Triple Bottom Line Assessment of Thermal Load Mitigation Alternatives

Including:

Riparian Shade Credit Contracting

Recycled Water Use for Agricultural Irrigation

Recycled Water Use for Industrial Aggregate Production

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For
Metropolitan Wastewater Management Commission

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1. EXECUTIVE SUMMARY

The discharge of treated effluent from the Eugene-Springfield Water Pollution Control Facility (WPCF) is regulated by the Oregon Department of Environmental Quality (ODEQ) through a National Pollutant Discharge Elimination System (NPDES) permit issued to the Metropolitan Wastewater Management Commission (MWMC). A requirement of the NPDES permit is compliance with temperature standards, which limits daily thermal discharge into the Willamette River. ODEQ is in the process of revising the 2006 Willamette Basin total maximum daily load (TMDL) for temperature. The temperature TMDL is driven by cold water criteria for salmon habitat, which vary by geography and season. Under the TMDL, the MWMC will be issued an allocation for allowable daily thermal load discharge from the WPCF.

The MWMC will be required to have a strategy in place to mitigate for excess thermal load risk under current conditions (determined from historical WPCF discharge data and the MWMC's permitted waste load allocation). To meet the anticipated mitigation need under the TMDL, the MWMC is in the process of comparing the feasibility of a number of thermal load mitigation alternatives. To support the comparison, the MWMC requested that Good Company complete a Triple Bottom Line (TBL) Assessment to inventory and compare the economic, social and environmental performance for *three* of the most promising thermal mitigation project alternatives, including:

Riparian Shade Credit Contracting

Under a water quality trading strategy involving regulatory credit for restoring riparian shading, no modification to WPCF effluent treatment and discharge into the Willamette River is necessary. In this conceptual alternative MWMC would contract for the production of Riparian Shade Credits with the Freshwater Trust. The contract would result in a series of riparian restoration projects in the McKenzie River watershed that would plant trees and other native vegetation that increase shade on the river to offset the WPCF's excess thermal load.

Recycled Water Use for Agricultural Irrigation at MWMC's Facilities

Effluent from the WPCF (currently treated to Class D recycled water standards) would be piped via existing and upgraded recycled water piping to a storage lagoon and used for agricultural irrigation at two MWMC-owned facilities including the Biocycle Farm (Biocycle) and the Beneficial Reuse Site (BRS). This project would include upgrading sections of recycled water pipeline infrastructure between the WPCF, Biosolids Management Facility (BMF), and the BRS along the Northwest Expressway. At the Biocycle Farm the existing method of irrigating via hose reels would be upgraded to a dedicated irrigation system, which includes new pipe, valves and irrigation outlets. At the BRS, the existing storage lagoon would be upgraded and relined, the pumping system would be upgraded, a dechlorination system would be added and various automated controls and instrumentation would be upgraded. The existing pivot irrigation system would be used with only minor upgrades. Recycled water would be applied at agronomic rates at both facilities for a combined daily demand of up to 3.1 million gallons per day (MGD), but demand would vary significantly throughout the year and be subject to climatic conditions. However, the 35 to 57 million gallons (MG) of off-line recycled water storage capacity provided at the BRS would allow effluent diversion to be managed for thermal mitigation drivers with subsequent reuse from storage based on seasonal demand.

Recycled Water Use for Industrial Aggregate Production

This alternative would divert a portion of treated effluent from the WPCF currently discharged to the Willamette River (currently treated to Class D recycled water standards), further treating it to the highest Class A recycled water standards for distribution to the site shared by Delta Sand & Gravel (Delta) and Knife River (Delta-Knife site) where it would be used in lieu of Willamette

River water for production. Water is used at the Delta-Knife site for a variety of industrial aggregate processes, including gravel washing, equipment rinsing, concrete batching, and asphalt production. The construction required for this alternative includes a segregated Class A recycled water production stream at the WPCF, distribution pumping, a pressurized storage tank, and dedicated recycled water distribution infrastructure at the Delta-Knife site. This alternative would utilize some existing infrastructure, including a recycled water pipeline between the WPCF and the Delta-Knife site, filtration units, and chlorine contact basins.

The purpose of this TBL assessment is to provide MWMC, wastewater staff[1] and other pertinent decision-makers with a summary of relevant economic, environmental and social performance data to compare the alternatives. In addition to this specific TBL Assessment, this project provided the following:

- A TBL framework that will allow MWMC to compare additional alternatives in the future
- Education and training for TBL process development to allow for future TBL assessments to be conducted internally, by staff (i.e. without consultant assistance)
- This assessment served as a "pilot project" for the TBL process within MWMC

TBL Scoring Methodology

The TBL process assembles an array of data that is largely qualitative in nature. Many measures of particular criteria are not expressed in units, but as a professional assessment of the project effect on the measure. This TBL imposed a scoring methodology to provide side-by-side numeric comparison of the evaluated alternatives. The methodology resulted in a weighted technical score for each of the nine criteria for each alternative.

Assigning Criterion Weight

A pairwise comparison was completed individually by each of the seven MWMC commissioners via an online survey. This method asked each member of the commission to compare each of the nine Criteria versus each of the remaining Criteria, one pair at a time. Then, for the Criterion selected for each pair, the respondent applied a scale of 1 to 3 to signify the degree of importance of the chosen Criterion over the compared Criterion. The responses to the survey were used to calculate weights (as a percentage) for each Criterion. The results of the seven individual commissioner responses were then averaged to arrive at an overall Criterion weight.

Assigning Criterion Score

The Project Technical Team assigned scores to the alternatives for each Measure. The scores for each individual Measure were then averaged to determine the Criterion Score. The team consisted of regional wastewater planning and operations staff and the consultant team (Kennedy/Jenks Consultants and Good Company staff). Scores were assigned on a scale of 1 to 10. The lower end of the scale indicated high risk / low value and, conversely, the upper end of the scale indicated low risk / high value. A score of 5 indicated neutral or existing conditions.

[1] "Wastewater staff" within the context of this report refers to City of Eugene and City of Springfield staff designated to support the MWMC's regional wastewater program.

Findings in Brief

The findings of this TBL assessment are summarized in Figures 1 - 5. Figure 1 provides the highest-level summary of the results of this assessment in the form of *TBL Score* for each alternative. Figure 2 provides the details of Criterion Weighting and Scoring process. Figures 3 – 5 provide a highly summarized comparison of the significant economic, environmental and social differences between alternatives. The following points briefly summarize the results of the TBL assessment:

Riparian Shade Credits

- This alternative provides the thermal mitigation needed to meet 2006 TMDL requirements for late October. Riparian shade credits represent the lowest-cost alternative (based on 20-year NPV and cost effectiveness) and externalize all operational requirements associated with thermal mitigation from the WPCF/MWMC to the shade credit vendor. Riparian restoration reduces impacts on the aquatic environment, but *also* enhances the terrestrial ecosystem for birds and other wildlife. The primary risk associated with this alternative includes the possibility of legal challenges to credits as a compliance mechanism under the Clean Water Act.

Recycled Water Use for Agricultural Irrigation

This alternative provides 130% of the thermal mitigation needed to meet 2006 TMDL requirements for late October. This alternative offers the greatest operational flexibility as a result of the proposed upgrades to recycled water transmission and storage infrastructure. The location of project infrastructure provides the greatest potential recycled water demand (within 1 mile) of the two recycled water alternatives. The use of recycled water for this and the Aggregate Production alternative offers the community a means for adapting to the effects of climate change, specifically long, intense drought conditions. Finally, this alternative is considered by the project team to offer the greatest relative permitting certainty. While this alternative provides many benefits, it comes at the greatest financial cost. Other risks associated with this alternative include wet weather conditions limiting irrigation demand and nitrate levels in the groundwater and associated testing requirements.

Recycled Water Use for Industrial Aggregate Production

Does not provide the thermal mitigation needed by the 2006 TMDL requirements (85% of total needs) during late October. The Delta-Knife site and operations provide a unique opportunity for development of recycled water infrastructure within our community as the site is close to the WPCF and site maximum daily use is nearly equivalent to the projected recycled water diversion needed to reduce thermal load in late October. From a Delta-Knife operational point of view, the project offers installation of recycled water infrastructure at no cost and reduced energy costs. However, there are numerous, significant and potentially insurmountable financial and operational barriers to overcome, which include; Delta Sand & Gravel has stated that they are not interested in participating in further study unless they can be assured of acceptable costs and regulatory burdens; neither Delta or Knife River are water limited for production (i.e. there is not a water need); the project may require a new NPDES permit; unknown quality impacts on Delta-Knife River products; concerns about health and safety; and a limited lifetime of Delta's production at the site before their source of material is consumed (significantly reducing water use).

Sources of Uncertainty in the Assessment

This assessment is based on currently available information, but there are four factors that are highly uncertain and could significantly change the outcome of this assessment.

- **Regulatory Requirements:** This assessment assumes 2006 Temperature TMDL requirements and estimates thermal mitigation need accordingly, including theoretical conditions, which would exacerbate the mitigation need presented by the 2006 TMDL. Any change to the TMDL would alter

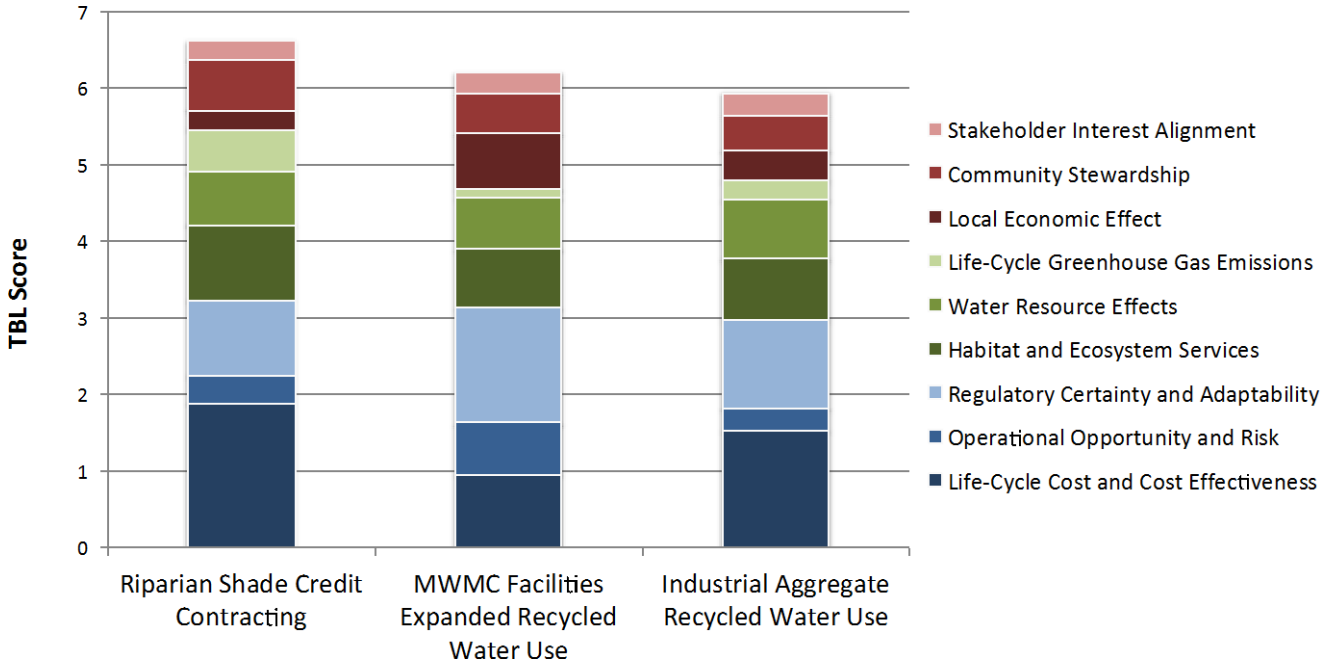
the most fundamental criteria used to assess alternatives – their ability to mitigate thermal discharge.

- **Timing and Severity of Climate Change Impacts:** The effects of climate change, specifically more frequent and severe drought could significantly increase the value of water resources within our community and therefore could increase the value of recycled water.
- **Large-Scale Recycled Water Customers:** The use of recycled water by private customers offers the promise of a net financial advantage to both external water users (reduced water costs) and to MWMC (sale of a recycled water product to offset treatment and conveyance costs). The net financial outcome depends on a variety of factors, but partnership with a large-scale water user nearby one of the recycled water alternatives could significantly alter the financial analysis.
- **Delta Sand & Gravel and Knife River Aggregate Water Demand:** Demand for this alternative is based on maximum water rights and estimates of demand and seasonal variation of demand.

Figure 1 shows that Riparian Shade Credits achieve the highest TBL Score of the three alternatives, followed by Recycled Water Use for Agricultural Irrigation for Agricultural Irrigation at MWMC Facilities and finally Recycled Water Use for Industrial Aggregate Production for Industrial Aggregate, Asphalt and Concrete.[2]

Figure 2 shows a detailed version of the variables used to calculate the TBL Scores shown on Figure 2 and includes: Criterion Score, Criterion Weights, Weighted Criterion Score and the final TBL Score, by thermal mitigation alternative. It is recommended the reader consider Figure 1 and 2 in parallel with Figures 3 – 5. Figures 1 and 2 present a highly summarized version of the TBL results and Figure 3, 4, and 5 presents the data used to assign the Criteria Scores shown on Figure 2.

Figure 1: Comparison of the alternatives, by TBL Score, with the highest score being best.



[2] Details of the TBL Scoring methodology may be found in Section 6 of this report.

Figure 2: Comparison of the alternatives, by TBL Score, with the highest score representing the highest value and lowest risk.

Triple Bottom Line (TBL) Categories / Criteria	Criterion Scores						Weighted Criterion Scores		
	Riparian Shade Credit Contracting	MWMC Facilities Expanded Recycled Water Use	Industrial Aggregate Recycled Water Use		Criteria Weights (%)		Riparian Shade Credit Contracting	MWMC Facilities Expanded Recycled Water Use	Industrial Aggregate Recycled Water Use
Economic Criterias					48%				
Life-Cycle Cost and Cost Effectiveness	10.0	5.0	8.1	X	19%	=	1.9	1.0	1.5
Operational Opportunity and Risk	3.8	7.0	3.0	X	10%	=	0.4	0.7	0.3
Regulatory Certainty and Adaptability	5.0	7.8	6.0	X	19%	=	1.0	1.5	1.2
Environmental Criterias					30%				
Habitat and Ecosystem Services	8.4	6.6	6.8	X	12%	=	1.0	0.8	0.8
Water Resource Effects	5.4	5.2	6.0	X	13%	=	0.7	0.7	0.8
Life-Cycle Greenhouse Gas Emissions	10.0	1.9	4.6	X	6%	=	0.6	0.1	0.3
Social Criterias					22%				
Local Economic Effect	3.0	9.0	4.8	X	8%	=	0.2	0.7	0.4
Community Stewardship	6.7	5.3	4.7	X	10%	=	0.7	0.5	0.5
Stakeholder Interest Alignment	6.4	6.8	7.3	X	4%	=	0.3	0.3	0.3
TBL Scores:					100%		6.6	6.2	5.9

Figure 3: Highest-level summary and comparison of Economic TBL Criteria.

Economic Criteria	Measure	Riparian Shade Credits	Recycled Water Use for Agricultural Irrigation	Recycled Water Use for Industrial Aggregate Production
Life-Cycle Cost and Cost Effectiveness	**20-Year Net Present Value**	$4,650,000	$11,924,000	$6,801,000
	Cost Effectiveness	$0.13 / kcal / day	$0.21 / kcal / day	$0.14 / kcal / day
Operational Opportunity and Risk	**Additional Recycled Water Conveyance Capacity**	0	1.7 – 2.2 MGD	7.2 MGD
	Additional Recycled Water Storage Capacity	0	41 MG	0.1 MG
	Other Significant Operational Opportunities or Risks	Opportunity • Externalizes all operational requirements and risk to a third party. Risk • None to note.	Opportunities • Develops recycled water operational experience that could be utilized in the future. • Utilizes existing infrastructure. Risk • Wet weather limits irrigation demand.	Opportunities • Develops recycled water operational experience that could be utilized in the future. • Utilizes existing infrastructure. Risks • Change to business model. The WPCF would be required to produce a product with consistent quality based on external specifications. • Liability for Delta-Knife River product failures as a result of recycled water composition. • Risk of Delta ceasing operations in 10-12 years.
	Resilience to Seismic Event	High to Mid	Mid	Mid to Low
Regulatory Certainty and Adaptability	**Permitting Certainty and Potential Challenges**	• Subject to ongoing third party challenges.	• Greater relative certainty and lower risk because it's an existing practice at MWMC-owned facilities.	• Uncertainty associated with permitting of thermal discharges from Delta-Knife settling ponds.
	Other Regulatory or Permitting Opportunities or Risk	Risks • Inability of credit vendor to recruit the landowners required to generate the needed thermal offset.	Opportunity • Reduces discharges of permitted constituents including CBOD, suspended solids and coliform. Risk • Nitrate levels in the Southern Willamette GWMA. • Additional groundwater testing requirements.	Opportunity • Reduces discharges of permitted constituents including CBOD, suspended solids and coliform. Risks • Delta-Knife River may need a new NPDES permit for thermal discharge. • WPCF permit compliance would be reliant on the water demand and timing of demand of external parties.
	Potential for Onsite Mitigation Expandability	• No potential for expansion.	• 3.5 - 35 MGD for discharge to constructed onsite wetlands.	• Gravel pit reclamation and habitat enhancement could be significant, but are not quantified.
	Decision-to-Project Implementation Period	5 – 7 years	2 - 3 years	2 - 3 years

Figure 4: Highest-level summary and comparison of Environmental TBL Criteria.

Environmental Criteria	Measure	Riparian Shade Credits	Recycled Water Use for Agricultural Irrigation	Recycled Water Use for Industrial Aggregate Production
Water Resource Effects	**Thermal Reduction Potential (indexed value)**	252	393	340
	Surface Water Quality Effects (Other than Thermal)	• Reduces discharges of sediment and nitrogen. Quantities of reduction are site dependent.	• Reduces discharge of all constituents contained in WPCF effluent in quantities that correspond to the volume of avoided discharge.	• Reduces discharge of all constituents contained in WPCF effluent in quantities that correspond to the volume of avoided discharge.
	Ground Water Quality Effects	• No known effects.	• Potential source of additional nitrates in the Southern Willamette Valley Ground Water Management Area.	• Not a significant concern.
	Net Change to River Flow	• No net change.	• Net decrease. Average decrease of 1.98 MGD (June through September) and a peak of 3.07 MGD (July)	• No net change.
	Offset of Surface or Groundwater Use	• *Surface*: No change. • *Ground:* No change.	• *Surface*: No change. • *Ground*: 0.0001 *MGD*.	• *Surface*: 2.36 MGD. • *Ground:* 0.06 MGD.
	Future Project Site Aquifer or Stream Flow Augmentation Opportunities	• No opportunities identified.	• Discharge to groundwater if treated to Class A standards. • Discharge to surface water through constructed wetland.	• No opportunities identified.
Habitat and Ecosystem Services	**Scale of Enhanced Habitat**	• *Acres:* 36 – 73 • *Stream Miles:* 5 - 10	• *Acres:* 0 • *Stream Miles:* 0	• *Acres:* 0 • *Stream Miles:* 0
	Soil Quality Effects	• Soil health improved by reducing compaction, improving drainage and reducing erosion.	• Low salinity hazard[3]	• No significant benefits or risks were identified.
	Future Project Site Habitat and Ecosystem Opportunities	• As restoration site matures it will increase habitat complexity for aquatic and terrestrial species.[4]	• If the maximum onsite wetland restoration potential were developed in the future it would create roughly 100 acres of wetland habitat.[5]	• No opportunities identified.
Life-Cycle GHG Emissions	**Net 20-Year Life-Cycle GHG Emissions**	1,092 MT CO_2e	5,680 MT CO_2e	2,395 MT CO_2e

[3] Based on Class C water quality testing results of 244 ppm compared to low hazard range in ODEQ's – *Implementing Oregon's Recycled Water Rules*, Table 18 and page 64.
[4] Oregon Department of Fish and Wildlife (2006). *Oregon Conservation Strategy.* Downloaded 3/14 at http://www.dfw.state.or.us/conservationstrategy/docs/document_pdf/b-habitat_10.pdf.
[5] Wetland habitat includes an estimated 90 acres at Biocycle Farm and 10 acres at BRS.

