# Chapter 4. Best Management Practice (BMP) Selection Process

This chapter provides guidance on selecting specific BMPs based on the target pollutant(s) (total suspended solids, dissolved metals, oil, and/or nutrients) or flow control method (infiltration, dispersion, or detention). As described in Section 1-3.4 of this manual, other guidance documents (HRM, SMMWW, SMMEW, or locally approved and equivalent manuals) should be consulted first to determine water quality treatment and flow control thresholds and requirements.

## 4-1. Flow Control Requirements

Based on a review of the applicable guidance documents, the project proponent will determine the following:

1. Is flow control required (based on thresholds and receiving water status)?
2. What level of flow control is required? For most projects in Washington, flow control facilities must be designed to match predeveloped peak flows and durations, from one-half of the 2-year to the 50-year design storm using the Western Washington Hydrologic Model (WWHM), MGSFlood, or another approved continuous hydrologic model, with predeveloped conditions modeled based on forested conditions. For eastern Washington, nonexempt projects are required to limit the peak rate of runoff to 50 percent of the predeveloped or existing 2-year peak flow, maintain the predeveloped or existing 25-year peak runoff rate, and demonstrate that the entire 2-year runoff volume from the proposed development condition shall be released at no more than 50 percent of the predeveloped or existing 2-year peak flow rate.

If flow control is required, the project proponent should consult Chapter 5 of this manual to determine whether the site is suitable for infiltration.

## 4-2. Treatment Targets

There are four runoff treatment targets:

- Total suspended solids removal (referred to by Ecology as basic treatment)
- Dissolved metals removal (referred to by Ecology as enhanced treatment)
- Oil control

- Phosphorus control (most nutrient-impaired water bodies in Washington are phosphorus limited).

## 4-3. Source Control BMPs

Source control BMPs are the preferred method of decreasing pollutant loads in stormwater. BMPs such as covering materials, providing secondary containment and good housekeeping measures such as regular sweeping that keep pollutants out of runoff are usually more effective and less expensive than treating runoff after the pollution has occurred.

Certain types of activities and facilities may also require pollutant source control BMPs. For detailed descriptions of the source control activities and associated BMPs, see Section 2.2 of Volume IV of the SMMWW (Ecology 2005) and Chapter 8 of the SMMEW (Ecology 2004). The project may have additional source control requirements as a result of area-specific pollution control plans (e.g., watershed or basin plans, water cleanup plans, groundwater management plans, or lake management plans), ordinances, and regulations.

## 4-4. Selection Process for Flow Control BMPs

This section provides guidance to the designer for selecting permanent BMPs for flow control for airport projects. Details for planning and design of each BMP are found in Chapter 6, with the BMPs presented in numerical order. (All BMPs contained in this manual contain the prefix "AR" for "Airport Runoff" to set them apart from similar BMPs in the SMMEW (Ecology 2004), SMMWW (Ecology 2005), or the HRM (WSDOT 2008a). The flow control BMP selection process described below applies if flow control applies to the project.

It is anticipated that the user of this manual will be directed here by requirements in the Ecology manuals or HRM (see Section 1-3.4). These thresholds include the amount of new or replaced impervious surface, landscaping, or other concerns. In addition, the use of the ASDM may be required as a condition of watershed plans or stormwater permits.

Once the designer has been directed to use this manual, they should complete a preliminary task, shown in Figure 4-1 (identification of wildlife of concern) using the methods described in Chapter 3. Different wildlife species may influence the choice of facilities, structural design of stormwater facilities, the vegetation mix used for the facilities, and/or operation and maintenance of the facilities. For example, Section 3-4 identifies some specific design modifications that should be implemented for BMPs depending on the species of concern, such as fencing around detention ponds if deer are of concern.

