

Chapter 8 - Material Source



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8.1 General

This chapter discusses the purpose for Oregon Department of Transportation (ODOT) disposal site and material source exploration and design. Identification, design, development, and permitting of material sources and disposal sites require nearly all the same elements that go into a large transportation project. Material sources and disposal sites require identification, investigation, environmental review, mining and land use permitting, right-of-way acquisition and/or delineation, topographic survey, CAD design, and reclamation.

Time lines associated with various tasks that go into site and source exploration, development, and reclamation generally do not follow along with project time lines associated with similar tasks (e.g., surveying and environmental surveys). In general, many of these tasks need to be completed for sources and disposal sites, in advance of when they would be scheduled for the project that the source(s) or disposal site(s) will be associated with.

Disposal sites and material sources are investigated and designed in conjunction with construction and maintenance of the transportation facilities.

- **Material source investigation:** The purpose of a material source investigation is to identify and prove out sufficient quantities of material meeting the quality requirements for the intended use.
- **Design:** The purpose of the design is to graphically represent the proposed development of the material source or disposal site in the contract plan sheets taking into account the property limits, site conditions, permitting requirements, most efficient extraction, current need, and future use of the source and/or site. Detailed design and reclamation plans are also requirements for the permitting of material sources.

Throughout this chapter, various guidance documents and forms are identified and referenced. Document names will be shown in italicized font. Information that hyperlinks to other information such as tables, figures, other documents, forms, or URLs will be displayed underlined and in bold. In other sections, there are references made to available information. These specific documents and referenced material can be found on the ODOT [Geology/Geotechnical](#) website.

8.2 Material Source and Disposal Site Definitions

The following definitions and terms are used in this chapter.

ODOT Material Source - A unique parcel or combination of parcels of land that are ODOT owned or controlled, specifically identified as the location from which material can be removed for utilization in the construction of a highway project and the continued maintenance of the transportation facility. Material from an ODOT source may or may not require secondary processing prior to incorporation into a project.

ODOT Disposal Site - A unique parcel or combination of parcels of land that are ODOT owned or controlled, specifically identified as the location where excess clean fill from a highway construction project, or generated through routine or emergency maintenance activities, can be

temporarily stockpiled for future beneficial use or permanently placed as a secondary beneficial use.

Note:

Placement of material without a beneficial use equates to the creation of a landfill requiring permitting through DEQ.

Material - Material can either be in-place, naturally occurring earthen material (soil, cinder, hard rock, or gravel) or earthen material that has been transported to this location from another site or sites and stockpiled for future use. In some situations, the term “material” can be used to refer to recycled material such as pavement grindings.

Clean Fill - Rock, soil, concrete with or without rebar (provided the rebar is not exposed), brick, building block, tile, or asphalt paving (weathered and consolidated with no free oil) that does not contain contaminants that could adversely impact waters of the state or public health. Wood is not considered clean fill.

Highway Shoulder Soil – Potentially contaminated soil from highway use outside the current highway pavement and within highway right of way. DEQ Beneficial Use Determination ([BUD-20181204](#)) categorizes shoulder soil by physiographic province, lateral distance for the edge of pavement (30 ft. max.), and vertical distance from the ground surface (1.5 ft. max.). Reference the BUD for approved beneficial uses by physiographic province, distance from pavement, and excavation depths.

Quarry - A term generally used to refer to a hard rock source that commonly will require blasting techniques to be utilized prior to extraction of the native material. In Oregon, this term is commonly associated with quarry operations located in igneous flow deposits.

Pit - A term used to refer to a mine site that generally does not require blasting prior to extraction, and is commonly associated with gravel, cinder, or soil sources.

Source/Site Designer - In the context of this discussion, the Source/Site designer is defined as the Certified Engineering Geologist (C.E.G) who ultimately will be the Professional of Record (POR) for the material source and/or disposal site design.

8.3 Material Source and Disposal Site Project Scoping

Project scoping is a key element of any project to assure a quality transportation solution and subsequently an efficient and economical design. Scoping related to material sources and disposal sites is critical at an early stage in the project development. As implied above, material sources and disposal site development should be viewed as small projects inside the larger transportation project. If the need for a source and/or disposal site and the subsequent identification of the site is not completed early in the process, there may be inadequate time and project funding to complete the required work tasks (especially if there is right-of-way acquisition, significant environmental requirements, or permitting requirements.).

In the scoping phase of a project, it should be determined if there will be materials needed for the project. If the proposed project will need material, consider the following:

- **Estimate material quantity needed:** An estimated quantity of the various types of material should be developed.
- **Evaluate:** Evaluation of the project and the availability of the various material products needed should then be undertaken to determine what options are available to meet these project needs. It should be determined if the project needs can be met by utilizing material coming from the project or if material will need to be imported. If project quantities or quality are determined to be insufficient to meet the project needs, and material will be imported, it will need to be determined what the options are for meeting these needs: existing commercial suppliers, private sources, other ODOT projects, ODOT controlled material sources or a combination of these sources of material. ODOT has developed guidance documents to assist in determining the potential need for a material source and/or a disposal site titled [Material Source Use Criteria](#), ODOT Material Source Management, Uses, and Associated Costs, Justification for Offering ODOT Material Sources, and Prospective versus Mandatory.

The same process should be followed in regards to disposal sites for excess materials generated on a project. The potential need for a publicly controlled disposal site for placement of excess materials should be evaluated using the above mentioned guidance document.