Figure 5: Highest-level summary and comparison of Social TBL Criteria.

Social Criteria	Measure	Riparian Shade Credits	Recycled Water Use for Agricultural Irrigation	Recycled Water Use for Industrial Aggregate Production
Local Economic Effect	**Construction Jobs**	17 FTE-years	55 FTE-years	30 FTE-years
	External Demand for Recycled Water	0 MGD	10.3 MGD	3.1 MGD
	Change in External Profit or Cost Avoidance	No change.	Increased profit for BRS tenant farmer. Irrigation could increase annual harvests by 3x.	Delta-Knife cost avoidances could include: process water pumping costs and process water heating costs.
Community Stewardship	**Human Health and Safety Concerns**	• No concerns identified.	• Concern from farm adjacent to BRS site about the risk of overspray on food crops.	• Concern for Delta S&G employees who are significantly exposed daily to aggregate wash water.
	Aesthetic Site Improvements	• Restoration will likely significantly improve aesthetics on privately owned land. Public benefit will be site-dependent and likely only accessible via navigable waterways.	• Potentially more greenery at Biocycle and BRS sites from increased irrigation particularly during dry months.	• No change expected.
	Develops Climate Change Adaptation Capacity	• Provides increased ecosystem services. The value of these services varies with site selection.	• Provides a substitute for sources of ground or surface water that could be utilized during future extreme drought conditions to maintain in-stream flows and groundwater supplies.	• Provides a substitute for sources of ground or surface water that could be utilized during future extreme drought conditions to maintain in-stream flows and groundwater supplies.
Stakeholder Interest Alignment	**Potential Project Partnerships**	• McKenzie Watershed Council: Riparian restoration facilitator. • EWEB: Depending on project location, could support their *Drinking Water Protection Plan*.	• EWEB: Supports goals of Water Management Conservation Plan • To-Be-Determined Recycled Water Users	• EWEB: Supports goals of Water Management Conservation Plan
	Alignment with Local & State Plans & Programs	Alignment with 2 of 5	Alignment with 2 of 5	Alignment with 2 of 5
	Stakeholder Acceptability and Alignment (Indexed Value)	9.8	11.6	15.8

2. INTRODUCTION

The discharge of treated effluent from the Eugene-Springfield Water Pollution Control Facility (WPCF) is regulated by the Oregon Department of Environmental Quality (ODEQ) with a National Pollutant Discharge Elimination System (NPDES) permit.[6] ODEQ is in the process revising the 2006 Willamette Basin total maximum daily load (TMDL) for temperature. A requirement of the NPDES permit is compliance with temperature standards, which will include a limitation of total daily thermal discharge into the Willamette River when the ODEQ issues the next permit renewal to the Metropolitan Wastewater Management Commission (MWMC) for the WPCF. Revisions to temperature TMDL requirements are driven by cold-water criteria for salmon habitat, which vary by geography and seasonality. Under the TMDL, the MWMC will be issued a waste load allocation for allowable daily thermal load discharged from the WPCF. The MWMC will be required to have a strategy in place to mitigate for any excess thermal load (determined from historical WPCF discharge data and the MWMC's permitted waste load allocation).

Based on the 2006 TMDL, historic WPCF data, and hypothetical future conditions which would exacerbate excess thermal loads, there are three critical time periods during the year when the WPCF effluent thermal load is most at risk of exceeding the projected permit limits for 2035 – early May, August - September and late October. Of these periods, the period of greatest risk is late October in terms of frequency and intensity (i.e. how often the event might recur and the degree of excess thermal loading) and August - September in terms of duration (i.e. the number of at-risk days for excess thermal load). The MWMC is currently evaluating the feasibility of a number of temperature TMDL compliance alternatives. This TBL Assessment was completed to support the MWMC's evaluation efforts.

Project Description

There are a number of thermal mitigation project alternatives possible to meet the WPCF's discharge requirements including: restoration of riparian areas, diverting discharge water to beneficial uses (e.g., irrigation or industrial use), temporarily storing the water in a lagoon, or mechanically cooling the water prior to discharge. To consider the best value to the community, the Metropolitan Wastewater Management Commission (MWMC) contracted with Kennedy/Jenks Consultants and Good Company to complete a Triple Bottom Line (TBL) assessment that inventories and compares the economic, social and environmental performance for the ***three*** most developed and promising thermal mitigation alternatives. These alternatives are well suited to a TBL assessment because they all have the opportunity to develop community partnerships as well as having implications for the community and environment beyond the issue of thermal load compliance. For all of the alternatives this assessment assumes a project term of 20 years. The alternatives considered in this report include:

Riparian Shade Credit Contracting (Riparian Shade Credits)
Under a water quality trading strategy involving regulatory credit for restoring riparian shading, no modification to WPCF effluent treatment and discharge into the Willamette River is necessary. In this conceptual alternative the MWMC would contract for the production of Riparian Shade Credits with the Freshwater Trust. The contract would result in a series of riparian restoration projects in the McKenzie River watershed to offset the WPCF's excess thermal load. The restoration projects would plant trees and other native vegetation, creating new shade onto the river, which offsets the excess thermal load in WPCF effluent.

[6] As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

Recycled Water Use for Agricultural Irrigation (Agricultural Irrigation)
Effluent from the WPCF (currently treated to Class D recycled water standards) would be piped via upgraded recycled water piping to a storage lagoon and used for agricultural irrigation at two MWMC-owned facilities including the Biocycle Farm (Biocycle) and the Beneficial Reuse Site (BRS). This project would include upgrading sections of recycled water pipeline infrastructure between the WPCF and the BRS along the Northwest Expressway. At the Biocycle Farm the existing method of irrigating via hose reels would be upgraded to a dedicated irrigation system, which includes new pipe, valves and irrigation outlets. At the BRS, the existing storage lagoon would be upgraded and relined, the pumping system would be reconditioned, a dechlorination system would be added and various electrical controls and SCADA equipment would be upgraded. Additionally, redundant WPCF pumping systems would be needed to ensure system functionality for thermal load compliance. The existing pivot irrigation system would be used with only minor upgrades. Recycled water would be applied at agronomic rates at both facilities for a combined daily demand of up to 3.1 million gallons per day (MGD), but demand would vary significantly throughout the year and be subject to climatic conditions.

Recycled Water Use for Industrial Aggregate Production (Industrial Aggregate)
This alternative would divert a portion of treated effluent from the WPCF currently discharged to the Willamette River (currently treated to Class D recycled water standards), further treating it to the highest Class A recycled water standards for distribution to the site shared by Delta Sand & Gravel (Delta) and Knife River where it would be used in lieu of Willamette River water for production. Water is used at the Delta-Knife site for a variety of industrial aggregate processes, including gravel washing, equipment rinsing, concrete patching, and asphalt production. The construction required for this alternative includes a segregated Class A recycled water production stream at the WPCF, distribution pumping, a pressurized storage tank, and dedicated recycled water distribution infrastructure at the Delta-Knife site. This alternative would utilize some existing infrastructure, including a recycled water pipeline between the WPCF and the Delta-Knife site, filtration units, and chlorine contact basins.

The purpose of this TBL assessment is to provide MWMC, wastewater staff[7] and other pertinent decision-makers with a summary of relevant economic, environmental and social performance data to compare the alternatives. In addition to this specific TBL Assessment, this project provided the following:

- A TBL framework that will allow MWMC to compare additional alternatives in the future
- Education and training for TBL process development to allow for future TBL assessments to be conducted internally, by staff (i.e. without consultant assistance)
- This assessment served as a "pilot project" for the TBL process within MWMC

Structure of Report

This report consists of 7 sections, which include the following:

1. **Executive Summary:** A highly summarized version of the assessment and results.
2. **Introduction:** An expanded version of the introduction included in the Executive Summary.
3. **Terminology and Methodology:** Defines the TBL terms used throughout this report and the approach and process used to complete this TBL assessment.
4. **Selection of TBL Criteria and Measures:** The selection of the Criteria and Measures is the single most important step in a TBL assessment because this selection defines the basis of the assessment and comparison. This section provides a description of the process and summary of

[7] "Wastewater staff" within the context of this report refers to City of Eugene and City of Springfield staff designated to support the MWMW's regional wastewater program.

the TBL Criteria and Measures that were selected for this assessment.

5. **Inventory of Data and Comparison of Alternatives:** Detailed inventory of available data to support comparison of the thermal mitigation alternatives according to the TBL Criteria and Measures.
6. **Scoring the Alternatives - Methodology and Results:** The inventory of data was used in conjunction with organizational values to "Score" the thermal mitigation alternatives. The process and results of this scoring exercise are documented in Section 6 of the report.
7. **Suggestions for Improving the TBL Process:** This assessment serves as the "pilot" TBL project for MWMC. The TBL framework is integrated differently by each organization and inevitably will evolve within MWMC over time. A few suggestions are offered for the next TBL assessment to improve efficiency and increase organization value.

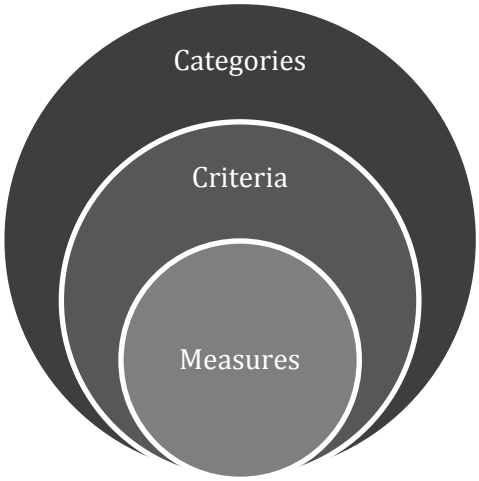
3. TERMINOLOGY AND METHODOLOGY

This section defines terms that are used throughout the report that are unique to this TBL assessment. The intent is to keep jargon to a minimum, but the terms listed here are required to provide structure, order and meaning for this assessment. This section also describes the methodology and approach used to complete this assessment.

Terminology

The following terms will be used consistently throughout this report to differentiate between the concepts and hierarchy within those concepts. The sub bullet points are used to illustrate hierarchy.

- **Categories:** The three broad groupings of issues considered within TBL thinking, frameworks and assessments. The three Categories are – *Economic, Environmental* and *Social.*
    - **Criteria:** Within each *Category* are sub-categories, called *Criteria*, which represent various decision-making considerations. For example Economic *Criteria* in this assessment include: Life-Cycle Cost, Operational Opportunity and Risk, and Regulatory Certainty and Adaptability.
        - **Measures:** A group of significant metrics or indicators, called *Measures*, is used to assess the alternatives for each *Criterion*. For example, *Measures* for the Life-Cycle Cost *Criterion* includes 20-Year Net Present Value and Cost Effectiveness of Thermal Mitigation.



- **TBL Score:** A numeric value calculated for each alternative based on *Criterion Weight* and *Criterion Score*. *Criterion Weight* is multiplied by *Criterion Score* for each thermal mitigation alternative to determine a weighted score. The weighted scores are summed across all *Criteria* to determine an alternative's *TBL Score*. See the *Scoring the Alternatives* section for details.
    - **Criterion Weight:** A relative percentage calculated for each individual *Criterion* to indicate its relative importance for this decision-making process. The sum of the nine *Criterion Weights* is equal to 100%. The Criterion Weights were calculated using data from a survey distributed to MWMC commissioners.
    - **Criterion Score:** A numeric value from 1 to 10 (10 = high value) applied by the technical project team to each thermal mitigation alternative, by individual *Measure,* to represent differences between the alternatives. The scores for all *Measures* are averaged, by *Criterion*, for each project alternative to determine the alternative's *Criterion Score*.

Methodology

TBL is an evaluation framework used to identify and scale significant economic, environmental and social benefits and costs in order to assess the overall value of an investment. The primary purpose and value of TBL is that a project's social and environmental performance is evaluated alongside typical "bottom line" financial considerations. TBL is particularly useful for high-stakes projects and long-term decision making to ensure all predictable or potential project consequences are considered to extract maximum value for large investments and to avoid short- or long-term negative impacts.

No single established protocol or methodology has been widely recognized as the best practice for conducting a TBL analysis. This is because the social, environmental and economic Criteria that are significant will change depending on the organization, project, or alternative being assessed. However, there are a variety of publically available TBL frameworks and guidelines, such as those developed by the Global Reporting Initiative[8], from which to take guidance.

The TBL approach used for this assessment consisted of three primary steps, which are described in detail in the following sections of this report:

- Selection of TBL Criteria and Measures
- Inventory of Data and Comparison of Alternatives
- Scoring the Alternatives

4. Selection of TBL Criteria and Measures

The process of selecting the TBL Criteria that are significant for this assessment began with a meeting of regional staff coordinated by the project manager. At this meeting staff was asked to assess the relevance of the alternatives based to a broad set of commonly used TBL Criteria summarized in Good Company's *TBL Screening Tool*. If relevance was established, staff was asked to describe significant benefits and concerns associated with each alternative for that specific Criterion. In addition to the group interview, the research team reviewed a variety of existing technical memos, documentation of other stakeholder interviews and other data to determine the key TBL Criteria.

The Criteria that were ultimately selected by the project technical team represent those that characterize a significant difference between the project alternatives – either as a benefit or a concern. The Criteria selected are presented in Figure 6 through Figure 8. The research team[9] considered other Criteria, which were ultimately excluded due to finding no significant difference between the alternatives. The excluded Criteria are summarized in Figure 9 and the reason for their exclusion is provided.

Once Criteria were selected, Measures within those Criteria were selected. The Measures highlight specific areas of benefit or concern that can be used to make a more side-by-side comparison across the group of alternatives. When possible, a Measure is represented by quantitative data, but some Measures use qualitative data for comparison. Each of the Measures used to compare the alternatives are listed by Criterion in Figure 6 - Figure 8.

[8] The Global Reporting Initiative (GRI) is a leading organization in the sustainability field. GRI promotes the use of sustainability reporting as a way for organizations to become more sustainable and contribute to sustainable development. For more details visit https://www.globalreporting.org.

[9] The research team fpr this assessment included City of Springfield staff, City of Eugene staff and a consultant team (Kennedy Jenks Consultants and Good Company).

Figure 6: Summary of Economic TBL Criteria and Measures.

TBL Category Triple Bottom Line (TBL) frameworks consist of three assessment *Categories*: Economic, Environmental and Social.	Criteria Criteria represent the significant economic, environmental and social considerations within the TBL assessment Categories to frame decision making by MWMC.	Measures of Criteria[1] Measures are used to evaluate and compare performance for Criteria across the project alternatives. Measures may be expressed in different ways, ranging from detailed quantitative measurements to qualitative evidence that is observable and / or scalable.
Economic	**Life-Cycle Cost and Cost Effectiveness:** Accounting for costs across the full life cycle by considering initial construction costs, on-going operation and maintenance expenses, and the value of potential revenue or cost avoidance provides a comprehensive comparison of the budget implications of each of the mitigation alternatives. Another way to evaluate the financial implications of each alternative is to evaluate it in the context of its potential to mitigate thermal load, or its cost-effectiveness. This Criterion describes the relative efficiency of each of the alternatives.	• **20-Year Net Present Value** - *Capital and Construction Cost* - *Annual Operations and Maintenance Cost* - *MWMC's Revenue Potential or Cost Avoidance* • **Indexed Cost Effectiveness of Thermal Mitigation** - *Late October Compliance Period* - *Late August Compliance Period* - *Early May Compliance Period*
	Operational Opportunity and Risk: It is important to recognize both the potential benefits, such as system capacity, and potential challenges, such as increased operational requirements, of different alternatives.	• **Additional Recycled Water Conveyance Capacity** • **Additional Recycled Water Storage Capacity** • **Other Significant Operational Opportunities or Risks** • **Resilience to Seismic Event**
	Regulatory Certainty and Adaptability: The ultimate purpose of a mitigation alternative is to ensure that it meets anticipated regulatory needs over the short- and long-term. It is also important to identify potential complications that might delay or otherwise jeopardize an alternative from meeting regulatory needs.	• **Permitting Certainty and Potential Challenges** • **Other Regulatory or Permitting Opportunities or Risks** • **Potential for Onsite Expandability of Thermal Mitigation** • **Decision-to-Project Implementation Period**

Note 1: Measures are listed in **bold**. Sub-measures, listed in *italics*, are used to calculate the Measures and are provided in the data summary, but are not used in the scoring process.

Figure 7: Summary of Environmental TBL Criteria and Measures.

TBL Category	Criteria and Descriptions	Measures of Criteria[1]
Environmental	**Water Resource Effects:** All living organisms depend on access to clean water. Each mitigation alternative could have different effects on surface or ground water quality or quantity. In addition, some project alternatives and their locations provide future opportunity to augment and enhance aquifer or stream flow.	• **Thermal Mitigation Potential** • **Surface Water Quality Effects (other than thermal)** • **Ground Water Quality Effects** • **Net Change to Willamette River In-Stream Flow** • **Offset of Current Water Use** - *Surface Water* - *Ground Water* • **Future Project Site Aquifer or Stream Flow Augmentation Opportunities**
	Habitat and Ecosystem Services: Water quality protection and improvement is important for aquatic ecosystem health. Projects may have additional benefits or unintended impacts to habitat or ecosystem functions.	• **Scale of Enhanced Habitat** • **Soil Quality Effects** • **Future Project Site Habitat and Ecosystem Opportunities**
	Life-Cycle GHG Emissions: Human-caused emissions of greenhouse gases (GHGs) are causing changes to the global and regional climate. Considering the scale of GHG impacts of the alternatives is consistent with elements of MWMC's ISO 14001 Environmental Management System.	• **Net 20-Year Life-Cycle Greenhouse Gas Emissions** - *Construction Emissions* - *Operational and Maintenance Emissions* - *Carbon Sequestration by Vegetation*

Note 1: Measures are listed in **bold**. Sub-measures, listed in *italics*, are used to calculate the Measures and are provided in the data summary, but are not used in the scoring process.

Figure 8: Summary of Social TBL Criteria and Measures.

TBL Category	Criteria and Descriptions	Measures of Criteria[1]
Social	**Local Economic Effect:** Infrastructure investments can result in significant local economic benefits in the form of both direct job creation and the provision of public goods that enhance economic development.	• **Creation of Construction Jobs** • **Nearby Private Demand for Recycled Water** • **Change in External Business Profit or Cost Avoidance**
	Community Stewardship: The siting or operation of mitigation alternatives can affect adjacent communities, including effects to health and safety, and changes in quality of life, now and in the future.	• **Human Health and Safety Concerns** • **Aesthetic Site Improvements** • **Develops Adaptation Capacity to Climate Change**
	Stakeholder Interest Alignment: Alignment with stakeholder priorities and engagement with community partners are project attributes that add overall community value.	• **Potential Project Partnerships** • **Alignment with Local and State Plans and Programs** • **Acceptability and Alignment with Local Stakeholders**

Note 1: Measures are listed in **bold**. Sub-measures, listed in *italics*, are used to calculate the Measures and are provided in the data summary, but are not used in the scoring process.

Figure 9: Summary of considered, but excluded Criteria and reason for exclusion.

Considered, but Excluded Criteria	Reason for Exclusion
Equity and Access	MWMC would consider supplying recycled water to any private customer that uses water for a purpose specified as a beneficial use for recycled water. Assumed: Customers have significant demand and agree to meet associated recycled water set-back requirements and in a location close to existing or planned recycled water infrastructure. None of the projects will limit site access beyond existing conditions.
Climate Mitigation	The primary purpose of these projects is not climate mitigation (i.e., reduction of greenhouse gas emissions). It is temperature TMDL compliance. There may be climate benefits associated with these alternatives, but those will be noted under the Criteria titled, Life-Cycle GHG Emissions.
Skill Development	None of the projects being considered in this analysis develop new skills for any of the stakeholders or their employees. The skills required to implement and operate the alternatives are already within existing employee skill sets and organization functions.
Noise and Vibrations	No new, significant sources of noise or vibrations are anticipated. Expected noise and vibrations will be confined to private property and not have significant outside-the-fence impacts beyond temporary construction impacts.
Odor or Noise	No new, significant sources of odor or noise are anticipated.
DMWESB Support	Disadvantaged, minority-owned, women-owned or emerging small businesses should be given equal opportunity and consideration for publically funded projects given their capability to deliver. This Criterion will become more relevant as the project moves into the implementation phase, and at that point be considered. This particular Criterion has limited relevance in the planning phase.
Criteria Air Pollutants	None of these alternatives is expected to be a significant, long-term source of criteria air pollutants. No combustion or treatment processes that will emit criteria pollutants, beyond existing conditions, will be used. As with any construction project, there may be a short-term need for dust control, but this will be limited to only the construction phase.
Green Building Practices	This Criterion will become more relevant as an alternative is selected and implemented and more resources are directed towards finalizing designs. It is premature to assess this Criterion in detail.

