F.21 Drainage Wells

F.21.1 Drainage well plan standards

1. Verify that the plans include an appropriate sequence of construction that is specific to the construction of the drainage well. Refer to Section 4.15.5 for guidance. [Section 2.3.1]
2. To avoid soil disturbance and compaction during construction, verify that the infiltration area is proposed to be clearly marked before any site work begins. [Section 4.15.5, 1]
3. Verify that the plans include an appropriate cross-sectional detail for the drainage well. [Section 2.3.1]

F.21.2 Drainage well design standards

1. Verify that the SMP drains within the acceptable 72-hour period after the 24-hour storm event. [Section 4.15.3, 1]
2. Verify that positive overflow is provided for large storm events, up to and including the 100-year, 24-hour storm event, or, if the project is exempt from Flood Control, the ten-year, 24-hour storm. [Section 4.15.3, 3]
3. Verify that overflow structures and pipes are designed to convey at least the ten-year, 24-hour storm event. [Section 4.15.3, 3]
4. Verify that the distance between the edge of a drainage well's stone storage bed and any adjacent private property line is at least ten feet. It is acceptable for SMPs to be located directly adjacent to the public right-of-way (ROW) (unless a deed restriction is put in place extending at least ten feet from the perimeter of the infiltrating SMP). [Section 4.15.3, 4]
5. Verify that the distance between the edge of a drainage well's stone storage bed and any building or retaining wall is at least ten feet. The following requirements and exceptions apply: [Section 4.15.3, 5]
    a. For existing and proposed buildings with basements, the setback is measured from the basement wall.
    b. For existing buildings without basements and existing retaining walls, the setback is measured from the foundation and may be waived if a signed and sealed geotechnical analysis is submitted that evaluates the impacts of infiltration and excavation on the existing foundation and determines it to be feasible.
    c. For proposed buildings without basements and proposed retaining walls, the setback is measured from the foundation and may be waived if the foundation is proposed to be designed with the drainage well's proximity in mind.
6. Verify that, when siting two or more drainage wells near each other, the lateral clearance between the edges of their stone storage beds is twice the distance of the height of the perforated well section. [Section 4.15.3, 6]
7. Verify that the invert elevation of the drainage well is at least two feet above any poorly infiltrating soils, seasonal high groundwater table, bedrock, or other hydraulically limiting zone. [Section 4.15.3, 7a]
8. For hydrologic modeling, verify that a soil permeability coefficient (k_{20}), calculated per the protocol described in Section 4.15.3, 7c(vi), is applied to the wetted area of the drainage well, spanning the perforated sides and bottom, to determine infiltration characteristics. [Section 4.15.3, 7b]

9. Verify that infiltration testing for drainage wells is performed according to the procedure described in Section 4.15.3, 7c. [Section 4.15.3, 7c]
10. If the drainage well location is used as a temporary sediment basin during construction, verify that the invert elevation of the infiltration SMP is a minimum of three feet below the bottom elevation of the pre-basin-conversion sediment basin. [Section 4.15.3, 7d]
11. Verify that any drainage well within the zone of influence of any nearby basements, sewers or sewer laterals, or other subsurface conditions where infiltration is not advisable is installed with an impervious liner. The zone of influence is defined by the area within a 1:1 (H:V) slope line from the outer edge of a sewer or sewer lateral. [Section 4.15.3, 7e]
12. Verify that pretreatment is provided for all runoff entering the drainage well, including pretreatment of runoff from all inlets. At a minimum, this can be achieved through the use of sumps and traps for inlets, sump boxes with traps downstream of trench drains, and filter strips for overland flow. [Section 4.15.3, 9]
13. Verify that the storage area provides static storage for the WQv between the bottom elevation of the drainage well and the elevation of the lowest outlet, including storage voids. For dynamically designed drainage wells, static storage of only one inch of the WQv must be provided if the designer demonstrates, through dynamic routing, that the full 1.5-inch WQv is managed throughout the design storm, without overflow. [Section 4.15.3, 12]
14. Verify that the maximum storage volume statically stored within the drainage well without supporting documentation (defined below) is the runoff volume from the one-year, 24-hour storm event. [Section 4.15.3, 13]
15. Verify that the maximum storage volume statically stored within the drainage well with supporting documentation is the runoff volume from the ten-year, 24-hour storm event. Requirements for supporting documentation include a letter, signed and sealed by both the geotechnical and design engineer, indicating that the proposed design is recommended, with the following components acknowledged and considered. The designer is encouraged to contact PWD for further guidance when pursuing this design. [Section 4.15.3, 14]
    a. A summary of the long-term impacts to the neighboring properties, including, but not limited to subsidence, change in basement moisture/water, and structural damage;
    b. The location of the groundwater table;
    c. References to other projects that have successfully infiltrated more than the one-year, 24-hour storm event; and
    d. Rigorous pretreatment to promote longevity of the infiltration SMP.
16. Verify that, when SMPs are used in series, the storage areas for all SMPs provide cumulative static storage for the WQv. There is no minimum storage requirement for each individual SMP used in series [Section 4.15.3, 15]
17. Verify that void space provided by drainage wells is as specified by the manufacturer and noted in supporting documentation. [Section 4.15.3, 17]
18. Verify that drainage wells are adequately bedded with stone to prevent settling or subsidence. [Section 4.15.3, 18a]
19. Verify that bedding thickness is not less than six inches. [Section 4.15.3, 18b]
20. Verify that foundations/footers are provided as warranted by system loading, geotechnical conditions, and manufacturer's recommendations. Foundation designs must be performed by an appropriate design professional. [Section 4.15.3, 18d]