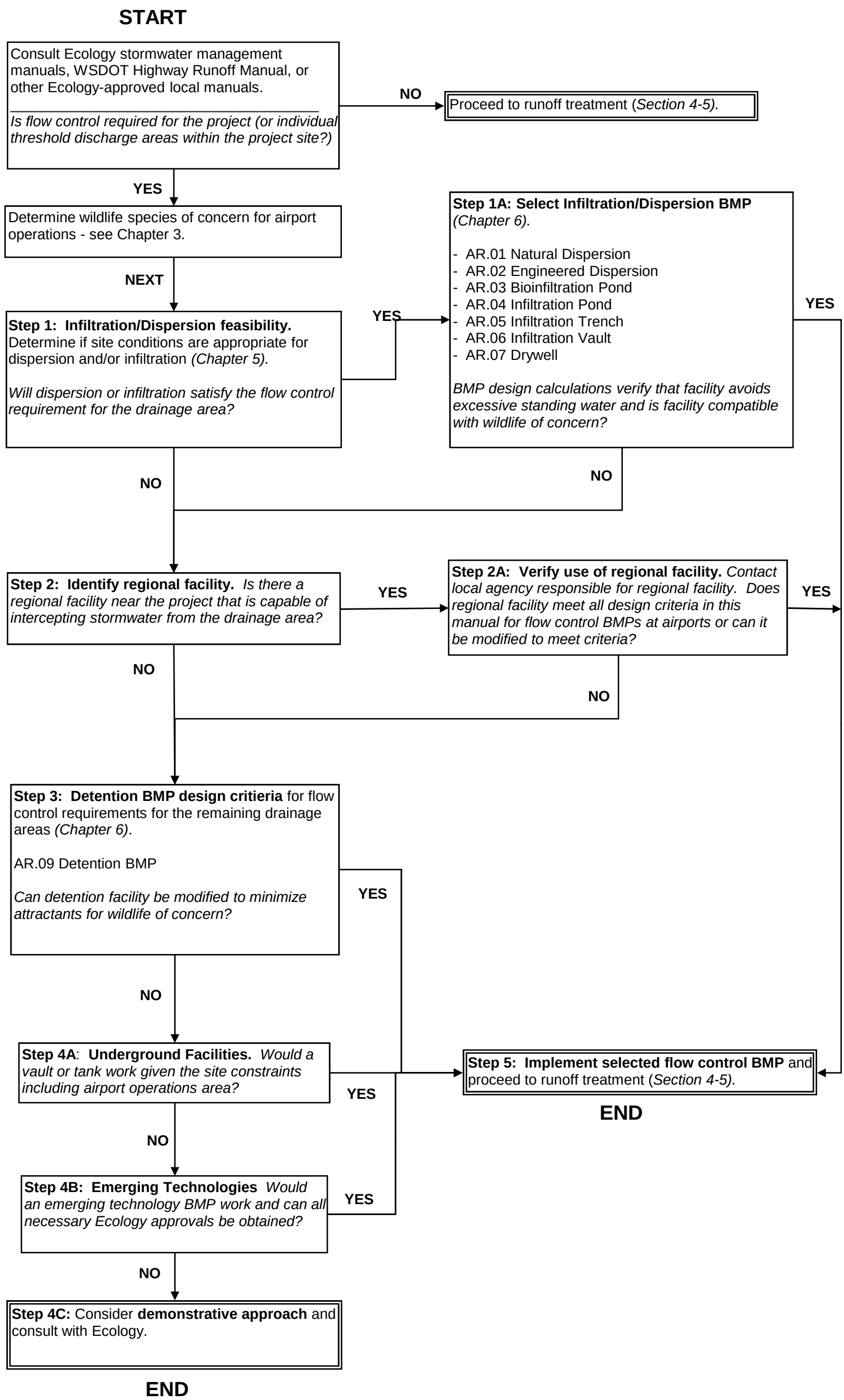


**Figure 4-1. Airport Runoff Manual, Flow Control BMP Selection Process**

## 4-4.1. Step 1: Determine if Site Conditions are Appropriate for Dispersion and/or Infiltration

As Figure 4-1 shows, dispersion or infiltration is the first choice to manage runoff from airport projects. Not only does dispersion/infiltration lessen downstream impacts on natural resources and infrastructure, but dispersion/infiltration facilities are less likely than open water facilities to attract wildlife that are potentially hazardous to aircraft (if the facilities are designed in accordance with the guidelines in Chapter 6 of this manual to ensure that they do not have standing water for extended periods of time). In addition, dispersion or infiltration will often have less infrastructure costs than a piped system.

