Stormwater Management Post-Construction Requirements (EP3-001) Guideline

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Applies To: As required by the National Pollutant Discharge Elimination System (NPDES) permit for University of Michigan (U-M), the scope of this Guideline includes all construction and renovation projects on U-M properties that involve either:

a. Earth disturbance of one (1) acre or greater,

OR

b. Earth disturbance of less than one (1) acre, but which are part of a larger common plan of development or sale that would disturb one (1) acre or more.

***Notes**: i. "Regulated site ", "Project site" and "Site" in this guideline refers to individual project construction sites meeting a. or b. above. Note – per previous discussion with EGLE staff, if a project site only exceeds one (1) acre due to the installation of elective stormwater best management practices (such as adding a bioswale around the perimeter of a parking lot), that project is not considered to have exceeded one (1) acre, and thus post-construction stormwater controls are not required, and remain elective. An SESC plan would, however, be required.*

ii. Per previous discussion with EGLE, if UM does not own/operate the MS4 first receiving the discharge, then that area is not subject to UM's post-construction requirements. This typically applies to ROW areas. These areas do not need to be accounted for in the stormwater management calculations, but should be noted for reference and be part of the site SESC plan.

iii. Common Plan of Development: The University treats each project with a different project number as a separate development. Projects that take place in the same area may be funded differently, have different approvals from the Regents, and additional site-specific requirements. Thus, they are stand-alone projects, not a common plan of development. Generally, a common plan of development is not applicable to U-M, since common plan developments, such as sub-divisions, do not occur on campus. If this type of development occurs, the requirements and procedures of this guideline will be met.

iv. Laydown and staging areas where topsoil/grass is not removed are not considered as earth disturbances as they will be returned to grass.

v. Projects that are part of a Planned Unit Development (PUD) meeting the local entities post-construction stormwater management requirements, or projects that follow the local entities post-construction stormwater management requirements are deemed to be within compliance of the UMs NPDES post-construction permit requirements.

Acronyms

AEC – Architecture, Engineering and Construction Department
BMPs – Best Management Practices

DEQ – Michigan Department of Environment (now EGLE)
EGLE – Michigan Department of Environment, Great Lakes, and Energy
EHS – Environment, Health & Safety
GI – Green Infrastructure
HUC – Hydrologic Unit Code
LID – Low Impact Development
MDNRE – Michigan Department of Natural Resources and Environment (now EGLE)
MS4 – Municipal Separate Storm Sewer System
NOAA – National Oceanic & Atmospheric Administration
NPDES – National Pollutant Discharge Elimination System
O&M – Operation & Maintenance
PCSM – Post-Construction Stormwater Management
SCMs – Stormwater control measures
TSS – Total Suspended Solids
UAs – Urbanized Areas
U-M – The University of Michigan

Post-Construction Requirements Policy Statement

U-M construction and redevelopment projects on U-M property are regulated under and **must** comply with the U-M NPDES permit for stormwater discharges, as issued by the Michigan Department of Environment, Great Lakes, and Energy (EGLE). The Stormwater Management Post-Construction Requirements Guideline has been developed to provide guidance regarding responsibilities and actions to meet the NPDES permit conditions for construction and renovation projects on U-M properties, which include but are not limited to, the Ann Arbor, Dearborn and Flint campuses.

Post-Construction Plan for Stormwater Management

The post-construction plan for stormwater management on regulated sites **must** include:

- A minimum treatment volume standard to address water quality impacts.
- Channel protection criteria to address resource impairment resulting from flow volumes and rates.
- Drawings showing the location of stormwater control measures (SCMs) and the storm system.
- Details on the proposed SCMs.
- Operation & Maintenance (O&M) requirements.
- Supporting information
  - Calculations used for designing all components of the stormwater management systems.
  - Total suspended Solids (TSS) design removal rates and supporting manufacturer documentation, if applicable.
  - Geotechnical report including soil boring and infiltration test data.

Refer to U-M Stormwater Management Program Plan and the Post-Construction Stormwater Worksheet for additional details on these requirements.

The project team [Architecture, Engineering & Construction (AEC), Other Project Managers, Project Developer and/or Contractors] shall develop the post-construction stormwater management plan in accordance with this guideline and the NPDES permit. Preferred design elements are identified in the Post-Construction Stormwater Worksheet.

Minimum Treatment Volume Standard

The minimum treatment volume standard **must** be either: One (1) inch of runoff from the entire site **OR** the calculated runoff for the entire site from the 90 Percent Annual Non-Exceedance Storm, as summarized in DEQ's memo dated March 24, 2006.

Total Suspended Solids Removal

The treatment methods **must** be designed on a site-specific basis to achieve the following:

a. A minimum of 80 percent removal of TSS, as compared with uncontrolled runoff.