[PD-10, Project Delivery Leadership Team Operational Notice - 10](#), provides additional guidance as to when a publicly controlled disposal site may be needed for a project. The [Geo-Environmental Bulletin GE08-04\(B\), Designating Construction Staging, and Disposal Sites](#) document also provides additional information on this issue. [The ODOT HazMat Program Manual](#) (Section 6.0) provides guidance on clean fill determinations and shoulder soil beneficial use determination.

8.4 Material Source and Disposal Site Project Reconnaissance

If it has been determined during, the project scoping phase that a publicly controlled source of materials and/or a publicly controlled disposal site or both are needed, existing sources and properties will need to be evaluated. ODOT has developed guidance documents that generally outline the steps necessary for disposal site and for source development titled, [ODOT Material Source Checklist](#) and [Disposal Site Checklist](#).

Evaluate existing database and file information to determine the existence of sources in the area and to identify those sites that may meet the project needs for both quantity and quality of material. Consider the following:

- **Additional information:** Information related to survey data, land use zoning, ownership, environmental clearances, visual restrictions, land use, and permits should also be reviewed. If the project is in need of a publicly controlled material source and no existing sources appear able to meet the demand, it is at this point that new or

alternative sources of material would be considered and additional reconnaissance be completed.

- When evaluating potential sources, a useful tool has been developed by ODOT to assist in gathering needed information. This tool is titled [Material Source Field Inventory](#).
- **Notifications:** If the proposed source or site is located near residential development or other potentially sensitive land use or environmental areas, it may be necessary to notify local property owners or groups of proposed activities in advance of onsite work beginning. ODOT has developed a template that can be modified to fit the proposed activities that can be
- Completed and used to notify interested parties in an effort to inform them of what is being proposed and in an attempt to eliminate unrealistic fear and objections related to misunderstandings and misinformation. This template is titled [Material Source Public Communication Document](#).
- **Other Agency information:** Valuable information on sources and source availability in the area of interest can be obtained by contacting the Department of Geology and Mineral Industries, the United States Forest Service, Bureau of Land Management as well as County Road/Public Works Departments.
- **Cost:** Once a site or sites have been identified, the estimated cost for development will need to be compared with the anticipated value of the site to the project and future projects to determine a cost benefit evaluation prior to moving forward with the source development. ODOT has developed an internal tool to assist in estimating the cost of source or site development titled [Material Source Evaluation Form](#) (on the second tab of excel workbook). In most cases, ODOT does not charge a royalty for material removed from their sources when the source is being offered for the project at the time of bidding. The cost of development and the value of the rock are realized in competitive bidding and long-term material availability. The document [Royalties & ODOT Sources](#) provides additional information on this issue.

8.5 Right-of-Way Needs for Material and Disposal Sites

If it is determined additional property is required at material sources or disposal sites to meet the proposed project, it is critical that this need is identified during the scoping phase. Right-of-way acquisition takes time and when dealing with material source properties, it generally will require an extended timeline. Once the agreements or permits of entry allowing additional work to be completed are in hand, a detailed evaluation and investigation can move forward. An [Acquisition Guidance](#) document has been prepared to explain the general process.

If the evaluation and investigation does not identify any fatal flaws, the right-of-way acquisition or lease negotiations can be finalized. The normal time lines associated with project right-of-way acquisitions do not generally allow for the right-of-way work associated with a material source or disposal site to move forward on the same schedule.

Note:

Right-of-way activities related to material sources and disposal sites generally need to start earlier than they would for the project to allow for adequate evaluation of sites and permitting.

Due to permitting requirements associated with the mining or disposal activity, the right-of-way purchase or other occupancy agreement must be completed prior to moving forward with the permit process that generally starts at the preliminary plan phase of a project. The investigation work associated with the evaluation of the site or sites in advance of finalizing what property is needed and the subsequent permitting work combine to lengthen the normal right-of-way process and also force an earlier than normal start to this effort for project right-of-way work.

8.6 Environmental Clearances for Material Sources and Disposal Sites

Material source and disposal site development, by nature of the activity, is a ground disturbing action. No source or disposal site development can take place without first obtaining all of the necessary environmental clearances required by state and federal law. ODOT projects must follow the federal standards instead of state requirements when obtaining environmental clearances due to frequent federal participation in the project funding. Even if the currently proposed project is not federally funded, ODOT still tries to meet federal standards related to material sources and disposal sites since the sources are long-term investments and will likely be used for federally funded projects in the future.

Investigation

The investigation work for sources and disposal sites is considered invasive enough to require environmental clearances prior to the implementation of the investigation plans. As a result, it likely will be necessary to obtain preliminary, if not all, clearances for the investigation work. If there is a high level of confidence that the source contains the necessary material quality and quantity, it is a better use of the resources to environmentally clear the entire site for all activities at one time prior to the implementation of the investigation plan. If there is uncertainty or inadequate time to complete the environmental surveys for the entire site prior to investigation, it may be necessary to complete only the minimum amount of clearances required to conduct the investigation. If only partial clearances are obtained in the early stages, and the source or site is pursued for use, follow up comprehensive environmental work to survey and clear the entire area will be required.

In addition to the common environmental concerns related to archeological, historic, wetland and Threatened and Endangered Species resources, the issue of noxious weeds, invasive plants and migratory birds will need to be evaluated and addressed in all source and/or site related activities.

8.7 Material Source and Disposal Site Investigation

Investigation techniques that are common to geologic and geotechnical investigations are also used for materials sources. Common methods include test pits, auger borings, and wire-line core sampling. Air track drill investigations are often used independently or in conjunction with core hole explorations.

