Appendix 3-A

Application of Evaluation Criteria to Surface Water Alternatives

Appendix 3-A
Application of Evaluation Criteria to Surface Water Alternatives

This Appendix applies the 8 evaluation criteria described in Section 3.7 to the four Surface Water Management Alternatives.

The four alternatives considered are:

- Alternative I-1: Major Storage Enhancement, with Targeted Improvements in Water-use Efficiency and Additional Actions
- Alternative I-2: Medium Storage Enhancement, with Targeted Improvements in Water-use Efficiency and Additional Actions
- Alternative I-3: Reliance on Efficiency Improvements, Water Reuse and Voluntary Transfers, with No Storage Enhancement
- Alternative I-4: No Action

The criteria used include four related to effectiveness; and four related to feasibility:

Table 1
Criteria

Effectiveness Criteria	Feasibility Criteria
Overall effectiveness	Legal authority
Cost-effectiveness	Approvals and Permits
Flexibility over time	Cost and funding sources
Environmental Impacts	Integration with related programs

For full definition of the four alternatives and the 8 criteria, see Section 3 of the Watershed Plan.

In the following subsections, each alternative is considered in turn. For each alternative, all 8 criteria are discussed in terms of how they apply to the alternative. It should be noted that more detailed discussion of environmental impacts is presented in Appendix 3-B.

Alternative I-1: Major Storage Enhancement, with Targeted Improvements in Water-use Efficiency and Additional Actions

Overall Effectiveness

Alternative I-1 would provide a major enhancement of storage capacity in the Yakima Basin. Several projects have been identified that could provide a large volume of additional storage capacity. The largest of these projects include: construction of a new Wymer Reservoir, enlargement of the existing Bumping Reservoir, and construction of Black Rock Reservoir. In its largest proposed configuration, Black Rock Reservoir alone could serve as the storage project for this alternative. None of the other projects by itself is large enough to fully meet the Planning Unit's objectives. Therefore, if the other projects are developed, at least two of them would be needed, under this alternative.

This alternative also includes implementation of a selected set of water conservation plans developed by irrigation districts pursuant to the Yakima Basin Water Enhancement Project, as well as other measures such as water rights transfers and municipal wastewater reuse. However, the major benefits of this alternative in terms of meeting Planning Unit objectives come from the large storage enhancements. Therefore, this section focuses on the ability of the large storage projects to meet the Planning Unit's objectives.

The effectiveness of this alternative in meeting Planning Unit objectives was analyzed through the hydrologic modeling effort described in Section 3.5. This modeling effort expressly considered how various combinations of storage projects would contribute to three of the Planning Unit's objectives:

- Improve reliability of surface water supply for irrigation use;
- Provide for growth in municipal, domestic and industrial demand; and
- Improve instream flows for all uses, with emphasis on improving fish habitat;

With regard to Alternative I-1, two main "sub-alternatives" were modeled. One of these, labeled I-1A, relies entirely on water from within the Yakima River Basin. Modeling of this sub-alternative was performed for several storage projects, including: constructing Wymer Reservoir, enlarging Bumping Lake, operating Lake Cle Elum at a higher pool elevation; and diverting high flows from Cabin and Silver Creeks into Kachess Reservoir. The other sub-alternative, labeled I-1B, utilizes water from the Columbia River, stored in the proposed Black Rock Reservoir. For modeling purposes, under this sub-alternative the largest proposed configuration of Black Rock Reservoir was used (yielding 500,000 acre-feet per year).

An additional element included in modeling of *both* sub-alternatives was implementation of water conservation plans that have been prepared for Kittitas

Reclamation District (KRD), Roza Irrigation District, and Sunnyside Valley Irrigation District (above Parker); and, Kennewick Irrigation District and Columbia Irrigation District (below Parker).

A complete presentation of modeling results in presented in the technical memorandum, Hydrologic Modeling of Surface Water Alternatives (MWG, 2002a). In summary, for both of the sub-alternatives I-1A and I-1B, the hydrologic modeling demonstrated that:

- *Alternative I-1 is very effective in improving reliability of surface water supply.* In addition to providing full supply of non-proratable entitlements, at least 70 percent of proratable entitlements can be provided, even in dry years. The exact benefits for proratable supplies vary, depending on how the stored water is used to meet multiple objectives. As an example, if a portion of the stored water were used in part to maintain stream flows of at least 200 cfs in the Yakima River below Keechelus Reservoir, and the rest were used to improve reliability, the delivery to proratable users in very dry years such as 1994 could be increased by approximately 37 percent. This would allow delivery of over 85 percent of entitlements to proratable users.
- *Alternative I-1 could provide sufficient supply to serve projected growth in demand in the municipal and industrial sector through year 2050.* The modeling effort accounted for these demands by assuming they would be met fully by surface water. This is a conservative assumption, in that many communities are more likely to serve growth in demand from ground water supplies. However, in cases where ground water pumping is deemed to have an undesirable impact on surface water flows, the stored water in Alternative I-1 could be released to fully mitigate those impacts. Regardless of whether the stored water were used to supply municipal and industrial needs directly, or were used to mitigate the effects of pumping on surface flows, Alternative I-1 provides sufficient storage capacity that these benefits can be achieved simultaneously with the benefits to irrigation supply and instream flow.