21. Verify that the storage design accounts for potential loading from vehicles, as appropriate, based on expected maximum active loading, including consideration for emergency vehicles. [Section 4.15.3, 19]
22. Verify that a porosity of 0.40 is used for stone storage volume calculations. [Section 4.15.3, 20]
23. Verify that the stone storage layer, if proposed, is separated from soil media by a geotextile to prevent sand, silt, and sediment from entering the system. A pea gravel filter may be used on the bottom in lieu of a geotextile. [Section 4.15.3, 21]
24. Verify that the stone storage layer, if proposed, is separated from the perforated manhole by a geotextile or geogrid to prevent stone from falling into the manhole. [Section 4.15.3, 22]
25. Verify that drainage wells have a level bottom or use a terraced system if installed along a slope, in series. [Section 4.15.3, 23]
26. Verify that manholes are accessible, to allow unobstructed and safe access to drainage wells for routine inspection and maintenance, and that inlet and outlet controls also contain access panels or other access features to inspect and maintain the same. [Section 4.15.3, 25]
27. Verify that ladder access is proposed for drainage wells greater than four feet in height. [Section 4.15.3, 26]

F.21.3 Drainage well material standards

1. Verify that precast concrete drainage well manholes, if proposed, meet the following specifications: [Section 4.15.4, 3]
    a. Concrete risers: five-inch thick, 4,000 psi concrete, 3×12 WWF (six gauge) reinforcement
    b. Base section: nine-inch thick, 4,000 psi concrete, #4 rebar reinforcement, six inches on center
    c. Perforations: two to four-inch diameter, eight inches on center
    d. Connections to be made with non-shrink grout
2. Verify that thermoplastic drainage well manholes, if proposed, meet the following specifications: [Section 4.15.4, 4]
    a. Thermoplastic well sections: PVC
    b. Perforations: one to two-inch diameter, six inches on center
    c. Connections to be made with like materials per manufacturer recommendations
3. Verify that stone designed for stormwater storage, if proposed, is specified on the plans as being uniformly graded, crushed, clean-washed stone and that it is noted that PWD defines “clean-washed” as having less than 0.5% wash loss, by mass, when tested per the AASHTO T-11 wash loss test. AASHTO No. 3 and No. 57 stone can meet this specification. [Section 4.15.4, 5]
4. Verify that geotextile, if proposed, is specified on the plans to consist of polypropylene fibers and to meet the following specifications (AASHTO Class 1 or Class 2 geotextile is recommended): [Section 4.15.4, 6]
    a. Grab Tensile Strength (ASTM-D4632): ≥ 205 lbs
    b. CBR Puncture Strength (ASTM-D6241): ≥ 500 lbs
    c. Flow Rate (ASTM-D4491): ≥ 95 gal/min/ft2
    d. UV Resistance after 500 hrs (ASTM-D4355): ≥ 70%
    e. Tear Resistance (ASTM-D4533): ≥ 80 lbs
    f. Heat-set or heat-calendared fabrics are not permitted.
5. Verify that geogrid, if proposed, is specified on the plans to meet the following specifications: [Section 4.15.4, 7]
    a. Maximum Apparent Opening Size (AOS): 0.25-inch
    b. Grab Tensile Strength (ASTM-D4632): ≥ 205 lbs
    c. CBR Puncture Strength (ASTM-D6241): ≥ 500 lbs
    d. UV Resistance after 500 hrs (ASTM-D4355): ≥ 70%
    e. Tear Resistance (ASTM-D4533): ≥ 80 lbs
6. Verify that manhole covers allow access to drainage wells. [Section 4.15.4, 9]