OR

b. Discharge concentrations of TSS not to exceed 80 milligrams per liter (mg/l).

NOTES:

i. A minimum treatment volume standard is not required where site conditions are such that TSS concentrations in stormwater discharges will not exceed 80 mg/l.

ii. 80mg/L will be determined by a mathematical calculation by land use and TSS values provided by EGLE or other reputable source. Site specific testing will not be performed (see text below from 2008 permit compliance assistance document)

The intent is not for permittees to monitor sites to determine compliance with this permit requirement. Instead, the expected reduction of suspended solids by BMPs is obtained from the literature.

The following table shall be used to determine post-construction TSS discharges from the project sites. If determined through calculation based on TSS load for a land use, that the land use alone or through a combination of land uses, the mean TSS from the project site will be less than 80 mg/l, no additional structural controls will be required.

Mean TSS Loading Rates by Land Use

Land Use Category	*Percent Imperviousness*	*Mean TSS (mg/l)*	*Mean TSS loading rate lbs/ft^3*
Forest/Rural Open	*2*	*51*	*0.0032*
Urban Open	*11*	*51*	*0.0032*
Agricultural/Pature	*2*	*145*	*0.0091*
Low-Density Residential	*19*	*70*	*0.0044*
Medium-Density Residential	*38*	*70*	*0.0044*
High-Density Residential	*51*	*97*	*0.0061*
Commercial	*56*	*77*	*0.0048*
Industrial	*76*	*149*	*0.0093*
Highways	*53*	*141*	*0.0088*

Adapted from "Rouge River Wet Weather demonstration Project, Selection of Stormwater Pollutant Loading Factors" RPO-MOD-TM34.00, October 1994, Table 3-13 (To convert mg/l to lbs/ft^3, multiply by 6.243 X 10^{-5})

Channel Protection Criteria

The channel protection criteria **must** maintain post-development site runoff volume and peak flow rate at or below existing levels for all storms up to the 2-year, 24-hour event. "Existing levels" means the runoff volume and peak flow rate for the last land use prior to the planned new development or redevelopment. More restrictive channel protection criteria may be utilized by U-M on a case-by-case basis, as appropriate.

Rainfall data

The rainfall data for calculating runoff volume and peak flow rate shall be the NOAA Atlas 14 Point Precipitation Frequency Estimates. Projects can electively opt to use larger storm events as an elective BMP.

Methods for estimating pre- and post-development runoff

The methods used for estimating pre- and post-development runoff shall follow curve number evaluations as described in MDNRE's (now EGLE) document Computing Flood Discharges for Small Ungaged Watersheds, June 2010, which notes other SCS (curve number) methods such as to TR-55 and TR-20 as acceptable methods for calculating runoff. In addition, other computer modeling, such as HydroCAD and SWMM are also acceptable to calculate pre and post runoff conditions. Section 6.1 of this referenced document indicates to see TR-55 Tables 2-2a through 2-2d for the complete list of curve numbers. Utilize this more comprehensive list of curve numbers for completing the channel protection calculations. As noted in section 6.2 of the above referenced document, a composite curve number approach is acceptable to calculate site runoff.

Alternative Approaches

Detention in Lieu

On-site extended detention may be utilized on project sites where retention (infiltration) is not feasible due to:

A. High water table present on-site, where adequate separation between the bottom of the infiltration bed and the groundwater is not feasible;
B. Site specific infiltration testing or geotechnical data determine that on-site soils are not suitable for infiltration (little to no infiltration capability);
C. There is known contamination or hotspots present that could be exacerbated by infiltration;
D. Infiltration would cause harm to building infrastructure or may cause harm to property adjacent to the project;
E. Soil instability as documented by a thorough geotechnical analysis;
F. Case by case conditions not covered by items a. though e. above, with prior EGLE approval.

In situations where detention in lieu is to be utilized, the U-M will detain a minimum of 120% of the required channel protection volume as described above. This is applicable to both on-site and off-site detention facilities. Detention facilities shall be designed to release required management volume within 36 hours (+/- 12 hrs), at a velocity at or below the existing 2yr/24hr storm peak flow rate and are encouraged to reduce peak flow rate through the 100yr/24hr event. The following considerations shall be made:

a. When feasible and prudent, a minimum of 10% of the total required channel protection volume shall be managed on-site as the first tier. This involves the use of LID and GI approaches. Each project shall document how this has been accomplished, or if it is not possible due to site constraints.
b. An offset ratio of 1:1.2 shall be applied to volume above the first-tier volume that is to be managed through the use of extended detention.

If it is not feasible to infiltrate (through the use of GI or LID) the first tier volume (or any portion thereof), the offset ratio for the first tier volume (or portion thereof) for management by extended detention shall be 1:1.2.