  For the City of Yakima specifically, the improvements in reliability discussed above would offer considerable benefits in dry years. The City of Yakima is called out specifically here, since it is the largest community that currently relies mainly on surface water. The City depends, in part, on proratable supplies from the Naches River. This supply would be more available in dry years, compared with the status quo, thereby assisting the City meet the needs of its residents.
- *Alternative I-1 would provide significant improvements in flexibility for management of stream flows in the mainstem system.* The exact improvements depend on how the water is used in system operations, and choices about which reaches should be targeted for improved stream flow. The hydrologic modeling

explored improvements in stream related to several different scenarios[1]. These are: securing flows of at least 200 cfs in the Yakima River below Keechelus Reservoir; eliminating the "flip-flop" between the Naches and Upper Yakima reservoirs; meeting Title XII target flows at Parker; and achieving flow recommendations of the Instream Flow Technical Advisory Group (IFTAG) at Parker. With the exception of the IFTAG flow targets, all of these flow objectives can be met under Alternative I-1, while still achieving the desired improvement in reliability for irrigation supply. In regards to the IFTAG targets, the Black Rock project could deliver these flows while achieving the reliability goal, even in dry years. The other projects would not meet the reliability goal in some years, but would still allow IFTAG flows to be met with significant *improvements* in reliability.

Charts displaying these results graphically can be found in Section 3.5 of the Watershed Plan.

Results from the hydrologic modeling can be combined with available information on economic output to reach the following conclusion:

- *Alternative I-1 will provide significant economic benefits to the Yakima Basin.* This finding is based on the above findings with respect to reliability of irrigation supply, coupled with the results of a 1997 study by Northwest Economic Associates (NEA) titled *The Economic Benefits of Enhanced Water Supplies in the Yakima River Basin*. This study was reviewed in a technical memorandum developed in the watershed planning process, titled "Reliability of Surface Water Supply for Irrigation, Yakima River Basin (MWG, 2002b). Benefits were estimated as direct benefits in terms of the value of crops produced; and indirect benefits in regional output from industries linked to agriculture. The NEA study estimated that economic benefits on an average annual basis would range from $16 million to $30 million, depending on the size of the storage capacity increase. In dry years this effect would be magnified considerably, ranging from $112 million to $244 million. For comparison purposes, the total direct and indirect value of crop production in the Yakima Basin in 1997 was estimated to be $2.5 billion. This is approximately 38 percent of regional gross economic output for Kittitas, Yakima and Benton counties combined.

[1] The Planning Unit notes that the hydrologic modeling necessarily simplifies the objective of flow management by specifying a short list of flow levels at specific points in the system. The Planning Unit does not intend that flow management programs be limited to these specific scenarios. Instead, the results show whether, and how much flexibility can be improved for managing flows system-wide. In this regard, the scenarios should be considered illustrative, but not prescriptive.

Cost-Effectiveness

For the cost-effectiveness comparison, an estimate of cost per acre-foot of water yield was developed, for all of the various projects defined within each alternative (i.e. storage projects, efficiency projects, etc.). This cost was calculated for both maximum yield and dry-year yield. Costs presented here focus on dry-year yield, as that is the measure most applicable to the Planning Unit's objectives. This cost effectiveness measure is valuable, but can also potentially be misleading. That is because, while the cost per acre foot can be calculated, the effectiveness of the four alternatives various widely, in terms of their ability to meet Planning Unit objectives. This should be factored in, in comparing cost effectiveness.

As discussed in Section 3.3.3 of the Watershed Plan, the projects considered within Alternative I-1 have a range of estimated costs per acre-foot (see Table 3-4). These include both capital costs and operations and maintenance (O&M) costs, in year 2002 dollars, on a present value basis.

Section 3.6 of this Plan groups these costs for the various alternatives considered. Based on these projects, a weighted average of cost per acre-foot can be calculated for Alternative I-1 as a whole (see Table 3-7). The weighted average "weights" the cost of the various projects based on how much water they yield. For sub-alternative I-1A, which would involve all of the projects in the above table except Black Rock, the weighted average is $2,000 per acre foot of yield. For sub alternative I-1B, which would involve construction of the Black Rock Reservoir and the three water use efficiency projects listed in the above table, the weighted average is $3,200 per acre foot of yield. These compare with costs of the other alternatives that range from $1,300 to $2,100 per acre foot of yield.