5. Inventory of Data and Comparison of Alternatives

Economic Criteria

Economic Criteria:

- Life-Cycle Cost and Cost Effectiveness
- Operational Opportunity and Risk
- Regulatory Certainty and Adaptability

Life-Cycle Cost and Cost Effectiveness

Criterion Description: Accounting for costs across the full life cycle, by considering initial construction costs, on-going operation and maintenance expenses, and the value of potential revenue or cost avoidance, provides a comprehensive comparison of the budget implications of each of the mitigation alternatives. Another way to evaluate the financial implications of each alternative is to evaluate the total cost in the context of its potential to mitigate thermal load, or its cost-effectiveness.

Measures:

- 20-Year Net Present Value
- Indexed Cost Effectiveness for Thermal Mitigation

Summary of Results: The lowest-cost alternative, based on 20-year NPV, is Riparian Shade at a cost of $4.7 million. Recycled Water Use for Industrial Aggregate Production is next at $6.8 million and highest-cost alternative is Recycled Water Use for Agricultural Irrigation at $11.9 million. While life-cycle cost is a critical decision-making factor, cost effectiveness may be an even more meaningful Measure for this assessment. Riparian Shade is the preferred alternative for the cost effectiveness Measure at $0.13 / kcal / day based on price estimates from the Freshwater Trust.

Figure 10: Summary of Life-Cycle Costs and Cost Effectiveness Criteria and Measures, by Alternative.

Measures	Riparian Shade Credits	Recycled Water Use for Agricultural Irrigation[1]	Recycled Water Use for Industrial Aggregate Production
20-Year Net Present Value (2014 $)	**$4,650,000**	**$11,924,000**	**$6,801,000**
First Costs	*$4,650,000*	*$7,852,000*	*$4,299,000*
O&M Costs (20-year NPV)	*$0*	*$1,323,000*	*$2,502,000*
MWMC 20-Year Revenue Potential	*$0*	*$507,691*[2]	*$0*
Indexed Cost Effectiveness[10] of Thermal Mitigation ($ / Kcal / day)	**$0.13**	**$0.21**	**$0.14**
Late October (Oct. 22 – 31)	*$0.05*	*$0.10*	*$0.11*
Late August (Aug. 17 – Sept. 9)	*$0.15*	*$0.33*	*$0.16*
Early May (May 8 – May 14)	*$0.29*	*$0.26*	*$0.17*

Data Gaps:

- Valuation of project risks, particularly for the Outside-the-Fence alternative. These risks include a significant change to the WPCF operational model (i.e., producing Class A water for an external customer).
- Valuation of staff time for project planning and implementation, program administration, customer relations, additional lab services, etc.

Note 1: Inside-the-fence 20-year NPV does not include 20-year revenue potential. The uncertainty associated with this valuation is high; therefore it was excluded from NPV calculations.
Note 2: NPV calculations use an inflation rate of 5% and a discount rate of 2.5%.

[10] See the Indexed Cost Effectiveness section of this report for methodology details.

20-year Net Present Value

Measure Description: Accounting of costs across a project's full life cycle provides a comprehensive comparison measure of the budget implications related to construction costs as well as annual operational and maintenance costs.

Riparian Shade Credits: $4.65 million.[11]

- ***Construction and Implementation Cost:*** $4.65 million. The Freshwater Trust's delivery of restoration credits costs $43,210 per acre, including 20 years of monitoring, maintenance, landowner payments, and reporting (based on estimated average costs from The Freshwater Trust). Per a discussion with The Freshwater Trust staff, a project of this scale could include 3 payments (i.e., 3 distinct restoration projects) over the course of ~7 years. The payments would coincide with the generation of credits by each of the three projects. MWMC would pay as a restoration project is completed and marketable credits are available for compliance purposes. After the 20-year contract term is complete, the MWMC could continue the contract with The Freshwater Trust as long as the landowner is willing to renew the lease. At this point, 20 years hence, the MWMC's cost for the credits would decrease, as they would not include the restoration cost. Instead the payments will be based on lease, maintenance and monitoring costs at market value in 20 years.
- ***Annual O&M Costs:*** $0 / year.[12] Note: This sub-measure only represents O&M costs to the MWMC. The Freshwater Trust will incur annual O&M costs over the life of the project, but these costs are built into the price of the shade credits and therefore will not impact the MWMC's annual operating budget.
- ***Financial Incentives:*** $0. No source of financial incentives was identified.

Recycled Water Use for Agricultural Irrigation: $11.9 million[13]

- ***Construction and Implementation Cost:*** $7.9 million. Costs are estimated at $5.4 million for construction and $2.8 million for design, engineering, admin, legal, etc.
- ***Annual O&M Costs:*** $99,000 / year (years 1-10), $75,374 / year (years 11-20). These annual costs have a 20-year net present value (NPV) of $1.3 million.
- ***Financial Incentives:*** $0. A search for state and federal grants and other financial incentives that could support this alternative was completed, but no funding sources were identified.
- ***Revenue Potential:*** $507,000 / 396-acres of poplar for 20 years of growth. The new source of revenue scaled for this assessment (beyond existing conditions) is based on the potential for increased biomass production as a result of increased irrigation. A range of $40,000 to $765,000 of additional net revenue for poplar plantations is estimated for a 52-acre plot.[14] The lower end of that range is used here to be conservative. Assuming that an additional $40,000 / 52-acres over a 12-year growth period, MWMC's 396 acres of poplar plantations would result in additional profit of $304,615 for a 12-year growth cycle.[15] The 12-year value is scaled up to account for 20 years of growth (the assumed project lifecycle), which equals $507,691 / 396 acres for 20 years.[16]

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[11] MWMC Recycled Water Program Briefing Book (March 2013)
[12] Interview with The Freshwater Trust staff.
[13] Cost details (including first costs, annual O&M and calculation of 20-year NPV) for this alternative are presented in a technical memorandum by Kennedy/Jenks Consultants titled *Thermal Load Mitigation Pre-Implementation Biocycle Farm, Beneficial Reuse Site and W2 Line Upgrades – Recycled Water Conceptual Design.*
[14] Technical Memorandum 19, Version 2 (Draft Date: Oct. 24, 2013)
[15] 396 acres / 52 acres X $40,000 / 52 acres of growth for 12 years = $304,615 / 396 acres for 12 years.
[16] (($304,615 / 12 years) X (8 years / 12 years)) + ($304,615 / 12 years) = $507,691 / 20 years

Recycled Water Use for Industrial Aggregate Production: $6.8 million[17]

- ***Construction and Implementation Cost:*** $4.3 million.
- ***Annual O&M Costs:*** $179,000 / year (years 1-10), $162,000 / year (years 11-20). These annual costs have a 20-year net present value (NPV) of $2.5 million.
- ***Financial Incentives:*** $0. A search for state and federal grants and other financial incentives that could support this alternative was completed, but no funding sources were identified. A possible opportunity could be through the U.S. Department of the Interior – Bureau of Reclamation's Water Reuse and Recycle Program (Title XVI).[18] The application process for this program is closed for this year, but may be open again for next calendar year. The application period is primarily in December.
- ***Revenue Potential:*** $0. Developing recycled water infrastructure does offer the potential for a revenue source for MWMC related to the sale of recycled water, but at this point in time no definitive information or data is available about potential customers or how the recycled water resource would be valued in the market and priced by MWMC.

Indexed Cost Effectiveness for Thermal Mitigation

Measure Description: A second metric to evaluate financial performance is cost effectiveness, or normalizing the 20-year NPV cost by the desired outcome of the investment (i.e., mitigation of thermal load in the WPCF's effluent). There are three potential critical thermal compliance periods for the WPCF: October, May and August. Each of these periods has its own cost based on the thermal mitigation potential during that period.

Riparian Shade Credits:
$0.13 / kcal / day.[19] Given the early planning stage, and that no project sites have been selected, an estimated price of $0.025 per credit (i.e., 1 kcal / day) was provided by The Freshwater Trust for the October compliance period. There would be a 2:1 credit purchasing requirement for compliance, per ODEQ, so the total cost per "compliance credit" is $0.05 / kcal / day. Per The Freshwater Trust staff, the economics of this option are primarily driven by the thermal reduction potential at the site, which is highly variable. In other words, the greater the thermal reduction potential for a given acre of land, the lower the cost per unit of thermal reduction. Factors that increase shade values (and lower costs) include wider streams (which provide greater surface area per foot of bank), lack of existing vegetation, lack of steep banks and hill shade, and dominant southern exposure. See Figure 11 for details.

Recycled Water Use for Agricultural Irrigation: $0.21 / kcal / day.[20] See the Methodology section and Figure 11 for details.

Recycled Water Use for Industrial Aggregate Production: $0.14 / kcal / day.[21] See the Methodology section and Figure 11 for details.

[17] Cost details (including first costs, annual O&M and calculation of 20-year NPV) for this alternative are presented in a technical memorandum by Kennedy/Jenks Consultants titled *Thermal Load Mitigation Pre-Implementation Biocycle Farm, Beneficial Reuse Site and W2 Line Upgrades – Recycled Water Conceptual Design.*
[18] For more information visit http://www.usbr.gov/WaterSMART/title/.
[19] The thermal reduction potentials are taken from an MWMC staff produced spreadsheet titled *ThermalRXMeasures* (DRAFT Date: May 1, 2014). The thermal mitigation values are provided in detail in a separate section of this this report describing the Thermal Reduction Potential measure, page 36. Indexed cost effectiveness calculations are performed in a separate spreadsheet created by Good Company titled *MWMC-TBL_Cost_Eff-030514.xlsx*.
[20] Ibid
[21] Ibid

Indexed Cost Effectiveness Methodology

The cost effectiveness for each alternative is calculated with the 20-year NPV divided by the average daily thermal reduction ($ / average kcal / day), which results in a cost effectiveness for each time period. The cost effectiveness for each time period is weighted to represent the importance of the compliance period to MWMC and the WPCF. The October time period is weighted most heavily (at 3) because this is the time period that has the greatest probability of exceeding the TMDL based on historic data, next is August (at 2) and finally May (at 1). These weights are multiplied by the cost effectiveness; the weighted values are summed and divided by 6 to determine the weighted cost effectiveness value for each alternative.

Figure 11: Summary of cost effectiveness variables and calculated values.

Alternative / Time Period	20-Year NPV 2014 $	Average Reduction kilocalories / day	Cost Effectiveness $ / kcal / day	Weight unitless	Weighted Cost $ / kcal / day
Riparian Shade Credits					
October 22 – 31	$4,650,000	87	$0.05	3	$0.16
May 8 – May 14	$4,650,000	16	$0.29	1	$0.29
Aug. 17 – Sept. 9	$4,650,000	31	$0.15	2	$0.30
Summed Values				6	$0.75
Weighted Cost Effectiveness					**$0.13**
Recycled Water Use for Agricultural Irrigation					
October 22 – 31	$11,924,000	116	$0.10	3	$0.31
May 8 – May 14	$11,924,000	45	$0.26	1	$0.26
Aug. 17 – Sept. 9	$11,924,000	36	$0.33	2	$0.66
Summed Values				6	$1.24
Weighted Cost Effectiveness					**$0.21**
Recycled Water Use for Industrial Aggregate Production					
October 22 – 31	$6,801,000	63	$0.11	3	$0.32
May 8 – May 14	$6,801,000	41	$0.17	1	$0.17
Aug. 17 – Sept. 9	$6,801,000	42	$0.16	2	$0.32
Summed Values				6	$0.81
Weighted Cost Effectiveness					**$0.14**

Operational Opportunity and Risk

Criterion Description: It is important to consider both the potential operational benefits, such as system conveyance and storage capacity, and potential risks, such as increased operational requirements, for the various alternatives.

Criterion Measures:

- Additional recycled water conveyance capacity
- Additional recycled water storage capacity
- Other significant operational opportunities or risks
- Resilience of project to seismic event

Summary of Results: A significant advantage of the Shade Credit alternative is that it involves a largely "turn-key" contract mechanism to the MWMC, deferring all project implementation and long-term management to The Freshwater Trust as well as a large part of the potential risk. In addition, green infrastructure (i.e., planted riparian vegetation) is likely more resilient to a seismic event, compared to built infrastructure, and therefore should require less repair time and costs. The recycled water alternatives result in built infrastructure, which could provide operational flexibility or future opportunities, such as expanded distribution of recycled water to external customers. In addition, the recycled water alternatives would build organizational experience and knowledge that would be future assets should community demands for emerge. Finally, the recycled water alternatives would make significant use of existing pipe and irrigation infrastructure.

Figure 12: Summary of Operational Opportunities and Risk Measures, by alternative.

Measures	Riparian Shade Credits	Recycled Water Use for Agricultural Irrigation	Recycled Water Use for Industrial Aggregate Production
Additional RW Conveyance Capacity	0	1.7 – 2.2 MGD	7.2 MGD
Additional RW Storage Capacity	0	41 MG	0.1 MG
Resilience to Seismic Event	High	Medium-Low	Low
Other Significant Operational Opportunities or Risks	Opportunity • This alternative externalizes all operational requirements and risk to a third party. Risk • None to note.	Opportunity • Operational experienced gained though this project could be leveraged in the future if demand for Class D recycled water increased. • Utilizes some existing pipe and irrigation infrastructure. Risk • Wet weather limits irrigation demand.	Opportunity • Operational experience gained though this project could be leveraged in the future if demand for Class A recycled water demand increased. • Utilizes some existing pipe and treatment infrastructure. Risk • Change to existing business model. The WPCF would be required to produce a product to be used as a feedstock that meets external quality and quantity requirements. • Liability for Delta-Knife product failures as a result of recycled water composition. • Risk of Delta Sand & Gravel ceasing operations in 10-12 years.
Data Gaps: • None to note.			

Additional Recycled Water Conveyance Capacity

Measure Description: The ability to convey recycled water and biosolids is a mission critical activity for MWMC and its facilities. Increasing this capacity provides additional operational flexibility in the treatment of wastewater or in the delivery of recycled water to internal or external customers.

Riparian Shade Credits:
0 MGD. This alternative does not provide the MWMC with any additional capacity to convey recycled water or biosolids between the WPCF and the Biocycle/BRS facilities.

Recycled Water Use for Agricultural Irrigation:
0.9 – 1.1 MGD (12 hours) and 1.7 – 2.2 MGD (24 hours).[22] This alternative increases the conveyance capacity of the existing infrastructure by upgrading the W2 line between the WPCF and the Biocycle / BRS sites. The existing W2 line conveyance capacity is 2.8 MGD (24 hours). This proposed conveyance capacity would be increased to between 4.5 and 5 MGD. The resulting increase is 1.7 – 2.2 MGD. This increased capacity allows for inside-the-fence operational flexibility and provides additional capacity to distribute recycled water.

Recycled Water Use for Industrial Aggregate Production:
3.6 MGD (12 hours) and 7.2 MGD (24 hours).[23] This new conveyance capacity would be installed between the WPCF and Delta-Knife facilities. This increased capacity provides operational flexibility to distribute recycled water in the future to external customers.

Additional Recycled Water Storage Capacity

Measure Description: The ability to store recycled water provides two primary operational flexibility benefits to MWMC. First, storage provides a means for thermal load mitigation when required. Second, it allows storage of recycled water for irrigation during times of surplus supply to use for future demand.

Riparian Shade Credits:
0 MG. This alternative does not provide MWMC with any additional recycled water storage capacity.

Recycled Water Use for Agricultural Irrigation:
41 MG of usable capacity for recycled water storage.[24] Total lagoon capacity is 57.3 MG. The difference between usable and total capacity is the volume that will be required to store average annual rainfall and minimum water depth to maintain liner integrity. It should be noted that the lagoon is currently in existence, but the existing liner does not permit it to be used at full capacity.

Recycled Water Use for Industrial Aggregate Production:
0.1 MG. This alternative provides a small amount of potential storage in the pressurized tank (12,500 gallons) and the recycled water pipelines (93,500 gallons).[25]

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[22] Kennedy/Jenks Consultants (2014). *Thermal Load Mitigation Pre-Implementation Biocycle Farm, Beneficial Reuse Site and W2 Line Upgrades – Recycled Water Conceptual Design.*
[23] Kennedy / Jenks Consultants (2013). Recycled Water Program Implementation Planning Phase 2 Technical Memorandum - Delta Sand/Knife River Industrial Aggregate Site Recycled Water Conceptual Design Estimate.
[24] Technical Memorandum 15, Version 1 - *Operational Assumptions for Conceptual Beneficial Reuse Site Recycled Water Use*
[25] Todd Miller email exchange 5/1/2014.

Resilience to Seismic Event

Measure Description: It is well know that the Pacific Coast and the Willamette Valley are at risk of seismic events that, when they occur, may cause significant damage to wastewater infrastructure. While it is impossible to determine the exact scale of risk, this Measure seeks to highlight significant differences between "green" infrastructure (i.e., planted riparian vegetation) and "grey infrastructure" (i.e., infrastructure built from concrete, steel or plastic). Selecting infrastructure that is resilient may reduce repair time and costs after a seismic event.

Riparian Shade Credits:
High resilience. For this purpose of this assessment, it is assumed that "green" infrastructure will be more resilient to a seismic event compared to "grey" infrastructure. This increased resilience will result in less damage following a seismic event that will require repair or new investment. It is assumed that "green" infrastructure will require no repair by the MWMC and that any damage done at the riparian restoration sites will repair itself over time. It is worth noting that if the seismic event is serious and the restoration project is destroyed – The Freshwater Trust is not liable or required (per their contract) to rehabilitate the site in the event of a *Force Majeure*.[26]

Recycled Water Use for Agricultural Irrigation:
Medium-low resilience. It is assumed that "grey" infrastructure will require repair following a seismic event and will cause a delay in thermal load mitigation capacity for MWMC. Resilience is found as medium to low for this alternative because the infrastructure will be a mix of "legacy" and "new" construction, and because the infrastructure is below ground. This designation is supported by the findings of Oregon's Seismic Safety Policy Advisory Commission.[27] The Oregon Resilience Plan's chapter on Water and Wastewater Systems[28] found the following:

> ***"****The Willamette Valley would experience moderate ground shaking. Well-engineered structures may perform well, but many older structures would likely fail, including treatment facilities, reservoirs, and pump stations. One of the major impacts to large population centers would be from liquefaction: extensive alluvial and fill deposits along rivers would lose strength, lose bearing capacity, and move towards riverbanks. Old cast iron water pipelines buried in the liquefied soil would snap, and modern pipelines constructed of ductile iron and PVC would likely pull apart at joints, resulting in a total loss of water pressure throughout communities. Large drainage structures along riverbanks in liquefiable areas would likely move, severing connecting piping and rendering the structures useless."*

Recycled Water Use for Industrial Aggregate Production:
Low. For the purpose of this assessment, it is assumed that "grey" infrastructure will require repair following a seismic event and will cause a delay in thermal load mitigation capacity for MWMC. Resilience is found as low for this alternative because the infrastructure is located below ground along a riverbank and therefore is susceptible to soil liquefaction and the associated impacts. This designation is supported by the findings of Oregon's Seismic Safety Policy Advisory Commission. See excerpt from Seismic Safety Policy Advisory Commission findings in previous section.

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[26] "Force Majeure" is an unforeseeable and unavoidable event or circumstance not within the reasonable control of TFT, which could not have been brought within control through commercially reasonable efforts, which causes a delay or non-performance of a duty or obligation under this Contract.

[27] State of Oregon - Oregon Seismic Safety Policy Advisory Commission (2013). *Oregon Resilience Plan's chapter on Water and Wastewater Systems*. This document may be downloaded online at http://www.oregon.gov/OMD/OEM/osspac/docs/08_ORP_Water.pdf.

[28] State of Oregon - Oregon Seismic Safety Policy Advisory Commission (2013). *Oregon Resilience Plan's chapter on Water and Wastewater Systems*. This document may be downloaded online at http://www.oregon.gov/OMD/OEM/osspac/docs/08_ORP_Water.pdf.

Other Significant Operational Opportunities or Risk

Measure Description: This Measure is meant to capture other significant operational opportunities and risks that are were not previously addressed for this Criterion.

