15. EROSION CONTROL AND SEDIMENT PREVENTION (ECSP)

Areas that are disturbed by construction require erosion control to prevent sediment from being transported into streams, lakes, or other water bodies. To achieve this goal during the construction of the WTP Expansion, a proactive approach to erosion and sediment control will be taken. This action will manifest itself both in utilizing erosion prevention techniques as well as sediment transport control. The approved approach will ultimately be documented in the finalized Erosion and Sediment Control Plan (ESCP), which will be developed by the selected Construction Contractor after final design of the treatment plant expansion has been completed.

This section provides some background, criteria and standards which will form the basis of the ESCP. Additional specifications adding or amending the general practices outlined herein will be provided in the final Contract Documents. This section has been prepared in accordance with the procedures outlined in the *Erosion Prevention and Sediment Control: Planning and Design Manual* published by Clackamas County Water Environment Services, December 2008.

Stormwater control and ongoing erosion control and sediment prevention is covered in the Stormwater Management Plan.

Project Site Topography

The existing site is gently sloped and therefore does not pose a significant risk for erosion once construction begins. The existing topography generally slopes from a high point on the southwest corner to low points along the north side of the property. The existing grade is less than 2%.

Soil Features

Based on the Natural Resources Conservation Service (NRCS) Soil Survey, the site features the following soils:

Aloha Silt Loam**.** Approximately 15% of the site is covered with this soil type which consists of very deep, somewhat poorly drained soils that formed in mixed alluvium or lacustrine silts. Aloha silt loam has slow runoff and moderately slow permeability.

Amity silt loam. Approximately 30% of the site is covered with this soil type which consists of very deep, somewhat poorly drained soils that formed in stratified glacio lacustrine silts. Amity silt loam has slow runoff and moderately slow permeability.

Woodburn silt loam. Approximately 55% of the site is covered with this soil type which consists of very deep, moderately well drained soils that formed in silty stratified glacio lacustrine deposits. Woodburn silt loam has slow to medium runoff and moderately slow permeability.

All the soils found on the site have varying severity of limitations ranging from “Somewhat Limited” to “Very Limited” for construction of commercial buildings, ponds and embankments and local roads. These limiting features include depth to saturated zone, shrink-swell, stability, low strength and large stones. The impacts of these limitations will be reduced or eliminated by a variety of means and methods. The impacts of depth to saturated zone, shrink-swell, stability and low strength will be reduced by one or a combination of the following:

- Providing foundation drains for buildings and underdrains for roads
- Over-excavation and replacement with suitable soils followed by adequate compaction and testing
- Engineered footings and foundation piles; and soil amendments.

Additional slope, footing and foundation stabilization measures may also be applied.

Climate and Rainfall

The closest National Climatic Data Center (NCDC) station is located in Oregon City, approximately 3 miles south of the WTP site. Average summer temperatures are 67 ^{o}F and average winter temperatures are 42 ^{o}F, however, extreme temperatures of 108^{o}F and -2^{o}F have been recorded. The average annual precipitation is 46 inches with most of the rainfall occurring in the fall, winter and spring. Only 3.5 inches of rainfall on average occurs during the summer months.

Revised Universal Soil Loss Equation (RUSLE)

The RUSLE is a tool used to estimate the rate of soil loss, based on site specific environmental conditions. This equation will be used to guide the selection and design of sediment and erosion control systems for the site. The equation itself is fairly simple, however the factors that go into it are fairly complex and have been studied and revised over the past 50 years. RUSLE can be expressed as follows:

$$A = R * K * LS * C * P$$

Where:
A = estimated average soil loss in tons per acre per year
R = rainfall-runoff erosivity factor
K = soil erodibility factor
L = slope length factor
S = slope steepness factor
C = cover-management factor
P = support practice factor

The RULSE is most easily applied using a computer program. Additional information about this program is available at the following web address:

http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm

Best Management Practices

The following key BMP's will be utilized for erosion prevention, specific details and requirements for each of these BMP's are described in the *Design Manual*:

Buffer Zone: Consisting of an undisturbed area or strip of natural vegetation, adjacent to a disturbed area, that reduces erosion and runoff

Dust Control: Including seeding, mulching, matting, and water to prevent wind transport of soil.