Flexibility Over Time

As discussed above, Alternative I-1 involves a combination of storage projects and water conservation projects. The greatest benefits related to Planning Unit objectives accrue from the storage projects. Moreover, the number and/or magnitude of storage projects is the feature that distinguishes Alternative I-1 from the remaining three alternatives. Therefore, in discussing the criterion of "flexibility over time," this discussion will focus on the storage features.

With regard to the ability to make changes in response to new conditions or improved information, storage projects can be considered from two separate perspectives. On the one hand, *installation of a major structure on the landscape, together with the reservoir pool and associated features, should be considered essentially permanent. From this standpoint, the Alternative is relatively inflexible.*

On the other hand, the installation of additional storage capacity offers significant operational flexibility for the Yakima River system. For example, as described in the technical memorandum "Hydrologic Modeling of Surface Water Alternatives (MWG,

2002a), the stored water can be used in a variety of different ways, to meet irrigation needs, municipal and industrial needs, and instream flow needs. The stored water would likely be used in different ways from year to year, depending on moisture conditions and snowpack. With regard to instream flow, the stored water can be used to meet a wide range of desired flow levels, in a number of different reaches of the mainstem Yakima/Naches River systems. For example, depending on flow conditions in a particular year, evolving scientific information about the fisheries response, and changing policy directives over time, the increased storage capacity could be used to achieve different flow objectives. *In this sense, because Alternative I-1 offers a greater increase in storage capacity, it provides greater flexibility than the other three alternatives.*

It should be noted that among the storage projects that could be installed under Alternative I-1, two are "lowland" reservoirs that are located in areas where there are currently no reservoirs, and closer to diversion points for the largest demands in the system (e.g. Roza, SVID and/or Wapato). These two projects are Black Rock and Wymer. Because of the location of these two reservoirs, in comparison with other projects in the Naches arm and Upper Yakima mainstem, these two projects may offer greater flexibility in terms of system operation.

Environmental Impacts

The environmental impacts of this alternative are discussed in Appendix 3B; and are also summarized in Section 3.12 of the Watershed Plan. For a summary, see Table 3-9 in Chapter 3. This alternative would have significant environmental impacts, but also offers the opportunity to improve stream flows to benefit fish.

Legal Authority

It is assumed that the U.S. Bureau of Reclamation would construct and operate any of the storage projects or storage improvements considered in Alternative I-1. These activities are generally consistent with the Bureau's mission and legal authorities. However, projects would need to be specifically authorized by the U.S. Congress.

The Bureau has "withdrawn" unappropriated waters of the Yakima River Basin for federal purposes, such as operation of the Yakima Irrigation Project. This withdrawal has been periodically extended by the Washington State Department of Ecology[2]. Therefore, use of Yakima Basin waters under sub-alternative I-1A would appear to be generally consistent with this withdrawal.

In contrast, sub-alternative I-1B, involves use of water from the Columbia River (with return flows rejoining the Columbia River at Kennewick). This action would

[2] See Watershed Assessment, p. 3-12.

likely involve additional legal issues and could potentially be subject to legal challenge.

With regard to the water conservation projects that are part of Alternative I-1A, these projects have already been authorized by Congress under YRBWEP.

In summary, legal authorities for implementation of Alternative I-1 are similar to those for the remaining alternatives, with one exception: if waters of the Columbia River are required (sub-alternative I-1A), additional legal issues will likely arise that are not present for the remaining three alternatives.

Approvals and Permits

A variety of permits and approvals would be required for each project in Alternative I-1. *This alternative would likely be the most complex in terms of obtaining permits and approvals, because of the major storage enhancements included in this alternative, which inherently involve a range of permitting needs.* In the case of sub-alternative I-1A, there are two major reservoir projects, two minor reservoir projects, and several water-use efficiency projects. In the case of sub-alternative I-1B, the Black Rock reservoir would require permits and approvals, which would involve elements in both the Yakima River Basin and Columbia River Basin. Many of these will also involve consultation with the federal fish and wildlife agencies, under the Endangered Species Act.

With respect to the storage projects alone, the following table illustrates some of the major permitting processes involved. This list is not intended to be comprehensive at this time.

Table 2
Permitting Processes – Alternative I-1

Permit or Approval	Sub-alternative I-1A Wymer, Bumping, etc.	Sub-alternative I-1B Black Rock Reservoir
Permit to appropriate surface water	✓	✓
Reservoir Storage Permit	✓	✓
Consultation Under ESA	✓	✓
Wetlands Modification (CWA Section 404)	✓	✓
Water Quality Certification (CWA Section 401)	✓	✓
Approvals for use of public lands or condemnation of private lands	✓	✓
Hydraulic Permit Approval	✓	✓
Archaeological Approval	✓	✓
Rights of Way for access roads, canals, power lines, etc.	✓	✓

In addition, one or more project-level Environmental Impact Statements (EIS) would need to be prepared, as part of the process for obtaining many of the permits and approvals listed above.