Off-Site Mitigation in Lieu (Retention and Detention)

Off-site mitigation shall be permitted when any of the following conditions are present at the proposed development site:

a. High water table present on-site, where adequate separation between bottom of infiltration bed and groundwater is not feasible, or where the retention and/or detention system would be within the anticipated high water table level.
b. Site specific infiltration testing or geotechnical data determines that on-site soils are not suitable for infiltration (little to no infiltration capability).
c. There is known contamination or hotspots present that could be exacerbated by infiltration.
d. Infiltration would cause harm to building infrastructure or may cause harm to property adjacent to the project.
e. Insufficient space outside of the building footprint to create the necessary infiltrative and/or storage capacity even with amended soils.
f. Soil instability as documented by a thorough geotechnical analysis.
g. Site use is inconsistent with the capture and retention/detention of stormwater.
h. Site use will be land consumptive, preventing future development needs required to meet the University's mission
i. Too much shade or other physical conditions that preclude adequate use of plants.
j. Regional BMPs are preferred when build-out land use density does not allow for multiple future BMP locations, when several agencies or municipalities are contributing to one treatment system, or when budgetary constraints align with the construction of a regional BMP. (Regional BMPs treat runoff from multiple projects or site locations using one designed BMP system. Such BMPs minimize overall land impacts and costs, as one large BMP is constructed in lieu of several smaller BMPs. A few examples of regional BMPs on U-M campus include the Palmer Drive Cistern, Museum of Art underground infiltration system, and the wetland detention basin system at the Art and Architecture Building). It is anticipated that regional systems previously installed and with available capacity shall be used as needed to meet U-M's post-construction stormwater management requirements.

The use of existing regional stormwater management facilities with adequate capacity may be permitted with prior approval from AEC. The facility must have available capacity to control the increased runoff as determined by section 2.2 outlined above. The regional stormwater management facility must be within the same 10-digit hydrologic unit code (HUC), and preferably within the same creekshed as the project requiring post-construction stormwater management.

Off-site mitigation sites shall meet the following minimum requirements

a. When feasible and prudent, a minimum of 10% of the total required channel protection volume shall be managed on-site as the first tier. This involves the use of LID and GI approaches. Each project shall document how this has been accomplished.
b. An offset ratio of 1:1.2 shall be applied to the volume above the first-tier volume that is to be managed at the off-site mitigation area.
c. If it is not feasible to manage the first-tier volume (or any portion thereof) on-site, the offset ratio for the first-tier volume (or portion thereof) for management in the off-site mitigation area shall be 1:1.2.
d. Offset ratio can be waived for off-site infiltration practices if the project site stormwater enters the infiltration feature through storm pipe or constructed stormwater conveyance (such as a swale or ditch) prior to discharge to surface waters of the State. Because there are no impacts to receiving waters, the use of an offset protection factor is not required.

Off-site stormwater banks and banking:

a. It is acceptable to create a stormwater bank for use by projects owned by the U-M.
b. In order for a project to utilize a bank, it must be within the same 10-digit HUC and preferably within the same creekshed as the project.
c. A bank can be created as a stand-alone project for future use by future development and redevelopment.
d. Projects installing a system to meet post-construction stormwater management (PCSM) requirements can over-design to create a bank for future use by another project.
    1. Clearly document the volume of water retained or detained at the bank site
    2. Deduct the initial project's PCSW needs from the calculated storage volume
    3. Document the volume available for use as a bank by other projects
    4. Perform calculations for individual sites, and apply to the bank
e. Water managed by the off-site mitigation does not have to come specifically from the new development/redevelopment project location, rather, it must be of equal volume (plus offset ratio).
f. Consideration shall also be made of the stream order and location within the watershed/creekshed/sewershed as it relates to the water quality impacts from the original project site *(e.g., the water quality impact from a site with a discharge to a small-sized stream would be greater than a site on a large river and an offset downstream of the project site may provide less water quality benefit.*)

> **Note:** If the off-site mitigation bank does not already exist, it shall be constructed and completed within 24 months from the start of construction for the project requiring the off-site mitigation. If more time is needed, prior approval from EGLE is required. There is no time limit for use of a created mitigation bank, as it pertains to future projects that wish to utilize credits from a previously constructed mitigation bank. If a created bank can take stormwater off-line in advance of a project, and chooses to do so, it shall be clearly tracked as to the volume being taken off-line, and that volume (including the required offset ratios) shall be applied to future development (i.e., a bank can be used now to help improve a receiving water, but that volume shall be available for credit to a future construction project).

