


7. What would you change about the technical content in Volume III to increase its usefulness?

	Response Count
	106
answered question	106
skipped question	94

Comment

1. more graphic materials available to developers and other designers, perhaps as pdf's
2. More pictures of good examples. Cost benefit details to encourage developers to use LID techniques.
3. More suggestions for installation of BMP's to ensure they are constructed correctly.
4. Reinforce MDCIA and continue to discourage extended detention
5. ????
6. Develop interim and permanent BMP's specifically for roadway construction projects
7. Comments on called porous landscape detention in Vol III: It may be beneficial to incorporate on the first page the uses, benefits (pollutant removal/volume retention/peak discharge reduction) and considerations/limiting factors for uses of bioretention cells in a quick/simple chart. The opening paragraph may include porous landscape, bioretention cells, or rain gardens consists of natural or excavated low lying area consisting of a natural or engineered soil media to promote infiltration and pollutant removal. The use of sand bed may imply that sand is the only media being utilized. Utilizing the word engineered media or natural media meeting WCQV, pollutant removal and storage requirements may be utilized may clear up the confusion of "sand bed" Update Location: Bioretention cells may be utilized within new or retrofit projects to meet Water quality and quantity control and goals. Locations may include: There are multiple methods for design of cells. Should there be multiple methods incorporated? Is this method the best for "Colorado conditions?" The limiting factor for bioretention performance is the insitu soils, do we want to specify testing insitu soil? Benefits: peak reduction, pollutant removal, volume retention, increase aesthetics and land value. It would be beneficial to incorporate a list of native plants acceptable for Colorado. Within Figure PLD-1 it specifies irrigated turf grasses, the point of bioretention cells is to minimize irrigation. Therefore, it doesn't make sense to include irrigated turf grass in detail. Specify vegetated area utilizing native grasses and plants. Depth requirements vary, studies have proven for pollutant removal 2.5 feet is a minimum depth to promote growth of plants, and meet WQ goals. Within Figure PLD-1 may want to include a range of depths, depending on water retention, cost, pollutant removal and vegetation. Soil amendments or soil specifications may include incorporation various amounts of topsoil (for particular nutrient removal), compost for soil retention, and sand. A table specifying particular soil mix designs depending on applications would be helpful. (for instance if water quality is important, addition of topsoil would be beneficial, if water retention is important incorporation of compost, and infiltration is important the incorporation of sand is important). Additional considerations: should take into account: seasonal high groundwater table selection of plants (should be native, submerged (for short periods of time) and drought tolerant, consideration of amount of sun) location of cell: if near roadway or parking lot consideration should be given to stock piles of snow (ensure bioretention cell is not in location where snow plows will put piles) Construction instructions and specifications would be helpful. More typical sections and standard drawings would be helpful.