Exploration methods: Test pits and auger hole explorations are the most common form of investigation in sources of common soil, cinder and gravel deposits. Air track drill and wire-line core explorations are frequently used in investigating hard rock deposits. The selected method of investigation, and the number, location, and depth of holes or test pits planned and then completed will depend on the site and the existing information available on the site. When determining the method(s) to use in investigating the site, the proposed development strategy will also influence the method selected.

Investigating material source sites: When investigating material source sites, the investigation plan should be developed and carried out to identify the lateral and vertical extent of the deposit or deposits. Vertical and lateral variations in the deposits such as material type, gradation characteristics, coatings on the material, weathering, hardness, relative density, joint spacing, joint infilling, cementation, vesicularity, slaking, and other characteristics that may impact the development and/or material quality are important and should be noted on the logs. Overburden thicknesses, flow contacts, and existence of water are also critical elements that need to be noted.

Air track drill investigations: Air track drill investigations are ideal for gathering information rather inexpensively over a large area. This method of investigation can be useful in determining overburden depths, existence of rock and some basic rock characteristics, but should not be used as the sole source of information on most hard rock quarries. Air track drill information does not generally provide enough detail to fully understand potential material variations and does not provide samples sufficient for determining rock quality. In most cases, air track drill investigations are used to obtain basic and preliminary information and to identify areas requiring more detailed wire line exploration.

Wire line core explorations: Wire line core explorations provide the investigator the details necessary to adequately characterize the material and the various source and material characteristics that will influence the source development.

The Engineering Geologist working on the source development must use experience and professional judgment in determining the level and type of investigation necessary for the proposed source development. As a guide, there are several “rules of thumb” associated with source investigations. These guidelines are:

- Sites with limited history and or complex geology will generally require a higher level of investigation.

- New sites will generally require a much more detailed and comprehensive effort than an existing site with a long history of use with no associated problems.
- In general, the larger the proposed operation the larger and more detailed the investigation will likely be.
- As mentioned earlier, if a site has rather simple geology or well-defined geology and a long history of use and good information is available, the Engineering Geologist may decide not to complete additional subsurface investigation. If subsurface investigation is completed on a site, at least one, if not more, of the exploration locations should be focused on and completed within the proposed excavation area for the upcoming project. Planned material source development should not exceed the extent or depth of the investigation.
- Investigations conducted for disposal sources are generally carried out to investigate for foundation stability concerns (see [Chapter 3](#) for details). Coordination between the engineering geologist and the geotechnical engineer will be critical in the site evaluation and development of the investigation plan, if required.
- In most situations, it will be necessary to have some form of land use agreement or permit and environmental clearances completed in advance of doing any investigation work.

8.8 Material Source and Disposal Site Sampling and Testing

The method of investigation and the sampling and testing program will be dependent on the site and proposed site use. For disposal sites, if sampling and testing is needed it will be associated with subsurface samples and testing associated with site stability evaluation. For material sources, the sampling and testing will be dependent on the site and the type of material that is needed for the project.

8.8.1 Sampling

Samples from the proposed source development area can be obtained from surface exposures for preliminary qualification information when completing initial site assessment, or when no subsequent investigation will be completed. When obtaining surface samples from an existing site that has not been worked for many years, the sampler should create a fresh face from which to obtain a representative sample. Existing stockpiled material can also be sampled and tested to obtain quality information. If follow up investigation is completed in the area or areas of proposed development, representative qualification samples should be obtained and tested. Sampling and testing differing units or zones of material becomes more important and critical as the quality requirements become more stringent. A source of material proposed for use on a paving project will require a more detailed investigation and sampling and testing program than a source proposed for use as common borrow.

Depending on the intended use of the material, it may be necessary to employ specific sampling techniques to determine if the material or various material units will meet the project

requirements beyond simply the quality of the material. An example would be the need to sample a quarry site using coring equipment to determine the joint spacing of the material if the project needs are for rip rap of a specified size and the site has little to no history that would allow for adequate site characterization.

Sampling guidelines for produced aggregate material or existing stockpiles are provided in AASHTO T2 ([ASTM D 75](#)).

No matter what is being sampled, or where the sample is coming from, it is critical that the person collecting the sample collect a representative sample of the material at the site, not just selecting the best or worst material.

Required sample size can vary, but for surface samples or samples obtained from a subsurface investigation, the following is a general rule of thumb for sample size: **six canvas sample bags (50 lbs. each) of quarry rock** or **nine** bags of gravel (a 5 gallon bucket could substitute for one canvas bag) per sample/per site. The size of quarry rock should be 4 to 6 inches chunks, and material from a gravel pit should be the whole range of sizes with the maximum size a 6 inches cobble.

8.8.2 Testing

In the past, the ODOT lab would only test sources that were involved or proposed for use on an ODOT project, but now the ODOT lab will run source compliance tests for a source not currently being used for an ODOT project as long as an ODOT source number has been assigned to the source.

The results of these source compliance tests, no matter if run by the ODOT lab or a private lab, are viewed as: **INFORMATIONAL ONLY**. These "Informational" test results are intended to assist ODOT, contractors, consultants, or material suppliers in evaluating the quality of the aggregate potentially available in a particular source. No matter the outcome of these tests, this testing will not eliminate or reduce the need to sample and test produced material to assure compliance with project specifications.