The other elements of this alternative, such as water-use efficiency projects, water rights transfers, etc. also require specific approvals. However, these are generally less complex, as discussed under Alternative I-3, below.

Total Cost and Funding Sources

This alternative would be the most expensive to implement, of the three "action" alternatives. This is due to the large capital cost associated with major enhancements of storage capacity.

In addition, some of the specific projects that could be constructed under Alternative I-1, such as Wymer and Black Rock, would involve high operating expenses due to the power needs associated with pumping water over substantial lifts. In the case of Wymer Reservoir, this would involve pumping water up from the Yakima River to the top of the reservoir. In the case of Black Rock Reservoir, this would involve lifting water from the elevation of the Columbia River to the elevation of the reservoir (note: in both cases some of the energy costs can be recovered through power generation when the water is released).

The cost of additional activities under Alternative I-1 would add to that of storage enhancement. Costs have been estimated for the irrigation district efficiency improvements included in this alternative.

Table 3-6 (see Chapter 3) displays the major costs estimated for Alternative I-1. The total cost, expressed as the present value of capital plus O&M costs, in year 2002 dollars, ranges from $1.07 billion to $2.58 billion, depending on which projects are included.

Like the other "action" alternatives, due to the magnitude of these costs, it is likely that a combination of federal, state and local sources would be needed to plan, design, construct and operate the facilities, with the largest share coming from the federal government.

Some funds have already been appropriated by Congress for the efficiency improvements, under YRBWEP. All remaining funds would need to be appropriated or requested from existing funding sources.

Integration with Related Programs

In general, as with the other alternatives, *Alternative I-1 can be readily integrated with existing programs.* These include existing Yakima Project operations by USBR; implementation of YRBWEP, application of the 1945 Consent Decree, and

existing activities of the various irrigation districts and communities that receive Project water.

As discussed above, it is assumed that USBR would construct and operate new or improved storage facilities. USBR currently has the technical and administrative capability to plan, contract and oversee construction, and operate the facilities identified under Alternative I-1. The increased extent and complexity of operating the Yakima Project with the additional projects may require some staffing increases.

If new or improved storage facilities are used to directly supply water to municipal and industrial water users, outside the framework of current entitlements, then specific authorizations will need to be developed for this purpose. The same may be true of water used for instream flow purposes, or to offset ground water pumping.

Alternative I-2: Medium Storage Enhancement, with Targeted Improvements in Water-use Efficiency and Additional Actions

Overall Effectiveness

Like Alternative I-1, Alternative I-2 involves enhancing storage capacity in the Yakima Basin. However, the increase in storage capacity is smaller than in Alternative I-1. Alternative I-2 would involve constructing only one "medium" sized storage project, such as either Wymer Reservoir or expansion of Bumping Lake. In addition, like Alternative I-1, this alternative includes implementation of a selected set of water conservation plans and other actions. With regard to these actions, Alternative I-2 is the same as I-1. Therefore, the primary difference between Alternative I-1 and I-2 is the magnitude of the storage enhancement.

The effectiveness of this alternative in meeting Planning Unit objectives was analyzed through the hydrologic modeling activity described in Section 3.5. A complete presentation of modeling results is presented in the technical memorandum, "Hydrologic Modeling of Surface Water Alternatives" (MWG, 2002a). In summary, the hydrologic modeling demonstrated that:

- *Alternative I-2 would improve reliability of surface water supply, but not as much as Alternative I-1.* In addition to providing full supply of non-proratable entitlements, at least 70 percent of proratable entitlements can be met in most years. However, in some dry years, the 70 percent goal cannot be met (although even in those years, reliability is improved). The ability of this alternative to improve reliability depends on how the stored water is used to meet multiple objectives. As an example, if a portion of the stored water were used in part to maintain stream flows of 200 cfs below Keechelus Reservoir, and the rest were

used to improve reliability, the delivery to proratable users in dry years such as the 1992-1994 time period could be increased by approximately 6 to 18 percent.

- *Alternative I-2 could provide sufficient supply to serve projected growth in demand in the municipal and industrial sector through year 2050.* However, because Alternative I-2 provides less yield, and does not fully meet the 70% reliability objective, *use of Alternative I-2 for this purpose may conflict with the reliability objective in some dry years.* For the City of Yakima specifically[3], results of Alternative I-2 are similar to those discussed above, under Alternative I-1.
- *Alternative I-2 could improve the flexibility of the Yakima Project reservoir system by providing storage and releases closer to the largest demands in the Basin.* The USBR will be able to respond more quickly to changes in demands from water users downstream of Wymer Reservoir and possibly reduce flow fluctuations in the mainstem Yakima River. However, the volume of storage is not sufficient to provide a large degree of flexibility over a long period of time during drought years.

Charts displaying these results graphically can be found in Section 3.5 of the Watershed Plan.