8. nothing
9. Not a one size fits all approach. Small sites require different things than large ones and I don't know how many times I specified a tiny WQ plate for a small pond because that is what the municipality knows and therefore wants. There is also a big discrepancy on swale slopes (2% versus something much less to slow down runoff). I also think that the spreadsheets are used blindly by engineers. If spreadsheets are to be provided, clear and easy to follow examples should be provided so that somebody could check it by hand, step by step. I have a very difficult time verifying the validity of the spreadsheets sometimes with the example problems that are provided and I have spent hours trying to do so. It's not just about plugging in numbers to the spreadsheet but understanding how the spreadsheet calculated the results. Also, we need more design guidelines for embankment riprap design (such as for emergency spillways or steep banks), trash rack on storm pipe recommendations, and riprap on storm outlets in detention ponds (do you size riprap for an empty pond, half full pond, etc) or are forays the only answer (again small versus big projects should be considered).
10. nothing
11. Nothing
12. We don't yet know. However, we may be moving towards numeric limits for nutrients on stormwater permits, so inclusion of techniques, data, references, etc, that point to BMPs that can be "relied" upon to meet future numeric standards may be useful. And, if numeric standards ever become a reality, this may seriously strengthen the need for programs that promote runoff reduction and LID techniques.
13. Volume II needs to be updated to reflect linear type projects such as roadways and non-channel trails. Currently, land use type projects are the emphasis of the document and linear projects are a different animal with its own set of issues and constraints. In addition, it would be nice to have a set of BMP's that could be used on linear projects and what effectiveness they provide.
14. I think it is important to consider/include BMP's appropriate for roadway widening/reconstruction projects and other public infrastructure projects in fully developed areas, rather than just the focusing on land development projects.
15. Make a section directed to planners (or others not completely comfortable with the technical jargon) that explains the general concept of the technical info.
16. Need to include information on BMP's for roadway widening in fully developed areas. Focus of Volume III seems to focus on parcels of land to develop, but not linear improvements such as roadways or trails.
17. Influence of LID techniques on 100-year detention volume requirements.
18. Not yet familiar enough to answer this.
19. works well for us
20. As many graphics as possible to help sell and to import into drawings. Information on cost comparisons between bad and good practices to help sell the idea to clients.
21. More specific design examples would be helpful. Also, information on what is LEEDs compliant would be useful.
22. More data and design tools on permeable pavements. Emphasis on BMP details being a starting point, and subject to site-specific modifications with engineering judgment.
23. NA
24. More guidance on Materials and Waste handling, esp. liquid waste
25. Discuss options and promote regional water quality treatment. I would like to see a fee in-lieu of WQ for urban in-fill with opportunities for end of pipe treatment,
26. More diagrams, less text
27. Not familiar enough to comment

28. Reduce the amount of concrete. The regional ponds are just plain ugly & overbuilt.
29. More examples of successful design, maintenance, and installation; more construction details; and cost (life cycle costs) information, where available
30. The manual should place performance guidelines on proprietary BMP's and IDF curves for the 80 percentile storm event.
31. Use more common terminology that reflects the method.
32. Create a section on LID with numerical methods to come up with reductions/credits for on-site detention so that designers and owners can obtain a credit for providing LID within their projects.
33. In my opinion, Volume III needs more clarification between required criteria and "suggested" or "typical" design specs.
34. Nothing
35. Quantify volume reductions better for BMP's such as grass swales, buffers, etc.
36. More examples with more graphics and more discussion about cost effective maintenance methods.
37. seems pretty complete
38. N/A
39. Include current mechanical treatment technologies
40. 1. More discussion of how to select the appropriate structural BMP's. 2. Discuss lessons learned from successful and unsuccessful structural BMP installations 3. Provide other structural BMP's for small sites and/or modifications to the standard structural BMP's acceptable for small sites. One size doesn't fit all.
41. Add some more guidance on nonstandard flow reduction BMPs.
42. More examples & worksheets
43. More construction details.
44. I wouldn't
45. broader examples
46. ???
47. Update non-structural BMPs section as well as structural Include Proprietary BMP information instead of "it won't work" - it is being used, so get on the leading edge and help improve the technology Include additional LID technical content Include underground systems in Manual
48. Don't use it often enough to give a good opinion?
49. Can't think of anything
50. Go back and tighten up the detail drawings, so they are more pertinent for construction. Some aspects are vague and could be improved. Also, see response to Q-9 regarding training.
51. BMPs for high-density urban development that work. We are asked to approve underground water quality systems frequently, but we haven't allowed any to date.
52. Provide volume based methodology
53. More content relative to limitations or factors that limit effective implementation of various BMPs. The construction process and attention to specific details regarding function can determine whether a BMP ultimately fails or functions well and there has never been much thought or guidance relative to construction. It may be appropriate to develop standard notes regarding the construction process that could be required on the project construction drawings.
54. ?
55. More examples for roadway projects