The decision to be made in Step 1 is whether dispersion or infiltration will satisfy the flow control requirement for the project. If space for the facility is limited or other physical factors such as steep slopes or impermeable soils preclude the successful use of dispersion or infiltration, then continue to Step 2. Otherwise, proceed to Step 1A to determine which type of dispersion or infiltration BMP is most appropriate.

## 4-4.2. Step 1A: Select Infiltration/Dispersion BMP

Dispersion BMPs include AR.01 – Natural Dispersion and AR.02 – Engineered Dispersion. Either of these dispersion options can be used at airports, with natural dispersion typically preferred if site soil conditions, vegetation, and topography are appropriate and the vegetation does not unduly attract wildlife or present a hazard for aircraft.

The designer should consult the detailed design criteria for dispersion/infiltration facilities in Chapter 6 before making a final decision on the use of these facilities.

If dispersion is not possible because of land use, soils, or space limitations, infiltration BMPs may be applied instead. This manual contains five types of infiltration facilities:

- AR.03 – Bioinfiltration Pond (for use in eastern Washington only)
- AR.04 – Infiltration Pond
- AR.05 – Infiltration Trench
- AR.06 – Infiltration Vault
- AR.07 – Drywell.

Any of these facilities may be appropriate for use at airports, provided that they are designed in accordance with the design guidelines in Chapter 6 of this manual.

If a dispersion or infiltration BMP is identified as technically feasible and suitable for airports based on the design guidelines and restrictions in Chapter 6 of this manual, proceed to Step 5. If soils meet the site suitability criteria (SSC) for infiltration treatment in Chapter 5 (soil infiltration rate in SSC 4 and physical and chemical characteristics in SSC 6), dispersion and infiltration are assumed to provide adequate runoff treatment, and additional BMPs are not needed in most cases. If dispersion and infiltration are not suitable, the designer should go to Step 2 to evaluate the use of regional flow control facilities.

## 4-4.3. Step 2: Identify Regional Facility

In some locations, a regional facility may be near the airport that could be used for flow control. One of the key considerations is whether it is feasible to route flows from impervious airport surfaces to the regional facility. Possible regional facilities include those constructed for industrial or office parks adjacent to the airport and stormwater facilities constructed by an adjacent municipality.

If a potential regional facility is identified, proceed to Step 2A, otherwise go to Step 3.

## 4-4.4. Step 2A: Determine Feasibility of Regional Facility

Step 2A determines whether airport use of the regional facility is feasible or not. The regional facility should be examined in view of the design guidelines presented for the BMPs in Chapter 6 of this manual. For instance, the most common regional facilities are detention ponds. The design guidelines for detention ponds (BMP AR.09) in Chapter 6 should be consulted to assess suitability. In addition, many regional facilities do not have adequate capacity to effectively manage additional stormwater. A regional facility often does not have enough storage capacity available to accommodate flows from new or redeveloped areas of any substantial size and still meet applicable flow control standards. This is especially true for older facilities that were designed according to less stringent stormwater requirements.

Another concern is that the regional facility may be located near the airport and present a hazard to aircraft by attracting birds and other hazardous wildlife. Airport operators may not want to contribute to a facility that may already cause wildlife hazards, unless participation by the airport may present an opportunity to improve the facility by contributing to physical modifications, such as covering an otherwise exposed water surface (see Section 3-4).

If an appropriate regional facility is available or can be modified, then proceed to Step 5. If an appropriate regional facility is not available, continue to Step 3 to assess the use of detention facilities.

## 4-4.5. Step 3: Determine Feasibility of Detention Pond

Detention ponds (BMP AR.09) are the only type of surface detention BMP recommended for airports, because they are designed to drain completely between storms. The use of combined detention and treatment ponds (BMP CO.01 from the HRM or BMP T10.40 from the SMMWW) is not recommended for airside locations because they include a wet pool, which is a permanent pool of water intended for water quality treatment. Stormwater treatment wetlands (BMP T10.30 from the SMMWW) are also not recommended because they too have a permanent pool of water. They also have vegetation that may be attractive to hazardous wildlife.

