



MEMORANDUM

7/13/07

Public Works Department
Development Services Division

M/S: 2SPW

Page 1 of 7

OFF-SITE STORMWATER ANALYSES

I. INTRODUCTION

An Off-Site Stormwater Analysis is a required part of the stormwater management information to be submitted for proposed land development projects in Redmond where the proposed project is located in a Regional Surcharge Area (See Redmond's Stormwater Notebook, Issue No. 5, page 87, available at City Hall and on line at www.redmond.gov). The term "Off-Site Stormwater Analysis" in this document is equivalent to the term "Downstream Hydrologic and Hydraulic Analysis" as used in the Stormwater Notebook.

An Off-Site Stormwater Analysis (a standard part of Stormwater Proposals) is also required when a proposed project is not located in a Regional Surcharge Area but a proposed Regional Facility is shown (on the Facilities Map) downstream of the proposed development project and the developer elects to participate in the Regional Facility Program.

The Regional Facility Program works to construct a very limited number of large, consolidated stormwater management facilities to provide water quality control and/or water quantity control for stormwater in each sub-basin. The consolidated facilities eliminate the need for potentially hundreds of small, on-site stormwater management systems located on each separate project site in the City. On-going operating, maintenance, monitoring, and management systems are all simplified and consolidated.

The on-site water quality and quantity control systems previously required are not provided under this program. The regional facilities take their place. This highly desirable end result does require careful and detailed analysis of the stormwater conveyance system(s) that transport runoff from each project site to the Regional Facility. The runoff from each site must be conveyed to the Regional Facility before it receives quality and quantity control.

The Off-Site Stormwater Analysis provides information about the stormwater conveyance system(s) that serve a proposed project. The analysis is used to identify which (if any) parts of the conveyance system need to be upgraded as part of the

proposed development project and to make other decisions about stormwater management for the project.

II. SUBMITTAL REQUIREMENTS FOR DIFFERENT PROJECT SIZES

This section defines submittal requirements for proposed development projects of different sizes that are located in a Regional Surcharge Area.

Small Projects

For Small Projects (as defined in Redmond's Stormwater Notebook), neither a Stormwater Proposal nor payment of fees under the Regional Stormwater Program are required.

Medium Projects

For Medium Projects (as defined in Redmond's Stormwater Notebook), the Off-Site Stormwater Analysis initially consists of an abbreviated, descriptive, and much less quantitative analysis. Based on this descriptive-level analysis, the City Stormwater Engineer will determine if a Full Off-Site Stormwater Analysis is required. Contents of a descriptive-level analysis and for a full analysis are presented in the following sections of this document.

Note: if it is clear to the City's Stormwater Engineer that a full analysis will be needed for a proposed project, then the Stormwater Engineer may determine that a descriptive-level analysis is not appropriate and that the full analysis must be prepared. Also, a developer may elect not to submit the descriptive-level analysis and, instead, proceed directly with the full analysis.

Large Projects

For Large Projects (as defined in Redmond's Stormwater Notebook), the Off-Site Stormwater Analysis will most likely require a full analysis. However, the developer of a large project may submit a letter to the City Stormwater Engineer, to request approval to submit an initial, descriptive-level analysis. This request is to include the reasons that support doing the descriptive level analysis rather than a full analysis. If the request is approved, the descriptive level analysis may be prepared and submitted. Note that projects may still be required to submit a full analysis after review of the descriptive level analysis.

III. USE OF ANALYSES PREVIOUSLY COMPLETED BY OTHERS

This section provides guidance where a descriptive or full off-site stormwater analysis has been completed for another project and the previous work addressed all or part of the conveyance system for the proposed development project.

Analyses previously submitted to and approved by the City of Redmond Development Services Division may be relied upon by other projects as long as the project Civil Engineer provides a stamped, signed certification that they have reviewed and concur with the findings of the information used. Nothing in this paragraph authorizes any engineer to infringe upon the intellectual property rights or otherwise improperly appropriate the work of another engineer. Any engineer relying upon the work of another shall be solely responsible for obtaining any required permissions.

