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| --- | --- |
| Minnesota Pollution Control Agency (MPCA), 520 Lafayette Road North, St. Paul, MN 55155-4194 | Rapid Infiltration Basins Review Checklist  NPDES/SDS Permit Program  National Pollutant Discharge Elimination System (NPDES)/ State Disposal System (SDS)  Doc Type: Plan/Specification Review Summary |

**Purpose:** This checklist is intended for use by design engineers, to assist Minnesota Pollution Control Agency (MPCA) review engineers in the efficient review of planning and design documents. The information requested is the minimum technical data necessary for MPCA staff to review proposed designs and to determine whether there is reasonable assurance that the treatment system, when constructed, will comply with permit conditions, regulations, and criteria of the MPCA.

**Instructions:** The information in this checklist is based on Environmental Protection Agency Process Design Manuals, other accepted engineering and hydrogeological references, and MPCA recommendations. Specific references are listed where appropriate.

The checklist is designed so that a “**yes**” answer indicates compliance with references and MPCA recommendations.

A “**no**” answer indicates a deviation from references and MPCA recommendations. Answering “no” to any question will require justification that can be provided at the end of the checklist and possibly supporting information, to demonstrate how the intent of the recommendation will be met. Additional information may be requested based on site specific conditions.

A “**N/A**” answer means not applicable because the equipment associated with the question is not included in the design.

Wastewater Treatment Facility information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Date** (mm/dd/yyyy): | |  | **MPCA Project No:** |  |
| **Title of project:** |  | | | |

Permittee information

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Facility name: | |  | | | | |
| Contact name and title: | | |  | NPDES/SDS Permit No: | MN |  |
| Email: |  | | | Phone number: |  | |

Design Engineer information

|  |  |  |  |
| --- | --- | --- | --- |
| Contact name: |  | Contact phone number: |  |
| Email: |  |  |  |

**Phase:**   Planning Phase  Design Phase

Influent Characteristics

|  |  |  |
| --- | --- | --- |
| **AWW flow** |  | MGD |
| **CBOD5** |  | mg/L |
| **TSS** |  | mg/L |
| **Phosphorus** |  | mg/L |
| **Total Organic Carbon** |  | mg/L |
| **Total Kjeldahl Nitrogen** |  | mg/L |
| **NH4** |  | mg/L |
| **NO3** |  | mg/L |
| **Fecal Coliform** |  | MPN/100 ml |

Rapid Infiltration Basins/Soil Aquifer Treatment Units

*(Only use a “NA” answer if the equipment associated with the question is not included in the design)*