Off-site mitigation long-term operation and maintenance & tracking

a. Any control that is installed to meet requirements of this permit shall remain in-place and be properly maintained in perpetuity. If a required stormwater control needs to be removed and relocated off-site due to, for example, future development needs, the replacement controls shall follow the above off-site

mitigation strategy. If a control is being replaced as maintenance, relocated on-site, or the control is being changed to a different style (for example, an infiltration basin becomes in-ground retention, or porous pavement is replaced by standard pavement, but the volume mitigated by porous is properly managed on-site by an alternate control), then it shall meet the original channel protection requirements for that project.

b. Documentation of allocations will be kept in a database, and copies attached to the PCSM file for each project using the bank. A spreadsheet and/or a database shall be maintained by EHS to track all required stormwater controls, both off-site, and on-site.

Use of reduction in impervious as a bank

This option has limited use at the U-M as the campus is generally growing. There are some instances when a significant amount of impervious is removed. In those cases (usually for sites >1acre), the U-M plans to track these reductions for use as an offset for future build-out (either at the same location, or within the 10 digit HUC, and preferably within the same creekshed).

a. The volume and rate of stormwater banking shall be calculated by using an approved curve number method as described above to determine the reduction in runoff volume and rate.
b. This volume and rate will be available for use by future projects, with the appropriate offset of 1:1.2 applied (if credit to be taken at a different location than the reduction in impervious occurred).
c. There will be no offset required if the bank is used to meet future needs at the same location that caused the banking.

Operation & Maintenance Plans

All structural and vegetative BMPs/SCMs installed as a requirement under this section of the permit shall include a plan for maintaining maximum design performance through long-term operation and maintenance.

The Environment, Health & Safety department at each campus will facilitate inspections (as needed) of the BMPs/SCMs, and report the findings to the facility manager(s) for remedy.

More frequent inspections of SCMs may be required, based on the O&M plan. All inspections, other than annual inspections, shall be the responsibility of the facility manager. A copy of all inspection reports shall be forwarded to the appropriate campus EHS department, as applicable, for recordkeeping.

Project Submittals

Development of the Post-Construction Plan for Stormwater Management is part of the formal U-M project review process. For each of the major phases of design (i.e. Schematic Phase, Design Development Phase, and Construction Document Phase), the Project Team (AEC, developer, and/or contractor) shall follow the stormwater management procedures as indicated in the Design Deliverables document and Stormwater Management Procedure document. The Project Team, with assistance by the Stormwater Management Team (representatives from EHS and AEC), sets the stormwater management requirements and goals at the pre-design phase to ensure that stormwater management is incorporated early into the planning process.

The Project Team shall submit the Post-Construction Plan for Stormwater Management to EHS-Ann Arbor for review and comment and ensure that the plan and all supporting information are deemed acceptable prior (preferably) to beginning any earth disturbance. The post-construction stormwater management plan shall

include all calculations, BMP/SCM details, stormwater system details, site plan, TSS designed removal rates, and the O&M plan

It is required that a Professional Engineer familiar with the project certifies that the design meets the minimum treatment volume standard and channel protection criteria required by the NPDES permit.

A second certification from the engineer is required after construction has been completed, stating that the as-built conditions meet the minimum treatment volume standard and channel protection criteria required by the NPDES permit, and outlined in the approved stormwater management plan.

Enforcement

EHS-Ann Arbor will administer and enforce the stormwater management program for U-M, including developing and maintaining procedures, guidance, information, etc. to aid U-M staff and contractors in complying with the post-construction requirements for stormwater management on regulated sites. Enforcement may include, but is not limited to: letters of warning, stop work orders, withholding Soil Erosion and Sedimentation Control permits, withholding payment to the contractor, etc. and shall be implemented with the participation of respective EHS departments, AEC, and other Project Managers at U-M.

Technical Support

All referenced regulations and other documents are available through the EHS – Ann Arbor Environmental Protection Permitting Program (734) 647-1143 or email stormwater@umich.edu.

Referenced Documents

U-M, EP3

- Attachment A – U-M Stormwater Discharge Permit (NPDES)
- Attachment B – 90 Percent Annual Non-Exceedance Storms, March 2006 – MDEQ
- Attachment C – NOAA Atlas 14 Point Precipitation Frequency Estimates – NOAA
- Attachment D – Computing Flood Discharges for Small Ungaged Watersheds, June 2010 - MDNRE
- Attachment E – Post-Construction Stormwater Worksheet
- Attachment F – TR-55 CN Tables 2-2a through 2-2d
- Attachment G – Detention in Lieu Flowchart
- Attachment H – Ann Arbor 10 Digit HUC Map

U-M, AEC

- Design Deliverables
- Stormwater Management Procedure

Federal Regulations

- Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq.)

Michigan Regulations

- Michigan Act 451, Public Acts 1994, as amended, Part 31.
- Michigan Executive Orders 1991-31, 1995-4, and 1995-18.