IV. DESCRIPTIVE-LEVEL OFF-SITE STORMWATER ANALYSES

As described in the previous section, a Descriptive-Level Off-Site Stormwater Analysis may be submitted initially in certain circumstances. The descriptive-level analysis helps determine if a full analysis is actually needed or, perhaps, if only certain parts of the off-site conveyance system need to be analyzed in detail. A descriptive-level analysis shall provide the following sections and information:

- A. In Section A, provide a map showing the site and the conveyance route with labels on each section of the conveyance system. At a minimum, separate sections must be identified for each type of conveyance (swale, ditch, pipe, stream, etc.). The conveyance route must extend from the site until it reaches any one of the following:
 - a. A completed Regional Facility.
 - b. The discharge point(s), consisting of the Sammamish River, Lake Sammamish, Bear Creek, Evans Creek, and recharge locations that have no outlet or overflow (for at least the 100-year frequency event).
 - c. A point that is ¼ mile outside the Redmond City Limits (or greater distance if specified by the City's Stormwater Engineer).

- B. In Section B, provide a narrative description of each section of the conveyance system. Include a brief discussion of the following topics:
 - a. The type of conveyance (swale, ditch, pipe, stream, etc.).
 - b. For pipes, describe any evidence found of flooding due to conveyance constraints and any damage to or deterioration of pipes.
 - c. For swales and ditches, describe the stability and evidence of flooding.
 - d. For streams, describe any evidence of erosion or scour, evidence of flooding, and potential impacts of un-detained flow on fish habitat.
 - e. Evidence of flooding is to include interviews with appropriate people who might have knowledge about flooding that would occur if there were conveyance constraints.

- C. In Section C, provide conclusions regarding the suitability and feasibility of

the Regional Facility Program for the proposed development project. That is, can the on-site water quantity and quality controls be eliminated (or reduced) considering the downstream conveyance system. Include any recommendations regarding improvements to any of the sections of the downstream conveyance system. Preliminary calculations may be included for selected locations.

V. OVERVIEW OF A FULL OFF SITE STORMWATER ANALYSIS

A Full Off-Site Stormwater Analysis requires detailed quantitative studies and narrative descriptions of the stormwater conveyance system that carries runoff from a proposed development project to the discharge point(s).

The information required for a full analysis is to include engineering studies that present sections and information addressing the following:

A. Existing Conveyance System: Include detailed identification and information about the segments (called elements) of the conveyance system between the site and one of the locations as listed in IV.A. Include a map showing and labeling the conveyance elements, showing and labeling land areas that contribute flow to the conveyance elements, and the location and status of the related Regional Facilities.

B. Basic Hydrologic/Hydraulic Study: The “Basic Study” is to address two design storm frequencies: the ten-year frequency storm; and the fifty-year frequency storm. For each of these design storm frequencies, two land cover conditions are to be addressed: current conditions plus the proposed project; and built-out conditions as defined in the City’s Comprehensive Plan. Both shall include all areas tributary to the systems.

The method of analysis for the study may be the “Rational Method” where the total sub-basin area does not exceed 25 acres. For larger sub-basins, the Western Washington Hydrology Model (WWHM) must be used.

Tailwater elevations are typically involved in Basic Studies. If possible, identify the future tailwater elevations based on the proposed regional facility elevations. If justifiable tailwater elevations cannot be determined, set the tailwater condition at the furthest downstream system at 0.7 of the pipe diameter above the pipe invert.

Note that if conveyance elements exist that will be replaced in the future by an identified Regional Facility, then the conveyance elements must be included in the Basic Study (see also “Adjusted Study” in the next section).

C. Adjusted Hydrologic/Hydraulic Study: An “Adjusted Study” may be required when the project’s conveyance system includes conveyance elements that will be, but have not yet been, replaced as part of an identified Regional Facility. If the Basic Study indicates any conveyance elements that are part of a future Regional facility will cause flooding or other damage, then an Adjusted Study is required in addition to the Basic Study.