Riparian Shade Credits:

Opportunities:

- This alternative externalizes all operational requirements and risk to a third party. MWMC would be purchasing a finished riparian shade credit product from The Freshwater Trust or other qualified restoration organization.

Risks:

- None to note.

Recycled Water Use for Agricultural Irrigation:

Opportunities:

- This project develops a recycled water infrastructure and production experience that could be further utilized to meet future temperature TMDL requirements or Class D recycled water demand.
- Utilizes some existing pipe and irrigation infrastructure. This alternative utilizes existing sections of the W2 pipeline infrastructure as well as the parts of the pivot irrigation infrastructure at BRS.[29]

Risks:

- Wet weather limits irrigation demand. If a wet weather pattern coincides with thermal mitigation needs, the capacity of this alternative to deliver mitigation capacity may limited or compromised.
- There is of course additional risk associated with having to maintain and repair additional equipment, infrastructure and irrigation processes, but this risk is estimated and accounted for in the 20-year O&M costs for equipment repair and associated staff and contracted labor.[30]

Recycled Water Use for Industrial Aggregate Production:

Opportunities:

- This project develops recycled water infrastructure and production experience that could be further utilized to meet future temperature TMDL requirements or future Class A recycled water demand.
- Utilizes the existing West Bank pipeline and connections and Class A treatment infrastructure.

Risks:

- Change to existing WPCF business model. The WPCF would be required to supply recycled water in daily quantities equal to Delta-Knife operational demand based on an external organization's water quality specifications.
- Potential liability risk for Delta-Knife product failure as a result of recycled water composition.
- Based on discussions with Delta management, the Delta site has 10-12 years of remaining minable materials, although that life span could be extended if Delta is approved to expand its minable land base. Given unfavorable land use judgments regarding expansion, the MWMC expects that Delta will wind down gravel mining operations in the 10-12 year time frame. At that time, both Delta and Knife River

[29] Kennedy/Jenks Consultants (2014). *Thermal Load Mitigation Pre-Implementation Biocycle Farm, Beneficial Reuse Site and W2 Line Upgrades – Recycled Water Conceptual Design.*
[30] Ibid

expect to continue construction business operations located at the site. Recycled water demand would decrease significantly with the loss of gravel washing operations, but gravel pit reclamation could open up opportunities for recycled water use for indirect discharge and habitat enhancement.

Regulatory Certainty and Adaptability

Criterion Description: The ultimate purpose of a mitigation alternative is to ensure that it meets anticipated regulatory needs over the short- and long-term. It is also important to identify potential complications that might delay or otherwise jeopardize an alternative from meeting regulatory needs.

Measures:

- Permitting Certainty and Potential Challenges
- Other Regulatory or Permitting Opportunities or Risks
- Potential for Future Expansion of Project Site Thermal Mitigation Capacity
- Decision-to-Project Implementation Period

Summary of Results: Recycled Water Use for Agricultural Irrigation offers many advantages for this Criterion. Reducing effluent discharge to the Willamette River reduces other permitted constituents, in addition to thermal load, including biological oxygen demand (BOD), suspended solids and coliform. This advantage is also true for Recycled Water Use for Industrial Aggregate Production and to a greater degree as the annual demand for recycled water would be greater by Delta-Knife operations compared to Biocycle / BRS. The recycled water projects also have permitting risks. The Agricultural Irrigation alternative could potentially be an additional source of nitrogen to the Southern Willamette Ground Water Management Area. The Industrial Aggregate has two primary sources of risk to the MWMC. First, it is likely that some quantity of the effluent will continue to require permitting (by WPCF or Delta-Knife) as it is discharged back to the river through Delta-Knife settling ponds. Second, WPCF temperature compliance would be reliant on the timing of an external entity's water demand. Project permitting certainty is greatest for the Agricultural Irrigation Recycled Water project. The other two alternatives both have regulatory and permitting uncertainty or face potential challenges. The Riparian Shade Credits alternative does not offer any additional permitting opportunities or risks to the WPCF.

Figure 13: Summary of Regulatory Certainty and Adaptability Measures, by alternative.

Measures	Riparian Shade Credits	Recycled Water Use for Agricultural Irrigation	Recycled Water Use for Industrial Aggregate Production
Permitting Certainty and Potential Challenges	• Currently acceptable practice by EPA and DEQ. Not valid under MWMC's current NPDES permit. Subject to ongoing third party challenges.	• Greater relative certainty and lower risk because it's an existing practice at MWMC-owned facilities.	• Uncertainty associated with permitting of thermal discharges from Delta-Knife settling ponds.
Other Regulatory or Permitting Opportunities or Risks	Risks • Inability of credit vendor to recruit landowner and lease land in the area required to generate the needed thermal offset.	Opportunity • Reduces discharges of CBOD, total suspended solids, residual chlorine and ammonia. Risk • Wet weather could limit mitigation capacity during critical periods of compliance. • Potential for increased nitrate levels in the Southern Willamette GWMA. • Likely would require additional groundwater testing. • Could require Class A treatment if infiltration into groundwater is expected.	Opportunity • Reduces discharges of CBOD, total suspended solids, residual chlorine and ammonia. Risks • New permit for WPCF discharge at Delta-Knife site. • Compliance would be reliant on recycled water demand and timing of demand by private companies.

Measures	Riparian Shade Credits	Recycled Water Use for Agricultural Irrigation	Recycled Water Use for Industrial Aggregate Production
Potential for Project Site Expandability to Meet Future Mitigation Needs	• None onsite, but depending on the site(s) selected, there may be additional, adjacent land suitable for restoration.	• Total alternative potential is between 3.5 and 35 MGD for indirect discharge of recycled water to constructed onsite wetlands at Biocycle Farm and BRS.	• Gravel pit reclamation and habitat enhancement could potentially be significant, but are not quantified.
Decision-to-Project Implementation Period	5 – 7 years	2 - 3 years	2 - 3 years
Data Gaps: • Actual water use data and timing of use (daily and seasonal) for Delta-Knife operations. • Scale of thermal reduction potential from gravel pit reclamation at the Delta-Knife site. • Scale of thermal reduction potential from wetland creation or groundwater recharge projects at the Biocycle / BRS sites.			

Permitting Certainty and Potential Challenges

Measure Description: The regulatory framework and requirements for temperature TMDL are still being finalized and likely won't be complete for years. While the exact requirements and allowed means of compliance are still being determined, there is precedent that separates the alternatives.

Riparian Shade Credits:
The purchase of Riparian Shade Credits is acceptable practice by EPA and DEQ as of this writing; however, it is not valid under MWMC's current NPDES permit. The ability to use compliance mechanism is at ODEQ's discretion and would be addressed during revision of the WPCF's existing NPDES permit. The use of Riparian Shade Credits is also subject to ongoing third party challenges. There is precedent for legal challenges to water quality credits as a compliance mechanism.[31]

Recycled Water Use for Agricultural Irrigation:
MWMC staff and K/J Consultants consider this alternative to have the greatest permitting certainty. The project sites are owned by the MWMC, are part of existing operations and, in the case of Biocycle, already use recycled water for irrigation. The planned uses of recycled water for agricultural irrigation under this alternative (i.e. poplar trees at Biocycle and forage crops at BRS) are on Oregon's defined list of beneficial uses for Class D recycled water.

Recycled Water Use for Industrial Aggregate Production:
There is permitting uncertainty related to the thermal load remaining in the recycled water that would return to the Willamette River via Delta-Knife settling ponds after its use in industrial aggregate processing. Use of recycled water for gravel washing and related activities, and subsequent discharge into infiltration ponds connected to the river hyporheic zone could require consideration of an NPDES outfall permit instead of the general WPCF permit for sand and gravel operations. Information on the scale of thermal load that would be discharged from the

[31] Northwest Environmental Advocates (NWEA) wrote a letter to the Environmental Protection Agency (EPA) outlining concerns associated with a restoration project in Medford by The Freshwater Trust on behalf of Medford's wastewater treatment plant. The Freshwater Trust provided a written response to NWEA's concerns which is available upon request.

ponds and who would be permitted for that discharge would require more extensive field study and determination.

Other Regulatory or Permitting Opportunities or Risks

Measure Description: Beyond temperature TMDL compliance, the alternatives may also offer MWMC or a project partner other regulatory opportunities or risks, such as reducing discharges of other permitted pollutants or creating the need for a new permit.

Riparian Shade Credits:

Opportunities:

- None to note.

Risks:

- Inability of credit vendor to recruit landowner and lease land in the area required to generate the needed thermal offset.

Recycled Water Use for Agricultural Irrigation:

Opportunities:

- Reduces discharges of CBOD, total suspended solids, residual chlorine and ammonia to the Willamette River. The discharge of most of these constituents is not regulated when land applied. The average aggregate irrigation demand is 1.98 MGD (12-hours) at the Biocycle / BRS sites. This daily demand was used in conjunction with analytical testing results for discharged WPCF effluent to calculate the weight (in pounds) of avoided discharges that are presented in Figure 14.[32]

Risks:

- Wet weather could limit mitigation capacity during critical periods of compliance.
- Potential source of nitrogen within the Southern Willamette Ground Water Management Area (GWMA). ODEQ manages the GWMA through an education and outreach campaign for voluntary action. However, certain nitrate (the nitrogen chemical of concern) sources such as wastewater treatment facilities are directly regulated and ODEQ can place special scrutiny of nitrate management on those sources. As part of the biosolids management program and former use of the BRS as a food processing waste facility, the MWMC monitors groundwater wells for nitrates. Based on the recent observations of elevated nitrate trends in groundwater beneath the BRS, use of recycled water at the site for irrigation will need to be done in special consideration of overall site nutrient management and continued monitoring for on- or off-site nitrate sources.
- It is also likely that ground water monitoring would be required with any new recycled water activities at the site.[33]
- Could require Class A treatment if infiltration into groundwater is expected.[34]

Recycled Water Use for Industrial Aggregate Production:

Opportunities:

- Reduces discharges of CBOD, total suspended solids, coliform and ammonia to the Willamette River. Most of these constituents (except ammonia) are not regulated as discharges when land applied. Delta-Knife operational water demand is assumed to be 3.09 MGD (10-hours), based on the operational pumping rates at the site. This daily demand was used in conjunction with analytical testing results for discharged WPCF effluent to calculate the weight of avoided discharges that are presented in

[32] Calculations are documented in a separate Excel spreadsheet titled MWMC-TBL_Water_Quality_Calcs-022514.
[33] CH2MHill (2013). *Beneficial Reuse Site Irrigation System and Agronomic Alternatives Assessment*.
[34] Casey Hanson (2013). *Preliminary Findings for Constructed Wetlands as Thermal Load Reduction Alternatives.*

Figure 14.[35]

Risks:

- Per discussion with the ODEQ, the project would likely require a modified discharge permit to reflect recycled water discharge as opposite to aggregate wash discharge. The recycled water used as wash water by Delta-Knife would ultimately be directed to their settling ponds, which discharge through infiltration into the subsurface (and indirectly to the Willamette River). Therefore, the discharge of used recycled water to the settling ponds would likely require an NPDES permit for a new outfall. While the burden of the permit could possibly fall on the MWMC under an NPDES permit (as opposed to Delta's onsite WPCF permit), Delta would still incur additional regulatory scrutiny at its site, and the MWMC would have additional discharge reporting requirements.[36]
- Compliance would be reliant on recycled water demand and timing of demand by private companies.

Potential for Future Expansion of Project Site Thermal Mitigation Capacity

Measure Description: Investment in an alternative will have greater long-term value if that initial investment funds a project that has additional, undeveloped on-site thermal load mitigation potential that may be developed in the future. The geographic boundaries of this measure are limited to the alternative site boundaries.

Riparian Shade Credits:
None onsite, but depending on the site(s) selected, there may be additional, adjacent land suitable for restoration. The purchase of Shade Credits are highly scalable, may be tailored to organizational compliance needs, and may benefit from economy of scale for the project (e.g., initial site selection and long term O&M are more cost effective in clustered locations rather than spread out).

Recycled Water Use for Agricultural Irrigation:
This alternative offers the potential for future add-on, onsite expandability of thermal load mitigation via wetland creation or groundwater recharge. A preliminary estimated that the potential at Biocycle Farm is between 2.8 and 28 MGD. The discharge potential at BRS is between 0.7 and 7.0 MGD. The total potential is between 3.5 and 35 MGD.[37] The cost or scale of thermal reduction associated with these future opportunities is not available and would require additional study.

Recycled Water Use for Industrial Aggregate Production:
There may be potential associated with reclamation of gravel pits at the Delta-Knife sites. The potential for gravel pit reclamation and habitat enhancement is likely to be significant in scale and may represent significant thermal mitigation potential, but quantification of this opportunity would require more study. Like the Agricultural Irrigation alternative, the Industrial Aggregate alternative offers the potential for additional, future thermal reduction capacity based on the initial infrastructure development for the industrial aggregate use of recycled water. This infrastructure could be used to convey water to the pits created on Confluence Island from gravel extraction. An estimate of pit area and volume post-full gravel extraction is 81 acres and 660 million gallons.[38]

[35] Calculations are documented in a separate Excel spreadsheet titled MWMC-TBL_Water_Quality_Calcs-022514.
[36] Todd Miller (2013). Email, subject line "Updates_MWMC_Recycled_Water_Study-051413," May 21, 2013.
[37] Casey Hanson (2013). *Preliminary Findings for Constructed Wetlands as Thermal Load Reduction Alternatives.*
[38] Sara Robertson (2011). *Three Scenarios For the Future of Confluence Island, their Effects and their Adaptability.*

Decision-to-Project Implementation Delay

Measure Description: The time between the decision-to-implement and actual thermal load mitigation may be an important factor given the uncertainty of final temperature TMDL regulatory requirements, particularly the compliance implementation period.

Riparian Shade Credits:
5 – 7 years. The lower end of this range is based on the expected regulatory time frame. The upper end of the range is based on an estimate from The Freshwater Trust staff about the timeline for implementation of the projects to generate credits equal to 93 Mkcal / day.[39] This estimate is based on an assumption of 3 individual projects that restore a total of between 5 and 10 miles of stream bank.

Recycled Water Use for Agricultural Irrigation:
2 - 3 years. This value assumes the full implementation period 0.5 – 1.5 years for the biding process and design and 1.5 years for construction.[40]

Recycled Water Use for Industrial Aggregate Production:
2 - 3 years. Same as above.

[39] Phone interview with Alex Johnson of The Freshwater Trust (July 2013).
[40] Email correspondence with Ron Walz of K/J Consultants (February 2014).

Environmental Criteria

Environmental Criteria

- Water Resource Effects
- Habitat and Ecosystem Services
- Life-Cycle Greenhouse Gas Emissions

Water Resource Effects

Criterion Description: All living organisms depend on access to clean water. Each mitigation alternative could have different effects on surface or ground water quality or quantity. In addition, some project alternatives and their locations provide future opportunity to augment and enhance aquifer or stream flow.

Measures:

- Thermal Reduction Potential
- Surface Water Quality Effects
- Ground Water Quality Effects
- Net Change to Willamette River In-Stream Flow
- Offset of Surface or Groundwater Use
- Future Project Site Aquifer or Stream Flow Augmentation Opportunities

Summary of Results: All of the alternatives will improve surface water quality. The benefits are quantifiable for the recycled water alternatives based on the quantity of WPCF effluent that is not discharged to the Willamette River; therefore the Industrial Aggregate of alternative (with the greater demand of the two) is the superior alternative. Riparian Shade will also improve water quality, but quantifiable information is not available. The primary risk to ground water is addition of nitrogen for the Agricultural Irrigation alternative - other impacts or benefits of soil infiltration would need to be assessed. The Agricultural Irrigation alternative results in a net decrease of Willamette River in-stream flow. The Industrial Aggregate alternative offers the greatest offset of surface and ground water use. The Agricultural Irrigation alternative site provides future potential for stream or groundwater augmentation.

Figure 14: Summary of data for Water Resource Effects TBL Measures.

Measures	Riparian Shade Credits	Recycled Water Use for Agricultural Irrigation	Recycled Water Use for Industrial Aggregate Production
Indexed Thermal Reduction Capacity	252	393	340
Surface Water Quality Effects (Other than Thermal Loading)	• Data is not available for this alternative, but depending on the site, restoration could have a significant impact on buffering surface water from non-point sources of pollution.	• This project reduces annual surface water discharge from WPCF by an estimated 264 MG. This results in the following estimated reductions of permitted constituents as well as other non-regulated constituents.	• This project reduces annual surface water discharge from WPCF by an estimated 575 MG. This results in the following estimated reductions of permitted constituents as well as other non-regulated constituents.
$CBOD_5$	• *Reduction possible*	• *Daily: -50 lbs./12 hours* • *Annual: -6,609 lbs.*	• *Daily: -77 lbs./10 hours* • *Annual: -14,771 lbs.*
Suspended Solids	• *Reduction likely*	• *Daily: -99 lbs./12 hours* • *Annual: -13,218 lbs.*	• *Daily: -155 lbs./10 hours* • *Annual: -29,541 lbs.*
Coliform	• *Reduction possible*	• *Daily: -6,692 lbs./ 12 hours* • *Annual: -892,274 lbs.*	• *Daily: -7,976 lbs./10 hours* • *Annual: -1,994,038 lbs.*
Ammonia (as Nitrogen)	• *Reduction likely for nitrogen reductions*	• *Daily: -119 lbs./12 hours* • *Annual: -15,862 lbs.*	• *Daily; -186 lbs./10 hours* • *Annual: -35,450 lbs.*

Measures	Riparian Shade Credits	Recycled Water Use for Agricultural Irrigation	Recycled Water Use for Industrial Aggregate Production
Ground Water Quality Effects	• No known effects.	• Risk of additional nitrogen source to Ground Water Management Area.	• Not a significant concern.[41]
Net Change to Willamette River In-Stream Flow	• No net change.	• Net decrease. Average decrease of 1.98 MGD (June through September) and a peak of 3.07 MGD (July)	• No net change.
Offset Surface or Groundwater Use	• *Surface:* No change. • *Ground:* No change.	• *Surface:* No change. • *Ground:* 0.0001 MGD.	• *Surface:* 2.36 MGD. • *Ground:* 0.06 MGD.
Future Onsite Aquifer or Stream Flow Augmentation Opportunities	• No opportunities identified.	• Discharge to groundwater is possible if treated to Class A standards. • Discharge to surface water via constructed wetland.	• No opportunities identified.
Data Gaps: • Data or modeling related to potential water quality impacts for riparian restoration. • Water quality testing results for Class A recycled water.			

Thermal Reduction Potential

Measure Description: The ability to mitigate thermal load discharged to the Willamette River is the most fundamental Measure for the primary purpose of this assessment – comparing thermal mitigation alternatives. The highest-level finding for this Measure is an indexed value that assesses mitigation potential for the period May through October based on a 20-year projection of mitigation need.

Riparian Shade Credits: 252 (indexed value).
This alternative **can provide 100%** of the thermal mitigation needed to provide the 93 Mkcal per day near-term compliance needs for the late October period based on the 2006 TMDL requirements and historic data. The Riparian Shade Credit alternative provides the thermal reduction potential required to meet a portion of the projected 2035 excess thermal load in early May, mid-July, September and late October. In May and from mid-July through early September the thermal mitigation potential only reaches about 30% of the total required for compliance purposes. This annual time period of low thermal reduction potential is the reason scores the lowest indexed thermal reduction score for the group of alternatives.

Recycled Water Use for Agricultural Irrigation: 393 (indexed value).
This alternative **can provide 100%** provide the thermal mitigation needed to provide the 93 Mkcal per day near-term compliance needs for the late October period based on the 2006 TMDL requirements and historic data. It provides approximately 130% of the total need based on 2006 TMDL requirements. The Agricultural Irrigation alternative provides a the thermal reduction potential required to meet projected 2035 excess thermal load in May and a portion of the reduction in mid-July and from mid-September through early October. From mid-July through early September the thermal mitigation potential reaches about 70% - 85% of the total required.

[41] Technical Memorandum 9, Version 2 - *Industrial Aggregate Water Fate and Discharge Assessment.* Because of the way water is known to migrate through the Willamette River's hyporheic zone, groundwater contamination is not a significant concern, as any leakage into the soil will likely migrate back to the River, not into groundwater aquifers or wells.