The tests run for source compliance are normally the following:

- T84 (Fine Bulk Gravity)
- T85 (Coarse Bulk Gravity)
- T96 (Abrasion)
- T104 (Sodium Sulfate)
- T113 (Lightweight Pieces)
- T176 (Sand Equivalent)
- TM 208 (Sodium Sulfate)

In addition to these tests, ODOT also runs the following tests for informational purposes when the material may be used for MSE wall or gabion backfill or pipe bedding material:

- AASHTO T288 (Resistivity)
- AASHTO T289 (pH)
- AASHTO T291 (Chlorides)

- AASHTO T290 (Sulfates)
- AASHTO T267 (Organic content)

For gravel sources, ODOT also runs AASHTO T27 (Sieve analysis) as part of the source compliance testing. This allows for a preliminary estimation of the percent of waste material that can be anticipated.

Material proposed for use on any ODOT project must meet the requirements laid out in the [Oregon Standards Specifications for Construction](#) as well as the Special Provisions for the intended use or uses unless modified by the Special Provisions.

8.9 Material Source and Disposal Site Exploration Logging

The proper technique and format for logging material source explorations is described in [Chapter 4](#). ODOT utilizes gINT software for the production of exploration logs. Site and exploration photos should be taken in the field at the time of the investigation. Sample and core photos should also be taken. When logging material source explorations, it is very important to note variations in the material even if there is no change in material type or geologic unit.

In gravel and cinder sources, it should be noted where there is a noticeable change either in the size of the material or in the grading. In gravel sites, it is also important to note whether a coating exists on the gravel, and if so, what it consists of.

In quarries, where the overall material type may not change it is still important to note minor differences such as the percent of vesicles, RQD, joint spacing, whether or not the joints are open or closed, and what the in-filling material is if open jointed.

Unit weight changes can also be an important variation that should be noted.

Any groundwater encountered should be noted, and if possible, distinguished from core drill water through checks against draw down or slug tests.

All of these subtle, and in some cases seemingly minor, variations may impact the development of the site for the proposed material use, and will only be obtainable with the proper investigation and logging of the explorations.

Logging holes for proposed material source requires close attention to details.

Another element that differs between material sources and disposal site investigations versus the more common geotechnical hole logging procedures and processes is the locating of various explorations. It is common for material source exploration to take place in advance of any type of formal topographic or other site survey work at a source. In many sources, no identifiable features exist from which to reference hole locations. As such, it is common practice to number each hole, place a survey stake at each location, and to obtain a GPS reading at each exploration hole at the time of exploration. This location information can be used later to assist the survey crew with locating or accurately placing the exploration locations on the overall site maps when surveyed with precise survey-grade equipment. With the recent availability of resource-grade

GPS units such as a Trimble GeoXT or GeoXH, the locations of drill holes and other features can be obtained using these devices, as long as sub-meter accuracy is acceptable.

Note:

GPS receivers used in locating material sources, disposal sites, and exploration site locations should have the datum set to WGS 84 for latitude/longitude and elevation, and International feet for Northing and Easting. Coordinates should be displayed as decimal degrees (D.D^o) or degrees/ minutes/seconds (D^oM'S'') only.

In addition to the GPS readings at every exploration location, a sketch map should be produced showing each hole location and dimensions and direction between holes, again to assist in the accurate placement of hole locations on the detailed site map.

8.10 Material Source and Disposal Site Mapping

Detailed and accurate surface characterization is just as important in material source and disposal site development as the accurate subsurface geologic characterization. Therefore, it is very important to have a high quality, three-dimensional topographic map that includes site features such as drainages, springs, existing roads, fences and property/permit boundaries, as well as the surface contours showing the general land form and any significant changes in slope gradient.

The survey will be based on the Local Datum Plane based on NAD83 and NAVD 88. At least one position, placed on site but out of any development area, will have 1983 Oregon State Plane Coordinates calculated and reported on the face of the map. This position will be a 5/8" x 30" iron rod or the equivalent. Accuracy shall be such as can be achieved by using the NGS OPUS positioning service. In addition, a narrative related to the survey needs to be included that details who did the survey work, exactly what was done, where and when it was completed, and how the work was performed. Included in this narrative should be information regarding which bench marks were used for elevation control, what was used to control the boundary work, and the scale factor between the latitude/longitude and the surveyed local datum plane. The narrative should be placed on the produced map in the area where the north arrow and scale bar is located.

Source design and development plans completed without this level of mapping (digitized features and topographic lines from USGS maps, topographic features collected with resource or recreational grade GPS units, and/or plans developed in GIS) will result in substandard work, and carry with it a much higher degree of risk with a greater potential for construction claims resulting from the inaccurate portrayal of the site features and topography.

In addition to topographic surveying, the site may need to have a boundary survey completed. Boundary work should be completed in accordance with the [ODOT Survey and Policy Manual \(2015\)](#) and DOGAMI regulation [OAR 632-030](#).

8.11 Design and Development of Material Sources and Disposal Sites

The investigation work, survey work, and environmental clearances come together in the design phase of the material source and disposal site development. A conceptual design should be formulated in advance of the investigation work, and then modified as needed based on the results of the investigation and clearances. With this information in hand, a source can be strategically developed to meet both the short term project needs and planned future utilization of the resource. Designing a material source requires the detailed analysis of both surface and subsurface information for maximum utilization of the resource in the most efficient and economical manner. Designing a source entry one project at a time without looking at future and long term development and reclamation will lead to poor utilization of the resources and generally lead to much higher costs in the long term. To assure best utilization of a source property or disposal site, the design should be developed and reviewed consistent with the appropriate Region's Quality Control Plan.