56. Significant guidance on retrofitting in already urbanized areas; stream daylighting
57. Not sure?
58. For wetlands channels, clarify the "n" values and velocities to use in the design. There seem to be contradictions in using the Constructed Wetlands Channel criteria in Volume III with the Composite Channels section in Volume II.
59. more details for BMPs that actually work and are widely used in the region
60. no suggestion.
61. Provide references and locations for other useful documents.
62. Need a user friendly summary version to introduce folks to the concepts
63. Many of the BMPs are not as cookie cutter as presented. Too many designers assume that what they see in the manual is all they need to know. Therefore, I'd add more detail. Let designers know that LID practices are custom made.
64. LID chapter and a model ordinance for LID implementation.
65. information pertaining to special districts such as CCBWQA including contacts and descriptions of regulations.
66. Better coordination with suppliers of related product (i.e. the CBP Manufacturer recommend a different detail than UDFCD)
67. It's hard to fit EDB's on small sites. Incorporate the pipe-integrated forebay and micropool designs from the SEMSWA manual. Also, I keep seeing designs that use sumps in roadway catch basins as BMP's, but the manual does not address these and provide guidance or recommendations.
68. ?
69. I think it's fine.
70. Have someone like Brian Greene write it
71. None
72. Just update what is there based on experience and new technologies that have developed since it was last updated
73. More examples
74. Forebay and micro pool design is difficult and often does not become incorporated into the designs. I have found that physically fitting these features into the BMP requires a significant amount of grading work.
75. I do not use it frequently enough to say if there should be certain changes made.
76. more results of local test cases of BMP effectiveness; results of maintenance testing; long term results & costs
77. Not much, I think it is a great document - some flexibility might be needed but could see how that could get abused or misused.
78. I think it is useful as is
79. More examples of successful LID practices and their cost comparisons to other structural BMPs. Simple or rule of thumb runoff reduction calcs would also be useful for convincing owners to pursue LID.
80. Maybe some documentation of successful facilities in the Metro area that could be used as a reference.
81. Haven't thought about it.
82. The document is less relevant than the Urban Drainage staff's willingness to be helpful.
83. add incentives to use BMP's
84. Recognize proprietary BMPs. Include and incorporate appropriate language recognizing when it is appropriate to consider using proprietary BMPs.
85. I would put some common sense into the applications for water quality. I would also

consider how valuable land is these days to allow for greater flexibility on tight sites. I would also consider mechanical treatments for quality in addition to underground water quality features. I would also consider practicality in uses such as downtown Denver in comparison to the single family residential neighborhoods.

86. Add better examples or more. Make some of the design worksheets a little more user friendly for people outside of engineering that don't use them frequently.
87. Provide technical data to support LID over traditional methods (i.e. provide design criteria that would account for LID's volume/flow rate reduction. This criteria would ideally lead to reducing the size of traditional infrastructure like detention ponds, storm sewer, and channels. Smaller sizing = saved money = LID promotion.
88. Update the construction details where necessary
89. do not know
90. Good as is.
91. The manual seems to emphasize the EDB as the only BMP that can be used. I am constantly asking the consultants to think beyond that BMP in their planning of their sites, especially now that the EDB has been limited in its use by Volume III.
92. more user friendly to non engineers
93. Review technical criteria and standards to ensure they meet current best practices. More clearly describe offsets for infiltration and other green infrastructure/low impact dev.
94. reflect new gravel & sand sections in PLD design and remove all mirafi from details. Include incentives matrix to encourage developers to perform onsite volume reductions.
95. N/A
96. Include performance measures for grassy swales and other items-stop encouraging so many EDB facilities
97. Add LID information.
98. Update the design forms to accomidate large developments with mulitple basins.
99. Quantification of runoff values for all BMP's and LID techniques, along with a corresponding reduction in water quality and detention volume requirements. Quantification of effectiveness of each treatment for TMDL or SS load reductions. Quantification of SS particle size effectiveness. Explicit details on recommended ways to construct all of the BMP's and LID techniques. Rain gardens need to be added to the selection. The manual refers to rain gardens and PLD's as the same BMP, but then the recommendations for PLD's prohibit the planting of anything but dryland grasses, and recommend sand bottoms. Grass does not do well in sandy soil, often requiring irrigation to survive, which is contrary to trying to reduce water consumption. Other plantings can and do work well in rain gardens, with the proper soil amendmets and proper plant choices. I would like to see more flexibility in the design of PLD's and rain gardens. Additionally, the time has come to embrace technological advances in stormwater management. There are hundreds of devices in production that can be effective for water quality and sediment management, that are not in the present manual. Examples are wattles, catch basin filters, manmade check dams; there are literally hundreds of them. Pumping of sediment-laden stormwater within water quality ponds needs to be addressed. All too often, in order to dewater a site, the very pollutants we are attempting to capture are pumped away from the site directly to a receiving storm sewer or open channel during construction. One of the most important additions needs to be the use of hydrodynamic separators for water quality treatment. The rest of the country, even the rest of the world has used them effectively for years. In many ways they can provide superior treatment, site usability, and improved maintenance accessibility. It's quite simple to have a truck access a separator from the surface in order to clean it. It's quite difficult to remove the sediment from above-ground ponds, and almost impossible to remove the sediment from detention and sand filter basins that have been installed in underground parking structures, or under buildings. The ban on underground treatment by UDFCD should be eliminated. Much more information needs to be included about appropriate