An Adjusted Study is to focus only on the conveyance elements that are to be replaced by the Regional facility. The specifications for the Adjusted Study are the same as those for the Basic Study except for land cover which is to be included as follows:

1. Start with existing land cover.
2. Obtain the total estimated cost of the proposed Regional Facility (from the City's Natural Resources Division)
3. Divide the estimated cost by the current Regional Facility Surcharge. Given that one Impervious Unit equals 2000 square feet, convert the result into square feet. This figure provides an estimate of the square feet of new development needed to fund the Regional Facility.
4. Assume that the added square feet are evenly distributed throughout the Regional facility Surcharge Area (unless directed otherwise by the City's Stormwater Engineer).
5. Combine the existing land cover with the land cover estimated above to obtain the land cover for the Adjusted Analysis.

D. Summary Tables: For this section, provide a table to present results from the each of the previously described conveyance studies scenarios. Each table is to provide the following columns and associated information for each existing conveyance element:

1. Conveyance element label – corresponding to a sub-basin map required as part of the conveyance system description for Item A.
2. Conveyance element type – ditch, pipe, stream, etc.
3. Conveyance element length – in feet.
4. Conveyance element capacity – in cubic feet per second. Detailed calculations are to be provided in the Conveyance Analysis appendix.
5. Conveyance flows - for conveyance elements that are part of a Regional Facility but have not yet been constructed, provide two columns: one showing calculated flows from the Basic Study and one showing calculated flows from the Adjusted Study. For all other conveyance elements, provide only the calculated flows from the Basic Study.
6. Overflows – provide a column showing the amount by which the calculated flows exceed the existing conveyance capacity.

E. Overflow Analysis – An Overflow Analysis must be provided for all locations where the calculated flows exceed the capacity of the existing conveyance elements. For conveyance elements to be replaced by a Regional Facility, the Overflow Analysis only needs to address overflows based on the Adjusted Study.

For each overflow location, provide a descriptive analysis of the overflow route. For 10-year frequency analyses, describe all predicted consequences, including ponding and

inconveniences, of any overflow. For 50-year frequency analyses, describe potentials to cause or significantly contribute to: (1) flooding of buildings; (2) safety issues such as flooded streets; (3) significant damage such as erosion, scour, or deposition; and (4) just plain water damage.

F. Upgrades List - The analysis must next identify all overflow locations that need to be addressed due to the potential results from the overflows. If upgrades are not proposed for all overflow locations, then explanations must be included where upgrades are not proposed. At this point in the analysis, the explanations must be based only on the predicted consequences of the overflows.

A separate table is to be included in the analysis listing the conveyance elements to be upgraded as part of the proposed development project based on the consequences of the overflows.

G. An optional Proportionality Argument may be included if the list of conveyance upgrades is felt to be disproportionate to the size and scope of the proposed development project. The upgrades listed in the table described above are to be sorted into a new table that ranks the potential upgrade elements in terms of the severity of their consequences. The Proportionality Argument must include a cost estimate for each upgrade shown on the ranked list.

A cost estimate is also required for providing on-site water quantity controls (e.g. detention). Note that the on-site quantity controls in this case need to reflect any size/cost increases required because of constraints presented by the existing downstream conveyance capacity of conveyance elements that are not being upgraded with the proposed project.

Next, indicate which of the potential upgrades are to be done as part of the proposed development project. Begin at the top of the ranked list. Provide an explanation for all projects on the ranked list that are not proposed to be part of the development project based on proportionality or other factors.

VI. OFF SITE STORMWATER ANALYSIS RESULTS

The Off-Site Stormwater Analysis is used by the City to make decisions about on-site stormwater controls and necessary conveyance system improvements.

In general, for water quality controls, if a conveyance system includes streams, other natural water features or open channels then on-site water quality controls will be required.

Most of the technical analyses required for off-site analyses address the question of water quantity controls. In general, the results of those analyses are applied as follow:

1. If all existing conveyance elements are adequate, neither on-site water quantity controls nor conveyance system improvements are needed.

2. If there are existing conveyance elements that are not adequate, then the upgrades to be required depend on case-by-case decisions by the City. The developer may identify which upgrades are highest priorities in the developer's view. The required on-site detention is also a case-by-case decision based on the conveyance upgrades and the remaining potential for flooding or other damage. Also considered is the Proportionality Argument (if submitted) and the potential for improvements to the conveyance system by other projects that are being proposed in the same area.