Ground Cover: Consisting of a protective layer of straw or other suitable material applied to the soil surface or straw mulch in conjunction with seeding to temporarily or permanently establish vegetation.

Matting: Using permeable materials such as straw, wood fiber, or plastic netting to prevent sediment transport and erosion on steeper slopes.

Plastic Sheeting: Provides immediate protection to slopes and stockpiles by covering these areas and protecting them from rain and wind transport.

Erosion Control BMPs

Additionally, the following key sediment control BMP's will be utilized during construction:

1. Bio-filter bags: Manufactured from wood products and placed in a plastic mesh bag, these bags filter out sediments from runoff and prevent the transport of sediment off site.
2. Construction Entrance: A designated construction entrance, which includes a rock pad placed at construction site ingress/egress locations, reduces the amount of sediment transported onto paved roads by vehicles or runoff.
3. Inlet Protection: Provided to protect sediments from entering storm drainage inlets or the storm sewer system. These can be constructed from geotextile inserts, bio-filter bags, or sediment fences.
4. Sediment Fences: Temporarily trap sediment in an entrenched geotextile, stretched across and attached to supporting posts. Sediment fences prevent the transport of sediment across a fixed boundary.
5. Tire Wash: prevents inadvertent removal of sediment and other contaminants off site via vehicle tires. Tire washes are shallow basins, constructed from either geotextile fabric and rock or shallow concrete lined structures, which exiting vehicles can drive through.
6. Wattles: Prevent sediment transport from runoff in a similar fashion to bio-filter bags. Wattles are manufactured from straw, coconut or other material that is wrapped in tubular plastic netting. They are generally 7 to 25 feet long.

Additional measures, outlined in the *Design Manual*, may be utilized as part of the final ESCP or on an "as needed" basis during construction, as described in the maintenance section.

Dewatering of Excavations

Some dewatering of deep excavations may be required. Filter bags or stilling basins will be used to remove sediment from water pumped from the excavations. This project will be covered under a General National Pollution discharge Elimination System (NPDES) Permit for Stormwater Discharge Associated with Construction Activities. Additional permits and requirements will be required for water discharge off site, which will be described in detail in the Construction Contract Documents and coordinated by the selected Construction Contractor.

Maintenance Program

The Construction Contractor will be required to incorporate temporary and permanent control measures and facilities into the project at the earliest practicable time. The Contractor will be responsible for applying, cleaning, and maintaining all control features during construction. Appropriate erosion and sediment pollution control features will be applied to sections such as borrow pits and material storage areas unforeseen prior to construction. Should unforeseen erosive conditions develop, it will be the contractor's responsibility to immediately correct the problem. Permanent erosion control facilities will be maintained by the Owner after acceptance of the project.

All seeded areas will be checked regularly to ensure that good vegetative cover is established. Eroded areas (i.e. washouts, gullies, etc.) will be filled, re-graded and topsoiled. Re-fertilizing, re-seeding and re-mulching will be performed, as often as necessary, until adequate ground cover is established. All sediment spilled, dropped, washed, or tracked onto any roadway or any public right-of-way will immediately be returned to an appropriate location.

During construction, the Contractor will, periodically or as directed during the progress of the work, remove and legally dispose of all surplus material and debris and keep the project area and public rights-of-way reasonably clear. Surplus or demolition materials will be recycled during the course of the work, whenever practical and approved by the Engineer or Owner's Representative.

Upon completion of the work, the contractor will remove all temporary construction facilities, debris and unused materials provided for the work, and put all of the sites of the work and public rights-of-way in a neat and clean condition.