Recycled Water Use for Industrial Aggregate Production: 340 (indexed value). This alternative ***might not*** provide the thermal mitigation needed to provide the 93 Mkcal per day near-term compliance needs for the late October period based on the 2006 TMDL requirements and historic data. It provides approximately 85% of the total need based on 2006 TMDL requirements. This alternative provides the thermal reduction potential required for the projected 2035 excess thermal load in May. From mid-July through mid-September the thermal mitigation potential reaches between 60% and 95% of the total required for compliance purposes and about 30% of the potential needed in October. This alternative scores the highest of any alternative. It's important to note that these results are highly dependent on the assumptions made about volume and timing of water demand at the Delta-Knife site.

Thermal Reduction Potential Methodology

The 2006 TMDL presented the MWMC with a potential need to mitigate for excess temperature impacts in late October. Given that the 2006 TMDL is in the process of being updated and potentially impose a different temperature compliance regime, conceptual temperature mitigation alternatives were also evaluated against a theoretical future risk of thermal load exceedance.

For planning purposes, regional wastewater staff developed theoretical projections of the WPCF's daily maximum excess thermal load risk by calendar day based on the 2006 TMDL under a series of exacerbating conditions. Those conditions included a combination of population influenced wastewater influent flow increases, federal dam management influenced river flow changes, and climate change influenced river flow and temperature changes. Projecting incremental annual changes out over a 20 year period (i.e. a theoretical year 2035 condition) provided a basis for planning for potential future thermal load constraints. This planning basis provided a means of judging how well a particular mitigation alternative could serve the MWMC's potential future needs.

For the period of May through October the excess thermal load from the WPCF is compared to the ability of the alternative to mitigate the thermal load based on the theoretical future projections. The average excess thermal load for any given day from May to October is based on historical data and is weighted by the number of years that day exceeded the WPCF's temperature waste load allocation. For the Riparian Shade Credit alternative the thermal reduction potential is estimated with a shade model.[42]

[42] Technical Memo 21 - Estimation of Riparian Shade Thermal Mitigation Benefit and the associated calculations in an Excel spreadsheet called ThermalRxMeasures.

Surface Water Quality Effects (Other than Thermal Load)

Measure Description: Compare the effect on surface water quality, by estimating the average daily and annual net change to the quantity of known water pollutants.

Riparian Shade Credits:
A riparian restoration project creates a vegetative buffer between a waterway and the adjacent land. Besides providing shade, this buffer could serve as a filter to capture run-off from storm events and irrigation, and reduces sources of non-point water pollution. The scale and types of the thermal reductions associated with the purchase of Riparian Shade Credits are site-and restoration-dependent. A site with baseline conditions of bare ground will result in greater thermal reductions than a site with existing vegetation. Likewise, a site adjacent to a dairy farm may have different effects than unused agricultural land. Some of the many variables that are important when considering water quality impacts[43] include: vegetation types, vegetation density, width of vegetation from stream bank, slope of bank, etc. For the purpose of this analysis, it is assumed that suspended solids, fecal coliform bacteria and nitrogen discharges will be reduced. The scale of these reductions is impossible to estimate without detailed information about the project site, baseline conditions and restoration plans. Once that information is available, existing publically available tools could be used to estimate the benefits.

Recycled Water Use for Agricultural Irrigation:
Discharge effluent from the WPCF includes permitted and unpermitted constituents that affect water quality. Using recycled water for irrigation will divert water from aquatic discharge to land application. This diversion reduces loading of effluent constituents including: total suspended solids, biochemical oxygen demand, coliform, ammonia and others.[44]

Recycled Water Use for Industrial Aggregate Production:
Discharge effluent from the WPCF includes permitted and unpermitted constituents that affect water quality. Using recycled water for irrigation will divert water from aquatic discharge to land application. This diversion reduces loading of effluent constituents including: total suspended solids, biochemical oxygen demand, coliform, ammonia and others.[45]

Ground Water Quality Effects

Measure Description: Compare the effect on ground water quality.

Riparian Shade Credits:
No known effects.

Recycled Water Use for Agricultural Irrigation:
The primary concern for groundwater impact is the addition of nitrogen contained within the recycled water used for irrigation within the context of the baseline levels in the Ground Water

[43] EPA. Effectiveness of Riparian Buffers for Managing Nitrogen. Accessed online Feb. 2014 at http://www.epa.gov/ada/eco/pdfs/riparian_buffer.pdf.
[44] Calculations related to the values presented in Figure 14 are documented in a Good Company created Excel spreadsheet titled *MWMC_TBL-Water_Quality_Calcs-030314.*
[45] Ibid

Management Area given the a relatively high water table thereby limiting soil attenuation potential at the project site.[46]

Recycled Water Use for Industrial Aggregate Production:
No known effects. Because of the way water is known to migrate through the Willamette River's hyporheic zone, groundwater contamination is not a significant concern, as any leakage into the soil will likely migrate back to the River through the hyporheic zone, not into groundwater aquifers or wells. [47]

Net Change to Willamette River In-Stream Flow

Measure Description: Compare the net change to the in-stream flow of the Willamette River in terms of scale and timing of change.

Riparian Shade Credits:
No net change.

Recycled Water Use for Agricultural Irrigation:
Net decrease. WPCF discharge to the Willamette River would decrease by an average of 1.98 MGD during June through September, with a peak reduction of 3.07 MGD during July.[48]

Recycled Water Use for Industrial Aggregate Production:
No net change. It is assumed that recycled water would offset the use of surface water currently pumped by Delta-Knife operations from the Willamette River in equal quantities. In other words, the volume of water the WPCF discharges to the Willamette River would be maintained in the Willamette because Delta-Knife operations would *not* be withdrawing an equal amount of water.

Offset Surface or Groundwater Use

Measure Description: An advantage of recycled water is that it allows our community to offset the use of surface and ground water resources. This Measure assesses the scale and timing of that offset. The most valuable time for demand offset of water resources in during late summer and early fall when our water reserves and river levels are at their lowest.

Riparian Shade Credits:
No offset of surface or ground water.

[46] Technical Memorandum 20
[47] Technical Memorandum 15, Version 2 - *Industrial Aggregate Water Fate and Discharge Assessment*
[48] Kennedy/Jenks Consultants (2014). *Thermal Load Mitigation Pre-Implementation Biocycle Farm, Beneficial Reuse Site and W2 Line Upgrades – Recycled Water Conceptual Design.*

Recycled Water Use for Agricultural Irrigation:
No offset of surface water. Offset of ground water is approximately 0.004 MG per year, or about 4,000 gallons per year, used for irrigation.[49] It is assumed the existing irrigation is applied during the dry summer months of July – September. While the volume of groundwater used for irrigation has been minimal in recent history, the MWMC's maximum groundwater rights are much greater and this project could potentially free us those rights for other uses.

Recycled Water Use for Industrial Aggregate Production:
Average annual aggregate surface water demand at the Delta-Knife site is 2.36 MGD, with peak demand occurring between June and August. The average annual ground water demand is 0.06 MGD with a peak of 0.16 MGD in May.[50] Both are assumed to be offset for this alternative.

Future Aquifer or Stream Flow Augmentation Opportunities at Project Site

Measure Description: The water currently discharged from the WPCF into the Willamette River may be found to have a higher and better use in augmenting stream flow or recharging aquifers. This Measure is not directly relevant to the alternatives being considered in this assessment, but is indirectly relevant in that implementing some of the alternatives would provide the foundational infrastructure that would support these opportunities in the future. This Measure also supports the assessment of other thermal mitigation alternatives in the future with this TBL framework.

Riparian Shade Credits:
No opportunities identified.

Recycled Water Use for Agricultural Irrigation:
Potential for augmentation. A preliminary research report, completed by Casey Hanson (MWMC Research Intern), found that there are opportunities at the Biocycle and BRS sites to discharge recycled water to groundwater resources provided the recycled water is treated to Class A standards. There is also the opportunity to discharge directly to surface water. It may be possible to discharge to surface water through subsurface soils, but it depends on the onsite soil attenuation.[51]

Recycled Water Use for Industrial Aggregate Production:
No opportunities identified.

[49] Randy Gray, City of Eugene staff, reported that 12,200 gallons of well water were applied over the last 3 years, or about 4,000 gallons per year.
[50] MWMC staff created Excel spreadsheet titled *Industrial Balance*
[51] Casey Hanson (2013). *Preliminary Findings for Constructed Wetlands as Thermal Load Reduction Alternatives.*

Habitat and Ecosystem Services

Criterion Description: All living organisms depend on "ecosystem services," such as clean water and habitat, provided by the healthy functioning of biological systems. While each mitigation alternative is intended to enhance water quality by reducing temperature, an alternative may have co-benefits that enhance the provision of ecosystem services. Alternatively, a mitigation option may have unintended negative impacts to ecosystem services.

Measures:

- Scale of Enhanced Habitat
- Soil Quality Effects
- Future Project Site Habitat and Ecosystem Opportunities

Summary of Results: Riparian Shade Credits offer the greatest benefits of all the alternatives, except for the thermal reduction potential measure. The project would enhance riparian shade habitat, improve soil quality and offer the greatest long-term habitat benefits as the riparian restoration matures and become a more complex ecosystem. The Agricultural Irrigation project provides infrastructure for future wetland restoration projects, but at additional cost beyond what is considered in this assessment. The greatest thermal reduction potential is the result of the Industrial Aggregate alternative, followed by Agricultural Irrigation and finally Riparian Shade Credits. It's important to note that *none* of the alternatives provide 100% of the thermal reduction potential needed to meet the estimated mitigation requirements based the 2006 temperature TMDL. See the following sections for details.

Figure 15: Summary of Findings for the Habitat and Ecosystem Services TBL Measures.

Measures	Riparian Shade Credits	Recycled Water Use for Agricultural Irrigation	Recycled Water Use for Industrial Aggregate Production
Scale of Enhanced Habitat	• *Acres:* 36 - 73 • *Stream Miles:* 5 - 10	• *Acres:* 0 • *Stream Miles:* 0	• *Acres:* 0 • *Stream Miles:* 0
Soil Quality Effects	• Soil health may be improved by reducing soil compaction, improving drainage and reducing erosion.[52]	• No significant benefits or risks were identified. Class D recycled water analytical testing results were compared with the EPA's Recommended Limits for Constituents in Recycled Water for Irrigation.[53]	• No significant benefits or risks were identified. Class D recycled water analytical testing results were compared with the EPA's Recommended Limits for Constituents in Recycled Water for Irrigation.[54]
Future Project Site Habitat and Ecosystem Opportunities	• None assumed beyond the project life-cycle benefits of the initial restoration.	• If the maximum onsite wetland restoration potential were utilized it would create roughly 100 acres of wetland habitat.[55]	• No opportunities identified.
Data Gaps: • Delta-Knife water demand and timing of demand data.			

[52] Hoorman, J. and McCutcheon, J. *Understanding the Benefits of Healthy Riparian Areas*. Access online in Feb. 2014 at http://ohioline.osu.edu/ls-fact/0001.html.
[53] Oregon Department of Environmental Quality (2009). *Implementing Oregon's Recycled Water Rules.* Accessed online in Feb. 2014 at http://www.deq.state.or.us/wq/pubs/imds/RecycledWater.pdf.
[54] Oregon Department of Environmental Quality (2009). *Implementing Oregon's Recycled Water Rules.* Accessed online in Feb. 2014 at http://www.deq.state.or.us/wq/pubs/imds/RecycledWater.pdf.
[55] Casey Hanson (2013). *Preliminary Findings for Constructed Wetlands as Thermal Load Reduction Alternatives.*

Note 1: The methodology used to calculate the Indexed Thermal Reduction Capacity values is described on page 40 of this report.

Scale of Enhanced Habitat

Measure Description: Enhancing the quality of any habitat through restoration will have direct effects on a variety of terrestrial and aquatic species of flora and fauna as well as on the soil. Riparian restoration is particularly important because riparian areas are known to support higher diversity of species than most other habitat types. In Oregon and Washington it is estimated that 359 animal species utilize riparian or wetland habitat at some point during their life. Therefore, riparian restoration has a significant, long-term beneficial impact on the local ecosystem.

Riparian Shade Credits:
The project will result in riparian restoration of 5 – 10 miles of stream bank at a width of 60 feet, or approximately 35 – 75 acres.[56]

Recycled Water Use for Agricultural Irrigation:
Habitat enhancement is not part of this alternative.

Recycled Water Use for Industrial Aggregate Production:
Habitat enhancement is not part of this alternative.

Soil Quality Effects

Measure Description: Compare the effects of the project on soil quality and health.

Riparian Shade Credits:
Net improvement to soil quality. The total soil effects realized from riparian restoration project will be site-dependent. However it is assumed for the purpose of this analysis that riparian restoration will have a significant beneficial and long-term effect on soil quality at the restoration sites by potentially reducing soil compaction, improving soil drainage, improving bank stability and reducing soil erosion.[57]

Recycled Water Use for Agricultural Irrigation:
Net negative to soil. Low hazard for soil salinity. Class C recycled water-testing results for total dissolved solids (used as a proxy for Class A data, which is unavailable) were compared to Table 18 in ODEQ's - *Implementing Oregon's Recycled Water Rules*. This table is meant to assess the general salinity hazard from recycled water. Class C water has a TDS concentration of 244ppm, which is considered "Low Salinity Hazard". The effects of this hazard class are that sensitive plants may show stress; moderate leaching prevents salt accumulation in soil. The Class C recycled water analytical testing results were also compared with the EPA's

[56] The Freshwater Trust staff estimated that 5-10 miles of stream bank would be restored at a width of 60 feet or 36-73 acres.
[57] Hoorman, J. and McCutcheon, J. *Understanding the Benefits of Healthy Riparian Areas*. Access online in Feb. 2014 at http://ohioline.osu.edu/ls-fact/0001.html.

Recommended Limits for Constituents in Recycled Water for Irrigation[58], but no other significant impacts were identified.

Recycled Water Use for Industrial Aggregate Production:
No significant benefits or risks were identified. Class A recycled water analytical testing results[59] were compared with the EPA's *Recommended Limits for Constituents in Recycled Water for Irrigation*[60], but no significant impacts were identified.

Future Project Site Habitat and Ecosystem Opportunities

Measure Description: This Measure assesses the potential of the project to facilitate future habitat and ecosystem benefits.

Riparian Shade Credits:
As restoration site matures it will increase habitat complexity for aquatic and terrestrial species.[61]

Recycled Water Use for Agricultural Irrigation:
The initial investment in this alternative would support future projects onsite to restore onsite wetlands. If the maximum onsite wetland restoration potential were utilized, this alternative would create roughly 100 acres of wetland habitat (90 acres at Biocycle Farm and 10 acres at BRS).[62]

Recycled Water Use for Industrial Aggregate Production:
No future opportunities identified.[63]

[58] Oregon Department of Environmental Quality (2009). *Implementing Oregon's Recycled Water Rules.* Accessed online in Feb. 2014 at http://www.deq.state.or.us/wq/pubs/imds/RecycledWater.pdf.
[59] Class A analytical results were not available so Class C testing results were used as a proxy.
[60] Oregon Department of Environmental Quality (2009). *Implementing Oregon's Recycled Water Rules.* Accessed online in Feb. 2014 at http://www.deq.state.or.us/wq/pubs/imds/RecycledWater.pdf.
[61] http://www.dfw.state.or.us/conservationstrategy/docs/document_pdf/b-habitat_10.pdf
[62] Casey Hanson (2013). *Preliminary Findings for Constructed Wetlands as Thermal Load Reduction Alternatives.*
[63] Sara Robertson (2011). *Three Scenarios For the Future of Confluence Island, their Effects and their Adaptability.*

Life-Cycle Greenhouse Gas (GHG) Emissions

Criterion Description: Man-made emissions of greenhouse gases (GHGs) are causing changes to the global and regional climate. Considering the scale of GHG impacts of the alternatives is consistent with the MWMC's ISO 14001 Environmental Management System.

Measures:

- Net 20-Year Life-Cycle Greenhouse Gas Emissions (20-year MT CO_2e). All GHG emissions presented in this report are represented in metric tons of carbon dioxide equivalent (MT CO2e), which is the international reporting standard in greenhouse gas inventory protocol.

Summary of Results: The Riparian Shade Credits alternative has the lowest life-cycle greenhouse gas impacts of the three alternatives. These results are based on a 20-year project life span. If the riparian restoration were allowed to mature, at year 35 the life-cycle carbon footprint would be net-zero and if the project had a 100-year life span the net carbon footprint would equal -6,555 MT CO_2e.

Figure 16: Summary of Net Life-Cycle Carbon Footprint Measure, by alternative.

Measures	Riparian Shade Credits	Recycled Water Use for Agricultural Irrigation	Recycled Water Use for Industrial Aggregate Production
Net 20-Year Life-Cycle GHG Emissions	**1,092 MT CO_2e**	**5,680 MT CO_2e**	**2,395 MT CO_2e**
Construction (Materials and Fuel Use)	*1,232*	*3,574*	*1,545*
20-Year O&M Equipment Replacement and Maintenance	*119*	*294*	*850*
Net 20-Year Energy Use (Compared to Existing Conditions)	*0*	*1,812*	*0*[64]
20-Year Carbon Sequestration by Vegetation	*-259*	*0*	*0*

Net 20-Year Life-Cycle Greenhouse Gas Emissions

Measure Description: The GHG emissions reported for this Measure are a net value of project emissions minus existing conditions. This net value is particularly important for the Industrial Aggregate alternative, as this recycled water project will not require any additional net energy use for water pumping. Instead the energy required will offset energy already being consumed to supply industrial aggregate operations with process water.

The calculations for this Measure are documented in a separate Excel spreadsheet titled *MWMC-TBL-GHGs-030414.*

Riparian Shade Credits: 1,092 MT CO_2e

- ***Construction:*** 1,232 MT CO_2e. This category of emissions includes embodied emissions in the materials and equipment used in the restoration project[65] and onsite fuel

[64] This value represents net energy use of the project compared to existing conditions. It is assumed that the energy Delta Sand and Knife River currently use to pump water from the river is equal to the energy the MWMC will use to pump recycled water to the Delta-Knife River site for the Industrial Aggregate alternative. Ideally this energy consumption would be split between pumping and treatment energy, but that level of detail is available. If it were available pumping energy would be excluded (as equal to EC), but treatment energy would be included.

[65] Embodied emissions are production emissions from raw material extraction through the point of retail or wholesale purchase.

used for powered equipment.

- ***20-Year Operations (Site Monitoring):*** 119 MT CO_2e. Over the course of the 20-year contract, emissions will be incurred for site monitoring and replanting (as necessary).
- ***Net 20-Year Electricity Use:*** 0 MT CO_2e. No operational energy use required for this alternative.
- ***Carbon Sequestration by Vegetation:*** -259 MT CO_2e. This value represents the maximum 20-year carbon sequestration for 55 acres. This sequestration value is allocated to this project with the assumption that the restoration project will be long-term and survive in its restored form well past the shade credit contract. It represents the maximum because a fundamental assumption in the per acre carbon sequestration value provide by The Freshwater Trust and used for this estimate is that the project site is bare ground devoid of any existing vegetation. In all likelihood, there will be some vegetation at the project site that has the potential to sequester carbon, which would reduce this maximum value to a net value that considers the difference between project carbon sequestration and existing conditions. As of this writing, details about vegetation at the project site are unavailable.

  The scale of 20-year carbon sequestration compared to project emissions may be a surprise to some (i.e., the project emissions are greater than carbon sequestration). To show the full beneficial effect of carbon sequestration from riparian restoration, one needs to look 100 years into the future. The period of rapid carbon sequestration in a riparian ecosystem is between year 30 and year 70. If carbon sequestration is estimated for a project life span of 100 years it changes the quantity significantly, from -259 MT CO_2e (20 years) to -7,960 MT CO_2e (100 years). Figure 17 shows the difference in scale. The 100-year sequestration is added (light green) for scaling purposes to the 20-year GHG emissions by alternative.

Recycled Water Use for Agricultural Irrigation: 5,680 MT CO_2e

- ***Construction:*** 3,574 MT CO_2e. This category of emissions includes embodied emissions in the materials and construction equipment used during project construction as well as onsite fuel used for powered equipment.
- ***20-Year Equipment Maintenance:*** 294 MT CO_2e. This category of emissions accounts for embodied emissions in the materials used in pump maintenance and replacement as well as the fuel used to provide the maintenance or replacement services.
- ***Net 20-Year Electricity Use:*** 1,812 MT CO_2e. Additional energy (compared to existing conditions) will be required for this alternative in order to pump the recycled water to Biocycle / BRS and distribute it onsite for irrigation.
- ***Carbon Sequestration by Vegetation:*** 0 MT CO_2e. While this project will increase biomass production at both the Biocycle / BRS sites, this increased biomass and the carbon it sequesters will only be stored for a relatively short period of time before it is returned to the atmosphere via combustion (poplars to hog fuel) or decomposition (hay is digested by animals).

