns require a site survey to determine flow paths and topography.

Micro-drainage patterns on a property may lead to separate hydrologic zones that are treated separately for BMP Installation. Refer to Chapter 1, Urban Hydrology for methodology for calculating flow rates. Flow rates are required to design collection and conveyance systems on larger scale projects.

On the map use an arrow, or alternative method to delineate flows. Indicate steep, moderate, and gradual slopes, and identify crowns and low spots in pavement. Identify drainage patterns including surface drainage features and existing drainage infrastructure. Surface drainage features include streams, ponds,

[29] SWQIC, 2004, *Formulating and Evaluating Alternatives, A-49*, http://www.trpa.org/wp-content/uploads/Final_FEA.pdf

wetlands, lakes, manmade channels, and stormwater runoff from impervious surfaces. Existing drainage infrastructure includes curb and gutter, drain inlets, sediment traps, infiltration systems, storm drains, outfalls, and detention basins. Determine if any existing drainage infrastructure may be used as is or retrofitted to accommodate improved and updated BMPs. The volume and peak flow of runoff from the site and the capacity of the existing infrastructure should be identified to determine this.

Running a hose on a property will help identify flow patterns on-site and can simulate what happens during a stormwater runoff event.

DISCHARGE LOCATIONS

Identify where stormwater drains. Does it drain to existing infrastructure, a pervious and vegetated dispersion area, pond up on impervious surfaces, or discharge off-site? If water is discharging to the county/city right of way, install a collection and conveyance system. For example, if water is flowing from a parking lot to the county/city right of way, installing a collection and conveyance system installed will convey water to an area where it can infiltrate on-site. Refer to Chapter 1, Urban Hydrology for more information on sizing conveyance systems.

Collection and conveyance systems shall convey water to an appropriate infiltration system without causing erosion. If there are existing drain inlets (DI) on the site identify them as well as where they outfall. Does the DI discharge to an area on-site where infiltration exists or is feasible? If so, the existing infrastructure may be used to retrofit the site with BMPs. Note the connectedness between DI's and outfalls.

2.3.2.3 SITE CONSTRAINED PROPERTIES

Properties may have existing conditions that do not lend themselves to implementing all of the BMPs on-site that are required by TRPA, therefore they are considered constrained. Some common constraints found on-site include shallow seasonal high ground water, shallow bedrock, utility placement, and a driveway on

a steep cut and fill slope. For example, if seasonal high ground water is verified through the entire site infiltration is not feasible and the property is considered constrained. If a property is determined to be constrained by TRPA, alternative BMPs shall be implemented.

By preserving natural drainage patterns, trees, native vegetation, riparian buffers, and wetlands, you may need to construct smaller structural stormwater controls to cope with runoff from your site. You should aim to reduce the volume and velocity of the runoff and reduce the pollutants in the stormwater that does leave your site.[30]

2.3.3 ADDITIONAL DATA GATHERING FOR DESIGN OR FOLLOW-UP SITE VISITS

After the initial site visit, you should know if a follow-up site visit will be required to complete the existing conditions site analysis. The following tools are used to identify site specific conditions that require specific expertise or potentially a TRPA application to get an accurate characterization of on-site conditions. The more site specific information obtained, the better the BMPs can be designed and the better they will function.

2.3.3.1 ON-SITE CONSTANT HEAD PERMEAMETER (CHP) OR PERCOLATION TEST

The CHP will identify the Ksat of the soil, which will give you more accurate information than what is found in the soil survey. A CHP should be requested from TRPA if the Ksat appears to be different than what the Soil Survey indicated. For example, if the Ksat is mapped at less than 1"/hr and the soils are sandy, chances are the Ksat may be different and it should be verified. Request a CHP test from TRPA or a qualified professional.