Material source and disposal site designs must be stamped by a Certified Engineering Geologist (C.E.G.) as per TSB11-01(D), the [Professional Sealing of Project Special Provisions](#). The registrant who stamps the material source design is the Professional of Record for the material source design.

8.11.1 Material Sources and Disposal Sites Slope Design

Slopes are a major consideration in all source and site developments. Final slope requirements by the Department of Geology and Mineral Industries are 1.5H:1V maximum. Slopes in gravel pits, cinder pit and most borrow sites can be developed steeper as working faces but should be reconstructed to 2H:1V or flatter for final slopes. [Additional guidance can be found in the Best Management Practices for Reclaiming Surface Mines in Washington and Oregon, DOGAMI OF 96-2](#)

The flatter slopes will provide for better long term stability and for higher quality reclamation.

The maximum slope requirements imposed by DOGAMI do not differentiate between quarries and other sources, but they may allow for steeper final slopes if steep slopes occur naturally in the area and the construction of steep slopes is approved in advance.

The development of rock slopes in quarries differs slightly from those detailed in [Chapter 11](#). Chapter 11 addresses rock slope development in and along transportation facilities, whereas most material source design will take place off highway, and generally will not require certain aspects of slope construction described in Chapter 11 such as controlled blasting. Occasionally, highway road cuts will be designated as sources of material. When this occurs, the direction and guidance contained in Chapter 11 takes precedent. In quarries, benches are often required, and multiple bench development scenarios are common. In quarries, the stability of the back slopes, as well as the height of the slopes, is an important consideration in the design of the

development plan. In quarries, no working face should be designed steeper than 0.25H:1V in order to prevent overhanging faces. ODOT uses 40 ft as a target maximum height. Actual slope height and slope angle will vary depending on the geology and topography of the sites and at what stage the development of the site is in. In hard rock quarries, a standard “rule of thumb” is to design for 30-ft-wide benches, 40-ft-high high walls at 0.25H:1V slopes between the benches, that will produce an overall 1H:1V slope (top of high wall to outermost bench toe). The steeper 1H:1V slopes can be approved for hard rock quarries when shown to be stable and blend into the natural landscape.

8.11.2 Material Sources and Disposal Sites Designed Safety Elements

Safety is a significant concern that needs to be factored into the development and reclamation scheme for every ODOT material source and disposal site. The key site specific safety elements are listed and addressed below.

Safety Berms: Axle high safety berms are a Mine Safety and Health Administration (MSHA) requirement along high walls and elevated roadways. The approved Special Provisions call for safety berms in ODOT sites to be constructed a minimum of 3 ft. (1 m) high with side slopes of 2H:1V. The footprint of the safety berms need to be considered when identifying roadway widths or clear areas

for overburden storage and working faces. The requirement for safety berms serves several purposes. They are required by MSHA; but in addition, when the operations are completed, they help to reduce potential liability by leaving the site with these safety features in place.

Ingress and Egress: Another key element in the safety of ODOT sources and disposal sites is site entrance/exits and their construction. Related to entrance/exit construction, the main concerns are sight distance, roadway width, safety berm construction, roadway grade, and storm water control. In quarry sites, access to benches should be designed to accommodate tracked vehicles, but prevent easy access to unauthorized rubber tired vehicles. Furthermore, entrance/exit closures should be considered after the operation is completed for the sake of public safety and reduced liability. This is to address the concern of unauthorized vehicle trespass. Restricting access is intended to reduce the possibility of accidents, theft, vandalism, and illegal dumping; therefore, reducing ODOT’s liability. Construction of features to control unauthorized trespass including fences, gates and other forms of entrance/exit closures should be coordinated with the appropriate ODOT Maintenance personnel. If sites have a history or potential for illegal dumping problems, ingress/egress control should be addressed during site development. For example, if fences and gates exist, provisions should be made for their maintenance or improvement. If there are no existing gates or fencing, the possibility of adding these features should be considered during site development.

Benches: Benches in quarry sites should be developed as working platforms. The minimum bench width design standard for ODOT quarries should be 30 ft. (10 m). Narrower benches have been used in the past with mixed results. Frequently in quarry development, precision blasting is not used and outer edges of the benches are unstable and tend to break and fall off.

With narrower bench designs, the potential for bench degradation often leads to unworkable benches for future operations. Using the wider design width allows for the inevitable degradation of the outer edge, provides room for placement of a safety berm, and will provide a stable working platform for subsequent entries. If narrower benches are specified for some reason, it needs to be recognized that it is likely they will not be usable during future operations unless controlled blasting techniques are also implemented in the site development.

8.12 Drafting of Material Source and Disposal Site Development Plans

ODOT utilizes Microstation and Inroads computer programs to model and manipulate information gathered for material sources and disposal sites. Development plan maps are drawn in Microstation, while Inroads is used in cross-section development and for quantity calculations. Material source and disposal site drawings should follow the examples available in the Geo-Environmental Drafting Program web site under Specialty Drawings.

8.13 Material Source and Disposal Site Operational Specifications

Boiler plate operational specifications have been developed for material sources and disposal sites and are included in Section 00235 and Section 00236 of the current Boiler Plate Special Provisions. The boiler plate specifications will need to be modified by the source or site designer to address project specifics and permit requirements.

8.14 Material Source and Disposal Site Quantity Calculations

In developing either material sources or disposal sites, it is important to obtain estimated project quantities from the project designers. Keep in mind as projects progress through various stages of design the quantity of material needed or in excess will likely fluctuate. It is important for the source designer to keep in contact with the project designer, especially at the various project milestones, to be aware of the current project estimates. Quantity calculations and the design of a material source or disposal site are intended to assure the source designer that there is adequate material available in the source to meet the anticipated material needs of the project or adequate space in the disposal site to accommodate material from the project.