| ***Treatment*** | | **Yes** | **No** | **N/A** |
| --- | --- | --- | --- | --- |
| Is primary or secondary treatment provided before discharge to the rapid infiltration basins? | |  |  |  |
| Identify type of treatment provided prior to discharge to the basins: |  | | | |
| Number of days of storage: |  | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| If the effluent will be chlorinated, has the development of possible chlorinated organics been considered? | |  |  |  |
| Is the BOD5 influent loading less than 115 lbs/acre/day? (U.S. EPA October 1981) | |  |  |  |
| Is the BOD:nitrogen ratio greater than 3:1 for effective denitrification? (MOP 8 1998) | |  |  |  |
| Has a limiting design parameter been identified (BOD5, nitrogen, phosphorus, etc.)? (U.S. EPA September 2006) | |  |  |  |
| Identify limiting design parameter(s): |  | | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***Site Characteristics*** | | | | | | | |
| **Preliminary Site Investigation** | | | | | | | |
| Was a soil survey conducted for the site? | | | | |  |  |  |
| |  |  |  |  | | --- | --- | --- | --- | | Soil series | Water table depth, feet | Water table, kind | Extent, % | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | | | | | | | | |
|  | | | | | **Yes** | **No** | **N/A** |
| Is the site in an area that does not have karst geology? | | | | |  |  |  |
| Has additional site evaluation work been conducted if karst features exist on the site? | | | | |  |  |  |
| Has a karst inventory been conducted to assist in characterizing the risks of an effluent discharge to groundwater? | | | | |  |  |  |
| **Surface Information** | | | | | | | |
| Does the site show signs of disturbance compaction? | | | | |  |  |  |
| Are there any pipelines, cables, tile, etc. going through the site? | | | | |  |  |  |
| Identify type of obstructions on the site: | |  | | | | | |
| Are there any residences located near the site? | | | | |  |  |  |
| Identify location and direction of any residences: | |  | | | | | |
| Landscape position of suitable site: | |  | | | | | |
| General description of elevations and contours of the site and adjacent area: | |  | | | | | |
| Average slope of the site: | |  | % | Recommended grade less than 5% (U.S. EPA September 2006) | | | | |
| Are the basins located in an area that is not a drainageway that will receive significant amounts of runoff? | | | | |  |  |  |
| Are there adequate provisions to divert stormwater around the basins? | | | | |  |  |  |
| **Field Investigation** | | | | | | | |
| Have soil borings been conducted? | | | | |  |  |  |
| Number of acres of site: |  | | | | | | |
| Number of borings: |  | | | | | | |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Boring # | Location | Observed redox features | | Elevation of groundwater, ft | Elevation of bottom of basin, ft | | Elevation of surface, ft | Elevation of redox features, ft | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | | | | | | | | |
|  | | | | | | | |