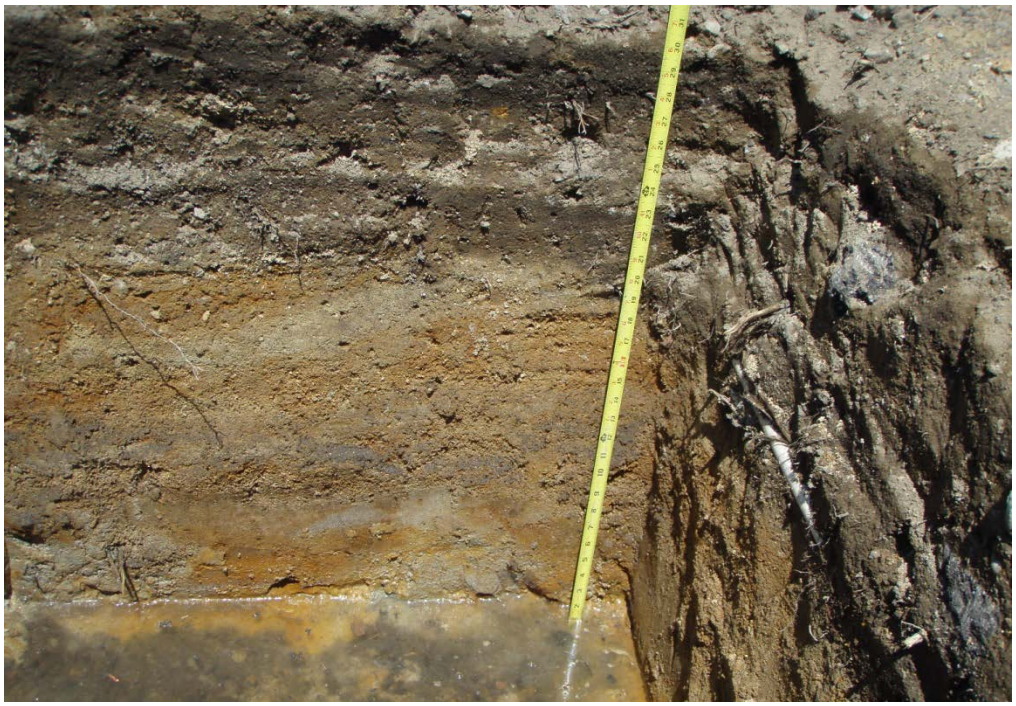
Licensed professional civil engineers may use a Percolation test to determine the soils ability to absorb water as an alternative to the CHP test. A percolation test will be acceptable to the permitting authority as long as their methodology is approved.

Designing infiltration BMPs based on inexact soils information may result in inaccurately sized infiltration systems.

2.3.3.2 SOILS HYDROLOGIC REPORT

The soils hydrological report identifies the depth of seasonal high groundwater. It is required for all excavation greater than 5 feet, if there is a reasonable possibility of interference or interception of groundwater and at the permitting authorities' discretion. A Soils/Hydrology Report application needs to be completed to request the investigation and report. The application can be found at www.trpa.org in the Permitting/Application and Forms section.

[30] EPA, 2007, Developing your Stormwater Pollution Prevention Plan: A Guide for Construction Sites; Page 13



Soil pit excavated for a soil/hydrologic report to identify the depth to seasonal high ground water.

2.3.3.3 PIEZOMETER

A piezometer is a small-diameter water well used to measure the hydraulic head of groundwater in aquifers. A piezometer may be used determine rate and direction of subsurface flow, which would be applicable when a large basin is being installed and you want to make sure that water is not going to flow subsurface and resurface in an undesirable location downstream. This may or may not be applicable for projects of this size and/or land use and it is up to the permitting authority to determine if this is required.

2.3.3.4 LAND CAPABILITY VERIFICATION/LAND COVERAGE VERIFICATION

If an unpaved, compacted, and disturbed area is slated for restoration, it is recommended that the Land Capability and Land Coverage be verified prior to restoration taking place. If it is restored before being legally verified, any potential legal coverage may be permanently lost.

The land capability and land coverage shall be verified if there are any proposed changes that will potentially add to on-site coverage. A primary example of a BMP Retrofit project requiring a Land Capability and Coverage Verification is if there is an unpaved, compacted area that is identified to be paved. If an unpaved, compacted, and disturbed area is slated for restoration, it is recommended that the Land Capability and Land Coverage be verified prior to restoration taking place. If it is restored before being legally verified, any potential legal coverage may be permanently lost. The Land Capability Verification and Land Coverage Verification applications may be found at www.trpa.org in the Permitting/Application and Forms section.

2.3.3.5 TOPOGRAPHIC SURVEY

A topographic survey is typically required to accurately design BMPs. The permitting authority may waive the requirement depending on the complexity of the project. Consult with the permitting authority to determine if a topographic survey will be required.

2.3.3.6 ON-SITE UTILITY VERIFICATION

All projects that are doing any excavation should always call 811 before any digging. Hitting a utility during construction is dangerous and costly and with the proper verification is avoidable.

2.4 PROJECTS GREATER THAN 5 ACRES

Jurisdiction scale projects go through the Stormwater Quality Improvement Committee (SWQIC) Existing Conditions Analysis Memorandum (ECAM) or equivalent process to analyze the project area. SWQIC is a group of agency representatives that were chartered to develop streamlined protocols to improve the planning, design, and effectiveness of Stormwater Quality Improvement Projects. The ECAM is similar to this Site Analysis chapter as it is a compilation of information gathered regarding hydrologic and water quality analysis used to inform the project alternatives. A large amount of information may be gathered and it should be up to the Technical Advisory Committee (TAC), or equivalent group, to determine the amount and detail of information collected. A TAC is group of project advisors, usually comprised of the implementer, funder, permitting agencies, and local jurisdictions. Contact the TRPA to obtain a copy of the SWQIC documents, or go to http://www.trpa.org/programs/water-quality-stormwater-management/.