The construction contractors are ultimately responsible for excavating adequate material to meet the project needs, factoring in the equipment that will be used, the way the products will be produced, and the timing of the production.

There are many factors that influence the final quantity of material needed or generated as described below:

Shrink/Swell factors: Common shrink/swell factors for various types of material are available in many different publications. Estimated shrink/swell of an excavated material may or may not influence the design of a material source or disposal site. Estimated shrink/swell factors may be a critical element when designing a disposal site design or attempting to utilize material from a highway road cut as a material source. If there is limited space or quantity, the shrink/swell factor of the material becomes more critical.

Project materials: Regarding the materials being produced for a project, some of the factors that will influence the overall project quantities are estimated construction loss, the type of material being produced, the narrowness of the allowed gradational bands, the cleanliness requirements of the produced material, the number of different sizes of material being produced, and the characteristics of the native material. In addition, contractors will influence overall quantities required based on the equipment they bring in and how they opt to produce the required materials. These factors will all influence the overall volume of native material needed to produce the final project requirements. In general, the shrink/swell factors of the material is not a significant design consideration when designing an off-highway material source where the contractors can, within reason, adjust the size of the excavation area based on material characteristics and the planned approach to meeting the project requirements.

Volume of material: There are several factors related to the native in-place material besides shrink/swell and construction loss that need to be taken into consideration when calculating the volume of material needed for the project and designing the planned excavation area. In general, gravel sources will produce larger volumes of waste material than quarries due to increased scalping and fracture requirements. As such, when calculating quantities in a gravel pit, it is critical to have a representative sieve analysis of the native material to determine the estimated percent of loss due to the size characteristics of the native material. These factors will need to be evaluated when determining a target quantity for the designed excavation area.

Quarry sites generally produce lower volumes of waste products than gravel sites due to the natural characteristics of the material, but there are still factors that may be encountered in a quarry site that need to be taken into consideration. In some quarry sites the material infilling the joints may be of low quality and may force a contractor to scalp on a larger screen size resulting in extra waste product.

There may be zones within a flow or between different flows that are of lower quality that can be reasonably sorted and removed. These areas would need to be taken into consideration when calculating the overall quantity and source design.

Quantity calculations: Quantity calculations for material sources and disposal sites should be based on high quality three dimensional site models coupled with computer generated excavation/embankment design surfaces. For the final development concept that is used in the contract plans, there should be an accompanying computer generated design surface and text report showing the calculated quantities and which surfaces were used to develop these quantities (all products of Microstation and InRoads).

In general, for both quarries and gravel pits, development plans should be designed for an additional 10 percent over the estimated material needs of the project. This extra 10 percent

within the designed excavation area is intended to cover minor quantity variations in the project, as well as a minor amount of variations such as varying overburden depth, irregular rock contacts, or increased scalping requirements over and above what is anticipated based on test results, the subsurface investigation, and the observations of the source designer.

8.15 Reclamation of Material Sources and Disposal Sites

Reclamation of material sources and disposal sites should not be considered an afterthought in the design process, or be viewed as an activity that will only take place when the site is ultimately depleted. Reclamation of mined sites is required by Oregon state law [ORS 517](#). Commonly, reclamation plans for a site are a requirement in both the Department of Geology and Mineral Industries (DOGAMI) and the local agency permitting process, and are required prior to site use. How the laws and regulations are implemented and reflected in the source's development is somewhat dependent on the ownership of the property, the long term and planned post mine beneficial use for the property, and the desire of the property owner. There are different requirements for federal lands versus those that are privately or publicly owned.

As with the design of the site, reclamation should be considered in both the short and long term source plan. Certain elements of the design should take into account elements of concurrent reclamation and planning for long term reclamation. Common elements of reclamation include the salvage of overburden and/or soils, re-vegetation plans for seeding and plantings, and planning for final slope configurations and drainage within property boundaries. The overall aesthetics of the reclaimed site should be considered when designing the development and reclamation scheme. In quarry sites, reclamation blasting, coupled with redistribution of soils and subsequent seeding, can be an effective technique for reclaiming slopes.

In designing the reclamation of a disposal site, the post beneficial use of the site is a significant concern. If the future use of the site will be for the placement of a building, proper placement of the material, construction in lifts, and uniform compaction become critical in the site development. If the disposal site is in a rural area and there are no plans for use of the site for a structure, it is more desirable to leave the upper and outer several feet of the material uncompacted, irregularly shaped, and blended into the surrounding topography. This shaping, blending, and lack of compaction on the surface will allow for better re-vegetation and a more natural appearance.

The uneven, roughened surface will also help to reduce erosion. Avoid building a flat topped, rectangular shaped stockpile of disposed of material with long uniform slopes.

8.16 Material Source Blasting

Blasting is a common and necessary practice in quarry sites, and used less frequently in the development of gravel sources and disposal sites. Commonly when blasting is planned, concerns are raised by permitting agencies and neighboring land owners. When designing a material source where blasting will be required, special attention needs to be paid to the site's

surroundings. The standard blasting requirements contained in the operational specifications for the material sources should be adequate if no special concerns exist. If there are environmentally sensitive areas or sensitive uses in the vicinity of the blast site, such as nesting sites, wetlands, fish bearing streams, homes, wells, utilities, or other fly rock, vibration and/or noise sensitive facilities, special provisions may need to be added to the standard blasting specifications. Several guidance documents have been developed by ODOT related to blasting and specifically blasting in quarry sites that may provide additional and needed information that are available on the Geo-Environmental [Material Sources website](#).