Results from the hydrologic modeling can be combined with available information on economic output to reach the following conclusion:

- *Alternative I-2 will provide significant economic benefits to the Yakima Basin, but these benefits are less than provided under Alternative I-1.* For further information, see discussion above, under Alternative I-1. The difference in economic benefits is based on the fact that Alternative I-2 does not increase reliability of supply as much as Alternative I-1, and therefore the benefits in terms of crop production and indirect economic activity are not as large. Alternative I-2 would provide increased yield of less than 200,000 acre-feet, and the NEA report does not include estimates of benefits for increases in supply of less than this amount. However, it is reasonable to expect that the benefits would be less than the lower end of the range reported by NEA. Based on this assumption, benefits would be less than $16 million on an average annual basis; and less than $112 million in dry years when water deliveries to proratable users are cut the most. As with the discussion under Alternative I-1, these estimates include both the value of increased crop production, and indirect benefits in regional output from industries linked to agriculture.

[3] As discussed above, the City of Yakima is called out specifically, because it is the largest community that currently relies mainly on surface water.

Cost-Effectiveness

As discussed previously, for the cost-effectiveness comparison, an estimate of cost per acre-foot of water yield was developed, for all of the various projects defined within each alternative (i.e. storage projects, efficiency projects, etc.). This cost effectiveness measure is valuable, but can also potentially be misleading. That is because, while the cost per acre foot can be calculated, the effectiveness of the four alternatives various widely, in terms of their ability to meet Planning Unit objectives. This should be factored in, in comparing cost effectiveness.

Section 3.3.3 presents the estimated costs per acre-foot of yield of the various projects in Alternative I-2. These include both capital costs and operations and maintenance (O&M) costs, in year 2002 dollars, on a present value basis.

Based on these projects, a weighted average of cost per acre-foot can be calculated for Alternative I-2 as a whole. The weighted average "weights" the cost of the various projects based on how much water they yield. The weighted average of this alternative ranges from $1,300 to $2,100 per acre foot of yield in dry years. This range overlaps with the cost-effectiveness of both Alternative I-1 and I-3.

Flexibility Over Time

As discussed under Alternative I-1, this criterion can be considered from two separate perspectives.

From the perspective of installation of a major structure on the landscape, the improvements associated with Alternative I-2 would be just as permanent as those for Alternative I-1.

From the perspective of increased operational flexibility for the Yakima River system, Alternative I-2 would increase flexibility over current conditions, but not as much as Alternative I-1. This is because Alternative I-2 does not provide as much water for operational changes, as Alternative I-1. For further discussion, see Alternative I-1.

Environmental Impacts

The environmental impacts of this alternative are discussed in Appendix 3B; and are also summarized in Section 3.12 of the Watershed Plan. For a summary, see Table 3-9 in Chapter 3. This alternative would have significant environmental impacts, but also offers the opportunity to improve stream flows for fish. Flow improvements would likely be less than under Alternative I-1.

Legal Authority

As for Alternative I-1, it is assumed that the USBR would construct and operate the storage projects or improvements considered in Alternative I-2. USBR's legal

authorities to do so are discussed under Alternative I-1, above. *There is essentially no difference between Alternative I-2 and the remaining alternatives, in this regard.* However, since Alternative I-2 does not involve use of water from the Columbia River, legal issues involving the Columbia River would not arise, as they would for one of the projects considered under Alternative I-1 (i.e. the Black Rock Project).

Approvals and Permits

A variety of permits and approvals would be required for the projects in Alternative I-2. Like Alternative I-1, this alternative would be complex in terms of obtaining permits and approvals, because the storage enhancement included in this alternative inherently involve a range of permitting needs. The permits and approvals needed would be similar to those listed for Alternative I-1, above. In addition, one or more project-level Environmental Impact Statements (EIS) would need to be prepared, as part of the process for obtaining many of the permits and approvals listed above.

However, since Alternative I-2 would involve only one storage project, and would not involve use of waters from the Columbia River, *this alternative would involve fewer permits and would generally be less complex than Alternative I-1 in this regard*.

The other elements of this alternative, such as water-use efficiency projects, water rights transfers, etc. also require specific approvals. However, these are generally less complex, as discussed under Alternative I-3, below.

Total Cost and Funding Sources

This alternative would be intermediate in cost, among the three "action" alternatives. This is because this alternative includes less storage enhancement than Alternative I-1, but still involves the large capital cost associated with a storage project such as Wymer or Bumping. In addition, the Wymer project, in its pumping configuration, would involve high operating expenses due to the power needs associated with pumping water up from the Yakima River to the top of the reservoir. (note: some of the energy costs can be recovered through power generation when the water is released).

The cost of additional activities under Alternative I-2 would add to that of storage enhancement. Costs have been estimated for the irrigation district efficiency improvements included in this alternative.

Table 3-6 (see Chapter 3) displays the major costs estimated for Alternative I-2. The total cost, expressed as the present value of capital plus O&M costs, in year 2002 dollars, ranges from $566 million to $791 million, depending on which projects are included.