Note: Detention pond design must address other issues, such as setback distance from an AOA and modifications to minimize attractants. In addition to the design modifications, the vegetation in or around the detention pond may need to be adjusted or additional controls, such as netting or fencing (see Section 3-4) may need to be used, depending on the hazardous wildlife that was identified in the preliminary step.

If a detention pond can be designed according to the detailed guidelines in Chapter 6, go to Step 5. If the detention pond is not feasible, go to Step 4A.

## 4-4.6. Step 4A: Determine Feasibility of Detention Vault or Tank

If none of the flow control BMPs introduced in the preceding steps is feasible, determine whether a detention vault (AR.10) or a detention tank (AR.11) will work.

If these BMPs are not feasible for the site or project, proceed to Step 4B.

## 4-4.7. Step 4B: Emerging Technologies

Emerging technologies are water quality treatment BMPs that have been evaluated by Ecology and have one of three designations: general use level designation (GULD), conditional use level designation (CUD), or pilot level designation (PLD). Technologies with a GULD may be used without additional approval for the designated treatment category (basic, enhanced, etc.), while Ecology approval would be required for technologies that are designated as PLD or CUD. Additional information on proprietary presettling devices may be found at Ecology's website (Ecology 2008a).

At this time, no emerging technologies have been formally approved by Ecology for flow control, but preliminary data for some BMPs, such as the media filter drain or compost amended vegetated filter strip (CAVFS), both of which were originally developed by WSDOT for runoff treatment, show potential for decreasing flows as well. The use of these technologies requires pilot or conditional use approval from Ecology if proposed for flow control.

If no suitable emerging technology BMPs are identified, the user should proceed to Step 4C.

### 4-4.8. Step 4C: Consider Demonstrative Approach

If the project proponent believes that the project will comply with state and federal water quality protection laws without implementing completely the minimum requirements of the Ecology manuals (including flow control) or BMPs in this manual, the project proponent may work with Ecology to implement a monitoring program to demonstrate that proposed alternatives will be adequate. See Section 1.6.3 of Volume I of the SMMWW for more information on the "presumptive" versus the "demonstrative" approach.

### 4-4.9. Step 5: Implement Selected Flow Control BMPs

The final step is to implement whichever flow control BMPs are selected as most appropriate for the airport site. Detailed guidance on flow control BMP design is provided in Chapter 6.

If the selected BMP only addresses flow control, such as a detention pond or detention vault, then the user must also select an additional BMP to provide runoff treatment (Section 4-5). Other BMPs, such as dispersion or infiltration, are intended to both control flows and treat runoff, and their selection indicates that the user does not have to add separate treatment BMPs.

Note that several BMPs that were formerly considered to be "Category 1" BMPs by WSDOT (WSDOT 2006a) due to cost-effectiveness concerns are included in the Flow Control selection process. Some BMPs formerly referred to as "Category 2" BMPs (WSDOT 2006b) are now included as Emerging Technologies. These changes were intended to broaden the suite of potential BMPs for use near airports.

## 4-5. Selection Process for Runoff Treatment BMPs

Runoff treatment BMPs selected for airports must meet the applicable federal, state, and local water quality treatment standards without compromising aircraft safety. The runoff treatment BMP selection process in this manual differs from that in the HRM and Ecology manuals to reflect the unique safety concerns at airports. In addition to avoiding wildlife attractants, BMPs sited at airside locations must meet soil compaction and other structural design criteria to ensure that aircraft, emergency vehicles and snow removal equipment can be supported adjacent to airport operation areas. The safety concerns must be part of the selection process. Specifically, preferred treatment BMPs for airports include media filtration systems, vaults, and biofiltration facilities, many of which have been discouraged for WSDOT roadway projects because of cost or maintenance considerations. Some of these are known as Category 1 BMPs (WSDOT 2006a). At airports, however, these underground facilities are preferred over traditional wet pool facilities.

The selection process for runoff treatment is shown in Figure 4-2 and detailed below.