8.17 Material Source and Disposal Site Erosion Control

Erosion control at material sources and disposal sites represent a significant concern at some locations due to the ground disturbing nature of the activity and the potential for erosion within and off of the source. With any source or disposal site development, there will generally be large areas of disturbed soil that has the potential to result in erosion and sediment transport off of the site. Erosion control is a design element that should be considered and incorporated into the development plan for any material source or disposal site when appropriate. Storm water control is a federally mandated requirement that in Oregon is delegated to the State Department of Environmental Quality (DEQ). When storm water is specifically associated with material sources, regulation and oversight has been delegated from DEQ to the Department of Geology and Mineral Industries (DOGAMI). Erosion control measures associated with the material source or disposal site should be shown on the development plan maps for the source or site rather than the project erosion control plan sheets.

It may be necessary for the source designer to coordinate with an erosion control designer on the project when developing the site specific erosion control elements.

8.18 Material Source and Disposal Site Permitting

Permitting of material sources is a critical element in the design, development, and use of material sources. With very few exceptions, the development and use of material sites will require permits. Ownership of the property, site characteristics, hours of operation, and the proposed extent and quantities of the operation will determine which permit(s) will be required. Permit requirements and/or conditions can influence the way a site is designed and developed. Permitting agencies such as DOGAMI, local public agencies, as well as federal agencies, will require property setbacks and/or buffer zones around drainage and other specific site features that will need to be taken into consideration when laying out the site development. Set back requirements will vary depending on the location of the site, other concurrent uses, and adjacent property ownership issues. Concerns over visual and noise impacts may also influence the direction and depth of development or the placement of stockpiles and berms. Similarly, groundwater, surface water drainages, and erosion control may be concerns to permitting agencies and may influence various elements of the design such as the buffers around these features, depth of the mining, and storm water control features. These concerns

make it critical for a successful design to account for the site characteristics, the limitations of the site, and the likely permit restrictions while still in the design phase. If concerns are not taken into consideration early in the process, there will likely be the need for re-work of the design prior to obtaining final approval of the permits, which may lead to a delay in obtaining the permits and impact the project schedule. **The statewide Material Sources Program Leader should review permit application drafts and development plans prior to agency submittals.**

Disposal sites may also need to be permitted due to added traffic, noise impacts, hours of operation or simply due to the current zoning and the proposed action. The source/site designer will need to verify what permits if any will be required for the proposed activity. ODOT planners and local agency planners can provide information on what permits are necessary for the proposed action and may assist in completing the applications and in obtaining the needed permits.

8.19 Material Source and Disposal Site Visual Concerns

In most situations, there will be no visual concerns to address, but in some areas, the overall visual impact of a material source or disposal site will become a critical element of the design and reclamation. If visuals are a significant concern due to the location of the site or the ability of the site to be viewed from a significant scenic corridor, the impacts or the requirements associated with the visuals will need to be factored into the design and reclamation of the source. In Oregon, there are numerous areas that have varying degrees of scenic value and restrictions (e.g., the Columbia River Gorge Scenic Area, wild and scenic rivers corridors, and the many scenic highway routes). In addition to these nationally and state recognized scenic areas, there are also local scenic designations that may impact a site development. When looking at a site for proposed development, the elements of potential visual restrictions should be evaluated early in the process.

8.20 Material Source and Disposal Site Narrative Reports

Material Source or Disposal Site Narrative reports have multiple purposes. This report, stamped by a Certified Engineering Geologist, provides an opportunity to summarize all of the information that was taken into consideration as part of the site design. In the narrative, the following types of information should be included:

- Location information
- Existing utilities both underground and overhead
- Topography
- Drainage conditions
- Vegetation
- Climate
- Development plan and cross section sheets from the Contract Plans

- Operating specifications
- Regional geology
- Site specific geology
- Exploration logs
- Core or test pit photos
- Site photos
- Currently available lab test results (preferably within last 5 years)
- Groundwater conditions, springs, well locations
- Stability
- Permits and permit conditions
- Source Use History

In addition, the narrative allows the source/site designer to describe both the plan for this particular operation as well as the long term development concept. Concerns related to material characteristics, operational history, past operational problems, design elements, restrictions, and reclamation strategies can all be explained in detail. The narrative provides detailed information as well as assumptions and concerns.

Narratives are part of the contract documentation and are a requirement outlined in the operational specifications for the sources and/or disposal site and are required to be sealed by a CEG stamp. Material source and disposal site narratives are intended to be distributed to all interested contractors who are potentially preparing their bids based on the use of these sites. Therefore, the narrative report should be factual and provide a presentation of data and design assumptions based on the information gathered and considered during site development. Speculative or non-supported assumptions should not be included in the narrative. Each proposed source of materials or disposal site shall have a separate narrative report.

At this time, ODOT has no formal policy that requires that the material source or disposal site narratives be reviewed by others prior to being sealed by the Professional of Record (POR). It is currently recommended that all narratives be reviewed by a competent peer or other registered professional prior to final signatures and affixing a CEG stamp.

An example of a narrative report is available on the ODOT website titled [Material Source Narrative Report Example](#).

Material Source Narratives and Disposal Site Narratives need to be prepared and given to the Construction Project Managers Office in advance of project advertisement. The narrative(s) will be distributed to all interested contractors by the Project Managers Office and a record of who requested the information, as well as when and how it was supplied to them, will be kept and become a part of the project records.