plantings for rain gardens, constructed wetland channels and detention basins, bioswales, and green roofs. There is much information from other parts of the country where a significant amount of rainfall occurs. There is very little information on arid climate plantings. One of the requirements for constructed wetland detention is to provide water balance calculations, yet there is no information available on how to do so. Trying to track down rain gauge information, and statistically apply it to a developed area in order to provide water balance calculations is difficult at best, and often impossible. It would be extremely helpful if UDFCD would provide the methodology and data required to calculate an accurate water balance. There are some developers willing to try constructed wetlands, but as an example on one recent project, the developer had to provide additional irrigation facilities to the detention basin before approval would be granted to build the constructed wetland, "just in case" we have a drought year, and there is not enough water to keep it fully wet. Extended detention basins need to be revisited. Engineers have become adept in designing them to meet the requirements for WQ capture volume, detention volume, paved forebays and micropools, release structures, maintenance access, overflow protection, etc. Most of them are quite ugly though, and neither the public or the developers like the way they turn out. As engineers, we are also not especially proud of them. They collect trash, and cause foul standing water. Very small detention basins cannot adequately support predatory species, and so there are no controls on mosquitoes. There must be better, more aesthetically pleasing ways to address both water quality and detention on small sites. What works well in large regional facilities may not work equally as well on small sites. The same design should not apply to both.

- 100.** I would set the design criteria for grass swales as follows: 1) Minimum hydraulic retention time of 5 minutes. 2) For the hydraulic retention time velocity calculation, the Manning's n should be set at 0.25 in order to account for vegetal retardance of velocity at very low depths. It could also be set according to Figure 13 from the Soil Conservation Service's "Handbook of Channel Design for Soil and Water Conservation." 3) The design event should be the 80th percentile runoff event instead of the 2-year event. This could be approximated with runoff calculations for a 0.5" precipitation event or by simply taking 5% of the 100-year event runoff.
- 101.** Overall it works pretty well. Could contain references for both structural and non-structural BMPs that appear to be working well.
- 102.** None-it is a technical document.
- 103.** Clarify WQCV vs Design volume
- 104.** More information on LID in CO. Maintenance section for LID's. Less emphasis on EDB Basins
- 105.** add information as to why there are certain BMP features (e.g., forebays, trickle channel, peat mix, etc.) so designers/engineers will understand why they can't leave them out.
- 106.** Standardize and emphasize runoff reduction techniques; improve construction BMPs and redo the revegetation section/information