Like the other alternatives, due to the magnitude of these costs, it is likely that a combination of federal, state and local sources would be needed to plan, design, construct and operate the facilities, with the largest share coming from the federal government.

Some funds have already been appropriated by Congress for the efficiency improvements, under YRBWEP. All remaining funds would need to be appropriated or requested from existing funding sources.

(comment on the sufficiency of these funds, for the three districts' efficiency projects covered in this alternative)

Integration with Related Programs

In general, as with the other alternatives, *Alternative I-1 can be readily integrated with existing programs*. These include existing Yakima Project operations by USBR; implementation of YRBWEP, application of the 1945 Consent Decree, and existing activities of the various irrigation districts and communities that receive Project water.

As discussed above, it is assumed that USBR would construct and operate new or improved storage facilities. USBR currently has the technical and administrative capability to plan, contract and oversee construction, and operate the facilities identified under Alternative I-2. The increased extent and complexity of operating the Yakima Project with the additional projects may require some staffing increases.

If new or improved storage facilities are used to directly supply water to municipal and industrial water users, outside the framework of current entitlements, then specific authorizations will need to be developed for this purpose. The same may be true of water used for instream flow purposes, or to offset ground water pumping.

Alternative I-3: Reliance on Efficiency Improvements, Water Reuse and Voluntary Transfers, with No Storage Enhancement

Overall Effectiveness

Unlike Alternatives I-1 and I-2, this alternative does not include storage enhancements. Instead, Alternative I-3 would rely entirely on efficiency improvements, water reuse projects, and voluntary transfers. The component with the greatest impact is the efficiency improvements associated with irrigation districts, already authorized under YRBWEP. For purposes of this Alternative, the agriculture efficiency projects that could be implemented are identified in water conservation plans identified by 13 irrigation districts[4]. Whereas Alternatives I-1 and I-2 include only a selected set of these plans (e.g. three districts were modeled in the hydrologic modeling activity), Alternative I-3 would include implementation of all of these plans.

The effectiveness of this alternative in meeting Planning Unit objectives was analyzed through the hydrologic modeling activity described in Section 3.5. A complete presentation of modeling results is presented in the technical memorandum, "Hydrologic Modeling of Surface Water Alternatives" (MWG, 2002a). In summary, the hydrologic modeling demonstrated that:

- *Alternative I-3 would improve reliability of surface water supply slightly, but not as much as Alternatives I-1 or I-2.* In addition to providing full supply of non-proratable entitlements, at least 70 percent of proratable entitlements can be met in most years. However, in some dry years, the 70 percent goal cannot be met (although even in those years, reliability is improved). The ability of this alternative to improve reliability depends on how the stored water is used to meet multiple objectives. As an example, if a portion of the stored water were used in part to maintain stream flows of 200 cfs below Keechelus Reservoir, and the rest were used to improve reliability, the delivery to proratable users in dry years such as the 1992-1994 time period could be increased by approximately 2 to 8 percent.
- *Alternative I-3 would provide improvements in stream flows in the mainstem system. However, with the conserved water used for stream flow, there is little improvement in reliability of water supply*. The hydrologic modeling activity examined scenarios in which water is used: to meet Title XII target flows at Parker; to meet IFTAG flows at Parker; and to increase flow in the Upper Yakima River below Keechelus Dam. Exact results vary, depending on which of

[4] Documented in technical memorandum entitled "Water Use Efficiency in the Agricultural Sector." (MWG, 2002d). Does not include Wapato Irrigation Project, as Yakama Nation lands and activities are outside the scope of this Watershed Plan.

these scenarios is modeled. However, in general, this alternative cannot achieve both flow objectives and reliability objectives simultaneously.

Charts displaying these results graphically can be found in Section 3.5 of the Watershed Plan.

Outside the framework of the hydrologic modeling, some additional conclusions can be drawn with respect to the ability of Alternative I-3 to meet Planning Unit objectives:

- The modeling results for Alternative I-3 are not highly relevant to the goal of meeting growth in municipal and industrial needs, because the irrigation district efficiency projects modeled are not intended to provide water for these needs.
- *To the extent that municipal and industrial entities undertake water conservation programs, these can help extend existing water supplies as communities grow.* A detailed analysis of this effect has not been undertaken at this time for the Yakima Basin. *However, it is unlikely that water conservation can fully offset growth in demand.* For example growth in demand in the municipal, industrial and domestic sectors is estimated to be 41% from year 2000 to 2020 (see Section 2.3).
- *Voluntary transfers of water rights could potentially be an important source of water to serve municipal growth, in areas where circumstances permit. Voluntary transfers can also offer an effective means for improving stream flows in some locations. However, voluntary transfers offer little ability to improve reliability of water supply for agriculture at the basin-wide scale.*[5] For further information, see the technical memorandum "Voluntary Water Transfers as a Strategy for Meeting Planning Objectives" (EES, 2002e).
- *Reuse of municipal wastewater offers some ability to extend municipal supplies as growth occurs. However, there are significant limitations on this strategy.* In particular, return flows to the Yakima River system are relied on by downstream users, so reuse projects that reduce return flows from cities may be problematic. *In addition, reuse of municipal wastewater is relatively costly, compared with other alternatives such as ground water production.* For further information, see technical memorandum "Water Reuse Opportunities in the Yakima River Basin" (EES, 2002f).