|  | | | | | | | | | | **Yes** | | **No** | **N/A** | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Are there at least 3 piezometers installed in bore holes to collect data over an extended period of time, particularly in the spring? | | | | | | | | | |  | |  |  | |
| Number of piezometers installed: |  | | | | | | | | | | | | | |
| Are the piezometer readings provided in the plans and specifications? | | | | | | | | | |  | |  |  | |
| Has it been determined that the site is not tile drained? | | | | | | | | | |  | |  |  | |
| If tiled, is the tile lowering the readings in the piezometers? | | | | | | | | | |  | |  |  | |
| Is the use of tile under the basins to permanently lower the groundwater table avoided? | | | | | | | | | |  | |  |  | |
| Is it specified that the piezometers be backfilled according to code? | | | | | | | | | |  | |  |  | |
| **Groundwater Impacts** | | | | | | | | | | | | | | |
| Has a hydrogeologist assessed the site from a groundwater perspective? | | | | | | | | | |  | |  |  | |
| Is there a greater than 10 foot separation distance from the bottom of the basin to the groundwater? (U.S. EPA September 2006) | | | | | | | | | |  | |  |  | |
| Identify depth to water table from natural soil surface: | | | | |  | | feet | | | | | | | |
| Has it been determined that there are no regional long term groundwater fluctuations that may affect the system over the 20 year life? | | | | | | | | | |  | |  |  | |
| Has the hydraulic conductivity of the aquifer been determined? | | | | | | | | | |  | |  |  | |
| Has it been determined that there are no compacted or differing soil conditions downgradient which could change groundwater flow direction or impede flow? | | | | | | | | | |  | |  |  | |
| Has it been determined that there are no drawdown or artificial recharge (other onsites) that could be affecting groundwater flow direction? | | | | | | | | | |  | |  |  | |
| Has the groundwater flow direction been determined? | | | | | | | | | |  | |  |  | |
| Identify direction of flow: |  | | | | | | | | | | | | | |
| Has the groundwater discharge area been identified? | | | | | | | | | |  | |  |  | |
| Method used to identify groundwater discharge area: | |  | | | | | | | | | | | | |
| Has a groundwater study been conducted to determine deleterious effects if site is in inland area? | | | | | | | | | |  | |  |  | |
| Are there wells between the rapid infiltration basins and the discharge point? | | | | | | | | | |  | |  |  | |
| Has an expected groundwater mound height been determined? | | | | | | | | | |  | |  |  | |
| Method used to evaluate mounding: | | |  | | | | | | | | | | | |
| Are the basins designed to be long and narrow to minimize mounding? | | | | | | | | | |  |  | | |  | | |
| Will the distance from the bottom of the basin to the capillary fringe above the groundwater mound always be greater than 2 feet? (U.S. EPA September 2006) | | | | | | | | | |  |  | | |  | | |
| Can the system be managed to minimize mounding if necessary? | | | | | | | | | |  |  | | |  | | |
| Will mounding of one basin cause hydraulic problems in adjacent basins? | | | | | | | | | |  |  | | |  | | |
| Travel time of pollutants: |  | | | in/hr | | | | | | | | | | | | |
| Configuration of contaminant plume: |  | | | | | | | | | | | | | | | |
| Describe the capacity of the aquifer to dilute the effluent: | | | |  | | | | | | | | | | | | |
| Has a survey been conducted to determine the characteristics of the nearby drinking water wells? | | | | | | | | | |  |  | | |  | | |
| Have nearby wells been tested to determine if groundwater drinking standards have already been exceeded? | | | | | | | | | |  |  | | |  | | |
| Identify wells within ¼ mile of the proposed site: | | | | | |  | | | | | | | | | | |
| Can groundwater drinking water standards be met at the property boundary? | | | | | | | | | |  |  | | |  | | |
| Has it been determined that there are no anticipated affects to receiving surface waters (NH4 and P)? | | | | | | | | | |  |  | | |  | | |
| Has a groundwater monitoring plan been developed to determine groundwater flow direction and its fluctuations throughout the seasons? | | | | | | | | | |  |  | | |  | | |
| Has it been determined that the groundwater flow direction will not be influenced by the groundwater mound? | | | | | | | | | |  |  | | |  | | |
| Identify location, proximity, and direction of water supplies: | | | | | |  | | | | | | | | | | |
| Identify groundwater flow/relation to possible contamination: | | | | | |  | | | | | | | | | | |
| **Soils** | | | | | | | | | | | | | | | | |
| Identify soil series at site: | | | | | |  | | | | | | | | | | |
| Identify landscape position: | | | | | |  | | | | | | | | | | |
| Identify number of borings: | | | | | |  | | | | | | | | | | |
| Identify type of borings: | | | | | |  | | | | | | | | | | |
| Identify number of pits: | | | | | |  | | | | | | | | | | |
| Identify quality of descriptions: | | | | | |  | | | | | | | | | | |
| Identify estimated seasonal watertable height: | | | | | |  | | feet | | | | | | | |
| Identify observed standing water in any borings: | | | | | |  | | | | | | | | | | |
| Identify depth to bedrock: | | | | | |  | | feet | Recommended separation distance of >10 feet from basin profile to bedrock (U.S. EPA September 2006) | | | | | | |
| Identify type of bedrock: | | | | | |  | | | | | | | | | | |
| Identify if geophysical data is needed: | | | | | |  | | | | | | | | | | |
| Identify flooding potential: | | | | | |  | | | | | | | | | | |
| Identify laboratory hydraulic conductivity test method conducted: | | | | | |  | | | | | | | | | | |
| Identify field infiltration test method conducted: | | | | | |  | | | | | | | | | | |
| Identify estimated hydraulic conductivity: | | | | | |  | | in/hr | Recommended soil permeability > 2.0 in/hr  (U.S. EPA September 2006 and MOP 8 1998) | | | | | | | |
| Identify the hydraulic conductivity of the most limiting layer in the soil profile: | | | | | |  | | in/hr | | | | | | | | |
| Identify depth to restricting layers: | | | | | |  | | | | | | | | | | |
|  | | | | | | | | | | **Yes** | **No** | | | **N/A** | | |
| Do the field infiltration test results compare well to the soil texture estimation of water movement? | | | | | | | | | |  |  | | |  | | |
| Is the site absent any lithogical discontinuities or abrupt textural changes? | | | | | | | | | |  |  | | |  | | |
| Are the soil textures considered suitable? Recommended sandy and sandy loams (U.S. EPA September 2006) | | | | | | | | | |  |  | | |  | | |
| Were chemical analyses conducted on the soils for effectiveness of treatment? (i.e., phosphorus removal) | | | | | | | | | |  |  | | |  | | |
| Are soil borings located in relation to the basin location on the plan sheet? | | | | | | | | | |  |  | | |  | | |
| Are the soil borings provided in the plans and specifications for the project? | | | | | | | | | |  |  | | |  | | |
| Are the site investigation cross sections shown on the plan sheets? | | | | | | | | | |  |  | | |  | | |