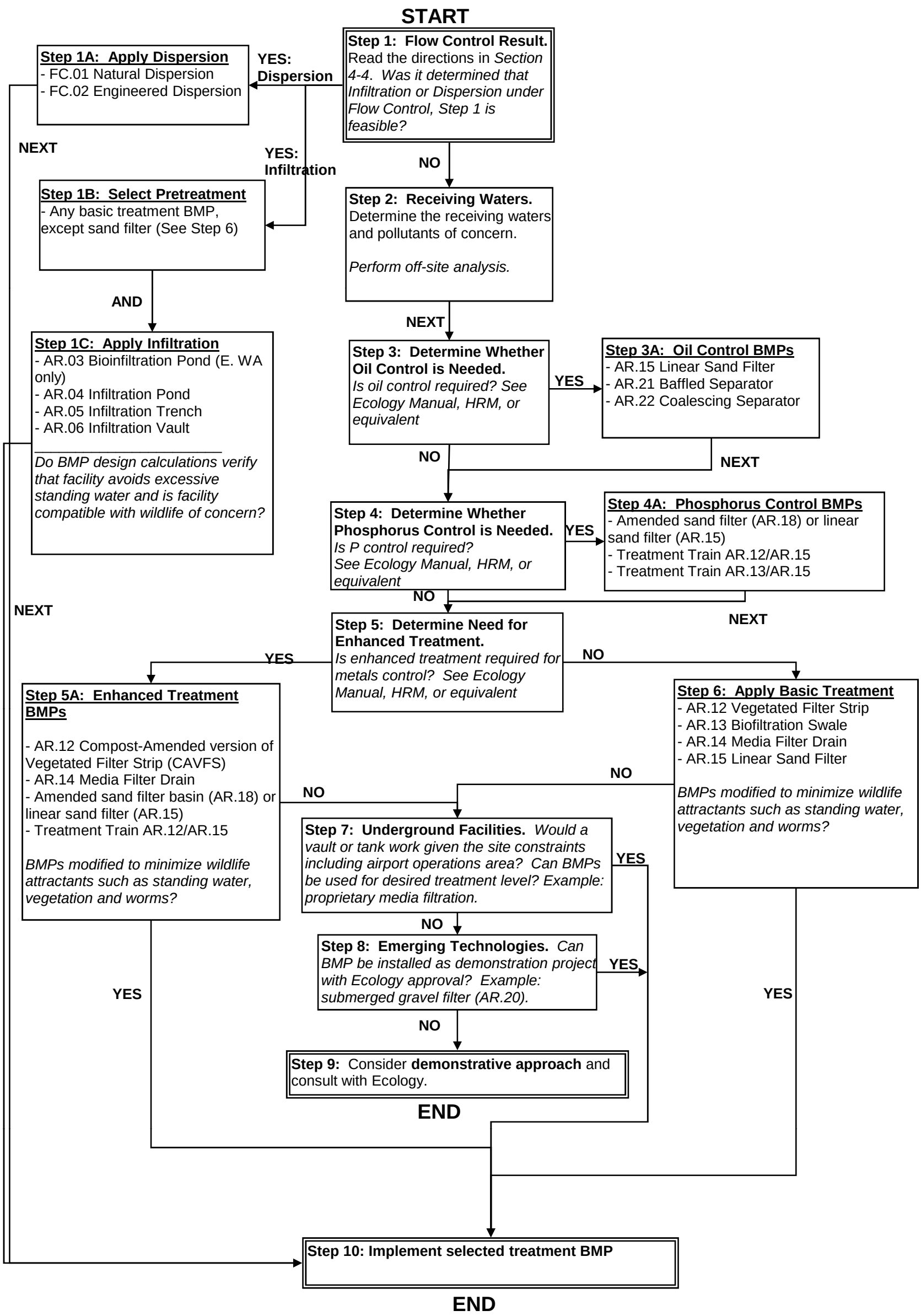


**Figure 4-2. Airport Runoff Manual, Runoff Treatment BMP Selection Process**

## 4-5.1. Step 1: Flow Control Result

If flow control is required and dispersion or infiltration BMPs are selected in Section 4-4.2, then proceed to Step 1A below for dispersion or Steps 1B and 1C for pretreatment and infiltration. Otherwise, go to Step 2. In some cases where flow control is not required, such as when discharging into an exempt water body, dispersion and infiltration should be examined for runoff treatment only.

## 4-5.2. Step 1A: Dispersion BMPs

If natural dispersion (AR.01) or engineered dispersion (AR.02) is selected as the flow control BMP, then it is also considered to meet runoff treatment criteria. Go to Step 10.