1. Until the site is stabilized, all Erosion Control Best Management Practices must be maintained properly. Maintenance will include inspections of all Erosion and Sediment Control BMP's after each runoff event and on a weekly basis. All preventative and remedial maintenance work, including clean out, repair, replacement, regrading, reseeding, remulching and renetting will immediately be performed (initiated within 24 hours). If Erosion and Sediment Control BMP's fail to perform as expected, replacement BMP's, or modifications of those installed will be required.
2. It will be the Contractor's responsibility to maintain all Erosion and Sediment Control BMP's during construction and until final site stabilization is achieved. It will be the operator or land owner's responsibility to maintain permanent erosion controls after final site stabilization.
3. During construction, a log showing dates that Erosion Control and Sediment BMP's were inspected as well as any deficiencies found and the date they were corrected will be maintained on the site and be made available to regulatory agency officials at the time of inspection.
4. Sediment will be removed from Erosion Control and Sediment BMP's when it accumulates to the clean-out elevation, or as otherwise specified, and will be dried if necessary and disposed in landscape areas outside steep slopes, wetlands, floodplains and drainage swales and immediately stabilized or placed in topsoil stockpiles.

Erosion and Sedimentation Control BMP Maintenance

Some maintenance practices are specific to the type of BMP being maintained. The following is a partial list of requirements for maintaining the BMP's discussed previously.

1. The construction entrance will be inspected daily. At the end of each construction day, all sediment deposited on public roadways will be removed and returned to the site.
2. The dewatering silt control system (pumped water filter bag or stilling basin) will be inspected daily. If any problem is detected, pumping will immediately cease and not resume until the problem is corrected. A suitable means of accessing the bag or basin with equipment required for maintenance and disposal will be provided. Filter bags will be replaced when they become ½ full. Additional filter bags will be kept available for replacement of those that are filled or have failed.
3. Filter fabric fencing will be inspected weekly and after each runoff event. Sediment must be removed where accumulations reach ½ the above ground height of the fence. Any fence section which has been undermined or topped must immediately be replaced with a rock filter outlet.
4. Inlet protection filter bags will be inspected weekly and after each runoff event. Bags will be cleaned and/or replaced when the filter bag is half full. Damaged filter bags will immediately be replaced. Filter bags will be kept available for replacement of those that are filled or have failed.

Earth Disturbance Activities

Significant earth disturbance including several deep excavations will be required as part of the WTP Expansion Project. The following criteria will apply:

1. Stockpile heights will not exceed 35 feet. Stockpile slopes will be 2:1 or flatter.
2. During Construction, the Contractor will assure that the approved ESCP is properly and completely implemented.
3. Until the site achieves final stabilization, the contractor will assure that the best management practices are implemented, operated and maintained properly, and completely. Maintenance will include inspections of all best management practice facilities after each runoff event, and on a weekly basis. All maintenance work, including cleaning, repair, replacement, regrading, reseeding, remulching, renetting and restabilization will be performed immediately. If erosion and sediment control BMP's fail to perform as expected, replacement BMP's, or modifications of those installed, will be required.
4. Immediately upon discovering unforeseen circumstances posing the potential for accelerated erosion and/or sediment pollution, the Construction Contractor will implement appropriate best management practices to eliminate potential for accelerated erosion and/or sediment pollution.
5. All pumping of sediment laden water will be through a sediment control BMP, such as a pumped water filter bag, discharging over non-disturbed areas.
6. Erosion and sediment BMP's will be constructed, stabilized, and functional before site disturbance begins within the tributary areas of those BMP's.
7. After final site stabilization has been achieved, temporary erosion and sedimentation BMP controls will be removed. Areas disturbed during removal of the BMP's will be stabilized immediately.

Erosion and Sediment Control Plant and Implementation Standards

Preliminary ESCP drawings are provided in The Land Use Drawings, Figure 4.0 through Figure 4.4. As part of the Contract Documents, the selected Construction Contractor will be required to further develop the ESCP based on the specific construction techniques used and approved variations to the proposed construction sequence. The approved, final ESCP will be prepared in accordance with this document, the Clackamas County *Erosion Prevention and Sediment Control: Planning and Design Manual* (December, 2008) and the Design Standards described in the West Linn Community Development Code (Section 31.070). The final ESCP will be designed by a certified erosion control specialist.