Cost-Effectiveness

As discussed previously, for the cost-effectiveness comparison, an estimate of cost per acre-foot of water yield was developed, for all of the various projects defined within each alternative (i.e. storage projects, efficiency projects, etc.). This cost effectiveness measure is valuable, but can also potentially be misleading. That is

[5] Transfers can be highly significant to individual producers, especially those with junior water rights.

because, while the cost per acre foot can be calculated, the effectiveness of the four alternatives various widely, in terms of their ability to meet Planning Unit objectives. This should be factored in, in comparing cost effectiveness.

Section 3.3.3 of the Watershed Plan presents the estimated costs per acre-foot of yield of the various projects in Alternative I-3. These include both capital costs and operations and maintenance (O&M) costs, in year 2002 dollars, on a present value basis.

Based on these projects, a weighted average of cost per acre-foot can be calculated for Alternative I-3 as a whole (see Table 3-7 in Chapter 3). The weighted average "weights" the cost of the various projects based on how much water they yield. The weighted average of this alternative is $1,300 per acre foot of yield. This is lower than Alternative I-1, and at the low end of the range of Alternative I-2.

Flexibility Over Time

This alternative includes construction of irrigation district improvements that are long-lived and essentially "permanent." However, many of these improvements would upgrade or replace facilities that are already in place, such as irrigation canals and associated control structures.

In contrast with Alternatives I-1 and I-2, this alternative does not involve addition of storage capacity to the Yakima Project system (except for minor reregulation reservoirs located adjacent to irrigation canals). *Without additional storage capacity, operational flexibility within the Yakima Project system is only marginally improved by the irrigation conservation projects.* However, these projects will provide individual irrigation districts with an improved ability to manage their water supply during water-short years.

Increased emphasis on voluntary water rights transfers, as well as municipal conservation, does provide opportunities for flexible management from year to year. To some extent, these programs can be increased or decreased in intensity, to accommodate changing conditions over time. However, it should be recognized that these programs have much smaller benefits, and so the value of this flexibility to water management needs of the Basin is relatively small.

Reuse of municipal wastewater typically requires construction of additional wastewater treatment facilities, as well as new piping systems to deliver treated water to customers. Once in place, these facilities are long-lived. In addition, because customers typically require reliable supplies, *reuse projects do not have high operational flexibility*.

Environmental Impacts

The environmental impacts of this alternative are discussed in Appendix 3B; and are also summarized in Section 3.12 of the Watershed Plan. For a summary, see

Table 3-9 in Chapter 3. Environmental impacts of this alternative are less extensive than for Alternatives I-1 and I-2. However, this alternative offers less benefit in terms of improving flows for fish.

Legal Authority

Irrigation districts would be the primary implementers of the water-use efficiency projects under YRBWEP, and funding would be provided by USBR. These entities are already authorized under YRBWEP and State law to carry out these activities.

Municipal water systems have the legal authority to carry out water conservation programs within their service areas.

Municipal wastewater systems have the legal authority to construct and operate wastewater reuse systems. However, issues of potential impairment of downstream water rights could be an issue, since reuse projects in the Yakima Basin would reduce return flows to the river system.

Water rights transfers are authorized under State law, subject to certain conditions. The legal viability of transfers must be examined on a case by case basis.

Approvals and Permits

Alternative I-3 would involve extensive improvements by irrigation districts related to water use efficiency, water rights transfers, municipal water conservation programs, and municipal wastewater reuse projects. *In general, on a project-by-project basis, these permits and approvals needed for these activities would be less complex than those needed for Alternatives I-1 and I-2. However, it should also be noted that there would be far more individual projects to be permitted, and permitting activities would be spread out over many more implementing organizations, compared with Alternatives I-1 and I-2.*

Types of permits and approvals needed for implementation of Alternative I-3 are listed in Table 3. This list is not intended to be comprehensive at this time.

Total Cost and Funding Sources

This alternative would be the least costly, among the three "action" alternatives. This is because this alternative does not include storage enhancement (other than minor reregulation reservoirs associated with irrigation district efficiency projects).

Table 3-6 (see Chapter 3) displays the major costs estimated for Alternative I-3. The total cost, expressed as the present value of capital plus O&M costs, in year 2002 dollars, is $437 million.