|  | | | | | | | | | **Yes** | **No** | | **N/A** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Basin Design*** | | | | | | | | |  |  | |  |
| Is the annual hydraulic loading rate calculated based on a percentage of the field infiltration measurement? (U.S. EPA September 2006) | | | | | | | | |  |  | |  |
| Is the annual hydraulic loading rate in the range of 50 to 100 feet/year for effective nitrogen removal? (MOP 8 1998) | | | | | | | | |  |  | |  |
| For effective nitrogen removal, is the soil profile of the basin 10 feet or deeper to ensure adequate detention time at 100 feet/year hydraulic loading rate? (MOP 8 1998) | | | | | | | | |  |  | |  |
| Is the annual hydraulic loading rate less than 400 feet/year? (U.S. EPA October 1981) | | | | | | | | |  |  | |  |
| Is the total square feet of basin bottom adequate? | | | | | | | | |  |  | |  |
| Is the number of basins adequate for dosing and resting? Determination based on treatment level of effluent to basin and loading cycle objective. (U.S. EPA September 2006 and MOP 8 1998) | | | | | | | | |  |  | |  |
| Is the wet/dry ratio for secondary effluent less than 0.1 where nitrification or maximum hydraulic loading is the objective, or 0.5 to 1.0 where nitrogen removal is the treatment objective? (U.S. EPA September2006) | | | | | | | | |  |  | |  |
| Will each basin be dosed for a period of 1 to 7 days and then rested for 6 to 20 days? (MOP 8 1998) | | | | | | | | |  |  | |  |
| Is the hydraulic loading rate less than 3 inches per day? | | | | | | | | |  |  | |  |
| Are there a minimum of three rapid infiltration basins? (U.S. EPA October 1981) | | | | | | | | |  |  | |  |
| Are there enough basins so one is always available for loading? (U.S. EPA September 2006) | | | | | | | | |  |  | |  |
| Do the dike slopes range from 1:1 to 1:2? (U.S. EPA September 2006) | | | | | | | | |  |  | |  |
| Is the height of the basins such that there will be 1 foot of freeboard? (U.S. EPA September 2006) | | | | | | | | |  |  | |  |
| Is the size of the basins such that the basins will completely fill? | | | | | | | | |  |  | |  |
| Are spillways designed in the dikes to allow for emergencies? | | | | | | | | |  |  | |  |
| Will the dikes and berms be planted with grass or covered with rip rap to prevent erosion? | | | | | | | | |  |  | |  |
| Can the basins be accessed for maintenance? | | | | | | | | |  |  | |  |
| Is the configuration such to allow for easy maintenance with equipment? (i.e., corners) | | | | | | | | |  |  | |  |
| Is the use of gravel to cover the basins avoided? (U.S. EPA September 2006) | | | | | | | | |  |  | |  |
| If flooding around the basins is expected, will the outside of the dike be rip rapped? | | | | | | | | |  |  | |  |
| ***Construction*** | | | | | | | | | | | | |
| Provide general description of work: |  | | | | | | | | | | | |
| **Planning** | | | | | | | | | | | | |
| Has an earthwork balance been performed? | | | | | | | | |  |  | |  |
| Is borrow needed for the project? | | | | | | | | |  |  | |  |
| Have borrow and disposal areas been identified in the plan set? | | | | | | | | |  |  | |  |
| If filling is needed to obtain basin subgrade elevations, will the fill material be placed to provide stability without decreasing the permeability? | | | | | | | | |  |  | |  |
| Will vegetation, topsoil and other unsuitable materials be removed from the area where the embankment is to be located? | | | | | | | | |  |  | |  |
| Has relatively incompressable material free of organic matter, debris, and rocks been located? | | | | | | | | |  |  | |  |
| If excessive volume shrinkage is anticipated due to a high percentage of rocks, has the effect of how this will diminish the usable material for construction been taken into consideration? | | | | | | | | |  |  | |  |