## 4-5.3. Step 1B: Select Pretreatment BMPs

Premature clogging of the filtration media or soils is the most common problem with infiltration facilities. If infiltration is chosen as the flow control BMP for the site, a pretreatment facility should also be selected. Pretreatment facilities include basic treatment BMPs (Step 6), such as a vegetated filter strip (BMP AR.12) or biofiltration swale (BMP AR.13). These BMPs should be used to remove the coarse particulates and debris in runoff that might clog the infiltration facility. Note that the linear sand filter (BMP AR.15), also a basic treatment BMP, is not recommended for pretreatment. As indicated in the individual BMP design guidelines in Chapter 6, the use of presettling basins is not recommended because of standing water concerns.

Note: Where applicable, the vegetation mix in the pretreatment BMP(s) should reflect the wildlife of concern for the airport (see Chapter 3 and Appendix A).

After selecting a pretreatment BMP, proceed to Step 1C.

## 4-5.4. Step 1C: Infiltration BMPs

Consult the hydrology section of this manual (Chapter 5) to determine whether site conditions are suitable for infiltration, if this was not already done as part of the flow control evaluation.

If infiltration can be used for runoff treatment at the site, proceed to Step 10.

## 4-5.5. Step 2: Receiving Waters

Different treatment requirements may apply depending on the water body that receives the runoff from the project site. The user should determine the receiving water and corresponding pollutants of concern based on Minimum Requirement 6 (Section 1-3.4 of this manual).

## 4-5.6. Step 3: Determine Whether Oil Control is Needed

For airports, refueling or maintenance activities are the primary sources of petroleum contamination in stormwater runoff; therefore, the user should proceed to Step 3A if either one of these activities occurs within the area served by the treatment BMP. If not, proceed to Step 4.

## 4-5.7. Step 3A: Oil Control BMPs

If oil control is required, select one of the following facilities specifically designed for oil removal:

- Linear sand filter (BMP AR.15)
- Baffle-type (API) oil/water separator (BMP AR.21)
- Coalescing plate separator (BMP AR.22).

These oil control devices do not work well with heavy sediment loads, so pretreatment should be included.

Catch basin inserts may be used on occasion to retrofit existing stormwater inlets, but special care must be taken to avoid clogging and slow drainage on runways and taxiways. In addition, frequent maintenance may preclude their use in heavily traveled areas of the airport.

More complex oil treatment facilities may be used in some airport applications, such as the industrial wastewater system (IWS) using dissolved air flocculation, but these are more expensive and more appropriate for indoor service facilities or if specifically required in a water quality permit. After selecting an oil control BMP, proceed to Step 4.

## 4-5.8. Step 4: Determine Whether Phosphorus Control is Needed

If the project is located in a designated area requiring phosphorus control as prescribed through an adopted basin plan or water cleanup plan/TMDL, then runoff treatment for phosphorus is required and the user is directed to Step 4A. If phosphorus control is not required, proceed to Step 5.

## 4-5.9. Step 4A: Phosphorus Control BMPs

If phosphorus control is required, the user must select one of the following methods for treatment:

- Media Filter Drain (BMP AR.14)
- Linear Sand Filter [with enhanced media] (BMP AR.15)
- Sand Filter Basin [with enhanced media] (BMP AR.16)
- Treatment Train Approach, using pretreatment (AR.12 or AR.13) with a linear sand filter (AR.15).

After selecting a phosphorus control BMP, proceed to Step 5.

## 4-5.10. Step 5: Determine Whether Enhanced Treatment is Needed

Enhanced treatment is required when elevated concentrations of metals in stormwater runoff are likely to result in adverse impacts on aquatic organisms. The user should first check with Minimum Requirement 6 in the applicable Ecology stormwater manual (eastern or western Washington) for a list of water bodies that require only basic treatment for stormwater runoff. If the receiving water for the airport is on this list, proceed to Step 6.