8.21 Material Sources and Disposal Sites and Construction

During construction, it is common for questions to arise regarding the source/site development. The Professional of Record (POR) should be available for source/site visits to review and decide upon proposed modifications to the design or to address other development issues.

During construction, at a minimum, the POR or an alternate should plan to be involved with the on-site Pre and Post work meetings. If blasting is required for source development, the POR or alternate would be required for the review of the blast plan and any subsequent modifications of the blast plan. It may also be necessary, depending on how source or site development progresses, for the POR or alternate to witness and document the loading and actual blast(s), and attend other on site meetings to address requested design changes.

The construction project manager should provide a written post construction source or site evaluation to the POR. Information contained within the evaluation should be quantities of material produced or disposed of. It should also include discussion of any problems encountered during site development and/or issues related to the materials produced. If changes were made to source or site development due to conditions encountered, these changes and the reasons for the changes should be noted in the evaluation. A form is available on the website titled [Material Source Post-Construction Report for Public and Private Sources](#).

8.22 Material Source Numbering

ODOT has an established numbering system for material source sites. This source numbering system provides each and every site that has been, or is currently, recognized as a potential source of materials for ODOT projects with a unique material source number regardless of material type, ownership, or location. Source numbers are used to match site specific information with material quality information. These source numbers are used by the ODOT Materials Laboratory in Salem for connecting material test results to the source where the material came from. Matching of test results and source numbers allow for the tracking of site history.

The numbering convention used by ODOT is as follows: **ODOT Source # OR-22-013-2**

1st two characters are letters that represent the state in which the site is located, for example OR for Oregon, CA for California, WA for Washington, ID for Idaho, and NV for Nevada.

2nd two characters are a numeric County code; a two digit county code has been issued for each county in each state that ODOT has recognized sources in.

3rd is a three character unique numeric identifier. This three character identifier is automatically assigned to the source when placing the information into the Aggregate Source Information System (ASIS) database.

4th character represents the ODOT region that the source exists in or the ODOT region that is closest to the neighboring state where the site is located.

For the example shown above, the number given indicates that the site is located in the State of Oregon (**OR**) and in Linn County (**22**), with a unique source number of 013 (**013**) and is located in ODOT Region 2 (**2**).

Material Source numbers can only be issued by ODOT personnel who have been given computer privilege to do so. These permissions have been limited to those who work in the Geology Units assigned to each Region, and to the Statewide Material Source staff.

If a new Source Number is Needed

If a new site or an existing site that has not previously been issued a source number is identified, the process to get a number assigned to the site is rather simple. The appropriate Region geology staff should be contacted. They will provide a list of information that will need to be supplied in advance of the issuance of a source number. Once the site specific information is supplied to the Region geology staff, the information can be entered into the system and a source number assigned to the site.

8.23 Asset Management for Material Sources: Inventory, Evaluate and Record

Asset management has become a key focus for ODOT. Material sources and sites used for disposal have been recognized as extremely valuable assets in ODOT's inventory. ODOT owns or controls approximately 1500 material sources located along, or in close proximity, to the State's transportation system. Managing these resources is a multi-faceted effort starting with the inventory and evaluation of these sites. Information gathered about the State's material sources is recorded into a database system that represents the primary tool used in managing these assets.

The Aggregate Source Information System (ASIS) is a SQL Server database with a user-friendly Intranet web-based input front end. Each material source, based on their unique source number, is an individual record with approximately one hundred individual data fields available per record. Several data fields are identified as required in each record prior to the system allowing for the record to be saved. Most of the required fields are associated with ownership and location data. Other data fields in each record are optional and may not apply to each source.

Similar to the issuing of source numbers, data input and editing of the database information is restricted to a few personnel within ODOT, primarily region Geology Unit staff members and Statewide Material Source staff who have been given the responsibility for site evaluation, inventory, and updating these records. Access to the information contained within the database is available for review and use by any and all ODOT employees. A link to the ASIS database is available on the ODOT Intranet Material Sources page.

Individual source records contained in ASIS are constantly being updated whenever additional information is obtained for a source. The ASIS database is also undergoing periodic upgrades with additional data fields and functionality.

An ODOT application for collecting physical features within material sources using ArcPad has been developed and is available from the ODOT GIS Unit. All data collected with this application for material sources is tied to the same unique source number contained within the ASIS database. The data collected in the field is downloaded and stored in the ODOT Enterprise Geodatabase and displayed in ArcMap.

With the development of the ArcPad application for materials sources, ODOT now has the GIS database for physical features found in material sources, tied to the ASIS database containing the nonphysical data for these sources. Coupled together, these two databases, and the information contained within them, are used to more effectively manage the ODOT Material Source assets.

Additional tools have been developed to assist ODOT staff in completing site evaluations. One such tool is the [Significant Site Evaluation Form](#). Through the use of this tool and others, ODOT staff is able to evaluate an individual source or site for its individual value and the value of this site within the framework of the ODOT Material Source Network. From these evaluations, ODOT staff can determine if a source or site requires permitting work to protect it for current or future use, or if the property is a candidate to be disposed of. In addition to these efforts, ODOT staff can effectively identify areas around the state where the network of sources/sites is either deficient of sources/sites, or deficient for specific needs, and take the proper steps to correct these deficiencies.

Through effective Asset Management and proper development and permitting of material sources and disposal sites, ODOT can assure the wisest and most efficient use of these resource properties to the benefit of the traveling public and the tax payers.

8.24 References

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