Table 3
Permits and Approvals Needed for Implementation of Alternative I-3

Permit or Approval	Irrigation District Efficiency Projects	Water Rights Transfers	Municipal Wastewater Reuse Projects	Municipal Water Conservation Programs
Reservoir Storage Permit	✓	N/A	N/A	
Rights of Way for access roads, canals, power lines, etc.	✓	N/A	N/A	
Wetlands Modification (CWA Section 404)	✓	N/A	N/A	
Water Quality Certification (CWA Section 401)	✓	N/A	N/A	
Water Rights Change	N/A	✓		(No specific Permits/Approvals Required)
Waste Discharge Permit	N/A	N/A	✓	
National Pollutant Discharge Elimination System Permit	N/A	N/A	✓	
Utility Permit to for transmission mains	N/A	N/A	✓	
Wastewater Engineering Report	N/A	N/A	✓	

Costs have not been estimated for additional activities included in this alternative, such as water rights transfers, municipal wastewater reuse projects, and municipal water conservation programs. Some of these costs have been discussed in the various technical memoranda prepared during the watershed planning process (see Table 3-1 in Chapter 3). These costs can be substantial to the entities involved in carrying out these actions, but will not alter the fact that Alternative I-3 is much less costly than the other two "action" alternatives.

Like the other alternatives, due to the magnitude of these costs, it is likely that a combination of federal, state and local sources would be needed to plan, design, construct and operate the facilities, with the largest share coming from the federal government.

Some funds have already been appropriated by Congress for the efficiency improvements, under YRBWEP. However, the amount appropriated to date falls

well short of the total cost listed above. All remaining funds would need to be appropriated or requested from existing funding sources.

For other projects, such as water rights transfers, municipal wastewater reuse projects, or municipal water conservation projects, additional funds would be needed. These types of projects are typically funded by a combination of local funds from the entity involved (e.g. a city, or an irrigation district); and available grant or loan funds from State sources. Availability of funding from state sources for these purposes may be available, but is not guaranteed.

Integration with Related Programs

Alternative I-3 is generally consistent with existing programs, such as YRBWEP, administration of the State water code; and delivery of municipal water and wastewater services in individual communities.

The most extensive activity under alternative I-3 would be the design, and construction of irrigation system improvements designed to improve water use efficiency. In general, both USBR and irrigation districts have adequate staff and administrative capacity to perform these activities. Some of this activity may be contracted to the private sector.

Staffing to process water transfers is already in place, involving both Water Conservancy Boards and the Department of Ecology.

Administration and staffing of municipal water conservation and wastewater reuse projects can represent a significant need in the local government context, depending on the size of the community involved.

Alternative I-4: No Action

Overall Effectiveness

The No-Action alternative offers no improvement over current conditions, in terms of meeting the Planning Unit objectives. Under this alternative, agricultural producers relying on proratable supplies from the Yakima Project would continue to experience substantial losses during drought years, substantially reducing the Basin's economic output and employment in those years. Management of stream flows in the mainstem Yakima River and Naches system would continue as under current conditions. Communities experiencing growth will face considerable difficulty in obtaining new water supplies, unless ground water supplies are made available (see Section 4).

Cost-Effectiveness

Not applicable. The No-Action alternative, by its nature, does not require an investment of financial resources. However, the Planning Unit notes that there are significant "costs" to the No-Action Alternative, in terms of the losses described above.

Flexibility Over Time

Under the No-Action alternative, the structures already present in the Yakima Basin, such as dams in the upper Yakima and Naches systems, would remain in place for the long-term. While the current system has some operational flexibility, this is limited due to the fact that the current system cannot meet all the needs of the Basin. In this regard, the existing system has less flexibility to adjust to changing conditions, in comparison with the three "action" alternatives.

Environmental Impacts

The environmental impacts of this alternative are discussed in Appendix 3B; and are also summarized in Section 3.12 of the Watershed Plan. For a summary, see Table 3-9 in Chapter 3. Essentially, the impacts would be zero, leaving a status quo result in terms of environmental quality and stream flows. Status quo flows are far from optimal in terms of fish habitat needs.

Legal Authority

No additional legal authorities are needed for the No-Action Alternative. It is assumed that current legal authorities would remain in place, for operation of the Yakima Basin's various water management activities.

Approvals and Permits

No new approvals or permits would be needed under the No-Action Alternative. It is assumed that existing water rights, federal responsibilities, etc. would remain in place.

Cost and Funding Sources

The No-Action Alternative, by its nature, does not impose new costs or require any additional funding sources. However, all existing programs currently operating in the Yakima Basin require ongoing funding, including the USBR's Yakima Project operations; the Department of Ecology's water rights administration activities; Water Conservancy Boards; municipal water and wastewater systems, etc.

Integration with Related Programs

A variety of existing programs is operational in the Yakima Basin, and would continue to operate. No special needs for integration are identified, under the No-Action Alternative. The No-Action Alternative, by its nature, does not require additional staffing or administrative structures. However, staffing of existing programs will continue to be needed, as described under the funding discussion, above.