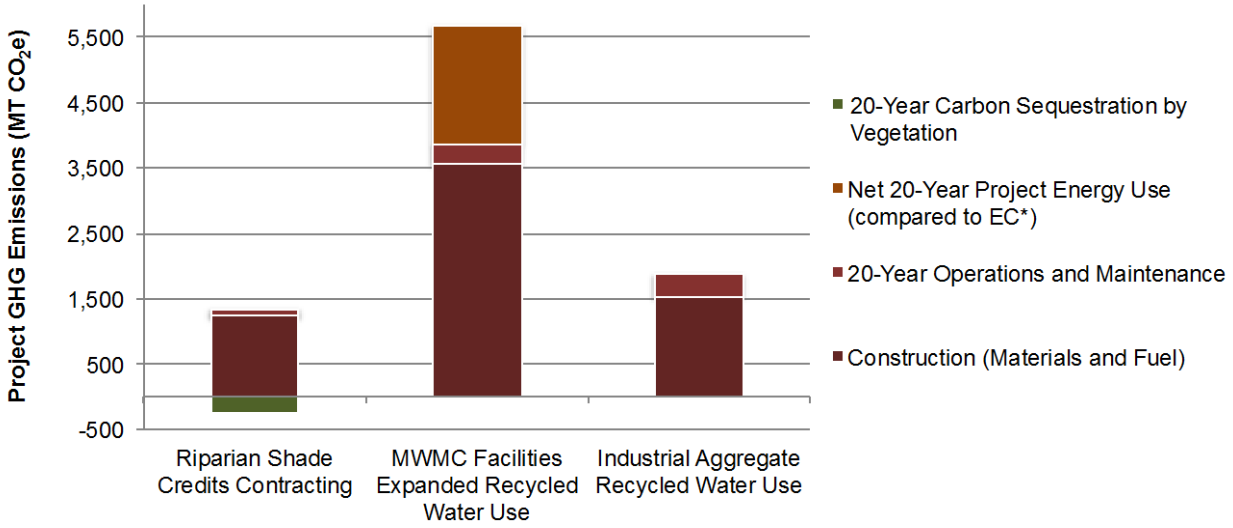
Recycled Water Use for Industrial Aggregate Production: 2,395 MT CO_2e

- ***Construction:*** 1,545 MT CO_2e. This category of emissions includes embodied emissions in the materials and construction equipment used during project construction as well as onsite fuel used for powered equipment.
- ***20-Year Operations (Treatment Chemical Use):*** 850 MT CO_2e. Emissions from this source represent the embodied emissions of the sodium hypochlorite used to treat the recycled water to Class A standards. No new pump maintenance or replacement is expected beyond existing conditions (i.e., pump maintenance and replacement by Delta-Knife) and therefore these emissions are excluded from this analysis.
- ***Net 20-Year Electricity Use:*** 0 MT CO_2e. Electricity is used in the 20-year operation of this alternative to pump the water from the WPCF to the Delta-Knife site. However,

compared to existing conditions, no new energy would be used. A benefit of this project is it accomplishes two tasks for the electricity currently being consumed for one under existing conditions. Delta-Knife is already using electricity to pump their process water from the Willamette River. This alternative meets that end of furnishing process water while also providing thermal mitigation load to the WPCF using the same electrical input. Because no additional energy is required for this alternative, emissions are accounted for as 0 MT CO_2e.

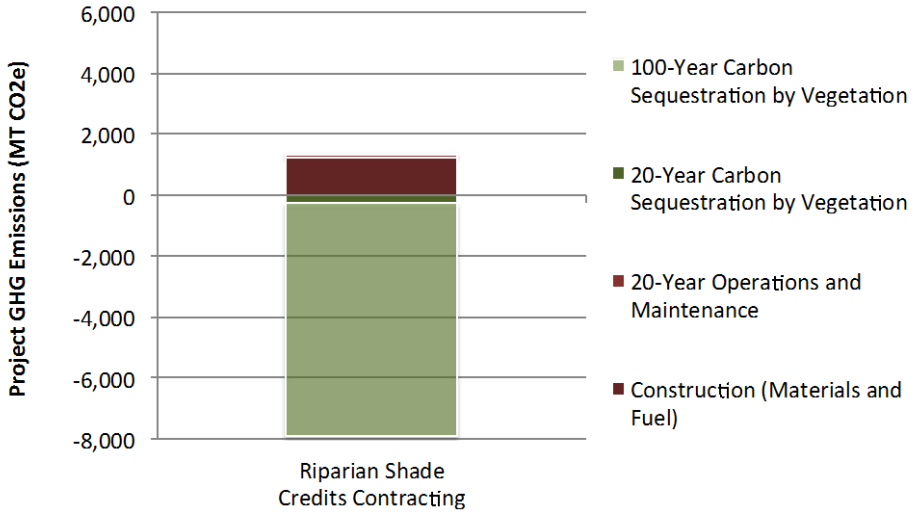
- ***Carbon Sequestration by Vegetation:*** 0 MT CO_2e. This project does not include changes to vegetation management that would result in significant sequestration.

Figure 17: Comparison of the 20-year Lifecycle GHG Emissions for All Alternatives, by emissions source, with 20-years of c-Sequestration by the Riparian Shade Credits Project.



*EC = Existing Conditions

Figure 18: Comparison of the 20-year Lifecycle GHG Emissions for All Alternatives, by emissions source, with 100-years of c-Sequestration by the Riparian Shade Credits Project.



Social Criteria

Social Criteria

- Local Economic Effect
- Community Stewardship
- Stakeholder Interest Alignment

Local Economic Effect

Criterion Description: Infrastructure investments can result in significant local economic benefits in the form of both direct job creation and the provision of public goods that enhance economic development.

Measures:

- Creation or Retention of Construction Jobs
- External Demand for Recycled Water
- Change in External Profit or Cost Avoidance

Summary of Results: Recycled Water Use for Agricultural Irrigation creates the greatest number of construction jobs. The Agricultural Irrigation alternative also has the greatest estimated theoretical private demand for recycled water within 1 mile of the alternative's infrastructure. This alternative also provides potential for the BRS tenant farmer to increase in the number of crop rotations per year. The Industrial Aggregate alternative also provides the potential for private entities utilizing recycled water for operations, as well as providing a cost avoidance opportunity for Delta-Knife operations.

Figure 19: Summary of findings for Local Economic Effect TBL Measures.

Measures	Riparian Shade Credits	Recycled Water Use for Agricultural Irrigation	Recycled Water Use for Industrial Aggregate Production
Creation of Construction Jobs	17 FTE-years (7.4 FTE / $1 million)	55 FTE-years (7.1 FTE / $1 million)	30 FTE-years (7.1 FTE / $1 million)
External Demand for Recycled Water	0 MGD	10.3 MGD	3.1 MGD
External Profit or Cost Avoidance	• The purchase of credits result in a lease payment for participating land owners who host the restoration projects.	• Potential for increased profit by BRS tenant farmer. Irrigation water would allow for more crop rotations in a given year (potentially increasing from 1 rotation to 3). Details are not currently available to scale this potential benefit in dollars.	• Sources of cost avoidance for Delta-Knife: 1. Process water pumping costs. The MWMC may assume a share the estimated annual cost of $55,000. 2. There may also be a small savings for Delta-Knife operators, relative to pumping costs, from the thermal load in the recycled water displacing the need to heat process water.
Data Gaps: • Identify specific businesses along the recycled water pipeline corridor that consume significant quantities of water for approved recycled water uses.			

Creation of Construction Jobs

Measure Description: The creation of short-term construction jobs or long-term operational positions has significant value to individuals, their families, the community and the local economy. The focus of this Measure is on construction jobs because, while all of the alternatives all create new operational responsibilities, it is not clear if these new responsibilities will be met by creating new positions or by reorganization or reallocation of existing staff time and responsibilities.

Riparian Shade Credits:
The University of Oregon's Ecosystem Workforce Program[66] has done considerable analysis on the economic impacts of riparian restoration contracting and projects in Oregon, which it summarized in a 2010 report titled *Economic and Employment Impacts of Forest and Watershed Restoration in Oregon*. The study found that for every $1 million spent on riparian restoration in Oregon, 7.4 construction jobs (FTE for 1 year) are created. For riparian shade credit contracting it is estimated that 50% of the costs go towards standard restoration and 50% are associated with regulatory crediting. Therefore for a project that costs $4.65 million, half of the cost will go towards construction ($2.35 million), which will result in approximately 17 FTE jobs will be created.

Recycled Water Use for Agricultural Irrigation:
PA Consulting Group, on behalf of the Clean Water Council, conducted an analysis on the economic impacts of wastewater infrastructure projects in the U.S., which it summarized in a 2009 report titled *Sudden Impact: An Assessment of Short-Term Economic Impacts of Water and Wastewater Construction Projects in the United States*. The report provides case studies for a number of states, not including Oregon. California is used as the closest geographic proxy for Oregon. For every $1 million spent on wastewater construction projects in California 7.1 construction jobs (FTE for 1 year) are created. Applying this multiplier to this alternative with construction costs of $7.9 million, approximately 55 FTE-years jobs will be created.

Recycled Water Use for Industrial Aggregate Production:
Applying the multiplier described in the previous section this alternative's construction costs of $4.3 million provide an estimate that 30 FTE-years jobs will be created.

External Demand for Recycled Water

Measure Description: The development of recycled water infrastructure offers the potential to deliver a recycled water product to interested outside-the-fence customers for whom it would provide a financial advantage over their existing source of water. The expansion of the recycled water system and service could benefit the MWMC in the future by expanding thermal mitigation capacity and/or as a source of revenue. The first step in assessing this potential is to scale and compare theoretical private demand for recycled water within 1 mile of the proposed project infrastructure. This estimate is not meant as a quantitative final answer, rather as a first step in assessing this potential opportunity.

Riparian Shade Credits:
Not applicable.

[66] The EWP was founded in 1994 to support the development of a high-skill, high-wage ecosystem management industry in the Pacific Northwest. Since that time, we have fostered forest-based sustainable rural development in forest communities by developing restoration workforce training curriculum and supporting local quality jobs programs in forest communities.

Recycled Water Use for Agricultural Irrigation:
10.3 MGD. Large demand sites (>1MGD) for this alternative are dominated by agricultural uses (3 tax lots that consist of 324 acres) followed by 1 green space site (135 acres). Medium demand sites (0.1 – 1 MGD) have the largest aggregate demand of three demand tiers, which are dominated by agricultural use (8 tax lots and 197 acres) followed by green space (2 tax lots and 92 acres). Small demand sites (<0.1 MGD) have the least aggregate demand of the three demand tiers and use is dominated by industry (9 tax lots and 238 acres). See Figure 20 and 21.

Recycled Water Use for Industrial Aggregate Production:
3.1 MGD. There were no large or medium demand sites identified within 1 mile from the project boundaries. Small demand sites are dominated by industry (27 tax lots at 391 acres). See Figure 20 and 21.

Private Recycled Water Demand Estimation Methodology
The estimates for potential future demand of recycled water are based on a GIS analysis completed by wastewater staff to support the TBL analysis. The analysis identified all of the properties (by tax lot) with at least one boundary within 1 mile of the proposed project corridors (W2 pipeline) and sites (Biocycle / BRS). For each property, staff identified three tiers of current water demand (based on OWRD and EWEB data): greater than 1 million gallons per day (>1MGD), between 0.1 and 1 MGD (0.1 – 1 MGD) and less than 0.1 MGD (<0.1MGD). Water demand was estimated by adding up the number of properties in each tier and multiplying the number by the most conservative estimate of water demand (1 MGD for large demand, 0.5 MGD for medium demand and 0.1 MGD for small demand).

Figure 20: Estimated Recycled Water Demand Within 1 Mile of the Agricultural Irrigation RW Alternative.

Potential Recycled Water Demand	Large Demand (>1 MGD)			Medium Demand (0.1 – 1 MGD)			Small Demand (<0.1 MGD)		
Land Use Type	Demand (MGD)	Tax Lots	Acres	Demand (MGD)	Tax Lots	Acres	Demand (MGD)	Tax Lots	Acres
Industrial	0	0	0	0	0	0	0.9	9	238
Agricultural	3	3	324	4	8	197	0	0	0
Green Space	1	1	135	1	2	92	0.4	4	31
Totals	**4**	**4**	**459**	**5**	**10**	**289**	**1.3**	**13**	**269**

Figure 21: Estimated Recycled Water Demand Within 1 Mile of the Outside-the-Fence RW Alternative.

Potential Recycled Water Demand	Large Demand (>1 MGD)			Medium Demand (0.1 – 1 MGD)			Small Demand (<0.1 MGD)		
Land Use	Demand (MGD)	Tax Lots	Acres	Demand (MGD)	Tax Lots	Acres	Demand (MGD)	Tax Lots	Acres
Industrial	0	0	0	0	0	0	2.7	27	391
Agricultural	0	0	0	0	0	0	0.1	1	23
Green Space	0	0	0	0	0	0	0.3	3	13
Totals	**0**	**0**	**0**	**0**	**0**	**0**	**3.1**	**31**	**427**

External Profit or Cost Avoidance

Measure Description: The ability and scale of the project alternative to financially benefit an external party – be it a project partner or other– provides a social benefit to members of our community.

Riparian Shade Credits:
The purchase of credits result in a lease payment for participating land owners who host the restoration projects.

Recycled Water Use for Agricultural Irrigation:
Increased profit. Potential for increased annual profit for BRS tenant farmer. Irrigation at the BRS site has the potential to allow the tenant farmer at BRS to increase from 1 harvest per year to 3 harvests.[67] The net profit from increased harvests is not known as of this writing and will likely change significantly based on a number of variables including crop type, market prices, etc. It is assumed that on average increased harvests will result in increased profits for the farmer.

Recycled Water Use for Industrial Aggregate Production:
Increased profit through cost avoidance. Estimated annual Delta-Knife savings for water pumping is $55,000 per year.[68] This project would transfer electricity costs related to pumping water for Delta-Knife River operations to the WPCF. The distribution of these cost have not been determined. For this analysis it is assumed that the annual electricity savings are realized solely by Delta-Knife River.

[67] CH2MHill (2013). Beneficial Reuse Site Irrigation System and Agronomic Alternatives Assessment.
[68] Based on the design cost estimate for annual operational electricity requirements.

Community Stewardship

Criterion Description: The siting or operation of mitigation alternatives can affect adjacent communities, including effects to health and safety and changes in quality of life, now and in the future.

Measures:

- Human Health and Safety Concerns
- Aesthetic Site Improvements
- Develops Climate Change Adaptation Capacity

Summary of Results: Each alternative carries its own set of potential or perceived health and safety risks due to construction, operation, or as a legacy of use. Given that recycled water use is regulated by Oregon statute and rules to be protective of human health and the environment, the perception of user risk could be the most limiting aspect of the project (or conversely, the key to community acceptance). Other project elements that bear on community livability and project acceptability include whether or not the project is within the ratepayer community, whether landscape aesthetics are impacted, and how the project provides assets for climate change resilience and adaptation.

Figure 22: Summary of Community Stewardship TBL Measures.

Measures	Riparian Shade Credits	Recycled Water Use for Agricultural Irrigation	Recycled Water Use for Industrial Aggregate Production
Human Health and Safety Concerns	• No concerns identified.	• Concern from farm adjacent to BRS site about the risk of overspray on food crops.	• Concern for Delta S&G employees who are significantly exposed daily to process water.
Aesthetic Improvements	• Restoration will likely significantly improve aesthetics on privately owned land. Public benefit will be site-dependent.	• No significant change expected.	• No change expected.
Develops Climate Change Adaptation Capacity	• Provides increased ecosystem services. Restoration increases capacity of the land to moderate flood and drought. The value of these services varies with site selection.	• Provides a substitute for sources of ground or surface water that could be utilized during future extreme drought conditions.	• Provides a substitute for sources of ground or surface water that could be utilized during future extreme drought conditions.
Data Gaps: • Analytical data of coliform levels to compare Class A recycled water to current process water used for rock crushing by Delta Sand & Gravel to assess employee risks and significance of exposure. • Timing, intensity and form of local impacts related to climate change. • Actual location of riparian restoration to scale aesthetic improvements and determine the project location.			

Human Health and Safety Concerns

Measure Description: Assess human health and safety concerns related to project construction and operation. It is assumed that health and safety risks for the alternatives considered here are equal.

Riparian Shade Credits:
No significant concerns.

Recycled Water Use for Agricultural Irrigation:
Irrigation at the Biocycle Farm with recycled water is an existing practice. Recycled water storage and irrigation at the BRS would be a modification, although not largely different from the historical practice of storage and irrigation. Recycled water rules dictate setback requirements and protections against overspray and drift from overhead irrigation as well as against site runoff. Maladjustments/malfunctioning equipment could present risks of inadvertent misapplication of recycled water. Primary concerns in this regard include unmanaged groundwater infiltration or runoff to Flat Creek and irrigation drift to neighboring properties. A neighbor of the BRS site has expressed concern about Class D recycled water overspray coming into contact with food crops. The overspray concern could be mitigated by either not applying recycled water, or not applying recycled water with the existing irrigation pivot, at the easternmost pivot irrigator.

Recycled Water Use for Industrial Aggregate Production:
The primary concern is risk of infection to Delta-Knife employees who would be frequently exposed to the recycled water in the course of their duties and workday. The employee group of greatest concern is those who work in the rock crushing operations at Delta Sand & Gravel, where large quantities of water are used for dust control. It is common for employees present during operation to be significantly exposed to the water, including exposure to their mouth and eyes. In order to determine the actual risk of exposure for these employees Class A recycled water should be tested, as should the river water currently being used for the operations to determine any significant difference and risk. A public multi-use bike path runs along the south property line near the facility entrance, but the site is fenced and isolated from public access or use. Class A recycled water has very few restrictions and does not require any setback distances. This alternative may require onsite training for aggregate staff and annual inspection by the MWMC staff. This is not a requirement per Oregon Rule, but is best practice in California.

Aesthetic Site Improvements

Measure Description: Significant aesthetic site improvements compared to existing conditions has the potential to improve property values for the project site as well as adjacent sites as well as providing a general public benefit.

Riparian Shade Credits:
Site aesthetics will likely be improved relative to existing conditions. These improvements will likely be located on privately owned land, per The Freshwater Trust staff, and therefore public access to the restoration site(s) will be limited use of adjacent waterways and associated recreational activities. Depending on the site location – aesthetics may be improved and highly visible to public roadways, lands and neighbors. See Figure 23 for an extreme example of before and after images from a restoration project.

Recycled Water Use for Agricultural Irrigation:
No significant improvements are anticipated beyond existing conditions. There may be a slight increase in the quantity and duration of greenery throughout the year due to irrigation. The Biocycle/BRS sites are not publically accessible, but they are highly visible from a nearby highway and airport.

Recycled Water Use for Industrial Aggregate Production:
No improvements are expected beyond existing conditions.

Develops Climate Change Adaptation Capacity

Measure Description**:** The climate is changing and will have effects on water resources and wildlife habitat among others. While the exact form, timing and intensity of the changes are unknown, developing the capacity to adapt to predicted changes benefits those who will face the acute and chronic climate challenges in the future.

Riparian Shade Credits:
Yes, provides increased ecosystem services. Restoration increases capacity of the land to moderate flooding by increase soil infiltration, provides enhanced native plant and wildlife habitat and provides the water quality benefits previously discussed (thermal load, sediments, nitrogen, etc.).[69] The value of these services will vary with site.

Recycled Water Use for Agricultural Irrigation:
Yes, recycled water could provide a substitute for sources of ground or surface water to be utilized during future drought conditions. The location of the Biocycle / BRS site may provide advantageous to nearby agricultural operations should ground water resources become limited.

Recycled Water Use for Industrial Aggregate Production:
Yes, recycled water could provide a substitute for sources of ground or surface water to be utilized during future drought conditions.

Figure 23: An Example of Before and After Riparian Shade Site Aesthetics.

[69] City of Eugene (2010). *A Community Climate and Energy Action Plan for Eugene*. Accessed online in Feb. 2014 at http://www.eugene-or.gov/ArchiveCenter/ViewFile/Item/2385.