| Has the material been tested for optimum moisture content and density? | | | | | | | | |  |  | |  |
| Is the contractor responsible for testing the material? | | | | | | | | |  |  | |  |
| Is a statement made that it is the contractor’s responsibility to determine to their satisfaction the location and nature of all surface and subsurface soil and water conditions which will be encountered during construction? | | | | | | | | |  |  | |  |
| **Project Specifications – Basin Bottom** | | | | | | | | | | | | |
| Do the project specifications indicate that erosion control must be practiced so that no fines enter the basins during construction? | | | | | | | | |  |  | |  |
| Do the project specifications indicate that topsoil will be removed from the entire basin site? | | | | | | | | |  |  | |  |
| Do the project specifications indicate where the topsoil will be disposed of? | | | | | | | | |  |  | |  |
| Do the plans and specifications indicate that the basin infiltrative surface will not be compacted during construction? (U.S. EPA September 2006) | | | | | | | | |  |  | |  |
| Is it specified that finished elevations of the basin bottom not be more than 0.2 feet from the average elevation of the bottom? | | | | | | | | |  |  | |  |
| Is it specified that the basin bottom uniformity will be verified by a minimum of one spot elevation per 5,000 square feet? | | | | | | | | |  |  | |  |
| Is it specified that deviation from stated tolerance shall be corrected prior to prefilling? | | | | | | | | |  |  | |  |
| **Project Specifications – Embankment Subgrade** | | | | | | | | | | | | |
| Is it specified that the subgrade will be scarified and compacted to a depth of 6 inches? | | | | | | | | |  |  | |  |
| Identify compaction method: | | |  | | | | | | | | | |
| Is it specified that the slope will be benched or flattened to less than 4:1, if the dikes will be built into natural slopes? | | | | | | | | |  |  | |  |
| **Project Specifications – Dike Core Materials** | | | | | | | | | | | | |
| Is it specified that the soil be relatively incompressible and tight? | | | | | | | | |  |  | |  |
| Is it specified that the soil be free of organic matter, vegetation, debris and rocks? | | | | | | | | |  |  | |  |
| Is it specified that topsoil will not be used for more than the outside of the 1:1 slope down and outward from the shoulder lines? | | | | | | | | |  |  | |  |
| Has a maximum rock size been specified? | | | | | | | | |  |  | |  |
| Is a cross section provided on the plans that identifies the materials for construction of the dike? | | | | | | | | |  |  | |  |
| Is a density specified? | | | | | | | | |  |  | |  |
| Is a moisture content specified? | | | | | | | | |  |  | |  |
| Do the specifications generally agree with MnDOT 2106.3? | | | | | | | | |  |  | |  |
| Is a maximum lift thickness specified? | | | | | | | | |  |  | |  |
| Is there any settlement time specified before structure placement? | | | | | | | | |  |  | |  |
| Is it specified that the outside of the dike will be covered by topsoil for seeding purposes? | | | | | | | | |  |  | |  |
| Identify the testing to be conducted during placement of the material: | | | | | |  | | | | | | |
| Identify what is specified for inspection while the material is being placed: | | | | | | | |  | | | | |
| Is it specified that 4 inches of fertile topsoil will cover all disturbed areas? | | | | | | | | |  |  |  | |
| Is there a specification for topsoil? | | | | | | | | |  |  |  | |
| Is there a specification for vegetation? | | | | | | | | |  |  |  | |
| Identify a seeding rate: | |  | | | | | | | | | | |
| Identify a seeding date: | |  | | | | | | | | | | |
| Identify fertilizer to be applied and rate: | | | | | Nitrogen | |  | | lbs/acre | | | |