Section 2.1 of the SMMWW includes thresholds for determining whether enhanced treatment is required. There are no airport-specific water quality enhanced treatment requirements. However, monitoring at some larger airports, such as the Seattle-Tacoma International Airport (Sea-Tac), has shown high metal concentrations in some samples (RW Beck and Parametrix 2006). These include landside areas with high traffic volumes, such as parking garages, terminal areas, and airside locations, such as service and fueling areas or touchdown areas of the runways. Where feasible, the most effective control measure is removing or covering the source of metal, such as painting galvanized roofing or covering aircraft service areas. Basic treatment appears effective for treating most runoff from runways and taxiways. However, in some cases, such as landside parking lots, enhanced treatment is recommended to address potential toxicity issues associated with fish exposure to dissolved metals.

If enhanced methods are required for runoff treatment, the user should proceed to Step 5A. Otherwise proceed to Step 6 for selection of a basic treatment BMP.

## 4-5.11. Step 5A: Enhanced Treatment BMPs

The enhanced treatment BMPs are similar in configuration to basic treatment BMPs, but with amendments added to the filter media or soil to enhance the removal of dissolved metals. Some amendments may also help remove phosphorus.

After selecting an enhanced treatment BMP, proceed to Step 10. If an enhanced treatment BMP is required but a suitable BMP cannot be identified or sited as part of Step 5A, proceed to Step 7.

## 4-5.12. Step 6: Basic Treatment BMPs

Basic treatment BMPs are intended to provide general pollutant removal and do not have special media designed for extra treatment of specific pollutants, such as dissolved metals. Basic treatment BMPs that are suitable for airports include vegetated filter strips (BMP AR.12) and biofiltration swales (BMP AR.13). The wet pool BMPs listed in the HRM and in the Ecology manuals for basic treatment are not considered appropriate for airport settings because of the attraction of wildlife to a permanent pool of water.

After selecting a basic treatment BMP that meets the siting and other restrictions included in the design guidelines in Chapter 6, the user may proceed to Step 10. If a basic treatment BMP is required but a suitable method cannot be found or applied as part of Step 6, go to Step 7.

## 4-5.13. Step 7: Underground Facilities

If none of the runoff treatment BMPs introduced in the preceding steps is feasible, alternative measures must be investigated. If surface facilities will not work, underground facilities may be a possibility. An important advantage of underground facilities at airports is that they do not attract wildlife of concern. Combining media for filtration may enhance the pollution removal potential for these facilities.

However, underground facilities also have a number of limitations. Many are proprietary, and many have not received full approval from Ecology. Underground facilities should not be placed under the main runway because of maintenance concerns. Vaults and tanks for runoff treatment are not as desirable as surface facilities as they are generally less effective at pollutant removal because of space constraints. They also present maintenance difficulties and are usually more expensive than a surface facility, although space constraints may necessitate their use.

If underground facilities are not feasible or are cost prohibitive, an emerging technology, as described in Step 8, or the demonstrative approach, as described in Step 9, may be considered. Both of these options require approval from Ecology.

## 4-5.14. Step 8: Emerging Technologies

Emerging technologies are those BMPs showing promise for runoff treatment, but that have not yet received full approval from Ecology. In some cases they may be allowed only as a pretreatment facility or as part of a treatment train. A number of proprietary media filtration systems and a variety of vault-type BMPs fall into this category, as does the submerged gravel biofilter (AR.20). Ecology may allow these emerging technologies to be installed as a demonstration project, requiring additional review and/or monitoring.

If a suitable emerging technology BMP is identified and the necessary approvals are obtained, proceed to Step 10.

## 4-5.15. Step 9: Consider Demonstrative Approach

If the project proponent believes that the project will comply with state and federal water quality protection laws without implementing completely the minimum requirements of the Ecology manuals (including runoff treatment) or BMPs in this manual, the project proponent may work with Ecology to implement a monitoring program to demonstrate that the proposed alternatives will be adequate. See Section 1.6.3 of Volume I of the SMMWW for more information on the "presumptive" versus the "demonstrative" approach.

## 4-5.16. Step 10: Implement Selected Runoff Treatment BMPs

The final step in satisfying runoff treatment requirements is to implement whichever BMPs are selected as most appropriate for the airport site. Detailed guidance on runoff treatment BMP design is presented in Chapter 6. The BMP selected for runoff treatment should be combined with any additional BMPs selected for flow control if necessary.