Stakeholder Interest Alignment

Criterion Description: Alignment with stakeholder priorities and engagement with community partners is important for maintaining and enhancing important relationships aligning goals within the relevant community(s).

Measures:

- Potential project partnerships
- Alignment with local and state plans and goals
- Acceptability and alignment with local stakeholders

Summary of Results: All of the alternatives are very similar for the Stakeholder Interest Alignment Measures. The most significant difference is for the Acceptability and Alignment with Local Stakeholders Measure for which the indexed score shows a stakeholder preference for the Recycled Water Use for Industrial Aggregate Production alternative.

Figure 24: Summary of Findings for Stakeholder Interest Alignment Measures.

Measures	Riparian Shade Credits	Recycled Water Use for Agricultural Irrigation	Recycled Water Use for Industrial Aggregate Production
Potential Project Partnerships	• EWEB • McKenzie Watershed Council	• EWEB	• EWEB
Alignment with Local and State Plans and Programs	2 of 5	2 of 5	2 of 5
Oregon's Integrated Water Resource Strategy	*Yes*	*Yes*	*Yes*
Oregon Water Reuse Program	*No*	*Yes*	*Yes*
Eugene Climate and Energy Action Plan	*No*	*No*	*No*
EWEB Water Management Conservation Plan	*No*	*Maybe*	*Maybe*
EWEB Drinking Water Protection Plan	*Yes*	*No*	*No*
Stakeholder Acceptability and Alignment (Indexed Score)	9.8	11.6	15.8

Potential Project Partnerships

Measure Description: Project partners could provide the project with financial, technical or resource support and reduce barriers to implementation as well as the potential to work collaboratively on community goals.

Riparian Shade Credits:
EWEB and McKenzie Watershed Council. Depending on the location selected for the restoration projects and if the projects supports the goals of EWEB's Drinking Water Plan, EWEB may be interested in project partnership. Other potential project partners, depending on project location, could be the McKenzie Watershed Council, who also is a local restoration

organization working in tandem with EWEB and TFT to implement watershed protection and restoration projects with private and public landowners. TFT could leverage EWEB's VIP [footnote what this is: Voluntary Incentives Program to reward landowners who host protected, high-functioning riparian lands] to conduct landowner outreach and identify high-value shade restoration sites.

Recycled Water Use for Agricultural Irrigation:
EWEB and potential recycled water users. Recycled water supports EWEB's goals laid out in its *Water Management Conservation Plan*. Of the two recycled water alternatives, the Agricultural Irrigation alternative project boundaries (W2 pipeline corridor, Biocycle / BRS) present greater potential recycled-water demand. According to the high-level estimate conducted for this TBL assessment, agricultural and green space managers should be contacted in the future to determine feasibility of recycled water use at these sites. See the Private Demand for Recycled Water Measure for more details.

Recycled Water Use for Industrial Aggregate Production:
EWEB. Recycled water supports EWEB's goals laid out in its *Water Management Conservation Plan*. In addition, there is potential for other recycled water users to become project partners, as there is an estimated 3.1 MGD of theoretical potential within 1 mile of the project site and infrastructure. While potential exists, none of the 31 tax lots that represent the 3.1 MGD of demand have been contacted or have expressed interest in partnering or using recycled water. In addition, the obvious project partners, Delta-Knife, have stated to MWMC staff that they are not currently interested in partnering on this project.

Alignment with Local and State Plans and Programs

Measure Description: The degree to which a project aligns with Oregon state or local (Eugene and Springfield) plans or goals provide a way to measure the project contribution towards regional goals. There are many state and local goals that could be interpreted to be relevant to the project at hand. Five plans were identified as most relevant to the projects being assessed. These include:

- *Oregon's Integrated Water Resource Strategy (2012)*[70]
- *Oregon Water Reuse Program*[71], *Eugene Climate and Energy Action Plan (2010)*[72]
- *EWEB Water Management Conservation Plan (2012)*[73]
- *EWEB Drinking Water Protection Plan (2000)*[74]
- *EWEB Proposal for Implementation of the Drinking Water Source Protection Program (2001)*[75].

Riparian Shade Credits: This project does not change profit or cost avoidance for external parties.

- *Oregon Integrated Water Resource Strategy:* Yes, project is aligned with the strategy. The importance of riparian areas is mentioned throughout the strategy in terms of water temperature, water quality, climate change, flood control, ecosystem and habitat.
- *Oregon Water Reuse Program:* No, project is not aligned with program. The Program focus is on water reuse and not riparian restoration.

[70] Oregon Water Resources Department (2012). *Oregon's Integrated Water Resource Strategy.* Accessed online in Feb. 2014 at http://www.oregon.gov/owrd/LAW/docs/IWRS_Final.pdf.
[71] Oregon Department of Environmental Quality. *Water Reuse Program webpage*. Accessed online in Feb. 2014 at http://www.deq.state.or.us/wq/reuse/reuse.htm.
[72] City of Eugene (2010). *A Community Climate and Energy Action Plan for Eugene*. Accessed online in Feb. 2014 at http://www.eugene-or.gov/ArchiveCenter/ViewFile/Item/2385.
[73] GSI Water Solutions, Inc. (2012). EWEB Water Management and Conservation Plan. Accessed online in Feb. 2014 at http://www.eweb.org/public/documents/water/waterCurtailment.pdf.
[74] EWEB (2000). Drinking Water Protection Plan. Accessed online Feb. 2014 at http://www.eweb.org/public/documents/water/WaterProtectionPlan.pdf.
[75] EWEB (2001). *Proposal for Implementation of the Drinking Water Source Protection Program. Accessed online in Feb. 2014 at http://www.eweb.org/public/documents/water/SourceProtectionProgramProposal.pdf.*

- *Eugene Climate and Energy Action Plan:* No, project is aligned with plan. Specifically Objective 26 of the plan, which focuses on protection of sensitive urban natural areas including riparian areas, wetlands and floodplains to improve water quality, reduce water temperatures, and reduce flooding. The degree of alignment is dependent on restoration project location as the Plan is specific to Eugene.
- *EWEB Water Management Conservation Plan:* No, project is not aligned with plan. There is no mention of riparian restoration projects in the plan.
- *EWEB Drinking Water Protection Plan:* Yes, the project is aligned with the Implementation Plan. Riparian restoration is named as a mitigation strategy in the Implementation Plan to "implement projects to enhance riparian functions in the vicinity of nonpoint source problem areas to increase filtering capabilities and stream health".

Recycled Water Use for Agricultural Irrigation:

- *Oregon Integrated Water Resource Strategy:* Yes, project is aligned with strategy. The strategy encourages the use of recycled water so long as the use protects human health and the environment.
- *Oregon Water Reuse Program:* Yes, project is aligned with program. This Program encourages water reuse (use of recycled water) in a manner that protects public health, the environment and provides a resource benefit.
- *Eugene Climate and Energy Action Plan:* No, project is not included as a strategy in the plan. That said – recycled water use might provide a strategy to reduce energy use and emissions compared to the requirements for treatment and distribution of potable water. Further analysis is required to define the scenarios that would result in a net benefit and to scale of the potential energy and emissions savings.
- *EWEB Water Management Conservation Plan:* Maybe, project is aligned with plan. Within the next 5 years, EWEB will continue to explore opportunities for water reuse and recycling, such as on playing fields and golf courses.
- *EWEB Drinking Water Protection Plan:* No, project is not relevant to plan. Recycled water use for industrial aggregate production does not offer any protection to Eugene's source of drinking water, the McKenzie River.

Recycled Water Use for Industrial Aggregate Production:

- *Oregon Integrated Water Resource Strategy:* Yes, project is aligned with strategy. The strategy encourages the use of recycled water so long as the use protects human health and the environment.
- *Oregon Water Reuse Program:* Yes, project is aligned with program. This Program encourages water reuse (use of recycled water) in a manner that protects public health, the environment and provides a resource benefit.
- *Eugene Climate and Energy Action Plan:* No, project is not included as a strategy in the plan. That said – recycled water use might provide a strategy to reduce energy use and emissions compared to the requirements for treatment and distribution of potable water. Further analysis is required to define the scenarios that would result in a net benefit and to scale of the potential energy and emissions savings.
- *EWEB Water Management Conservation Plan: Maybe,* project is aligned with plan. Within the next 5 years, EWEB will continue to explore opportunities for water reuse and recycling, such as on playing fields and golf courses.
- *EWEB Drinking Water Protection Plan:* No, project is not relevant to plan. Eugene's source of drinking water is the McKenzie River and this alternative affects water flow in the Willamette River.

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Stakeholder Acceptability and Alignment

Measure Description: Assessing a project's acceptability to local and significant stakeholders is an important step in determining potential success of implementation. Public outreach can identify potential project partners, barriers and opportunities from a variety of perspectives.

Riparian Shade Credits:
9.8 indexed score. Based on the results of a stakeholder survey, Riparian Shade Credits scored lowest of the alternatives. The results are summarized in Figure 25 and the methodology used to calculate the index score is described on the next page.

Recycled Water Use for Agricultural Irrigation:
11.6 indexed score. Based on the results of a stakeholder survey, Agricultural Irrigation scored in the middle of the three alternatives. Agricultural Irrigation performed better than Riparian Shade due to its ability to convey significant volumes of recycled water by pipe.

Recycled Water Use for Industrial Aggregate Production:
15.8 indexed score. Based on the results of a stakeholder survey, Aggregate Production scored the highest of the three alternatives. Aggregate Production performed better than Riparian Shade due to its ability to convey significant volumes of recycled water by pipe, its utilization of indirect discharge into floodplain system (i.e. discharge of recycled water back to the Willamette via the Delta-Knife settling ponds), and its ability to augment river flow.

Figure 25: Relative index of stakeholder acceptability and issues alignment.

Relative Index of Stakeholder Acceptability and Issues Alignment Evaluation of three thermal load mitigation alternatives.	**Alternative 1: Industrial Aggregate Use**		**Alternative 2: MWMC Storage and Irrigation**		**Alternative 3: Riparian Shade Contracting**	
Evaluation question	**Reponse**	**Points**	**Reponse**	**Points**	**Reponse**	**Points**
Does the project address or provide socio-economic benefits such as business opportunities, new water uses, recreational features, or reduced costs or carbon footprint?	N	0.0	N	0.0	Y	0.5
Does the alternative involve addressing community behavior and/or adopting a decentralized approach to wastewater management?	N	0.0	N	0.0	N	0.0
Does the alternative maintain an "inside the fence" or demonstration project as a step toward recycled water adoption?	N	0.0	Y	1.2	N	0.0
Does the alternative result in ecosystem enhancements (other than temperature)?	N	0.0	N	0.0	Y	3.9
Does the alternative maintain or augment river or groundwater flow?	Y	2.5	N	0.0	N	0.0
Does the alternative utilize indirect discharge into wetland or floodplain systems?	Y	2.8	N	0.0	N	0.0
Is the alternative a large scale project involving significant volume of piped water?	Y	5.2	Y	5.2	N	0.0
Does the alternative complement regional water supply needs?	N	0.0	N	0.0	N	0.0
Does the alternative Involve irrigation or land-based application of recycled water?	N	0.0	Y	-0.2	N	0.0
Does the alternative directly result in river temperature reduction and/or provide other water quality benefits?	Y	5.4	Y	5.4	Y	5.4
TOTAL POINTS		**15.8**		**11.6**		**9.8**

Stakeholder Acceptability and Issues Alignment Index Methodology

The results of a survey of stakeholders were used to identify a set of key indicators used to assess stakeholder acceptability and alignment with recycled water use concepts. The survey included general questions about recycled water infrastructure investment, groundwater protection, and human and environmental health. The results of the survey were analyzed and used to generate the indexed score for each alternative.

The Interest Group Alignment Tool, a separate Excel spreadsheet created by Todd Miller, presents how survey questions were categorized into unifying themes and distilled into weighted indicators that can be applied to any alternative. Questions were grouped into related categories and question responses were tallied to calculate an average category weight. The three alternatives were screened using this tool. An answer of “yes” to category screening questions were given a value of “1” multiplied by the weight of the category, and answers of “no” were given a value of “0”.

While the study focus is on recycled water acceptance and urban water resource management, the indicators were developed in order to be applicable to non-recycled water, such as riparian shade contracting. Figure 25 presents the index results for the study alternatives. The higher the index value the higher the degree of stakeholder alignment.

6. SCORING THE ALTERNATIVES – METHODOLOGY AND RESULTS

The TBL Criteria, supporting data and comparison of alternatives, summarized and presented in the previous section, were used to derive a numeric TBL Score for each alternative. Scoring of the criteria for each alternative provides a representation of the assessed project values, which can be expressed in table or chart form for ease of reference and comparison. The scoring process involved two key stakeholder groups directly into the TBL process: (1) the MWMC decision-making body for weighting the relative importance of each criterion to the overall score, and (2) the staff and consultant technical project team for assessing the relative value of each alternative's criteria as indicated by their individual measures. There are noted limitations associated with the scoring process.

The process used to calculate TBL Scores for each alternative in this assessment relied on the creation of two variables, generated by two independent groups who were blind to one another's work:

- Criterion Weight
- Criterion Score

The following subsections provide a detailed description of each variable, the process used to generate them, and how the variables were used to calculate a TBL Score for each thermal mitigation alternative.

Assigning Criterion Weight

For any decision there will be a number of Criteria used to make the decision, but they rarely hold equal importance. Take purchasing a house, for example. The set of Criteria used to make this decision may include cost, location and features. Depending on the buyer – the importance (or weight) of any single Criteria may vary significantly – based on the buyers values. If it is the buyer's first house, cost may far outweigh the other Criteria, whereas if the buyer is upgrading, location and features may rise significantly in importance and weight.

For this TBL assessment and scoring process, the MWMC's commissioners were responsible for assigning Criterion Weights. As appointed officials and the decision-making body for the organization, they are in the best position to represent organizational and community values.

A Pairwise Comparison method was used to determine the Criterion Weights. This method asked each member of the commission to compare each of the nine Criteria versus each of the remaining Criteria. This process results in 36 pairs to compare. See Figure 26 for a visual depiction of the Pairwise Comparison used for this assessment.

For each pair, each commissioner selected one of the two Criteria as more important in the overall decision making than the other, even if the difference between the two is perceived as nearly equal. Then, for the chosen Criterion, the respondent applied a scale of 1 to 3 to signify the degree of importance of the chosen Criterion over the compared Criterion. The numbers of the scale signify the following degrees of importance:

1 = slightly higher in importance
2 = higher in importance
3 = significantly higher in importance

The pairwise comparison was completed individually by each of the seven MWMC commissioners via an online survey. The survey did not provide the respondent with a real-time indication of how the weightings were impacted by the selections for each paired comparison. The intent was to record the pair-by-pair selection without consideration of impact on the overall Criteria weighting. The responses to the survey were used to calculate weights (as a percentage) for each Criterion. The results of the seven individual commissioner responses were averaged. The average Criteria weights were presented to the

commission to determine if any adjustments were required, resulting in the final TBL Criteria Weights. The results are presented in Figure 27.

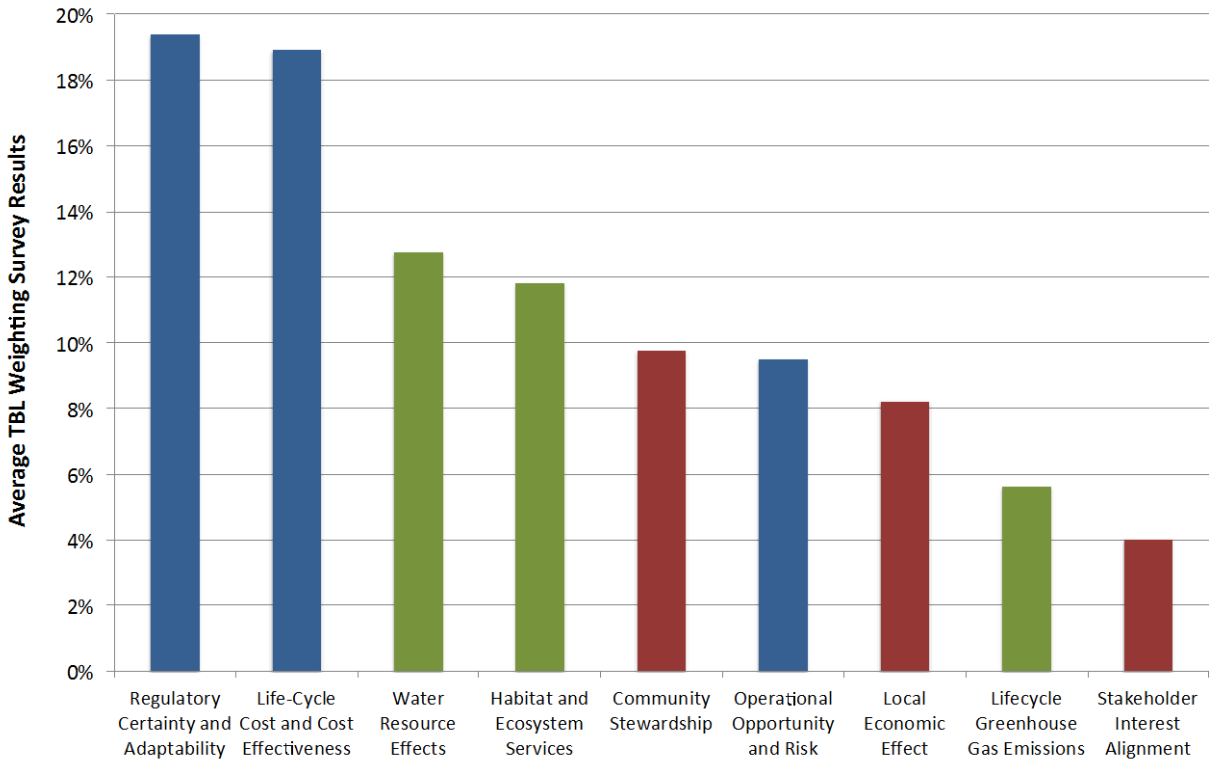
Figure 26: Pairwise Matrix Used in the Commissioner Survey to Generate the Criterion Weights.

Instructions for criteria weighting:

In each yellow cell
* Enter a **letter** (A - I) and a **number** (1 -3)
* Choose letter of preferred criterion
* Rate criterion on following scale:
  1 = *slightly higher* in priority
  2 = *higher* in priority
  3 = *significantly higher* in priority

		Economic			Environmental			Social		
		Life-Cycle Cost and Cost Effectiveness	Operational Opportunity and Risk	Regulatory Certainty and Adaptability	Water Resource Effects	Habitat and Ecosystem Services	Life-Cycle Greenhouse Gas Emissions	Local Economic Effect	Community Stewardship	Stakeholder Interest Alignment
		A	B	C	D	E	F	G	H	I
Life-Cycle Cost and Cost Effectiveness	A									
Operational Opportunity and Risk	B									
Regulatory Certainty and Adaptability	C									
Water Resource Effects	D									
Habitat and Ecosystem Services	E									
Life-Cycle Greenhouse Gas Emissions	F									
Local Economic Effect	G									
Community Stewardship	H									
Stakeholder Interest Alignment	I									

Figure 27: Summary of Averaged Criterion Weights Ordered According to Weight Percent.



Assigning Criterion Score

The Project Technical Team assigned scores to the alternatives for each Measure. The scores for each individual Measure were then averaged to determine the Criterion Score. The team consisted of the MWMC planning and operations staff, consultant team (Kennedy / Jenks Consultants staff and Good Company). This group consisted of those individuals with knowledge of the alternatives and related data sets or how the alternatives would impact the MWMC's operations.

Scores were assigned on a scale of 1 to 10. The lower end of the scale indicated high risk / low value and, conversely, the upper end of the scale indicated low risk / high value. A score of 5 indicated neutral or existing conditions. The primary intent of the Criterion Scoring is to represent the difference between alternatives numerically.

Scores were assigned in one of two ways, either with a quantitatively (with a formula) or qualitatively (with professional judgment).

- *Formula:* For the TBL Measures that had quantitative data available, a formula was used to assign a score. The "preferable" alternative was assigned the highest score possible, a 10. The other alternatives were assigned a score based on the proportional difference between it and the preferred alternative.
- *Professional Judgment:* For the TBL Measures that had either qualitative data or incomplete data, scores were assigned using the best possible information and professional judgment.