| Phosphorus | |  | |
| Potassium | |  | |
| Is there a specification for mulch? | | | | | | | | |  |  | |  |
| Is there a specification for weed control? | | | | | | | | |  |  | |  |
| Is there a specification for a watering schedule? | | | | | | | | |  |  | |  |
| Identify who will conduct the watering: | | | |  | | | | | | | | |
| Identify the source of the water to be used: | | | |  | | | | | | | | |
| Is it specified that vegetation will be established from the outside toe to the minimum basin operating depth? | | | | | | | | |  |  | |  |
| Is the area to be reseeded identified on the plans and addressed in the specifications? | | | | | | | | |  |  | |  |
| Is there a specification to address erosion control during construction? | | | | | | | | |  |  | |  |
| Is there a specification to provide additional erosion control, if needed, on the exterior dike slopes to protect from severe flooding? | | | | | | | | |  |  | |  |
| **Project Specifications - Testing Requirements** | | | | | | | | | | | | |
| Is it specified that all soil test results: density, permeability, and moisture content for all the dikes will be submitted for approval? | | | | | | | | |  |  | |  |
| Is it specified that the results of a survey of the basin bottom, demonstrating that the level is within the proper tolerances, be submitted for approval? | | | | | | | | |  |  | |  |
| Is a seepage test specified to determine seepage performance? | | | | | | | | |  |  | |  |
| Is an acceptable seepage rate specified? | | | | | | | | |  |  | |  |
| ***Operation & Maintenance, Monitoring, and Permit Requirements*** | | | | | | | | | | | | |
| Is the groundwater monitoring adequate? | | | | | | | | |  |  | |  |
| Are piezometers located in the basins to check for groundwater mounding? | | | | | | | | |  |  | |  |
| Does the permit indicate monitoring frequency for wells and piezometers? | | | | | | | | |  |  | |  |
| Does the permit indicate maximum groundwater mounding and maximum contaminant concentration at the property boundary? | | | | | | | | |  |  | |  |
| Does the permit specify effluent quality into the basins? | | | | | | | | |  |  | |  |
| Is equipment available to maintain the basin? | | | | | | | | |  |  | |  |
| Does the Operation & Maintenance Manual state that surface scarification will be conducted every  6-12 months? | | | | | | | | |  |  | |  |
| If the basins will be operated in the winter, are winter operational details provided in the Operation & Maintenance Manual? | | | | | | | | |  |  | |  |
| Have heating costs been incorporated into the operating budget if there will be discharge to the basins in the winter? | | | | | | | | |  |  | |  |

|  |
| --- |
| Justification for all questions answered with a “no”: |
|  |
| Additional comments: |
|  |

**References**

U.S. EPA (October 1981) *Process Design Manual for Land Treatment of Municipal Wastewater* Center for Environmental Research Information, U.S. Environmental Protection Agency, Cincinnati OH. (U.S. EPA October 1981)

U.S. EPA (September 2006) *Process Design Manual, Land Treatment of Municipal Wastewater Effluents* Land Remediation and Pollution Control Division, National Risk Management Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati OH. (U.S. EPA September 2006)

WEF (1998) *Design of Municipal Wastewater Treatment Plants, Manual of Practice No. 8*, Water Environment Federation, Alexandria, VA. (MOP 8 1998)

**Acronym definitions**

AWW average wet weather

CBOD5 carbonaceous biochemical oxygen demand

ft feet

in/hr inches per hour

lbs/acre pounds per acre

lbs/acre/day pounds per acre per day

mgd million gallons per day

mg/L milligrams per liter

ml milliliter

MPN most probable number

NH4 ammonium

NO3 nitrate

P phosphorus

TSS total suspended solids