The results of the Criterion Scoring process are documented in Figure 33. In addition, notes were taken describing how scores were assigned (documented in Appendix A).[76]

Using the Variables to Calculate TBL Scores

Figure 28 shows how the Criterion Weight and Criterion Scores are used to calculate the TBL Score for each alternative. The Project Technical Team scored each individual Measure. The values presented are the average of these Measure scores. See Appendix A for the full presentation of Measure Scoring results.

The Criterion Scores are multiplied by the Criterion Weights to arrive at the weighted Criterion Scores presented on the right-hand side of Figure 28. The 9 weighted Criterion Scores are summed and the result is a TBL Score for each alternative (see the three values in larger text on the right-hand side of the bottom grey row of Figure 28).

[76] The formulas used to calculate scores may be found in a separate Excel spreadsheet titled *MWMC-Temp_Mitigation-TBL_Score-032814*

Figure 28: Summary of Criterion Scores, Criterion Weights and TBL Scores, by alternative.

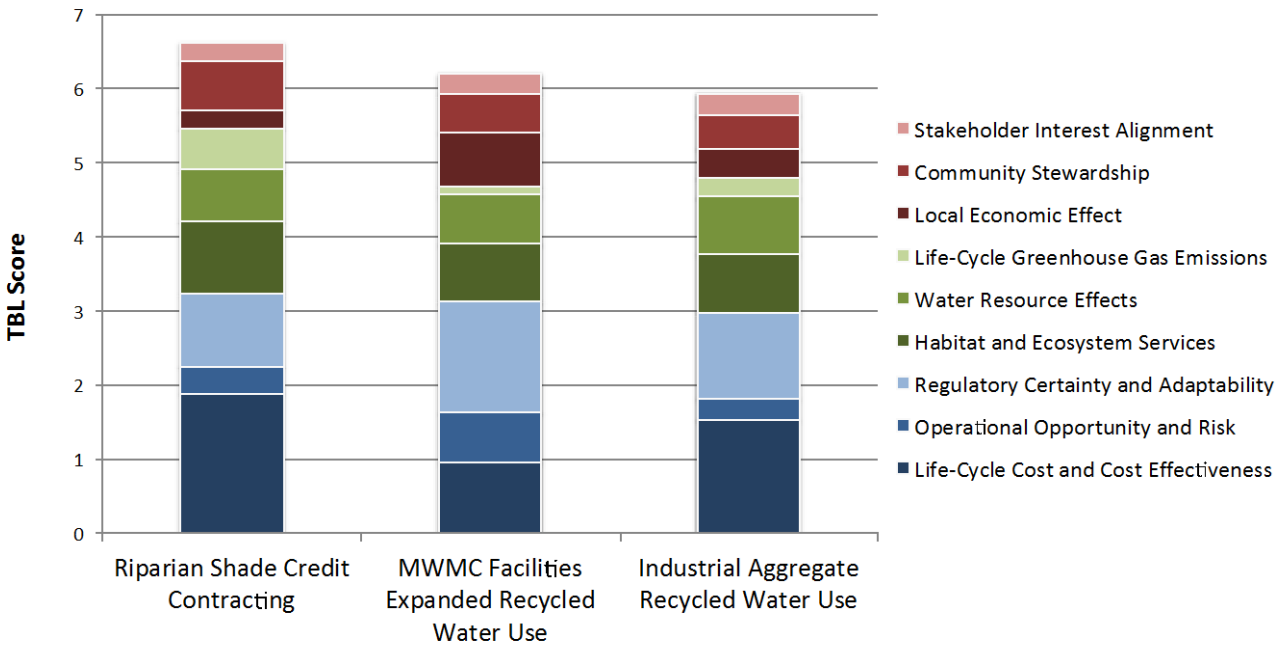
Triple Bottom Line (TBL) Categories / Criteria	Criterion Scores: Riparian Shade Credit Contracting	Criterion Scores: MWMC Facilities Expanded Recycled Water Use	Criterion Scores: Industrial Aggregate Recycled Water Use		Criteria Weights (%)		Weighted Criterion Scores: Riparian Shade Credit Contracting	Weighted Criterion Scores: MWMC Facilities Expanded Recycled Water Use	Weighted Criterion Scores: Industrial Aggregate Recycled Water Use
Economic Criterias					48%				
Life-Cycle Cost and Cost Effectiveness	10.0	5.0	8.1	X	19%	=	1.9	1.0	1.5
Operational Opportunity and Risk	3.8	7.0	3.0	X	10%	=	0.4	0.7	0.3
Regulatory Certainty and Adaptability	5.0	7.8	6.0	X	19%	=	1.0	1.5	1.2
Environmental Criterias					30%				
Habitat and Ecosystem Services	8.4	6.6	6.8	X	12%	=	1.0	0.8	0.8
Water Resource Effects	5.4	5.2	6.0	X	13%	=	0.7	0.7	0.8
Life-Cycle Greenhouse Gas Emissions	10.0	1.9	4.6	X	6%	=	0.6	0.1	0.3
Social Criterias					22%				
Local Economic Effect	3.0	9.0	4.8	X	8%	=	0.2	0.7	0.4
Community Stewardship	6.7	5.3	4.7	X	10%	=	0.7	0.5	0.5
Stakeholder Interest Alignment	6.4	6.8	7.3	X	4%	=	0.3	0.3	0.3
TBL Scores:					100%		6.6	6.2	5.9

Results of Scoring

The TBL Scores presented in tabular form in Figure 28 are presented in graphical form in Figure 29. Each stacked bar represents an alternative. Each stack within the bar represents a single Criterion. The colors of the bars are consistent with the rest of the report: Red (Social), Green (Environmental) and Blue (Economic). As can be seen, the Riparian Shade alternative has the highest TBL Score of the group, followed by the Recycled Water Use for Agricultural Irrigation, and finally Recycled Water Use for Industrial Aggregate Production.

These Scores do not represent a definitive answer to the question of which alternative is most advantageous as a thermal mitigation alternative. It is, however, a numeric summary of the available data combined with organization values, which could be used to provide direction. Figure 29 will be most useful when used in parallel with review of the raw data.

Figure 29: Comparison of TBL Scores by Alternative.



TBL Scoring Limitations

Scoring a TBL assessment of alternatives is a useful exercise - it provides a numeric summary and comparison for a set of Criteria that are difficult to compare in terms of units or intent. Another high value function of the scoring process is that it required participation by many individuals within the MWMC (including a variety of staff members and all commissioners), outside consultant experts and many external members of the community through project outreach (surveys and interviews). The internal portion of this process provided a "pilot project" for TBL within the MWMC and laid the groundwork for future use by establishing a draft process and a common understanding of the process and terminology.

There are also limitations, inherent to the TBL Scoring process that should be reconsidered prior to the next use of the next TBL by the MWMC.

- **Incomplete or unavailable data:** There are commonly data gaps for one or more alternatives for a single Criterion or Measure. This lack of data may warrant exclusion of the Criterion or Measure. If the decision is made to keep the Measure, even with the known data gap, the Project Team should be aware that scoring that Measure will be a unique challenge.
- **Mix of quantitative and qualitative data:** Those Criteria chosen as significant for the TBL assessment will have a mix of quantitative and qualitative data between Criteria and also potentially with a single Criterion.
- **Defining a scoring system:** Defining the system used to score the alternatives across various alternatives and Measures is a challenge. Measures with quantitative data are relatively easy to score compared to those with qualitative data. The scoring for each individual Measure will need to be discussed and method agreed upon during the Criterion Scoring process.
- **Scores are relative:** Scores are relative to alternatives considered, not absolute. Rescoring may be necessary if broadening the alternatives.
- **Transparency of results:** The resulting TBL score (see Figure 28) is built upon a complex series of decisions. Many decisions are made during the selection of the Criteria and Measures as well as in the scoring process. These decisions should be documented for full transparency and future reference.

7. SUGGESTIONS FOR IMPROVING THE TBL PROCESS

During the course of this TBL Assessment a number of potential improvements were identified that should be incorporated during future TBL Assessments conducted by the MWMC.

- Clearly define the question being assessed. If the purpose isn't clear it becomes very difficult to select effective and meaningful Criteria and Measures.
- Clearly define the alternatives. Limiting the alternatives or clearly defining all alternatives will provide clarity to the selection of Criteria, data inventory and final results.
- Keep the number of Criteria and Measures limited to only the most significant factors.
- Be as inclusive as possible within the organization during the Criteria and Measure selection process. The process used in for this assessment included MWMC staff, Kennedy/Jenks staff and Good Company. In the future, if possible, it is suggested that the selection of Criteria and Measures is discussed with commissioners as well as all managers who will be affected by the project as early in the process as possible. The success of a TBL assessment requires repeated, focused discussion by many, not subjective decision making by a few. If the results are to be valued by the organization, all relevant stakeholders should be given a voice in the process.
- Consider having staff complete the Criterion Weighting Survey in parallel with the commissioners. This would allow both staff and commissioners alike to gauge alignment on organization values.

APPENDIX A: DETAILS OF TECHNICAL SCORING SESSION

Triple Bottom Line (TBL) Criterion / Measure Description	Assign TBL Measure Points to Alternatives Riparian Shade Credit Contracting	MWMC Facilities Expanded Recycled Water Use	Industrial Aggregate Recycled Water Use	Discussion of Scores
Economic Aspects				
Life-Cycle Cost and Cost Effectiveness	10.0	5.0	8.1	
20-Year Net Present Value	*10.0*	*3.9*	*6.8*	Calculated. See E26-G26 for formula. Riparian Shade Credits have lowest cost of the group and therefore are assigned a score of 10. The other alternatives are proportionally assigned scores based on the delta between Riparian and the other alternative.
Cost Effectiveness	*10.0*	*6.2*	*9.3*	Calculated. See E27-G27 for formula. Riparian Shade Credits have lowest cost of the group and therefore are assigned a score of 10. The other alternatives are proportionally assigned scores based on the delta between Riparian and the other alternative.
Operational Opportunity and Risk	3.8	7.0	3.0	
Additional Recycled Water Storage Capacity	*0.0*	*10.0*	*0.0*	This measure is not directly applicable to Riparian Shade or the Outside-the-Fence alternatives; therefore the Inside-the-Fence recieves the highest possible score of 10 and the other alternatives recieve a score of 0 to reflect no addtional capacity. There is a possible future storage opportunity for Delta/Knife if Confluence Island or gravel pit became available.
Additional Recycled Water Conveyance Capacity	*0.0*	*7.0*	*5.0*	*Not applicable to Riparian Shade. No control / shared control over Delta/Knife capacity, but possible future opportunity for Delta/Knife conveyance infrastructure to be expanded for additional recycled water users. BMF/BRS offers some flexibility. Riparian scored a 0 to reflect no capacity, Inside-the-Fence scored a 7 to represent the increased operational flexibility the increased capacity provides. Outside-the-fence scored a neutral 5 to reflect infrastructure in conjunction with no / shared control over use of the conveyance infrastructure.*
Resilience to Seismic Event	*7.0*	*4.0*	*3.0*	*Riparian has no operational risk to MWMC. Alternatives with pipes and pumps comparitvely assume more risk. As green infrastructure, riparian restoration is most relilianct and therefore score a 7. Outside-the-fence scores the lowest at 3 as gray infrastructure located near the riverbank where soils are prone to liquification. Inside-the-fence score a 4 as grey infrastructure, but not along a riverbank.*
Other Significant Operational Opportunities or Risks	*8.0*	*7.0*	*4.0*	Riparian resporation contract externalizes most project related risks; operationally staff doesn't have to do anything. BMF/BRS has infrastructure in place highest operational opportunity but risk of possible maintenance failures. Delta/Knife has some infrastructure in place (pipe), additional experience gathered with recycled water; risk is change to MWMC business model - producing Class A water at a consistent quantity and any liability that may come with that could be significant; high risk with public perception if something goes wrong. If MWMC built a pump station in Delta/Knife vicinity staff would have the infrastructure to able to deliver RW from a different set of equipment through a different pipeline that has some T's and maybe have the capacity to send it somewhere else. Riparian shade is scored at 8 to represent externaliztion of risk. Inside-the-fence is scored at 7 to represent benefits of utilizing existing infrastructure and operationa benefits and opportunities. Outside-the-fence is scored at 4 to represent the risk associated with new operational model (i.e. suppling water to an externail business and liability for product quality)
Regulatory Certainty and Adaptability	5.0	7.8	6.0	
Decision-to-Project Implementation Period	*4.2*	*10.0*	*10.0*	Calculated. See E44-G44 for formula. Riparian Shade has the longest implementation period due to the time it takes to identify and contract with landowners and establish vegetation. The recycled water products have similar design and construction time periods.
Other Regulatory or Permitting Opportunities or Risks	*5.0*	*7.0*	*4.0*	Biocycle /BRS (Class D) not discharging into the river provides benefits for some of MWMC's permitting constituents; some risk in nitrate levels. Delta/Knife (Class A) same opportunity as Biocycle /BRS though larger in scale; risk is Delta/Knife River would probably need NPDES permit for thermal load, and WPCF compliance would be reliant on an external organization. Riparian shade offers no change from existing conditions.
Permitting Certainty and Potential Challenges	*4.0*	*8.0*	*4.0*	Permitting certainty high at Biocycle/BRS not changing the use of recycled water; just increasing irrigation volume. Riparian Shade is considered the most uncertain as EPA has not made a final decision on the use of trading credits combined with the precedent for Riparian Shade Credit permit challenge in Medford. DEQ could prescribe a regulatory compliance program strategy that requires Delta/Knife River to obtain a new NPDES permit.
Potential for Onsite Expandability to Meet Future Mitigation Needs	*7.0*	*6.0*	*6.0*	Riparian Shade restoration sites lend themselves to expansion - albeit at the same per credit cost. The thermal mitigation potential at Confluence Island at the Delta/Knife River site is considered equivalent to the potential for wetland construction at Biocycle / BRS.

Appendix A: Details of Technical Scoring Session (continued)

Triple Bottom Line (TBL) Criterion / Measure Description	Assign TBL Measure Points to Alternatives Riparian Shade Credit Contracting	MWMC Facilities Expanded Recycled Water Use	Industrial Aggregate Recycled Water Use	Discussion of Scores
Environmental Aspects				
Habitat and Ecosystem Services	**8.4**	**6.6**	**6.8**	
Scale of Enhanced Riparian Habitat	*10.0*	*5.0*	*5.0*	Riparian Shade Credits offers a significant increase in enhanced riparian habitat. The two recycled water options are equal to existing conditions.
Soil Quality Effects	*8.0*	*6.0*	*5.0*	Riparian shade possible for benefits reducing compaction and improving health of soil as that land is brought back to a highly functioning riparian habitat. BMF/BRS RW would be offsetting chemical fertilizer use somewhat. Delta/Knife River would be equal to existing conditions.
Future Habitat and Ecosystem Opportunities	*9.0*	*7.0*	*7.0*	Riparian creates more habitat and the benfit of that habitat will expand as the restoration ages. Biocycle-BRS has potential for future wetland habitat. Likewise for the Delta-Knife site at Confluence Island.
Thermal Mitigation Potential	*6.4*	*8.3*	*10.0*	Calculated. See E75-75 for formula. Outsie-the-Fence has the greatest indexed thermal mitigation potential and therefore is assigned a score of 10. The other alternatives are proportionally assigned scores based on the delta between Outside-the-Fence and the other alternative.
Water Resource Effects	**5.4**	**5.2**	**6.0**	
Surface Water Quality Effects (other than thermal)	*7.0*	*6.0*	*8.0*	Quantifiable information on BMF/BRS and Delta/Knife River reductions; none on Riparian, but research on the subject indicates likely benefits for sediment and nitrogen removal. The difference between the recycled water alternative reflects the difference in annual onsite recycled water demand (i.e. greater demand at Delta/Knife River site compared to Biocycle/BRS). Riparian score was a semi-educated guess based on the scale of stream bank enhancement. Group thought this is highly imperfect exercise for this one measure.
Ground Water Quality Effects	*5.0*	*4.0*	*5.0*	BMF/BRS concerns about nitrates in groundwater management area. Chlorine impacts as Class A RW makes its way from Delta/Knife discharge very little impact once used for aggregate purposes before sending back into the river. No quantifiable information on Riparian.
Net Change to Willamette River Flow	*5.0*	*4.0*	*5.0*	Riparian is just shade and doesn't impact the river flow. BMF/BRS taking effluent currently discharged to the river and repurposing it at the facility for irrigation. Delta/Knife we are short circuiting the river instead of discharge going to the river gets pumped back out by Delta/Knife; MWMC just delivering to Delta/Knife and whatever happens to the water on that end is still whatever happens and basically no change.
Displacement of "Virgin" Surface or Groundwater Use	*5.0*	*6.0*	*7.0*	Displacement of what Delta/Knife is currently pumping out of the river with RW. BMF/BRS based on slight displacement of groundwater at the Biocycle/BRS site. Riparian Shade offers no advantage over existing conditions.
Future Aquifer or Stream Flow Augmentation Opportunities at Site	*5.0*	*6.0*	*5.0*	Increasing flow to the stream or discharging to an aquifer. BMF/BRS holds some opportunity, feasible or not is yet to be explored in much greater detail but plausible.
Lifecycle Greenhouse Gas Emissions	**10.0**	**1.9**	**4.6**	
20-Year Net Greenhouse Gas Emissions	*10.0*	*1.9*	*4.6*	Calculated. See Cells for Forumla. Riparian Shade Credits have lowest 20-year net GHG emissions of the group and therefore are assigned a score of 10. The other alternatives are proportionally assigned scores based on the difference between Riparian and the other alternative.

Appendix A: Details of Technical Scoring Session (continued)

Triple Bottom Line (TBL) Criterion / Measure Description	Assign TBL Measure Points to Alternatives Riparian Shade Credit Contracting	MWMC Facilities Expanded Recycled Water Use	Industrial Aggregate Recycled Water Use	Discussion of Scores
Social Aspects				
Local Economic Effect	3.0	9.0	4.8	
Construction Jobs	3.1	10.0	5.5	Calculated. See E118-G118 for Forumla. Inside-the-Fence has the greatest creation of construction jobs and therefore are assigned a score of 10. The other alternatives are proportionally assigned scores based on the difference between Riparian and the other alternative.
Outside-the-Fence Potential Demand for Recycled Water	0.0	10.0	3.0	Calculated. See E119-G119 for Forumla. Inside-the-Fence has the greatest creation of construction jobs and therefore are assigned a score of 10. The other alternatives are proportionally assigned scores based on the difference between Riparian and the other alternative.
Change in Outside-the-Fence Profit or Cost Avoidance	6.0	7.0	6.0	Riparian could provide some benefit. BMF/BRS could increase crop rotation. Delta/Knife assumes some sort of savings in cost.
Community Stewardship	6.7	5.3	4.7	
Human Health and Safety	5.0	4.0	3.0	BMF/BRS risk is around a concern about over spray on food crops. Delta/Knife River concern is high particularly with the rock crusher. Riparian no risk.
Aesthetic Site Improvements	8.0	6.0	5.0	Riparian Shade offers the greatest aestetic benefit in terms of sclae of improvement, but the project will likey be on private land without public access. BMF/BRS may be greener but no public access or significant improvements.
Develops Capacity to Adapt to Climate Change	7.0	6.0	6.0	Riparian - more climate change provokes non-native plants to take over areas that aren't established with natives and enhanced soil infiltration provides flood control. These benefits were scored higher than the recycled water alternatives that provide a substitute source of water for our community in times of extreme drought.
Stakeholder Interest Alignment	6.4	6.8	7.3	
Potential Project Partnerships	*7.0*	*7.0*	*6.0*	Riparian partner with The Freshwater Trust or Long-Tom could be a vendosr for credits and a partner in this process. EWEB with drinking water protection plan. RW supports EWEBs water management conservation plan. If big RW user wants to play it could change the nature of the alternatives significantly. BMF/BRS existing relationship theorefically MWMC is providing an addifional opportunity and more potential in water limited time, more acreage and tax lots within a mile of the pipeline. Delta/Knife and Riparian have more potential for partners that would be served.
Alignment with State and Local Plans and Goals	*6.0*	*6.0*	*6.0*	All three alternatives were found to be equivalent.
Alignment with Stakeholders	*6.2*	*7.3*	*10.0*	Calculated. See E138-G138 for Forumla. Outside-the-Fence was found to have the greatest alignment with stakeholders based on an indexed scoring methology for survey result and therefor is assigned a score of 10. The other alternatives are proportionally assigned scores based on the difference between Riparian and the other alternative.